BEA WebLogic Server™

Programming WebLogic Enterprise JavaBeans

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Programming WebLogic Enterprise JavaBeans

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About This Document

This document describes how to develop and deploy Enterprise JavaBeans (EJBs) on WebLogic Server. This document is organized as follows:

- Chapter 1, "Overview of WebLogic Server Enterprise JavaBeans (EJBs)," is an overview of EJB features supported in WebLogic Server.
- Chapter 2, "Designing Session and Entity EJBs," is an overview of design techniques developers can use to create session and entity EJBs.
- Chapter 3, "Designing Message-Driven Beans," explains how to design, develop and deploy message-driven beans in the WebLogic Server container.
- Chapter 4, "The WebLogic Server EJB Container and Supported Services," describes the services available to the EJB with the WebLogic Services container.
- Chapter 5, "WebLogic Server Container-Managed Persistence Service - Basic Features," describes the basic features of the EJB container-managed persistence service available for entity EJBs in the WebLogic Server container.
- Chapter 6, "WebLogic Server Container-Managed Persistence Service - Advanced Features," describes the advanced features of the EJB container-managed persistence service available for entity EJBs in the WebLogic Server container.
- Chapter 10, "WebLogic Server EJB Tools," describes the tools shipped with WebLogic Server that are used with EJBs.
- Chapter 11, "The weblogic-ejb-jar.xml Deployment Descriptor," describes the WebLogic-specific deployment descriptor elements found in `weblogic-ejb-jar.xml`.

- Chapter 12, "The weblogic-cmp-rdbms- jar.xml Deployment Descriptor," describes the WebLogic-specific deployment descriptor elements found in `weblogic-cmp-rdbms-jar.xml`.
- Chapter 13, "Important Information for EJB 1.1 Users," contains design and implementation information for EJB 1.1.

Audience

This document is intended mainly for application developers who are interested in developing Enterprise JavaBeans (EJBs) for use in dynamic Web-based applications. Readers are assumed to be familiar with EJB architecture, XML coding, and Java programming.

e-docs Web Site

BEA WebLogic Server product documentation is available on the BEA corporate Web site. From the BEA Home page, click on Product Documentation.

How to Print the Document

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Adobe Acrobat Reader is available at no charge from the Adobe Web site at http://www.adobe.com/.

Related Information

The BEA corporate Web site provides all documentation for WebLogic Server. However, the following information will provide you with related information that may help you when using Enterprise JavaBeans with WebLogic Server.

- For more information about Sun Microsystem's EJB Specification, see the JavaSoft EJB Specification.
- For more information about the J2EE Specification, see the JavaSoft J2EE Specification.
- For more information about SunMicrosystem's EJB deployment descriptors and descriptions, see the JavaSoft EJB Specification.
- For more information on the deployment descriptors in WebLogic Server's weblogic-ejb-jar.xml file, see Chapter 11, "The weblogic-ejb-jar.xml Deployment Descriptor."
- For more information on the deployment descriptors in WebLogic Server's weblogic-cmp-rdbms-jar.xml file, see Chapter 12, "The weblogic-cmp-rdbms-jar.xml Deployment Descriptor."
- For more information on transactions, see Programming WebLogic JTA.
- For more information about WebLogic's implementation of the JavaSoft Remote Method Invocation (RMI) specification, see the following:
  - JavaSoft Remote Method Invocation Specification
  - Programming WebLogic RMI
  - Programming RMI over IIOP

Contact Us!

Your feedback on the BEA WebLogic Server documentation is important to us. Send us e-mail at **docsupport@bea.com** if you have questions or comments. Your comments will be reviewed directly by the BEA professionals who create and update the WebLogic Server documentation.

In your e-mail message, please indicate the software name and version you are using as well as the title and document date of your documentation.

If you have any questions about this version of BEA WebLogic Server, or if you have problems installing and running BEA WebLogic Server, contact BEA Customer Support through BEA WebSupport at http://www.bea.com. You can also contact Customer Support by using the contact information provided on the Customer Support Card, which is included in the product package.

When contacting Customer Support, be prepared to provide the following information:

- Your name, e-mail address, phone number, and fax number
- Your company name and company address
- Your machine type and authorization codes
- The name and version of the product you are using
- A description of the problem and the content of pertinent error messages

Documentation Conventions

The following documentation conventions are used throughout this document.

Convention	Item
Ctrl+Tab	Indicates that you must press two or more keys simultaneously.
italics	Indicates emphasis or book titles.

Convention	Item

`monospace text`	Indicates code samples, commands and their options, data structures and their members, data types, directories, and file names and their extensions. Monospace text also indicates text that you must enter from the keyboard.
	Examples:
	`#include <iostream.h> void main ( ) the pointer psz`
	`chmod u+w *`
	`\tux\data\ap`
	`.doc`
	`tux.doc`
	`BITMAP`
	`float`

`monospace italic text`	Identifies variables in code. *Example*: `String` *`expr`*
UPPERCASE TEXT	Indicates device names, environment variables, and logical operators. *Example*s: LPT1 SIGNON OR
`{ }`	Indicates a set of choices in a syntax line. The braces themselves should never be typed.

`[ ]`	Indicates optional items in a syntax line. The brackets themselves should never be typed.
	Example:
	`buildobjclient [-v] [-o name ] [-f` *`file-list`*`]...`
	`[-l` *`file-list`*`]...`

`|`	Separates mutually exclusive choices in a syntax line. The symbol itself should never be typed.

