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Developing Enterprise JavaBeans for Oracle WebLogic Server 12.1.3
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This document is a resource for software developers who develop applications that include WebLogic Server 12.1.3 Enterprise JavaBeans (EJBs) using the Java Platform, Enterprise Edition 6.
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This preface describes the document accessibility features and conventions used in this guide—Developing Enterprise JavaBeans for Oracle WebLogic Server 12.1.3.

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Conventions
The following text conventions are used in this document:

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

This chapter describes the contents and organization of this guide—Developing Enterprise JavaBeans for Oracle WebLogic Server 12.1.3.

This chapter includes the following sections:

- Document Scope and Audience
- Guide to this Document
- Related Documentation
- Comprehensive Examples for the EJB Developer
- New and Changed Features in this Release

1.1 Document Scope and Audience

This document is a resource for software developers who develop applications that include WebLogic Server Enterprise JavaBeans (EJBs).

The document mostly discusses the Java EE 6-based, EJB 3.1 programming model, in particular the use of metadata annotations to simplify development. This document does not address EJB topics that are different between versions 2.x and 3.x, such as design considerations, EJB container architecture, entity beans, deployment descriptor use, and so on. This document also does not address production phase administration, monitoring, or performance tuning. For links to WebLogic Server documentation and resources for these topics, see Section 1.3, "Related Documentation."

It is assumed that the reader is familiar with Java Platform, Enterprise Edition (Java EE) Version 6 and basic EJB programming concepts.

For information on programming and packaging 2.1 EJBs, see Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

1.2 Guide to this Document

- This chapter, Chapter 1, "Introduction and Roadmap," introduces the organization of this guide.
- Chapter 2, "Understanding Enterprise JavaBeans," provides an overview of the new EJB 3.1 features, as well as a brief description of the differences between EJB 3.1 and 3.0.
- Chapter 3, "Simple Enterprise JavaBeans Examples," provides examples of programming EJBs using the metadata annotations specified by EJB 3.x.
Related Documentation

- Chapter 4, “Iterative Development of Enterprise JavaBeans,” describes the EJB implementation process, and provides guidance for how to get an EJB up and running in WebLogic Server.
- Chapter 5, “Programming the Annotated EJB Class,” describes the requirements and typical steps when programming the EJB bean class that contains the metadata annotations.
- Chapter 8, “Configuring the Persistence Provider in Oracle WebLogic Server,” provides an overview of developing an Oracle TopLink application using Oracle WebLogic Server.
- Appendix A, “EJB Metadata Annotations Reference,” provides reference information for the EJB 3.0 metadata annotations, as well as information about standard metadata annotations that are used by EJB.
- Appendix B, “Using Oracle Kodo with Oracle WebLogic Server,” describes how to use Oracle Kodo to create entity beans. Oracle Kodo is a product that provides the implementation of the Java Persistence API section of the EJB 3.0 specification, as well as other persistence-related technologies such as Java Data Objects (JDO).

Note: Oracle Kodo JPA/JDO is deprecated in this release. Customers are encouraged to use Oracle TopLink, which supports JPA 2.0. Kodo supports only JPA 1.0.


1.3 Related Documentation

This document contains EJB 3.1-specific development information. Additionally, it provides information only for session and message-driven beans. For complete information on general EJB design and architecture, the EJB 2.x programming model (which is fully supported in EJB 3.1), see the following documents.

1.3.1 EJB Documentation in WebLogic Server

For information about developing and deploying EJBs with WebLogic Server, see:

- "Enterprise Java Beans (EJBs)" in Understanding Oracle WebLogic Server.
- For instructions on how to organize and build WebLogic Server EJBs in a split directory environment, see Developing Applications for Oracle WebLogic Server.
- For information on programming and packaging 2.x EJBs, see Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.
- Deploying Applications to Oracle WebLogic Server is the primary source of information about deploying WebLogic Server applications in development and production environments.
### 1.3.2 Additional EJB Information

It is assumed the reader is familiar with programming in Java EE 6 and EJB 3.1 concepts and features. To learn more about basic EJB concepts, such as the benefits of enterprise beans, the types of enterprise beans, and their life cycles, then visit the following Web sites:

- Enterprise JavaBeans 3.1 Specification (JSR-318) at
- The "Enterprise Beans" chapter of the Java EE 6 Tutorial at
- Introducing the Java EE 6 Platform: Part 3 (EJB Technology, Even Easier to Use) at
  [http://www.oracle.com/technetwork/articles/javaee/javaee6overview-part3-139660.html#ejbeasy](http://www.oracle.com/technetwork/articles/javaee/javaee6overview-part3-139660.html#ejbeasy)

### 1.4 Comprehensive Examples for the EJB Developer

In addition to this document and the basic examples described in Chapter 3, "Simple Enterprise JavaBeans Examples," Oracle provides comprehensive examples in the WebLogic Server distribution kit.

WebLogic Server optionally installs these in EXAMPLES_HOME/wl_server/examples/src/examples, where EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see "Sample Applications and Code Examples" in *Understanding Oracle WebLogic Server*.

Oracle recommends that you run these examples before programming your own application that uses EJBs.

#### 1.4.1 New EJB 3.1 Examples

Oracle provides Java EE 6 examples that demonstrate new features in EJB 3.1, such as:

- Section 3.2.1, "EJB 3.1: Example of a Singleton Session Bean"
- Section 3.2.2, "EJB 3.1: Example of an Asynchronous Method EJB"
- Section 3.2.3, "EJB 3.1: Example of a Calendar-based Timer EJB"
- Section 3.2.4, "EJB 3.1: Example of Simplified No-interface Programming and Packaging in a WAR File"
- Section 3.2.5, "EJB 3.1: Example of Using a Portable Global JNDI Name in an EJB"

For more information, see these examples in the WebLogic Server distribution kit: EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb where EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see "Sample Applications and Code Examples" in *Understanding Oracle WebLogic Server*.

#### 1.4.2 EJB 3.0 Example

There is also an EJB 3.0 persistence service example, Section 3.2.6, "EJB 3.1: Example of Using the Embeddable EJB Container in Java SE", that includes actual business code and provides practical instructions on how to perform key EJB 3.0 development tasks. In particular, the example demonstrates usage of EJB 3.x with:

- Java Persistence API
- Stateless Session Bean
New and Changed Features in this Release

- Message Driven Bean
- Asynchronous JavaScript based browser application

The example uses a persistent domain model for entity EJBs. For more information, see the example in the WebLogic Server distribution kit: `EXAMPLES_HOME/wl_server/examples/src/examples/ejb/ejb30` where `EXAMPLES_HOME` represents the directory in which the WebLogic Server code examples are configured. For more information, see “Sample Applications and Code Examples” in Understanding Oracle WebLogic Server.

1.5 New and Changed Features in this Release

For a comprehensive listing of the new features in EJB 3.1 features introduced in this release of WebLogic Server, see “Enterprise Java Beans (EJBs)” in What’s New in Oracle WebLogic Server.
This chapter describes the new features and programming model of EJB 3.1 and also provides a basic overview of the EJB components, anatomy, and features used in WebLogic Server 12.1.3.

This chapter includes the following sections:

- New Features and Changes in EJB
- Understanding EJB Components
- EJB Anatomy and Environment
- EJB Clients and Communications
- Securing EJBs

2.1 New Features and Changes in EJB

These sections summarize the changes in the EJB programming model and requirements between EJB 3.0 and 3.1, as well between EJB 2.x and 3.0.

2.1.1 What Is New and Changed in EJB 3.1

The EJB 3.1 specification provides simplified programming and packaging model changes. The mandatory use of Java interfaces from previous versions has been removed, allowing plain old Java objects to be annotated and used as EJB components. The simplification is further enhanced through the ability to place EJB components directly inside of Web applications, removing the need to produce separate archives to store the Web and EJB components and combine them together in an EAR file.

For a comprehensive listing of the new features in EJB 3.1 features introduced in this release of WebLogic Server, see "Enterprise Java Beans (EJBs)" in What’s New in Oracle WebLogic Server.

- **Singleton Session Bean** – singleton session beans provide a formal programming construct that guarantees a session bean will be instantiated once per application in a particular Java Virtual Machine (JVM), and that it will exist for the life cycle of the application. With singletons, you can easily share state between multiple instances of an enterprise bean component or between multiple enterprise bean components in the application.

- **Simplified No Interface Client View** – The No-interface local client view type simplifies EJB development by providing local session bean access without requiring a separate local business interface, allowing components to have EJB bean class instances directly injected.
■ **Packaging and Deploying EJBs Directly in a WAR File** – EJB 3.1 provides the ability to place EJB components directly inside of Web application archive (WAR) files, removing the need to produce archives to store the Web and EJB components and combine them together in an enterprise application archive (EAR) file.

■ **Portable Global JNDI Names** – The Portable Global JNDI naming option in EJB 3.1 provides a number of common, well-known namespaces in which EJB components can be registered and looked up from using the pattern `java:global[/<app-name>]/<module-name>/<bean-name>`. This standardizes how and where EJB components are registered in JNDI, and how they can be looked up and used by applications.

■ **Asynchronous Session Bean Invocations** – An EJB 3.1 session bean can expose methods with asynchronous client invocation semantics. Using the `@Asynchronous` annotation in an EJB class or specific method will direct the EJB container to return control immediately to the client when the method is invoked. The method may return a future object to allow the client to check on the status of the method invocation, and retrieve result values that are asynchronously produced.

■ **EJB Timer Enhancements** – The EJB 3.1 Timer Service supports calendar-based EJB Timer expressions. The scheduling functionality takes the form of CRON-styled schedule definitions that can be placed on EJB methods, in order to have the methods be automatically invoked according to the defined schedule. EJB 3.1 also supports the automatic creation of a timer based on metadata in the bean class or deployment descriptor, which allows the bean developer to schedule a timer without relying on a bean invocation to programmatically invoke one of the Timer Service timer creation methods. Automatically created timers are created by the container as a result of application deployment.

■ **Embeddable EJB Container** – EJB 3.1 supports an embeddable API for executing EJB components within a Java SE environment. Unlike traditional Java EE server-based execution, embeddable usage allows client code and its corresponding enterprise beans to run within the same virtual machine and class loader. This provides better support for testing, offline processing (e.g., batch jobs), and the use of the EJB programming model in desktop applications.

■ **JPA 2.0 Support** – Oracle EclipseLink is the default JPA 2.0 persistence provider that is shipped with Oracle WebLogic Server. Oracle Kodo was deprecated in Oracle Fusion Middleware 11gR1 (11.1.1.1.0) (Oracle WebLogic Server 10.3.1). WebLogic Server runs with the JPA 2.0 JAR in the server `classpath`. Although JPA 2.0 is upwardly compatible with JPA 1.0, JPA 2.0 introduced some methods to existing JPA interfaces that conflict with existing signatures in OpenJPA interfaces. As a result, applications that continue to use Kodo/JPA as the persistence provider with WebLogic Server 12.1.1 must be recompiled. For more information, see "Updating Applications to Overcome Conflicts" in Developing Enterprise JavaBeans for Oracle WebLogic Server.

■ **JPA 2.0 Support Using the Default TopLink Persistence Provider** – Oracle TopLink, a JPA 2.0 persistence provider, is now the default JPA provider, replacing Kodo, which was the default provider in previous releases. Any application that does not specify a JPA provider in `persistence.xml` will now use TopLink by default. Applications can continue to use Kodo (a JPA 1.0 provider) by explicitly specifying Kodo/OpenJPA as their persistence provider in `persistence.xml`. In addition, a WebLogic Server domain can be configured to use Kodo by default, if desired.

For more information, see Chapter 8, "Configuring the Persistence Provider in Oracle WebLogic Server."
2.1.2 What Was New and Changed in EJB 3.0

The following summarizes the new functionality and simplifications made in EJB 3.0 to the earlier EJB APIs:

- You are no longer required to create the EJB deployment descriptor files (such as ejb-jar.xml). You can now use metadata annotations in the bean file itself to configure metadata. You are still allowed, however, to use XML deployment descriptors if you want; in the case of conflicts, the deployment descriptor value overrides the annotation value.

- The only required metadata annotation in your bean file is the one that specifies the type of EJB you are writing (@javax.ejb.Stateless, @javax.ejb.Stateful, @javax.ejb.MessageDriven, or @javax.persistence.Entity). The default value for all other annotations reflect typical and standard use of EJBs. This reduces the amount of code in your bean file in the case where you are programming a typical EJB; you only need to use additional annotations if the default values do not suit your needs.

- The bean file can be a plain old Java object (or POJO); it is no longer required to implement javax.ejb.SessionBean or javax.ejb.MessageDrivenBean.

- As a result of not having to implement javax.ejb.SessionBean or javax.ejb.MessageDrivenBean, the bean file no longer has to implement the lifecycle callback methods, such as ejbCreate, ejbPassivate, and so on. If, however, you want to implement these callback methods, you can name them anything you want and then annotate them with the appropriate annotation, such as @javax.ejb.PostActivate.

- Session beans may expose client views via business interfaces. Session beans may either explicitly implement the business interface or they can specify it using the @javax.ejb.Remote or @javax.ejb.Local annotations.)

- The business interface is a plain old Java interface (or POJI); it should not extend javax.ejb.EJBObject or javax.ejb.EJBLocalObject.


- Bean files supports dependency injection. Dependency injection is when the EJB container automatically supplies (or injects) a variable or setter method in the bean file with a reference to another EJB or resource or another environment entry in the bean's context.

- Bean files support interceptors, which is a standard way of using aspect-oriented programming with EJB.
  - You can configure two types of interceptor methods: those that intercept business methods and those that intercept lifecycle callbacks.
  - You can configure multiple interceptor methods that execute in a chain in a particular order.
You can configure default interceptor methods that execute for all EJBs contained in a JAR file.

Because the EJB 3.x programming model is so simple, Oracle no longer supports using the EJBGen tags and code-generating tool on EJB 3.x beans. Rather, you can use this tool only on 2.x beans. For information, see the "EJBGen Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

2.2 Understanding EJB Components

Enterprise JavaBeans (EJB) 3.1 technology is the server-side component architecture for Java EE 6. EJB 3.1 technology enables rapid and simplified development of distributed, transactional, secure and portable applications based on Java technology.

2.2.1 Session EJBs Implement Business Logic

Session beans implement business logic. There are three types of session beans: stateful, stateless, and singleton. Stateful and stateless session beans serve one client at a time; whereas, singleton session beans can be invoked concurrently.

For detailed information about the types of session beans and when to use them, see "What Is a Session Bean" in the "Enterprise Beans" chapter of the Java EE 6 Tutorial at http://docs.oracle.com/javaee/6/tutorial/doc/gipjg.html.

2.2.1.1 Stateful Session Beans

Stateful session beans maintain state information that reflects the interaction between the bean and a particular client across methods and transactions. A stateful session bean can manage interactions between a client and other enterprise beans, or manage a workflow.

Example: A company Web site that allows employees to view and update personal profile information could use a stateful session bean to call a variety of other beans to provide the services required by a user, after the user clicks "View my Data" on a page:

- Accept the login data from a JSP, and call another EJB whose job it is to validate the login data.
- Send confirmation of authorization to the JSP.
- Call a bean that accesses profile information for the authorized user.

2.2.1.2 Stateless Session Beans

A stateless session bean does not store session or client state information between invocations—the only state it might contain is not specific to a client, for instance, a cached database connection or a reference to another EJB. At most, a stateless session bean may store state for the duration of a method invocation. When a method completes, state information is not retained.

Any instance of a stateless session bean can serve any client—any instance is equivalent. Stateless session beans can provide better performance than stateful session beans, because each stateless session bean instance can support multiple clients, albeit one at a time. The client of a stateless session bean can be a web service endpoint.

Example: An Internet application that allows visitors to click a "Contact Us" link and send an email could use a stateless session bean to generate the email, based on the "to" and "from" information gathered from the user by a JSP.
2.2.1.3 Singleton Session Beans

Singleton session beans provide a formal programming construct that guarantees a session bean will be instantiated once per application in a particular Java Virtual Machine (JVM), and that it will exist for the life cycle of the application. With singletons, you can easily share state between multiple instances of an enterprise bean component or between multiple enterprise bean components in the application.

Singleton session beans offer similar functionality to stateless session beans but differ from them in that there is only one singleton session bean per application, as opposed to a pool of stateless session beans, any of which may respond to a client request. Like stateless session beans, singleton session beans can implement Web service endpoints. Singleton session beans maintain their state between client invocations but are not required to maintain their state across server crashes or shutdowns.

Example: The Apache Web site provides a "Simple Singleton: ComponentRegistry" example that demonstrates how a singleton bean uses Container-Managed Concurrency to utilize the Read (@Lock(READ)) functionality, to allow multi-threaded access to the bean, and the Write (@Lock(WRITE)) functionality, to enforce single-threaded access to the bean.

2.2.2 Message-Driven Beans Implement Loosely Coupled Business Logic

A message-driven bean implements loosely coupled or asynchronous business logic in which the response to a request need not be immediate. A message-driven bean receives messages from a JMS Queue or Topic, and performs business logic based on the message contents. It is an asynchronous interface between EJBs and JMS.

Throughout its life cycle, an MDB instance can process messages from multiple clients, although not simultaneously. It does not retain state for a specific client. All instances of a message-driven bean are equivalent—the EJB container can assign a message to any MDB instance. The container can pool these instances to allow streams of messages to be processed concurrently.

The EJB container interacts directly with a message-driven bean—creating bean instances and passing JMS messages to those instances as necessary. The container creates bean instances at deployment time, adding and removing instances during operation based on message traffic.

For detailed information, see Developing Message-Driven Beans for Oracle WebLogic Server.

Example: In an on-line shopping application, where the process of taking an order from a customer results in a process that issues a purchase order to a supplier, the supplier ordering process could be implemented by a message-driven bean. While taking the customer order always results in placing a supplier order, the steps are loosely coupled because it is not necessary to generate the supplier order before confirming the customer order. It is acceptable or beneficial for customer orders to "stack up" before the associated supplier orders are issued.

2.3 EJB Anatomy and Environment

These sections briefly describe classes required for each bean type, the EJB run-time environment, and the deployment descriptor files that govern a bean's run-time behavior.

- Section 2.3.1, "EJB Components"
- Section 2.3.2, "The EJB Container"
### 2.3.1 EJB Components

Every bean type requires a bean class. Table 2–1 defines the supported client views that make up each type of EJB, and defines any additional required classes.

#### Table 2–1 Support Client Views in EJB 3.1

<table>
<thead>
<tr>
<th>Client Views</th>
<th>Session Bean Types</th>
<th>Additional Required Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Client</td>
<td>Stateful, Stateless, and Singleton</td>
<td>Remote business interface that defines the bean’s business and lifecycle methods.</td>
</tr>
<tr>
<td></td>
<td>session beans</td>
<td></td>
</tr>
<tr>
<td>Local Client</td>
<td>Stateful, Stateless, and Singleton</td>
<td>Local business interface that defines the bean’s business and lifecycle methods.</td>
</tr>
<tr>
<td></td>
<td>session beans</td>
<td></td>
</tr>
<tr>
<td>Local No-interf</td>
<td>Stateful, Stateless, and Singleton</td>
<td>Only requires the bean class.</td>
</tr>
<tr>
<td>e</td>
<td>session beans</td>
<td></td>
</tr>
<tr>
<td>Web Service</td>
<td>Stateless and Singleton session</td>
<td>A Web service endpoint that is accessed as a JAX-WS or JAX-RPC service endpoint using the JAX-WS or JAX-RPC client view APIs.</td>
</tr>
<tr>
<td>Clients</td>
<td>beans</td>
<td></td>
</tr>
</tbody>
</table>

### Note:

The EJB 2.1 and earlier API required that Local and Remote clients access the stateful or stateless session bean by means of the session bean’s local or remote home and the local or remote component interfaces. These interfaces remain available for use with EJB 3.x; however, the EJB 2.1 Remote and Local client view is not supported for singleton session beans.

For more information see "Create EJB Classes and Interfaces" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

### 2.3.2 The EJB Container

An EJB container is a run-time container for beans that are deployed to an application server. The container is automatically created when the application server starts up, and serves as an interface between a bean and run-time services such as:

- Life cycle management
- Code generation
- Security
- Transaction management
- Locking and concurrency control

### 2.3.3 EJB Metadata Annotations

The WebLogic Server EJB 3.1 programming model uses the Java EE 6 metadata annotations feature in which you create an annotated EJB 3.1 bean file, and then compile the class with standard Java compiler, which can then be packaged into a target module for deployment. At runtime, WebLogic Server parses the annotations and applies the required behavioral aspects to the bean file.

For more information, see Section 5, "Programming the Annotated EJB Class."
2.3.4 Optional EJB Deployment Descriptors

As of EJB 3.0, you are no longer required to create the EJB deployment descriptor files (such as ejb-jar.xml). However, you can still use XML deployment descriptors if you want. In the case of conflicts, the deployment descriptor value overrides the annotation value.

If you are continuing to use deployment descriptors in your EJB implementation, refer to "EJB Deployment Descriptors" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

The WebLogic Server EJB container supports three deployment descriptors:

- **ejb-jar.xml** — The standard Java EE deployment descriptor. The ejb-jar.xml may be used to define EJBs and to specify standard configuration settings for the EJBs. An ejb-jar.xml can specify multiple beans that will be deployed together.

- **weblogic-ejb-jar.xml** — WebLogic Server-specific deployment descriptor that contains elements related to WebLogic Server features such as clustering, caching, and transactions. This file is required if your beans take advantage of WebLogic Server-specific features. Like ejb-jar.xml, weblogic-ejb-jar.xml can specify multiple beans that will be deployed together.

- **weblogic-cmp-jar.xml** — WebLogic Server-specific deployment descriptor that contains elements related to container-managed persistence for entity beans. Entity beans that use container-managed persistence must be specified in a weblogic-cmp-jar.xml file.

For descriptions of the WebLogic Server EJB deployment descriptors, refer to "Deployment Descriptor Schema and Document Type Definitions Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

2.4 EJB Clients and Communications

An EJB can be accessed by server-side or client-side objects such as servlets, Java client applications, other EJBs, web services, and non-Java clients. Any client of an EJB, whether in the same or a different application, accesses it in a similar fashion. WebLogic Server automatically creates implementations of an EJB’s remote home and remote business interfaces, which can function remotely.

2.4.1 Accessing EJBs

Clients access enterprise beans either through a no-interface view or through a business interface. A no-interface view of an enterprise bean exposes the public methods of the enterprise bean implementation class to clients. Clients using the no-interface view of an enterprise bean may invoke any public methods in the enterprise bean implementation class or any super-classes of the implementation class. A business interface is a standard Java programming language interface that contains the business methods of the enterprise bean.

The client of an enterprise bean obtains a reference to an instance of an enterprise bean through either dependency injection, using Java programming language annotations, or JNDI lookup, using the Java Naming and Directory Interface syntax to find the enterprise bean instance.

Dependency injection is the simplest way of obtaining an enterprise bean reference. Clients that run within a Java EE server-managed environment, JavaServer Faces web applications, JAX-RS web services, other enterprise beans, or Java EE application clients, support dependency injection using the javax.ejb.EJB annotation.
Applications that run outside a Java EE server-managed environment, such as Java SE applications, must perform an explicit lookup. JNDI supports a global syntax for identifying Java EE components to simplify this explicit lookup. For more information see, Section 4.7.3.2, "Using the JNDI Portable Syntax".

Because of network overhead, it is more efficient to access beans from a client on the same machine than from a remote client, and even more efficient if the client is in the same application.

For information on programming client access to an EJB, see "Accessing Enterprise Beans" in the "Enterprise Beans" chapter of the Java EE 6 Tutorial at http://docs.oracle.com/javaee/6/tutorial/doc/gipjg.html.

### 2.4.2 EJB Communications

WebLogic Server EJBs use:

- **T3**—To communicate with remote objects. T3 is a WebLogic-proprietary remote network protocol that implements the Remote Method Invocation (RMI) protocol.

- **RMI**—To communicate with remote objects. RMI enables an application to obtain a reference to an object located elsewhere in the network, and to invoke methods on that object as though it were co-located with the client on the same JVM locally in the client's virtual machine. An EJB with a remote interface is an RMI object. For more information on WebLogic RMI, see Developing RMI Applications for Oracle WebLogic Server.

- **HTTP**—An EJB can obtain an HTTP connection to a Web server external to the WebLogic Server environment by using the `java.net.URL` resource connection factory. For more information, see "Configuring EJBs to Send Requests to an URL" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

You can specify the attributes of the network connection an EJB uses by binding the EJB to a WebLogic Server custom network channel. For more information, see "Configuring Network Resources" in Administering Server Environments for Oracle WebLogic Server.

### 2.5 Securing EJBs

By default, any user can invoke the public methods of an EJB. Therefore, if you want to restrict access to the EJB, you can use security-related annotations to specify the roles that are allowed to invoke all, or a subset, of the methods, which is explained in Section 5.3.8, "Securing Access to the EJB."

In addition, you create security roles and map users to roles using the WebLogic Server Administration Console to update your security realm. For details, see "Manage Security Roles" in the Oracle WebLogic Server Administration Console Online Help.

For additional information about security and EJBs, see:

- "Security Fundamentals" in Understanding Security for Oracle WebLogic Server has introductory information about authentication, authorization and other security topics.

- "Securing Enterprise JavaBeans (EJBs)" in Developing Applications with the WebLogic Security Service provides instructions for configuring authentication and authorization for EJBs.
Securing Resources Using Roles and Policies for Oracle WebLogic Server contains instructions for configuring authentication and authorization for your EJBs using the WebLogic Server Administration Console.
This chapter describes Java examples of EJBs in WebLogic Server 12.1.3 that use the version 3.x programming model.

This chapter includes the following sections:

■ Simple Java Examples of 3.x EJBs
■ Packaged EJB 3.1 Examples in WebLogic Server

3.1 Simple Java Examples of 3.x EJBs

The following sections describe simple Java examples of EJBs that use the new metadata annotation programming model. Some procedural sections in this guide that describe how to program an EJB may reference these examples.

■ Section 3.1.1, "Example of a Simple No-interface Stateless EJB"
■ Section 3.1.2, "Example of a Simple Business Interface Stateless EJB"
■ Section 3.1.3, "Example of a Simple Stateful EJB"
■ Section 3.1.4, "Example of an Interceptor Class"

3.1.1 Example of a Simple No-interface Stateless EJB

The EJB 3.1 no-interface local client view type simplifies EJB development by providing local session bean access without requiring a separate local business interface, allowing components to have EJB bean class instances directly injected.

The following code shows a simple no-interface view for the ServiceBean stateless session EJB:

```java
package examples;
@Stateless
public class ServiceBean {
    public void sayHelloFromServiceBean() {
        System.out.println("Hello From Service Bean!");
    }
}
```

The main points to note about the preceding code are:

■ The EJB automatically exposes the no-interface view because no other client views are exposed and its bean class implements clause is empty.

■ The ServiceBean bean file is a plain Java file; it is not required to implement any EJB-specific interface.
The class-level @Stateless metadata annotation specifies that the EJB is of type stateless session.

### 3.1.2 Example of a Simple Business Interface Stateless EJB

The following code shows a simple business interface for the ServiceBean stateless session EJB:

```java
package examples;
/**
 * Business interface of the Service stateless session EJB
 */
public interface Service {
    public void sayHelloFromServiceBean();
}
```

The code shows that the Service business interface has one method, `sayHelloFromServiceBean()`, that takes no parameters and returns void.

The following code shows the bean file that implements the preceding Service interface; the code in bold is described after the example:

```java
package examples;
import javax.ejb.Stateless;
import javax.interceptor.ExcludeDefaultInterceptors;
/**
 * Bean file that implements the Service business interface.
 * Class uses following EJB 3.x annotations:
 * - @Stateless - specifies that the EJB is of type stateless session
 * - @ExcludeDefaultInterceptors - specifies any configured default
 *   interceptors should not be invoked for this class
 */
@Stateless
@ExcludeDefaultInterceptors
public class ServiceBean implements Service {
    public void sayHelloFromServiceBean() {
        System.out.println("Hello From Service Bean!");
    }
}
```

The main points to note about the preceding code are:

- Use standard `import` statements to import the metadata annotations you use in the bean file:

  ```java
  import javax.ejb.Stateless;
  import javax.interceptor.ExcludeDefaultInterceptors
  ```

  The annotations that apply only to EJB 3.1 are in the `javax.ejb` package. Annotations that can be used by other Java EE Version 6 components are in more generic packages, such as `javax.interceptor` or `javax.annotation`.

- The `ServiceBean` bean file is a plain Java file that implements the Service business interface; it is not required to implement any EJB-specific interface. This means that the bean file does not need to implement the lifecycle methods, such as `ejbCreate` and `ejbPassivate`, that were required in the 2.x programming model.
The class-level @Stateless metadata annotation specifies that the EJB is of type stateless session.

The class-level @ExcludeDefaultInterceptors annotation specifies that default interceptors, if any are defined in the ejb-jar.xml deployment descriptor file, should never be invoked for any method invocation of this particular EJB.

3.1.3 Example of a Simple Stateful EJB

The following code shows a simple business interface for the AccountBean stateful session EJB:

```java
package examples;
/**
 * Business interface for the Account stateful session EJB.
 */
public interface Account {
    public void deposit(int amount);
    public void withdraw(int amount);
    public void sayHelloFromAccountBean();
}
```

The code shows that the Account business interface has three methods, deposit, withdraw, and sayHelloFromAccountBean.

The following code shows the bean file that implements the preceding Account interface; the code in bold is described after the example:

```java
package examples;
import javax.ejb.Stateful;
import javax.ejb.Remote;
import javax.ejb.EJB;
import javax.annotation.PreDestroy;
import javax.interceptor.Interceptors;
import javax.interceptor.ExcludeClassInterceptors;
/**
 * Bean file that implements the Account business interface.
 * Uses the following EJB annotations:
 * - @Stateful: specifies that this is a stateful session EJB
 * - @Remote: specifies the Remote interface for this EJB
 * - @EJB: specifies a dependency on the ServiceBean stateless session ejb
 * - @Interceptors: Specifies that the bean file is associated with an Interceptor class; by default all business methods invoke the method in the interceptor class annotated with @AroundInvoke.
 * - @ExcludeClassInterceptors: Specifies that the interceptor methods defined for the bean class should NOT fire for the annotated method.
 * - @PreDestroy: Specifies lifecycle method that is invoked when the bean is about to be destroyed by EJB container.
 */
@Stateful
@Remote({examples.Account.class})
@Interceptors({examples.AuditInterceptor.class})
public class AccountBean
    implements Account
{
    private int balance = 0;
    @EJB(beanName="ServiceBean")
    private Service service;
```
public void deposit(int amount) {
    balance += amount;
    System.out.println('deposited: '+'amount'+" balance: "+balance);
}
public void withdraw(int amount) {
    balance -= amount;
    System.out.println('withdrew: '+'amount'+" balance: "+balance);
}@ExcludeClassInterceptors
public void sayHelloFromAccountBean() {
    service.sayHelloFromServiceBean();
}@PreDestroy
public void preDestroy() {
    System.out.println("Invoking method: preDestroy()");
}

The main points to note about the preceding code are:

- Use standard import statements to import the metadata annotations you use in the bean file:
  
  ```java
  import javax.ejb.Stateful;
  import javax.ejb.Remote;
  import javax.ejb.EJB;
  import javax.annotation.PreDestroy;
  import javax.interceptor.Interceptors;
  import javax.interceptor.ExcludeClassInterceptors;
  
  import javax.annotation.PostConstruct;
  import javax.annotation.Priority;
  import javax.interceptor.AroundInvoke;
  import javax.interceptor.Interceptors;
  ```
  
  The annotations that apply only to EJB 3.1 are in the `javax.ejb` package. Annotations that can be used by other Java EE 6 components are in more generic packages, such as `javax.interceptor` or `javax.annotation`.

- The AccountBean bean file is a plain Java file that implements the Account business interface; it is not required to implement any EJB-specific interface. This means that the bean file does not need to implement the lifecycle methods, such as `ejbCreate` and `ejbPassivate`, that were required in the 2.x programming model.

- The class-level @Stateful metadata annotation specifies that the EJB is of type stateful session.

- The class-level @Remote annotation specifies the name of the remote interface of the EJB; in this case it is the same as the business interface, Account.

- The class-level @Interceptors({examples.AuditInterceptor.class}) annotation specifies the interceptor class that is associated with the bean file. This class typically includes a business method interceptor method, as well as lifecycle callback interceptor methods. See Section 3.1.4, "Example of an Interceptor Class" for details about this class.

- The field-level @EJB annotation specifies that the annotated variable, service, is injected with the dependent ServiceBean stateless session bean context. The data type of the injected field, Service, is the business interface of the ServiceBean EJB. The following code in the `sayHelloFromAccountBean` method shows how to invoke the `sayHelloFromServiceBean` method of the dependent ServiceBean:
  
  ```java
  service.sayHelloFromServiceBean();
  ```
The method-level @ExcludeClassInterceptors annotation specifies that the
@AroundInvoke method specified in the associated interceptor class
(AuditInterceptor) should not be invoked for the sayHelloFromAccountBean
method.

The method-level @PreDestroy annotation specifies that the EJB container should
invoke the preDestroy method before the container destroys an instance of the
AccountBean. This shows how you can specify interceptor methods (for both
business methods and lifecycle callbacks) in the bean file itself, in addition to
using an associated interceptor class.

### 3.1.4 Example of an Interceptor Class

The following code shows an example of an interceptor class, specifically the
AuditInterceptor class that is referenced by the preceding AccountBean stateful
session bean with the @Interceptors({examples.AuditInterceptor.class})
annotation; the code in bold is described after the example:

```java
package examples;
import javax.interceptor.AroundInvoke;
import javax.interceptor.InvocationContext;
import javax.ejb.PostActivate;
import javax.ejb.PrePassivate;
/**
 * Interceptor class. The interceptor method is annotated with the
 * @AroundInvoke annotation.
 */
public class AuditInterceptor {
    public AuditInterceptor() {}  
    @AroundInvoke
    public Object audit(InvocationContext ic) throws Exception {
        System.out.println("Invoking method: "+ic.getMethod());
        return ic.proceed();
    }
    @PostActivate
    public void postActivate(InvocationContext ic) {
        System.out.println("Invoking method: "+ic.getMethod());
    }
    @PrePassivate
    public void prePassivate(InvocationContext ic) {
        System.out.println("Invoking method: "+ic.getMethod());
    }
}
```

The main points to notice about the preceding example are:

- As usual, import the metadata annotations used in the file:
  ```java
  import javax.interceptor.AroundInvoke;
  import javax.interceptor.InvocationContext;
  import javax.ejb.PostActivate;
  import javax.ejb.PrePassivate;
  ```

- The interceptor class is a plain Java class.

- The class has an empty constructor:
  ```java
  public AuditInterceptor() {}
  ```

- The method-level @AroundInvoke specifies the business method interceptor
  method. You can use this annotation only once in an interceptor class.
The method-level @PostActivate and @PrePassivate annotations specify the methods that the EJB container should call after reactivating and before passivating the bean, respectively.

---

**Note:** These lifecycle callback interceptor methods apply only to stateful session beans.

---

### 3.2 Packaged EJB 3.1 Examples in WebLogic Server

The following sections describe the packaged Java EE 6 examples included with Oracle WebLogic Server, which demonstrate new features in EJB 3.1.

- Section 3.2.1, "EJB 3.1: Example of a Singleton Session Bean"
- Section 3.2.2, "EJB 3.1: Example of an Asynchronous Method EJB"
- Section 3.2.3, "EJB 3.1: Example of a Calendar-based Timer EJB"
- Section 3.2.4, "EJB 3.1: Example of Simplified No-interface Programming and Packaging in a WAR File"
- Section 3.2.5, "EJB 3.1: Example of Using a Portable Global JNDI Name in an EJB"
- Section 3.2.6, "EJB 3.1: Example of Using the Embeddable EJB Container in Java SE"
- Section 3.2.7, "EJB 3.0: Example of Invoking an Entity From A Session Bean"

### 3.2.1 EJB 3.1: Example of a Singleton Session Bean

This example demonstrates the use of the EJB 3.1 singleton session bean, which provides application developers with a formal programming construct that guarantees a session bean will be instantiated once for an application in a particular Java Virtual Machine (JVM). In this example, a @Singleton session bean provides a central counter service. The Counter EJB is called from a Java client to demonstrate it is being used, with the count being consistently incremented by "1" as the client is invoked multiple times.

After you have installed WebLogic Server, the example is in the following directory:

```text
EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb/singletonBean
```

**EXAMPLES_HOME** represents the directory in which the WebLogic Server code examples are configured. For more information, see "Sample Applications and Code Examples" in *Understanding Oracle WebLogic Server*.

### 3.2.2 EJB 3.1: Example of an Asynchronous Method EJB

This example demonstrates the use of the EJB 3.1 asynchronous method invocation. Adding the @Asynchronous annotation to an EJB class or specific method will direct the EJB container to return control immediately to the client when the method is invoked. The method may return a Future object to allow the client to check on the status of the method invocation, and then retrieve result values that are asynchronously produced.

In this example, an @Stateless bean is annotated at the class level, with @Asynchronous indicating its methods are all asynchronous, with each of the methods simulating a long-running calculation. A servlet is used to call the various
asynchronous methods, keeping track of the invocation and completion times to demonstrate the asynchronous nature of the method calls.

After you have installed WebLogic Server, the example is in the following directory:

EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb/asyncMethodOfEJB

EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see "Sample Applications and Code Examples" in Understanding Oracle WebLogic Server.

3.2.3 EJB 3.1: Example of a Calendar-based Timer EJB

This example demonstrates the enhanced scheduling capabilities of EJB 3.1. This scheduling functionality takes the form of CRON-styled schedule definitions that can be placed on EJB methods, in order for the methods to be automatically invoked according to the defined schedule. This example shows the use of the @Schedule annotation defined for a method of a @Singleton session bean, which generates and stores the timestamp of when the method was called. A corresponding servlet is provided, into which the TimerBean is injected, which retrieves the list of timestamps to display in a browser.

After you have installed WebLogic Server, the example is in the following directory:

EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb/calendarStyledTimer

EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see "Sample Applications and Code Examples" in Understanding Oracle WebLogic Server.

3.2.4 EJB 3.1: Example of Simplified No-interface Programming and Packaging in a WAR File

This example demonstrates the simplified programming and packaging model changes provided in EJB 3.1. Since the mandatory use of Java interfaces from previous versions has been removed in EJB 3.1, plain-old Java objects can be annotated and used as EJB components. The simplification is further enhanced by the ability to place EJB components directly inside of Web applications, thereby removing the need to produce archives to store the Web and EJB components and combine them together in an enterprise archive (EAR) file.

In this example, a @Stateless annotation is provided on a plain-old Java class that exposes it as an EJB session bean. This is then injected into a @WebServlet class using an @EJB annotation to demonstrate that it is being used as an EJB module. The EJB session bean and servlet classes are then packaged and deployed together in a single WAR file, which demonstrates the simplified packaging and deployment changes available in Java EE 6.

After you have installed WebLogic Server, the example is in the following directory:

EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb/noInterfaceViewInWAR

EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see "Sample Applications and Code Examples" in Understanding Oracle WebLogic Server.
3.2.5 EJB 3.1: Example of Using a Portable Global JNDI Name in an EJB

This example demonstrates the use of the Portable Global JNDI naming option that is available in EJB 3.1. Portable Global JNDI provides a number of common, well-known namespaces in which EJB components can be registered and looked up from using the pattern java:global[/<app-name>/]<module-name>/<bean-name>. This standardizes how and where EJB components are registered in JNDI and how they can be looked up and used by applications. In this example, a servlet is used to look up an EJB session bean using its portable JNDI name java:module/HelloBean.

After you have installed WebLogic Server, the example is in the following directory:
EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb/portableGlobalJNDIName

EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see “Sample Applications and Code Examples” in Understanding Oracle WebLogic Server.

3.2.6 EJB 3.1: Example of Using the Embeddable EJB Container in Java SE

This example demonstrates using the embeddable EJB container available in EJB 3.1, which allows client code and its corresponding enterprise beans to run in a Java SE environment without having to deploy them to a Java EE server.

The example uses the embeddable WebLogic EJB container to view all the user objects being invoked from a Java SE environment. All the user objects are predefined during eager initialization of a singleton component InitBean when the application is started, using the annotations @Startup and @PostConstruct. An instance of EJBContainer is created in the Java client UserClient to look up the session bean reference UserBean and call its business method viewUsers in the application.

After running the example, the client class is executed automatically and prints run-time messages in the command shell in which the example was built. All the existing user objects are retrieved from the samples database and are displayed in detail in the command shell.

After you have installed WebLogic Server, the example is in the following directory:
EXAMPLES_HOME/wl_server/examples/src/examples/javaee6.ejb/ embeddableContainer

EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see “Sample Applications and Code Examples” in Understanding Oracle WebLogic Server.

3.2.7 EJB 3.0: Example of Invoking an Entity From A Session Bean

For an example of invoking an entity from a session bean, see the EJB 3.0 example in the distribution kit. After you have installed WebLogic Server, the example is in the following directory:
EXAMPLES_HOME/wl_server/examples/src/examples.ejb/ejb30

EXAMPLES_HOME represents the directory in which the WebLogic Server code examples are configured. For more information, see “Sample Applications and Code Examples” in Understanding Oracle WebLogic Server.
This chapter describes the general EJB 3.1 implementation process, and provides guidance for how to get an EJB up and running in WebLogic Server 12.1.3.

This chapter includes the following sections:

- Overview of the EJB Development Process
- Create a Source Directory
- Program the Annotated EJB Class
- Program the EJB Interface
- Optionally Program Interceptors
- Optionally Program the EJB Timer Service
- Programming Access to EJB Clients
- Programming and Configuring Transactions
- Compile Java Source
- Optionally Create and Edit Deployment Descriptors
- Packaging EJBs
- Deploying EJBs

4.1 Overview of the EJB Development Process

This section is a brief overview of the EJB 3.1 development process. It describes the key implementation tasks and associated results.

The following section mostly discusses the EJB 3.1 programming model and points out the differences between the 3.1 and 2.x programming model in only a few places. If you are an experienced EJB 2.x programmer and want the full list of differences between the two models, see Section 2.1, "New Features and Changes in EJB."

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Section 4.2, &quot;Create a Source Directory&quot;</td>
<td>Create the directory structure for your Java source files, and optional deployment descriptors.</td>
<td>A directory structure on your local drive.</td>
</tr>
<tr>
<td>2</td>
<td>Section 4.3, &quot;Program the Annotated EJB Class&quot;</td>
<td>Create the Java file that implements the interface and includes the EJB 3.1 metadata annotations that describe how your EJB behaves.</td>
<td>.java file.</td>
</tr>
</tbody>
</table>
4.2 Create a Source Directory

Create a source directory where you will assemble the EJB 3.1 module.

Oracle recommends a split development directory structure, which segregates source and output files in parallel directory structures. For instructions on how to set up a split directory structure and package your EJB 3.1 as an enterprise application archive (EAR), see "Overview of the Split Development Directory Environment" in Developing Applications for Oracle WebLogic Server.
4.2.1 Directory Structure for Packaging a JAR

If you prefer to package and deploy your EJBs in a JAR file, create a directory for your class files. If you are also using the EJB deployment descriptor (which is optional but supported in the EJB 3.1 programming model), you can package it as META-INF/ejb-jar.xml.

Example 4–1 Directory Structure for Packaging a JAR

myEJBjar/
  META-INF/
    ejb-jar.xml
    weblogic-ejb-jar.xml
    weblogic-cmp-jar.xml
    foo.class
    fooBean.class

For more information see, Section 4.11.1, "Packaging EJBs in a JAR."

4.2.2 Directory Structure for Packaging a WAR

EJBs can also be packaged directly in a web application module (WAR) by putting the EJB classes in a subdirectory named WEB-INF/classes or in a JAR file within WEB-INF/lib directory. Optionally, if you are also using the EJB deployment descriptor, you can package it as WEB-INF.ejb-jar.xml.

Example 4–2 Directory Structure for Packaging a WAR

myEJBwar/
  WEB-INF/
    ejb-jar.xml
    weblogic.xml
    weblogic-ejb-jar.xml
    /classes
      foo.class
      fooServlet.class
      fooBean.class

Note: EJB 2.1 Entity Beans and EJB 1.1 Entity Beans are not supported within WAR files. These component types must only be packaged in a stand-alone ejb-jar file or an ejb-jar file packaged within an EAR file.

For more information see, Section 4.11.2, "Packaging an EJB In a WAR."

4.3 Program the Annotated EJB Class

The EJB bean class is the main EJB programming artifact. It implements the EJB business interface and contains the EJB metadata annotations that specify semantics and requirements to the EJB container, request container services, and provide structural and configuration information to the application deployer or the container runtime.

In the 3.1 programming model, there is only one required annotation: either @javax.ejb.Stateful, @javax.ejb.Stateless, or @javax.ejb.MessageDriven to specify the type of EJB. Although there are many other annotations you can use to
further configure your EJB, these annotations have typical default values so that you are not required to explicitly use the annotation in your bean class unless you want it to behave other than in the default manner. This programming model makes it very easy to program an EJB that exhibits typical behavior.

For additional details and examples of programming the bean class, see Chapter 5, "Programming the Annotated EJB Class."

4.4 Program the EJB Interface

Clients access enterprise beans either through a no-interface view or through a business interface.

4.4.1 Accessing EJ Bs Using the No-Interface Client View

The EJB 3.1 No-interface local client view type simplifies EJB development by providing local session bean access without requiring a separate local business interface, allowing components to have EJB bean class instances directly injected. The no-interface view has the same behavior as the EJB 3.0 local view. For example, it supports features such as pass-by-reference calling semantics and transaction, and security propagation. However, a no-interface view does not require a separate interface. That is, all public methods of the bean class are automatically exposed to the caller. By default, any session bean that has an empty implements clause and does not define any other local or remote client views, exposes a no-interface client view.

There is a code example of a no-interface client view in Section 3.1.1, "Example of a Simple No-interface Stateless EJB." There is also an example of using the no-interface client view bundled in the WebLogic Server distribution kit. See Section 3.2.4, "EJB 3.1: Example of Simplified No-interface Programming and Packaging in a WAR File."

For more detailed information about the implementing the no-interface client view, see "Accessing Local Enterprise Beans Using the No-Interface View" in the "Enterprise Beans" chapter of the Java EE 6 Tutorial at http://docs.oracle.com/javaee/6/tutorial/doc/gipjg.html.

4.4.2 Accessing EJ Bs Using the Business Interface

The EJB 3.1 business interface is a plain Java interface that describes the full signature of all the business methods of the EJB. For example, assume an Account EJB represents a client's checking account; its business interface might include three methods (withdraw, deposit, and balance) that clients can use to manage their bank accounts.

The business interface can extend other interfaces. In the case of message-driven beans, the business interface is typically the message-listener interface that is determined by the messaging type used by the bean, such as javax.jms.MessageListener in the case of JMS. The interface for a session bean has not such defining type; it can be anything that suits your business needs.

---

**Note:** The only requirement for an EJB 3.1 business interface is that it must not extend javax.ejb.EJBObject or javax.ejb.EJBLocalObject, as required in EJB 2.x.

See Section 3.1.2, "Example of a Simple Business Interface Stateless EJB" and Section 3.1.3, "Example of a Simple Stateful EJB" for examples of business interfaces implemented by stateless and stateful session beans.
For additional details and examples of specifying the business interface, see Chapter 5.3.2, "Specifying the Business and Other Interfaces."

### 4.4.2.1 Business Interface Application Exceptions

When you design the business methods of your EJB, you can define an application exception in the `throws` clause of a method of the EJB's business interface. An *application exception* is an exception that you program in your bean class to alert a client of abnormal application-level conditions. For example, a `withdraw()` method in an `Account` EJB that represents a bank checking account might throw an application exception if the client tries to withdraw more money than is available in their account.

Application exceptions are different from *system exceptions*, which are thrown by the EJB container to alert the client of a system-level exception, such as the unavailability of a database management system. You should not report system-level errors in your application exceptions.

Finally, your business methods should not throw the `java.rmi.RemoteException`, even if the interface is a remote business interface, the bean class is annotated with the `@WebService` JWS annotation, or the method is annotated with `@WebMethod`. The only exception is if the business interface extends `java.rmi.Remote`. If the EJB container encounters problems at the protocol level, the container throws an `EJBException` which wraps the underlying `RemoteException`.