Convention	Item

. . .	Indicates one of the following in a command line:
	■ That an argument can be repeated several times in a command line
	■ That the statement omits additional optional arguments
	■ That you can enter additional parameters, values, or other information
	The ellipsis itself should never be typed.
	Example:
	`buildobjclient [-v] [-o name ] [-f file-list]...`
	`[-l file-list]...`

. . .	Indicates the omission of items from a code example or from a syntax line. The vertical ellipsis itself should never be typed.

CHAPTER

1 Overview of WebLogic Server Enterprise JavaBeans (EJBs)

The following sections provide an overview of EJBs, and how they are implemented in WebLogic Server, as well as a discussion of WebLogic Server EJB features and changes introduced in this release.

- "What Are EJBs?" on page 1-1
- "Creating EJBs: Main Steps" on page 1-4
- "EJB Developer Tools" on page 1-5
- "Implementation of Java Specifications" on page 1-7
- "EJB Features and Changes in this Release" on page 1-8

What Are EJBs?

Enterprise JavaBeans (EJBs) are reusable Java components that implement business logic and enable you to develop component-based distributed business applications. EJBs reside in an EJB container, which provides a standard set of services such as persistence, security, transactions, and concurrency. Enterprise JavaBeans are the

standard for defining server-side components. WebLogic Server's implementation of the Enterprise JavaBeans component architecture is based on Sun Microsystems EJB specification.

WebLogic Server is compliant with the Sun J2EE specification and EJB 1.1 and EJB 2.0 specifications. While you can deploy existing EJB 1.1 beans in this version of WebLogic Server, BEA strongly recommends that any new beans you develop be EJB 2.0 beans.

The information in this guide is focused on the EJB 2.0 implementation. Features and behaviors specific to EJB 1.1 are covered in Chapter 13, "Important Information for EJB 1.1 Users."

Types of EJBs

There are four types of EJBs:

- **Stateless session.** An instance of these non-persistent EJBs provides a service without storing an interaction or conversation state between methods. Any instance can be used for any client. Stateless session beans can use either container-managed or bean-managed transaction demarcation.
- **Stateful session.** An instance of these non-persistent EJBs maintains state across methods and transactions. Each instance is associated with a particular client. Stateful session beans can use either container-managed or bean-managed transaction demarcation.
- **Entity.** An instance of these persistent EJBs represents an object view of the data, usually rows in a database. An entity bean has a primary key as a unique identifier. Entity bean persistence can be either container-managed or bean-managed and use either container-managed or bean-managed transaction demarcation.
- **Message-driven.** An instance of these EJBs is integrated with the Java Message Service (JMS) to enable message-driven beans to act as a standard JMS message consumer and perform asynchronous processing between the server and the JMS message producer. The WebLogic Server container directly interacts with a message-driven bean by creating bean instances and passing JMS messages to those instances as necessary. Message-driven beans can use either container-managed or bean-managed transaction demarcation.

EJB Components

An **entity** or **session** EJB consists of these main components:

- **Remote interface**. This interface exposes business logic to clients *running in a separate application from the EJB*. It defines the business methods a client can access to do work.
- **Local interface**. This interface exposes business logic to clients *running within the same application as the EJB*. It defines the business methods a client can access to do work. This interface is not available for 1.1 EJBs.
- **Remote home interface**. The EJB factory, also known as a life-cycle interface. Clients *running in a separate application from the EJB* use this interface to create, remove and find EJB instances.
- **Local home interface**. The EJB factory, also known as a life-cycle interface. Clients *running within the same application as the EJB* use this interface to create, remove and find EJB instances. This interface is not available for 1.1 EJBs.
- **Bean class.** This interface implements business logic. Session and entity bean classes implement a bean's business and life-cycle methods.
- **Primary key**. A class that provides a pointer into a database. This class is relevant for entity beans only.

A **message-driven** EJB consists only have a bean class. It has neither component interfaces nor a primary key class.

The EJB Container

The EJB container takes care of "behind-the-scenes" system-level work so that beans do not have to. WebLogic Server manages the EJB container, providing EJBs access to system-level services such as database management, lifecycle management, security, and transaction services.

Chapter 4, "The WebLogic Server EJB Container and Supported Services," examines the WebLogic Server EJB container in detail.

Chapter 5, "WebLogic Server Container-Managed Persistence Service - Basic Features," and Chapter 6, "WebLogic Server Container-Managed Persistence Service - Advanced Features," help you design your application to make the best use of the container-managed persistence service the WebLogic Server EJB container provides.

Creating EJBs: Main Steps

To create an EJB, you code a distributed application's business logic into the EJB's implementation class; specify the deployment parameters in deployment descriptor files; and package the EJB into a JAR file. You can then deploy the EJB individually from a JAR file, or package it along with other EJBs and a Web application into an EAR file, which you then deploy on WebLogic Server. Finally you monitor the health of your running EJBs and tune them as needed. The following are the specific steps:

1. Design the EJBs. Decide which type of beans you want your application to use, how many, where they will be deployed, what their behavior will be, etcetera. This process includes choosing values for the elements in the EJB-relevant deployment descriptor files: `ejb-jar.xml`, `weblogic-ejb-jar.xml` and `weblogic-cmp-rdbms-jar.xml`.

   Use the design process documented in this guide to design the EJBs that are deployed in the WebLogic Server environment. For more information on the design process, see Chapter 2, "Designing Session and Entity EJBs," and Chapter 3, "Designing Message-Driven Beans."

2. Write the EJB code. The result of this process is an `ejb.jar` file that contains one or more EJB java files.

3. Compile the EJB java files into class files with a Java compiler, typically `javac`.

4. Generate deployment descriptors.

5. Edit the deployment descriptors as needed to fine-tune the behavior of your EJBs.

   Note: You have a number of different tools to choose from for generating and editing deployment descriptors. See Chapter 10, "WebLogic Server EJB Tools."

6. Generate stub and skeleton files and EJB container classes with the `appc` tool.

7. Package the EJB class files and deployment descriptors. This means placing the class files and deployment descriptor files into their proper locations in preparation for deployment. Packaging can also include archiving the class files and deployment descriptors into JARs.

   Chapter 7, "Packaging EJBs for the WebLogic Server Container," discusses packaging in detail.

   Chapter 11, "The weblogic-ejb-jar.xml Deployment Descriptor," and Chapter 12, "The weblogic-cmp-rdbms- jar.xml Deployment Descriptor," examine deployment descriptor files and their elements in detail.

8. Deploy the EJBs on WebLogic Server from a JAR file or package them along with other EJBs and WebLogic Server components in a EAR file, which you then deploy on WebLogic Server. Chapter 7, "Packaging EJBs for the WebLogic Server Container," discusses deployment in detail.

9. Monitor your EJBs via the WebLogic Server Administration console. Tune their behavior as needed by adjusting the appropriate deployment descriptor values and redeploying. See Chapter 9, "EJB Runtime Monitoring," and the "Tuning WebLogic Server EJBs" chapter of the *WebLogic Server Performance and Tuning Guide* (http://http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html).

   For more information on the deployment descriptors, see Chapter 11, "The weblogic-ejb-jar.xml Deployment Descriptor," and Chapter 12, "The weblogic-cmp-rdbms- jar.xml Deployment Descriptor."

   For more information on container-managed persistence, see Chapter 5, "WebLogic Server Container-Managed Persistence Service - Basic Features," and Chapter 6, "WebLogic Server Container-Managed Persistence Service - Advanced Features." For more information on the deploy process, see Chapter 7, "Packaging EJBs for the WebLogic Server Container."

EJB Developer Tools

BEA provides several tools you can use to help you create and configure EJBs.

ANT Tasks to Create Skeleton Deployment Descriptors

You can use the WebLogic ANT utilities to create skeleton deployment descriptors. These utilities are Java classes shipped with your WebLogic Server distribution. The ANT task looks at a directory containing an EJB and creates deployment descriptors based on the files it finds in the `ejb.jar` file. Because the ANT utility does not have information about all of the desired configurations and mappings for your EJB, the skeleton deployment descriptors the utility creates are incomplete. After the utility creates the skeleton deployment descriptors, you can use a text editor, an XML editor, or the EJB Deployment Descriptor Editor in the Administration Console to edit the deployment descriptors and complete the configuration of your EJB.

For more information on using ANT utilities to create deployment descriptors, see Packaging Enterprise JavaBeans at `http://e-docs.bea.com/wls/docs81b/programming/packaging.html` in the `Developing WebLogic Server Applications`.

WebLogic Builder

WebLogic Builder is a development tools that provides a visual environment for you to edit an application's deployment descriptor XML files. You can use WebLogic Builder's interface to view these XML files as you edit them, but you will not need to make textual edits to the XML files. For instructions on how to use the WebLogic Builder tool, see WebLogic Builder.

EJBGen

`EJBGen` is an Enterprise JavaBeans 2.0 code generator. You can annotate your Bean class file with javadoc tags and then use `EJBGen` to generate the Remote and Home classes and the deployment descriptor files for an EJB application. For more information on EJBGen and a list of the supported javadoc tags, see "EJBGen" on page 10-13.

DDInit

DDInit examines the contents of a staging directory and builds the standard J2EE and WebLogic-specific deployment descriptors based on the EJB classes. See "DDInit" on page 10-12.

weblogic.Deployer

The `weblogic.Deployer` command-line tool allows you to initiate deployment from the command line, a shell script, or any automated environment other than Java.

For instructions on using `weblogic.Deployer` and a list of the commands, see Deploying Using weblogic.Deployer.

XML Editor

The XML editor is a simple, user-friendly tool from Ensemble for creating and editing XML files. It can validate XML code according to a specified DTD or XML Schema. You can use the XML editor on Windows or Solaris machines and download it from the Dev2Dev Online.

Implementation of Java Specifications

WebLogic Server is compliant with the following Java Specifications.

- J2EE Specification

  WebLogic Server 8.1 is compliant with the J2EE 1.3 specification.

- EJB 2.0 Specification

The Enterprise JavaBeans 2.0 implementation in WebLogic Server is fully compliant and can be used in production.

EJB Features and Changes in this Release

The following EJB features and changes are introduced in this release of WebLogic Server.

Performance Monitoring Improvements

This release introduces greatly improved monitoring of performance, via new tab pages in the WebLogic Server Administration Console.

Performance monitoring is discussed in detail in Chapter 9, "EJB Runtime Monitoring."

appc

appc provides a single tool for compiling and validating a J2EE ear file, an ejb-jar file or war file for deployment. Previously, a user wanting to compile all modules within an ear file had to extract the individual components of an ear and manually execute the appropriate compiler (jspc or ejbc) to prepare the module for deployment. appc automates this process and performs additional pre-deployment validation checks not previously performed.

appc is discussed in detail in "appc" on page 10-3.