#### Note:
The `@WebService` and `@WebMethod` annotations are in the `javax.jws` package; you use them to specify that your EJB implements a Web Service and that the EJB business will be exposed as public Web Service operations. For details about these annotations and programming Web Services in general, see *Developing JAX-WS Web Services for Oracle WebLogic Server*.

### 4.4.2.2 Using Generics in EJBs

The EJB 3.1 programming model supports the use of generics in the business interface at the class level.

Oracle recommends as a best practice that you first define a super-interface that uses the generics, and then have the actual business interface extend this super-interface with a specific data type.

The following example shows how to do this. First, program the super-interface that uses generics:

```java
public interface RootI<T> {
    public T getObject();
    public void updateObject(T object);
}
```

Then program the actual business interface to extend `RootI<T>` for a particular data type:

```java
@Remote
public interface StatelessI extends RootI<String> { }
```

Finally, program the actual stateless session bean to implement the business interface; use the specified data type, in this case `String`, in the implementation of the methods:

```java
@Stateless
public class StatelessSample implements StatelessI {
    public String getObject() {
```
If you define the type variables on the business interface or class, they will be erased. In this case, the EJB application can be deployed successfully only when the bean class parameterizes the business interface with upper bounds of the type parameter and no other generic information. For example, in the following example, the upper bound is `Object`:

```java
class StatelessSample implements StatelessI<Object> {
    public Object getObject() {
        return null;
    }
    public void updateObject(Object object) {
    }
}
```

### 4.4.2.3 Serializing and Deserializing Business Objects
Business object serialization and deserialization are supported by the following interfaces, which are implemented by all business objects:

- `weblogic.ejb.spi.BusinessObject`
- `weblogic.ejb.spi.BusinessHandle`

Use the `BusinessObject._WL_getBusinessObjectHandle()` method to get the business handle object and serialize the business handle object.

To deserialize a business object, deserialize the business handle object and use the `BusinessHandle.getBusinessObject()` method to get the business object.

### 4.5 Optionally Program Interceptors
An interceptor is a method that intercepts the invocation of a business method or a life cycle callback event.

You can define an interceptor method within the actual bean class, or you can program an interceptor class (distinct from the bean class itself) and associate it with the bean class using the `@javax.ejb.Interceptor` annotation.

See Section 5.3.6, "Specifying Interceptors for Business Methods or Life Cycle Callback Events" for information on programming the bean class to use interceptors.

### 4.6 Optionally Program the EJB Timer Service
WebLogic Server supports the EJB timer service defined in the EJB 3.1 Specification. As per the EJB 3.1 "specification, the EJB Timer Service is a "container-managed service that allows callbacks to be scheduled for time-based events. The container provides a reliable and transactional notification service for timed events. Timer notifications may be scheduled to occur according to a calendar-based schedule, at a specific time, after a specific elapsed duration, or at specific recurring intervals."

The Timer Service is implemented by the EJB container. An enterprise bean accesses this service by means of dependency injection, through the `EJBContext` interface, or through lookup in the JNDI namespace.
The Timer Service is intended to be used as a coarse-grained timer service. Rather than having a large number of timer objects performing the same task on a unique set of data, Oracle recommends using a small number of timers that perform bulk tasks on the data. For example, assume you have an EJB that represents an employee’s expense report. Each expense report must be approved by a manager before it can be processed. You could use one EJB timer to periodically inspect all pending expense reports and send an email to the corresponding manager to remind them to either approve or reject the reports that are waiting for their approval.

### 4.6.1 Overview of the Timer Service

The timer service provides methods for the programmatic creation and cancellation of timers, as well as for locating the timers that are associated with a bean. Timers can also be created automatically by the container at deployment time based on metadata in the bean class or in the deployment descriptor. Timer objects can be created for stateless session beans, singleton session beans, message-driven beans, and 2.1 entity beans. Timers cannot be created for stateful session beans.

**Note:** The calendar-based timer, automatically-created timers, and non-persistent timer functionality is not supported for 2.1 Entity beans.

A timer is created to schedule timed callbacks. The bean class of an enterprise bean that uses the timer service must provide one or more timeout callback methods, as follows:

- **Programmatic Timers** – For programmatically-created timers, this method may be a method that is annotated with the `Timeout` annotation, or the bean may implement the `javax.ejb.TimedObject` interface. The `javax.ejb.TimedObject` interface has a single method, the timer callback method `ejbTimeout`.

- **Automatic Timers** – For automatically-created timers, the timeout method may be a method that is annotated with the `Schedule` annotation.

- **2.1 Entity Bean Timers** – A timer that is created for a 2.1 entity bean is associated with the entity bean’s identity. The timeout callback method invocation for a timer that is created for a stateless session bean or a message-driven bean may be called on any bean instance in the pooled state.

### 4.6.2 Calendar-based EJB Timers

The EJB 31. Timer Service supports calendar-based EJB Timer expressions. The scheduling functionality takes the form of CRON-styled schedule definitions that can be placed on EJB methods, in order to have the methods be automatically invoked according to the defined schedule.

**Note:** Calendar-based timers are not supported for EJB 2.x entity beans.

Calendar-based timers can be created programmatically using the two methods in the `javax.ejb.TimerService` that accept a `javax.ejb.ScheduleExpression` as an argument. The `ScheduleExpression` is constructed and populated prior to creating the Timer. For creating automatic calendar-base timers, the `javax.ejb.Schedule`
For detailed information about the seven attributes in a calendar-based time expression, see "Section 18.2.1, Calendar Based Timer Expressions" in the Enterprise JavaBeans 3.1 Specification (JSR-318) at http://jcp.org/en/jsr/summary?id=318.

## 4.6.3 Automatically-created EJB Timers

The EJB 3.1 Timer Service supports the automatic creation of a timer based on metadata in the bean class or deployment descriptor. This allows the bean developer to schedule a timer without relying on a bean invocation to programmatically invoke one of the Timer Service timer creation methods. Automatically created timers are created by the container as a result of application deployment.

The `javax.ejb.Schedule` annotation can be used to automatically create a timer with a particular timeout schedule. This annotation is applied to a method of a bean class (or super-class) that should receive the timer callbacks associated with that schedule. Multiple automatic timers can be applied to a single timeout callback method using the `javax.ejb.Schedules` annotation.

When the clustered EJB Timer implementation is used, each `Schedule` annotation corresponds to a single persistent timer, regardless of the number of servers across which the EJB is deployed.

## 4.6.4 Non-persistent Timers

By default, EJB timers are persistent. A non-persistent timer is a timer whose lifetime is tied to the JVM in which it is created. A non-persistent timer is considered canceled in the event of application shutdown, container crash, or a failure/shutdown of the JVM on which the timer was started.

**Note:** Non-persistent timers are not supported for EJB 2.x Entity Beans.

Non-persistent timers can be created programmatically or automatically (using `@Schedule` or the deployment descriptor).

Automatic non-persistent timers can be specified by setting the persistent attribute of the `@Schedule` annotation to false. For automatic non-persistent timers, the container creates a new non-persistent timer during application initialization for each JVM across which the container is distributed.

## 4.6.5 Clustered Versus Local EJB Timer Services

You can configure two types of EJB timer services: clustered or local.

### 4.6.5.1 Clustered EJB Timer Services

Clustered EJB timer services provide the following advantages:

- **Better visibility.**

  Timers are accessible from any node in a cluster. For example, the `javax.ejb.TimerService.getTimers()` method returns a complete list of all stateless session or message-driven bean timers in a cluster that were created for the EJB. If you pass the primary key of the entity bean to the `getTimers()` method, a list of timers for that entity bean are returned.
- Automatic load balancing and failover.

Clustered EJB timer services take advantage of the load balancing and failover capabilities of the Job Scheduler.

For information about configuring a clustered EJB timer service, see Section 4.6.6, "Configuring Clustered EJB Timers."

### 4.6.5.2 Local EJB Timer Services

Local EJB timer services execute only on the server on which they are created and are visible only to the beans on that server. With a local EJB timer service, you do not have to configure a cluster, database, JDBC data source, or leasing service, as you do for clustered EJB timer services.

You cannot migrate a local EJB timer object from one server to another; timer objects can only be migrated as part of an entire server. If a server that contains EJB timers goes down for any reason, you must restart the server or migrate the entire server in order for the timers to execute.

---

**Caution:** In a clustered environment, the local timer implementation has severe limitations; therefore Oracle recommends not using local timers in a clustered environment. Instead, use the clustered timer implementation in a clustered environment. A deployment-time warning will be thrown when a local timer implementation is configured to be used in a clustered environment.

---

### 4.6.6 Configuring Clustered EJB Timers

**Note:** To review the advantages of using clustered EJB timers, see Section 4.6.5, "Clustered Versus Local EJB Timer Services."

To configure the clustering of EJB timers, perform the following steps:

1. Ensure that you have configured the following:
   - A clustered domain. For more information, see "Setting up WebLogic Clusters" in *Administering Clusters for Oracle WebLogic Server*.
   - Features of the Job Scheduler, including:
     - HA database, such as Oracle, DB2, Informix, MySQL, Sybase, or MSSQL.
     - JDBC data source that is mapped to the HA database using the `<data-source-for-job-scheduler>` element in the `config.xml` file.
     - Leasing service. By default, database leasing will be used and the JDBC data source defined by the `<data-source-for-job-scheduler>` element in the `config.xml` file will be used.
   
   For more information about configuring the Job Scheduler, see "The Timer and Work Manager API" in *Developing CommonJ Applications for Oracle WebLogic Server*.

2. To enable the clustered EJB timer service, set the `timer-implementation` element in the `weblogic-ejb-jar.xml` deployment descriptor to `Clustered`:

```xml
<timer-implementation>Clustered</timer-implementation>
```
For more information, see the "timer-implementation" element description in the "weblogic-ejb-jar.xml Deployment Descriptor Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

Please note the following changes in the behavior of the clustered EJB timer service:

- The weblogic.ejb.WLTimer* interfaces are not supported with clustered EJB timer services.
- When creating a new clustered EJB timer using the createTimer() method, you may notice a delay in timeout execution during the initial setup of the timer.
- The Job Scheduler provides an "at least once" execution guarantee. When a clustered EJB timer expires, the database is not updated until the timer listener callback method completes. If the server were to crash before the database is updated, the timer expiration would be executed twice.
- Timer configuration options related to the actions to take in the event of failure are not valid for the clustered EJB timer service. These configuration options include: retry delay, maximum number of retry attempts, maximum number of time-outs, and time-out failure actions.
- The Job Scheduler queries the database every 30 seconds to identify timers that are due to expire. Execution may be delayed for timers with an interval duration less than 30 seconds.
- Only transactional timers will be retried in the event of failure.
- Fixed rate scheduling of timer execution is not supported.

4.6.7 Using Java Programming Interfaces to Program Timer Objects

This section summarizes the Java programming interfaces defined in the EJB 3.1 Specification that you can use to program timers. For detailed information on these interfaces, refer to the EJB 3.1 Specification. This section also provides details about the WebLogic Server-specific timer-related interfaces.

4.6.7.1 EJB 3.1 Timer-related Programming Interfaces

EJB 3.1 interfaces you can use to program timers are described in the following table.

<table>
<thead>
<tr>
<th>Programming Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>javax.ejb.ScheduleExpression</td>
<td>Create calendar-based EJB Timer expressions.</td>
</tr>
<tr>
<td>javax.ejb.Schedule</td>
<td>Automatically create a timer with a particular timeout schedule. Multiple automatic timers can be applied to a single timeout callback method using the javax.ejb.Schedules annotation.</td>
</tr>
<tr>
<td>javax.ejb.TimedObject</td>
<td>Implement for the enterprise bean class of a bean that will be registered with the timer service for timer callbacks. This interface has a single method, ejbTimeout.</td>
</tr>
<tr>
<td>EJBContext</td>
<td>Access the timer service using the getTimerService method.</td>
</tr>
<tr>
<td>javax.ejb.TimerService</td>
<td>Create new EJB timers or access existing EJB timers for the EJB.</td>
</tr>
<tr>
<td>javax.ejb.Timer</td>
<td>Access information about a particular EJB timer.</td>
</tr>
</tbody>
</table>
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Optionally Program the EJB Timer Service

For more information on EJB 2.1 timer-related programming interfaces, see the EJB 2.1 Specification.

### 4.6.7.2 WebLogic Server-specific Timer-related Programming Interfaces

WebLogic Server-specific interfaces you can use to program timers include:

- `weblogic.management.runtime.EJBTimerRuntimeMBean`—provides runtime information and administrative functionality for timers from a particular `EJBHome`. The `weblogic.management.runtime.EJBTimerRuntimeMBean` interface is shown in Example 4–3.

Example 4–3   `weblogic.management.runtime.EJBTimerRuntimeMBean` Interface

```java
public interface weblogic.management.runtime.EJBTimerRuntimeMBean {
    public int getTimeoutCount(); // get the number of successful timeout notifications that have been made
    public int getActiveTimerCount(); // get the number of active timers for this EJBHome
    public int getCancelledTimerCount(); // get the number of timers that have been cancelled for this EJBHome
    public int getDisabledTimerCount(); // get the number of timers temporarily disabled for this EJBHome
    public void activateDisabledTimers(); // activate any temporarily disabled timers
}
```

- `weblogic.ejb.WLTimerService` interface—extends the `javax.ejb.TimerService` interface to allow users to specify WebLogic Server-specific configuration information for a timer. The `weblogic.ejb.WLTimerService` interface is shown in Example 4–4; for information on the `javax.ejb.TimerService`, see the EJB 2.1 Specification.

Example 4–4   `weblogic.ejb.WLTimerService` Interface

```java
public interface WLTimerService extends TimerService {
    public Timer createTimer(Date initial, long duration, Serializable info, WLTimerInfo wlTimerInfo)
        throws IllegalArgumentException, IllegalStateException, EJBException;
    public Timer createTimer(Date expiration, Serializable info, WLTimerInfo wlTimerInfo)
        throws IllegalArgumentException, IllegalStateException, EJBException;
    public Timer createTimer(long initial, long duration, Serializable info, WLTimerInfo wlTimerInfo)
        throws IllegalArgumentException, IllegalStateException, EJBException;
    public Timer createTimer(long duration, Serializable info, WLTimerInfo wlTimerInfo)
        throws IllegalArgumentException, IllegalStateException, EJBException;
}
```

Note: The `weblogic.ejb.WLTimerService` interface is not supported by the clustered EJB timer service, as described in Section 4.6.6, "Configuring Clustered EJB Timers."

### Table 4–2 (Cont.) EJB 3.1 Timer-related Programming Interfaces

<table>
<thead>
<tr>
<th>Programming Interface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>javax.ejb.TimerHandle</code></td>
<td>Define a serializable timer handle that can be persisted. Since timers are local objects, a <code>TimerHandle</code> must not be passed through a bean's remote interface or Web service interface.</td>
</tr>
</tbody>
</table>

For more information on EJB 3.1 timer-related programming interfaces, see the EJB 3.1 Specification.
weblogic.ejb.WLTimerInfo interface—used in the weblogic.ejb.WLTimerService interface to pass WebLogic Server-specific configuration information for a timer. The weblogic.ejb.WLTimerInfo method is shown in Example 4–5.

Note: The weblogic.ejb.WLTimerService interface is not supported by the clustered EJB timer service, as described in Section 4.6.6, “Configuring Clustered EJB Timers.”

Example 4–5  weblogic.ejb.WLTimerInfo Interface

```java
public final interface WLTimerInfo {
    public static int REMOVE_TIMER_ACTION  = 1;
    public static int DISABLE_TIMER_ACTION = 2;
    public static int SKIP_TIMEOUT_ACTION  = 3;
    /**
     * Sets the maximum number of retry attempts that will be
     * performed for this timer. If all retry attempts
     * are unsuccessful, the timeout failure action will
     * be executed.
     */
    public void setMaxRetryAttempts(int retries);
    public int getMaxRetryAttempts();
    /**
     * Sets the number of milliseconds that should elapse
     * before any retry attempts are made.
     */
    public void setRetryDelay(long millis);
    public long getRetryDelay();
    /**
     * Sets the maximum number of timeouts that can occur
     * for this timer. After the specified number of
     * timeouts have occurred successfully, the timer
     * will be removed.
     */
    public void setMaxTimeouts(int max);
    public int getMaxTimeouts();
    /**
     * Sets the action the container will take when ejbTimeout
     * and all retry attempts fail. The REMOVE_TIMER_ACTION,
     * DISABLE_TIMER_ACTION, and SKIP_TIMEOUT_ACTION fields
     * of this interface define the possible values.
     */
    public void setTimeoutFailureAction(int action);
    public int getTimeoutFailureAction();
}
```

weblogic.ejb.WLTimer interface—extends the javax.ejb.Timer interface to provide additional information about the current state of the timer. The weblogic.ejb.WLTimer interface is shown in Example 4–6.

Note: The weblogic.ejb.WLTimerService interface is not supported by the clustered EJB timer service, as described in Section 4.6.6, “Configuring Clustered EJB Timers.”
Example 4-6  weblogic.ejb.WLTimer Interface

public interface WLTimer extends Timer {
    public int getRetryAttemptCount();
    public int getMaximumRetryAttempts();
    public int getCompletedTimeoutCount();
}

4.7 Programming Access to EJB Clients

This section provides some guidelines in determining the client view to provide for accessing an enterprise bean.

4.7.1 Remote Clients

As stated in the EJB 3.1 specification, a remote client accesses a session bean through the bean’s remote business interface. For a session bean client and component written to the EJB 2.1 and earlier APIs, the remote client accesses the session bean through the session bean’s remote home and remote component interfaces.

---

**Note:** The EJB 2.1 and earlier API required that a remote client access the stateful or stateless session bean by means of the session bean’s remote home and remote component interfaces. These interfaces remain available for use with EJB 3.x, and are described in "Create EJB Classes and Interfaces" in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

---

The remote client view of an enterprise bean is location independent. A client running in the same JVM as a bean instance uses the same API to access the bean as a client running in a different JVM on the same or different machine.

4.7.2 Local Clients

As stated in the EJB 3.1 specification, a local client accesses a session bean through the bean’s local business interface or through a no-interface client view representing all the public methods of the bean class. For a session bean or entity bean client and component written to the EJB 2.1 and earlier APIs, the local client accesses the enterprise bean through the bean’s local home and local component interfaces. The container object that implements a local business interface or the no-interface local view is a local Java object.

A local client is a client that is collocated in the same application with the session bean that provides the local client view and which may be tightly coupled to the bean. A local client of a session bean may be another enterprise bean or a Web component. Access to an enterprise bean through the local client view requires the collocation in the same application of both the local client and the enterprise bean that provides the local client view. The local client view therefore does not provide the location transparency provided by the remote client view.

4.7.3 Looking Up EJBs From Clients

The client of an enterprise bean obtains a reference to an instance of an enterprise bean through either dependency injection, using Java programming language annotations,
or JNDI lookup, using the Java Naming and Directory Interface syntax to find the enterprise bean instance.

---

**Note:** For instructions on how clients can look up 2.x or earlier enterprise beans using EJB Links, see “Using EJB Links” in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.*

---

### 4.7.3.1 Using Dependency Injection

*Dependency injection* is when the EJB container automatically supplies (or injects) a bean’s variable or setter method with a reference to a resource or another environment entry in the bean’s context. Dependency injection is simply an easier-to-program alternative to using the `javax.ejb.EJBContext` interface or JNDI APIs to look up resources.

You specify dependency injection by annotating a variable or setter method with one of the following annotations, depending on the type of resource you want to inject:

- `@javax.ejb.EJB`—Specifies a dependency on another EJB.
- `@javax.annotation.Resource`—Specifies a dependency on an external resource, such as a JDBC datasource or a JMS destination or connection factory.

For detailed information, see Section 5.3.4, “Injecting Resource Dependency into a Variable or Setter Method.”

### 4.7.3.2 Using the JNDI Portable Syntax

The Portable Global JNDI naming option in EJB 3.1 provides a number of common, well-known namespaces in which EJB components can be registered and looked up from using the patterns listed in this section. This standardizes how and where EJB components are registered in JNDI, and how they can be looked up and used by applications.

Three JNDI namespaces are used for portable JNDI lookups: `java:global`, `java:module`, and `java:app`.

- The `java:global` JNDI namespace is the portable way of finding remote enterprise beans using JNDI lookups. JNDI addresses are of the following form:

  ```
  java:global[/application name]/module name/enterprise bean name[/interface name]
  ```

  Application name and module name default to the name of the application and module minus the file extension. Application names are required only if the application is packaged within an EAR. The interface name is required only if the enterprise bean implements more than one business interface.

- The `java:module` namespace is used to look up local enterprise beans within the same module. JNDI addresses using the `java:module` namespace are of the following form:

  ```
  java:module/enterprise bean name[/interface name]
  ```

  The interface name is required only if the enterprise bean implements more than one business interface.

- The `java:app` namespace is used to look up local enterprise beans packaged within the same application. That is, the enterprise bean is packaged within an EAR file containing multiple Java EE modules. JNDI addresses using the `java:app` namespace are of the following form:
java:app[/module name]/enterprise bean name[/interface name]

The module name is optional. The interface name is required only if the enterprise bean implements more than one business interface.

For example, if an enterprise bean, MyBean, is packaged within the Web application archive myApp.war, the default module name is myApp. (In this example, the module name could be explicitly configured in the web.xml file.) The portable JNDI name is java:module/MyBean. An equivalent JNDI name using the java:global namespace is java:global/myApp/MyBean.

### 4.7.3.3 Customizing JNDI Names

Though global JNDI bindings are registered by default, you can also customize the JNDI names of your EJB client view bindings by using the `weblogic.javaee.JNDIName` and `weblogic.javaee.JNDINames` annotations. For more information, see Section A.7.7, "weblogic.javaee.JNDIName" and Section A.7.8, "weblogic.javaee.JNDINames."

For EJBs using deployment descriptors, you can specify the custom JNDI bindings in the `weblogic-ejb-jar.xml` deployment descriptor by using the `jndi-binding` element. For more information, see "EJB Deployment Descriptors" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

### 4.7.4 Configuring EJBs to Send Requests to a URL

To enable an EJB to open an `HttpURLConnection` to an external HTTP server using the `java.net.URL` resource manager connection factory type, specify the URL, or specify an object bound in the JNDI tree that maps to a URL, using either the `@Resource` annotation in the bean class, or if using deployment descriptors, by using the `resource-ref` element in `ejb-jar.xml` and the `res-ref-name` element in `weblogic-ejb-jar.xml`.

### 4.7.5 Specifying an HTTP Resource by URL

When using annotations to specify the URL to which an EJB sends requests:

1. Annotate a URL field in your bean class with `@Resource`.
2. Specify the URL value using the look-up element of `@Resource`.

When using deployment descriptors to specify the URL to which an EJB sends requests:

1. In `ejb-jar.xml`, specify the URL in the `<jndi-name>` element of the `resource-ref` element.
2. In `weblogic-ejb-jar.xml`, specify the URL in the `<jndi-name>` element of the `resource-description` element:

   ```xml
   <resource-description>
     <res-ref-name>url/MyURL</res-ref-name>
     <jndi-name>http://www.rediff.com/</jndi-name>
   </resource-description>
   ```

WebLogic Server creates a URL object with the `jndi-name` provided and binds the object to the `java:comp/env`. 
4.7.6 Specifying an HTTP Resource by Its JNDI Name

When using annotations to specify an object that is bound in JNDI and maps to a URL, instead of specifying a URL:

1. Annotate a URL field in your bean class with @Resource.
2. Specify the name by which the URL is bound in JNDI using the look-up element of @Resource.

When using deployment descriptors to specify an object that is bound in JNDI and maps to a URL, instead of specifying a URL:

1. In ejb-jar.xml, specify the name by which the URL is bound in JNDI in the <jndi-name> element of the resource-ref element.
2. In weblogic-ejb-jar.xml, specify the name by which the URL is bound in JNDI in the <jndi-name> element of the resource-description element:

   ```xml
   <resource-description>
     <res-ref-name>url/MyURL1</res-ref-name>
     <jndi-name>firstName</jndi-name>
   </resource-description>
   ```

   where firstName is the object bound to the JNDI tree that maps to the URL. This binding could be done in a startup class. When jndi-name is not a valid URL, WebLogic Server treats it as an object that maps to a URL and is already bound in the JNDI tree, and binds a LinkRef with that jndi-name.

4.7.7 Accessing HTTP Resources from Bean Code

Regardless of how you specified an HTTP resource—by its URL or a JNDI name that maps to the URL—you can access it from EJB code in this way:

```java
URL url = (URL) context.lookup("java:comp/env/url/MyURL");
connection = (HttpURLConnection)url.openConnection();
```

4.7.8 Configuring Network Communications for an EJB

You can control the attributes of the network connection an EJB uses for communications by configuring a custom network channel and assigning it to the EJB. For information about WebLogic Server network channels and associated configuration instructions see "Configure Network Resources" in Administering Server Environments for Oracle WebLogic Server. After you configure a custom channel, assign it to an EJB using the network-access-point element in weblogic-ejb-jar.xml.

4.8 Programming and Configuring Transactions

The following sections contain guidelines for programming transactions.

4.8.1 Programming Container-Managed Transactions

Container-managed transactions are simpler to program than bean-managed transactions, because they leave the job of demarcation—starting and stopping the transaction—to the EJB container. You configure the desired transaction behaviors using EJB annotations javax.ejb.TransactionAttribute or by using EJB deployment descriptors ejb-jar.xml and weblogic-ejb-jar.xml.
Key programming guidelines for container-managed transactions include:

- Preserve transaction boundaries—Do not invoke methods that interfere with the transaction boundaries set by the container. Do not use:
  - The commit, setAutoCommit, and rollback methods of java.sql.Connection
  - The getUserTransaction method of javax.ejb.EJBContext
  - Any method of javax.transaction.UserTransaction

- Roll back transactions explicitly—To cause the container to roll back a container-managed transaction explicitly, invoke the setRollbackOnly method of the EJBContext interface. (If the bean throws a non-application exception, typically an EJBException, the rollback is automatic.)

- Avoid serialization problems—Many data stores provide limited support for detecting serialization problems, even for a single user connection. In such cases, even with transaction-isolation in weblogic-ejb-jar.xml set to TransactionSerializable, exceptions or rollbacks in the EJB client might occur if contention occurs between clients for the same rows. To avoid such exceptions, you can:
  - Include code in your client application to catch SQL exceptions, and resolve them appropriately; for example, by restarting the transaction.
  - For Oracle databases, use the transaction isolation settings described in "isolation-level" in the "weblogic-ejb-jar.xml Deployment Descriptor Reference" appendix in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

4.8.2 Configuring Automatic Retry of Container-Managed Transactions

In Oracle WebLogic Server, you can specify that, if a business method that has started a transaction fails because of a transaction rollback that is not related to a system exception, the EJB container will start a new transaction and retry the failed method up to a specified number of times. If the method fails for the specified number of retry attempts, the EJB container throws an exception.

---

Note: The EJB container does not retry any transactions that fail because of system exception-based errors.

---

To configure automatic retry of container-managed transactions:

1. Make sure your bean is a container-managed session or entity bean.

You can configure automatic retry of container-managed transactions for container-managed session and entity beans only. You cannot configure automatic retry of container-managed transactions for message-driven beans because MDBs do not acknowledge receipt of a message they are processing when the transaction that brackets the receipt of the message is rolled back; messages are automatically retried until they are acknowledged. You also cannot configure automatic retry of
container-managed transactions for timer beans because, when a timer bean’s 
ejbTimeout method starts and is rolled back, the timeout is always retried.

2. Make sure the business methods for which you want to configure automatic retry 
of transactions are defined in the bean’s remote or local interface or as home 
methods (local home business logic that is not specific to a particular bean 
instance) in the home interface; the methods must have one of the following 
container-managed transaction attributes:

   – RequiresNew. If a method’s transaction attribute (trans-attribute element in 
ejb-jar.xml) is RequiresNew, a new transaction is always started prior to the 
invocation of the method and, if configured, automatic retry of transactions 
occurs if the transaction fails.

   – Required. If a method’s transaction attribute (trans-attribute element in 
ejb-jar.xml) is Required, the method is retried with a new transaction only if 
the failed transaction was begun on behalf of the method.

For more information on:

   – Programming interfaces, see Section 4.7, "Programming Access to EJB Clients."

   – The trans-attribute element in ejb-jar.xml, see "Container-Managed 
Transaction Elements" in Developing Enterprise JavaBeans, Version 2.1, for Oracle 
WebLogic Server, which provides detailed information about creating and 
editing EJB deployment descriptors.

3. Make sure the methods for which you want to enable automatic retry of 
transactions are safe to be re-invoked. A retry of a failed method must yield results 
that are identical to the results the previous attempt, had it been successful, would 
have yielded. In particular:

   – If invoking a method initiates a call chain, it must be safe to re-invoke the 
entire call chain when the method is retried.

   – All of the method’s parameters must be safe for reuse; when a method is 
retried, it is retried with the same parameters that were used to invoke the 
failed attempt. In general, parameters that are primitives, immutable objects, 
or are references to read-only objects are safe for reuse. If a parameter is a 
reference to an object that is to be modified by the method, re-invoking the 
method must not negatively affect the result of the method call.

   – If the bean that contains the method that is being retried is a stateful session 
bean, the bean’s conversational state must be safe to re-invoke. Since a stateful 
session bean’s state is not transactional and is not restored during a transaction 
rollback, in order to use the automatic retry of transactions feature, you must 
first be sure the bean’s state is still valid after a rollback.

4. Specify the methods for which you want the EJB container to automatically retry 
transactions and the number of retry attempts you want the EJB container to make 
in the retry-methods-on-rollback element in weblogic-ejb-jar.xml. 

The retry-count sub-element to retry-methods-on-rollback can also be modified 
via the WebLogic Server Administration Console.

### 4.8.3 Programming Bean-Managed Transactions

This section contains programming considerations for bean-managed transactions.

- Demarcate transaction boundaries—To define transaction boundaries in EJB or 
client code, you must obtain a UserTransaction object and begin a transaction
before you obtain a Java Transaction Service (JTS) or JDBC database connection. To obtain the UserTransaction object, use this command:

ctx.lookup("javax.transaction.UserTransaction");

After obtaining the UserTransaction object, specify transaction boundaries with tx.begin(), tx.commit(), tx.rollback().

If you start a transaction after obtaining a database connection, the connection has no relationship to the new transaction, and there are no semantics to “enlist” the connection in a subsequent transaction context. If a JTS connection is not associated with a transaction context, it operates similarly to a standard JDBC connection that has autocommit equal to true, and updates are automatically committed to the data store.

Once you create a database connection within a transaction context, that connection is reserved until the transaction commits or rolls back. To optimize performance and throughput, ensure that transactions complete quickly, so that the database connection can be released and made available to other client requests.

**Note:** You can associate only a single database connection with an active transaction context.

---

- Setting transaction isolation level—For bean-managed transactions, you define isolation level in the bean code. Allowable isolation levels are defined on the java.sql.Connection interface. For information on isolation level behaviors, see "isolation-level" in the "weblogic-ejb-jar.xml Deployment Descriptor Reference" appendix in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*. See Example 4–7 for a code sample.

**Example 4–7 Setting Transaction Isolation Level in BMT**

```java
import javax.transaction.Transaction;
import java.sql.Connection
import weblogic.transaction.TxHelper;
import weblogic.transaction.Transaction;
import weblogic.transaction.TxConstants;
User Transaction tx = (UserTransaction)
ctx.lookup("javax.transaction.UserTransaction");
//Begin user transaction
tx.begin();
//Set transaction isolation level to TransactionReadCommitted
Transaction tx = TxHelper.getTransaction();
    tx.setProperty (TxConstants.ISOLATION_LEVEL, new Integer
            (Connection.TransactionReadCommitted));
//perform transaction work
    tx.commit();
```

- Avoid restricted methods—Do not invoke the getRollbackOnly and setRollbackOnly methods of the EJBCContext interface in bean-managed transactions. These methods should be used only in container-managed transactions. For bean-managed transactions, invoke the getStatus and rollback methods of the UserTransaction interface.

- Use one connection per active transaction context—You can associate only a single database connection with an active transaction context.
4.8.4 Programming Transactions That Are Distributed Across EJBs

This section describes two approaches for distributing a transaction across multiple beans, which may reside on multiple server instances.

4.8.4.1 Calling multiple EJBs from a client's transaction context

The code fragment below is from a client application that obtains a UserTransaction object and uses it to begin and commit a transaction. The client invokes two EJBs within the context of the transaction.

```java
import javax.transaction.*;
...
u = (UserTransaction) jndiContext.lookup("javax.transaction.UserTransaction");
u.begin();
account1.withdraw(100);
account2.deposit(100);
u.commit();
...
```

The updates performed by the account1 and account2 beans occur within the context of a single UserTransaction. The EJBs commit or roll back together, as a logical unit, whether the beans reside on the same server instance, different server instances, or a WebLogic Server cluster.

All EJBs called from a single transaction context must support the client transaction—each beans' trans-attribute element in ejb-jar.xml must be set to Required, Supports, or Mandatory.

4.8.4.2 Using an EJB "Wrapper" to Encapsulate a Cross-EJB Transaction

You can use a "wrapper" EJB that encapsulates a transaction. The client calls the wrapper EJB to perform an action such as a bank transfer, and the wrapper starts a new transaction and invokes one or more EJBs to do the work of the transaction.

The wrapper EJB can explicitly obtain a transaction context before invoking other EJBs, or WebLogic Server can automatically create a new transaction context, if the wrapper's trans-attribute element in ejb-jar.xml is set to Required or RequiresNew.

All EJBs invoked by the wrapper EJB must support the wrapper EJB's transaction context— their trans-attribute elements must be set to Required, Supports, or Mandatory.

4.9 Compile Java Source

Once you have written the Java source code for your EJB bean class and optional interceptor class, you must compile it into class files, typically using the standard Java compiler. The resulting class files can then be packaged into a target module for deployment. Typical tools to compile include:

- `javac` — The javac compiler provided with the Java SE SDK provides Java compilation capabilities. See [http://www.oracle.com/technetwork/java/javase/documentation/index.html](http://www.oracle.com/technetwork/java/javase/documentation/index.html).
- `weblogic.appc` — To reduce deployment time, use the weblogic.appc Java class (or its equivalent Ant task `wlappc`) to pre-compile a deployable archive file, (WAR, JAR, or EAR). Precompiling with weblogic.appc generates certain helper classes and performs validation checks to ensure your application is compliant with the
current Java EE specifications. See "Building Modules and Applications Using wlappc" in Developing Applications for Oracle WebLogic Server.

- **wlcompile** Ant task—Invokes the javac compiler to compile your application's Java components in a split development directory structure. See "Compiling Applications Using wlcompile" in Developing Applications for Oracle WebLogic Server.

### 4.10 Optionally Create and Edit Deployment Descriptors

An important aspect of the EJB 3.x programming model was the introduction of metadata annotations. Annotations simplify the EJB development process by allowing a developer to specify within the Java class itself how the bean behaves in the container, requests for dependency injection, and so on. Annotations are an alternative to deployment descriptors that were required by older versions (2.x and earlier) of EJB. However, EJB 3.x fully supports the use of deployment descriptors, even though the standard Java EE 6 ones are not required. For example, you may prefer to use the old 2.x programming model, or might want to allow further customizing of the EJB at a later development or deployment stage; in these cases you can create the standard deployment descriptors in addition to, or instead of, the metadata annotations.

Deployment descriptor elements always override their annotation counterparts. For example, if you specify the @javax.ejb.TransactionManagement(BEAN) annotation in your bean class, but then create an ejb-jar.xml deployment descriptor for the EJB and set the <transaction-type> element to container, then the deployment descriptor value takes precedence and the EJB uses container-managed transaction demarcation.

---

**Note:** This version of EJB 3.1 also supports all 2.x WebLogic-specific EJB features. However, the features that are configured in the weblogic-ejb-jar.xml or weblogic-cmp-rdbms-jar.xml deployment descriptor files must continue to be configured that way for this release of EJB 3.1 because currently they do not have any annotation equivalent.

---

The 2.x version of Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server provides detailed information about creating and editing EJB deployment descriptors, both the Java EE standard and WebLogic-specific ones. In particular, see the following sections:

- "EJB Deployment Descriptors" (Overview Information)
- "Edit Deployment Descriptors"
- "Deployment Descriptor Schema and Document Type Definitions Reference"
- "weblogic-ejb-jar.xml Deployment Descriptor Reference"
- "weblogic-cmp-jar.xml Deployment Descriptor Reference"

### 4.11 Packaging EJBs

Oracle recommends that you package EJBs as part of an enterprise application. For more information, see "Deploying and Packaging from a Split Development Directory" in Developing Applications for Oracle WebLogic Server.

However, EJB 3.1 simplifies packaging by providing the ability to place EJB components directly inside of Web application archive (WAR) files, removing the need
to produce separate archives to store the Web and EJB components and combine them together in an enterprise application archive (EAR) file.

**4.11.1 Packaging EJBs in a JAR**

WebLogic Server supports the use of *ejb-client.jar* files for packaging the EJB classes that a programmatic client in a different application requires to access the EJB.

Specify the name of the client JAR in the *ejb-client-jar* element of the bean's *ejb-jar.xml* file. When you run the *appc* compiler, a JAR file with the classes required to access the EJB is generated.

Make the client JAR available to the remote client. For Web applications, put the *ejb-client.jar* in the */lib* directory. For non-Web clients, include *ejb-client.jar* in the client's classpath.

**Note:** WebLogic Server classloading behavior varies, depending on whether the client is stand-alone. Stand-alone clients with access to the *ejb-client.jar* can load the necessary classes over the network. However, for security reasons, programmatic clients running in a server instance cannot load classes over the network.

**4.11.2 Packaging an EJB In a WAR**

EJB 3.1 has removed the restriction that enterprise bean classes must be packaged in an *ejb-jar* file. Therefore, EJB classes can be packaged directly inside a Web application archive (WAR) using the same packaging guidelines that apply to Web application classes. Simply put your EJB classes in the *WEB-INF/classes* directory or in a JAR file within *WEB-INF/lib* directory. Optionally, if you are also using the EJB deployment descriptor, you can package it as *WEB-INF/ejb-jar.xml*. When you run the *appc* compiler, a WAR file with the classes required to access the EJB components is generated.

In a WAR file there is a single component naming environment shared between all the components (web, enterprise bean, etc.) defined by the module. Each enterprise bean defined by the WAR file shares this single component environment namespace with all other enterprise beans defined by the WAR file and with all other web components defined by the WAR file.

Enterprise beans (and any related classes) packaged in a WAR file have the same class loading requirements as other non-enterprise bean classes packaged in a WAR file. This means, for example, that a servlet packaged within a WAR file is guaranteed to have visibility to an enterprise bean component packaged within the same WAR file, and vice versa.

**Caution:** EJB 2.1 Entity Beans and EJB 1.1 Entity Beans are not supported within WAR files. These component types must only be packaged in a stand-alone *ejb-jar* file or an *ejb-jar* file packaged within an EAR file. Applications that violate this restriction will fail to deploy.

There is an example of using the simplified WAR packaging method bundled in the WebLogic Server distribution kit. See Section 3.2.4, "EJB 3.1: Example of Simplified No-interface Programming and Packaging in a WAR File."
4.12 Deploying EJBs

Deploying an EJB enables WebLogic Server to serve the components of an EJB to clients. You can deploy an EJB using one of several procedures, depending on your environment and whether or not your EJB is in production.

For general instructions on deploying WebLogic Server applications and modules, including EJBs, see Deploying Applications to Oracle WebLogic Server. For EJB-specific deployment issues and procedures, see Section 6.3.1, “Deploying Standalone EJBs as Part of an Enterprise Application.” and Section 6.3.2, “Deploying EJBs as Part of an Web Application.”

For more information about deploying an EJB created with the 2.x programming model, see “Deployment Guidelines For Enterprise JavaBeans” in the Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server guide, which concentrates on the 2.x programming model.
This chapter describes how to program the annotated EJB 3.1 class file in WebLogic Server 12.1.3.

This chapter includes the following sections:

■ Overview of Metadata Annotations and EJB Bean Files
■ Programming the Bean File: Requirements and Changes From 2.x
■ Programming the Bean File
■ Complete List of Metadata Annotations By Function

5.1 Overview of Metadata Annotations and EJB Bean Files

The WebLogic Server EJB 3.1 programming model uses the Java EE 6 metadata annotations feature in which you create an annotated EJB 3.1 bean file, compile the class with the standard Java compiler, and the resulting class can then be packaged into a target module for deployment. At runtime, WebLogic Server parses the annotations and applies the required behavioral aspects to the bean file.

Tip: To reduce deployment time, you can also use the WebLogic compile tool weblogic.appc (or its Ant equivalent wlappc) to pre-compile a deployable archive file, (WAR, JAR, or EAR). Precompiling with weblogic.appc generates certain helper classes and performs validation checks to ensure your application is compliant.

The annotated 3.1 bean file is the core of your EJB. It contains the Java code that determines how your EJB behaves. The 3.1 bean file is an ordinary Java class file that implements an EJB business interface that outlines the business methods of your EJB. You then annotate the bean file with JDK metadata annotations to specify the shape and characteristics of the EJB, document your EJB, and provide special services such as enhanced business-level security or special business logic during runtime.

See Section 5.4, "Complete List of Metadata Annotations By Function" for a breakdown of the annotations you can specify in a bean file, by function. These annotations include those described by the following specifications:


See Appendix A, "EJB Metadata Annotations Reference," for reference information about the annotations, listed in alphabetical order. This topic is part of the iterative
development procedure for creating an EJB 3.1, described in Chapter 4, "Iterative Development of Enterprise JavaBeans."

For more information on general EJB design and architecture, see the following documents:

- Introducing the Java EE 6 Platform: Part 3 (EJB Technology, Even Easier to Use) at http://www.oracle.com/technetwork/articles/javaee/javaee6overview-part3-139660.html#ejbeasy
- The Java EE 6 Tutorial at http://docs.oracle.com/javaee/6/tutorial/doc/gipjg.html

5.2 Programming the Bean File: Requirements and Changes From 2.x

The requirements for programming the 3.1 bean class file are essentially the same as the 2.x requirements. This section briefly describes the basic mandatory requirements of the bean class, mostly for overview purposes, as well as changes in requirements between 2.x and 3.1.

See Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server for detailed information about the mandatory and optional requirements for programming the bean class.

5.2.1 Bean Class Requirements and Changes From 2.x

The following bullets list the 3.1 requirements for programming a bean class, as well as the 2.x requirements that no longer apply:

- The class must specify its bean type, typically using one of the following metadata annotations, although you can also override this using a deployment descriptor:
  - @javax.ejb.Stateless
  - @javax.ejb.Stateful
  - @javax.ejb.Singleton
  - @javax.ejb.MessageDriven

**Note:** Oracle Kodo JPA/JDO is deprecated in this release. However, if you still using Oracle Kodo, programming a 3.0 entity bean (@javax.ejb.Entity) is discussed in a separate document.

Customers are encouraged to use Oracle TopLink, which supports JPA 2.0. Kodo supports only JPA 1.0. For more information, see Section 8.3, "Using Oracle TopLink in Oracle WebLogic Server."

- If the bean is a session bean, the bean class can implement either:
  - The no-interface local client view type, which simplifies EJB development by providing local session bean access without requiring a separate local business interface.
  - The bean's business interface(s) or the methods of the bean's business interface(s), if any.
- Session beans no longer need to implement `javax.ejb.SessionBean`, which means the bean no longer needs to implement the `ejbXXX()` methods, such as `ejbCreate()`, `ejbPassivate()`, and so on.
- Stateful session beans no longer need to implement `java.io.Serializable`.
- Message-driven beans no longer need to implement `javax.ejb.MessageDrivenBean`.

The following requirements are the same as in EJB 2.x and are provided only as a brief overview:

- The class must be defined as `public`, must not be `final`, and must not be `abstract`. The class must be a top level class.
- The class must have a `public` constructor that takes no parameters.
- The class must not define the `finalize()` method.
- If the bean is message-driven, the bean class must implement, directly or indirectly, the message listener interface required by the messaging type that it supports or the methods of the message listener interface. In the case of JMS, this is the `javax.jms.MessageListener` interface.

### 5.2.2 Bean Class Method Requirements

The method requirements have not changed since EJB 2.x and are provided in this section for a brief overview only.

The requirements for programming the session bean class' methods (that implement the business interface methods) are as follows:

- The method names can be arbitrary.
- The business method must be declared as `public` and must not be `final` or `static`.
- The argument and return value types for a method must be legal types for RMI/IIOP if the method corresponds to a business method on the session bean's remote business interface or remote interface.
- The `throws` clause may define arbitrary application exceptions.

The requirements for programming the message-driven bean class' methods are as follows:

- The methods must implement the listener methods of the message listener interface.
- The methods must be declared as `public` and must not be `final` or `static`.

### 5.3 Programming the Bean File

The sections that follow provide the recommended steps when programming the annotated EJB 3.1 class file.

- Section 5.3.1, "Typical Steps When Programming the Bean File"
- Section 5.3.2, "Specifying the Business and Other Interfaces"
- Section 5.3.3, "Specifying the Bean Type (Stateless, Singleton, Stateful, or Message-Driven)"
- Section 5.3.4, "Injecting Resource Dependency into a Variable or Setter Method"
Section 5.3.5, "Invoking a 3.0 Entity"
Section 5.3.6, "Specifying Interceptors for Business Methods or Life Cycle Callback Events"
Section 5.3.7, "Programming Application Exceptions"
Section 5.3.8, "Securing Access to the EJB"
Section 5.3.9, "Specifying Transaction Management and Attributes"

5.3.1 Typical Steps When Programming the Bean File

The following procedure describes the typical basic steps when programming the 3.1 bean file for a EJB. The steps you follow depends, of course, on what your EJB does.

Refer to Chapter 3, "Simple Enterprise JavaBeans Examples," for code examples of the topics discussed in the remaining sections.

1. Import the EJB 3.1 and other common annotations that will be used in your bean file. The general EJB annotations are in the javax.ejb package, the interceptor annotations are in the javax.interceptor package, the annotations to invoke a 3.1 entity are in the javax.persistence package, and the common annotations are in the javax.common or javax.common.security packages. For example:

   ```java
   import javax.ejb.Stateless;
   import javax.ejb.TransactionAttribute;
   import javax.interceptor.ExcludeDefaultInterceptors;
   ```

2. Specify the interface that your EJB is going to implement, either a business interface or a no-interface view, as well as other standard interfaces. You can either explicitly implement the interface, or use an annotation to specify it.

   See Section 5.3.2, "Specifying the Business and Other Interfaces."

3. Use the required annotation to specify the type of bean you are programming (session or message-driven).

   See Section 5.3.3, "Specifying the Bean Type (Stateless, Singleton, Stateful, or Message-Driven)."

4. Optionally, use dependency injection to use external resources, such as another EJB or other Java EE 6 object.

   See Section 5.3.4, "Injecting Resource Dependency into a Variable or Setter Method."

5. Optionally, create an EntityManager object and use the entity annotations to inject entity information.

   See Section 5.3.5, "Invoking a 3.0 Entity."

6. Optionally, program and configure business method or life cycle callback method interceptor method. You can program the interceptor methods in the bean file itself, or in a separate Java file.

   See Section 5.3.6, "Specifying Interceptors for Business Methods or Life Cycle Callback Events."

7. If your business interface specifies that business methods throw application exceptions, you must program the exception class, the same as in EJB 2.x.

   See Section 5.3.7, "Programming Application Exceptions" for EJB 3.1 specific information.
8. Optionally, specify the security roles that are allowed to invoke the EJB methods using the security-related metadata annotations.

See Section 5.3.8, "Securing Access to the EJB."

9. Optionally, change the default transaction configuration in which the EJB runs.

See Section 5.3.9, "Specifying Transaction Management and Attributes."

5.3.2 Specifying the Business and Other Interfaces

The EJB 3.x local or remote client of a session bean written to the EJB 3.x API accesses a session bean through its business interface. A local client may also access a session bean through a no-interface view that exposes all public methods of the bean class.

5.3.2.1 Specifying the Business Interface

There are two ways you can specify the business interface for the EJB bean class:

- By explicitly implementing the business interface, using the `implements` Java keyword.
- By using metadata annotations (such as `javax.ejb.Local` and `javax.ejb.Remote`) to specify the business interface. In this case, the bean class does not need to explicitly implement the business interface.

Typically, if an EJB bean class implements an interface, it is assumed to be the business interface of the EJB. Additionally, the business interface is assumed to be the local interface unless you explicitly denote it as the remote interface, either by using the `javax.ejb.Remote` annotation or updating the appropriate EJB deployment descriptor.

You can specify the `javax.ejb.Remote` annotation, as well as the `javax.ejb.Local` annotation, in either the business interface itself, or the bean class that implements the interface.

A bean class can have more than one interface. In this case (excluding the interfaces listed below), you must specify the business interface of the EJB by explicitly using the `javax.ejb.Local` or `javax.ejb.Remote` annotations in either the business interface itself, the bean class that implements the business interface, or the appropriate deployment descriptor.

The following interfaces are excluded when determining whether the bean class has more than one interface:

- `java.io.Serializable`
- `java.io.Externalizable`
- Any of the interfaces defined by the `javax.ejb` package

The following code snippet shows how to specify the business interface of a bean class by explicitly implementing the interface:

```java
public class ServiceBean
    implements Service
```

For the full example, see Section 3.1.2, "Example of a Simple Business Interface Stateless EJB."

5.3.2.2 Specifying the No-interface View

Client access to an enterprise bean that exposes a local, no-interface view is accomplished through either dependency injection or JNDI lookup.
To obtain a reference to the no-interface view of an enterprise bean through dependency injection, use the `javax.ejb.EJB` annotation and specify the enterprise bean’s implementation class:

```java
@EJB
ExampleBean exampleBean;
```

To obtain a reference to the no-interface view of an enterprise bean through JNDI lookup, use the `javax.naming.InitialContext` interface’s `lookup` method:

```java
ExampleBean exampleBean = (ExampleBean) InitialContext.lookup("java:module/ExampleBean");
```

Clients do not use the new operator to obtain a new instance of an enterprise bean that uses a no-interface view.

There is an example of using the No-interface client view bundled in the WebLogic Server distribution kit. See Section 3.2.4, "EJB 3.1: Example of Simplified No-interface Programming and Packaging in a WAR File."

For more detailed information about the implementing the no-interface client view, see "Accessing Local Enterprise Beans Using the No-Interface View" in the "Enterprise Beans" chapter of the Java EE 6 Tutorial at [http://docs.oracle.com/javaee/6/tutorial/doc/gipjf.html](http://docs.oracle.com/javaee/6/tutorial/doc/gipjf.html).

### 5.3.3 Specifying the Bean Type (Stateless, Singleton, Stateful, or Message-Driven)

There is only one required metadata annotation in a 3.1 bean class: an annotation that specifies the type of bean you are programming. You must specify one, and only one, of the following:

- `@javax.ejb.Stateless`—Specifies that you are programming a stateless session bean.
- `@javax.ejb.Singleton`—Specifies that you are programming a singleton session bean.
- `@javax.ejb.Stateful`—Specifies that you are programming a stateful session bean.
- `@javax.ejb.MessageDriven`—Specifies that you are programming a message-driven bean.

**Note:** Oracle Kodo JPA/JDO is deprecated in this release. However, if you still using Oracle Kodo, programming a 3.0 entity bean (`@javax.ejb.Entity`) is discussed in a separate document.

Customers are encouraged to use Oracle TopLink, which supports JPA 2.0. Kodo supports only JPA 1.0. For more information, see Section 8.3, "Using Oracle TopLink in Oracle WebLogic Server."

Although not required, you can specify attributes of the annotations to further describe the bean type. For example, you can set the following attributes for all bean types:

- `name`—Name of the bean class; the default value is the unqualified bean class name.
- `mappedName`—Product-specific name of the bean.
description—Description of what the bean does.

If you are programming a message-driven bean, then you can specify the following optional attributes:

- messageListenerInterface—Specifies the message listener interface, if you haven’t explicitly implemented it or if the bean implements additional interfaces.
- activationConfig—Specifies an array of activation configuration name-value pairs that configure the bean in its operational environment.

The following code snippet shows how to specify that a bean is a stateless session bean:

```java
@Stateless
public class ServiceBean
    implements Service
```

For the full example, see Section 3.1.2, "Example of a Simple Business Interface Stateless EJB.”

### 5.3.4 Injecting Resource Dependency into a Variable or Setter Method

Dependency injection is when the EJB container automatically supplies (or injects) a bean’s variable or setter method with a reference to a resource or another environment entry in the bean’s context. Dependency injection is simply an easier-to-program alternative to using the `javax.ejb.EJBContext` interface or JNDI APIs to look up resources.

You specify dependency injection by annotating a variable or setter method with one of the following annotations, depending on the type of resource you want to inject:

- `@javax.ejb.EJB`—Specifies a dependency on another EJB.
- `@javax.annotation.Resource`—Specifies a dependency on an external resource, such as a JDBC datasource or a JMS destination or connection factory.

Both annotations have an equivalent grouping annotation to specify a dependency on multiple resources (`@javax.ejb.EJBs` and `@javax.annotation.Resources`).

Although not required, you can specify attributes to these dependency annotations to explicitly describe the dependent resource. The amount of information you need to specify depends upon its usage context and how much information the EJB container can infer from that context. See Section A.2.10, "javax.ejb.EJB” and Section A.5.3, "javax.annotation.Resource” for detailed information on the attributes and when you should specify them.

The following code snippet shows how to use the `@javax.ejb.EJB` annotation to inject a dependency on an EJB into a variable; only the relevant parts of the bean file are shown:

```java
package examples;
import javax.ejb.EJB;
...
@Stateful
public class AccountBean
```
implements Account
{
    @EJB(beanName="ServiceBean")
    private Service service;
    ...
    public void sayHelloFromAccountBean() {
        service.sayHelloFromServiceBean();
    }
}

In the preceding example, the private variable service is annotated with the @javax.ejb.EJB annotation, which makes reference to the EJB with a bean name of ServiceBean. The data type of the service variable is Service, which is the business interface implemented by the ServiceBean bean class. As soon as the EJB container creates the AccountBean EJB, the container injects a reference to ServiceBean into the service variable; the variable then has direct access to all the business methods of SessionBean, as shown in the sayHelloFromAccountBean method implementation in which the sayHelloFromServiceBean method is invoked.

5.3.5 Invoking a 3.0 Entity

This section describes how to invoke and update a 3.0 entity from within a session bean.

Note: Oracle TopLink, a JPA 2.0 persistence provider, is now the default JPA provider, replacing Kodo, which was the default provider in previous releases. Any application that does not specify a JPA provider in persistence.xml will now use TopLink by default. Applications can continue to use Kodo (a JPA 1.0 provider) by explicitly specifying Kodo/OpenJPA as their persistence provider in persistence.xml. In addition, a WebLogic Server domain can be configured to use Kodo by default, if desired. For more information, see Chapter 8, "Configuring the Persistence Provider in Oracle WebLogic Server."

An entity is a persistent object that represents datastore records; typically an instance of an entity represents a single row of a database table. Entities make it easy to query and update information in a persistent store from within another Java EE component, such as a session bean. A Person entity, for example, might include name, address, and age fields, each of which correspond to the columns of a table in a database. Using an javax.persistence.EntityManager object to access and manage the entities, you can easily retrieve a Person record, based on either their unique id or by using a SQL query, and then change the information and automatically commit the information to the underlying datastore.

The following sections describe the typical programming tasks you perform in your session bean to interact with entities:

- Section 5.3.5.1, "Injecting Persistence Context Using Metadata Annotations"
- Section 5.3.5.2, "Finding an Entity Using the EntityManager API"
- Section 5.3.5.3, "Creating and Updating an Entity Using EntityManager"

5.3.5.1 Injecting Persistence Context Using Metadata Annotations

In your session bean, use the following metadata annotations inject entity information into a variable:
■ @javax.persistence.PersistenceContext—Injects a persistence context into a variable of data type javax.persistence.EntityManager. A persistence context is simply a set of entities such that, for any persistent identity, there is a unique entity instance. The persistence.xml file defines and names the persistence contexts available to a session bean.

■ @javax.persistence.PersistenceContexts—Specifies a set of multiple persistence contexts.

■ @javax.persistence.PersistenceUnit—Injects a persistence context into a variable of data type javax.persistence.EntityManagerFactory.

■ @javax.persistence.PersistenceUnits—Specifies a set of multiple persistence contexts.

The @PersistenceContext and @PersistenceUnit annotations perform a similar function: inject persistence context information into a variable; the main difference is the data type of the instance into which you inject the information. If you prefer to have full control over the life cycle of the EntityManager in your session bean, then use @PersistenceUnit to inject into an EntityManagerFactory instance, and then write the code to manually create an EntityManager and later destroy when you are done, to release resources. If you prefer that the EJB container manage the life cycle of the EntityManager, then use the @PersistenceContext annotation to inject directly into an EntityManager.

The following example shows how to inject a persistence context into the variable `em` of data type EntityManager; relevant code is shown in bold:

```
package examples;

import javax.ejb.Stateless;

import javax.persistence.PersistenceContext;
import javax.persistence.EntityManager;

@Stateless
public class ServiceBean
  implements Service
{
  @PersistenceContext private EntityManager em;

  ...
```

### 5.3.5.2 Finding an Entity Using the EntityManager API

Once you have instantiated an EntityManager object, you can use its methods to interact with the entities in the persistence context. This section discusses the methods used to identify and manage the life cycle of an entity; see Chapter 8.3, "Using Oracle TopLink in Oracle WebLogic Server." for additional uses of the EntityManager, such as transaction management, caching, and so on.

---

**Note:** For clarity, this section assumes that the entities are configured such that they represent actual rows in a database table.

---

Use the `EntityManager.find()` method to find a row in a table based on its primary key. The `find` method takes two parameters: the entity class that you are querying, such as `Person.class`, and the primary key value for the particular row you want to
retrieve. Once you retrieve the row, you can use standard getXXX methods to get particular properties of the entity. The following code snippet shows how to retrieve a Person with whose primary key value is 10, and then get their address:

```java
public List<Person> findPerson () {
    Person p = em.find(Person.class, 10);
    Address a = p.getAddress();

    Query q = em.createQuery("select p from Person p where p.name = :name");
    q.setParameter("name", "Patrick");
    List<Person> l = (List<Person>) q.getResultList();

    return l;
}
```

The preceding example also shows how to use the EntityManager.createQuery() method to create a Query object that contains a custom SQL query; by contrast, the EntityManager.find() method allows you to query using only the table's primary key. In the example, the table is queried for all Persons whose first name is Patrick; the resulting set of rows populates the List<Person> object and is returned to the findPerson() invoker.

### 5.3.5.3 Creating and Updating an Entity Using EntityManager

To create a new entity instance (and thus add a new row to the database), use the EntityManager.persist method, as shown in the following code snippet

```java
@TransactionAttribute(REQUIRED)
public Person createNewPerson(String name, int age) {
    Person p = new Person(name, age);
    em.persist(p); // register the new object with the database

    Address a = new Address();
    p.setAddress(a);
    em.persist(a); // depending on how things are configured, this may or
                   // may not be required
    return p;
}
```

The preceding example shows how to create a new Person, based on parameters passed to the createNewPerson method, and then call the EntityManager.persist method to automatically add the row to the database table.

The preceding example also shows how to update the newly-created Person entity (and thus new table row) with an Address by using the setAddress() entity method. Depending on the cascade configuration of the Person entity, the second persist() call may not be necessary; this is because the call to the setAddress() method might have automatically triggered an update to the database. For more information about cascading operations, see Chapter 8.3, "Using Oracle TopLink in Oracle WebLogic"
Server.

If you use the `EntityManager.find()` method to find an entity instance, and then use a `setXXX` method to change a property of the entity, the database is automatically updated and you do not need to explicitly call the `EntityManager.persist()` method, as shown in the following code snippet:

```java
@TransactionAttribute(REQUIRED)
public Person changePerson(int id, int newAge) {
    Person p = em.find(Person.class, id);
    p.setAge(newAge);
    return p;
}
```

In the preceding example, the call to the `Person.setAge()` method automatically triggered an update to the appropriate row in the database table.

Finally, you can use the `EntityManager.merge()` method to quickly and easily update a row in the database table based on an update to an entity made by a client, as shown in the following example:

```java
@TransactionAttribute(REQUIRED)
public Person applyOfflineChanges(Person pDTO) {
    return em.merge(pDTO);
}
```

In the example, the `applyOfflineChanges()` method is a business method of the session bean that takes as a parameter a `Person`, which has been previously created by the session bean client. When you pass this `Person` to the `EntityManager.merge()` method, the EJB container automatically finds the existing row in the database table and automatically updates the row with the new data. The `merge()` method then returns a copy of this updated row.

### 5.3.6 Specifying Interceptors for Business Methods or Life Cycle Callback Events

An interceptor is a method that intercepts a business method invocation or a life cycle callback event. There are two types of interceptors: those that intercept business methods and those that intercept life cycle callback methods.

Interceptors can be specified for session and message-driven beans.

You can program an interceptor method inside the bean class itself, or in a separate interceptor class which you then associate with the bean class with the `@javax.interceptor.Interceptors` annotation. You can create multiple interceptor methods that execute as a chain in a particular order.

Interceptor instances may hold state. The life cycle of an interceptor instance is the same as that of the bean instance with which it is associated. Interceptors can invoke JNDI, JDBC, JMS, other enterprise beans, and the EntityManager. Interceptor methods share the JNDI name space of the bean for which they are invoked. Programming restrictions that apply to enterprise bean components to apply to interceptors as well.

Interceptors are configured using metadata annotations in the `javax.interceptor` package, as described in later sections.

The following topics discuss how to actually program interceptors for your bean class:

- Section 5.3.6.1, "Specifying Business or Life Cycle Interceptors: Typical Steps"
- Section 5.3.6.2, "Programming the Interceptor Class"
- Section 5.3.6.3, "Programming Business Method Interceptor Methods"
5.3.6.1 Specifying Business or Life Cycle Interceptors: Typical Steps

The following procedure provides the typical steps to specify and program interceptors for your bean class.

See Section 3.1.3, "Example of a Simple Stateful EJB" for an example of specifying interceptors and Section 3.1.4, "Example of an Interceptor Class" for an example of programming an interceptor class.

1. Decide whether interceptor methods are programmed in bean class or in a separate interceptor class.

2. If you decide to program the interceptor methods in a separate interceptor class
   a. Program the class, as described in Section 5.3.6.2, "Programming the Interceptor Class."
   b. In your bean class, use the @javax.interceptor.Interceptors annotation to associate the interceptor class with the bean class. The method in the interceptor class annotated with the @javax.interceptor.AroundInvoke annotation then becomes a business method interceptor method of the bean class. Similarly, the methods annotated with the life cycle callback annotations become the life cycle callback interceptor methods of the bean class.

   You can specify any number of interceptor classes for a given bean class—the order in which they execute is the order in which they are listed in the annotation. If you specify the interceptor class at the class-level, the interceptor methods apply to all appropriate bean class methods. If you specify the interceptor class at the method-level, the interceptor methods apply to only the annotated method.

3. In the bean class or interceptor class (wherever you are programming the interceptor methods), program business method interceptor methods, as described in Section 5.3.6.3, "Programming Business Method Interceptor Methods."

4. In the bean class or interceptor class (wherever you are programming the interceptor methods), program life cycle callback interceptor methods, as described in Section 5.3.6.3, "Programming Business Method Interceptor Methods."

5. In the bean class, optionally annotate methods with the @javax.interceptor.ExcludeClassInterceptors annotation to exclude any interceptors defined at the class-level.

6. In the bean class, optionally annotate the class or methods with the @javax.interceptor.ExcludeDefaultInterceptors annotation to exclude any default interceptors that you might define later. Default interceptors are configured in the ejb-jar.xml deployment descriptor, and apply to all EJBs in the JAR file, unless you explicitly use the annotation to exclude them.

7. Optionally specify default interceptors for the entire EJB JAR file, as described in Section 5.3.6.6, "Specifying Default Interceptor Methods."
5.3.6.2 Programming the Interceptor Class

The interceptor class is a plain Java class that includes the interceptor annotations to specify which methods intercept business methods and which intercept life cycle callback methods.

Interceptor classes support dependency injection, which is performed when the interceptor class instance is created, using the naming context of the associated enterprise bean.

You must include a public no-argument constructor.

You can have any number of methods in the interceptor class, but restrictions apply as to how many methods can be annotated with the interceptor annotations, as described in the following sections.

For an example, see Section 3.1.4, "Example of an Interceptor Class."

5.3.6.3 Programming Business Method Interceptor Methods

You specify business method interceptor methods by annotating them with the @AroundInvoke annotation.

An interceptor class or bean class can have only one method annotated with @AroundInvoke. To specify that multiple interceptor methods execute for a given business method, you must associate multiple interceptor classes with the bean file, in addition to optionally specifying an interceptor method in the bean file itself. The order in which the interceptor methods execute is the order in which the associated interceptor classes are listed in the @Interceptor annotation. Interceptor methods in the bean class itself execute after those defined in the interceptor classes.

You cannot annotate a business method itself with the @AroundInvoke annotation.

The signature of an @AroundInvoke method must be:

Object <METHOD>(InvocationContext) throws Exception

The method annotated with the @AroundInvoke annotation must always call InvocationContext.proceed() or neither the business method will be invoked nor any subsequent @AroundInvoke methods. See Section 5.3.6.7, "Saving State Across Interceptors With the InvocationContext API" for additional information about the InvocationContext API.

Business method interceptor method invocations occur within the same transaction and security context as the business method for which they are invoked. Business method interceptor methods may throw runtime exceptions or application exceptions that are allowed in the throws clause of the business method.

For an example, see Section 3.1.4, "Example of an Interceptor Class."

5.3.6.4 Programming Asynchronous Business Methods

Session beans can implement asynchronous methods, business methods where control is returned to the client by the enterprise bean container before the method is invoked on the session bean instance. Clients may then use the Java SE concurrency API to retrieve the result, cancel the invocation, and check for exceptions. Asynchronous methods are typically used for long-running operations, for processor-intensive tasks, for background tasks, to increase application throughput, or to improve application response time if the method invocation result isn't required immediately.

When a session bean client invokes a typical non-asynchronous business method, control is not returned to the client until the method has completed. Clients calling
asynchronous methods, however, immediately have control returned to them by the
enterprise bean container. This allows the client to perform other tasks while the
method invocation completes. If the method returns a result, the result is an
implementation of the `java.util.concurrent.Future<V>` interface, where “V” is the
result value type. The `Future<V>` interface defines methods the client may use to check
if the computation is completed, wait for the invocation to complete, retrieve the final
result, and cancel the invocation.

Asynchronous method invocation semantics only apply to the no-interface, local
business, and remote business client views. Methods exposed through the EJB 2.x
local, EJB 2.x remote, and Web service client views must not be designated as
asynchronous.

For detailed instructions on creating an asynchronous business method, see
"Asynchronous Method Invocation" in the “Enterprise Beans” chapter of the Java EE 6

### 5.3.6.5 Programming Life Cycle Callback Interceptor Methods

You specify a method to be a life cycle callback interceptor method so that it can
receive notification of life cycle events from the EJB container. Life cycle events include
creation, passivation, and destruction of the bean instance.

You can name the life cycle callback interceptor method anything you want; this is
different from the EJB 2.x programming model in which you had to name the methods
ejbCreate(), ejbPassivate(), and so on.

You use the following life cycle interceptor annotations to specify that a method is a
life cycle callback interceptor method:

- `@javax.ejb.PrePassivate`—Specifies the method that the EJB container notifies
  when it is about to passivate a stateful session bean.

- `@javax.ejb.PostActivate`—Specifies the method that the EJB container notifies
  right after it has reactivated a stateful session bean.

- `@javax.annotation.PostConstruct`—Specifies the method that the EJB container
  notifies before it invokes the first business method and after it has done
dependency injection. You typically apply this annotation to the method that
performs initialization.

- `@javax.annotation.PreDestroy`—Specifies the method that the EJB container
  notifies right before it destroys the bean instance. You typically apply this
  annotation to the method that release resources that the bean class has been
holding.

---

**Note:** This annotation is in the `javax.annotation` package, rather than `javax.ejb`.

---

You use the preceding annotations the same way, whether the annotated method is in
the bean class or in a separate interceptor class. You can annotate the same method
with more than one annotation.
You can also specify any subset or combination of life cycle callback annotations in the bean class or in an associated interceptor class. However, the same callback annotation may not be specified more than once in a given class. If you do specify a callback annotation more than once in a given class, the EJB will not deploy.

To specify that multiple interceptor methods execute for a given life cycle callback event, you must associate multiple interceptor classes with the bean file, in addition to optionally specifying the life cycle callback interceptor method in the bean file itself. The order in which the interceptor methods execute is the order in which the associated classes are listed in the @Interceptor annotation. Interceptor methods in the bean class itself execute after those defined in the interceptor classes.

The signature of the annotated methods depends on where the method is defined:

- Life cycle callback methods defined on a bean class have the following signature:
  
  void <METHOD>()

- Life cycle callback methods defined on an interceptor class have the following signature:

  void <METHOD>(InvocationContext)

See Section 5.3.6.7, "Saving State Across Interceptors With the InvocationContext API" for additional information about the InvocationContext API.


For an example, see Section 3.1.4, "Example of an Interceptor Class."

5.3.6.6 Specifying Default Interceptor Methods

Default interceptor methods apply to all components in a particular EJB JAR file or exploded directory, and thus can only be configured in the ejb-jar.xml deployment descriptor file and not with metadata annotations, which apply to a particular EJB.

The EJB container invokes default interceptor methods, if any, before all other interceptors defined for an EJB (both business and life cycle). If you do not want the EJB container to invoke the default interceptors for a particular EJB, specify the class-level @javax.interceptor.ExcludeDefaultInterceptors annotation in the bean file.

In the ejb-jar.xml file, use the <interceptor-binding> child element of <assembly-descriptor> to specify default interceptors. In particular, set the <ejb-name> child element to *, which means the class applies to all EJBs, and then the <interceptor-class> child element to the name of the interceptor class.

The following snippet from an ejb-jar.xml file shows how to specify the default interceptor class org.mycompany.DefaultIC:

```xml
<?xml version="1.0" encoding="UTF-8"?>

<ejb-jar version="3.0"
  xmlns="http://java.sun.com/xml/ns/javaee"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
  http://java.sun.com/xml/ns/javaee.ejb-jar_3_0.xsd">
  ...
</ejb-jar>
```
5.3.6.7 Saving State Across Interceptors With the InvocationContext API

Use the javax.interceptor.InvocationContext API to pass state information between the interceptors that execute for a given business method or life cycle callback. The EJB Container passes the same InvocationContext instance to each interceptor method, so you can, for example save information when the first business method interceptor method executes, and then retrieve this information for all subsequent interceptor methods that execute for this business method. The InvocationContext instance is not shared between business method or life cycle callback invocations.

All interceptor methods must have an InvocationContext parameter. You can then use the methods of the InvocationContext interface to get and set context information. The InvocationContext interface is shown below:

```java
public interface InvocationContext {
    public Object getBean();
    public Method getMethod();
    public Object[] getParameters();
    public void setParameters(Object[]);
    public java.util.Map getContextData();
    public Object proceed() throws Exception;
}
```

The getBean method returns the bean instance. The getMethod method returns the name of the business method for which the interceptor method was invoked; in the case of life cycle callback interceptor methods, getMethod returns null.

The proceed method causes the invocation of the next interceptor method in the chain, or the business method itself if called from the last @AroundInvoke interceptor method.

For an example of using InvocationContext, see Section 3.1.4, "Example of an Interceptor Class."

5.3.7 Programming Application Exceptions

If you specified in the business interface that a method throws an application method, then you must program the exception as a separate class from the bean class.

Use the @javax.ejb.ApplicationException annotation to specify that an exception class is an application exception thrown by a business method of the EJB. The EJB container reports the exception directly to the client in the event of the application error.
Use the rollback Boolean attribute of the @ApplicationException annotation to specify whether the application error causes the current transaction to be rolled back. By default, the current transaction is not rolled back in event of the error.

You can annotate both checked and unchecked exceptions with this annotation. The following ProcessingException.java file shows how to use the @ApplicationException annotation to specify that an exception class is an application exception thrown by one of the business methods of the EJB:

```java
package examples;

import javax.ejb.ApplicationException;

/**
 * Application exception class thrown when there was a processing error
 * with a business method of the EJB. Annotated with the
 * @ApplicationException annotation.
 */
@ApplicationException()
public class ProcessingException extends Exception {

 /**
  * Catches exceptions without a specified string
  *
  */
  public ProcessingException() {} 

  /**
  * Constructs the appropriate exception with the specified string
  *
  * @param message           Exception message
  */
  public ProcessingException(String message) {super(message);} 
}
```

### 5.3.8 Securing Access to the EJB

By default, any user can invoke the public methods of an EJB. If you want to restrict access to the EJB, you can use the following security-related annotations to specify the roles that are allowed to invoke all, or a subset, of the methods:

- `javax.annotation.security.DeclareRoles`—Explicitly lists the security roles that will be used to secure the EJB.
- `javax.annotation.security.RolesAllowed`—Specifies the security roles that are allowed to invoke all the methods of the EJB (when specified at the class-level) or a particular method (when specified at the method-level.)
- `javax.annotation.security.DenyAll`—Specifies that the annotated method can not be invoked by any role.
- `javax.annotation.security.PermitAll`—Specifies that the annotated method can be invoked by all roles.
- `javax.annotation.security.RunAs`—Specifies the role which runs the EJB. By default, the EJB runs as the user who actually invokes it.

The preceding annotations can be used with many Java EE components that allow metadata annotations, not just EJB 3.1.
You create security roles and map users to roles using the WebLogic Server Administration Console to update your security realm. For details, see "Manage Security Roles" in the Oracle WebLogic Server Administration Console Online Help.

The following example shows a simple stateless session EJB that uses all of the security-related annotations; the code in bold is discussed after the example:

```java
package examples;

import javax.ejb.Stateless;

import javax.annotation.security.DeclareRoles;
import javax.annotation.security.PermitAll;
import javax.annotation.security.DenyAll;
import javax.annotation.security.RolesAllowed;
import javax.annotation.security.RunAs;

/**
 * Bean file that implements the Service business interface.
 */
@Stateless
@DeclareRoles( { "admin", "hr" } )
@RunAs ("admin")
public class ServiceBean implements Service
{
    @RolesAllowed ( {"admin", "hr"} )
    public void sayHelloRestricted() {
        System.out.println("Only some roles can invoke this method.");
    }

    @DenyAll
    public void sayHelloSecret() {
        System.out.println("No one can invoke this method.");
    }

    @PermitAll
    public void sayHelloPublic() {
        System.out.println("Everyone can invoke this method.");
    }
}
```

The main points to note about the preceding example are:

- Import the security-related metadata annotations:

```java
import javax.annotation.security.DeclareRoles;
import javax.annotation.security.PermitAll;
import javax.annotation.security.DenyAll;
import javax.annotation.security.RolesAllowed;
import javax.annotation.security.RunAs;
```

- The class-level @DeclareRoles annotation explicitly specifies that the admin and hr security roles will later be used to secure some or all of the methods. This annotation is not required; any security role referenced in, for example, the @RolesReferenced annotation is implicitly declared. However, explicitly declaring the security roles makes your code easier to read and understand.
The class-level @RunAs annotation specifies that, regardless of the user who actually invokes a particular method of the EJB, the EJB container runs the method as the admin role, assuming, of course, that the original user is allowed to invoke the method.

The @RolesAllowed annotation on the sayHelloRestricted method specifies that only users mapped to the admin and hr roles are allowed to invoke the method.

The @DenyAll annotation on the sayHelloSecret method specifies that no one is allowed to invoke the method.

The @PermitAll annotation on the sayHelloPublic method specifies that all users mapped to any roles are allowed to invoke the method.

5.3.9 Specifying Transaction Management and Attributes

By default, the EJB container invokes a business method within a transaction context. Additionally, the EJB container itself decides whether to commit or rollback a transaction; this is called container-managed transaction demarcation.

You can change this default behavior by using the following annotations in your bean file:

- javax.ejb.TransactionManagement—Specifies whether the EJB container or the bean file manages the demarcation of transactions. If you specify that the bean file manages it, then you must program transaction management in your bean file, typically using the Java Transaction API (JTA).

- javax.ejb.TransactionAttribute—Specifies whether the EJB container invokes methods within a transaction.

For an example of using the javax.ejb.TransactionAttribute annotation, see Section 3.1.3, "Example of a Simple Stateful EJB."

5.4 Complete List of Metadata Annotations By Function

The tables in the sections that follow group the annotations based on what task they perform. Appendix A, "EJB Metadata Annotations Reference," provides full reference information about the EJB 3.1 metadata annotations in alphabetical order.

- Section 5.4.1, "Annotations to Specify the Bean Type"
- Section 5.4.2, "Annotations to Specify the Local or Remote Interfaces"
- Section 5.4.3, "Annotations to Support EJB 2.x Client View"
- Section 5.4.4, "Annotations to Invoke a 3.0 Entity Bean"
- Section 5.4.5, "Transaction-Related Annotations"
- Section 5.4.6, "Annotations to Specify Interceptors"
- Section 5.4.7, "Annotations toSpecify Life Cycle Callbacks"
- Section 5.4.8, "Security-Related Annotations"
- Section 5.4.9, "Context Dependency Annotations"
- Section 5.4.10, "Timeout and Exceptions Annotations"

5.4.1 Annotations to Specify the Bean Type

The following summarize the annotations used to specify the bean type.
5.4.2 Annotations to Specify the Local or Remote Interfaces

The following summarize the annotations used to specify the local or remote interfaces.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.Local</td>
<td>Specifies a local interface of the bean. For more information, see Section A.2.13, &quot;javax.ejb.Local.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.Remote</td>
<td>Specifies a remote interface of the bean. For more information, see Section A.2.20, &quot;javax.ejb.Remote.&quot;</td>
</tr>
</tbody>
</table>

5.4.3 Annotations to Support EJB 2.x Client View

The following summarize the annotations used to support EJB 2.x client view.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.LocalHome</td>
<td>Specifies a local home interface of the bean. For more information, see Section A.2.15, &quot;javax.ejb.LocalHome.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.RemoteHome</td>
<td>Specifies a remote home interface of the bean. For more information, see Section A.2.21, &quot;javax.ejb.RemoteHome.&quot;</td>
</tr>
</tbody>
</table>

5.4.4 Annotations to Invoke a 3.0 Entity Bean

The following summarize the annotations used to invoke a 3.0 entity bean.
5.4.5 Transaction-Related Annotations

The following summarize the annotations used for transactions.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.TransactionManagement</td>
<td>Specifies the transaction management demarcation type (container- or bean-managed). For more information, see Section A.2.31, &quot;javax.ejb.TransactionManagement.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.TransactionAttribute</td>
<td>Specifies whether a business method is invoked within the context of a transaction. For more information, see Section A.2.31, &quot;javax.ejb.TransactionManagement.&quot;</td>
</tr>
</tbody>
</table>

5.4.6 Annotations to Specify Interceptors

The following summarize the annotations used to specify interceptors.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.interceptor.Interceptors</td>
<td>Specifies the list of interceptor classes associated with a bean class or method. For more information, see Section A.3.4, &quot;javax.interceptor.Interceptors.&quot;</td>
</tr>
<tr>
<td>@javax.interceptor.AroundInvoke</td>
<td>Specifies an interceptor method. For more information, see Section A.3.1, &quot;javax.interceptor.AroundInvoke.&quot;</td>
</tr>
<tr>
<td>@javax.interceptor.ExcludeClassInterceptors</td>
<td>Specifies that, when the annotated method is invoked, the class-level interceptors should not invoke. For more information, see Section A.3.2, &quot;javax.interceptor.ExcludeClassInterceptors.&quot;</td>
</tr>
</tbody>
</table>
5.4.7 Annotations to Specify Life Cycle Callbacks

The following summarize the annotations used to specify life cycle callbacks.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.PostActivate</td>
<td>Designates a method to receive a callback after a stateful session bean has been activated. For more information, see Section A.2.18, &quot;javax.ejb.PostActivate.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.PrePassivate</td>
<td>Designates a method to receive a callback before a stateful session bean is passivated. For more information, see Section A.2.19, &quot;javax.ejb.PrePassivate.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.PostConstruct</td>
<td>Specifies the method that needs to be executed after dependency injection is done to perform any initialization. For more information, see Section A.5.1, &quot;javax.annotation.PostConstruct.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.PreDestroy</td>
<td>Specifies a method to be a callback notification to signal that the instance is in the process of being removed by the container. For more information, see Section A.5.2, &quot;javax.annotation.PreDestroy.&quot;</td>
</tr>
</tbody>
</table>

5.4.8 Security-Related Annotations

The following metadata annotations are not specific to EJB 3.1, but rather, are general security-related annotations in the javax.annotation.security package.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.annotation.security.DeclareRoles</td>
<td>Specifies the references to security roles in the bean class. For more information, see Section A.6.1, &quot;javax.annotation.security.DeclareRoles.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.security.RolesAllowed</td>
<td>Specifies the list of security roles that are allowed to invoke the bean's business methods. For more information, see Section A.6.4, &quot;javax.annotation.security.RolesAllowed.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.security.PermitAll</td>
<td>Specifies that all security roles are allowed to invoke the method. For more information, see Section A.6.3, &quot;javax.annotation.security.PermitAll.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.security.DenyAll</td>
<td>Specifies that no security roles are allowed to invoke the method. For more information, see Section A.6.2, &quot;javax.annotation.security.DenyAll.&quot;</td>
</tr>
</tbody>
</table>

Table 5–6 (Cont.) Annotations to Specify Interceptors

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.interceptor.ExcludeDefaultInterceptors</td>
<td>Specifies that, when the annotated method is invoked, the default interceptors should not invoke. For more information, see Section A.3.3, &quot;javax.interceptor.ExcludeDefaultInterceptors.&quot;</td>
</tr>
</tbody>
</table>

Table 5–7 Annotations to Specify Life Cycle Callbacks

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.PostActivate</td>
<td>Designates a method to receive a callback after a stateful session bean has been activated. For more information, see Section A.2.18, &quot;javax.ejb.PostActivate.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.PrePassivate</td>
<td>Designates a method to receive a callback before a stateful session bean is passivated. For more information, see Section A.2.19, &quot;javax.ejb.PrePassivate.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.PostConstruct</td>
<td>Specifies the method that needs to be executed after dependency injection is done to perform any initialization. For more information, see Section A.5.1, &quot;javax.annotation.PostConstruct.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.PreDestroy</td>
<td>Specifies a method to be a callback notification to signal that the instance is in the process of being removed by the container. For more information, see Section A.5.2, &quot;javax.annotation.PreDestroy.&quot;</td>
</tr>
</tbody>
</table>
5.4.9 Context Dependency Annotations

The following summarize the annotations used for context dependency.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.EJB</td>
<td>Specifies a dependency to an EJB business interface or home interface. For more information, see Section A.2.10, &quot;javax.ejb.EJB.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.EJBs</td>
<td>Specifies one or more @EJB annotations. For more information, see Section A.2.11, &quot;javax.ejb.EJBs.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.Resource</td>
<td>Specifies a dependency on an external resource in the bean's environment. For more information, see Section A.5.3, &quot;javax.annotation.Resource.&quot;</td>
</tr>
<tr>
<td>@javax.annotation.Resources</td>
<td>Specifies one or more @Resource annotations. For more information, see Section A.5.4, &quot;javax.annotation.Resources.&quot;</td>
</tr>
</tbody>
</table>

5.4.10 Timeout and Exceptions Annotations

The following summarize the annotations used for timeout and exceptions.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.Timeout</td>
<td>Specifies the timeout method of the bean class. For more information, see Section A.2.29, &quot;javax.ejb.Timeout.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.ApplicationException</td>
<td>Specifies that an exception is an application exception and should be reported to the client directly. For more information, see Section A.2.5, &quot;javax.ejb.ApplicationException.&quot;</td>
</tr>
</tbody>
</table>

5.4.11 Timer and Scheduling Annotations

The following summarize the annotations used for timers scheduling-specific annotations.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@javax.ejb.Timeout</td>
<td>Specifies the timeout method of the bean class. For more information, see Section A.2.29, &quot;javax.ejb.Timeout.&quot;</td>
</tr>
<tr>
<td>@javax.ejb.ApplicationException</td>
<td>Specifies that an exception is an application exception and should be reported to the client directly. For more information, see Section A.2.5, &quot;javax.ejb.ApplicationException.&quot;</td>
</tr>
</tbody>
</table>
This chapter provides EJB-specific deployment guidelines. For deployment topics that are common to all deployable application units, this chapter gives cross-references to topics in *Deploying Applications to Oracle WebLogic Server*, a comprehensive guide to deploying WebLogic Server 12.1.3 applications and modules.

This chapter includes the following sections:

- Before You Deploy an EJB
- Understanding and Performing Deployment Tasks
- Deployment Guidelines for EJBs

### 6.1 Before You Deploy an EJB

Before starting the deployment process you should have:

- Functional, tested bean code, in an exploded directory format or packaged in an archive file—a JAR for a stand-alone EJB, an EAR if the EJB is part of an enterprise application, or a WAR if the EJB is part of a Web application—along with the deployment descriptors. For production environments, Oracle recommends that you package your application as an EAR.
  
  For an overview of the steps required to create and package an EJB, see Section 4.1, "Overview of the EJB Development Process."

  - Program the required annotated EJB class to specify the type of EJB—either:
    - `@javax.ejb.Stateful`, `@javax.ejb.Stateless`, `@javax.ejb.Singleton`, or
    - `@javax.ejb.MessageDriven`.

  For additional details and examples of programming the bean class, see Chapter 5, "Programming the Annotated EJB Class."

  - Configured the optional, but supported, deployment descriptors—`ejb-jar.xml` and `weblogic-ejb-jar.xml`, and, for entity EJBs that use container-managed persistence, `weblogic-cmp-jar.xml`.  

  **Note:** EJB 3.1 has removed the restriction that enterprise bean classes must be packaged in an `ejb-jar` file. Therefore, EJB classes can be packaged directly inside a Web application archive (WAR) using the same packaging guidelines that apply to Web application classes. See Section 6.3.2, "Deploying EJBs as Part of an Web Application."
To create EJB deployment descriptors, see "Generate Deployment Descriptors" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

6.2 Understanding and Performing Deployment Tasks

Table 6–1 is a guide to WebLogic Server documentation topics that help you make decisions about deployment strategies and provide instructions for performing deployment tasks. For EJB-specific deployment topics, see Section 6.3, "Deployment Guidelines for EJBs."

Table 6–1  Deployment Tasks and Topics

<table>
<thead>
<tr>
<th>If You Want To</th>
<th>See This Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deploy in a development environment</td>
<td>&quot;Deploying and Packaging from a Split Development Directory&quot; in Developing Applications for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>Select a deployment tool</td>
<td>&quot;Deployment Tools&quot; in Deploying Applications to Oracle WebLogic Server</td>
</tr>
<tr>
<td>Determine appropriate packaging for a deployment</td>
<td>&quot;Preparing Applications and Modules for Deployment&quot; in Deploying Applications to Oracle WebLogic Server.</td>
</tr>
<tr>
<td>Organizing EJB components in a split directory structure.</td>
<td>&quot;EJBs&quot; in Developing Applications for Oracle WebLogic Server.</td>
</tr>
<tr>
<td>Select staging mode</td>
<td>&quot;Controlling Deployment File Copying with Staging Modes&quot; in Deploying Applications to Oracle WebLogic Server.</td>
</tr>
<tr>
<td>Perform specific deployment tasks</td>
<td>&quot;Overview of the Deployment Process&quot; in Deploying Applications to Oracle WebLogic Server.</td>
</tr>
</tbody>
</table>

6.3 Deployment Guidelines for EJBs

The following sections provide guidelines for deploying EJBs.

- Section 6.3.1, "Deploying Standalone EJBs as Part of an Enterprise Application"
- Section 6.3.2, "Deploying EJBs as Part of an Web Application"
- Section 6.3.3, "Deploying EJBs That Call Each Other in the Same Application"
- Section 6.3.4, "Deploying EJBs That Use Dependency Injection"
- Section 6.3.5, "Deploying Homogeneously to a Cluster"
- Section 6.3.6, "Deploying Pinned EJBs to a Cluster"
- Section 6.3.7, "Redeploying an EJB"
- Section 6.3.8, "Using FastSwap Deployment to Minimize Deployment"
- Section 6.3.9, "Understanding Warning Messages"
- Section 6.3.10, "Disabling EJB Deployment Warning Messages"

6.3.1 Deploying Standalone EJBs as Part of an Enterprise Application

Oracle recommends that you package and deploy your stand-alone EJB applications as part of an Enterprise application. An Enterprise application is a Java EE 6 deployment unit that bundles together Web applications, EJBs, and Resource Adapters into a single deployable unit.
This is a Oracle best practice, which allows for easier application migration, additions, and changes. Also, packaging your applications as part of an Enterprise application allows you to take advantage of the split development directory structure, which provides a number of benefits over the traditional single directory structure.

See "Overview of the Split Development Directory Environment" in Developing Applications for Oracle WebLogic Server.

6.3.2 Deploying EJBs as Part of an Web Application

Enterprise beans can also be packaged within a web application module (WAR).

EJB 3.1 has removed the restriction that enterprise bean classes must be packaged in an ejb-jar file. Therefore, EJB classes can be packaged directly inside a Web application archive (WAR) using the same packaging guidelines that apply to Web application classes. Simply put your EJB classes in the WEB-INF/classes directory or in a JAR file within WEB-INF/lib directory. Optionally, if you are also using the EJB deployment descriptor, you can package it as WEB-INF/ejb-jar.xml. When you run the appc compiler, a WAR file with the classes required to access the EJB components is generated.

See Chapter 4.11.2, "Packaging an EJB In a WAR."

6.3.3 Deploying EJBs That Call Each Other in the Same Application

When an EJB in one application calls an EJB in another application, WebLogic Server passes method arguments by value, due to classloading requirements. When EJBs are in the same application, WebLogic Server can pass method arguments by reference; this improves the performance of method invocation because parameters are not copied.

For best performance, package components that call each other in the same application, and set enable-call-by-reference in weblogic-ejb-jar.xml to True. (By default, enable-call-by-reference is False.)

6.3.4 Deploying EJBs That Use Dependency Injection

When an EJB uses dependency injection, the resource name defined in the class and the superclass must be unique. For example:

```java
public class ClientServlet extends HttpServlet {
    @EJB(name = 'DateServiceBean', beanInterface = DateService.class)
    private DateService bean; .... }

public class DerivedClientServlet extends ClientServlet {
    @EJB(name = 'MyDateServiceBean', beanInterface = DateService.class)
    private DateService bean; .... }
```

For more information about dependency injection, see "Using Java EE Annotations and Dependency Injection" in Developing Applications for Oracle WebLogic Server.

6.3.5 Deploying Homogeneously to a Cluster

If your EJBs will run on a WebLogic Server cluster, Oracle recommends that you deploy them homogeneously—to each Managed Server in the cluster. Alternatively, you can deploy an EJB to only to a single server in the cluster (that is, "pin" a module to a server). This type of deployment is less common, and should be used only in special circumstances where pinned services are required. For more information,
"Understanding Cluster Configuration" in *Administering Clusters for Oracle WebLogic Server*.

### 6.3.6 Deploying Pinned EJBs to a Cluster

There is a known issue with deploying or redeploying EJBs to a single server instance in a cluster—referred to as pinned deployment—if the JAR file contains uncompiled classes and interfaces.

During deployment, the uncompiled EJB is copied to each server instance in the cluster, but it is compiled only on the server instance to which it has been deployed. As a result, the server instances in the cluster to which the EJB was not targeted lack the classes generated during compilation that are necessary to invoke the EJB. When a client on another server instance tries to invoke the pinned EJB, it fails, and an Assertion error is thrown in the RMI layer.

If you are deploying or redeploying an EJB to a single server instance in a cluster, compile the EJB with `appc` before deploying it, to ensure that the generated classes are copied to all server instances available to all nodes in the cluster.

For more information on pinned deployments, see "Deploying to a Single Server Instance (Pinned Deployment)" in *Administering Clusters for Oracle WebLogic Server*.

### 6.3.7 Redeploying an EJB

When you make changes to a deployed EJB's classes, you must redeploy the EJB. If you use automatic deployment, deployment occurs automatically when you restart WebLogic Server. Otherwise, you must explicitly redeploy the EJB.

Redeploying an EJB deployment enables an EJB provider to make changes to a deployed EJB's classes, recompile, and then "refresh" the classes in a running server.

When you redeploy, the classes currently loaded for the EJB are immediately marked as unavailable in the server, and the EJB's classloader and associated classes are removed. At the same time, a new EJB classloader is created, which loads and maintains the revised EJB classes.

When clients next acquire a reference to the EJB, their EJB method calls use the changed EJB classes.

You can redeploy an EJB that is standalone or part of an application using any of the administration tools listed in "Summary of System Administration Tools and APIs" in *Understanding Oracle WebLogic Server*. For instructions, see "Redeploying Applications in a Production Environment" in *Deploying Applications to Oracle WebLogic Server*.

Production redeployment is not supported for:

- applications that use JTS drivers.
- applications that include EJB 1.1 container-managed persistence (CMP) EJBs. To use production redeployment with applications that include CMP EJBs, use EJB 2.0 CMP instead of EJB 1.1 CMP.

For more information on production redeployment limitations, see "Requirements and Restrictions for Production Redeployment" in *Deploying Applications to Oracle WebLogic Server*.
6.3.8 Using FastSwap Deployment to Minimize Deployment

During iterative development of an EJB application, you make many modifications to the EJB implementation class file, typically redeploying an EJB module multiple times during its development.

Java EE 5 introduces the ability to redefine a class at runtime without dropping its ClassLoader or abandoning existing instances. This allows containers to reload altered classes without disturbing running applications, vastly speeding up iterative development cycles and improving the overall development and testing experiences.

With FastSwap, Java classes are redefined in-place without reloading the ClassLoader, thereby having the decided advantage of fast turnaround times. This means that you do not have to wait for an application to redeploy for your changes to take affect. Instead, you can make your changes, auto compile, and then see the effects immediately.

For more information about FastSwap, see "Using FastSwap Deployment to Minimize Redeployment" in Deploying Applications to Oracle WebLogic Server.

6.3.9 Understanding Warning Messages

To get information about a particular warning, use the weblogic.GetMessage tool. For example:

```
java weblogic.GetMessage -detail -id BEA-010202
```

6.3.10 Disabling EJB Deployment Warning Messages

You can disable certain WebLogic Server warning messages that occur during deployment. You may find this useful if the messages provide information of which you are already aware.

For example, if the methods in your EJB makes calls by reference rather than by value, WebLogic Server generates this warning during deployment: "Call-by-reference not enabled."

You can use the disable-warning element in weblogic-ejb-jar.xml to disable certain messages. For a list of messages you can disable, and instructions for disabling the messages, see "disable-warning" in the "weblogic-ejb-jar.xml Deployment Descriptor Reference" chapter of Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.
This chapter provides an overview of using an embeddable EJB container in Oracle WebLogic Server 12.1.3.

This chapter includes the following sections:

- **Overview of the Embeddable EJB Container**
- **EJB 3.1 Lite Functionality Supported in the Embedded EJB Container**

### 7.1 Overview of the Embeddable EJB Container

Unlike traditional Java EE server-based execution, embeddable container usage allows client code and its corresponding enterprise beans to run in a Java SE environment without having to deploy them to a Java EE server. This provides better support for testing, offline processing (e.g., batch jobs), and the use of the EJB programming model in desktop applications.

Most of the services present in the enterprise bean container in a Java EE server are available in the embedded enterprise bean container, including injection, container-managed transactions, and security. Enterprise bean components execute similarly in both embedded and Java EE environments, and therefore the same enterprise bean can be easily reused in both standalone and networked applications.

For a detailed example of using the Embedded EJB container in a Java SE environment, see Section 3.2.6, "EJB 3.1: Example of Using the Embeddable EJB Container in Java SE."

### 7.1.1 Requirements for Using the Embedded EJB Container with WebLogic Server

Using the Embedded EJB container with WebLogic Server requires the following:

- A standard WebLogic Server installation as installed by the Oracle Universal Installer or provided by the developer Zip distribution. Use of subsets of a valid installation is not supported (for example, taking an installation and deleting selected files).