Batch Operations

WebLogic Server now supports batch updates and deletes, in addition to the existing batch insert (previously known as "bulk insert") support. In addition, the EJB container now prevents exceptions by performing dependency checks between batch operations. See "Batch Operations" on page 4-24.

Automatic Database Detection

As application developers develop their entity beans, the underlying table schema must change. With the automatic database detection feature enabled, WebLogic Server automatically changes the underlying table schema as entity beans change. See "Automatic Database Detection" on page 6-21 for more information on automatic database detection.

EJB QL Compiler Enhancements

Compiler error messages in EJB QL now provide a visual aid to identify which part of the query is in error and allow the reporting of more than one error per compilation. See "EJB QL Error-Reporting Enhancements" on page 5-26 for more information on this feature.

Performance Improvements

WebLogic Server provides improved performance for EJB bulk updates, optimistic concurrency, field groups, relationship caching, and EJB redeployment.

Reloadable EJB Modules

With the Reloadable J2EE Modules feature, you can also redeploy EJBs independently of other components in an Enterprise Application. For more information, see *Developing WebLogic Server Applications* at http://http://e-docs.bea.com/wls/docs81b/programming/index.html.

EJB Deployment Assistants

The Administration Console provides an EJB Module Deployment Assistant to help you deploy EJBs. For more information, see the EJB section of the Administration Console Online Help at http://http://e-docs.bea.com/wls/docs81b/ConsoleHelp/ejb.html.

New dbms-column-type Values

WebLogic Server supports two additional values for the `dbms-column-type` element in `weblogic-cmp-rdbms.xml`: `LongString` and `SybaseBinary`. See "dbms-column-type" on page 12-21 for details.

sql-select-distinct Deprecated

This version of WebLogic Server deprecates the `sql-select-distinct` element in `weblogic-cmp-rdbms-jar.xml`. Use the `DISTINCT` clause directly in finder queries instead of this XML element. For finder queries that have a `DISTINCT` clause, the container defers duplicate elimination to the database if `FOR UPDATE` is not used and filter duplicates if used.

If `sql-select-distinct` is set to true, but the finder query does not have a `DISTINCT` clause, it is equivalent to not specifying `sql-select-distinct` but having a `DISTINCT` clause in the finder query.

If `sql-select-distinct` is set to false, but the finder query has a `DISTINCT` clause, the value of `sql-select-distinct` is ignored.

For more information on `sql-select-distinct`, see "sql-select-distinct" on page 12-49.

For more information on the `SELECT DISTINCT` clause in EJB QL, see "Using SELECT DISTINCT" on page 5-15.

ejbc Deprecated

The `ejbc` compiler has been deprecated. Use `appc` in its place.

CHAPTER

2 Designing Session and Entity EJBs

The following sections provide guidelines for designing session and entity EJBs, and include a discussion of inheritance, access to deployed EJBs and transaction resource preservation.

- Designing Session Beans
- Designing Entity Beans
- Using Inheritance with EJBs
- Accessing Deployed EJBs
- Preserving Transaction Resources

Message-driven bean design is discussed in Chapter 3, "Designing Message-Driven Beans."

Designing Session Beans

One way to design session beans is to use the model-view design. The *view* is the graph-user interface (GUI) form and the *model* is the piece of code that supplies data to the GUI. In a typical client-server system, the model lives on the same server as the view and talks to the server.

Have the model reside on the server, in the form of a session bean. (This is analogous to having a servlet providing support for an HTML form, except that a model session bean does not affect the final presentation.) There should be one model session bean instance for each GUI form instance, which acts as the form's representative on the server. For example, if you have a list of 100 network nodes to display in a form, you might have a method called `getNetworkNodes()` on the corresponding EJB that returns an array of values relevant to that list.

This approach keeps the overall transaction time short, and requires minimal network bandwidth. In contrast, consider an approach where the GUI form calls an entity EJB finder method that retrieves references to 100 separate network nodes. For each reference, the client must go back to the datastore to retrieve additional data, which consumes considerable network bandwidth and may yield unacceptable performance.

Session Facade Pattern

IN DEVELOPMENT.

Designing Entity Beans

Reading and writing RDBMS data via an entity bean can consume valuable network resources. Network traffic may occur between a client and WebLogic Server, as well as between WebLogic Server and the underlying datastore. Use the following suggestions to model entity EJB data correctly and avoid unnecessary network traffic.

Entity Bean Home Interface

The container provides an implementation of the home interface for each entity bean deployed in the container and it makes the home interface accessible to the clients through JNDI. An object that implements an entity beans's home interface is called an EJBHome object. The entity bean's home interface enables a client to do the following:

- Use the `create()` methods to create new entity objects within the home.
- Use the `finder()` methods to find existing entity objects within the home.
- Use the `remove()` methods to remove an entity object from the home.
- Execute a home method that is not specific to a particular entity bean instance.

Make Entity EJBs Coarse-Grained

Do not attempt to model every object in your system as an entity EJB. In particular, small subsets of data consisting of only a few bytes should never exist as entity EJBs, because the trade-off in network resources is unacceptable.

For example, cells in a spreadsheet are too fine-grained and should not be accessed frequently over a network. In contrast, logical groupings of an invoice's entries, or a subset of cells in a spreadsheet can be modeled as an entity EJB, if additional business logic is required for the data.