- **weblogic.jar** on the system classpath when running the EJB client:

  ```
  $ java -classpath $CLASSPATH:$ORACLE_HOME/wlserver/server/lib/weblogic.jar
  ```

- Running `setWLSEnv` to set your system classpath is *not* required, provided:

  - You need only the EJB 3.1 Lite runtime functions as outlined in Section 7.2, "EJB 3.1 Lite Functionality Supported in the Embedded EJB Container".

Using an Embedded EJB Container in Oracle WebLogic Server 7-1
You do not need additional supporting functionality from the WebLogic Server distribution, such as full EJB 3.1 full support, or other WebLogic Server/Java EE 6 support beyond EJB 3.1 Lite, such as support for other WebLogic Server-related features that run in a separate process from WebLogic Server, like Node Manager and Configuration Wizard.

**Tip:** During testing of the embedded EJB container, Oracle has successfully used the default allocation of 256 megabytes of Java heap memory. To do so, start the server using the `java -Xms256m` option.

However, it may be possible to run with lower memory settings, but this would depend on the nature of the application being deployed.

For more information on setting JVM parameters when starting WebLogic Server, see "weblogic.Server Configuration Options" in the Command Reference for Oracle WebLogic Server.

### 7.2 EJB 3.1 Lite Functionality Supported in the Embedded EJB Container

The EJB Lite subset of the EJB 3.1 API is supported in the Embedded EJB Container. EJB Lite is by definition a subset of functionality and does not describe any new feature or functionality. This section outlines the requirements of EJB Lite support as defined by the EJB 3.1 specification.

Table 7–1 represents the official requirements for EJB 3.1 Lite functionality support as defined by the EJB 3.1 specification.

<table>
<thead>
<tr>
<th>Table 7–1  EJB Lite Functionality Support</th>
<th>EJB 3.1 Lite</th>
<th>EJB 3.1 Full</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Components</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session Beans (stateful, stateless, singleton)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Message-Driven Beans</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2.x/1.1 CMP/BMP Entity Beans</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>JPA 2.0</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Session Bean Client Views</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local/No Interface</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3.0 Remote</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2.x Remote Home/Component</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>JAX-WS Web Services Endpoint</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>JAX-RPC Web Services Endpoint</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EJB Timer Service</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Asynchronous Session Bean Invocations</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Interceptors</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>RMI-IIOP Interoperability</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Container-managed Transactions/Bean-managed Transactions</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Declarative and Programmatic Security</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 7-1 (Cont.) EJB Lite Functionality Support

<table>
<thead>
<tr>
<th></th>
<th>EJB 3.1 Lite</th>
<th>EJB 3.1 Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embeddable API</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
This chapter describes Oracle TopLink, the default persistence provider in Oracle WebLogic Server 12.1.3, and introduces how to use it. This chapter also tells how to set the default persistence provider in WebLogic Server, how to modify existing Kodo applications for use in the current release, and how to upgrade to a newer version of OpenJPA.

This chapter includes the following sections:

- Overview of Oracle TopLink
- Specifying a Persistence Provider
- Using Oracle TopLink in Oracle WebLogic Server
- Using JPA 2.1 with Oracle TopLink in WebLogic Server
- Using Oracle Kodo in Oracle WebLogic Server
- Using a Newer Version of OpenJPA in Oracle WebLogic Server

### 8.1 Overview of Oracle TopLink

Oracle TopLink is the default persistence provider in WebLogic Server 12c and later. It is a comprehensive standards-based object-persistence and object-transformation framework that provides APIs, schemas, and run-time services for the persistence layer of an application.

The core component of TopLink is the EclipseLink project’s produced libraries and utilities. EclipseLink is the open source implementation of the development framework and the runtime provided in TopLink. EclipseLink implements the following specifications, plus value-added extensions:

- **Java Persistence 2.0 (JPA 2.0).**

  JPA 2.0 is part of Java Platform, Enterprise Edition 6 (Java EE 6). It includes improvements and enhancements to domain modeling, object/relational mapping, EntityManager and Query interfaces, and the Java Persistence Query Language (JQL). It includes an API for criteria queries, a metamodel API, and support for validation.

  For the JPA 2.0 Specification, see "JSR-000317 Java Persistence 2.0" at [http://jcp.org/aboutJava/communityprocess/final/jsr317/index.html](http://jcp.org/aboutJava/communityprocess/final/jsr317/index.html).

- **Java Architecture for XML Binding (JAXB) 2.2.** (The EclipseLink JAXB implementation, plus EclipseLink extensions, is called MOXy.)
For the JAXB 2.0 specification, see "JSR-000222 Java Architecture for XML Binding (JAXB) 2.0" at http://jcp.org/aboutJava/communityprocess/pfd/jsr222/index.html.

- EclipseLink also includes Database Web Service (DBWS), which provides access to relational database artifacts by using a Java API for XML Web Services (JAX-WS) 2 Web service.

EclipseLink also provides support for Oracle Spatial and Oracle XDB mapping.

For more information about EclipseLink, including other supported services, see the EclipseLink project home at http://wiki.eclipse.org/EclipseLink and the EclipseLink Documentation Center at http://wiki.eclipse.org/EclipseLink/UserGuide.

In addition to all of EclipseLink, Oracle TopLink includes:

- TopLink Grid, an integration between EclipseLink JPA with Oracle Coherence that allows EclipseLink to use Oracle Coherence as a level 2 (L2) cache and persistence layer for entities. For more information, see Developing Applications with Oracle Coherence and Oracle Fusion Middleware Integration Guide for Oracle TopLink with Coherence Grid.

**Note:** You must have a license for Oracle Coherence to be able to use TopLink Grid.

- Logging integration with WebLogic Server.
- MBean support in WebLogic Server.

For information about developing, deploying, and configuring Oracle TopLink applications, see the following:

- Solutions Guide for Oracle TopLink
- Understanding Oracle TopLink
- Java API Reference for Oracle TopLink

## 8.2 Specifying a Persistence Provider

You can specify what persistence provider to use for a persistence unit in the application code or by accepting the default persistence provider set for the WebLogic Server domain, as described in the following sections:

- Section 8.2.1, "Setting the Default Provider for the Domain"
- Section 8.2.2, "Specifying the Persistence Provider in an Application"

### 8.2.1 Setting the Default Provider for the Domain

Unless you specify otherwise, TopLink is used as the default persistence provider for a WebLogic Server domain. The default provider is used for any entities in an application that are not configured to use a different persistence provider. The default provider is used for both injected and application-managed entity managers and factories.
You can set the default provider in the WebLogic Server Administration Console or by directly setting JPAMBean.DefaultJPAProvider. In the WebLogic Server Administration Console, the options are Oracle TopLink or Oracle Kodo.

---

**Note:** Oracle Kodo JPA/JDO is deprecated in this release. Customers are encouraged to use Oracle TopLink, which supports JPA 2.0. Kodo supports only JPA 1.0.

---

For instructions on setting the default through the WebLogic Server Administration Console, see "Configure the Default JPA Persistence Provider" in Oracle WebLogic Server Administration Console Online Help.

If you change the default provider, you must do the following for any deployed applications that do not specify a JPA provider:

- Restart applications that use application-managed entity manager factories.
- Redeploy applications that use injected entity manager factories or entity managers.

8.2.2 Specifying the Persistence Provider in an Application

A persistence provider specified in an application takes precedence over the default provider set for the WebLogic Server domain.

You can set the provider to use in the following ways:

- Specify the provider in the `<provider>` element for a persistence unit in the `persistence.xml` file, for example:

  ```xml
  <persistence-unit name="example">
    <provider>org.eclipse.persistence.jpa.PersistenceProvider</provider>
    ...
  </persistence-unit>
  ```

- Specify the provider in the `javax.persistence.provider` property passed to the `javax.persistence.Persistence.createEntityManagerFactory(String, Map)` method.

8.3 Using Oracle TopLink in Oracle WebLogic Server

For detailed information about using Oracle TopLink in WebLogic server, see "Using TopLink with WebLogic Server" in Solutions Guide for Oracle TopLink.

8.4 Using JPA 2.1 with Oracle TopLink in WebLogic Server

When you use Oracle TopLink as the persistence provider in this release of WebLogic Server, you can install a patch that provides support for the Java Persistence Architecture (JPA) 2.1. If you do not apply this patch, JPA 2.0 is supported by default.
JPA 2.1 includes new support or enhancements for features including Criteria Bulk Update/Delete, stored procedures, JPQL Generic function, injectable entity listeners, TREAT, converters, DDL generation, and entity graphs. For the complete JPA 2.1 specification, see "JSR-00338 Java Persistence 2.1 (Final Release)" at http://jcp.org/aboutJava/communityprocess/final/jsr338/index.html.

To use JPA 2.1 in this release of WebLogic Server:

1. Use Oracle TopLink as the persistence provider, as described in "Using TopLink with WebLogic Server" in Solutions Guide for Oracle TopLink.

2. Apply the patch, using either of the following methods:
   - Section 8.4.1, "Applying the Patch Using OPatch"
   - Section 8.4.2, "Applying the Patch Manually"

### 8.4.1 Applying the Patch Using OPatch

OPatch is a Java-based utility that runs on all supported operating systems and is automatically included with WebLogic Server when you use the generic installer. It is used to apply patches to Oracle software. For information on using OPatch, see Patching with OPatch.

To download the patch that enables JPA 2.1 support, log in to My Oracle Support at http://support.oracle.com/. Select the Patches and Updates page, and enter the patch number, 17754607, in the search field.

### 8.4.2 Applying the Patch Manually

Note: Oracle recommends using OPatch to apply patches to WebLogic Server. However, if you created your WebLogic Server installation with the developer-only installer, which does not include OPatch, you can install the patch manually as described in this section.

The files required for supporting JPA 2.1 are included with a default WebLogic Server installation, but they are not enabled by default. The files are:

- The javax.persistence_2.1.jar file that contains the JPA 2.1 libraries. This file is installed in the ORACLE_HOME\oracle_common\modules directory.
- The com.oracle.weblogic.jpa21support_1.0.0.0.2-1.jar file that contains the files for enabling JPA 2.1 support in WebLogic Server. This file is installed in the WL_HOME\modules directory.

You can install the patch manually by putting the files at the start of the WebLogic classpath. For example, you can use either of the following methods:
Define a `PRE_CLASSPATH` environment variable before starting WebLogic Server.

For example, in a Windows console window, run the following script before running `startWebLogic.cmd`:

```batch
@echo off
if "."%1" == "." goto TellSyntax
set
PRE_CLASSPATH=%MW_HOME%;oracle_common\modules\javax.persistence_2.1.jar;%MW_HOME%;wlserver\modules\com.oracle.weblogic.jpa21support_1.0.0.0_2-1.jar
goto End
:TellSyntax
echo setJPA21SupportPatch %MW_HOME%;wlserver\modules
:End
echo PRE_CLASSPATH=%PRE_CLASSPATH%
```

A similar script can be written for Linux, UNIX, or Macintosh.

Modify the `commEnv.cmd` or `commEnv.sh` script in the `WL_HOME\common\bin` directory and add the `PRE_CLASSPATH` at the beginning of the script, setting it to the paths of the JPA 2.1 JAR file and the JPA 2.1 patch.

### 8.5 Using Oracle Kodo in Oracle WebLogic Server

It is advantageous to use the default Oracle TopLink for your applications, due to its implementation of JPA 2.0, its enhanced set of features, its integration in WebLogic Server, and its integration with TopLink Grid. However, you may want to continue to use Kodo for existing applications that were written for use with Kodo. Although deprecated, Kodo is still included with WebLogic Server: you do not have to install it. You can set it as the default provider, as described in Section 8.2, "Specifying a Persistence Provider," or configure an application to use it.

**Note:** Switching an application from one JPA provider to another usually involves more than just flipping a switch. Most obviously, if the application uses proprietary features of the original JPA implementation, that usage will have to change when moving to a different implementation.

In addition, differences in the implementations of a standard specification (that is, JPA) can affect the behavior of an application. Although Kodo and TopLink implement their JPA specifications, as do other conforming JPA implementations, each implementation makes its own decisions about unspecified details that can affect the behavior of the application using JPA. When making the switch from one JPA implementation to another, the application should be thoroughly tested with the expectation that some behavioral differences will have to be corrected.

If you use Kodo, note the information described in the following sections:

- **Section 8.5.1, "Using JPA 1.0 APIs"**
8.5.1 Using JPA 1.0 APIs
You cannot use any JPA 2 APIs with Kodo. Because Kodo supports only JPA 1, trying to use any JPA 2 APIs will generate an error.

8.5.2 Using persistence-configuration.xml
The Kodo persistence-configuration.xml descriptor is valid only when Kodo is the persistence provider. If you include a persistence-configuration.xml in an application that uses injection and you do not specify Kodo as the persistence provider, the persistence-configuration.xml descriptor is ignored and a warning is issued.

8.5.3 Updating Applications to Overcome Conflicts with JPA 2.0
Kodo is based on open-source OpenJPA 1.x, the JPA 1.0 framework and provider from the Apache Foundation. Although JPA 1.0 is upwardly compatible with JPA 2.0, JPA 2.0 introduced some methods to existing JPA interfaces that conflict with existing signatures in the OpenJPA interfaces used in Kodo. These conflicts arise because the OpenJPA interfaces extend the JPA interfaces that contain the methods that are revised in JPA 2.0.

These conflicts could cause problems with applications that use Kodo as the persistence provider, because the JPA 2.0 jar (rather than the JPA 1.0 jar) is on the WebLogic Server classpath.

To prevent these conflicts, two methods have been changed in the OpenJPA interfaces that ship with Kodo in WebLogic Server 12c and later. The OpenJPA methods that cause the conflict are:

- public <T> T OpenJPAEntityManager.detach(T pc)
  The above method conflicts with the following JPA 2.0 method in the EntityManager interface:
  public void detach(Object)
- public Properties OpenJPAEntityManagerFactory.getProperties()
  The above method conflicts with the following JPA 2.0 method in the EntityManagerFactory interface:
  public Map<String, Object> getProperties()

The new signatures are:

- public <T> T OpenJPAEntityManager.detachCopy(T pc)
- public Map<String, Object> OpenJPAEntityManagerFactory.getProperties()
- public Properties OpenJPAEntityManagerFactory.getPropertiesAsProperties()

The first two new signatures follow the changes made in OpenJPA 2.x to address these same conflicts. These signature changes do not alter the semantics of the methods. The getPropertiesAsProperties method is provided as a convenience to application developers who do not want to accept the different return type of the redesigned
getProperties method. However, the method getPropertiesAsProperties is not currently in the OpenJPA 2.x interface.

Because of these changes, you should update any applications that use these methods and recompile them with the Kodo OpenJPA 1.0 jar (org.apache.openjpa_n.jar) and the JPA 1 jar (javax.persistence_n.jar) that are shipped with WebLogic Server 12c (or later). This will prevent the old method signatures from being used. After recompiling and deploying, the applications will run without change in behavior.

Applications that use Kodo/JDO are not affected by the conflicts described above. Therefore, you do not have to modify or recompile them.

8.6 Using a Newer Version of OpenJPA in Oracle WebLogic Server

The current release of OpenJPA from the Apache Foundation supports JPA 2, and you can use it as the persistence provider for applications deployed to WebLogic Server.

Note: OpenJPA is a third-party library that you must plug into WebLogic Server. As such, Oracle support for Oracle WebLogic Server does not include support for the use of OpenJPA. These instructions are provided as a courtesy.

To use the newer version of OpenJPA, do the following:

- Configure a filtering classloader to use the Kodo and OpenJPA classes, as follows:
  - In a Web application, include the following stanza in the weblogic.xml file:
    ```xml
    <container-descriptor>
    <prefer-application-packages>
    <package-name>org.apache.openjpa.*</package-name>
    </prefer-application-packages>
    </container-descriptor>
    ```
  - In an enterprise application, include the prefer-application-packages stanza in weblogic-application.xml. (For more information about filtering classloaders, see "Using a Filtering Classloader" in Developing Applications for Oracle WebLogic Server.

- Include the OpenJPA jar file in the application’s lib directory. For more information about library directories, see "Library Directories" in Developing Applications for Oracle WebLogic Server.

- Configure the application to use OpenJPA (Kodo) as the provider. You cannot simply set Kodo as the domain’s default provider in WebLogic Server. You must configure it in the application, as described in Section 8.2.2, "Specifying the Persistence Provider in an Application."

Note: This last step applies for any JPA implementation that is packaged with an application. You must specify the implementation to use in the application code and not just accept the default set in WebLogic Server.
This appendix provides reference information for the EJB 3.x metadata annotations used in WebLogic Server 12.1.3.

This appendix includes the following sections:

- Overview of EJB 3.x Annotations
- Annotations for Stateless, Stateful, and Message-Driven Beans
- Annotations Used to Configure Interceptors
- Annotations Used to Interact With Entity Beans
- Standard JDK Annotations Used By EJB 3.x
- Standard Security-Related JDK Annotations Used by EJB 3.x
- WebLogic Annotations

A.1 Overview of EJB 3.x Annotations

The WebLogic Server EJB 3.1 programming model uses the Java EE 6 metadata annotations feature in which you create an annotated EJB 3.1 bean file, and then compile the class with standard Java compiler, which can then be packaged into a target module for deployment. At runtime, WebLogic Server parses the annotations and applies the required behavioral aspects to the bean file.

The following sections provide reference information for the metadata annotations you can specify in the EJB bean file. Some of the annotations are in the javax.ejb package, and are thus specific to EJBs; others are more common and are used by other Java EE 6 components, and are thus in more generic packages, such as javax.annotation.

Note: If you are continuing to use deployment descriptors in your EJB implementation, refer to "EJB Deployment Descriptors" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.2 Annotations for Stateless, Stateful, and Message-Driven Beans

This section provides reference information for the following annotations:

- Section A.2.1, "javax.ejb.AccessTimeout"
- Section A.2.2, "javax.ejb.ActivationConfigProperty"
- Section A.2.3, "javax.ejb.AfterBegin"
Annotations for Stateless, Stateful, and Message-Driven Beans

- Section A.2.4, "javax.ejb.AfterCompletion"
- Section A.2.5, "javax.ejb.ApplicationException"
- Section A.2.6, "javax.ejb.Asynchronous"
- Section A.2.7, "javax.ejb.BeforeCompletion"
- Section A.2.8, "javax.ejb.ConcurrencyManagement"
- Section A.2.9, "javax.ejb.DependsOn"
- Section A.2.10, "javax.ejb.EJB"
- Section A.2.11, "javax.ejb.EJBs"
- Section A.2.12, "javax.ejb.Init"
- Section A.2.13, "javax.ejb.Local"
- Section A.2.14, "javax.ejb.LocalBean"
- Section A.2.15, "javax.ejb.LocalHome"
- Section A.2.16, "javax.ejb.Lock"
- Section A.2.17, "javax.ejb.MessageDriven"
- Section A.2.18, "javax.ejb.PostActivate"
- Section A.2.19, "javax.ejb.PrePassivate"
- Section A.2.20, "javax.ejb.Remote"
- Section A.2.21, "javax.ejb.RemoteHome"
- Section A.2.22, "javax.ejb.Remove"
- Section A.2.23, "javax.ejb.Schedule"
- Section A.2.24, "javax.ejb.Schedules"
- Section A.2.25, "javax.ejb.Singleton"
- Section A.2.26, "javax.ejb.Startup"
- Section A.2.27, "javax.ejb.StatefulTimeout"
- Section A.2.28, "javax.ejb.Stateless"
- Section A.2.29, "javax.ejb.Timeout"
- Section A.2.30, "javax.ejb.TransactionAttribute"
- Section A.2.31, "javax.ejb.TransactionManagement"

A.2.1 javax.ejb.AccessTimeout

The following sections describe the annotation in more detail.

A.2.1.1 Description

**Target:** Method, Type

Specifies the amount of time in a given time unit that a concurrent access attempt should block before timing out.

This annotation may be applied to a stateful session bean or to a singleton session bean that uses container managed concurrency.
By default, clients are allowed to make concurrent calls to a stateful session object and the container is required to serialize such concurrent requests. The `AccessTimeout` annotation is used to specify the amount of time a stateful session bean request should block in the case that the bean instance is already processing a different request. Use of the `AccessTimeout` annotation with a value of 0 specifies to the container that concurrent client requests to a stateful session bean are prohibited.

The `AccessTimeout` annotation can be specified on a business method or a bean class. If it is specified on a class, it applies to all business methods of that class. If it is specified on both a class and on a business method of the class, the method-level annotation takes precedence for the given method.

Access time-outs for a singleton session bean only apply to methods eligible for concurrency locks. The `AccessTimeout` annotation can be specified on the singleton session bean class or on an eligible method of the class. If `AccessTimeout` is specified on both a class and on a method of that class, the method-level annotation takes precedence for the given method.

For details, see Section 4.6, "Optionally Program the EJB Timer Service."

### A.2.1.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the amount of time in a given time unit that a concurrent access attempt should block before timing out.</td>
<td>Long</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>■ A value &gt; 0 indicates a timeout value in the units specified by the unit element.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ A value of 0 means concurrent access is not permitted.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ A value of -1 indicates that the client request will block indefinitely until forward progress it can proceed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Values less than -1 are not valid.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>unit</td>
<td>Specifies the units used for the specified value.</td>
<td>TimeUnit</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>The default value for this attribute is <code>java.util.concurrent.TimeUnit.MILLISEC</code></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### A.2.2 javax.ejb.ActivationConfigProperty

The following sections describe the annotation in more detail.

**Note:** Based on the Enterprise JavaBean specification, the `javax.ejb.ActivationConfigProperty` annotation is used for MDBs only. This annotation is not used for session or entity beans.

#### A.2.2.1 Description

**Target:** Any
 Specifies properties used to configure a message-driven bean in its operational environment. This may include information about message acknowledgement modes, message selectors, expected destination or endpoint types, and so on. The ActivationConfigProperty is used only for message-driven beans only; it is not used for session beans or entity beans.

This annotation is used only as a value to the activationConfig attribute of the @javax.ejb.MessageDriven annotation. For more information about this annotation, see "Using EJB 3.3.x0 Compliant MDBs" and "Deployment Elements and Annotations for MDBs" in Developing Message-Driven Beans for Oracle WebLogic Server.

### A.2.2.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>propertyName</td>
<td>Specifies the name of the activation property.</td>
<td>String</td>
<td>Yes</td>
</tr>
<tr>
<td>propertyValue</td>
<td>Specifies the value of the activation property.</td>
<td>String</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### A.2.3 javax.ejb.AfterBegin

The following sections describe the annotation in more detail.

#### A.2.3.1 Description

**Target:** Method

Designate a stateful session bean method to receive the after begin session synchronization callback.

The after begin callback notifies a stateful session bean instance that a new transaction has started and that the subsequent business methods on the instance will be invoked in the context of the transaction.

This method executes in the proper transaction context. A bean must have at most one AfterBegin method. The signature of this method must observe the following rules:

- The method must not be declared as final or static.
- The method may have any access type.
- The return type must be void.
- The method must take no arguments.

This method executes with no transaction context.

A stateful session bean class may use either the SessionSynchronization interface or the session synchronization annotations, but not both.

### A.2.4 javax.ejb.AfterCompletion

The following sections describe the annotation in more detail.

#### A.2.4.1 Description

**Target:** Method
Designate a stateful session bean method to receive the after completion session synchronization callback.

The after completion callback notifies a stateful session bean instance that a transaction commit protocol has completed. A completion status of true indicates that the transaction has committed. A status of false indicates that a rollback has occurred.

A bean must have at most one `AfterCompletion` method. The signature of this method must observe the following rules:

- The method must not be declared as `final` or `static`.
- The method may have any access type.
- The return type must be `void`.
- The method must take a single argument of type `boolean`.

This method executes with no transaction context.

A stateful session bean class may use either the `SessionSynchronization` interface or the session synchronization annotations, but not both.

### A.2.5 `javax.ejb.ApplicationException`

The following sections describe the annotation in more detail.

#### A.2.5.1 Description

**Target:** Class

Specifies that an exception is an application exception and that it should be reported to the client application directly, or unwrapped.

This annotation can be applied to both checked and unchecked exceptions.

#### A.2.5.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>rollback</td>
<td>Specifies whether the EJB container should rollback the transaction, if the bean is currently being invoked inside of one, if the exception is thrown. Valid values for this attribute are <code>true</code> and <code>false</code>. Default value is <code>false</code>, or the transaction should not be rolled back.</td>
<td>boolean</td>
<td>No</td>
</tr>
</tbody>
</table>

### A.2.6 `javax.ejb.Asynchronous`

The following sections describe the annotation in more detail.

#### A.2.6.1 Description

**Target:** Method, Type

Used to mark a session bean method as an asynchronous method or to designate all business methods of a session bean class as asynchronous, where control is returned to the client by the enterprise bean container before the method is invoked on the session
bean instance. Asynchronous methods are typically used for long-running operations, for processor-intensive tasks, for background tasks, to increase application throughput, or to improve application response time if the method invocation result isn’t required immediately.

Clients calling asynchronous methods, immediately have control returned to them by the enterprise bean container. This allows the client to perform other tasks while the method invocation completes. If the method returns a result, the result is an implementation of the return type void or java.util.concurrent.Future<V> interface, where V is the result value type. The Future<V> interface defines methods the client may use to check if the computation is completed, wait for the invocation to complete, retrieve the final result, and cancel the invocation.

Asynchronous method invocation semantics only apply to the no-interface, local business, and remote business client views. Methods exposed through the EJB 2.x local, EJB 2.x remote, and Web service client views must not be designated as asynchronous.

A.2.7 javax.ejb.BeforeCompletion

The following sections describe the annotation in more detail.

A.2.7.1 Description

Target: Method

Designate a stateful session bean method to receive the before completion session synchronization callback.

The before completion callback notifies a stateful session bean instance that a transaction is about to be committed.

This method executes in the proper transaction context.

---

Note: The instance may still cause the container to rollback the transaction by invoking the setRollbackOnly() method on the session context or by throwing an exception. A bean must have at most one BeforeCompletion method.

---

The signature of this method must observe the following rules:

- The method must not be declared as final or static.
- The method may have any access type.
- The return type must be void.
- The method must take no arguments.

This method executes with no transaction context.

A stateful session bean class may use either the SessionSynchronization interface or the session synchronization annotations, but not both.

A.2.8 javax.ejb.ConcurrencyManagement

The following sections describe the annotation in more detail.

A.2.8.1 Description

Target: Type
Declares a singleton session bean’s concurrency management type.

If this annotation is not specified, the singleton bean is assumed to have container managed concurrency.

This annotation may be applied to stateful session beans, but doing so has no impact on the semantics of concurrency management for such beans. The concurrency management type for bean-managed concurrency (BEAN) does not apply to stateful session beans.

**A.2.8.2 Attributes**

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the concurrency management type used by the bean class.</td>
<td>String</td>
<td>No.</td>
</tr>
<tr>
<td></td>
<td>Valid values for this attribute are:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ConcurrencyManagementType.CONTAINER</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ConcurrencyManagementType.BEAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The default value for this attribute is javax.ejb.ConcurrencyManagementType.CONTAINER.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**A.2.9 javax.ejb.DependsOn**

The following sections describe the annotation in more detail.

**A.2.9.1 Description**

**Target**: Type

Used to express an initialization dependency between singleton components.

The container ensures that all singleton beans with which a singleton has a DependsOn relationship have been initialized before the singleton’s PostConstruct method is called.

During application shutdown the container ensures that all singleton beans on with which the singleton has a DependsOn relationship are still available during the singleton’s PreDestroy method.

**A.2.9.2 Attributes**

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies ejb-names of singleton components whose initialization must occur before this singleton. The order in which these names are listed is not significant.</td>
<td>String</td>
<td>No.</td>
</tr>
</tbody>
</table>

**A.2.10 javax.ejb.EJB**

The following sections describe the annotation in more detail.
A.2.10.1 Description

**Target:** Class, Method, Field

Specifies a dependency or reference to an EJB business or home interface.

You annotate a bean’s instance variable with the `@EJB` annotation to specify a dependence on another EJB. WebLogic Server automatically initializes the annotated variable with the reference to the EJB on which it depends; this is also called *dependency injection*. This initialization occurs before any of the bean’s business methods are invoked and after the bean’s `EJBContext` is set.

You can also annotate a setter method in the bean class; in this case WebLogic Server uses the setter method itself when performing dependency injection. This is an alternative to instance variable dependency injection.

If you apply the annotation to a class, the annotation declares the EJB that the bean will look up at runtime.

Whether using variable or setter method injection, WebLogic Server determines the name of the referenced EJB by either the name or data type of the annotated instance variable or setter method parameter. If there is any ambiguity, you should use the `beanName` or `mappedName` attributes of the `@EJB` annotation to explicitly name the dependent EJB.

A.2.10.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name by which the referenced EJB is to be looked up in the environment.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>This name must be unique within the deployment unit, which consists of the class and its superclass.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beanInterface</td>
<td>Specifies the interface type of the referenced EJB (either a business or home interface).</td>
<td>Class</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default value for this attribute is <code>Object.class</code>.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beanName</td>
<td>Specifies the name of the referenced EJB.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>This attribute corresponds to the <code>name</code> element of the <code>@Stateless</code> or <code>@Stateful</code> annotation in the referenced EJB, which by default is the unqualified name of the referenced bean class.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This attribute is most useful when multiple session beans in an EJB JAR file implement the same interface, because the name of each bean must be unique.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A.2.11 javax.ejb.EJBs

The following sections describe the annotation in more detail.

A.2.11.1 Description

Target: Class

Specifies an array of @javax.ejb.EJB annotations.

A.2.11.2 Attribute

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>mappedName</td>
<td>Specifies the global JNDI name of the referenced EJB. For example: mappedName=&quot;bank.Account&quot; specifies that the referenced EJB has a global JNDI name of bank.Account and is deployed in the WebLogic Server JNDI tree. Note: EJBs that use mapped names may not be portable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>Describes the EJB reference.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>

A.2.12 javax.ejb.Init

The following sections describe the annotation in more detail.

A.2.12.1 Description

Target: Method

Specifies the correspondence of a method in the bean class with a createMETHOD method for an adapted EJB 2.1 EJBHome or EJBLocalHome client view.

This annotation is used only in conjunction with stateful session beans, or those that have been annotated with the @javax.ejb.Stateful class-level annotation,

The return type of a method annotated with the @javax.ejb.Init annotation must be void, and its parameter types must be exactly the same as those of the referenced createMETHOD method or methods.

The @Init annotation is required only for stateful session beans that provide a Remote-Home or LocalHome interface. You must specify the name of the adapted create method of the Home or LocalHome interface, using the value attribute, if there is any ambiguity.
A.2.12.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the name of the corresponding create&lt;METHOD&gt; method.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>This attribute is required only when the @Init annotation is used to associate an adapted Home interface of a stateful session bean that has more than one create&lt;METHOD&gt; method.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A.2.13 javax.ejb.Local
The following sections describe the annotation in more detail.

A.2.13.1 Description
Target: Class
Specifies the local interface or interfaces of a session bean. The local interface exposes business logic to local clients—those running in the same application as the EJB. It defines the business methods a local client can call.

You are required to specify this annotation if your bean class implements more than a single interface, not including the following:

- java.io.Serializable
- java.io.Externalizable
- javax.ejb.*

This annotation applies only to stateless or stateful session beans.

A.2.13.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the list of local interfaces as an array of classes.</td>
<td>Class[]</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>You are required to specify this attribute only if your bean class implements more than a single interface, not including the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- java.io.Serializable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- java.io.Externalizable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- javax.ejb.*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A.2.14 javax.ejb.LocalBean
The following sections describe the annotation in more detail.
A.2.14.1 Description
Target: Type

Designates that a session bean exposes a no-interface view.

A.2.15 javax.ejb.LocalHome

The following sections describe the annotation in more detail.

A.2.15.1 Description
Target: Class

Specifies the local home interface of the bean class.

The local home interface provides methods that local clients—those running in the same application as the EJB—can use to create, remove, and in the case of an entity bean, find instances of the bean. The local home interface also has home methods—business logic that is not specific to a particular bean instance.

This attribute applies only to stateless and stateful session beans.

You typically specify this attribute only if you are going to provide an adapted EJB 2.1 component view of the EJB 3.x bean. You can also use this annotation with bean classes that have been written to the EJB 2.1 APIs.

A.2.15.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the local home class.</td>
<td>Class</td>
<td>Yes</td>
</tr>
</tbody>
</table>

A.2.16 javax.ejb.Lock

The following sections describe the annotation in more detail.

A.2.16.1 Description
Target: Type, Method

Declares a concurrency lock for a singleton session bean with container managed concurrency.

This annotation may be specified on the bean class, the business methods of the bean class or both. Specifying the annotation on a business method overrides the value specified at class level, if any.

If this annotation is not used, a value of Lock(WRITE) is assumed.

A.2.16.2 Attributes

The following table summarizes the attributes.
A.2.17 javax.ejb.MessageDriven

The following sections describe the annotation in more detail.

A.2.17.1 Description

Target: Class

Specifies that the Enterprise JavaBean is a message-driven bean.

A.2.17.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name of the message-driven bean.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>If you do not specify this attribute, the default value is the unqualified name of the bean class.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>messageListenerInterface</td>
<td>Specifies the message-listener interface of the bean class.</td>
<td>Class</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>You must specify this attribute if the bean class does not explicitly implement the message-listener interface, or if the bean class implements more than one interface other than java.io.Serializable, java.io.Externalizable, or any of the interfaces in the javax.ejb package.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The default value for this attribute is Object.class.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>activationConfig</td>
<td>Specifies the configuration of the message-driven bean in its operational environment. This may include information about message acknowledgement modes, message selectors, expected destination or endpoint types, and so on. You specify activation configuration information using an Array of @javax.ejb.ActivationConfigProperty annotation, specify the property name and value.</td>
<td>Activation ConfigProperty[]</td>
<td>No</td>
</tr>
</tbody>
</table>

Table A–11 Attributes of the javax.ejb.LockType Annotation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
</table>
| value | Specifies the concurrency lock used by the singleton session bean with container managed concurrency. Valid values for this attribute are:  
  - LockType.READ  
  - LockType.WRITE  
  Default value is javax.ejb.LockType.WRITE. | String | No. |

Table A–12 Attributes of the javax.ejb.MessageDriven Annotation
A.2.18 javax.ejb.PostActivate

The following sections describe the annotation in more detail.

A.2.18.1 Description

Target: Method

Specifies the life cycle callback method that signals that the EJB container has just reactivated the bean instance.

This annotation applies only to stateful session beans. Because the EJB container automatically maintains the conversational state of a stateful session bean instance when it is passivated, you do not need to specify this annotation for most stateful session beans. You only need to use this annotation, along with its partner @PrePassivate, if you want to allow your stateful session bean to maintain the open resources that need to be closed prior to a bean instance’s passivation and then reopened during the bean instance’s activation.

Only one method in the bean class can be annotated with this annotation. If you annotate more than one method with this annotations, the EJB will not deploy.

The method annotated with @PostActivate must follow these requirements:

- The return type of the method must be void.
- The method must not throw a checked exception.
- The method may be public, protected, package private or private.
- The method must not be static.
- The method must not be final.

This annotation does not have any attributes.

A.2.19 javax.ejb.PrePassivate

The following sections describe the annotation in more detail.
A.2.19.1 Description
Target: Method

Specifies the life cycle callback method that signals that the EJB container is about to passivate the bean instance.

This annotation applies only to stateful session beans. Because the EJB container automatically maintains the conversational state of a stateful session bean instance when it is passivated, you do not need to specify this annotation for most stateful session beans. You only need to use this annotation, along with its partner @PostActivate, if you want to allow your stateful session bean to maintain the open resources that need to be closed prior to a bean instance’s passivation and then reopened during the bean instance’s activation.

Only one method in the bean class can be annotated with this annotation. If you annotate more than one method with this annotations, the EJB will not deploy.

The method annotated with @PrePassivate must follow these requirements:

- The return type of the method must be void.
- The method must not throw a checked exception.
- The method may be public, protected, package private or private.
- The method must not be static.
- The method must not be final.

This annotation does not have any attributes.

A.2.20 javax.ejb.Remote

The following sections describe the annotation in more detail.

A.2.20.1 Description
Target: Class

Specifies the remote interface or interfaces of a session bean. The remote interface exposes business logic to remote clients—clients running in a separate application from the EJB. It defines the business methods a remote client can call.

This annotation applies only to stateless or stateful session beans.

A.2.20.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the list of remote interfaces as an array of classes. You are required to specify this attribute only if your bean class implements more than a single interface, not including the following:</td>
<td>Class[]</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>• java.io.Serializable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• java.io.Externalizable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• javax.ejb.*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A.2.21 javax.ejb.RemoteHome

The following sections describe the annotation in more detail.

A.2.21.1 Description

**Target:** Class

Specifies the remote home interface of the bean class.

The remote home interface provides methods that remote clients—those running in a separate application from the EJB—can use to create, remove, and find instances of the bean.

This attribute applies only to stateless and stateful session beans.

You typically specify this attribute only if you are going to provide an adapted EJB 2.1 component view of the EJB 3.x bean. You can also use this annotation with bean classes that have been written to the EJB 2.1 APIs.

A.2.21.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the remote home class.</td>
<td>Class</td>
<td>Yes</td>
</tr>
</tbody>
</table>

A.2.22 javax.ejb.Remove

The following sections describe the annotation in more detail.

A.2.22.1 Description

**Target:** Method

Use the `@javax.ejb.Remove` annotation to denote a remove method of a stateful session bean.

When the method completes, the EJB container will invoke the method annotated with the `@javax.annotation.PreDestroy` annotation, if any, and then destroy the stateful session bean.

A.2.22.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>retainIfException</td>
<td>Specifies that the container should not remove the stateful session bean if the annotated method terminates abnormally with an application exception. Valid values are true and false. Default value is false.</td>
<td>boolean</td>
<td>No</td>
</tr>
</tbody>
</table>

A.2.23 javax.ejb.Schedule

The following sections describe the annotation in more detail.
A.2.23.1 Description

Target: Class

Schedule a timer for automatic creation with a timeout schedule based on a CRON-like time expression. The annotated method is used as the timeout callback method.

All elements of this annotation are optional. If none are specified a persistent timer will be created with callbacks occurring every day at midnight in the default time zone associated with the container in which the application is executing.

There are seven elements that constitute a schedule specification which are listed below. In addition, the timezone element may be used to specify a non-default time zone in whose context the schedule specification is to be evaluated; the persistent element may be used to specify a non-persistent timer, and the info element may be used to specify additional information that may be retrieved when the timer callback occurs.

A.2.23.1.1 Calendar-based Schedule Elements

The elements that specify the calendar-based schedule itself are as follows:

- **second** – one or more seconds within a minute.
  Allowable values: [0,59]
- **minute** – one or more minutes within an hour.
  Allowable values: [0,59]
- **hour** – one or more hours within a day.
  Allowable values: [0,23]
- **dayOfMonth** – one or more days within a month.
  Allowable values: [1,31]
  - -7, -1
  - "Last"
  "Last" means the last day of the month.
  -x (where x is in the range [-7, -1]) means x day(s) before the last day of the month
  "1st","2nd", etc. applied to a day of the week identifies a single occurrence of that day within the month.
- **month** – one or more months within a year.
  Allowable values:
  - [1,12]
- **dayOfWeek** – one or more days within a week.
  Allowable values:
  - [0,7]
  - {"Sun", "Mon", "Tue", "Wed", "Thu", "Fri", "Sat"}
"0" and "7" both refer to Sunday

- **year** – a particular calendar year.
  Allowable values: a four-digit calendar year

### A.2.23.1.2 Forms of Supported Element Values

Each element supports values expressed in one of the following forms:

- **Single Value** – Constrains the attribute to only one of its possible values.
  
  Example: second = "10"
  Example: month = "Sep"

- **Wild Card** – "*" Represents all allowable values for a given attribute.
  
  Example: second = "*"
  Example: dayOfWeek = "*"

- **List** – Constrains the attribute to two or more allowable values or ranges, with a comma used as a separator character within the string. Each item in the list must be a single value or range. List items cannot be lists, wild cards, or increments. Duplicate values are ignored.
  
  Example: second = "10,20,30"
  Example: dayOfWeek = "Mon,Wed,Fri"
  Example: minute = "0-10,30,40"

- **Range** – Constrains the attribute to an inclusive range of values, with a dash separating both ends of the range. Each side of the range must be a single attribute value. Members of a range cannot be lists, wild cards, ranges, or increments. If $x$ is larger than $y$ in a range "x-y", the range is equivalent to "x-max, min-y", where max is the largest value of the corresponding attribute and min is the smallest. The range "x-x", where both range values are the same, evaluates to the single value $x$. The day of the week range "0-7" is equivalent to "*".
  
  Example: second = "1-10"
  Example: dayOfWeek = "Fri-Mon"
  Example: dayOfMonth = "27-3" (Equivalent to "27-Last, 1-3"

- **Increments** – The forward slash constrains an attribute based on a starting point and an interval, and is used to specify every $N$ seconds, minutes, or hours within the minute, hour, or day, respectively. For the expression $x/y$, the attribute is constrained to every $y$th value within the set of allowable values beginning at time $x$. The $x$ value is inclusive. The wild card character ("*") can be used in the $x$ position, and is equivalent to 0. The use of increments is only supported within the second, minute, and hour elements. For the second and minute elements, $x$ and $y$ must each be in the range \([0,59]\). For the hour element, $x$ and $y$ must each be in the range \([0,23]\).
  
  Example: minute = "*/5" (Every five minutes within the hour)

This is equivalent to: minute = "0,5,10,15,20,25,30,35,40,45,50,55"

Example: second = "30/10" (Every 10 seconds within the minute, starting at second 30)

This is equivalent to: second = "30,40,50"

Note that the set of matching increment values stops once the maximum value for that attribute is exceeded. It does not "roll over" past the boundary.
Example: (minute = "?/14", hour="1,2")

This is equivalent to: (minute = "0,14,28,42,56", hour = "1,2") (Every 14 minutes within the hour, for the hours of 1 and 2 a.m.)

A.2.23.1.3 Additional Rules for Schedule Specification Elements  The following additional rules apply to the schedule specification elements.

- If the dayOfMonth element has a non-wildcard value and the dayOfWeek element has a non-wildcard value, then any day matching either the dayOfMonth value or the dayOfWeek value will be considered to apply.

- Whitespace is ignored, except for string constants and numeric values.

- All string constants (e.g., "Sun", "Jan", "1st", etc.) are case insensitive.

Schedule-based timer times are evaluated in the context of the default time zone associated with the container in which the application is executing. A schedule-based timer may optionally override this default and associate itself with a specific time zone. If the schedule-based timer is associated with a specific time zone, all its times are evaluated in the context of that time zone, regardless of the default time zone in which the container is executing.

The timeout callback method to which the Schedule annotation is applied must have one of the following signatures, where <METHOD> designates the method name:

```java
void <METHOD>()
void <METHOD>(Timer timer)
```

A timeout callback method can have public, private, protected, or package level access. A timeout callback method must not be declared as final or static. Timeout callback methods must not throw application exceptions.

A.2.23.2 Attributes  The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>dayOfMonth</td>
<td>Specifies one or more days within a month.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default value is * .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dayOfWeek</td>
<td>Specifies one or more days within a week.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default value is * .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hour</td>
<td>Specifies one or more hours within a day.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default value is 0.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>info</td>
<td>Specifies an information string that is</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>associated with the timer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Default value is 0.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>minute</td>
<td>Specifies one or more minutes within a hour.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default value is 0.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>month</td>
<td>Specifies one or more months within a year.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default value is * .</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A.2.24 javax.ejb.Schedules

The following sections describe the annotation in more detail.

A.2.24.1 Description

Target: Method

Applied to a timer callback method to schedule multiple calendar-based timers for the method. The method to which the Schedules annotation is applied must have one of the following signatures, where <METHOD> designates the method name:

```java
void <METHOD>()
void <METHOD>(Timer timer)
```

A.2.24.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>persistent</td>
<td>Specifies whether the timer that is created is persistent. Valid values for this attribute are true and false. Default value is true.</td>
<td>Boolean</td>
<td>No</td>
</tr>
<tr>
<td>second</td>
<td>Specifies one or more seconds with in a minute. Default value is 0.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td>timezone</td>
<td>Specifies the time zone within which the schedule is evaluated. Time zones are specified as an ID string. The set of required time zone IDs is defined by the Zone Name(TZ) column of the public domain zoneinfo database. Default value: If a timezone is not specified, the schedule is evaluated in the context of the default timezone associated with the container in which the application is executing.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td>year</td>
<td>Specifies one or more years. Default value is *.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>

A.2.25 javax.ejb.Singleton

The following sections describe the annotation in more detail.

A.2.25.1 Description

Target: Class

Specifies that the Enterprise JavaBean is a singleton session bean.
A.2.25.2 Attributes

The following table summarizes the attributes.

Table A–18 Attributes of the javax.ejb.Singleton Annotation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name of the singleton session bean. If you do not specify this</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>attribute, the default value is the unqualified name of the bean class.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mappedName</td>
<td>Specifies the product-specific name to which the singleton session bean</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>should be mapped. You can also use this attribute to specify the JNDI name</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of this singleton session bean. WebLogic Server uses the value of the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mappedName attribute when creating the bean’s global JNDI name. In</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>particular, the JNDI name will be:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mappedName#name_of_businessInterface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>where name_of_businessInterface is the fully qualified name of the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>business interface of this session bean.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For example, if you specify mappedName=&quot;bank&quot; and the fully qualified</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>name of the business interface is com.CheckingAccount, then the JNDI of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the business interface is</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bank#com.CheckingAccount.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: If you specify this attribute, the singleton session bean may not</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>be portable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>Describes the singleton session bean.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>

A.2.26 javax.ejb.Startup

The following sections describe the annotation in more detail.

A.2.26.1 Description

Target: Class

Specifies that the Enterprise JavaBean is a stateful session bean.

A.2.27 javax.ejb.StatefulTimeout

The following sections describe the annotation in more detail.

A.2.27.1 Description

Target: Type

Specifies the amount of time a stateful session bean can be idle (not receive any client invocations) before it is eligible for removal by the container.

A.2.27.2 Attributes

The following table summarizes the attributes.
A.2.28 javax.ejb.Stateless

The following sections describe the annotation in more detail.

A.2.28.1 Description

**Target**: Class

Specifies that the Enterprise JavaBean is a stateless session bean.

A.2.28.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the amount of time the stateful session bean can be idle.</td>
<td>Long</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>■ A value &gt; 0 indicates a timeout value in the units specified by the unit element.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ A value of 0 means concurrent access is not permitted.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ A value of -1 indicates that the client request will block indefinitely until forward progress it can proceed. Values less than -1 are not valid.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>unit</td>
<td>Specifies the units used for the specified value.</td>
<td>TimeUnit</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>The default value for this attribute is java.util.concurrent.TimeUnit.MINUTES.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table A–19 Attributes of the java.ejb.StatefulTimeout Annotation**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name of the stateless session bean.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>If you do not specify this attribute, the default value is the unqualified name of the bean class.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table A–20 Attributes of the javax.ejb.Stateless Annotation**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
</table>
A.2.29 **javax.ejb.Timeout**

The following sections describe the annotation in more detail.

A.2.29.1 **Description**

**Target:** Method

Specifies the timeout method of the bean class.

This annotation makes it easy to program an EJB timer service in your bean class. The EJB timer service is an EJB-container provided service that allows you to create timers that schedule callbacks to occur when a timer object expires.

Previous to EJB 3.x, your bean class was required to implement `javax.ejb.TimedObject` if you wanted to program the timer service. Additionally, your bean class had to include a method with the exact name `ejbTimeout`. These requirements are relaxed in Version 3.x of EJB. You no longer are required to implement the `javax.ejb.TimedObject` interface, and you can name your timeout method anything you want, as long as you annotate it with the `@Timeout` annotation. You can, however, continue to use the pre-3.x way of programming the timer service if you want.

For details, see Section 4.6, "Optionally Program the EJB Timer Service."

This annotation does not have any attributes.

A.2.30 **javax.ejb.TransactionAttribute**

The following sections describe the annotation in more detail.

A.2.30.1 **Description**

**Target:** Class, Method
Specifies whether the EJB container invokes an EJB business method within a transaction context.

**Note:** If you specify this annotation, you are also required to use the @TransactionManagement annotation to specify container-managed transaction demarcation.

You can specify this annotation on either the bean class, or a particular method of the class that is also a method of the business interface. If specified at the bean class, the annotation applies to all applicable business interface methods of the class. If specified for a particular method, the annotation applies to that method only. If the annotation is specified at both the class and the method level, the method value overrides if the two disagree.