Encapsulate Additional Business Logic in Entity EJBs

Even coarse-grained objects may be inappropriate for modeling as an entity EJB if the data requires no additional business logic. For example, if the methods in your entity EJB work only to set or retrieve data values, it is more appropriate to use JDBC calls in an RDBMS client or to use a session EJB for modeling.

Entity EJBs should encapsulate additional business logic for the modeled data. For example, a banking application that uses different business rules for "Platinum" and "Gold" customers might model all customer accounts as entity EJBs; the EJB methods can then apply the appropriate business logic when setting or retrieving data fields for a particular customer type.

Optimize Entity EJB Data Access

Entity EJBs ultimately model fields that exist in a data store. Optimize entity EJBs wherever possible to simplify and minimize database access. In particular:

- Limit the complexity of joins against EJB data.
- Avoid long-running operations that require disk access in the datastore.

Ensure that EJB methods return as much data as possible, so as to minimize round-trips between the client and the datastore. For example, if your EJB client must retrieve data fields, use bulk get/setAttributes() methods to minimize network traffic.

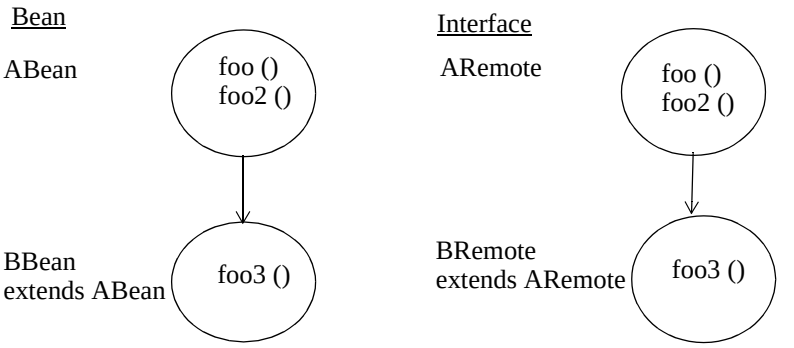
Using Inheritance with EJBs

Using inheritance may be appropriate when building groups of related beans that share common code. However, be aware of several inheritance restrictions apply to EJB implementations.

For bean-managed entity EJBs, the `ejbCreate()` method must return a primary key. Any class that inherits from the bean-managed EJB class cannot have an `ejbCreate()` method that returns a different primary key class than does the bean-managed EJB class. This restriction applies even if the new class is derived from the base EJB's primary key class. The restriction also applies to the bean's `ejbFind()` method.

Also, EJBs inheriting from other EJB implementations change the interfaces. For example, the following figure shows a situation where a derived bean adds a new method that is meant to be accessible remotely.

Figure 2-1 Derived bean (BBean) adding new method to be accessible remotely



An additional restriction is that because `AHome.create()` and `BHome.create()` return different remote interfaces, you cannot have the `BHome` interface inherit from the `AHome` interface. You can still use inheritance to have methods in the beans that are unique to a particular class, that inherit from a superclass or that are overridden in the subclass. See the EJB 1.1 subclass Child example in the and classes in the WebLogic Server distribution for an examples of inheritance.

Accessing Deployed EJBs

WebLogic Server automatically creates implementations of an EJB's home and remote interfaces that can function remotely. This means that all clients — whether they reside on the same server as the EJB, or on a remote computer — can access deployed EJBs in a similar fashion.

All EJBs must specify their environment properties using Java Naming and Directory Interface (JNDI). You can configure the JNDI name spaces of EJB clients to include the home EJBs that reside anywhere on the network — on multiple machines, application servers, or containers.

However, in designing enterprise application systems, you must still consider the effects of transmitting data across a network between EJBs and their clients. Because of network overhead, it is still more efficient to access beans from a "local" client — a servlet or another EJB — than to do so from a remote client where data must be marshalled, transmitted over the network, and then unmarshalled.

Differences Between Accessing EJBs from Local Clients and Remote Clients

One difference between accessing EJBs from local clients and remote clients is in obtaining an `InitialContext` for the bean. Remote clients obtain an `InitialContext` from the WebLogic Server `InitialContext` factory. WebLogic Server local clients generally use a `getInitialContext` method to perform this lookup, similar to the following excerpt:

Figure 2-2 Code sample of a local client performing a lookup

```
...
Context ctx = getInitialContext("t3://localhost:7001", "user1", "user1Password");
...
static Context getInitialContext(String url, String user, String password) {
   Properties h = new Properties();
   h.put(Context.INITIAL_CONTEXT_FACTORY,
      "weblogic.jndi.WLInitialContextFactory");
   h.put(Context.PROVIDER_URL, url);
   h.put(Context.SECURITY_PRINCIPAL, user);
   return new InitialContext(h);
}
```

Internal clients of an EJB, such as servlets, can simply create an `InitialContext` using the default constructor, as shown here:

```
Context ctx = new InitialContext();
```

Restrictions on Concurrency Access of EJB Instances

Although database concurrency is the default and recommended concurrency access option, multiple clients can use the exclusive concurrency option to access EJBs in a serial fashion. Using this exclusive option means that if two clients simultaneously attempt to access the same entity EJB instance (an instance having the same primary key), the second client is blocked until the EJB is available. For more information on the database concurrency option, see "Exclusive Concurrency Strategy" on page 5-37.