If you do not specify the @TransactionAttribute annotation in your bean class, and the bean uses container managed transaction demarcation, the semantics of the REQUIRED transaction attribute are assumed.

### A.2.30.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
</table>
| value         | Specifies how the EJB container manages the transaction boundaries when invoking a business method. For details about these values, see the description of the trans-attribute element in the "Container-Managed Transactions Elements" table in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server. Valid values for this attribute are:  
  - TransactionAttributeType.MANDATORY  
  - TransactionAttributeType.REQUIRED  
  - TransactionAttributeType.REQUIRED_NEW  
  - TransactionAttributeType.SUPPORTS  
  - TransactionAttributeType.NOT_SUPPORTED  
  - TransactionAttributeType.NEVER  
  Default value is TransactionAttributeType.REQUIRED. | String     | No.       |

### A.2.31 javax.ejb.TransactionManagement

The following sections describe the annotation in more detail.

#### A.2.31.1 Description

**Target:** Class

Specifies the transaction management demarcation type of the session bean or message-driven bean.
A transaction is a unit of work that changes application state—whether on disk, in memory or in a database—that, once started, is completed entirely, or not at all. Transactions can be demarcated—started, and ended with a commit or rollback—by the EJB container, by bean code, or by client code. This annotation specifies whether the EJB container or the user-written bean code manages the demarcation of a transaction.

If you do not specify this annotation in your bean class, it is assumed that the bean has container-managed transaction demarcation.

For additional information about transactions, see “Transaction Design and Management Options” in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.2.3.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the transaction management demarcation type used by the bean class.</td>
<td>String</td>
<td>No.</td>
</tr>
</tbody>
</table>

Valid values for this attribute are:
- TransactionManagementType.CONTAINER
- TransactionManagementType.BEAN

Default value is TransactionManagementType.CONTAINER.

A.3 Annotations Used to Configure Interceptors
This section provides reference information for the annotations described in the following sections:
- Section A.3.1, "javax.interceptor.AroundInvoke"
- Section A.3.2, "javax.interceptor.ExcludeClassInterceptors"
- Section A.3.3, "javax.interceptor.ExcludeDefaultInterceptors"
- Section A.3.4, "javax.interceptor.Interceptors"

A.3.1 javax.interceptor.AroundInvoke
The following sections describe the annotation in more detail.

A.3.1.1 Description
Target: Method
Specifies the business method interceptor for either a bean class or an interceptor class.

You can annotate only one method in the bean class or interceptor class with the @AroundInvoke annotation; the method cannot be a business method of the bean class.

This annotation does not have any attributes.

A.3.2 javax.interceptor.ExcludeClassInterceptors
The following sections describe the annotation in more detail.
A.3.2.1 Description

Target: Method

Specifies that any class-level interceptors should not be invoked for the annotated method. This does not include default interceptors, whose invocation are excluded only with the @ExcludeDefaultInterceptors annotation.

This annotation does not have any attributes.

A.3.3 javax.interceptor.ExcludeDefaultInterceptors

The following sections describe the annotation in more detail.

A.3.3.1 Description

Target: Class, Method

Specifies that any defined default interceptors (which can be specified only in the EJB deployment descriptors, and not with annotations) should not be invoked.

If defined at the class-level, the default interceptors are never invoked for any of the bean’s business methods. If defined at the method-level, the default interceptors are never invoked for the particular business method, but they are invoked for all other business methods that do not have the @ExcludeDefaultInterceptors annotation.

This annotation does not include any attributes.

A.3.4 javax.interceptor.Interceptors

The following sections describe the annotation in more detail.

A.3.4.1 Description

Target: Class, Method

Specifies the interceptor classes that are associated with the bean class or method. An interceptor class is a class—distinct from the bean class itself—whose methods are invoked in response to business method invocations and/or life cycle events on the bean.

The interceptor class can include both an business interceptor method (annotated with the @javax.interceptor.AroundInvoke annotation) and life cycle callback methods (annotated with the @javax.annotation.PostConstruct, @javax.annotation.PreDestroy, @javax.ejb.PostActivate, and @javax.ejb_PrePassivate annotations).

Any number of interceptor classes may be defined for a bean class. If more than one interceptor class is defined, they are invoked in the order they are specified in the annotation.

If the annotation is specified at the class-level, the interceptors apply to all business methods of the EJB. If specified at the method-level, the interceptors apply to just that method. You can specify the same interceptor class to more than one method of the bean class. By default, method-level interceptors are invoked after all applicable interceptors (default interceptors, class-level interceptors, and so on).

A.3.4.2 Attributes

The following table summarizes the attributes.
A.4 Annotations Used to Interact With Entity Beans

This section provides reference information about the annotations described in the following sections:

- Section A.4.1, "javax.persistence.PersistenceContext"
- Section A.4.2, "javax.persistence.PersistenceContexts"
- Section A.4.3, "javax.persistence.PersistenceUnit"
- Section A.4.4, "javax.persistence.PersistenceUnits"

A.4.1 javax.persistence.PersistenceContext

The following sections describe the annotation in more detail.

A.4.1.1 Description

Target: Class, Method, Field

Specifies a dependency on a container-managed EntityManager persistence context.

You use this annotation to interact with a 3.x entity bean, typically by performing dependency injection into an EntityManager instance.

The EntityManager interface defines the methods that are used to interact with the persistence context. A persistence context is a set of entity instances; an entity is a lightweight persistent domain object. The EntityManager API is used to create and remove persistent entity instances, to find entities by their primary key, and to query over entities.

A.4.1.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name by which the EntityManager and its persistence unit are to be known within the context of the session or message-driven bean. You only need to specify this attribute if you use a JNDI lookup to obtain an EntityManager; if you use dependency injection, then you do not need to specify this attribute.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>
### A.4.2 javax.persistence.PersistenceContexts

The following sections describe the annotation in more detail.

#### A.4.2.1 Description

**Target:** Class

Specifies an array of `@javax.persistence.PersistenceContext` annotations.

#### A.4.2.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the array of <code>@javax.persistence.PersistenceContext</code> annotations.</td>
<td>PersistenceContext</td>
<td>Yes</td>
</tr>
</tbody>
</table>

#### A.4.3 javax.persistence.PersistenceUnit

The following sections describe the annotation in more detail.

Note: The `persistence.xml` file is an XML file, located in the `META-INF` directory of the EJB JAR file, that specifies the database used with the entity beans and specifies the default behavior of the `EntityManager`.

You must specify this attribute if there is more than one persistence unit within the referencing scope.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>unitName</td>
<td>Specifies the name of the persistence unit. If you specify a value for this attribute that is the same as the name of a persistence unit in the <code>persistence.xml</code> file, the EJB container automatically deploys the persistence unit and sets its JNDI name to its persistence unit name. Similarly, if you do not specify this attribute, but the name of the variable into which you are injecting the persistence context information is the same as the name of a persistence unit in the <code>persistence.xml</code> file, then the EJB container again automatically deploys the persistence unit with its JNDI name equal to its unit name.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>String</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
</table>
| type   | Specifies whether the lifetime of the persistence context is scoped to a transaction or whether it extends beyond that of a single transaction. Valid values for this attribute are:

- `PersistenceContextType.TRANSACTION`
- `PersistenceContextType.EXTENDED`

Default value is `PersistenceContextType.TRANSACTION`. | PersistenceContextType | No          |

Table A–25 (Cont.) Attributes of the `javax.persistence.PersistenceContextAnnotation`

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the array of <code>@javax.persistence.PersistenceContext</code> annotations.</td>
<td>PersistenceContext</td>
<td>Yes</td>
</tr>
</tbody>
</table>
A.4.3.1 Description

Target: Class, Method, Field

Specifies a dependency on an EntityManagerFactory object.

You use this annotation to interact with a 3.x entity bean, typically by performing dependency injection into an EntityManagerFactory instance. You can then use the EntityManagerFactory to create one or more EntityManager instances. This annotation is similar to the @PersistenceContext annotation, except that it gives you more control over the life of the EntityManager because you create and destroy it yourself, rather than let the EJB container do it for you.

The EntityManager interface defines the methods that are used to interact with the persistence context. A persistence context is a set of entity instances; an entity is a lightweight persistent domain object. The EntityManager API is used to create and remove persistent entity instances, to find entities by their primary key, and to query over entities.

A.4.3.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name by which the EntityManagerFactory is to be known within the context of the session or message-driven bean. You are not required to specify this attribute if you use dependency injection, only if you also use JNDI to look up information.</td>
<td>String</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>unitName</td>
<td>Refers to the name of the persistence unit as defined in the persistence.xml file. This file is an XML file, located in the META-INF directory of the EJB JAR file, that specifies the database used with the entity beans and specifies the default behavior of the EntityManager. If you set this attribute, the EJB container automatically deploys the referenced persistence unit and sets its JNDI name to its persistence unit name. Similarly, if you do not specify this attribute, but the name of the variable into which you are injecting the persistence context information is the same as the name of a persistence unit in the persistence.xml file, then the EJB container again automatically deploys the persistence unit with its JNDI name equal to its unit name. You are required to specify this attribute only if there is more than one persistence unit in the referencing scope.</td>
<td>String</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

A.4.4 javax.persistence.PersistenceUnits

The following sections describe the annotation in more detail.
A.4.4.1 Description
Target: Class
Specifies an array of @javax.persistence.PersistenceUnit annotations.

A.4.4.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the array of</td>
<td>PersistenceUnit</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>@javax.persistence.PersistenceUnit</td>
<td>annotations.</td>
<td></td>
</tr>
</tbody>
</table>

A.5 Standard JDK Annotations Used By EJB 3.x
This section provides reference information about the annotations described in the following sections:
- Section A.5.1, "javax.annotation.PostConstruct"
- Section A.5.2, "javax.annotation.PreDestroy"
- Section A.5.3, "javax.annotation.Resource"
- Section A.5.4, "javax.annotation.Resources"

A.5.1 javax.annotation.PostConstruct
The following sections describe the annotation in more detail.

A.5.1.1 Description
Target: Method
Specifies the life cycle callback method that the EJB container should execute before the first business method invocation and after dependency injection is done to perform any initialization.
You may specify a @PostConstruct method in any bean class that includes dependency injection.
Only one method in the bean class can be annotated with this annotation. If you annotate more than one method with this annotations, the EJB will not deploy.
The method annotated with @PostConstruct must follow these requirements:
- The return type of the method must be void.
- The method must not throw a checked exception.
- The method may be public, protected, package or private.
- The method must not be static.
- The method must not be final.
This annotation does not have any attributes.

A.5.2 javax.annotation.PreDestroy
The following sections describe the annotation in more detail.
A.5.2.1 Description
Target: Method

Specifies the life cycle callback method that signals that the bean class instance is about to be destroyed by the EJB container. You typically apply this annotation to methods that release resources that the bean class has been holding.

Only one method in the bean class can be annotated with this annotation. If you annotate more than one method with this annotations, the EJB will not deploy.

The method annotated with @PreDestroy must follow these requirements:

- The return type of the method must be void.
- The method must not throw a checked exception.
- The method may be public, protected, package private or private.
- The method must not be static.
- The method must not be final.

This annotation does not have any attributes.

A.5.3 javax.annotation.Resource

The following sections describe the annotation in more detail.

A.5.3.1 Description
Target: Class, Method, Field

Specifies a dependence on an external resource, such as a JDBC data source or a JMS destination or connection factory.

If you specify the annotation on a field or method, the EJB container injects an instance of the requested resource into the bean when the bean is initialized. If you apply the annotation to a class, the annotation declares a resource that the bean will look up at runtime.

A.5.3.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name of the resource reference. If you apply the @Resource</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>annotation to a field, the default value of the name attribute is the field</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>name, qualified by the class name. If you apply it to a method, the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>default value is the JavaBeans property name corresponding to the method,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>qualified by the class name. If you apply the annotation to class, there is</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>no default value and thus you are required to specify the attribute.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following sections describe the annotation in more detail.

## A.5.4 javax.annotation.Resources

### A.5.4.1 Description

**Target:** Class

Specifies an array of @Resource annotations.

### A.5.4.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>Specifies the Java data type of the resource.</td>
<td>Class</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>If you apply the @Resource annotation to a field, the default value of the type attribute is the type of the field. If you apply it to a method, the default is the type of the JavaBeans property. If you apply it to a class, there is no default value and thus you are required to specify this attribute.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>authenticationType</td>
<td>Specifies the authentication type to use for the resource.</td>
<td>AuthenticationType</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>You specify this attribute only for resources representing a connection factory of any supported type. Valid values for this attribute are:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ AuthenticationType.CONTAINER</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ AuthenticationType.APPLICATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Default value is AuthenticationType.CONTAINER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shareable</td>
<td>Indicates whether a resource can be shared between this EJB and other EJBs.</td>
<td>boolean</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>You specify this attribute only for resources representing a connection factory of any supported type or ORB object instances. Valid values for this attribute are true and false. Default value is true.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mappedName</td>
<td>Specifies the global JNDI name of the dependent resource.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>For example: mappedName=&quot;my.Datasource&quot; specifies that the JNDI name of the dependent resources is my.Datasource and is deployed in the WebLogic Server JNDI tree.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>Specifies a description of the resource.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>
A.6 Standard Security-Related JDK Annotations Used by EJB 3.x

This section provides reference information about the annotations described in the following sections:

- Section A.6.1, "javax.annotation.security.DeclareRoles"
- Section A.6.2, "javax.annotation.security.DenyAll"
- Section A.6.3, "javax.annotation.security.PermitAll"
- Section A.6.4, "javax.annotation.security.RolesAllowed"
- Section A.6.5, "javax.annotation.security.RunAs"

A.6.1 javax.annotation.security.DeclareRoles

The following sections describe the annotation in more detail.

A.6.1.1 Description

**Target:** Class

Defines the security roles that will be used in the EJB.

You typically use this annotation to define roles that can be tested from within the methods of the annotated class, such as using the `isUserInRole` method. You can also use the annotation to explicitly declare roles that are implicitly declared if you use the `@RolesAllowed` annotation on the class or a method of the class.

You create security roles in WebLogic Server using the WebLogic Server Administration Console. For details, see "Manage Security Roles" in the Oracle WebLogic Server Administration Console Online Help.

A.6.1.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies an array of <code>@Resource</code> annotations.</td>
<td>Resource[]</td>
<td>Yes</td>
</tr>
</tbody>
</table>

A.6.2 javax.annotation.security.DenyAll

The following sections describe the annotation in more detail.

A.6.2.1 Description

**Target:** Method

Specifies that no security role is allowed to access the annotated method, or in other words, the method is excluded from execution in the EJB container.

This annotation does not have any attributes.
A.6.3 javax.annotation.security.PermitAll

The following sections describe the annotation in more detail.

A.6.3.1 Description

Target: Method

Specifies that all security roles currently defined for WebLogic Server are allowed to access the annotated method.

This annotation does not have any attributes.

A.6.4 javax.annotation.security.RolesAllowed

The following sections describe the annotation in more detail.

A.6.4.1 Description

Target: Class, Method

Specifies the list of security roles that are allowed to access methods in the EJB.

If you specify it at the class-level, then it applies to all methods in the bean class. If you specify it at the method-level, then it only applies to that method. If you specify the annotation at both the class- and method-level, the method value overrides the class value.

You create security roles in WebLogic Server using the WebLogic Server Administration Console. For details, see "Manage Security Roles" in the Oracle WebLogic Server Administration Console Online Help.

A.6.4.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>List of security roles that are allowed to access methods of the bean class.</td>
<td>String[]</td>
<td>Yes</td>
</tr>
</tbody>
</table>

A.6.5 javax.annotation.security.RunAs

The following sections describe the annotation in more detail.

A.6.5.1 Description

Target: Class

Specifies the security role which actually executes the EJB in the EJB container.

The security role must exist in the WebLogic Server security realm and map to a user or group. For details, see "Manage Security Roles" in the Oracle WebLogic Server Administration Console Online Help.

A.6.5.2 Attributes

The following table summarizes the attributes.
A.7 WebLogic Annotations

This section provides reference information for the WebLogic annotations described in the following sections:

- Section A.7.1, "weblogic.javaee.AllowRemoveDuringTransaction"
- Section A.7.2, "weblogic.javaee.CallByReference"
- Section A.7.3, "weblogic.javaee.DisableWarnings"
- Section A.7.4, "weblogic.javaee.EJBReference"
- Section A.7.5, "weblogic.javaee.Idempotent"
- Section A.7.6, "weblogic.javaee.JMSClientID"
- Section A.7.7, "weblogic.javaee.JNDIName"
- Section A.7.8, "weblogic.javaee.JNDINames"
- Section A.7.9, "weblogic.javaee.MessageDestinationConfiguration"
- Section A.7.10, "weblogic.javaee.TransactionIsolation"
- Section A.7.11, "weblogic.javaee.TransactionTimeoutSeconds"

**Table A–32 Attributes of the javax.annotation.security.RunAs Annotation**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Specifies the security role which the EJB should run as.</td>
<td>String</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Note:** The annotations described in this section are overridden if the comparable configuration is defined in the `weblogic-ejb-jar.xml` deployment descriptor. For more information, see "weblogic-ejb-jar.xml Deployment Descriptor Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.1 weblogic.javaee.AllowRemoveDuringTransaction

The following sections describe the annotation in more detail.

**A.7.1.1 Description**

**Target:** Class (Stateful session EJBs only)

Flag that specifies whether an instance can be removed during a transaction.

**Note:** This annotation is overridden by the `allow-remove-during-transaction` element in the `weblogic-ejb-jar.xml` deployment descriptor. For more information, see "weblogic-ejb-jar.xml Deployment Descriptor Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.2 weblogic.javaee.CallByReference

The following sections describe the annotation in more detail.
A.7.2.1 Description

**Target:** Class (Stateful or stateless sessions EJBs only)

Flag that specifies whether parameters are copied—or passed by reference—regardless of whether the EJB is called remotely or from within the same EAR.

---

**Note:** Method parameters are *always* passed by value when an EJB is called remotely. This annotation is overridden by the `enable-call-by-reference` element in the `weblogic-ejb-jar.xml` deployment descriptor. For more information, see "weblogic-ejb-jar.xml Deployment Descriptor Reference" in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

---

A.7.3 `weblogic.javaee.DisableWarnings`

The following sections describe the annotation in more detail.

A.7.3.1 Description

**Target:** Class

Specifies that WebLogic Server should disable the warning message whose ID is specified.

---

**Note:** This annotation is overridden by the `disable-warning` element in the `weblogic-ejb-jar.xml` deployment descriptor. For more information, see "weblogic-ejb-jar.xml Deployment Descriptor Reference" in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

---

A.7.3.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>WarningCode</code></td>
<td>Specifies the warning code. Set this element to one of the following four values:</td>
<td>String</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>• <strong>BEA-010001</strong>—Disables this warning message: &quot;EJB class loaded from system classpath during deployment.&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>BEA-010054</strong>—Disables this warning message: &quot;EJB class loaded from system classpath during compilation.&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>BEA-010200</strong>—Disables this warning message: &quot;EJB impl class contains a public static field, method or class.&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>BEA-010202</strong>—Disables this warning message: &quot;Call-by-reference not enabled.&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A.7.4  weblogic.javaee.EJBReference

The following sections describe the annotation in more detail.

A.7.4.1 Description

Target: Class, Method, Field

Maps EJB reference name to its JNDI name.

A.7.4.2 Attribute

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the name by which the referenced EJB is to be looked up in the environment. This name must be unique within the deployment unit, which consists of the class and its superclass.</td>
<td>String</td>
<td>Yes</td>
</tr>
<tr>
<td>jndiName</td>
<td>Specifies the JNDI name of an actual EJB, resource, or reference available in WebLogic Server.</td>
<td>String</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: This annotation is overridden by the idempotent-method and retry-methods-on-rollback elements in the weblogic-ejb-jar.xml deployment descriptor. For more information, see “weblogic-ejb-jar.xml Deployment Descriptor Reference” in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.5  weblogic.javaee.Idempotent

The following sections describe the annotation in more detail.

A.7.5.1 Description

Target: Class

Specifies an EJB that is written in such a way that repeated calls to the same method with the same arguments has exactly the same effect as a single call. This allows the failover handler to retry a failed call without knowing whether the call actually compiled on the failed server. When you enable idempotent for a method, the EJB stub can automatically recover from any failure as long as it can reach another server hosting the EJB.

Note: This annotation is overridden by the idempotent-method and retry-methods-on-rollback elements in the weblogic-ejb-jar.xml deployment descriptor. For more information, see “weblogic-ejb-jar.xml Deployment Descriptor Reference” in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.5.2 Attributes

The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>retryOnRollbackCount</td>
<td>Number of times to automatically retry container-managed transactions that have rolled back. This attribute defaults to 0.</td>
<td>int</td>
<td>No</td>
</tr>
</tbody>
</table>
A.7.6 weblogic.javaee.JMSTargetID

The following sections describe the annotation in more detail.

A.7.6.1 Description

Target: Method

Specifies a client ID for the MDB when it connects to a JMS destination. Required for
durable subscriptions to JMS topics.

If you specify the connection factory that the MDB uses in Section A.7.9,
"weblogic.javaee.MessageDestinationConfiguration," the client ID can be defined in
the ClientID element of the associated JMSCreationFactory element in config.xml.

If JMSCreationFactory in config.xml does not specify a ClientID, or if you use the
default connection factory, (you do not specify Section A.7.9,
"weblogic.javaee.MessageDestinationConfiguration") the MDB uses the
jms-client-id value as its client id.

Note: This annotation is overridden by the jms-client-id element
in the weblogic-ejb-jar.xml deployment descriptor. For more
information, see "weblogic-ejb-jar.xml Deployment Descriptor
Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle
WebLogic Server.

A.7.6.2 Attributes

The following table summarizes the attributes.

Table A–36 Attributes of the weblogic.javaee.JMSTargetID

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Client ID.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td>generateUniqueID</td>
<td>Flag that indicates whether or not you want the EJB container to generate a unique client ID for every instance of an MDB. Enabling this flag makes it easier to deploy durable MDBs to multiple server instances in a WebLogic Server cluster.</td>
<td>Class</td>
<td>No</td>
</tr>
</tbody>
</table>

A.7.7 weblogic.javaee.JNDIName

The following sections describe the annotation in more detail.

A.7.7.1 Description

Target: Class (Stateful or stateless session EJBs only)

Specifies a custom JNDI name that can be applied to a bean class for a certain client
view. When applied to a bean class to indicate the JNDI name of a no-interface view,
the className is optional.

Note: This annotation is overridden by the jndi-binding element in
the weblogic-ejb-jar.xml deployment descriptor. For more
information, see "weblogic-ejb-jar.xml Deployment Descriptor
Reference" in Developing Enterprise JavaBeans, Version 2.1, for Oracle
WebLogic Server.
A.7.7.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>classname</td>
<td>Class name of the client view.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td>value</td>
<td>JNDI name of the client view.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>

A.7.8 weblogic.javaee.JNDINames
The following sections describe the annotation in more detail.

A.7.8.1 Description
Target: Class (Stateful or stateless session EJBs only)
Specifies the multiple, custom JNDI names that can be applied to an EJB.

A.7.8.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Multiple, custom JNDI names for the EJB.</td>
<td>JNDINam e</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: This annotation is overridden by the connection-factory-jndi-name element in the weblogic-ejb-jar.xml deployment descriptor. For more information, see “weblogic-ejb-jar.xml Deployment Descriptor Reference” in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.9 weblogic.javaee.MessageDestinationConfiguration
The following sections describe the annotation in more detail.

A.7.9.1 Description
Target: Class (Message-driven EJBs only)
Specifies the JNDI name of the JMS Connection Factory that a message-driven EJB looks up to create its queues and topics.

Note: This annotation is overridden by the connection-factory-jndi-name element in the weblogic-ejb-jar.xml deployment descriptor. For more information, see “weblogic-ejb-jar.xml Deployment Descriptor Reference” in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.9.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>connectionFactoryJNDIName</td>
<td>Connection factory JNDI name. This attribute defaults to an empty string.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>
A.7.10 weblogic.javaee.TransactionIsolation
The following sections describe the annotation in more detail.

A.7.10.1 Description
Target: Method
Method-level transaction isolation settings for an EJB.

Note: This annotation is overridden by the trans-timeout-seconds element in the weblogic-ejb-jar.xml deployment descriptor. For more information, see “weblogic-ejb-jar.xml Deployment Descriptor Reference” in Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server.

A.7.10.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>initialContextFactor</td>
<td>WebLogic initial context factory. This attribute defaults to...</td>
<td>Class</td>
<td>No</td>
</tr>
<tr>
<td>providerURL</td>
<td>URL of the provider. This attribute defaults to...</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>

Table A–40 Attributes of the weblogic.javaee.Idempotent

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>IsolationLevel</td>
<td>Isolation level. Valid values include:</td>
<td>int</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>■ READ_COMMITTED—Transaction can view only committed updates from other transactions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ READ_UNCOMMITTED—Transactions can view uncommitted updates from other transactions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ REPEATABLE_READ—Once the transaction reads a subset of data, repeated reads of the same data return the same values, even if other transactions have subsequently modified the data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ SERIALIZABLE—Simultaneously executing this transaction multiple times has the same effect as executing the transaction multiple times in a serial fashion.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This attribute defaults to DEFAULT.

A.7.11 weblogic.javaee.TransactionTimeoutSeconds
The following sections describe the annotation in more detail.
A.7.11.1 Description
Target: Class
Defines the timeout for transactions in seconds.

A.7.11.2 Attributes
The following table summarizes the attributes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Type</th>
<th>Required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Transaction timeout value in seconds. This attribute defaults to 30 (seconds).</td>
<td>int</td>
<td>No</td>
</tr>
</tbody>
</table>
This appendix provides an overview of developing, deploying, and configuring an Oracle Kodo application using WebLogic Server.

Kodo Deprecation Notes: Oracle Kodo JPA/JDO is deprecated in this release. Customers are encouraged to use Oracle TopLink, a JPA 2.0 provider. For more information about Oracle TopLink, see Chapter 8, "Configuring the Persistence Provider in Oracle WebLogic Server." Just as Kodo is deprecated, the Kodo documentation is also deprecated. For current information about using Kodo in WebLogic Server, see Section 8.5, "Using Oracle Kodo in Oracle WebLogic Server."

This release of WebLogic Server runs with the JPA 2.0 JAR in the server’s classpath. Although JPA 2.0 is upwardly compatible with JPA 1.0, JPA 2.0 introduced some methods to existing JPA interfaces that conflict with existing signatures in OpenJPA interfaces. As a result, applications that continue to use Kodo/JPA as the persistence provider with WebLogic Server 12.1.1 must be recompiled. For more information, see Section 8.5.3, "Updating Applications to Overcome Conflicts with JPA 2.0."

Kodo does not support JPA 2.0. Trying to used JPA 2.0 APIs with Kodo in WebLogic Server will produce an error. However, using Kodo as the persistence provider for a specific persistence unit or as the default provider for the domain does not prevent you from using TopLink for a different persistence unit. For more information, see Section 8.5, "Using Oracle Kodo in Oracle WebLogic Server."

This appendix includes the following sections:

- Overview of Oracle Kodo
- Creating an Oracle Kodo Application
- Using Different Oracle Kodo Versions
- Configuring Persistence
- Deploying an Oracle Kodo Application
- Configuring an Oracle Kodo Application
B.1 Overview of Oracle Kodo

Oracle Kodo is an implementation of the Java Persistence API (JPA) specification and Java Data Objects (JDO) specification for transparent data objects. Oracle Kodo is available as a stand-alone product and is integrated within WebLogic Server.

This chapter describes how to implement an application using JPA or JDO in WebLogic Server. Within WebLogic Server, the JPA and JDO implementations are part of WebLogic Server’s overall Enterprise JavaBean 3.0 persistence implementation.

B.2 Creating an Oracle Kodo Application

The first step in implementing a Oracle Kodo application on WebLogic Server is to write the application code. The following resources provide general information on writing an application that uses Oracle Kodo to manage persistence of your data:

- Oracle Kodo JPA Tutorials
- Oracle Kodo JDO Tutorials

Once you are familiar with the steps involved in creating applications using Oracle Kodo and have created your application, the following sections describe how to deploy and configure your application using WebLogic Server.

B.3 Using Different Oracle Kodo Versions

If you choose to use a different version of Oracle Kodo than the one provided by default within WebLogic Server, you must use the FilterClassLoader to specify the packages—in this case Oracle Kodo and OpenJPA—that you want to be loaded from the application, and not from the system classloader.

The following example shows how to load the Oracle Kodo and OpenJPA packages from the application using weblogic-application.xml:

```
<prefer-application-packages>
  <package-name>org.apache.openjpa.*</package-name>
  <package-name>kodo.*</package-name>
</prefer-application-packages>
```

For more information on filtering classloaders, see "Understanding WebLogic Server Application Classloading" in Developing Applications for Oracle WebLogic Server.

Then, you can package the Oracle Kodo and OpenJPA packages with your application using the library directory, as described in "Library Directories" in Developing Applications for Oracle WebLogic Server.

B.4 Configuring Persistence

The following sections describe how to configure persistence.

- Section B.4.1, "Editing the Configuration Property Files"
- Section B.4.2, "Using the Configuration Files Together"
- Section B.4.3, "Configuring Plug-ins"

B.4.1 Editing the Configuration Property Files

Oracle Kodo uses two XML files, listed in the following table, to define configuration properties.
Edit the contents of the configuration files as required to configure persistence. Persistence units can be packaged as part of a WAR or EJB JAR file, or can be packaged as a JAR file that can be included in a WAR or EAR file. The files should be available as resources in the META-INF directory of the root of the persistence unit. For container environments, the root of a persistence unit may be one of the following:

- EJB-JAR file
- WEB-INF/classes directory of a WAR file
- JAR file in the WEB-INF/lib directory of a WAR file
- JAR file in the root of the EAR
- JAR file in the EAR library directory
- Application client jar file

### B.4.2 Using the Configuration Files Together

The following provide considerations for using the configuration files together.

- When using the persistence-configuration.xml file, all Oracle Kodo-specific properties must be included in the persistence-configuration.xml file and not the persistence.xml file. In this case, the WebLogic Server Administration Console and WebLogic Scripting Tool (WLST) recognizes the persistence unit as an Oracle Kodo persistence unit and provide advanced configuration and tunables support.

- If Oracle Kodo-specific properties are included in the persistence.xml file, the persistence unit will be treated as a third-party persistence unit by the WebLogic Server Administration Console and WLST.

- If the persistence-configuration.xml descriptor is available and contains an entry for a given persistence unit, then no Oracle Kodo (kodo) or OpenJPA (openjpa) properties can be specified in the <properties> tag of the persistence.xml file for that persistence unit.

---

### Table B–1  Persistence Configuration Files

<table>
<thead>
<tr>
<th>Configuration File</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>persistence.xml</td>
<td>Oracle Kodo configuration parameters defined by the JPA functional specifications. This file is required. The XML schema for structuring this configuration is available at: <a href="http://java.sun.com/xml/ns/persistence/persistence_1_0.xsd">http://java.sun.com/xml/ns/persistence/persistence_1_0.xsd</a>.</td>
</tr>
<tr>
<td>persistence-configuration.xml</td>
<td>Configuration parameters that are specific to Oracle Kodo. This file is not required when deploying an application. If specified, you must still provide a persistence.xml descriptor. If you do not include persistence-configuration.xml in your deployment, WebLogic Server will create reasonable defaults for each configuration parameter. The XML schema for structuring this configuration is available at: <a href="http://xmlns.oracle.com/weblogic/persistence-configuration/1.0/persistence-configuration.xsd">http://xmlns.oracle.com/weblogic/persistence-configuration/1.0/persistence-configuration.xsd</a>. Note: The weblogic.jar file must be in the CLASSPATH when using the persistent-configuration.xml file in the Java SE environment.</td>
</tr>
</tbody>
</table>
B.4.3 Configuring Plug-ins

Because Oracle Kodo is a highly customizable environment, many configuration properties relate to the creation and configuration of system plug-ins. Plug-in properties have a syntax very similar to that of Java annotations. They allow you to specify both what class to use for the plug-in and how to configure the public fields or bean properties of the instantiated plug-in instance.

Essentially, plug-ins are defined using a series of properties using name/value pairs. For example, the following shows how a plug-in is defined within persistence.xml:

```
<properties>
<property name='myplugin.DataCache' value='com.bea.MyDataCache(CacheSize=1000, RemoteHost='CacheServer')'/>
</properties>
```

B.5 Deploying an Oracle Kodo Application

Before you deploy a Oracle Kodo application, you must perform the following tasks:

- Create a Oracle Kodo application, as described in Section B.2, "Creating an Oracle Kodo Application."
- Configure persistence, as described in Section B.4, "Configuring Persistence."
- Create an archive for your application (.ear or .war).

Once completed, you are ready to deploy your application on WebLogic Server. Once your application is configured, an Oracle Kodo application is deployed just like any other application. For complete information on deploying applications, see Deploying Applications to Oracle WebLogic Server.

B.6 Configuring an Oracle Kodo Application

**Note:** You cannot create a new persistence unit from the WebLogic Server Administration Console. To create a new persistence unit, you must edit persistence.xml manually.

Once you have deployed your Oracle Kodo application, you can alter the configuration parameters defined in persistence.xml and persistence-configuration.xml.

The following sections describe how to configure a Oracle Kodo application with or without using the WebLogic Server Administration Console.

B.6.1 Using the Administration Console

If your deployed application has defined a persistence unit within persistence.xml, you can access configuration from within the WebLogic Server Administration Console using the following:

1. Select **Deployments**.
2. Select the name of the module containing a persistence unit that you want to configure.
3. Select the **Configuration** tab.
4. Select the **Persistence** tab.
5. From the list of persistence units, select the one that you want to configure.

From here, you can access all of the Oracle Kodo persistence parameters that can be edited from the WebLogic Server Administration Console.

**B.6.2 Configuring Oracle Kodo Without Using the Administration Console**

If you need to alter parameters that are not available using the WebLogic Server Administration Console, use one of the following methods:

- Manually edit the `persistence.xml` and `persistence-configuration.xml` files that are archived with the application.

- Use the `SessionHelper` to access and configure the deployment plan. For more information, see "SessionHelper" in "The Tools Package" in "Understanding the WebLogic Deployment API" in *Deploying Applications with the WebLogic Deployment API*.

- Use the WLST `loadApplication()` method to load and update the application deployment plan. For more information, see "Updating the Deployment Plan" in *Understanding the WebLogic Scripting Tool*.

- Manually edit your deployment plan. For more information, see "Manually Customizing the Deployment Plan" in "Exporting an Application for Deployment to New Environments" in *Deploying Applications to Oracle WebLogic Server*.
This appendix describes the namespace, schema location, file structure, and elements in the Kodo-specific deployment descriptor, `persistence-configuration.xml`.

---

**Kodo Deprecation Notes:** Oracle Kodo JPA/JDO is deprecated in this release of WebLogic Server. Customers are encouraged to consider using Oracle TopLink. For more information about Oracle TopLink, see Chapter 8, "Configuring the Persistence Provider in Oracle WebLogic Server".

WebLogic Server does not support JPA 2.0 when using Kodo. For more information, see Section 8.3, "Using Oracle TopLink in Oracle WebLogic Server".

---

This appendix includes the following sections:

- `persistence-configuration.xml` Namespace Declaration and Schema Location
- `persistence-configuration.xml` Deployment Descriptor File Structure
- `persistence-configuration.xml` Deployment Descriptor Elements

### C.1 `persistence-configuration.xml` Namespace Declaration and Schema Location

The correct text for the namespace declaration and schema location for the Kodo `persistence-configuration.xml` file is as follows.

```xml
<persistence-configuration
    xmlns="http://xmlns.oracle.com/weblogic/persistence-configuration"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://xmlns.oracle.com/weblogic/persistence-configuration
                       http://xmlns.oracle.com/weblogic/persistence-configuration/1.0/persistence-configuration.xsd">

    ...

</persistence-configuration>
```
C.2 persistence-configuration.xml Deployment Descriptor File Structure

The persistence-configuration.xml deployment descriptor file describes the elements that are unique to Oracle Kodo.

The top-level elements in the Kodo persistence-configuration.xml are as follows:

- persistence-configuration
  - persistence-configuration-unit
    * aggregate-listeners
    * auto-clear
    * auto-detaches
    * default-broker-factory | abstract-store-broker-factory | client-broker-factory | jdbc-broker-factory | custom-broker-factory
    * default-broker-impl | kodo-broker | custom-broker-impl
    * default-class-resolver | custom-class-resolver
    * default-compatibility | compatibility | default-compatibility
    * connection2-driver-name
    * connection2-password
    * connection2-properties
    * connection2-url
    * connection2-user-name
    * connection-decorators
    * connection-driver-name
    * connection-factory2-name
    * connection-factory2-properties
    * connection-factory-mode
    * connection-factory-name
    * connection-factory-properties
    * connection-password
    * connection-properties
    * connection-retain-mode
    * connection-url
    * connection-user-name
    * data-caches
    * data-cache-timeout
sybase-dictionary | custom-dictionary

* default-detach-state | detach-options-loaded |
detach-options-fetch-groups | detach-options-all | custom-detach-state

* default-driver-data-source | kodo-pooling-data-source |
simple-driver-data-source | custom-driver-data-source

* stack-execution-context-name-provider |
transaction-name-execution-context-name-provider |
user-object-execution-context-name-provider

* none-profiling | local-profiling | export-profiling | gui-profiling

* none-jmx | local-jmx | gui-jmx | jmx2-jmx | mx4j1-jmx | wls81-jmx

* dynamic-data-structs

* eager-fetch-mode

* fetch-batch-size

* fetch-direction

* fetch-groups

* filter-listeners

* flush-before-queries

* ignore-changes

* inverse-manager

* jdbc-listeners

* default-lock-manager | pessimistic-lock-manager | none-lock-manager |
single-jvm-exclusive-lock-manager | version-lock-manager |
custom-lock-manager

* lock-timeout

* commons-log-factory | log4j-log-factory | log-factory-impl |
none-log-factory | custom-log

* lrs-size

* mapping

* default-mapping-defaults | deprecated-jdo-mapping-defaults |
mapping-defaults-impl | persistence-mapping-defaults |
custom-mapping-defaults

* extension-deprecated-jdo-mapping-factory |
kodo-persistence-mapping-factory |
mapping-file-deprecated-jdo-mapping-factory |
orm-file-jdor-mapping-factory | table-deprecated-jdo-mapping-factory |
table-jdor-mapping-factory | custom-mapping-factory

* default-meta-data-factory | jdo-meta-data-factory |
deprecated-jdo-meta-data-factory | kodo-persistence-meta-data-factory |
custom-meta-data-factory

* default-meta-data-repository | kodo-mapping-repository |
custom-meta-data-repository

* multithreaded
* nontransactional-read
* nontransactional-write
* optimistic
* default-orphaned-key-action | log-orphaned-key-action | exception-orphaned-key-action | none-orphaned-key-action | custom-orphaned-key-action
* http-transport | tcp-transport | custom-persistence-server
* default-proxy-manager | profiling-proxy-manager | proxy-manger-impl | custom-proxy-manager
* query-caches
* default-query-compilation-cache | cache-map | concurrent-hash-map | custom-query-compilation-cache
* read-lock-level
* jms-remote-commit-provider | single-jvm-remote-commit-provider | tcp-remote-commit-provider | cluster-remote-commit-provider | custom-remote-commit-provider
* restore-state
* result-set-type
* retain-state
* retry-class-registration
* default-savepoint-manager | in-memory-savepoint-manager | jdbc3-savepoint-manager | oracle-savepoint-manager | custom-savepoint-manager
* schema
* default-schema-factory | dynamic-schema-factory | file-schema-factory | lazy-schema-factory | table-schema-factory | custom-schema-factory
* schemas
* class-table-jdbc-seq | native-jdbc-seq | table-jdbc-seq | time-seeded-seq | value-table-jdbc-seq | custom-seq
* default-sql-factory | kodo-sql-factory | custom-sql-factory
* subclass-fetch-mode
* synchronize-mappings
* transaction-isolation
* transaction-mode
* write-lock-level
  * profiling
    - none-profiling
- local-profiling
- export-profiling
- gui-profiling

- execution-context-name-provider
  - stack-execution-context-name-provider
  - transaction-name-execution-context-name-provider
  - user-object-execution-context-name-provider

- jmx
  - none-jmx
  - local-jmx
  - gui-jmx
  - jmx2-jmx
  - mx4j1-jmx
  - wls81-jmx

C.3 persistence-configuration.xml Deployment Descriptor Elements

The following list of the elements in persistence-configuration.xml includes all elements that are supported in this release of Kodo.

C.3.1 abstract-store-broker-factory

Range of values: N/A
Default value: N/A
Parent elements:
  - persistence-configuration
  - persistence-configuration-unit

C.3.1.1 Function
Specifies a plugin string describing the kodo.kernel.BrokerFactory type to use, in this case abstract store.

C.3.1.2 Example

<abstract-store-broker-factory/>

C.3.2 access-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
  - persistence-configuration
  - persistence-configuration-unit
C.3.2.1 Function
Defines configuration values for the Access Dictionary. For a complete description of each of the values that you can specify, see "Access Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.2.2 Example
The default values for each of the configuration values are shown in the example below.

```xml
<access-dictionary>
  <char-type-name>CHAR</char-type-name>
  <outer-join-clause>LEFT OUTER JOIN</outer-join-clause>
  <binary-type-name>BINARY</binary-type-name>
  <clob-type-name>CLOB</clob-type-name>
  <supports-locking-with-distinct-clause>true</supports-locking-with-distinct-clause>
  <simulate-locking>false</simulate-locking>
  <system-tables>true</system-tables>
  <concatenate-function>({0}||{1})</concatenate-function>
  <substring-function-name>SUBSTR</substring-function-name>
  <supports-query-timeout>true</supports-query-timeout>
  <use-set-bytes-for-blobs>true</use-set-bytes-for-blobs>
  <max-constraint-name-length>18</max-constraint-name-length>
  <search-string-escape>\</search-string-escape>
  <supports-cascade-update-action>true</supports-cascade-update-action>
  <string-length-function>CHAR_LENGTH({0})</string-length-function>
  <long-varbinary-type-name>LONGVARBINARY</long-varbinary-type-name>
  <supports-unique-constraints>true</supports-unique-constraints>
  <supports-restrict-delete-action>true</supports-restrict-delete-action>
  <trim-leading-function>LTRIM(LEADING '{1}' from {0})</trim-leading-function>
  <supports-default-delete-action>false</supports-default-delete-action>
  <next-sequence-query></next-sequence-query>
  <long-varchar-type-name>LONGVARCHAR</long-varchar-type-name>
  <cross-join-clause>CROSS JOIN</cross-join-clause>
  <max-embedded-clob-size>-1</max-embedded-clob-size>
  <date-type-name>DATE</date-type-name>
  <supports-schema-for-get-tables>true</supports-schema-for-get-tables>
  <current-time-function>CURRENT_TIME</current-time-function>
  <requires-condition-for-cross-join>false</requires-condition-for-cross-join>
  <ref-type-name>REF</ref-type-name>
  <concatenate-delimiter>'OPENJPATOKEN'</concatenate-delimiter>
  <catalog-separator>.</catalog-separator>
  <supports-mod-operator>false</supports-mod-operator>
  <schema-case>upper</schema-case>
  <java-object-type-name>JAVA_OBJECT</java-object-type-name>
  <driver-vendor></driver-vendor>
  <supports-locking-with-multiple-tables>true</supports-locking-with-multiple-tables>
  <max-column-name-length>128</max-column-name-length>
  <double-type-name>DOUBLE</double-type-name>
  <use-get-string-for-clobs>false</use-get-string-for-clobs>
  <decimal-type-name>DECIMAL</decimal-type-name>
  <smallint-type-name>SMALLINT</smallint-type-name>
  <date-precision>1000000</date-precision>
</access-dictionary>
```
<supports-alter-table-with-add-column>true</supports-alter-table-with-add-column>
  <bit-type-name>BIT</bit-type-name>

<supports-null-table-for-get-columns>true</supports-null-table-for-get-columns>
  <to-upper-case-function>UPPER({0})</to-upper-case-function>
  <supports-select-end-index>false</supports-select-end-index>
  <supports-auto-assign>false</supports-auto-assign>
  <store-large-numbers-as-strings>false</store-large-numbers-as-strings>
  <constraint-name-mode>before</constraint-name-mode>
  <allows-alias-in-bulk-clause>true</allows-alias-in-bulk-clause>
  <support-select-for-update>true</support-select-for-update>
  <distinct-count-column-separator></distinct-count-column-separator>
  <support-subselect>true</support-subselect>
  <time-type-name>TIMESTAMP</time-type-name>
  <auto-assign-type-name></auto-assign-type-name>
  <use-get-object-for-blobs>false</use-get-object-for-blobs>
  <max-auto-assign-name-length>31</max-auto-assign-name-length>
  <validation-sql></validation-sql>
  <struct-type-name>STRUCT</struct-type-name>
  <varchar-type-name>VARCHAR</varchar-type-name>
  <range-position>0</range-position>
  <supports-restrict-update-action>true</supports-restrict-update-action>
  <auto-assign-clause></auto-assign-clause>

<supports-multiple-nontransactional-result-sets>true</supports-multiple-nontransactional-result-sets>
  <bit-length-function>(OCTET_LENGTH({0}) * 8)</bit-length-function>
  <create-primary-keys>true</create-primary-keys>
  <null-type-name>NULL</null-type-name>
  <float-type-name>FLOAT</float-type-name>
  <use-get-bytes-for-blobs>true</use-get-bytes-for-blobs>
  <table-types>TABLE</table-types>
  <numeric-type-name>NUMERIC</numeric-type-name>
  <for-update-clause>FOR UPDATE</for-update-clause>
  <boolean-type-name>BOOLEAN</boolean-type-name>


<supports-foreign-keys>true</supports-foreign-keys>
  <drop-table-sql>DROP TABLE {0}</drop-table-sql>
  <use-set-string-for-clobfalse</use-set-string-for-clobfalse>
  <supports-locking-with-order-clause>false</supports-locking-with-order-clause>
  <platform>Generic</platform>
  <fixed-size-type-names></fixed-size-type-names>
  <store-chars-as-numbers>true</store-chars-as-numbers>
  <max-indexes-per-table>2147483647</max-indexes-per-table>
  <requires-cast-for-comparisons>false</requires-cast-for-comparisons>
  <supports-having>true</supports-having>
  <supports-locking-with-outer-join>true</supports-locking-with-outer-join>
  <supports-correlated-subselect>true</supports-correlated-subselect>

<supports-null-table-for-get-imported-keys>false</supports-null-table-for-get-imported-keys>
  <bigint-type-name>BIGINT</bigint-type-name>
  <last-generated-key-query></last-generated-key-query>
  <reserved-words></reserved-words>
<supports-null-update-action>true</supports-null-update-action>
<use-schema-name>true</use-schema-name>
<supports-deferred-constraints>true</supports-deferred-constraints>
<real-type-name>REAL</real-type-name>
<requires-alias-for-subselect>false</requires-alias-for-subselect>

<supports-null-table-for-get-index-info>false</supports-null-table-for-get-index-info>
<trim-trailing-function>TRIM(TRAILING '{1}' FROM {0})</trim-trailing-function>
<supports-locking-with-select-range>true</supports-locking-with-select-range>
<storage-limitations-fatal>false</storage-limitations-fatal>
<supports-locking-with-inner-join>true</supports-locking-with-inner-join>
<current-timestamp-function>CURRENT_TIMESTAMP</current-timestamp-function>
<cast-function>CAST({0} AS {1})</cast-function>
<other-type-name>OTHER</other-type-name>
<max-index-name-length>128</max-index-name-length>
<distinct-type-name>DISTINCT</distinct-type-name>
<character-column-size>255</character-column-size>
<varbinary-type-name>VARBINARY</varbinary-type-name>
<max-table-name-length>128</max-table-name-length>
<close-pool-sql></close-pool-sql>
<current-date-function>CURRENT_DATE</current-date-function>
<join-syntax>sql92</join-syntax>
<max-embedded-blob-size>-1</max-embedded-blob-size>
<trim-both-function>TRIM(BOTH '{1}' FROM {0})</trim-both-function>
<supports-select-start-index>false</supports-select-start-index>
<to-lower-case-function>LOWER({0})</to-lower-case-function>
<inner-join-clause>INNER JOIN</inner-join-clause>
<supports-default-update-action>true</supports-default-update-action>
<supports-schema-for-get-columns>true</supports-schema-for-get-columns>
<tinyint-type-name>TINYINT</tinyint-type-name>

<supports-null-table-for-get-primary-keys>false</supports-null-table-for-get-primary-keys>
<system-schemas></system-schemas>
<requires-cast-for-math-functions>false</requires-cast-for-math-functions>
<supports-null-delete-action>true</supports-null-delete-action>
<requires-auto-commit-for-meta-data>false</requires-auto-commit-for-meta-data>
<timestamp-type-name>TIMESTAMP</timestamp-type-name>
<initialization-sql></initialization-sql>
<supports-cascade-delete-action>true</supports-cascade-delete-action>
<supports-timestamp-nanos>true</supports-timestamp-nanos>
</access-dictionary>

C.3.3 access-unloaded

Range of values: true | false
Default value: true

Parent elements:
persistence-configuration
persistence-configuration-unit
detach-options-all

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C.3.3.1 Function
Flag that specifies whether to allow access to unloaded fields of detached objects. Set to false to throw an exception whenever an unloaded field is accessed. This option is only available when you use detached state managers.