Simultaneous access to a stateful session EJB results in a `RemoteException`. This access restriction on stateful session EJBs applies whether the EJB client is remote or internal to WebLogic Server. However, you can set the `allow-concurrent-calls` option to specify that a stateful session bean instance will allow concurrent method calls.

If multiple servlet classes access a session EJB, each servlet thread (rather than each instance of the servlet class) must have its own session EJB instance. To avoid concurrent access, a JSP/servlet can use a stateful session bean in request scope.

Storing EJB References in Home Handles

Once a client obtains the `EJBHome` object for an EJB instance, you can create a handle to the home object by calling `getHomeHandle()`. `getHomeHandle()` returns a `HomeHandle` object, which can be used to obtain the home interface to the same EJB at a later time.

A client can pass the `HomeHandle` object as arguments to another client, and the receiving client can use the handle to obtain a reference to the same EJBHome object. Clients can also serialize the `HomeHandle` and store it in a file for later use.

Using Home Handles Across a Firewall

By default, WebLogic Server stores its IP address in the `HomeHandle` object for EJBs. This can cause problems with certain firewall systems. If you cannot locate `EJBHome` objects when you use home handles passed across a firewall, use the following steps:

1. Start WebLogic Server.

2. Start the WebLogic Server Administration Console.
3. From the left pane, expand the Servers node and select a server.
4. In the right pane, select the Configuration tab for that server and then the Network tab.
5. Check the Reverse DNS Allowed box to enable reverse DNS lookups.

When you enable reverse DNS lookups, WebLogic Server stores the DNS name of the server, rather than the IP address, in EJB home handles.

Preserving Transaction Resources

Database transactions are typically one of the most valuable resources in an online transaction-processing system. When you use EJBs with WebLogic Server, transaction resources are even more valuable because of their relationship with database connections.

WebLogic Server can use a single connection pool to service multiple, simultaneous database requests. The efficiency of the connection pool is largely determined by the number and length of database transactions that use the pool. For non-transactional database requests, WebLogic Server can allocate and deallocate a connection very quickly, so that the same connection can be used by another client. However, for transactional requests, a connection becomes “reserved” by the client for the duration of the transaction.

To optimize transaction use on your system, always follow an “inside-out” approach to transaction demarcation. Transactions should begin and end at the “inside” of the system (the database) where possible, and move “outside” (toward the client application) only as necessary. The following sections describe this rule in more detail.

Allowing the Datastore to Manage Transactions

Many RDBMS systems provide high-performance locking systems for Online Transaction Processing (OLTP) transactions. With the help of Transaction Processing (TP) monitors such as Tuxedo, RDBMS systems can also manage complex decision

support queries across multiple datastores. If your underlying datastore has such capabilities, use them where possible. Never prevent the RDBMS from automatically delimiting transactions.

Using Container-Managed Transactions Instead of Bean-Managed Transactions for EJBs

Your system should rarely rely on bean-managed transaction demarcation. Use WebLogic Server container-managed transaction demarcation unless you have a specific need for bean-managed transactions.

Possible scenarios where you must use bean-managed transactions are:

- You define multiple transactions from within a single method call. WebLogic Server demarcates transactions on a per-method basis.

  Rather than using multiple transactions in a single method call, break the method into multiple methods, with each of the multiple methods having its own container-managed transaction.

- You define a single transaction that "spans" multiple EJB method calls. For example, you define a stateful session EJB that uses one method to begin a transaction, and another method to commit or roll back a transaction.

  Note: Avoid this practice if possible because it requires detailed information about the workings of the EJB object. However, if this scenario is required, you must use bean-managed transaction coordination, and you must coordinate client calls to the respective methods.

Never Demarcate Transactions from Application

In general, client applications are not guaranteed to stay active over long periods of time. If a client begins a transaction and then exits before committing, it wastes valuable transaction and connection resources in WebLogic Server. Moreover, even if the client does not exit during a transaction, the duration of the transaction may be unacceptable if it relies on user activity to commit or roll back data. Always demarcate transactions at the WebLogic Server or RDBMS level where possible.

For more information on demarcating transaction see "Transaction Management Responsibilities" on page 4-17.

Always Use A Transactional Datasource for Container-Managed EJBs

If you configure a JDBC datasource factory for use with container-managed EJBs, make sure you configure a transactional datasource (`TXDataSource`) rather than a non-transactional datasource (`DataSource`). With a non-transactional datasource, the JDBC connection operates in auto commit mode, committing each insert and update operation to the database immediately, rather than as part of a container-managed transaction.

CHAPTER

3 Designing Message-Driven Beans

The following sections describe how to develop message-driven beans and to deploy then on WebLogic Server. Because message-driven beans use parts of the standard Java Messing Service (JMS) API, you should first become familiar with the WebLogic JMS before attempting to implement message-driven beans. See *Programming WebLogic JMS* for more information.

- What Are Message-Driven Beans?
- Developing and Configuring Message-Driven Beans
- Invoking a Message-Driven Bean
- Creating and Removing Bean Instances
- Deploying Message-Driven Beans in WebLogic Server
- Using Transaction Services with Message-Driven Beans
- Message-Driven Bean Migratable Service

What Are Message-Driven Beans?

A message-driven bean is an EJB that acts as a message consumer in the WebLogic JMS messaging system. As with standard JMS message consumers, message-driven beans receive messages from a JMS Queue or Topic, and perform business logic based on the message contents.

EJB deployers create listeners to a Queue or Topic at deployment time, and WebLogic Server automatically creates and removes message-driven bean instances as needed to process incoming messages.

Differences Between Message-Driven Beans and Standard JMS Consumers

Because message-driven beans are implemented as EJBs, they benefit from several key services that are not available to standard JMS consumers. Most importantly, message-driven bean instances are wholly managed by the WebLogic Server EJB container. Using a single message-driven bean class, WebLogic Server creates multiple EJB instances as necessary to process large volumes of messages concurrently. This stands in contrast to a standard JMS messaging system, where the developer must create a `MessageListener` class that uses a server-wide session pool.

The WebLogic Server container provides other standard EJB services to message-driven beans, such as security services and automatic transaction management. These services are described in more detail in "When you configure a cluster, you supply a cluster address that identifies the Managed Servers in the cluster. The cluster address is used in entity and stateless beans to construct the host name portion of URLs. If the cluster address is not set, EJB handles may not work properly. For more information on cluster addresses, see Using WebLogic Server Clusters." on page 4-16 and in "Using Transaction Services with Message-Driven Beans" on page 3-12.

Finally, message-driven beans benefit from the write-once, deploy-anywhere quality of EJBs. Whereas a JMS `MessageListener` is tied to specific `session pools`, Queues, or Topics, message-driven beans can be developed independently of available server resources. A message-driven bean's Queues and Topics are assigned only at deployment time, utilizing resources available on WebLogic Server.

Note: One limitation of message-driven beans compared to standard JMS listeners is that you can associate a given message-driven bean deployment with only one Queue or Topic, as described in "Invoking a Message-Driven Bean" on page 3-11. If your application requires a single JMS consumer to service messages from multiple Queues or Topics, you must use a standard JMS consumer, or deploy multiple message-driven bean classes.

Differences Between Message-Driven Beans and Stateless Session EJBs

The dynamic creation and allocation of message-driven bean instances partially mimics the behavior of stateless session EJB instances. However, message-driven beans differ from stateless session EJBs (and other types of EJBs) in several significant ways:

- Message-driven beans process multiple JMS messages asynchronously, rather than processing a serialized sequence of method calls.
- Message-driven beans have no home or remote interface, and therefore cannot be directly accessed by internal or external clients. Clients interact with message-driven beans only indirectly, by sending a message to a JMS Queue or Topic.

Note: Only the WebLogic Server container directly interacts with a message-driven bean by creating bean instances and passing JMS messages to those instances as necessary.

- WebLogic Server maintains the entire life cycle of a message-driven bean; instances cannot be created or removed as a result of client requests or other API calls.

Concurrent Processing for Topics and Queues

Message-Driven Beans support concurrent processing for both Topics and Queues. Previously, only concurrent processing for Queues was supported.

To ensure concurrency, the container uses threads from the execute queue. The default setting for the `max-beans-in-free-pool` deployment descriptor found in the `weblogic-ejb-jar.xml` file provides the most parallelism. The only reason to change this setting would be to limit the number of parallel consumers. For more information on this element see, "max-beans-in-free-pool" on page 11-55.

Developing and Configuring Message-Driven Beans

When developing message-driven beans, follow the conventions described in the JavaSoft EJB 2.0 specification, and observe the general practices that result in proper bean behavior. Once you have created the message-driven bean class, configuring the bean for WebLogic Server by specify the bean's deployment descriptor elements in the EJB XML deployment descriptor files.

To develop a message-driven bean:

1. Create a source file (message-driven bean class) that implements both the `javax.ejb.MessageDrivenBean` and `javax.jms.MessageListener` interfaces.

   The message-driven bean class must define the following methods:

   - One `ejbCreate()` method that the container uses to create an instance of the message-driven bean on the free pool.
   - One `onMessage()` method that is called by the bean's container when a message is received. This method contains the business logic that handles processing of the message.
   - One `setMessageDrivenContext{}` method that provides information to the bean instance about its environment (certain deployment descriptor values); the Context is also the mechanism the bean class uses to access some services provided by the EJB container.
   - One `ejbRemove()` method that removes the message-driven bean instance from the free pool.

   For an example of output for a message-driven bean class, see "Message-Driven Bean Class Requirements" on page 3-6.

2. Specify the following XML deployment descriptor files for the message-driven bean.

   - `ejb-jar.xml`
   - `weblogic-ejb-jar.xml`
   - `weblogic-cmp-rdbms-jar.xml`

For instructions on specifying the XML files, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

3. Set the `message-driven` element in the bean's `ejb-jar.xml` file to declare the bean.
4. Set the `message-driven-destination` element in the bean's `ejb-jar.xml` file to specify whether the bean is intended for a Topic or Queue.
5. Set the `subscription-durability` sub-element in the bean's `ejb-jar.xml` file when you want to specify whether an associated Topic should be durable.
6. If your bean will demarcate its own transaction boundaries, set the `acknowledge-mode` sub-element to specify the JMS acknowledgment semantics to use. This element has two possible values: `AUTO_ACKNOWLEDGE` (the default) or `DUPS_OK_ACKNOWLEDGE`.
7. If the container will manage the transaction boundaries, set the `transaction-type` element in the bean's `ejb-jar.xml` file to specify how the container must manage the transaction boundaries when delegating a method invocation to an enterprise bean's method.

The following sample shows how to specify a message-driven bean in the `ejb-jar.xml` file.