C.3.3.2 Example
<access-unloaded>true</access-unloaded>

C.3.4 action
Range of values: warn | exception
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
    inverse-manager

C.3.4.1 Function
Controls the action taken when the inverse manager detects an inconsistent bidirectional relation. Valid options include:
- warn—Log a warning.
- exception—Throw an exception.

C.3.4.2 Example
<action>warn</action>

C.3.5 addresses
Range of values: Valid IP addresses
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.5.1 Function
Specifies a semicolon separated list of IP addresses to which notifications should be sent.

C.3.5.2 Example
<addresses>[]</addresses>
C.3.6 advanced-sql

- **Range of values**: String
- **Default value**: N/A
- **Parent elements**:
  - persistence-configuration
  - persistence-configuration-unit

**C.3.6.1 Function**
Configures advanced SQL features.

C.3.7 aggregate-listeners

- **Range of values**: N/A
- **Default value**: N/A
- **Parent elements**:
  - persistence-configuration
  - persistence-configuration-unit

**C.3.7.1 Function**
Specifies a list of aggregate listeners to make available to all queries. Each listener must implement the `org.apache.openjpa.kernel.exps.AggregateListener` interface. For more information, see "kodo.AggregateListeners" in *Kodo JPA/JDO Reference for Oracle WebLogic Server*.

**C.3.7.2 Example**

```xml
<aggregate-listeners>
  <custom-aggregate-listener>
    <classname>...</classname>
    <properties>...</properties>
  </custom-aggregate-listener>
</aggregate-listeners>
```

C.3.8 allocate

- **Range of values**: Integer
- **Default value**: 50
- **Parent elements**:
  - persistence-configuration
  - persistence-configuration-unit
  - class-table-jdbc-seq
  - native-jdbc-seq
  - table-jdbc-seq
  - persistence-configuration

C.3.8.1 Function
Specifies the number of values to allocate on each database trip. Defaults to 50, meaning the class will set aside the next 50 numbers each time it accesses the sequence table. In this case, Kodo only accesses the database to get new sequence numbers once every 50 sequence number requests.

C.3.8.2 Example
<allocate>50</allocate>

C.3.9 assert-allowed-type
Range of values: true | false
Default value: false
Parent elements:
- persistence-configuration
  - persistence-configuration-unit

C.3.9.1 Function
Flag that specifies whether to immediately throw an exception if you attempt to add an element to a collection or map that is not assignable to the element type declared in metadata.

C.3.9.2 Example
<assert-allowed-type>false</assert-allowed-type>

C.3.10 auto-clear
Range of values:
- persistence-configuration-unit: datastore | all
- kodo-broker: 0 | 1
Default value: datastore (0)
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
  - kodo-broker

C.3.10.1 Function
Controls whether an object's field values are cleared when entering a transaction. Valid values include:
- datastore (0)—Clear object field values when entering a datastore transaction. This is the default.
all (1) — Clear object field values when entering any transaction.

C.3.10.2 Example

<auto-clear>datastore</auto-clear>

C.3.11 auto-detach

Range of values:
- auto-detaches: close | commit | nontx-read
- kodo-broker: 0 | 1 | 2

Default value: close (0)

Parent elements:
- persistence-configuration
  - persistence-configuration-unit
    - auto-detaches
- persistence-configuration
  - persistence-configuration-unit
    - kodo-broker
      - auto-detach

C.3.11.1 Function
Specifies the event on which the managed instances are automatically detached. When specified as a child of the auto-detaches element, valid event types include:

- close (0) — Detach all objects when the PersistenceManager closes. This is the default.
- commit (1) — Detach all objects when a transaction ends.
- nontx-read (2) — Reads outside of a transactions will automatically detach instances before returning them.

C.3.11.2 Example

<auto-detach>close</auto-detach>

C.3.12 auto-detaches

Range of values: N/A

Default value: N/A

Parent elements:
- persistence-configuration
  - persistence-configuration-unit

C.3.12.1 Function
Specifies a list of events on which the managed instances are automatically detached. Specifies one or more Section C.3.11, "auto-detach" elements. For more information, see "Automatic Detachment" in Kodo JPA/JDO Reference for Oracle WebLogic Server.
C.3.12.2 Example

```xml
<auto-detaches>
  <auto-detach>close</auto-detach>
</auto-detaches>
```

C.3.13 base-name

**Range of values**: String  
**Default value**: N/A  
**Parent elements**:  
- profiling  
  - export-profiling

**C.3.13.1 Function**
 Defines the basename of the exported data file to create.

**C.3.13.2 Example**

```xml
<base-name>base</base-name>
```

C.3.14 batching-operation-order-update-manager

**Range of values**: N/A  
**Default value**: N/A  
**Parent elements**:  
- profiling

**C.3.14.1 Function**
 Defines an update manager capable of statement batching, that ignores foreign keys and table-level locking, but optimizes based on the order in which the application has modified objects.

**C.3.14.2 Example**

```xml
<batching-operation-order-update-manager>
  <maximize-batch-size>true</maximize-batch-size>
</batching-operation-order-update-manager>
```

C.3.15 buffer-size

**Range of values**: Integer  
**Default value**: 10  
**Parent elements**:  
- persistence-configuration  
- persistence-configuration-unit  
- cluster-remote-commit-provider
C.3.15 Function
Specifies the buffer size of the remote commit provider.

C.3.15.2 Example
<buffer-size>10</buffer-size>

C.3.16 cache-map

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.16.1 Function
Defines the cache map used to associate query strings and their parsed form.

C.3.16.2 Example
<cache-map>
  <cache-size>1000</cache-size>
  <soft-reference-size>-1</soft-reference-size>
</cache-map>

C.3.17 cache-size

Range of values: Integer
Default value: 1000
Parent elements:
persistence-configuration
  persistence-configuration-unit
    kodo-concurrent-data-cache

C.3.17.1 Function
Set the data or query cache size.

C.3.17.2 Example
<cache-size>1000</cache-size>
C.3.18 channel

Range of values: String
Default value: openjpa.Runtime
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.18.1 Function
Specifies the channel to which you want to log.

C.3.18.2 Example
<channel>openjpa.Runtime</channel>

C.3.19 class-table-jdbc-seq

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.19.1 Function
Specifies a plugin string describing the kodo.kernel.Seq interface to use to create your own custom generators, in this case kodo.jdbc.kernel.TableJDBCSeq.

The TableJDBCSeq uses a special single-row table to store a global sequence number. If the table does not already exist, it is created the first time you run the mapping tool on a class that requires it. You can also use the class' main method or the sequencetable shell/bat script to manipulate the table; see the TableJDBCSeq.main method Javadoc for usage details.

C.3.19.2 Example
<class-table-jdbc-seq>
  <type>0</type>
  <allocate>50</allocate>
  <table-name>OPENJPA_SEQUENCES_TABLE</table-name>
  <ignore-virtual>false</ignore-virtual>
  <ignore-unmapped>false</ignore-unmapped>
  <table>OPENJPA_SEQUENCES_TABLE</table>
  <primary-key-column>ID</primary-key-column>
  <use-aliases>false</use-aliases>
  <sequence-column>SEQUENCE_VALUE</sequence-column>
  <increment>1</increment>
</class-table-jdbc-seq>

C.3.20 classname

Range of values: Valid classname
Default value: N/A
**Parent elements:**

persistence-configuration
  persistence-configuration-unit
  aggregate-listener
    custom-aggregate-listener

persistence-configuration
  persistence-configuration-unit
  custom-broker-factory

persistence-configuration
  persistence-configuration-unit
  custom-broker-impl

persistence-configuration
  persistence-configuration-unit
  custom-class-resolver

persistence-configuration
  persistence-configuration-unit
  custom-compatibility

persistence-configuration
  persistence-configuration-unit
  custom-connection-decorator

persistence-configuration
  persistence-configuration-unit
  custom-data-cache

persistence-configuration
  persistence-configuration-unit
  custom-dictionary

**C.3.20.1 Function**

Name of the class associated with the custom feature.

**C.3.21 classpath-scan**

*Range of values:* true | false

*Default value:* true

**Parent elements:**

persistence-configuration
  persistence-configuration-unit
  deprecated-jdo-meta-data-factory

persistence-configuration
  persistence-configuration-unit
  extension-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
  jdo-meta-data-factory

persistence-configuration
  persistence-configuration-unit
  jdor-mapping-factory
C.3.21.1 Function
Specifies a semicolon-separated list of directories or jar archives listed in your classpath. Each directory and jar archive is scanned for annotated JP entities or JDO metadata files based on your metadata factory.

C.3.21.2 Example
<classpath-scan>build</classpath-scan>

C.322 clear-on-close

Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
tangosol-data-cache

C.3.22.1 Function
Flag that specifies whether the Tangosol named cache should be completely cleared when the EntityManagerFactory or PersistenceManagerFactory is closed.

C.3.22.2 Example
<clear-on-close>false</clear-on-close>

C.3.23 client-broker-factory

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
C.3.23.1 Function
A plugin string describing the `kodo.kernel.BrokerFactory` type to use, in this case remote.

C.3.23.2 Example
```xml
<client-broker-factory/>
```

C.3.24 `close-on-managed-commit`

**Range of values**: true | false

**Default value**: true

**Parent elements**:
- `persistence-configuration`
- `persistence-configuration-unit`
- `compatibility`

C.3.24.1 Function
Flag that specifies whether the JDO PersistenceManager closes after a managed transaction commits, assuming you have invoked the close method.

If set to false, then the PersistenceManager will not close. This means that objects passed to a processing tier in the same JVM will still be usable, as their owning PersistenceManager will still be open. This behavior is not in strict compliance with the JDO specification, but is convenient for applications that were coded against Kodo 2.x, which did not close the PersistenceManager in these situations.

C.3.24.2 Example
```xml
<close-on-managed-commit>false</close-on-managed-commit>
```

C.3.25 `cluster-remote-commit-provider`

**Range of values**: N/A

**Default value**: N/A

**Parent elements**:
- `persistence-configuration`
- `persistence-configuration-unit`

C.3.25.1 Function
Configures Kodo to share commit notifications among `persistenceManagerFactories` in a cluster.

C.3.25.2 Example
```xml
<cluster-remote-commit-provider>
  <name>kodo.RemoteCommitProvider</name>
  <buffer-size>10</buffer-size>
  <recover-action>none</recover-action>
</cluster-remote-commit-provider>
```
C.3.26 commons-log-factory

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.26.1 Function
Specifies the Apache Jakarta Commons Logging thin library for issuing log messages. The Commons Logging libraries act as a wrapper around a number of popular logging APIs, including the Jakarta Log4J project, and the native java.util.logging package in JDK 1.4. If neither of these libraries are available, then logging will fall back to using simple console logging.

C.3.26.2 Example
<commons-log-factory/>

C.3.27 compatibility

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.27.1 Function
Configure backwards compatibility settings for certain runtime behaviors.

C.3.27.2 Example
<compatibility>
  <copy-object-ids>false</copy-object-ids>
  <close-on-managed-commit>true</close-on-managed-commit>
  <validate-true-checks-store>false</validate-true-checks-store>
  <validate-false-returns-hollow>true</validate-false-returns-hollow>
  <strict-identity-values>false</strict-identity-values>
  <quoted-numbers-in-queries>false</quoted-numbers-in-queries>
</compatibility>

C.3.28 concurrent-hash-map

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit
C.3.28.1 Function
Defines the concurrent hash map used to associate query strings and their parsed form.

C.3.28.2 Example

```xml
<concurrent-hash-map>
  <max-size>2147483647</max-size>
</concurrent-hash-map>
```

C.3.29 connection-decorators

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
- persistence-configuration-unit

C.3.29.1 Function
A plugin string describing org.apache.openjpa.lib.jdbc.ConnectionDecorator implementations to install on the connection factory. Specify one or more Section C.3.54, "custom-connection-decorator" elements.

These decorators can wrap connections passed from the underlying DataSource to add functionality. Kodo will pass all connections through the list of decorators before using them.

---

**Note:** By default Kodo JPA/JDO employs all of the built-in decorators in the com.solarmetric.jdbc package already; you do not need to list them here.

---

C.3.29.2 Example

```xml
<connection-decorators>
  <custom-connection-decorator>
    <classname>...</classname>
    <properties>...</properties>
  </custom-connection-decorator>
</connection-decorators>
```

C.3.30 connection-driver-name

Range of values: Valid classname
Default value: N/A
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
  - kodo-pooling-data-source
C.3.30.1 Function

Full class name of either the JDBC `java.sql.Driver` or a `javax.sql.DataSource` implementation to use to connect to the database.

The following provides sample values:

- COM.FirstSQL.Dbcp.DbcpDriver
- COM.cloudscape.core.JDBCDriver
- COM.ibm.db2.jdbc.app.DB2Driver
- COM.ibm.db2.jdbc.net.DB2Driver
- centura.java.sqlbase.SqlbaseDriver
- com.ddtek.jdbc.db2.DB2Driver
- com.ddtek.jdbc.oracle.OracleDriver
- com.ddtek.jdbc.sqlserver.SQLServerDriver
- com.ddtek.jdbc.sybase.SysbaseDriver
- com.ibm.as400.access.AS400JDBCDriver
- com.imaginary.sql.msql.MsqlDriver
- com.inet.tds.TdsDriver
- com.informix.jdbc.IfxDriver
- com.internetcds.jdbc.tds.Driver
- com.jnetdirect.jsql.JSQLDriver
- com.mckoi.JDBCDriver
- com.microsoft.jdbc.sqlserver.SQLServerDriver
- com.mysql.jdbc.DatabaseMetaData
- com.mysql.jdbc.Driver
- com.pointbase.jdbc.jdbcUniversalDriver
- com.sap.dbtech.jdbc.DriverSapDB
- com.sybase.jdbc.SybDriver
- com.sybase.jdbc2.jdbc.SybDriver
- com.thinweb.tds.Driver
- in.co.daffodil.db.jdbc.DaffodilDBDriver
- interbase.interclient.Driver
- intersolv.jdbc.sequelink.SequeLinkDriver
- openlink.jdbc2.Driver
- oracle.jdbc.driver.OracleDriver
- oracle.jdbc.pool.OracleDataSource
- org.axiondb.jdbc.AxionDriver
- org.enhydra.instantdb.jdbc.jdbcDriver
- org.jta.jta.jdbc.Driver
- org.postgresql.Driver
- org.sourceforge.jxdbcon.JXDBConDriver
- postgres95.PGDriver
- postgresql.Driver
- solid.jdbc.SolidDriver
- sun.jdbc.odbc.JdbcOdbcDriver
- weblogic.jdbc.mssqlserver4.Driver
- weblogic.jdbc.pool.Driver

C.3.30.2 Example

```xml
<connection-driver-name>oracle.jdbc.driver.OracleDriver</connection-driver-name>
```
### C.3.31 connection-factory-mode

**Range of values:** local | managed

**Default value:** local

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit

#### C.3.31.1 Function
The connection factory mode to use when integrating with the application server's managed transactions. Valid options include:

- **local**—Specifies a standard data source under Kodo control.
- **managed**—Specifies a data source managed by an application server and automatically enlisted in global transactions.

#### C.3.31.2 Example

```xml
<connection-factory-mode>local</connection-factory-mode>
```

### C.3.32 connection-factory-name

**Range of values:** JNDI name

**Default value:** N/A

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit

#### C.3.32.1 Function
The JNDI location of a `javax.sql.DataSource` to use to connect to the database.

#### C.3.32.2 Example

```xml
<connection-factory-name>java:/OracleSource</connection-factory-name>
```

### C.3.33 connection-factory-properties

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit

#### C.3.33.1 Function
A plugin string listing properties for configuration of the `javax.sql.DataSource`, described at [http://docs.oracle.com/javase/6/docs/api/javax/sql/DataSource.html](http://docs.oracle.com/javase/6/docs/api/javax/sql/DataSource.html), in use.
C.3.33.2 Example

```xml
<connection-factory-properties>
  <property>
    <name>QueryTimeout</name>
    <value>5000</value>
  </property>
  <property>
    <name>MaxIdle</name>
    <value>1</value>
  </property>
</connection-factory-properties>
```

C.3.34 connection-factory2-name

Range of values: JNDI name
Default value: N/A
Parent elements:
- persistence-configuration
- persistence-configuration-unit

C.3.34.1 Function
The JNDI location of an unmanaged `javax.sql.DataSource` to use to connect to the database.

C.3.34.2 Example

```xml
<connection-factory2-name>java:/OracleXASource</connection-factory2-name>
```

C.3.35 connection-factory2-properties

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
- persistence-configuration-unit

C.3.35.1 Function
Properties used to configure the `javax.sql.DataSource`, described at [http://docs.oracle.com/javase/6/docs/api/javax/sql/DataSource.html](http://docs.oracle.com/javase/6/docs/api/javax/sql/DataSource.html), used as the unmanaged ConnectionFactory.

C.3.35.2 Example

```xml
<connection-factory2-properties>
  <property>
    <name>MaxActive</name>
    <value>20</value>
  </property>
  <property>
    <name>MaxIdle</name>
    <value>1</value>
  </property>
</connection-factory2-properties>
```
C.3.36 connection-password

Range of values: Valid password
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.36.1 Function
Password for the user specified by connection-user-name.

C.3.36.2 Example
<connection-password>tiger</connection-password>

C.3.37 connection-properties

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.37.1 Function
A plugin string listing properties to configure the driver listed in the connection-driver-name element. If the given driver class is a DataSource, these properties will be used to configure the bean properties of the DataSource.

C.3.37.2 Example
<connection-properties>
  <property>
    <name>PortNumber</name>
    <value>1521</value>
  </property>
  <property>
    <name>ServerName</name>
    <value>saturn</value>
  </property>
  <property>
    <name>DatabaseName</name>
    <value>solarisid</value>
  </property>
  <property>
    <name>DriverType</name>
    <value>thin</value>
  </property>
</connection-properties>

C.3.38 connection-retain-mode

Range of values: always | on-demand | persistence-manager | transaction
Default value: N/A

Parent elements:

- persistence-configuration
- persistence-configuration-unit

C.3.38.1 Function

Controls how Kodo uses datastore connections. Valid values include:

- **always**—Each EntityManager or PersistenceManager obtains a single connection and uses it until the EntityManager or PersistenceManager closes.
- **on-demand**—Connection is obtained only when needed. This option is equivalent to the transaction option when datastore transactions are used. For optimistic transactions, though, it means that a connection will be retained only for the duration of the datastore flush and commit process.
- **persistence-manager**—Connection is obtained from the persistence manager.
- **transaction**—Connection is obtained when each transaction begins (optimistic or datastore), and is released when the transaction completes. Non-transactional connections are obtained on-demand.

C.3.38.2 Example

```
<connection-retain-mode>on-demand</connection-retain-mode>
```

C.39. connection-url

Range of values: Valid URL

Default value: N/A

Parent elements:

- persistence-configuration
- persistence-configuration-unit

C.39.1 Function

The JDBC URL for the database.

The following provides possible values:

```
jdbc:JSQLConnect://<hostname>/database=<database>
jdbc:cloucscape:<database>;create=true
jdbc:daffodilDB_embedded:<database>;create=true
jdbc:datadirect:db2://<hostname>:50000;databaseName=<database>
jdbc:datadirect:oracle://<hostname>:1521;SID=<database>;MaxPooledStatements=0
jdbc:datadirect:sqlserver://<hostname>:1433;SelectMethod=cursor;DatabaseName=<database>
jdbc:datadirect:sybase://<hostname>:5000
jdbc:db2://<hostname>/database
```
jdbc:dbaw://<hostname>:8889/<database>
jdbc:hsqldb:<database>
jdbc:id:<database>.properties
jdbc:inetae:<hostname>:1433
jdbc:interae://<hostname>/<database>.gdb
jdbc:msqlserver://<hostname>:1433;DatabaseName=<database>;SelectMethod=cursor
jdbc:mysql://<hostname>/<database>?autoReconnect=true
jdbc:jdbc:<database>
jdbc:openlink://<hostname>/DSN=SQLServerDB/UID=sa/PWD=
jdbc:oraclenew:<hostname>:1521:<database>
jdbc:postgresql://<hostname>:5432/<database>
jdbc:postgresql://:<hostname>/<database>
jdbc:sequelink://<hostname>:4003/[Oracle]
jdbc:sequelink://<hostname>:4004/[Informix];Database=<database>
jdbc:sequelink://<hostname>:4005/[Sybase];Database=<database>
jdbc:sequelink://<hostname>:4006/[SQLServer];Database=<database>
jdbc:sequelink://<hostname>:4007/[ODBC MS Access];Database=<database>
jdbc:solid://<hostname>:<port>/<UID>/<PWD>
jdbc:sybase:Tds:<hostname>:4100/<database>?ServiceName=<database>
jdbc:twtds:sqlserver://<hostname>/<database>
jdbc:weblogic:mssqlserver4:<database>@<hostname>:1433

C.3.39.2 Example
<connection-url>
jdbc:oracle:thin:@<hostname>:1521:<database>
</connection-url>

C.3.40 connection-user-name

Range of values: Valid username

Default value: N/A

Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.40.1 Function
Username to use when connecting to the data source specified by Section C.3.39, "connection-url."

C.3.40.2 Example
<connection-user-name>scott</connection-user-name>
C.3.41 connection2-driver-name

Range of values: Valid username
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.41.1 Function
Full class name of either the JDBC `java.sql.Driver` or a `javax.sql.DataSource` implementation to use to connect to the unmanaged database.

C.3.41.2 Example
<connection2-driver-name>oracle.jdbc.driver.OracleDriver</connection2-driver-name>

C.3.42 connection2-password

Range of values: Valid password
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.42.1 Function
Password for the unmanaged data source specified by `connection2-url`.

C.3.42.2 Example
<connection2-password>tiger</connection2-password>

C.3.43 connection2-properties

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.43.1 Function
Properties for the unmanaged data source specified by `connection2-driver-name`.

C.3.43.2 Example
<connection2-properties>
  <property>
    <name>PortNumber</name>
    <value>1521</value>
  </property>
  <property>
    <name>ServerName</name>
  </property>
</connection2-properties>
<value>saturn</value>
</property>
<property>
  <name>DatabaseName</name>
  <value>solarisid</value>
</property>
<property>
  <name>DriverType</name>
  <value>thin</value>
</property>
</connection2-properties>

### C.3.44 connection2-url

**Range of values:** Valid URL  
**Default value:** N/A  
**Parent elements:**  
persistence-configuration  
persistence-configuration-unit

#### C.3.44.1 Function
The JDBC URL for the unmanaged datasource.

#### C.3.44.2 Example

```
<connection2-url>jdbc:oracle:thin:@CROM:1521:KodoDB</connection2-url>
```

### C.3.45 connection2-user-name

**Range of values:** Valid username  
**Default value:** N/A  
**Parent elements:**  
persistence-configuration  
persistence-configuration-unit

#### C.3.45.1 Function
Username to use when connecting to the data source specified by Section C.3.41, "connection2-driver-name."

#### C.3.45.2 Example

```
<connection2-user-name>scott</connection2-user-name>
```

### C.3.46 constraint-names

**Range of values:** true | false  
**Default value:** false  
**Parent elements:**  
persistence-configuration  
persistence-configuration-unit
C.3.46.1 Function
Flag that specifies whether to include the names of foreign key and unique constraints in all generated mappings.

C.3.46.2 Example
<constraint-names>false</constraint-names>

C.3.47 constraint-update-manager
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
C.3.47.1 Function
Defines the standard update manager, capable of statement batching and foreign key constraint evaluation.

C.3.47.2 Example
<constraint-update-manager>
  <maximize-batch-size>true</maximize-batch-size>
</constraint-update-manager>

C.3.48 copy-object-ids
Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
    compatibility
C.3.48.1 Function
Flag that specifies whether to copy oid objects before returning them to you. Kodo versions prior to 3.0 always copied oid objects before returning them to you. This prevents possible errors resulting from you mutating the oid object by reference, but was not very efficient for the majority of users who do not modify oid instances. Thus Kodo 3.0 and higher does not copy oids by default. Set this property to true to force Kodo to copy the oids.

C.3.48.2 Example
<copy-object-ids>false</copy-object-ids>
C.3.49 custom-aggregate-listener

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit
    - aggregate-listeners

C.3.49.1 Function

C.3.49.2 Example

```xml
<aggregate-listeners>
  <custom-aggregate-listener>
    <classname>...</classname>
    <properties>...</properties>
  </custom-aggregate-listener>
</aggregate-listener>
```

C.3.50 custom-broker-factory

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit

C.3.50.1 Function
Enables you to specify a custom broker factory.

C.3.50.2 Example

```xml
<custom-broker-factory>
  <classname>...</classname>
  <properties>...</properties>
</custom-broker-factory>
```

C.3.51 custom-broker-impl

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit

C.3.51.1 Function
Enables you to define a custom broker implementation.
C.3.51.2 Example

```xml
<custom-broker-impl>
    <classname>...</classname>
    <properties>...</properties>
</custom-broker-impl>
```

C.3.52 custom-class-resolver

**Range of values:** N/A  
**Default value:** N/A  
**Parent elements:**
- persistence-configuration
- persistence-configuration-unit

C.3.52.1 Function

Enables you to define a custom class resolver for class name resolution.

C.3.52.2 Example

```xml
<custom-class-resolver>
    <classname>...</classname>
    <properties>...</properties>
</custom-class-resolver>
```

C.3.53 custom-compatibility

**Range of values:** N/A  
**Default value:** N/A  
**Parent elements:**
- persistence-configuration
- persistence-configuration-unit

C.3.53.1 Function

Enables you to define your own custom compatibility flag.

C.3.53.2 Example

```xml
<custom-compatibility>
    <classname>...</classname>
    <properties>...</properties>
</custom-compatibility>
```

C.3.54 custom-connection-decorator

**Range of values:** N/A  
**Default value:** N/A  
**Parent elements:**
- persistence-configuration
- persistence-configuration-unit
C.3.54 connection-decorators

C.3.54.1 Function
Enables you to define a custom org.apache.openjpa.lib.jdbc.ConnectionDecorator implementation to install on all connection pools.

C.3.54.2 Example
<connection-decorators>
  <custom-connection-decorator>
    <classname>...</classname>
    <properties>...</properties>
  </custom-connection-decorator>
</connection-decorators>

C.3.55 custom-data-cache

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
data-caches

C.3.55.1 Function
Enables you to define a custom data cache.

C.3.55.2 Example
<data-caches>
  <custom-data-cache>
    <name>...</name>
    <classname>...</classname>
    <properties>...</properties>
  </custom-data-cache>
</data-caches>

C.3.56 custom-data-cache-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.56.1 Function
Enables you to define a custom data cache manager.

C.3.56.2 Example
<custom-data-cache-manager>
  <classname>...</classname>
C.3.57 custom-detach-state

Range of values: N/A
Default value: N/A
Parent elements:
   persistence-configuration
   persistence-configuration-unit

C.3.57.1 Function
Enables you to define a custom detach state.

C.3.57.2 Example
<custom-detach-state>
   <classname>...</classname>
   <properties>...</properties>
</custom-detach-state>

C.3.58 custom-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
   persistence-configuration
   persistence-configuration-unit

C.3.58.1 Function
Enables you to define a custom dictionary. For more information, see "Custom Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.58.2 Example
<custom-dictionary>
   <name>custom-dictionary</name>
   <classname>...</classname>
   <properties>...</properties>
</custom-dictionary>

C.3.59 custom-driver-data-source

Range of values: N/A
Default value: N/A
Parent elements:
   persistence-configuration
   persistence-configuration-unit
C.3.59 custom-driver-data-source

**C.3.59.1 Function**
Enables you to define a custom datasource driver.

**C.3.59.2 Example**
```xml
<custom-driver-data-source>
  <classname>...</classname>
  <properties>...</properties>
</custom-driver-data-source>
```

C.3.60 custom-filter-listener

**C.3.60.1 Function**
Enables you to define a custom filter listener.

**C.3.60.2 Example**
```xml
<filter-listeners>
  <custom-filter-listener>
    <classname>...</classname>
    <properties>...</properties>
  </custom-filter-listener>
</filter-listeners>
```

C.3.61 custom-jdbc-listener

**C.3.61.1 Function**
Enables you to define a custom JDBC listener.

**C.3.61.2 Example**
```xml
<jdbc-listeners>
  <custom-jdbc-listener>
    <classname>...</classname>
    <properties>...</properties>
  </custom-jdbc-listener>
</jdbc-listeners>
```
C.3.62 custom-lock-manager

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.62.1 Function
Enables you to define a custom lock manager.

C.3.62.2 Example
<custom-lock-manager>
  <classname>...</classname>
  <properties>...</properties>
</custom-lock-manager>

C.3.63 custom-log

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.63.1 Function
Enables you to define a custom log file.

C.3.63.2 Example
<custom-log>
  <classname>...</classname>
  <properties>...</properties>
</custom-log>

C.3.64 custom-mapping-defaults

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.64.1 Function
Enables you to define custom mapping defaults.

C.3.64.2 Example
<custom-mapping-defaults>
  <classname>...</classname>
**C.3.65 custom-mapping-factory**

Range of values: N/A  
Default value: N/A  
Parent elements:  
persistence-configuration  
persistence-configuration-unit

**C.3.65.1 Function**

Specifies a custom mapping factory.

**C.3.65.2 Example**

```xml
<custom-mapping-factory/>
```

**C.3.66 custom-meta-data-factory**

Range of values: N/A  
Default value: N/A  
Parent elements:  
persistence-configuration  
persistence-configuration-unit

**C.3.66.1 Function**

Enables you to specify a custom metadata factory.

**C.3.66.2 Example**

```xml
<custom-meta-data-factory>
  <classname>...</classname>
  <properties>...</properties>
</custom-meta-data-factory>
```

**C.3.67 custom-meta-data-repository**

Range of values: N/A  
Default value: N/A  
Parent elements:  
persistence-configuration  
persistence-configuration-unit

**C.3.67.1 Function**

Enables you to specify a custom metadata repository. For more information, see "Metadata Factory" in the *Kodo JPA/IDO Reference for Oracle WebLogic Server*. 
C.3.67.2 Example

<custom-meta-data-repository>
   <classname>...</classname>
   <properties>...</properties>
</custom-meta-data-repository>

C.3.68 custom-orphaned-key-action

Range of values: N/A
Default value: N/A
Parent elements:
   persistence-configuration
   persistence-configuration-unit

C.3.68.1 Function
Enables you to define a custom orphaned key action.

C.3.68.2 Example

<custom-orphaned-key-action>
   <channel>openjpa.Runtime</channel>
   <level>4</level>
   <classname>...</classname>
   <properties>...</properties>
</custom-orphaned-key-action>

C.3.69 custom-persistence-server

Range of values: N/A
Default value: N/A
Parent elements:
   persistence-configuration
   persistence-configuration-unit

C.3.69.1 Function
Enables you to define a custom persistence server.

C.3.69.2 Example

<custom-persistence-server>
   <classname>...</classname>
   <properties>...</properties>
</custom-persistence-server>

C.3.70 custom-proxy-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.70  persistence-configuration

C.3.70.1  Function
Enables you to define a custom proxy manager.

C.3.70.2  Example
<custom-proxy-manager>
  <classname>...</classname
  <properties>...</properties>
</custom-proxy-manager>

C.3.71  custom-query-compilation-cache

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.71.1  Function
Enables you to define a custom query compilation cache.

C.3.71.2  Example
<custom-query-compilation-cache>
  <classname>...</classname
  <properties>...</properties>
</custom-query-compilation-cache>

C.3.72  custom-remote-commit-provider

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.72.1  Function
Enables you to specify a custom remote commit provider.

C.3.72.2  Example
<custom-remote-commit-provider>
  <name>kodo.RemoteCommitProvider</name>
  <classname>...</classname>
  <properties>...</properties>
</custom-remote-commit-provider>
C.3.73 custom-savepoint-manager

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.73.1 Function
Enables you to specify a custom savepoint manager.

C.3.73.2 Example
  <custom-savepoint-manager>
    <classname>...</classname>
    <properties>...</properties>
  </custom-savepoint-manager>

C.3.74 custom-schema-factory

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.74.1 Function
Specifies a custom schema factory.

C.3.74.2 Example
  <custom-schema-factory>
    <classname>...</classname>
    <properties>...</properties>
  </custom-schema-factory>

C.3.75 custom-seq

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.75.1 Function
Enables you to define a custom generator.

C.3.75.2 Example
  <custom-seq>
    <classname>...</classname>
<properties>...</properties>
</custom-seq>

**C.3.76 custom-sql-factory**

**Range of values**: N/A  
**Default value**: N/A  
**Parent elements**:  
- persistence-configuration  
- persistence-configuration-unit

**C.3.76.1 Function**
Enables you to define a custom SQL factory.

**C.3.76.2 Example**

```
<custom-sql-factory>
  <classname>...</classname>
  <properties>...</properties>
</custom-sql-factory>
```

**C.3.77 custom-update-manager**

**Range of values**: N/A  
**Default value**: N/A  
**Parent elements**:  
- persistence-configuration  
- persistence-configuration-unit

**C.3.77.1 Function**
Enables you to define a custom update manager to use to flush persistent object changes to the datastore.

**C.3.77.2 Example**

```
<custom-update-manager>
  <classname>...</classname>
  <properties>...</properties>
</custom-update-manager>
```

**C.3.78 data-caches**

**Range of values**: N/A  
**Default value**: N/A  
**Parent elements**:  
- persistence-configuration  
- persistence-configuration-unit
C.3.78 Function
Specifies plugins used to cache data loaded from the data store. Must implement org.apache.openjpa.datacache.DataCache.

C.3.78.2 Example
<data-caches>
  <default-data-cache>...</default-data-cache>
  <kodo-concurrent-data-cache>...</kodo-concurrent-data-cache>
  <gem-fire-data-cache>...</gem-fire-data-cache>
  <lru-data-cache>...</lru-data-cache>
  <tangosol-data-cache>...</tangosol-data-cache>
  <custom-data-cache>...</custom-data-cache>
</data-caches>

C.3.79 data-cache-manager-impl
Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
    persistence-configuration-unit

C.3.79.1 Function
Enables the kodo.datacache.DataCacheManager that manages the system data caches.

C.3.79.2 Example
<data-cache-manager-impl/>

C.3.80 data-cache-timeout
Range of values: Integer
Default value: -1
Parent elements:
  persistence-configuration
    persistence-configuration-unit

C.3.80.1 Function
Specifies the amount of time in milliseconds that a class' data is valid. A value of -1 specifies no expiration.

C.3.80.2 Example
<data-cache-timeout>-1</data-cache-timeout>

C.3.81 db2-dictionary
Range of values: N/A
Default value: N/A
C.3.81.1 Function
Defines the configuration values for the DB2 Dictionary persistence plugin. For a complete description of each of the values that you can specify, see “DB2 Dictionary Configuration” in the Oracle WebLogic Server Administration Console Online Help.

C.3.81.2 Example
The db2-dictionary element shares the same subelements as “access-dictionary” on page C-5.

C.3.82 default-access-type

**Range of values:** FIELD | PROPERTY

**Default value:** FIELD

**Parent elements:**
persistence-configuration
  persistence-configuration-unit

**C.3.82.1 Function**
Specifies the default access type. Valid values include:

- **FIELD**—Injects state directly into your persistent fields, and retrieves changed state from your fields as well.
- **PROPERTY**—Retrieves and loads state through JavaBean "getter" and "setter" methods.

**C.3.82.2 Example**
<default-access-type>FIELD</default-access-type>

C.3.83 default-broker-factory

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**
persistence-configuration
  persistence-configuration-unit

**C.3.83.1 Function**
Specifies a plugin string describing the kodo.kernel.BrokerFactory type to use, in this case the default, which is JDBC.
C.3.83.2 Example
<default-broker-factory/>

C.3.84 default-broker-impl
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
   persistence-configuration-unit

C.3.84.1 Function
Specifies a plugin string describing the kodo.kernel.Broker type to use at runtime, in this case the default.

C.3.84.2 Example
<default-broker-impl/>

C.3.85 default-class-resolver
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
   persistence-configuration-unit

C.3.85.1 Function
Specifies a plugin string describing the kodo.util.ClassResolver implementation to use for class name resolution, in this case the default. You may wish to plug in your own resolver if you have special class loading needs.

C.3.85.2 Example
<default-class-resolver/>

C.3.86 default-compatibility
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
   persistence-configuration-unit

C.3.86.1 Function
Sets the default compatibility settings.
C.3.86.2 Example
<default-compatibility/>

C.3.87 default-data-cache

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
data-caches

C.3.87.1 Function
Defines the default data cache.

C.3.87.2 Example
<data-caches>
  <default-data-cache>
    <name>kodo.DataCache</name>
  </default-data-cache>
</data-caches>

C.3.88 default-detach-state

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.88.1 Function
Specifies the default detached state, in this case loaded.

C.3.88.2 Example
<default-detach-state/>

C.3.89 default-data-cache-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
C.3.89.1 Function
Specifies a plugin string describing the kodo.datacache.DataCacheManager that manages the system data caches, in this case the default.

C.3.89.2 Example
<default-data-cache-manager>...</default-data-cache-manager>

C.390 default-driver-data-source

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.390.1 Function
Specifies the default kodo.jdbc.schema.DriverDataSource implementation to use to wrap JDBC Driver classes with javax.sql.DataSource instances. The provided default implementation, kodo.jdbc.schema.KodoPoolingDataSource, will perform connection pooling.

C.390.2 Example
<default-driver-data-source/>

C.391 default-level

Range of values: TRACE | DEBUG | INFO | WARN | ERROR
Default value: INFO
Parent elements:
persistence-configuration
  persistence-configuration-unit
  log-factory-impl

C.391.1 Function
Specifies the default logging level of unconfigured channels.

C.391.2 Example
<default-level>INFO</default-level>

C.392 default-lock-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
C.3.92  Function
Specifies to use the default lock manager.

C.3.92.2  Example
<default-lock-manager/>

C.3.93  default-mapping-defaults

  Range of values: String
  Standard implementations include: jdo and jpa
  Default value: N/A
  Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.93.1  Function
Specifies a plugin string describing the kodo.jdbc.meta.MappingDefaults to use to define default column names, table names, and constraints for your persistent classes.

C.3.93.2  Example
<default-mapping-defaults>jpa</default-mapping-defaults>

C.3.94  default-meta-data-factory

  Range of values: N/A
  Default value: N/A
  Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.94.1  Function
Specifies a plugin string describing the kodo.meta.MetaDataFactory type to use, in this case the default, which is kodo.jdo.JDOMetaDataFactory.

C.3.94.2  Example
<default-meta-data-factory/>

C.3.95  default-meta-data-repository

  Range of values: N/A
  Default value: N/A
  Parent elements:
    persistence-configuration
    persistence-configuration-unit
C.3.95.1 Function
Specifies a plugin string describing the `kodo.meta.MetaDataRepository` to use to store the metadata for your persistent classes, in this case the default.

C.3.95.2 Example
```
<default-meta-data-repository/>
```
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.98.1 Function
Specifies a plugin string describing the Map used to associate query strings and their parsed form, in this case the default.

C.3.98.2 Example
<default-query-compilation-cache/>

C.3.99 default-savepoint-manager

  Range of values: N/A
  Default value: N/A

  Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.99.1 Function
Specifies a plugin string describing the kodo.kernel.SavepointManager to use for managing transaction savepoints, in this case the default which is kodo.kernel.InMemorySavepointManager. This plugin stores all state, including field values, in memory. Because of this behavior, each set savepoint is designed for small to medium transactional object counts.

C.3.99.2 Example
<default-savepoint-manager/>

C.3.100 default-schema-factory

  Range of values: N/A
  Default value: N/A

  Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.100.1 Function
Specifies a plugin string describing the kodo.jdbc.schema.SchemaFactory to use to store and retrieve information about the database schema, in this case the default which is kodo.jdbc.schema.DynamicSchemaFactory.

The DynamicSchemaFactory is the most performant schema factory, because it does not validate mapping information against the database. Instead, it assumes all object-relational mapping information is correct, and dynamically builds an in-memory representation of the schema from your mapping metadata. When using this factory, it is important that your mapping metadata correctly represent your
database's foreign key constraints so that Kodo can order its SQL statements to meet them.

C.3.100.2 Example
<default-schema-factory/>

C.3.101 default-sql-factory
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.101.1 Function
Specifies a plugin string describing the kodo.jdbc.SQLFactory to use to abstract common SQL constructs, in this case the default.

C.3.101.2 Example
<default-meta-data-factory/>

C.3.102 default-update-manager
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.102.1 Function
Specifies to use the default update manager, kodo.jdbc.kernel.ConstraintUpdateManager.

C.3.102.2 Example
<default-update-manager/>

C.3.103 deprecated-jdo-mapping-defaults
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.103.1 Function
Specifies the mapping defaults for JDO 1.0.
C.3.103.2 Example
The deprecated-jdo-mapping-defaults element shares the same subelements as mapping-defaults-impl.

C.3.104 deprecated-jdo-meta-data-factory

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.104.1 Function
Specifies a plugin string describing the kodo.meta.MetaDataFactory type to use, in this case kodo.jdo.DeprecatedJDOMetaDataFactory.

C.3.104.2 Example

<deprecated-jdo-meta-data-factory>
  <use-schema-validation>false</use-schema-validation>
  <urls>t3://localhost:7001/metadata.jar</urls>
  <files>com/file1;com/file2</files>
  <classpath-scan>build</classpath-scan>
  <types>classname1;classname2</types>
  <store-mode>1</store-mode>
  <strict>false</strict>
  <resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>
  <scan-top-down>false</scan-top-down>
</deprecated-jdo-meta-data-factory>

C.3.105 derby-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.105.1 Function
Configures the Derby Dictionary. For a complete description of each of the values that you can specify, see "Derby Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.105.2 Example
The derby-dictionary element shares the same subelements as, plus the following subelement (default shown):

<derby-dictionary>
  ...
  <shutdown-on-close>true</shutdown-on-close>
</derby-dictionary>
C.3.106 detach-options-all

Range of values: N/A
Default value: N/A
Parent elements:

persistence-configuration
  persistence-configuration-unit

C.3.106.1 Function
Sets the detach state to all to detach all fields and relations. Be very careful when using this mode; if you have a highly-connected domain model, you could end up bringing every object in the database into memory.

C.3.106.2 Example
<detach-options-all>
  <detached-state-manager>true</detached-state-manager>
  <detached-state-transient>false</detached-state-transient>
  <access-unloaded>true</access-unloaded>
  <detached-state-field>true</detached-state-field>
</detach-options-all>

C.3.107 detach-options-fetch-groups

Range of values: N/A
Default value: N/A
Parent elements:

persistence-configuration
  persistence-configuration-unit

C.3.107.1 Function
Sets the detach state to detach all fields and relations in the default fetch group, and any other fetch groups that you have added to the current fetch configuration.

C.3.107.2 Example
<detach-options-fetch-groups>
  <detached-state-manager>true</detached-state-manager>
  <detached-state-transient>false</detached-state-transient>
  <access-unloaded>true</access-unloaded>
  <detached-state-field>true</detached-state-field>
</detach-options-fetch-groups>

C.3.108 detach-options-loaded

Range of values: N/A
Default value: N/A
Parent elements:

persistence-configuration
  persistence-configuration-unit
C.3.108 Function
Sets the detach state to detach all fields and relations that are already loaded, but do not include unloaded fields in the detached graph. This is the default.

C.3.108.2 Example

```
<detach-options-loaded>
  <detached-state-manager>true</detached-state-manager>
  <detached-state-transient>false</detached-state-transient>
  <access-unloaded>true</access-unloaded>
  <detached-state-field>true</detached-state-field>
</detach-options-loaded>
```

C.3.109 detach-state

**Range of values:** 1 | 2 | 3

**Default value:** 1

**Parent elements:**
- persistence-configuration
- persistence-configuration-unit
- kodo-broker

C.3.109.1 Function
Configures the detach state. Valid values include:

- **1**—(loaded) Detach all fields and relations that are already loaded, but do not include unloaded fields in the detached graph.
- **2**—(fetch-groups) Detach all fields and relations in the current fetch configuration.
- **3**—(all) Detach all fields and relations. Be very careful when using this mode; if you have a highly-connected domain model, you could end up bringing every object in the database into memory.

Any field that is not included in the set determined by the detach mode is set to its Java default value in the detached instance.

C.3.109.2 Example

```
<detach-state>1</detach-state>
```

C.3.110 detached-state-field

**Range of values:** true | false

**Default value:** true

**Parent elements:**
- persistence-configuration
- persistence-configuration-unit
- detach-options-all
- persistence-configuration
- persistence-configuration-unit
- detach-options-fetch-groups
C.3.110.1 Function
Flag that specifies whether Kodo should take advantage of a detached state field to make the attach process more efficient. This field is added by the enhancer and is not visible to your application.

C.3.110.2 Example
<detached-state-field>true</detached-state-field>

C.3.111 detached-state-manager

Range of values: true | false
Default value: true
Parent elements:

C.3.111.1 Function
Flag that specifies whether to use a detached state manager. A detached state manager makes attachment much more efficient. Like a detached state field, however, it breaks serialization compatibility with the unenhanced class if it is not transient.

This setting piggybacks on the Section C.3.110, "detached-state-field" element. If your detached state field is transient, the detached state manager will also be transient. If the detached state field is disabled, the detached state manager will also be disabled. This is typically what you want.

By setting the detach-state-field element to true (or transient) and setting this property to false, however, you can use a detached state field without using a detached state manager. This may be useful for debugging or for legacy Kodo users who find differences between Kodo's behavior with a detached state manager and Kodo's older behavior without one.

C.3.111.2 Example
<detached-state-manager>true</detached-state-manager>

C.3.112 detached-state-transient

Range of values: true | false
Default value: true

Parent elements:

persistence-configuration
  persistence-configuration-unit
    detach-options-all

persistence-configuration
  persistence-configuration-unit
    detach-options-fetch-groups

persistence-configuration
  persistence-configuration-unit
    detach-options-loaded

C.3.112.1 Function
Flag that specifies whether to use a transient detached state field. Setting this to true provides the benefits of a detached state field to local objects that are never serialized, but retains serialization compatibility for client tiers without access to the enhanced versions of your classes.

C.3.112.2 Example
<detached-state-transient>false</detached-state-transient>

C.3.113 detached-new

Range of values: true | false
Default value: true

Parent elements:

persistence-configuration
  persistence-configuration-unit
    kodo-broker

C.3.113.1 Function
Flag that specifies whether to use a non-transient detached state field so that objects crossing serialization barriers can still be attached efficiently. This requires, however, that your client tier have the enhanced versions of your classes and the Kodo libraries.

C.3.113.2 Example
<detached-new>true</detached-new>

C.3.114 diagnostic-context

Range of values: String
Default value: kodo.ID property, if set

Parent elements:

persistence-configuration
  persistence-configuration-unit
    log-factory-impl
C.3.114.1 Function
String that is prepended to all log messages. The kodo.ID property is used by default, if specified.

C.3.114.2 Example
<diagnostic-context>KodoID</diagnostic-context>

C.3.115 dynamic-data-structs
Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
    persistence-configuration-unit

C.3.115.1 Function
Flag that specifies whether to dynamically generate customized structs to hold persistent data. Both the Kodo data cache and the remote framework rely on data structs to cache and transfer persistent state. With dynamic structs, Kodo can customize data storage for each class, eliminating the need to generate primitive wrapper objects. This saves memory and speeds up certain runtime operations.

The cost is a longer warm-up time for the application—generating and loading custom classes into the JVM takes time. Therefore, only set this property to true if you have a long-running application where the initial cost of class generation is offset by memory and speed optimization over time.

C.3.115.2 Example
<dynamic-data-structs>false</dynamic-data-structs>

C.3.116 dynamic-schema-factory
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
    persistence-configuration-unit

C.3.116.1 Function
Specifies a plugin string describing the kodo.jdbc.schema.SchemaFactory to use to store and retrieve information about the database schema, in this case the default which is kodo.jdbc.schema.DynamicSchemaFactory.

The DynamicSchemaFactory is the most performant schema factory, because it does not validate mapping information against the database. Instead, it assumes all object-relational mapping information is correct, and dynamically builds an in-memory representation of the schema from your mapping metadata. When using this factory, it is important that your mapping metadata correctly represent your database’s foreign key constraints so that Kodo can order its SQL statements to meet them.
C.3.116.2 Example

<dynamic-schema-factory/>

C.3.117 eager-fetch-mode

Range of values: join | multiple | none | parallel | single

Default value: parallel

Parent elements:
persistence-configuration
persistence-configuration-unit

C.3.117.1 Function

Configures eager fetching. Eager fetching is the ability to efficiently load subclass data and related objects along with the base instances being queried.

You can set this value to one of the following:

- **join**—In this mode, Kodo joins to-one relations in the configured fetch groups. If Kodo is loading data for a single instance, then Kodo will also join to any collection field in the configured fetch groups. When loading data for multiple instances, though, (such as when executing a Query) Kodo will not join to collections by default. Instead, Kodo defaults to parallel mode for collections, as described below. You can force Kodo to use a join rather than parallel mode for a collection field using the metadata extension.

  Under join mode, Kodo uses a left outer join (or inner join, if the relations’ field metadata declares the relation non-nullable) to select the related data along with the data for the target objects. This process works recursively for to-one joins, so that if Person has an Address, and Address has a TelephoneNumber, and the fetch groups are configured correctly, Kodo might issue a single select that joins across the tables for all three classes. To-many joins can not recursively spawn other to-many joins, but they can spawn recursive to-one joins.

  Under the join subclass fetch mode, subclass data in joined tables is selected by outer joining to all possible subclass tables of the type being queried. Unjoined subclass data is selected with a SQL UNION where possible. As you’ll see below, subclass data fetching is configured separately from relation fetching, and can be disabled for specific classes.

- **multiple**—Same as parallel.

- **none**—No eager fetching is performed. Related objects are always loaded in an independent select statement. No joined subclass data is loaded unless it is in the table(s) for the base type being queried. Unjoined subclass data is loaded using separate select statements rather than an SQL UNION operation.

- **parallel**—Under this mode, Kodo selects to-one relations and joined collections as outlined in the join mode description above. Unjoined collection fields, however, are eagerly fetched using a separate select statement for each collection, executed in parallel with the select statement for the target objects. The parallel selects use the WHERE conditions from the primary select, but add their own joins to reach the related data. Thus, if you perform a query that returns 100 Company objects, where each company has a list of Employee objects and Department objects, Kodo will make three queries. The first will select the company objects, the second will select the employees for those companies, and the third will select the departments for the same companies. Just as for joins, this process can be
recursively applied to the objects in the relations being eagerly fetched. Continuing our example, if the Employee class had a list of Projects in one of the fetch groups being loaded, Kodo would execute a single additional select in parallel to load the projects of all employees of the matching companies.

Using an additional select to load each collection avoids transferring more data than necessary from the database to the application. If eager joins were used instead of parallel select statements, each collection added to the configured fetch groups would cause the amount of data being transferred to rise dangerously, to the point that you could easily overwhelm the network.

Polymorphic to-one relations to table-per-class mappings use parallel eager fetching because proper joins are impossible. You can force other to-one relations to use parallel rather than join mode eager fetching using the metadata extension.

Setting your subclass fetch mode to parallel affects table-per-class and vertical inheritance hierarchies. Under parallel mode, Kodo issues separate selects for each subclass in a table-per-class inheritance hierarchy, rather than UNIONing all subclass tables together as in join mode. This applies to any operation on a table-per-class base class: query, by-id lookup, or relation traversal.

When dealing with a vertically-mapped hierarchy, on the other hand, parallel subclass fetch mode only applies to queries. Rather than outer-joining to subclass tables, Kodo will issue the query separately for each subclass. In all other situations, parallel subclass fetch mode acts just like join mode in regards to vertically-mapped subclasses.

When Kodo knows that it is selecting for a single object only, it never uses parallel mode, because the additional selects can be made lazily just as efficiently. This mode only increases efficiency over join mode when multiple objects with eager relations are being loaded, or when multiple selects might be faster than joining to all possible subclasses.

- single—Same as join.

**C.3.117.2 Example**

```
<eager-fetch-mode>parallel</eager-fetch-mode>
```

**C.3.118 empress-dictionary**

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**

```
persistence-configuration
  persistence-configuration-unit
```

**C.3.118.1 Function**

Configures the Empress Dictionary. For a complete description of each of the values that you can specify, see "Empress Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

**C.3.118.2 Example**

The `empress-dictionary` element shares the same subelements as Section C.3.2, "access-dictionary," plus the following sub-element (default shown):
C.3.119 EnableLogMBean

**Range of values:** true | false
**Default value:** N/A
**Parent elements:**
- jmx
  - local-jmx

**C.3.119.1 Function**
Flag that specifies whether the LogMBean should be registered.

**C.3.119.2 Example**

```xml
<EnableLogMBean>true</EnableLogMBean>
```

C.3.120 EnableRuntimeMBean

**Range of values:** true | false
**Default value:** N/A
**Parent elements:**
- jmx
  - local-jmx

**C.3.120.1 Function**
Flag that specifies whether the RuntimeMBean should be registered.

**C.3.120.2 Example**

```xml
<EnableRuntimeMBean>true</EnableRuntimeMBean>
```

C.3.121 evict-from-data-cache

**Range of values:** true | false
**Default value:** false
**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit
  - kodo-broker

**C.3.121.1 Function**
Flag that specifies whether to evict data from the data cache at specific times. You defined the eviction schedule using the Section C.3.122, "eviction-schedule" element.
C.3.121.2 Example

<evict-from-data-cache>true</evict-from-data-cache>

C.3.122 eviction-schedule

Range of values: N/A
Default value: N/A

Parent elements:

persistence-configuration
  persistence-configuration-unit
    data-caches
      gem-fire-data-cache

persistence-configuration
  persistence-configuration-unit
    data-caches
      kodo-current-data-cache

persistence-configuration
  persistence-configuration-unit
    data-caches
      lru-data-cache

persistence-configuration
  persistence-configuration-unit
    data-caches
      tangosol-data-cache

C.3.122.1 Function
You can clear a data cache at specific times. The EvictionSchedule property of Kodo's cache implementation accepts a cron style eviction schedule. The format of this property is a whitespace-separated list of five tokens. You can use the * symbol (asterisk) as a wildcard to match all values. The following lists the tokens in the order that they must be specified:

- Minute
- Hour of Day
- Day of Month
- Month
- Day of Week

C.3.122.2 Example
The following setting schedules the default cache to evict values from the cache at 15 and 45 minutes past 3:00 pm on Sunday.

<eviction-schedule>15,45 15 * * 1</eviction-schedule>

C.3.123 exception-orphaned-key-action

Range of values: N/A
Default value: N/A
C.3.123.1 Function
Specifies a plugin string describing the `kodo.event.OrphanedKeyAction` to invoke when Kodo discovers an orphaned datastore key, in this case `kodo.event.ExceptionOrphanedKeyAction`. In this case, Kodo throws an exception for each orphaned key. In JPA, the exception will be `javax.persistence.EntityNotFoundException`. In JDO, the exception type will be `javax.jdo.JDOObjectNotFoundException`.

C.3.123.2 Example
```
<exception-orphaned-key-action/>
```

C.3.124 exception-reconnect-attempts

Range of values: Integer
Default value: 0
Parent elements:
persistence-configuration
  persistence-configuration-unit
  jms-remote-commit-provider

C.3.124.1 Function
Specifies the number of times to attempt to reconnect if the JMS system notifies Kodo of a serious connection error. A value of 0 (the default) indicates that Kodo will log the error but otherwise ignore it, hoping the connection is still valid.

C.3.124.2 Example
```
<exception-reconnect-attempts>0<exception-reconnect-attempts>
```

C.3.125 execution-context-name-provider

Range of values: N/A
Default value: N/A
Parent elements: N/A

C.3.125.1 Function
Configure the execution context name provider.

C.3.125.2 Example
```
<execution-context-name-provider>
  <stack-execution-context-name-provider>...
  </stack-execution-context-name-provider>
  <transaction-name-execution-context-name-provider>...
  </transaction-name-execution-context-name-provider>
  <user-object-execution-context-name-provider>...
</execution-context-name-provider>
```
C.3.126  export-profiling

Range of values: N/A
Default value: N/A

Parent elements:
  persistence-configuration
  persistence-configuration-unit
  profiling

C.3.126.1  Function
Configure export profiling data.

C.3.126.2  Example

```xml
<profiling>
  <export-profiling>
    <interval-millis>-1</interval-millis>
    <base-name>name</base-name>
  </export-profiling>
</profiling>
```

C.3.127  extension-deprecated-jdo-mapping-factory

Range of values: N/A
Default value: N/A

Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.127.1  Function
A plugin string describing the kodo.meta.MetaDataFactory to use to store and retrieve object-relational mapping information for your persistent classes. This setting is valid for JDO 1.0.

C.3.127.2  Example

```xml
<extension-deprecated-jdo-mapping-factory>
  <use-schema-validation>true</use-schema-validation>
  <urls>t3://localhost:7001/metadata.jar</urls>
  <files>com/file1;com/file2</files>
  <classpath-scan>build</classpath-scan>
  <types>classname1;classname2</types>
  <store-mode>1</store-mode>
  <strict>false</strict>
  <resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>
  <scan-top-down>false</scan-top-down>
</extension-deprecated-jdo-mapping-factory>
```
C.3.128 fetch-batch-size

Range of values: Integer
Default value: -1
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.128.1 Function
The number of rows to fetch at one time when scrolling through a result set. The fetch size can also be set at runtime.

C.3.128.2 Example
<fetch-batch-size>-1</fetch-batch-size>

C.3.129 fetch-direction

Range of values: forward | reverse | unknown
Default value: true
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.129.1 Function
The expected order in which query result lists are accessed. This value affects the type of data structure Kodo uses to store the results, and is passed to the JDBC driver in case it can optimize for certain access patterns. This element accepts the following values, each of which corresponds exactly to the same-named java.sql.ResultSet FETCH constant:

- forward—Query results are listed in order. This is the default.
- reverse—Query results are listed in reverse order.
- unknown—The order is not specified.

This property can also be varied at runtime.

C.3.129.2 Example
<fetch-direction>forward</fetch-direction>

C.3.130 fetch-group

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  fetch-group
C.3.130.1 Function
Name of a fetch group. Fetch group names are global, and are expected to be shared among classes. For example, a shopping website may use a detail fetch group in each product class to efficiently load all the data needed to display a product’s "detail" page. The website might also define a sparse list fetch group containing only the fields needed to display a table of products, as in a search result.

The following names are reserved for use by Kodo: default, values, all, none, and any name beginning with jdo, ejb, or kodo.

C.3.130.2 Example

```xml
<fetch-groups>
  <fetch-group>detail</fetch-group>
</fetch-groups>
```

C.3.131 fetch-groups

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**
- persistence-configuration
- persistence-configuration-unit

C.3.131.1 Function
Define one or more custom fetch groups.

By default, Kodo places any field that is eagerly loaded according to the JPA metadata rules into the built-in default fetch group. You may define your own named fetch groups and activate or deactivate them at runtime. Kodo will eagerly-load the fields in all active fetch groups when loading objects from the datastore.

C.3.131.2 Example

```xml
<fetch-groups>
  <fetch-group>detail</fetch-group>
</fetch-groups>
```

C.3.132 field-override

**Range of values:** true | false

**Default value:** true

**Parent elements:**
- persistence-configuration
- persistence-configuration-unit
- kodo-persistence-mapping-factory
- kodo-persistence-meta-data-factory
C.3.132 Flag that specifies whether to enable field override.

C.3.132.2 Example

<field-override>true</field-override>

C.3.133 File

Range of values: String
Default value: Described below
Parent elements:

C.3.133.1 Function

If the parent element is Section C.3.135, "file-schema-factory," specifies the resource name of the XML schema file. By default, the factory looks for a resource called package.schema located in any top-level directory of the CLASSPATH or in the top level of any JAR in your CLASSPATH.

If the parent element is Section C.3.183, "log-factory-impl," specifies the name of the file to which messages are logged. Specify stdout or stderr to log messages to standard out and standard error, respectively. The default is stderr.

C.3.133.2 Example

<file>stdout</file>

C.3.134 File Name

Range of values: String
Default value: package.schema
Parent elements:

C.3.134.1 Function

Specifies the resource name of the XML schema file. By default, the factory looks for a resource called package.schema located in any top-level directory of the CLASSPATH or in the top level of any JAR in your CLASSPATH.

C.3.134.2 Example

<file-name>package.schema</file-name>
C.3.135 file-schema-factory

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
  - persistence-configuration-unit

C.3.135.1 Function

Specifies a plugin string describing the kodo.jdbc.schema.SchemaFactory to use to store and retrieve information about the database schema, in this case kodo.jdbc.schema.FileSchemaFactory.

This factory is a lot like the Section C.3.277, "table-schema-factory," and has the same advantages and disadvantages. Instead of storing its XML schema definition in a database table, though, it stores it in a file.

C.3.135.2 Example

```xml
<file-schema-factory>
  <file-name>package.schema</file-name>
  <file>package.schema</file>
</file-schema-factory>
```

C.3.136 files

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
    - deprecated-jdo-meta-data-factory
- persistence-configuration
  - persistence-configuration-unit
    - extension-deprecated-jdo-mapping-factory
- persistence-configuration
  - persistence-configuration-unit
    - jdo-meta-data-factory
- persistence-configuration
  - persistence-configuration-unit
    - jdor-mapping-factory
- persistence-configuration
  - persistence-configuration-unit
    - kodo-persistence-mapping-factory
- persistence-configuration
  - persistence-configuration-unit
    - kodo-persistence-meta-data-factory
- persistence-configuration
  - persistence-configuration-unit
mapping-file-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
    orm-file-jdor-mapping-factory

persistence-configuration
  persistence-configuration-unit
    table-deprecated-jdo-mapping-factory

C.3.136.1 Function
Specifies a semicolon-separated list of metadata files or JAR archives. Each jar archive
will be scanned for annotated JPA entities or JDO metadata files based on your
metadata factory.

C.3.136.2 Example
<files>com/file1;com/file2</files>

C.3.137 filter-listeners
  Range of values: N/A
  Default value: N/A
  Parent elements:
    persistence-configuration
      persistence-configuration-unit

C.3.137.1 Function
Defines one or more full plugin strings for custom kodo.FilterListeners to make
available to all queries, in addition to the standard set of listeners. You can also add
filter listeners to individual queries.

C.3.137.2 Example
<filter-listeners>
  <custom-filter-listener>detail</custom-filter-listener>
</filter-listeners>

C.3.138 foreign-keys
  Range of values: true | false
  Default value: false
  Parent elements:
    persistence-configuration
      persistence-configuration-unit
        lazy-schema-factory

C.3.138.1 Function
Flag that specifies whether to read automatically foreign key information during
schema validation.
C.3.138.2 Example

<foreign-keys>false</foreign-keys>

C.3.139 format

Range of values: String
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
    native-jdbc-seq

C.3.139.1 Function

Specifies the format.

C.3.140 foxpro-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.140.1 Function

Configuration values for the FoxPro Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "FoxPro Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.140.2 Example

The foxpro-dictionary element shares the same subelements as Section C.3.2, "access-dictionary."

C.3.141 flush-before-queries

Range of values: true | false | with-connection
Default value: true
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.141.1 Function

Flag that specifies whether to flush any changes made in the current transaction to the datastore before executing a query. Valid values include:

- true—Always flush rather than executing the query in-memory. If the current transaction is optimistic, Kodo will begin a non-locking datastore transaction. This is the default.
- false—Never flush before a query.
with-connection—Flush only if the EntityManager or PersistenceManager has already established a dedicated connection to the datastore, otherwise execute the query in-memory.

This option is useful if you use long-running optimistic transactions and want to ensure that these transactions do not consume database resources until commit. Kodo's behavior with this option is dependent on the transaction status and mode, as well as the configured connection retain mode described earlier in this section.

C.3.141.2 Example

```
<flush-before-queries>true</flush-before-queries>
```

C.3.142 gem-fire-data-cache

Range of values: N/A
Default value: N/A
Parent elements:

- persistence-configuration
- persistence-configuration-unit
- data-caches

C.3.142.1 Function
Integrates with GemStone's GemFire v5.0.1 caching system.

C.3.142.2 Example

```
<data-caches>
  <gem-fire-data-cache>
    <name>kodo.DataCache</name>
    <gem-fire-cache-name>root/kodo-data-cache</gem-fire-cache-name>
    <eviction-schedule>15, 45 15 * * 1</eviction-schedule>
  </gem-fire-data-cache>
</data-caches>
```

C.3.143 gem-fire-data-cache-name

Range of values: Valid GemFire region name
Default value:

- Data cache: root/kodo-data-cache
- Query cache: root/kodo-query-cache
Parent elements:

- persistence-configuration
- persistence-configuration-unit
- data-caches
- gem-fire-data-cache

C.3.143.1 Function

GemFire region name.

C.3.143.2 Example

```
<gem-fire-data-cache-name>root/kodo-data-cache</gem-fire-data-cache-name>
```
C.3.144 gui-jmx

Range of values: N/A
Default value: N/A
Parent elements:

jmx

C.3.144.1 Function
Enable management and invoke the JMX management console in the local JVM. Supports optional parameters in the Management Group.

C.3.144.2 Example
<gui-jmx>
    <MBeanServerStrategy>any-create</MBeanServerStrategy>
    <EnableLogMBean>true</EnableLogMBean>
    <EnableRuntimeMBean>true</EnableRuntimeMBean>
</gui-jmx>

C.3.145 gui-profiling

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
    persistence-configuration-unit
    profiling

C.3.145.1 Function
Turns on the local profiling GUI.

C.3.145.2 Example
<profiling>
    <gui-profiling/>
</profiling>

C.3.146 Host

Range of values: N/A
Default value: N/A
Parent elements:

jmx
    mx4j1-jmx

C.3.146.1 Function
Hostname on which the RMI registry naming service listens. Defaults to localhost.
C.3.146.2 Example

<Host>localhost</Host>

C.3.147 host

Range of values: Valid hostname
Default value: localhost
Parent elements:
  persistence-configuration
  persistence-configuration-unit
tcp-transport

C.3.147.1 Function
Specifies the host name of the server. This setting is used by clients, not by the server.

C.3.147.2 Example

<host>localhost</host>

C.3.148 hsql-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.148.1 Function
Configuration values for the HSQL Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "HSQL Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.148.2 Example
The hsql-dictionary element shares the same subelements as Section C.3.2, "access-dictionary."

C.3.149 http-transport

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.149.1 Function
Specifies the URL of the remote server.
C.3.149.2 Example

```
<http-transport>
  <url>servlet-url</url>
</http-transport>
```

C.3.150 ignore-changes

**Range of values:** true | false

**Default value:** false

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit
    - kodo-broker

**C.3.150.1 Function**
Flag that specifies whether to consider modifications to persistent objects made in the current transaction when evaluating queries. Setting this to true allows Kodo to ignore changes and execute the query directly against the datastore. A value of false forces Kodo to consider whether the changes in the current transaction affect the query, and if so to either evaluate the query in-memory or flush before running it against the datastore.

**C.3.150.2 Example**

```
<ignore-changes>false</ignore-changes>
```

C.3.151 ignore-unmapped

**Range of values:** true | false

**Default value:** false

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit
    - class-table-jdbc-seq

**C.3.151.1 Function**
Flag that specifies whether to ignore unmapped base classes and instead use one row per least-derived mapped class.

**C.3.151.2 Example**

```
<ignore-unmapped>false</ignore-unmapped>
```

C.3.152 ignore-virtual

**Range of values:** true | false

**Default value:** true

**Parent elements:**
- persistence-configuration
C.3.152.1 Function
Flag that specifies whether to ignore virtual classes.

C.3.152.2 Example
<ignore-virtual>false</ignore-virtual>

C.3.153 in-memory-savepoint-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.153.1 Function
Specifies a plugin string describing the kodo.kernel.SavepointManager to use for managing transaction savepoints, in this case kodo.kernel.InMemorySavepointManager. This plugin stores all state, including field values, in memory. Because of this behavior, each set savepoint is designed for small to medium transactional object counts.

C.3.153.2 Example
<in-memory-savepoint-manager/>

C.3.154 increment

Range of values: Integer
Default value: 1
Parent elements:
persistence-configuration
  persistence-configuration-unit
  class-table-jdbc-seq
  persistence-configuration
  persistence-configuration-unit
  native-jdbc-seq
  persistence-configuration
  persistence-configuration-unit
  table-jdbc-seq
  persistence-configuration
  persistence-configuration-unit
  time-seeded-seq
  persistence-configuration
  persistence-configuration-unit
C.3.154 value-table-jdbc-seq

C.3.154.1 Function
Specifies the amount of sequence increments.

C.3.154.2 Example
<increment>1</increment>

C.3.155 indexes

Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
    lazy-schema-factory

C.3.155.1 Function
Flag that specifies whether to read automatically index information during schema validation.

C.3.155.2 Example
<indexes>false</indexes>

C.3.156 informix-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.156.1 Function
Configuration values for the Informix Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "Informix Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.156.2 Example
The informix-dictionary element shares the same subelements as Section C.3.2, "access-dictionary," plus the following subelements (defaults shown):

<informix-dictionary>
  ...
  <lock-mode-enabled>false</lock-mode-enabled>
  <lock-wait-seconds>30</lock-wait-seconds>
  <swap-schema-and-catalog>true</swap-schema-and-catalog>
</informix-dictionary>
C.3.157 initial-value

Range of values: N/A
Default value: 1
Parent elements:
persistence-configuration
    persistence-configuration-unit
        native-jdbc-seq

C.3.157.1 Function
Specifies the initial sequence value.

C.3.157.2 Example
<initial-value>1</initial-value>

C.3.158 interval-millis

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
    persistence-configuration-unit
        export-profiling
        profiling
            export-profiling

C.3.158.1 Function
Number of milliseconds between exports. This value defaults to -1, indicating that there will be a single export upon exit.

C.3.158.2 Example
<interval-millis>-1</interval-millis>

C.3.159 inverse-manager

Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
    persistence-configuration-unit

C.3.159.1 Function
A plugin string describing a kodo.kernel.InverseManager to use for managing bidirectional relations upon a flush.
C.3.159.2 Example

```xml
<inverse-manager>
    <action>warn</action>
    <manage-lrs>false</manage-lrs>
</inverse-manager>
```

C.3.160 jdatastore-dictionary

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit

**C.3.160.1 Function**

Configuration values for the JDataStore Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "JDataStore Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

**C.3.160.2 Example**

The `jdatastore-dictionary` element shares the same subelements as Section C.3.2, "access-dictionary."

C.3.161 jdbc-broker-factory

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit

**C.3.161.1 Function**

A plugin string describing the `kodo.kernel.BrokerFactory` type to use, in this case JDBC.

**C.3.161.2 Example**

```xml
<jdbc-broker-factory/>
```

C.3.162 jdbc-listeners

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit
C.3.162 Function
Defines one or more full plugin strings for custom kodo.jdbc.kernel.exps.JDBCFilterListeners to make available to all queries, in addition to the standard set of listeners. You can also add filter listeners to individual queries.

C.3.162.2 Example
<jdbc-listeners>detail</jdbc-listeners>

C.3.163 jdbc3-savepoint-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
    persistence-configuration-unit

C.3.163.1 Function
Specifies a plugin string describing the kodo.kernel.SavepointManager to use for managing transaction savepoints, in this case the default which is kodo.jdbc.kernel.JDBCSavepointManager. This plugin implements savepoints by issuing a flush to the database.

C.3.163.2 Example
<jdbc3-savepoint-manager/>

C.3.164 jdo-meta-data-factory

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
    persistence-configuration-unit

C.3.164.1 Function
Specifies a plugin string describing the kodo.meta.MetaDataFactory type to use, in this case kodo.jdo.JDOMetaDataFactory.

C.3.164.2 Example
<jdo-meta-data-factory>
    <use-schema-validation>false</use-schema-validation>
    <urls>t3://localhost:7001/metadata.jar</urls>
    <files>com/file1;com/file2</files>
    <classpath-scan>build</classpath-scan>
    <constraint-names>false</constraint-names>
    <types>classname1;classname2</types>
    <store-mode>1</store-mode>
    <strict>false</strict>
    <resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>
</jdo-meta-data-factory>
<scan-top-down>false</scan-top-down>
</jdo-meta-data-factory>

C.3.165  jms-remote-commit-provider

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.165.1 Function
Configures the JMS remote commit provider.

C.3.165.2 Example
<jms-remote-commit-provider>
  <name>kodo.RemoteCommitProvider</name>
  <topic>topic/KodoCommitProviderTopic</topic>
  <exception-reconnect-attempts>0</exception-reconnect-attempts>
  <topic-connection-factory>java:/ConnectionFactory</topic-connection-factory>
</jms-remote-commit-provider>

C.3.166  jmx

Range of values: N/A
Default value: N/A
Parent elements:

C.3.166.1 Function
Enables for the configuration of management capabilities. For more information, see "Management and Monitoring" in the Kodo JPA/JDO Reference for Oracle WebLogic Server.

C.3.166.2 Example
<jmx>
  <none-jmx/>
  <local-jmx>...</local-jmx>
  <gui-jmx>...</gui-jmx>
  <jmx2-jmx>...</jmx2-jmx>
  <mx4j1-jmx>...</mx4j1-jmx>
  <wls81-jmx>...</wls81jmx>
</jmx>

C.3.167  jmx2-jmx

Range of values: N/A
Default value: N/A
Parent elements:
**jmx**

**C.3.167.1 Function**

**C.3.167.2 Example**

```xml
<jmx2-jmx>
    <MBeanServerStrategy>any-create</MBeanServerStrategy>
    <EnableLogMBean>true</EnableLogMBean>
    <EnableRuntimeMBean>true</EnableRuntimeMBean>
    <NamingImpl>mx4j.tools.naming.NamingService</NamingImpl>
    <ServiceURL>service:jmx:rmi://localhost/jndi/jmxservice</ServiceURL>
</jmx2-jmx>
```

**C.3.168 JNDIName**

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
    - persistence-configuration-unit
      - JNDIName

**C.3.168.1 Function**
JNDI name under which to register the remote JMX adaptor. Defaults to jrmp.

**C.3.168.2 Example**

```xml
<JNDIName>jrmp</JNDIName>
```

**C.3.169 kodo-broker**

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
    - persistence-configuration-unit

**C.3.169.1 Function**
Configures the kodo.BrokerImpl.

**C.3.169.2 Example**

```xml
<kodo-broker>
    <large-transaction>false</large-transaction>
    <auto-clear>datastore</auto-clear>
    <detach-state>1</detach-state>
    <nontransactional-read>true</nontransactional-read>
    <retain-state>false</retain-state>
</kodo-broker>
```
<evict-from-data-cache>false</evict-from-data-cache>
<detached-new>true</detached-new>
<optimistic>true</optimistic>
<nontransactional-write>false</nontransactional-write>
<sync-with-managed-transactions>false</sync-with-managed-transactions>
<multithreaded>false</multithreaded>
<populate-data-cache>true</populate-data-cache>
<ignore-changes>false</ignore-changes>
<auto-detach>0</auto-detach>
<restore-state>1</restore-state>
<order-dirty-objects>false</order-dirty-objects>
</kodo-broker>

C.3.170 kodo-concurrent-data-cache

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**

- persistence-configuration
- persistence-configuration-unit
- data-caches

C.3.170.1 Function

Enables the basic concurrent data cache.

C.3.170.2 Example

```xml
<data-caches>
  <kodo-concurrent-data-cache>
    <name>default</name>
    <cache-size>1000</cache-size>
    <soft-reference-size>0</soft-reference-size>
    <eviction-schedule>15,45 15 * * 1</eviction-schedule>
  </kodo-concurrent-data-cache>
</data-caches>
```

C.3.171 kodo-data-cache-manager

**Range of values:** N/A

**Default value:** N/A

**Parent elements:**

- persistence-configuration
- persistence-configuration-unit

C.3.171.1 Function

Enables the kodo.datacache.DataCacheManager that manages the system data caches.

C.3.171.2 Example

```xml
<kodo-data-cache-manager/>
```
C.3.172 kodo-mapping-repository

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.172.1 Function
Specifies a plugin string describing the kodo.meta.MetaDataRepository to use.

C.3.172.2 Example
<kodo-mapping-repository>
  <resolve>3</resolve>
  <validate>7</validate>
  <source-mode>7</source-mode>
</kodo-mapping-repository>

C.3.173 kodo-persistence-mapping-factory

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.173.1 Function
A plugin string describing the kodo.meta.MetaDataFactory to use to store and retrieve object-relational mapping information for your persistent classes. This setting is valid for JPA 1.0.

C.3.173.2 Example
<kodo-persistence-mapping-factory>
  <urls>t3://localhost:7001/metadata.jar</urls>
  <files>com/file1;com/file2</files>
  <classpath-scan>build</classpath-scan>
  <default-access-type>FIELD</default-access-type>
  <field-override>true</field-override>
  <types>classname1;classname2</types>
  <store-mode>1</store-mode>
  <strict>false</strict>
  <resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>
</kodo-persistence-mapping-factory>

C.3.174 kodo-persistence-meta-data-factory

Range of values: N/A
Default value: N/A
Parent elements:
C.3.174 persistence-configuration
  persistence-configuration-unit

C.3.174.1 Function
Specifies a plugin string describing the kodo.meta.MetaDataFactory type to use, in this case org.apache.openjpa.persistence.PersistenceMetaDataFactory.

C.3.174.2 Example
<kodo-persistence-meta-data-factory>
  <urls>t3://localhost:7001/metadata.jar</urls>
  <files>com/file1;com/file2</files>
  <classpath-scan>build</classpath-scan>
  <default-access-type>FIELD</default-access-type>
  <field-override>true</field-override>
  <types>classnamel;classname2</types>
  <store-mode>1</store-mode>
  <strict>false</strict>
  <resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>
</kodo-persistence-meta-data-factory>

C.3.175 kodo-pooling-data-source

C.3.175.1 Function
Configures the kodo.jdbc.schema.KodoPoolingDataSource which by default performs connection pooling.

C.3.175.2 Example
<kodo-pooling-data-source>
  <connection-user-name>KodoPool</connection-user-name>
  <login-timeout>10</login-timeout>
  <connection-password>password</connection-password>
  <connection-url>jdbc:hsqldb:db-hypersonic</connection-url>
  <connection-driver-name>org.hsqldb.jdbcDriver</connection-driver-name>
</kodo-pooling-data-source>

C.3.176 kodo-sql-factory

C.3.176.1 Function
Configures the kodo.jdbc.schema.KodoSqlFactory which by default uses JDO D2DBC.
C.3.176 Function
Specifies a plugin string describing the kodo.jdbc.SQLFactory to use to abstract common SQL constructs.

C.3.176 Example

```xml
<kodo-sql-factory>
  <advanced-sql>...</advanced-sql>
</kodo-sql-factory>
```

C.3.177 large-transaction

Range of values: true | false
Default value: true
Parent elements:
persistence-configuration
  persistence-configuration-unit
    kodo-broker

C.3.177.1 Function
Flag that specifies whether the transaction will generate a large number of objects.

C.3.177.2 Example

```xml
<large-transaction>false</large-transaction>
```

C.3.178 lazy-schema-factory

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.178.1 Function
Specifies a plugin string describing the kodo.jdbc.schema.SchemaFactory to use to store and retrieve information about the database schema, in this case kodo.jdbc.schema.LazySchemaFactory.

As persistent classes are loaded by the application, Kodo reads their metadata and object-relational mapping information. This factory uses the java.sql.DatabaseMetaData interface to reflect on the schema and ensure that it is consistent with the mapping data being read. Because the factory does not reflect on a table definition until that table is mentioned by the mapping information, it is referred to as lazy. Use this factory if you want up-front validation that your mapping metadata is consistent with the database during development.

C.3.178.2 Example

```xml
<lazy-schema-factory>
  <foreign-keys>false</foreign-keys>
  <indexes>false</indexes>
</lazy-schema-factory>
```
<primary-keys>false</primary-keys>
</lazy-schema-factory>

C.3.179  level

Range of values: 1 | 2 | 3 | 4 | 5
Default value: 4
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.179.1 Function
Specifies the level at which to log. Valid values include: 1 (TRACE), 2 (DEBUG), 3 (INFO), 4 (WARN), and 5 (ERROR).

C.3.179.2 Example
<level>4</level>

C.3.180  local-jmx

Range of values: N/A
Default value: N/A
Parent elements:
  jmx

C.3.180.1 Function
Enabled local management. This setting is suitable for use in JBoss and other environments where all MBeans should be registered with a JMX MBeanServer for either management via a user defined mechanism, or via a mechanism defined by the MBeanServer. Supports optional parameters in the Management Group.

C.3.180.2 Example
<local-jmx>
  <MBeanServerStrategy>any-create</MBeanServerStrategy>
  <EnableLogMBean>true</EnableLogMBean>
  <EnableRuntimeMBean>true</EnableRuntimeMBean>
</local-jmx>

C.3.181  local-profiling

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  profiling
C.3.181 Function
Enable profiling without export or GUI. Useful when trying to access the ProfilingAgent programmatically.

C.3.181.2 Example
<pre>
<profiling>
  <local-profiling/>
</profiling>
</pre>

C.3.182 lock-timeout

- **Range of values:** Integer
- **Default value:** -1
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit

C.3.182.1 Function
Default amount of time that Kodo waits when trying to obtain a lock. A value of -1 specifies that there is no limit.

C.3.182.2 Example
<pre>
<lock-timeout>-1</lock-timeout>
</pre>

C.3.183 log-factory-impl

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit

C.3.183.1 Function
Configures the default logging system.

C.3.183.2 Example
<pre>
<log-factory-impl>
  <diagnostic-context>Id</diagnostic-context>
  <default-level>INFO</default-level>
  <file>stdout</file>
</log-factory-impl>
</pre>

C.3.184 log-orphaned-key-action

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
C.3.184 persistence-configuration

C.3.184.1 Function
Specifies a plugin string describing the `kodo.event.OrphanedKeyAction` to invoke when Kodo discovers an orphaned datastore key, in this case `kodo.event.LogOrphanedKeyAction`. In this case, Kodo logs a message for each orphaned key.

C.3.184.2 Example

```xml
<log-orphaned-key-action>
    <channel>openjpa.Runtime</channel>
    <level>4</level>
</log-orphaned-key-action>
```

C.3.185 log4j-log-factory

Range of values: N/A
Default value: N/A
Parent elements:

```xml
persistence-configuration
  persistence-configuration-unit
```

C.3.185.1 Function
Specifies to use Log4J for logging. In a standalone application, Log4J logging levels are controlled by a resource named `log4j.properties`, which should be available as a top-level resource (either at the top level of a jar file, or in the root of one of the CLASSPATH directories). When deploying to a web or EJB application server, Log4J configuration is often performed in a `log4j.xml` file instead of a properties file. For further details on configuring Log4J, please see the Log4J 2.x Manual at http://logging.apache.org/log4j/2.x/manual/index.html.

C.3.185.2 Example

```xml
<log4j-log-factory/>
```

C.3.186 login-timeout

Range of values: Valid classname
Default value:

- Section C.3.175, "kodo-pooling-data-source": 10
- Section C.3.255, "simple-driver-data-source": 0

Parent elements:

```xml
persistence-configuration
  persistence-configuration-unit
doctrine-data-source
```
C.3.186 Function
Specifies the login timeout.

C.3.186.2 Example
<login-timeout>0</login-timeout>

C.3.187 lrs-size

Range of values: query | last | unknown
Default value: query

Parent elements:
persistence-configuration
persistence-configuration-unit

C.3.187.1 Function
Specifies the size of results sets. This property is only used if you change the fetch batch size from its default of -1 so that Kodo uses the on-demand results loading. Valid values include:

- query—The first time you ask for the size of a query result, Kodo will perform a SELECT COUNT(*) query to determine the number of expected results. Note that depending on transaction status and settings, this can mean that the reported size is slightly different than the actual number of results available. This is the default.

- last—If you have chosen a scrollable result set type, this setting will use the ResultSet.last method to move to the last element in the result set and get its index. Unfortunately, some JDBC drivers will bring all results into memory in order to access the last one. Note that if you do not choose a scrollable result set type, then this will behave exactly like unknown. The default result set type is forward-only, so you must change the result set type in order for this property to have an effect.

- unknown—Kodo returns Integer.MAX_VALUE as the size for any query result that uses on-demand loading.

C.3.187.2 Example
<lrs-size>query</lrs-size>

C.3.188 lru-data-cache

Range of values: N/A
Default value: N/A

Parent elements:
persistence-configuration
persistence-configuration-unit
data-caches

C.3.188.1 Function
Sets the least-recently-used (LRU) data caching option.
C.3.188.2 Example

```xml
<data-caches>
  <lru-data-cache>
    <name>kodo.DataCache</name>
    <cache-size>1000</cache-size>
    <soft-reference-size>0</soft-reference-size>
    <eviction-schedule>15,45 15 * * 1</eviction-schedule>
  </lru-data-cache>
</data-caches>
```

C.3.189 manage-lru

- **Range of values**: true | false
- **Default value**: false
- **Parent elements**:
  - persistence-configuration
  - persistence-configuration-unit
  - inverse-manager

**C.3.189.1 Function**
Flag that specifies whether large result set fields are included from management.

**C.3.189.2 Example**

```xml
<manage-lrs>false</manage-lrs>
```

C.3.190 mapping

- **Range of values**: String
- **Default value**: N/A
- **Parent elements**:
  - persistence-configuration
  - persistence-configuration-unit
  - orm-file-mapping-factory

**C.3.190.1 Function**
When a child element of Section C.3.222, "persistence-configuration-unit," specifies the symbolic name of the object-to-datastore mapping to use.

When a child element of Section C.3.218, "orm-file-jdor-mapping-factory," specifies the logical name of these mappings. Mapping files are suffixed with `logicalname.orm`. If not specified, the `kodo.Mapping` configuration property is used.

**C.3.190.2 Example**

```xml
<mapping>org/mag/Magazine-hsql.orm</mapping>
```
C.3.191 mapping-column

Range of values: String
Default value: MAPPING_DEF
Parent elements:
persistence-configuration
  persistence-configuration-unit
    table-deprecated-jdo-mapping-factory

c.3.191.1 Function
Specifies the name of the column that holds the XML mapping.

C.3.191.2 Example
<mapping-column>MAPPING_DEF</mapping-column>

C.3.192 mapping-defaults-impl

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.192.1 Function
Configures the mapping defaults if you set Section C.3.93, "default-mapping-defaults" to jdo.

C.3.192.2 Example
<mapping-defaults-impl>
  <use-class-criteria>false</use-class-criteria>
  <base-class-strategy>ColumnPerLockGroupVersionStrategy</base-class-strategy>
  <version-strategy>version-number</version-strategy>
  <discriminator-column-name>test</discriminator-column-name>
  <subclass-strategy>vertical</subclass-strategy>
  <version-column-name>version</version-column-name>
  <data-store-id-column-name>ID</data-store-id-column-name>
  <index-discriminator>true</index-discriminator>
  <store-enum-ordinal>false</store-enum-ordinal>
  <order-lists>true</order-lists>
  <order-column-name>false</order-column-name>
</mapping-defaults-impl>
<add-null-indicator>false</add-null-indicator>
<store-unmapped-object-id-string>false</store-unmapped-object-id-string>
</mapping-defaults-impl>

C.3.193 mapping-file-deprecated-jdo-mapping-factory

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.193.1 Function
A plugin string describing the kodo.meta.MetaDataFactory to use to store and retrieve object-relational mapping information for your persistent classes. This setting is valid for JDO 1.0.

C.3.193.2 Example

<mapping-file-deprecated-jdo-mapping-factory>
  <use-schema-validation>true</use-schema-validation>
  <urls>t3://localhost:7001/metadata.jar</urls>
  <files>com/file1;com/file2</files>
  <classpath-scan>build</classpath-scan>
  <single-file>false</single-file>
  <types>classname1;classname2</types>
  <store-mode>1</store-mode>
  <strict>true</strict>
  <resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>
  <scan-top-down>false</scan-top-down>
</mapping-file-deprecated-jdo-mapping-factory>

C.3.194 max-active

Range of values: Integer
Default value: 2
Parent elements:
persistence-configuration
  persistence-configuration-unit
  tcp-remote-commit-provider

C.3.194.1 Function
Specifies the maximum allowed number of TCP sockets (channels) to open simultaneously between each peer in the cluster.

C.3.194.2 Example

<max-active>2</max-active>
C.3.195 max-idle

Range of values: Integer
Default value: 2

Parent elements:
- persistence-configuration
  - persistence-configuration-unit
  - tcp-remote-commit-provider

C.3.195.1 Function
Specifies the maximum allowed number of TCP sockets (channels) to open simultaneously between each peer in the cluster.

C.3.195.2 Example
```
<max-idle>2</max-idle>
```

C.3.196 max-size

Range of values: Integer
Default value: 2147483647

Parent elements:
- persistence-configuration
  - persistence-configuration-unit

C.3.196.1 Function
Defines the maximum size of the concurrent hash map used to associate query strings and their parsed form.

C.3.196.2 Example
```
<max-size>2147483647</max-size>
```

C.3.197 maximize-batch-size

Range of values: true | false
Default value: true

Parent elements:
- persistence-configuration
  - persistence-configuration-unit
    - constraint-update-manager
  - persistence-configuration-unit
    - batching-operation-order-update-manager
  - persistence-configuration-unit
    - table-lock-update-manager
C.3.197 Function
Flag that specifies whether to sort statements in order to optimize batch size when statement batching is on.

C.3.197.2 Example
<maximize-batch-size>true</maximize-batch-size>

C.3.198 MBeanServerStrategy

Range of values: any-create | create | agentID:<agentID>
Default value: any-create
Parent elements:
  jmx
    local-jmx

C.3.198.1 Function
If JMX-based management is enabled, Kodo needs to locate an existing MBeanServer or create a new one, based on one of the following options:

  - any-create—Locate an existing MBeanServer. If multiple are found, use the first one. If none are found, create a new server. This is the default.
  - create—Create a new server. Do not attempt to find an existing MBeanServer.
  - agentID:<agentID>—Locate an existing MBeanServer with the given agent id. If not found, create a new server.

C.3.198.2 Example
<MBeanServerStrategy>any-create</MBeanServerStrategy>

C.3.199 multithreaded

Range of values: true | false
Default value: false
Parent elements:
  persistence-configuration
    persistence-configuration-unit
  persistence-configuration
    persistence-configuration-unit
    kodo-broker

C.3.199.1 Function
Flag that specifies whether persistent instances and Kodo components are accessed by multiple threads at once.

C.3.199.2 Example
<multithreaded>false</multithreaded>
C.3.200 mx4j1-jmx

Range of values: N/A
Default value: N/A
Parent elements:
jmx

C.3.200.1 Function
Enable remote management via MX4J v.1.x implementations (supporting versions of the JMX specification prior to 1.2). Supports optional parameters in the Management Group and the Remote Group.

C.3.200.2 Example

```xml
<mx4j1-jmx>
  <MBeanServerStrategy>any-create</MBeanServerStrategy>
  <EnableLogMBean>true</EnableLogMBean>
  <EnableRuntimeMBean>true</EnableRuntimeMBean>
  <Host>localhost</Host>
  <Port>1099</Port>
  <JNDIName>jrmp</JNDIName>
</mx4j1-jmx>
```

C.3.201 mysql-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.201.1 Function
Configuration values for the MySQL Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "MySQL Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.201.2 Example

The mysql-dictionary element shares the same subelements as Section C.3.2, "access-dictionary," plus the following subelements (defaults shown):

```xml
<mysql-dictionary>
  ...
  <table-type>innodb</table-type>
  <use-clobs>true</use-clobs>
  <driver-deserializes-blobs>true</driver-deserializes-blobs>
</mysql-dictionary>
```

C.3.202 name

Range of values: N/A
Default value: N/A
Parent elements:

```xml
  <persistence-configuration>
    <persistence-configuration-unit>
      <data-cache/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <db-dictionary/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <jms-remote-commit-provider/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <property-type/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <query-cache/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <single-jvm-remote-commit-provider/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <tcp-remote-commit-provider/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <cluster-remote-commit-provider/>
    </persistence-configuration-unit>
  </persistence-configuration>

C.3.202.1 Function
Specifies the name of the corresponding element.

C.3.203 name-column

Range of values: String
Default value: Name

Parent elements:

```xml
  <persistence-configuration>
    <persistence-configuration-unit>
      <table-deprecated-jdo-mapping-factory/>
    </persistence-configuration-unit>
  </persistence-configuration>
  <persistence-configuration>
    <persistence-configuration-unit>
      <table-jdor-mapping-factory/>
    </persistence-configuration-unit>
  </persistence-configuration>
```

C.3.203.1 Function
Name of the column that holds the mapping name. For class mappings, the mapping name is the class name. For named queries and sequences, it is the sequence or query name.
C.3.203.2 Example

C.3.204 NamingImpl

Range of values: Valid classname
Default value: N/A
Parent elements:
    jmx
    jmx2-jmx

C.3.204.1 Function

Classname of the naming service implementation to start in order to register the RMI connector with a JNDI name. Defaults to mx4j.tools.naming.NamingService, which is appropriate for MX4J v. 2.x. If set to the empty string, no naming service will be started. This setting is appropriate if a naming service is already running, or if a non-RMI connector is used.

C.3.204.2 Example

C.3.205 native-jdbc-seq

Range of values: N/A
Default value: N/A
Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.205.1 Function

Specifies a plugin string describing the kodo.kernel.Seq interface to use to create your own custom generators, in this case kodo.jdbc.kernel.NativeJDBCSeq.

Many databases have a concept of native sequences—a built-in mechanism for obtaining incrementing numbers. For example, in Oracle, you can create a database sequence with a statement like CREATE SEQUENCE MYSEQUENCE. Sequence values can then be atomically obtained and incremented with the statement SELECT MYSEQUENCE.NEXTVAL FROM DUAL. Kodo provides support for this common mechanism of sequence generation with the NativeJDBCSeq.

C.3.205.2 Example

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C.3.206 none-jmx

Range of values: N/A

Default value: N/A

Parent elements:

jmx

C.3.206.1 Function

No management is turned on. This is the default. For more information, see "Configuration" in Kodo JPA/JDO Reference for Oracle WebLogic Server.

C.3.206.2 Example

<none-jmx/>

C.3.207 none-lock-manager

Range of values: N/A

Default value: N/A

Parent elements:

persistence-configuration
  persistence-configuration-unit

C.3.207.1 Function

Specifies the kodo.kernel.NoneLockManager which does not perform any locking.

C.3.207.2 Example

<none-lock-manager/>

C.3.208 none-log-factory

Range of values: N/A

Default value: N/A

Parent elements:

persistence-configuration
  persistence-configuration-unit

C.3.208.1 Function

Disable logging.

C.3.208.2 Example

<none-log-factory/>
C.3.209  none-orphaned-key-action

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.209.1 Function
Specifies a plugin string describing the kodo.event.OrphanedKeyAction to invoke when Kodo discovers an orphaned datastore key, in this case kodo.event.NoneOrphanedKeyAction. In this case, Kodo ignores orphaned keys.

C.3.209.2 Example
  <none-orphaned-key-action/>

C.3.210  none-profiling

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  profiling

C.3.210.1 Function
Turns off profiling of your code.

C.3.210.2 Example
  <profiling>
    <none-profiling/>
  </profiling>

C.3.211  nontransactional-read

Range of values: true | false
Default value:
persistence-configuration: false
kodo-broker: true
Parent elements:
persistence-configuration
  persistence-configuration-unit
  persistence-configuration
  persistence-configuration-unit
  kodo-broker
C.3.211.1 Function
Flag that specifies whether the Kodo runtime allows you to read data outside of a transaction.

C.3.211.2 Example
<nontransactional-read>true</nontransactional-read>

C.3.212 nontransactional-write

Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.212.1 Function
Flag that specifies whether you can modify persistent objects and perform persistence operations outside of a transaction. Changes will take effect in the next transaction.

C.3.212.2 Example
<nontransactional-write>false</nontransactional-write>

C.3.213 num-broadcast-threads

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
  tcp-remote-commit-provider

C.3.213.1 Function
Specifies the number of threads to create for the purpose of transmitting events to peers. You should increase this value as the number of concurrent transactions increases. The maximum number of concurrent transactions is a function of the size of the connection pool. Setting a value of 0 will result in behavior where the thread invoking commit will perform the broadcast directly.

C.3.213.2 Example
<num-broadcast-threads>2</num-broadcast-threads>
C.3.214 operation-order-update-manager

Range of values: N/A
Default value: N/A
Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.214.1 Function
Defines an update manager that writes SQL in object-level operation order.

C.3.214.2 Example
<operation-order-update-manager/>

C.3.215 optimistic

Range of values: true | false
Default value: true
Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.215.1 Function
Flag that specifies whether the datastore transactional mode is optimistic.

C.3.215.2 Example
<optimistic>true</optimistic>

C.3.216 oracle-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.216.1 Function
Configuration values for the Oracle Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "Oracle Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.
C.3.216.2 Example
The oracle-dictionary element shares the same subelements as Section C.3.2, “access-dictionary,” plus the following subelements (defaults shown):

```
<oracle-dictionary>
  ... 
  <use-triggers-for-auto-assign>false</use-triggers-for-auto-assign>
  <auto-assign-sequence-name>false</auto-assign-sequence-name>
  <use-set-form-of-use-for-unicode>true</use-set-form-of-use-for-unicode>
</oracle-dictionary>
```

C.3.217 oracle-savepoint-manager

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
- persistence-configuration-unit

C.3.217.1 Function
Specifies a plugin string describing the kodo.kernel.SavepointManager to use for managing transaction savepoints, in this case the default which is kodo.jdbc.sql.OracleSavepointManager. This plugin operates similarly to Section C.3.163, "jdbc3-savepoint-manager," but it uses Oracle-specific calls. This plugin requires using the Oracle JDBC driver and database, versions 9.2 or higher. This plugin implements savepoints by issuing a flush to the database.

C.3.217.2 Example
```
<oracle-savepoint-manager/>
```

C.3.218 orm-file-jdor-mapping-factory

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
- persistence-configuration-unit

C.3.218.1 Function
A plugin string describing the kodo.jdo.jdbc.ORMFileJDORMappingFactory that stores mapping metadata in .orm files. This setting is valid for JDO 1.0.

C.3.218.2 Example
```
<orm-file-jdor-mapping-factory>
  <use-schema-validation>true</use-schema-validation>
  <mapping>mapping</mapping>
  <urls>jdbc:t3://localhost:7001/metadata.jar</urls>
  <files>com/file1;com/file2</files>
  <classpath-scan>build</classpath-scan>
  <types>classname1;classname2</types>
  <store-mode>1</store-mode>
</orm-file-jdor-mapping-factory>
```
C.3.219 order-dirty-objects

**Range of values**: true | false

**Default value**: false

**Parent elements**:
- persistence-configuration
- persistence-configuration-unit
- kodo-broker

**C.3.219.1 Function**
Flag that specifies whether Kodo maintains the order that changes were made to dirty objects when writing the changes back to the database.

**C.3.219.2 Example**

```xml
<order-dirty-objects>false</order-dirty-objects>
```

C.3.220 Password

**Range of values**: N/A

**Default value**: N/A

**Parent elements**:
- jmx
- wls81-jmx

**C.3.220.1 Function**
Password that Kodo should use to access the WebLogic MBeanServer. This must be set.

**C.3.220.2 Example**

```xml
<Password>admin</Password>
```

C.3.221 persistence-configuration

**Range of values**: N/A

**Default value**: N/A

**Parent elements**: N/A

**C.3.221.1 Function**
Root element of the persistence deployment descriptor.
C.3.222 persistence-configuration-unit

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration

C.3.222.1 Function
Contains the deployment information for a persistence unit that is available in WebLogic Server.

C.3.223 pessimistic-lock-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
persistence-configuration-unit

C.3.223.1 Function
Specifies the kodo.jdbc.kernel.PessimisticLockManager, which uses SELECT FOR UPDATE statements (or the database's equivalent) to lock the database rows corresponding to locked objects. This lock manager does not distinguish between read locks and write locks; all locks are write locks.

C.3.223.2 Example
<pessimistic-lock-manager>
  <version-check-on-read-lock>false</version-check-on-read-lock>
  <version-update-on-write-lock>false</version-update-on-write-lock>
</pessimistic-lock-manager>

C.3.224 persistence-mapping-defaults

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
persistence-configuration-unit

C.3.224.1 Function
Configures the mapping defaults if you set Section C.3.93, "default-mapping-defaults" to jpa.

C.3.224.2 Example
The persistence-mapping-defaults element shares the same subelements as Section C.3.192, "mapping-defaults-impl."
C.3.225  populate-data-cache

Range of values: true | false
Default value: true
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
    - kodo-broker

C.3.225.1 Function
Flag that specifies whether to populate the data cache. If your transaction will visit objects that you know are very unlikely to be accessed by other transactions, for example an exhaustive report run only once a month, you can turn off population of the data cache so that the transaction does not fill the entire data cache with objects that will not be accessed again.

C.3.225.2 Example
<populate-data-cache>true</populate-data-cache>

C.3.226  Port

Range of values: N/A
Default value: N/A
Parent elements:
- jmx
  - mx4j1-jmx

C.3.226.1 Function
Port on which the RMI registry naming service listens. Defaults to 1099.

C.3.226.2 Example
<Port>1099</Port>

C.3.227  port

Range of values: Valid port
Default value: See below (depends on parent element)
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
    - tcp-transport
  - tcp-remote-commit-provider
C.3.227.1 Function
Specifies the port on which the server will listen. This setting is used by clients, not by the server.

If the parent element is Section C.3.282, "tcp-transport," the element defaults to 5637.
If the parent element is Section C.3.281, "tcp-remote-commit-provider," the element defaults to 5636.

C.3.227.2 Example

```
<port>5637</port>
```

C.3.228 postgres-dictionary

**Range of values:** N/A  
**Default value:** N/A  
**Parent elements:**  
persistence-configuration  
persistence-configuration-unit

C.3.228.1 Function
Configuration values for the Postgres Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "Postgres Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.228.2 Example
Thepostgres-dictionary element shares the same subelements as Section C.3.2, "access-dictionary," plus the following subelements (defaults shown):

```
<postgres-dictionary>
  ...
  <all-sequences-sql>SELECT NULL AS SEQUENCE_SCHEMA, relname AS SEQUENCE_NAME FROM pg_class WHERE relkind='S'</all-sequences-sql>
  <named-sequences-from-all-schemas-sql>SELECT NULL AS SEQUENCE_SCHEMA, relname AS SEQUENCE_NAME FROM pg_class WHERE relkind='S' AND relname = ?</named-sequences-from-all-schemas-sql>
  <all-sequences-from-one-schema-sql>SELECT NULL AS SEQUENCE_SCHEMA, relname AS SEQUENCE_NAME FROM pg_class, pg_namespace WHERE relkind='S' AND pg_class.relnamespace = pg_namespace.oid AND nspname = ?</all-sequences-from-one-schema-sql>
  <supports-set-fetch-size>true</supports-set-fetch-size>
</postgres-dictionary>
```

C.3.229 primary-key-column

**Range of values:** String  
**Default value:** ID  
**Parent elements:**  
persistence-configuration
C.3.229.1 Function
Specifies the name of the table's numeric primary key column.

C.3.229.2 Example
<primary-key-column>ID</primary-key-column>

C.3.230 primary-key-value
Range of values: String
Default value: DEFAULT
Parent elements:
persistence-configuration
  persistence-configuration-unit
table-jdbc-seq

C.3.230.1 Function
Specifies the primary key that is used by this instance.

C.3.230.2 Example
<primary-key-value>DEFAULT</primary-key-value>

C.3.231 primary-keys
Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
  lazy-schema-factory

C.3.231.1 Function
Flag that specifies whether to read automatically primary key information during schema validation.
C.3.231 Example
<primary-keys>false</primary-keys>

C.3.232 profiling

Range of values: N/A
Default value: N/A
Parent elements: N/A

C.3.232.1 Function
Enables you to configure profiling of your application code.

C.3.232.2 Example
<profiling>
  <export-profiling>
    <interval-millis>-1</interval-millis>
    <base-name>name</base-name>
  </export-profiling>
</profiling>
<profiling>
  <gui-profiling/>
</profiling>
<profiling>
  <local-profiling/>
</profiling>
<profiling>
  <none-profiling/>
</profiling>

C.3.233 profiling-proxy-manager

Range of values: N/A
Default value: N/A
Parent elements: persistence-configuration
  persistence-configuration-unit

C.3.233.1 Function
Configures the profiling proxy manager.

C.3.233.2 Example
<profiling-proxy-manager>
  <assert-allowed-type>false</assert-allowed-type>
  <track-changes>true</track-changes>
</profiling-proxy-manager>

C.3.234 properties

Range of values: N/A
**Default value:** N/A

**Parent elements:**
- `persistence-configuration`
- `persistence-configuration-unit`
- `aggregate-listener`
- `custom-aggregate-listener`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-broker-factory`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-broker-impl`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-class-resolver`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-compatibility`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-connection-decorator`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-data-cache`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-dictionary`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-driver-data-source`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-filter-listener`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-jdbc-listener`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-lock-manager`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-logType`
- `persistence-configuration`
- `persistence-configuration-unit`
- `custom-mapping-defaults`
C.3.234.1 Function
Specifies one or more Section C.3.235, "property" elements.

C.3.235 property

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
    custom-meta-data-respository

persistence-configuration
  persistence-configuration-unit
    custom-orphaned-key-action

persistence-configuration
  persistence-configuration-unit
    custom-persistence-server

persistence-configuration
  persistence-configuration-unit
    custom-proxy-manager

persistence-configuration
  persistence-configuration-unit
    custom-query-cache

persistence-configuration
  persistence-configuration-unit
    custom-query-compilation

persistence-configuration
  persistence-configuration-unit
    custom-remote-commit-provider

persistence-configuration
  persistence-configuration-unit
    custom-savepoint-manager

persistence-configuration
  persistence-configuration-unit
    custom-seq

persistence-configuration
  persistence-configuration-unit
    custom-sql-factory

persistence-configuration
  persistence-configuration-unit
    custom-update-manager
C.3.235 Function
Enables you to specify the name and value of a property.

C.3.235 Example
<property>
  <name>timeout</name>
  <value>1000</value>
</property>

C.3.236 proxy-manger-impl
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.236 Function
Configures the default proxy manager.

C.3.236 Example
<proxy-manager-impl>
  <assert-allowed-type>false</assert-allowed-type>
  <track-changes>true</track-changes>
</proxy-manager-impl>

C.3.237 query-caches
Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.237 Function
A plugin string describing the kodo.datacache.QueryCache implementation to use for caching of queries loaded from the data store.

C.3.237 Example
<query-caches>
  <default-query-cache>...</default-query-cache>
</query-caches>
<query-caches>
  <kodo-concurrent-query-cache>...</kodo-concurrent-query-cache>
</query-caches>
<query-caches>
  <gem-fire-query-cache>...</gem-fire-query-cache>
</query-caches>
<lruc-query-cache>...</lruc-query-cache>
</query-caches>
<query-caches>
  <tangosol-query-cache>...</tangosol-query-cache>
</query-caches>
<query-caches>
  <disabled-query-cache>...</disabled-query-cache>
</query-caches>
<query-caches>
  <custom-query-cache>...</custom-query-cache>
</query-caches>

C.3.238 quoted-numbers-in-queries

**Range of values:** true | false

**Default value:** false

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit
  - compatibility

C.3.238.1 Function
Flag that specifies whether to interpret quoted numbers in query strings as numbers, as opposed to strings. Set to true to mimic the behavior of Kodo 3.1 and earlier and treat quoted numbers as numbers.

C.3.238.2 Example
<quoted-numbers-in-queries>false</quoted-numbers-in-queries>

C.3.239 read-lock-level

**Range of values:** none | read | write | numeric values for lock manager-specific lock levels

**Default value:** read

**Parent elements:**
- persistence-configuration
  - persistence-configuration-unit

C.3.239.1 Function
Sets the default read level at which to lock objects retrieved during a non-optimistic transaction. Valid values include:

- none—No lock level.
- read—Read lock level.
- write—Write lock level.
- Numeric values for lock-manager specific lock levels.
C.3.239.2 Example

```xml
<read-lock-level>read</read-lock-level>
```

C.3.240 recover-action

**Range of values:** none | clear

**Default value:** none

**Parent elements:**

- persistence-configuration
  - persistence-configuration-unit
    - cluster-remote-commit-provider

**C.3.240.1 Function**

Specifies the action to take during recovery. Valid values include:

- none—No action is performed.
- clear—Clears the notifications.

**C.3.240.2 Example**

```xml
<recover-action>none</recover-action>
```

C.3.241 recovery-time-millis

**Range of values:** Integer

**Default value:** 15000

**Parent elements:**

- persistence-configuration
  - persistence-configuration-unit
    - tcp-remote-commit-provider

**C.3.241.1 Function**

Specifies the amount of time to wait in milliseconds before attempting to reconnect to a peer of the cluster when connectivity to the peer is lost.

**C.3.241.2 Example**

```xml
<recovery-time-millis>15000</recovery-time-millis>
```

C.3.242 resources

**Range of values:** Valid resource path

**Default value:** N/A

**Parent elements:**

---

**Note:** For the default JDBC lock manager, the read and write lock levels are equivalent.
C.3.242.1 Function
Specifies a semicolon-separated list of resource paths to metadata files or jar archives. Each jar archive will be scanned for annotated JPA entities or JDO metadata files based on your metadata factory.

C.3.242.2 Example
<resources>com/aaa/package.jdo;com/bbb/package.jdo</resources>

C.3.243 restore-state

Range of values: true

C.3.243.1 Function
Flag that specifies whether to restore managed fields to their pre-transaction values when a rollback occurs.
Valid values include:
- all (1)—Restores all managed values.
- none (2)—Do not roll back state. The object becomes hollow and will reload its state the next time it is accessed.
- immutable (3)—Restores immutable values (primitives, primitive wrappers, strings) and clears mutable values so that they are reloaded on next access.
- true (4)—Same as all.
- false (5)—Same as none.

C.3.243.2 Example
<restore-state>none</restore-state>

C.3.244 result-set-type

Range of values: forward-only | scroll-sensitive | scroll-insensitive

Default value: forward-only
C.3.244.1 Function
Specifies the JDBC result set type to use when fetching return lists. This setting can also be varied at runtime.

Valid values include:
- forward-only—Result set whose cursor may move only forward. The result set is not updatable.
- scroll-sensitive—Scrollable result set that is sensitive to changes made by others. The result set is updatable.
- scroll-insensitive—Scrollable result set that is not sensitive to changes made by others. The result set is updatable.

C.3.244.2 Example
<result-set-type>forward-only</result-set-type>

C.3.245 retain-state

Range of values: true | false
Default value: See below (depends on parent)
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
- persistence-configuration
  - persistence-configuration-unit
  - kodo-broker

C.3.245.1 Function
Flag that specifies whether persistent fields retain their values on transaction commit. This element defaults to true when a child element of the Section C.3.222, "persistence-configuration-unit" and false when a child element of the Section C.3.169, "kodo-broker" element.

C.3.245.2 Example
<retain-state>true</retain-state>

C.3.246 retry-class-registration

Range of values: true | false
Default value: false
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
C.3.246.1 Function
Flag that specifies whether to log a warning and defer registration instead of throwing an exception when a persistent class cannot be fully processed. This element should only be used in complex classloader situations where security is preventing Kodo from reading registered classes. Setting this to true unnecessarily may obscure more serious problems.

C.3.246.2 Example
<retry-class-registration>false</retry-class-registration>

C.3.247 scan-top-down

Range of values: true | false
Default value: false
Parent elements:
- persistence-configuration
  - persistence-configuration-unit
    - deprecated-jdo-meta-data-factory
  - deprecated-jdo-meta-data-factory
- persistence-configuration
  - persistence-configuration-unit
    - extension-deprecated-jdo-mapping-factory
  - jdor-mapping-factory
  - deprecated-jdo-mapping-factory
  - mapping-file-deprecated-jdo-mapping-factory
  - orm-file-jdor-mapping-factory
  - table-deprecated-jdo-mapping-factory

C.3.247.1 Function
Flag that specifies whether to search for metadata files top-down in the package tree. Kodo defaults to bottom-up scanning. For example, when scanning metadata for class C, Kodo looks first for C.jdo, then package.jdo in C's package, then package.jdo in the parent package, and so on to the package root. For more information, see "Metadata Factory" in Kodo JPA/JDO Reference for Oracle WebLogic Server.

C.3.247.2 Example
<scan-top-down>false</scan-top-down>
C.3.248 **schema**

- **Range of values:** String
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit

**C.3.248.1 Function**

Specifies the default schema name to prepend to unqualified table names. In addition, specifies the schema in which Kodo creates new tables. For more information, see "Default Schema" in the *Kodo JPA/JDO Reference for Oracle WebLogic Server*.

**C.3.248.2 Example**

```xml
<schema>SCHEMA</schema>
```

C.3.249 **schema-column**

- **Range of values:** String
- **Default value:** SCHEMA_DEF
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit
  - table-schema-factory

**C.3.249.1 Function**

Specifies the name of the table's string column for holding the schema definition as an XML string.

**C.3.249.2 Example**

```xml
<schema-column>SCHEMA_DEF</schema-column>
```

C.3.250 **schemas**

- **Range of values:** N/A
- **Default value:** N/A
- **Parent elements:**
  - persistence-configuration
  - persistence-configuration-unit

**C.3.250.1 Function**

Specifies a comma-separated list of the schemas and/or tables used for your persistent data.

**C.3.250.2 Example**

```xml
<schemas>BUSOBJS,GENERAL.ADDRESS,.SYSTEM_INFO</schemas>
```
C.3.251  sequence

Range of values: N/A

Default value: OPENJPA_SEQUENCE

Parent elements:

persistence-configuration
  persistence-configuration-unit
    native-jdbc-seq

C.3.251.1  Function

Specifies the name of the database sequence.

C.3.251.2  Example

<sequence>OPENJPA_SEQUENCE</sequence>

C.3.252  sequence-column

Range of values: String

Default value: SEQUENCE_VALUE

Parent elements:

persistence-configuration
  persistence-configuration-unit
    class-table-jdbc-seq

persistence-configuration
  persistence-configuration-unit
    table-jdbc-seq

persistence-configuration
  persistence-configuration-unit
    value-table-jdbc-seq

C.3.252.1  Function

Specifies the name of the column that holds the current sequence value.

C.3.252.2  Example

<sequence-column>SEQUENCE_VALUE</sequence-column>

C.3.253  sequence-name

Range of values: String

Default value: OPENJPA_SEQUENCE

Parent elements:

persistence-configuration
  persistence-configuration-unit
    native-jdbc-seq
C.3.253 Function
Specifies the name of the database sequence.

C.3.253.2 Example
<sequence-name>OPENJPA_SEQUENCE</sequence-name>

C.3.254 ServiceURL
Range of values: Valid service URL.
Default value: service:jmx:rmi://localhost/jndi/jmxservice
Parent elements:
  jmx
  jmx2-jmx

C.3.254.1 Function
JMX service URL name under which to register the JMX Connector Server. This value defaults to service:jmx:rmi://localhost/jndi/jmxservice, indicating that the RMI connector will be used and registered under the JNDI name jmxservice.

C.3.254.2 Example
<ServiceURL>service:jmx:rmi://localhost/jndi/jmxservice</ServiceURL>

C.3.255 simple-driver-data-source
Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.255.1 Function
Configures the Kodo datasource implementation.

C.3.255.2 Example
<simple-driver-data-source>
  <connection-user-name>user</connection-user-name>
  <login-timeout>10</login-timeout>
  <connection-password>password</connection-password>
  <connection-url>jdbc:hsqldb:db-hypersonic</connection-url>
  <connection-driver-name>org.hsqldb.jdbcDriver</connection-driver-name>
</simple-driver-data-source>

C.3.256 single-file
Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
    mapping-file-deprecated-jdo-mapping-factory

C.3.256  Function
Flag specifying whether or not to use a single file.

C.3.256.2  Example
<single-file>false</single-file>

C.3.257  single-jvm-exclusive-lock-manager

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.257.1  Function
Specifies the kodo.kernel.SingleJVMExclusiveLockManager. This lock manager uses in-memory mutexes to obtain exclusive locks on object ids. It does not perform any database-level locking. Also, it does not distinguish between read and write locks; all locks are write locks.

C.3.257.2  Example
<single-jvm-exclusive-lock-manager>
  <version-check-on-read-lock>false</version-check-on-read-lock>
  <version-check-on-write-lock>false</version-check-on-write-lock>
</single-jvm-exclusive-lock-manager>

C.3.258  single-jvm-remote-commit-provider

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.258.1  Function
Configures Kodo to share commit notifications among persistenceManagerFactories in the same JVM.

C.3.258.2  Example
<single-jvm-remote-commit-provider>
  <name>kodo.RemoteCommitProvider</name>
</single-jvm-remote-commit-provider>
**C.3.259  soft-reference-size**

- **Range of values:** Integer
- **Default value:** -1
- **Parent elements:**
  - persistence-configuration
    - persistence-configuration-unit
      - kodo-concurrent-data-cache
  - persistence-configuration
    - persistence-configuration-unit
      - kodo-concurrent-query-cache
  - persistence-configuration
    - persistence-configuration-unit
      - lru-data-cache
  - persistence-configuration
    - persistence-configuration-unit
      - lru-query-cache
  - persistence-configuration
    - persistence-configuration-unit
      - query-compilation-cache

**C.3.259.1 Function**
Sets the number of soft references that Kodo maintains. When the maximum cache or query size is reached, random entries are moved to a soft reference map so that they are maintained for awhile longer. By default, this value is set to -1 which specifies that an unlimited number of soft references are maintained. Set the property to 0 to disable soft references.

**C.3.259.2 Example**
```
<soft-reference-size>-1</soft-reference-size>
```

**C.3.260  so-timeout**

- **Range of values:** Integer
- **Default value:** 0
- **Parent elements:**
  - persistence-configuration
    - persistence-configuration-unit
      - http-transport

**C.3.260.1 Function**
Specifies the socket read timeout in milliseconds.

**C.3.260.2 Example**
```
<so-timeout>0</so-timeout>
```
C.3.261 sql-server-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.261.1 Function
Configuration values for the SQLServer Dictionary persistence plugin. For a complete description of each of the values that you can specify, see "SQLServer Dictionary Configuration" in the Oracle WebLogic Server Administration Console Online Help.

C.3.261.2 Example
The sql-server-dictionary element shares the same subelements as Section C.3.2, "access-dictionary," plus the following subelements (defaults shown):

```xml
<sql-server-dictionary>
  ...
  <unique-identifier-as-varbinary>true</unique-identifier-as-varbinary>
</sql-server-dictionary>
```

C.3.262 stack-execution-context-name-provider

Range of values: N/A
Default value: N/A
Parent elements:
  execution-context-name-provider

C.3.262.1 Function
Provider examines the current thread's stack and builds an execution context name based on that information.

C.3.262.2 Example

```xml
<stack-execution-context-name-provider>
  <style>full</style>
</stack-execution-context-name-provider>
```

C.3.263 store-mode

Range of values: Integer
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  deprecated-jdo-meta-data-factory
  persistence-configuration
  persistence-configuration-unit
extension-deprecated-jdo-mapping-factory

persistence-configuration
    persistence-configuration-unit
        jdo-meta-data-factory

persistence-configuration
    persistence-configuration-unit
        jdor-mapping-factory

persistence-configuration
    persistence-configuration-unit
        kodo-persistence-mapping-factory

persistence-configuration
    persistence-configuration-unit
        kodo-persistence-meta-data-factory

persistence-configuration
    persistence-configuration-unit
        mapping-file-deprecated-jdo-mapping-factory

persistence-configuration
    persistence-configuration-unit
        orm-file-jdor-mapping-factory

persistence-configuration
    persistence-configuration-unit
        table-deprecated-jdo-mapping-factory

persistence-configuration
    persistence-configuration-unit
        table-jdor-mapping-factory

C.3.263.1 Function
Specifies the data store mode.

C.3.263.2 Example
<store-mode>1</store-mode>

C.3.264 strict

Range of values: true | false
Default value: false
Parent elements:
  persistence-configuration
      persistence-configuration-unit
          deprecated-jdo-meta-data-factory

  persistence-configuration
      persistence-configuration-unit
          extension-deprecated-jdo-mapping-factory

  persistence-configuration
      persistence-configuration-unit
          jdo-meta-data-factory
C.3.264 Function
Flag that specifies whether strict mode is enabled.

C.3.264.2 Example
<strict>true</strict>

C.3.265 strict-identity-values
Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
    compatibility

C.3.265.1 Function
Flag that specifies whether to require identity values used for finding application identity instances to be of the exact right type. By default, Kodo allows stringified identity values, and performs conversions between numeric types.

C.3.265.2 Example
<strict-identity-values>false</strict-identity-values>
C.3.266 style

Range of values: line | partial | full
Default value: N/A
Parent elements:
  execution-context-name-provider
  stack-execution-context-name-provider

C.3.266.1 Function
Provider examines the current thread’s stack and builds an execution context name based on that information and the following setting:
- line—Name will be the first non-Kodo stack line, including class name, method name, and line number, if available.
- partial—Full stack trace minus the Kodo lines will be used.
- full—Entire stack trace will be used.

C.3.266.2 Example
<style>full</style>

C.3.267 subclass-fetch-mode

Range of values: join | multiple | none | parallel | single
Default value: join
Parent elements:
  execution-context-name-provider
  stack-execution-context-name-provider

C.3.267.1 Function
Specifies the method to use to select subclass data when it is in other tables. For a description of the valid values, see under Section C.3.117, "eager-fetch-mode."

C.3.267.2 Example
<subclass-fetch-mode>join</subclass-fetch-mode>

C.3.268 sybase-dictionary

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.268.1 Function
Configuration values for the Sybase Dictionary persistence plugin. For a complete description of each of the values that you can specify, see “Sybase Dictionary Configuration” in the Oracle WebLogic Server Administration Console Online Help.
C.3.268.2 Example
The `sybase-dictionary` element shares the same subelements as Section C.3.2, "access-dictionary," plus the following subelements (defaults shown):

```xml
<sybase-dictionary>
...  
  <create-identity-column>true</create-identity-column>
  <identity-column-name>UNQ_INDEX</identity-column-name>
</sybase-dictionary>
```

C.3.269 sync-with-managed-transactions

Range of values: true | false

Default value: false

Parent elements:
- persistence-configuration
- persistence-configuration-unit
- kodo-broker

C.3.269.1 Function
Flag that specifies whether to sync with managed transactions.

C.3.269.2 Example
```
<sync-with-managed-transactions>false</sync-with-managed-transactions>
```

C.3.270 synchronize-mappings

Range of values: true | false

Default value: false

Parent elements:
- persistence-configuration

C.3.270.1 Function
Controls whether Kodo attempts to run the mapping tool on all persistent classes to synchronize their mappings and schema at runtime. This element save you the trouble of running the mapping tool manually, and is useful for rapid test and debug cycles.

C.3.270.2 Example
```
<synchronize-mappings>false</synchronize-mappings>
```

C.3.271 table

Range of values: String

Default value: See below

Parent elements:
- persistence-configuration
  - persistence-configuration-unit
C.3.271 Function
Specifies the name of the table. The default value depends on the parent element:

- class-table-jdbc-seq: OPENJPA_SEQUENCE_TABLE
- table-jdbc-seq: OPENJPA_SEQUENCE_TABLE
- table-jdor-mapping-factory: KODO_JDO_MAPPINGS
- table-schema-factory: OPENJPA_SCHEMA
- value-table-jdbc-seq: OPENJPA_SEQUENCES_TABLE

C.3.271.2 Example
<table>RODO_JDO_MAPPINGS</table>

C.3.272 table-deprecated-jdo-mapping-factory

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.272.1 Function
A plugin string describing the kodo.jdo.jdbc.TableJDORMappingFactory that stores mapping metadata as XML strings in a database table. This setting is valid for JDO 1.0.

C.3.272.2 Example
<table-deprecated-jdo-mapping-factory>
  <table-name>JDO_MAPPINGS</table-name>
  <urls>t3://localhost:7001/metadata.jar</urls>
  <classpath-scan>build</classpath-scan>
  <types>classname1;classname2</types>
  <mapping-column>MAPPING_DEF</mapping-column>
  <store-mode></store-mode>
  <strict>false</strict>
  <name-column>NAME</name-column>

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C.3.273 table-jdbc-seq

Range of values: N/A
Default value: N/A
Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.273.1 Function
Specifies a plugin string describing the kodo.kernel.Seq interface to use to create your own custom generators, in this case kodo.jdbc.kernel.TableJDBCSeq.

The TableJDBCSeq uses a special single-row table to store a global sequence number. If the table does not already exist, it is created the first time you run the mapping tool's on a class that requires it. You can also use the class' main method or the sequencetable shell/bat script to manipulate the table; see the TableJDBCSeq.main method Javadoc for usage details.

C.3.273.2 Example
<table-jdbc-seq>
  <type>0</type>
  <allocate>50</allocate>
  <table-name>OPENJPA_SEQUENCE_TABLE</table-name>
  <primary-key-column>ID</primary-key-column>
  <sequence-column>SEQUENCE_VALUE</sequence-column>
  <increment>1</increment>
</table-jdbc-seq>

C.3.274 table-jdor-mapping-factory

Range of values: N/A
Default value: N/A
Parent elements:
    persistence-configuration
    persistence-configuration-unit

C.3.274.1 Function
A plugin string describing the kodo.jdo.jdbc.TableJDORMappingFactory that stores mapping metadata as XML strings in a database table. This setting is valid for JDO 2.0.

C.3.274.2 Example
<table-jdor-mapping-factory>
  <use-schema-validation>false</use-schema-validation>
</table-jdor-mapping-factory>
C.3.275 table-lock-update-manager

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.275.1 Function
Defines an update manager capable of statement batching, that ignores foreign keys and auto-increment, but optimizes for table level locking. This is useful when using table-level locking and trying to avoid deadlocks.

C.3.275.2 Example
<table-lock-update-manager>
  <maximize-batch-size>true</maximize-batch-size>
</table-lock-update-manager>

C.3.276 table-name

Range of values: String
Default value: See below
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  class-table-jdbc-seq
  persistence-configuration
  persistence-configuration-unit
  native-jdbc-seq
  persistence-configuration
  persistence-configuration-unit
  table-deprecated-jdo-mapping-factory
  persistence-configuration
  persistence-configuration-unit
  table-jdbc-seq
  persistence-configuration
  persistence-configuration-unit
  table-schema-factory
C.3.276.1 Function
Specifies the name of the table.

The default varies based on the parent element, as follows:

- class-table-jdbc-seq: OPENJPA_SEQUENCES_TABLE.
- Section C.3.205, "native-jdbc-seq": DUAL.
- Section C.3.272, "table-deprecated-jdo-mapping-factory": JDO_MAPPING.
- Section C.3.273, "table-jdbc-seq": OPENJPA_SEQUENCE_TABLE.
- Section C.3.277, "table-schema-factory": OPENJPA_SCHEMA.
- Section C.3.302, "value-table-jdbc-seq": OPENJPA_SEQUENCE_TABLE.

C.3.276.2 Example
<table-name>JDO_MAPPING</table-name>

C.3.277 table-schema-factory

Range of values: N/A
Default value: N/A
Parent elements:
- persistence-configuration
  - persistence-configuration-unit

C.3.277.1 Function
Specifies a plugin string describing the kodo.jdbc.schema.SchemaFactory to use to store and retrieve information about the database schema, in this case kodo.jdbc.schema.TableSchemaFactory.

This schema factory stores schema information as an XML document in a database table it creates for this purpose. If your JDBC driver doesn't support the java.sql.DatabaseMetaData standard interface, but you still want some schema validation to occur at runtime, you might use this factory. It is not recommended for most users, though, because it is easy for the stored XML schema definition to get out-of-sync with the actual database.

C.3.277.2 Example
<table-schema-factory>
  <schema-column>SCHEMA_DEF</schema-column>
  <table-name>OPENJPA_SCHEMA</table-name>
  <table>OPENJPA_SCHEMA</table>
  <primary-key-column>ID</primary-key-column>
</table-schema-factory>
C.3.278  tangosol-cache-name

Range of values: String
Default value: kodo
Parent elements:
persistence-configuration
  persistence-configuration-unit
tangosol-data-cache

C.3.278.1 Function
Name of the Tangosol Coherence cache to use.

C.3.278.2 Example
<tangosol-cache-name>kodo</tangosol-cache-name>

C.3.279  tangosol-cache-type

Range of values: named | distributed | replicated
Default value: named
Parent elements:
persistence-configuration
  persistence-configuration-unit
tangosol-data-cache

C.3.279.1 Function
Type of Tangosol Coherence cache to use. Valid values include:
- named—Cache is looked up via the com.tangosol.net.CacheFactory.getCache(String) method. This method looks up the cache by the name as defined in the Coherence configuration.
- distributed
- replicated

C.3.279.2 Example
<tangosol-cache-type>name</tangosol-cache-type>

C.3.280  tangosol-data-cache

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit
data-caches
**C.3.280 Function**
Integrates with Tangosol's Coherence caching system.

**C.3.280 Example**

```
<data-caches>
  <tangosol-data-cache>
    <name>kodo.dataCache</name>
    <clear-on-close>false</clear-on-close>
    <tangosol-cache-type>name</tangosol-cache-type>
    <tangosol-cache-name>kodo</tangosol-cache-name>
    <eviction-schedule>15,45 15 * * 1</eviction-schedule>
  </tangosol-data-cache>
</data-caches>
```

**C.3.281 tcp-remote-commit-provider**

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

**C.3.281.1 Function**
Configures the TCP remote commit provider.

**C.3.281.2 Example**

```
<tcp-remote-commit-provider>
  <name>kodo.RemoteCommitProvider</name>
  <max-idle>2</max-idle>
  <num-broadcast-threads>2</num-broadcast-threads>
  <recovery-time-millis>15000</recovery-time-millis>
  <max-active>2</max-active>
  <port>5636</port>
  <addresses>()[/addresses>
</tcp-remote-commit-provider>
```

**C.3.282 tcp-transport**

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

**C.3.282.1 Function**
Specifies the transport layer for the remote communication.

**C.3.282.2 Example**

```
<tcp-transport>
  <so-timeout>0</so-timeout>
</tcp-transport>
```
C.3.283 time-seeded-seq

Range of values: N/A
Default value: N/A
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.283.1 Function
Specifies a plugin string describing the kodo.kernel.Seq interface to use to create your own custom generators, in this case kodo.jdbc.kernel.TimeSeededSeq.
This type uses an in-memory static counter, initialized to the current time in milliseconds and monotonically incremented for each value requested. It is only suitable for single-JVM environments.

C.3.283.2 Example
<time-seeded-seq>
  <type>0</type>
  <increment>1</increment>
</time-seeded-seq>

C.3.284 topic

Range of values: Valid topic
Default value: topic/KodoCommitProviderTopic
Parent elements:
persistence-configuration
  persistence-configuration-unit
    jms-remote-commit-provider

C.3.284.1 Function
Specifies the topic to which the remote commit provider should publish notifications and subscribe for notifications sent from other JVMs.

C.3.284.2 Example
<topic>topic/KodoCommitProviderTopic</topic>

C.3.285 topic-connection-factory

Range of values: Valid connection factory
Default value: java:/ConnectionFactory
Parent elements:
persistence-configuration
persistence-configuration-unit
  jms-remote-commit-provider

C.3.285.1 Function
Specifies the JNDI name of a `javax.jms.TopicConnectionFactory` factory to use for finding topics. This setting may vary depending on the application server in use; consult the application server’s documentation for details about the default JNDI name for the topic instance. For WebLogic, the JNDI name for the `TopicConnectionFactory` is `javax.jms.TopicConnectionFactory`.

C.3.285.2 Example
```xml
<topic-connection-factory>java:/ConnectionFactory</topic-connection-factory>
```

C.3.286 track-changes

Range of values: true | false
Default value: true
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.286.1 Function
Flag that specifies whether to use smart proxies.

C.3.286.2 Example
```xml
<track-changes>true</track-changes>
```

C.3.287 transaction-isolation

Range of values: default | none | read-committed | read-uncommitted | repeatable-read | serializable
Default value: default
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.287.1 Function
Specifies the JDBC transaction isolation level to use.
- default—JDBC driver’s default level. This is the default.
- none—No transaction isolation.
- read-committed—Dirty reads are prevented; non-repeatable reads and phantom reads can occur.
- read-uncommitted—Dirty reads, non-reputable reads, and phantom reads can occur.
- repeatable-read—Dirty reads and non-repeatable reads are prevented; phantom reads can occur.
■ serializable—Dirty reads, non-reputable reads, and phantom reads are prevented.

C.3.287.2 Example
<transaction-isolation>default</transaction-isolation>

C.3.288 transaction-mode
Range of values: local | managed
Default value: local
Parent elements:
persistence-configuration
  persistence-configuration-unit

C.3.288.1 Function
Specifies the transaction mode to use. You can override this setting per session.
■ local—Perform transaction operations locally. This is the default.
■ managed—Integrate with the application server’s managed global transactions.

C.3.288.2 Example
<transaction-mode>local</transaction-mode>

C.3.289 transaction-name-execution-context-name-provider
Range of values: N/A
Default value: N/A
Parent elements:
  execution-context-name-provider

C.3.289.1 Function
Provider returns the current transaction’s name, as defined by WebLogic transaction naming semantics.

C.3.289.2 Example
<transaction-name-execution-context-name-provider/>

C.3.290 type
Range of values: N/A
Default value: 0
Parent elements:
persistence-configuration
  persistence-configuration-unit
  class-table-jdbc-seq
persistence-configuration
  persistence-configuration-unit
    native-jdbc-seq

persistence-configuration
  persistence-configuration-unit
    table-jdbc-seq

persistence-configuration
  persistence-configuration-unit
    time-seeded-seq

persistence-configuration
  persistence-configuration-unit
    value-table-jjdbc-seq

C.3.290.1 Function
Specifies the type of generator.

C.3.290.2 Example
  <type>0</type>

C.3.291 type-column

Range of values: 0 | 1 | 2 | 3
Default value: 0
Parent elements:
  persistence-configuration
    persistence-configuration-unit
      table-jdor-mapping-factory

C.3.291.1 Function
Specifies the name of the column that holds the mapping type. Valid types constants include:

- 0—Class mapping.
- 1—Named sequence.
- 2—System-level named query.
- 3—Class-level named query.

C.3.291.2 Example
  <type-column>0</type-column>

C.3.292 types

Range of values: Valid persistent class names
Default value: N/A
Parent elements:
  persistence-configuration
C.3.292.1 Function
Specifies a semicolon-separated list of fully-qualified persistent class names.

C.3.292.2 Example
<types>classname1; classname2</types>

C.3.293 URL
Range of values: Valid URL
Default value: t3://localhost:7001
Parent elements:
- jmx
- wls81-jmx

C.3.293.1 Function
URL to which Kodo should connect to access the WebLogic MBeanServer.

C.3.293.2 Example
<URL>t3://localhost:7001</URL>

C.3.294 url
Range of values: Valid URL
Default value: N/A
Parent elements:
persistence-configuration
- persistence-configuration-unit
- http-transport

C.3.294.1 Function
URL to which Kodo should connect to access the remote server.

C.3.294.2 Example
<url>t3://localhost:7001/remote-server</url>

C.3.295 urls
Range of values: Valid URL
Default value: t3://localhost:7001
Parent elements:
persistence-configuration
- persistence-configuration-unit
- deprecated-jdo-meta-data-factory
persistence-configuration
  persistence-configuration-unit
    extension-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
    jdo-meta-data-factory

persistence-configuration
  persistence-configuration-unit
    jdor-mapping-factory

persistence-configuration
  persistence-configuration-unit
    kodo-persistence-mapping-factory

persistence-configuration
  persistence-configuration-unit
    kodo-persistence-meta-data-factory

persistence-configuration
  persistence-configuration-unit
    mapping-file-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
    orm-file-jdor-mapping-factory

persistence-configuration
  persistence-configuration-unit
    table-deprecated-jdo-mapping-factory

C.3.295.1 Function
Specifies a semicolon-separated list of URLs of metadata files or jar archives. Each jar
archive will be scanned for annotated JPA entities or JDO metadata files based on your
metadata factory.

C.3.295.2 Example
<urls>t3://localhost:7001/metadata.jar</urls>

C.3.296 use-aliases

Range of values: true | false
Default value: false
Parent elements:
persistence-configuration
  persistence-configuration-unit
    class-table-jdbc-seq

C.3.296.1 Function
Flag that specifies whether to use each class’ entity name as the primary key value of
each row rather than the full classname.
C.3.296.2 Example

<use-aliases>false</use-aliases>

C.3.297 use-schema-validation

Range of values: true | false

Default value: N/A

Parent elements:

persistence-configuration
  persistence-configuration-unit
    deprecated-jdo-meta-data-factory

persistence-configuration
  persistence-configuration-unit
    extension-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
    jdo-meta-data-factory

persistence-configuration
  persistence-configuration-unit
    jdor-mapping-factory

persistence-configuration
  persistence-configuration-unit
    mapping-file-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
    orm-file-jdor-mapping-factory

persistence-configuration
  persistence-configuration-unit
    table-deprecated-jdo-mapping-factory

persistence-configuration
  persistence-configuration-unit
    table-jdor-mapping-factory

C.3.297.1 Function

Flag that specifies whether to use schema validation.

C.3.297.2 Example

<use-schema-validation>true</use-schema-validation>

C.3.298 user-object-execution-context-name-provider

Range of values: N/A

Default value: N/A

Parent elements:

execution-context-name-provider
**C.3.298 Function**

Provider returns the user object specified in the current EntityManager/PersistenceManager whose key is com.solarmetric.profile ExecutionContextNameProvider. User objects can be set using the OpenJPAEntityManager.putUserObject(Object, Object) or PersistenceManager.putUserObject(Object, Object).

**C.3.298.2 Example**

```xml
<user-object-execution-context-name-provider/>
```

**C.3.299 UserName**

**Range of values:** N/A  
**Default value:** N/A  
**Parent elements:**

```xml
jmx  
  ws181-jmx
```

**C.3.299.1 Function**

Specifies the username that Kodo should use to access the WebLogic MBeanServer. This must be set.

**C.3.299.2 Example**

```xml
<ws181-jmx>  
  <MBeanServerStrategy>any-create</MBeanServerStrategy>  
  <EnableLogMBean>true</EnableLogMBean>  
  <EnableRuntimeMBean>true</EnableRuntimeMBean>  
  <URL>t3://localhost:7001</URL>  
  <UserName>admin</UserName>  
  <Password>admin</Password>  
</ws181-jmx>
```

**C.3.300 validate-false-returns-hollow**

**Range of values:** true | false  
**Default value:** true  
**Parent elements:**

```xml
persistence-configuration  
persistence-configuration-unit  
compatibility
```

**C.3.300.1 Function**

Flag that specifies whether to return hollow objects (objects for which no state has been loaded) from calls to PersistenceManager.getObjectById(oid, false). This is the default behavior of Kodo 4.0 and above. Previous Kodo versions, however, always loaded the object from the datastore. Set this property to false to get the old behavior.

**C.3.300.2 Example**

```xml
<validate-false-returns-hollow>true</validate-false-returns-hollow>
```
C.3.301 validate-true-checks-store

**Range of values:** true | false  
**Default value:** false  
**Parent elements:**
- persistence-configuration  
  - persistence-configuration-unit  
  - compatibility

**C.3.301.1 Function**
Flag that specifies whether to check the datastore to be sure the given oid exists. Prior to Kodo 4.0, calling PersistenceManager.getObjectById(oid, true) always checked the datastore to be sure the given oid existed, even when the corresponding object was already cached. Kodo 4.0 and above does not check the datastore when the instance is already cached and loaded. Set this property to true to mimic previous behavior.

**C.3.301.2 Example**

```xml
<validate-true-checks-store>false</validate-true-checks-store>
```

C.3.302 value-table-jdbc-seq

**Range of values:** N/A  
**Default value:** N/A  
**Parent elements:**
- persistence-configuration  
  - persistence-configuration-unit

**C.3.302.1 Function**
Specifies a plugin string describing the kodo.kernel.Seq interface to use to create your own custom generators, in this case kodo.jdbc.kernel.ValueTableJDBCSeq.

This Seq is like the Section C.3.273, "table-jdbc-seq," but has an arbitrary number of rows for sequence values, rather than a fixed pattern of one row per class.

**C.3.302.2 Example**

```xml
<value-table-jdbc-seq>
  <type>0</type>
  <allocate>50</allocate>
  <table-name>OPENJPA_SEQUENCE_TABLE</table-name>
  <primary-key-value>DEFAULT</primary-key-value>
  <table>OPENJPA_SEQUENCE_TABLE</table>
  <primary-key-column>ID</primary-key-column>
  <sequence-column>SEQUENCE_VALUE</sequence-column>
  <increment>1</increment>
</value-table-jdbc-seq>
```
C.3.303 version-check-on-read-lock

Range of values: true | false
Default value: false
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  pessimistic-lock-manager

C.3.303.1 Function
Specifies whether to perform version checking and incrementing behavior of the pessimistic lock manager on read operations.

C.3.303.2 Example
<version-check-on-read-lock>false</version-check-on-read-lock>

C.3.304 version-check-on-write-lock

Range of values: true | false
Default value: false
Parent elements:
  persistence-configuration
  persistence-configuration-unit
  pessimistic-lock-manager

C.3.304.1 Function
Specifies whether to perform version checking and incrementing behavior of the pessimistic lock manager on write operations.

C.3.304.2 Example
<version-check-on-write-lock>false</version-check-on-write-lock>

C.3.305 version-lock-manager

Range of values: N/A
Default value: N/A
Parent elements:
  persistence-configuration
  persistence-configuration-unit

C.3.305.1 Function
Specifies the kodo.kernel.VersionLockManager. This lock manager does not perform any exclusive locking, but instead ensures read consistency by verifying that the version of all read-locked instances is unchanged at the end of the transaction. Furthermore, a write lock will force an increment to the version at the end of the transaction, even if the object is not otherwise modified. This ensures read consistency with non-blocking behavior.
C.3.305.2 Example

```xml
<version-lock-manager>
  <version-check-on-read-lock>false</version-check-on-read-lock>
  <version-check-on-write-lock>false</version-check-on-write-lock>
</version-lock-manager>
```

C.3.306 wls81-jmx

- **Range of values**: N/A
- **Default value**: N/A
- **Parent elements**: jmx

**C.3.306.1 Function**
Enable management and invoke the JMX management console in the local JVM. Supports optional parameters in the Management Group and WebLogic 8.1 Group.

**C.3.306.2 Example**

```xml
<wls81-jmx>
  <MBeanServerStrategy>any-create</MBeanServerStrategy>
  <EnableLogMBean>true</EnableLogMBean>
  <EnableRuntimeMBean>true</EnableRuntimeMBean>
  <URL>t3://localhost:7001</URL>
  <UserName>admin</UserName>
  <Password>admin</Password>
</wls81-jmx>
```

C.3.307 write-lock-level

- **Range of values**: none | read | write | numeric values for lock-manager specific lock levels.
- **Default value**: read
- **Parent elements**:
  - persistence-configuration
  - persistence-configuration-unit

**C.3.307.1 Function**
Sets the default write level at which to lock objects retrieved during a non-optimistic transaction. Valid values include:

- none—No lock level.
- read—Read lock level.
- write—Write lock level.
- Numeric values for lock-manager specific lock levels.

**Note:** For the default JDBC lock manager, the read and write lock levels are equivalent.
C.3.307.2 Example

<write-lock-level>read</write-lock-level>