Figure 3-1 Sample XML stanza from an `ejb-jar.xml` file:

```
<enterprise-beans>
       <message-driven>
              <ejb-name>exampleMessageDriven1</ejb-name>

<ejb-class>examples.ejb20.message.MessageTraderBean</ejb-class>
              <transaction-type>Container</transaction-type>
              <message-driven-destination>
                     <destination-type>
                            javax.jms.Topic
                     </destination-type>
              </message-driven-destination>
```

```
            ...
        </message-driven>
        ...
</enterprise-beans>
```

8. Set the `message-driven-descriptor` element in the bean's `weblogic-ejb-jar.xml` file to associate the message-driven bean with a JMS destination in WebLogic Server.

The following sample shows how to specify a message-driven bean in an `weblogic-ejb-jar.xml` file.

Figure 3-2 Sample XML stanza from an `weblogic-ejb-jar.xml` file:

```
<message-driven-descriptor>
        <destination-jndi-name>...</destination-jndi-name>
</message-driven-descriptor>
```

9. Compile and generate the message-driven bean class using instructions in "Packaging EJBs into a Deployment Directory" on page 7-9.
10. Deploy the bean on WebLogic Server using the instructions in "Deploying Compiled EJB Files" on page 8-7.

The container manages the message-driven bean instances at runtime.

Message-Driven Bean Class Requirements

The EJB 2.0 specification provides detailed guidelines for defining the methods in a message-driven bean class. The following output shows the basic components of a message-driven bean class. Classes, methods, and method declarations are highlighted **`bold`**.

Figure 3-3 Sample output of basic components of message-driven beans class

```
public class MessageTraderBean implements MessageDrivenBean,
MessageListener{
        public MessageTraderBean() {...};
```

```
            // An EJB constructor is required, and it must not

            // accept parameters. The constructor must not be
declared as

            // final or abstract.

      public void ejbCreate() (...)

            //ejbCreate () is required and must not accept
parameters.

            The throws clause (if used) must not include an
application

            //exception. ejbCreate() must not be declared as
final or static.

      public void onMessage(javax.jms.Message MessageName) {...}

            // onMessage() is required, and must take a single
parameter of

            // type javax.jms.Message. The throws clause (if
used) must not

            // include an application exception. onMessage() must
not be

            // declared as final or static.

      public void ejbRemove() {...}

            // ejbRemove() is required and must not accept
parameters.

            // The throws clause (if used) must not include an
application

            //exception. ejbRemove() must not be declared as
final or static.

      // The EJB class cannot define a finalize() method

}
```

Using the Message-Driven Bean Context

WebLogic Server calls `setMessageDrivenContext()` to associate the message-driven bean instance with a container context.This is not a client context; the client context is not passed along with the JMS message. WebLogic Server provides the EJB with a container context, whose properties can be accessed from within the bean's instance by using the following methods from the `MessageDrivenContext` interface:

- `getCallerPrincipal())` – This method is inherited from the EJBContext interface and should not be called by message-driven bean instances.
- `isCallerInRole())` – This method is inherited from the EJBContext interface and should not be called by message-driven bean instances.
- `setRollbackOnly()` – The EJB can use this method only if it uses container-managed transaction demarcation.
- `getRollbackOnly()` – The EJB can use this method only if it uses container-managed transaction demarcation.
- `getUserTransaction()` – The EJB can use this method only if it uses bean-managed transaction demarcation.

Note: Although `getEJBHome()` is also inherited as part of the `MessageDrivenContext` interface, message-driven beans do not have a home interface. Calling `getEJBHome()` from within a message-driven EJB instance yields an `IllegalStateException`.

Implementing Business Logic with onMessage()

The message-driven bean's `onMessage()` method implements the business logic for the EJB. WebLogic Server calls `onMessage()` when the EJB's associated JMS Queue or Topic receives a message, passing the full JMS message object as an argument. It is the message-driven bean's responsibility to parse the message and perform the necessary business logic in `onMessage()`.

Make sure that the business logic accounts for asynchronous message processing. For example, it cannot be assumed that the EJB receives messages in the order they were sent by the client. Instance pooling within the container means that messages are not received or processed in a sequential order, although individual `onMessage()` calls to a given message-driven bean instance are serialized.

See javax.jms.MessageListener.onMessage() for more information.

Specifying Principals and Setting Permissions for JMS Destinations

Message-driven beans connect to the JMS destination using the `run-as` principal. The `run-as` principal maps to the `run-as` element that is set in the `ejb-jar.xml` file. This setting specifies the `run-as` identity used for the execution of the message-driven bean's methods. A message-driven bean is associated with a JMS destination when you deploy the bean in the WebLogic Server EJB container. The JMS destination can either be a queue or a topic. You specify the JMS destination by setting the `destination-type` element to either `queue` or `topic` in the message-driven bean's `ejb-jar.xml` file.

Set the permissions for the bean's `run-as` principal to `receive`, as described below, when connecting message-driven beans to the JMS destinations. This allows the message-driven bean to connect to remote queues in the same domain or in another domain as long as the same principal is defined in the other domain. WebLogic Server uses the default `guest` user if you do not specify the `run-as` principal. However, whether you use the `run-as` principal or `guest`, you must assign the `receive` permission to the security principal.

To set the `receive` permission, you must first create a new access control list (ACL) or modify an existing one. ACLs are lists of Users and Groups that have permission to access the resources. Permissions are the privileges required to access resources, such as permission to read, write, send, and receive files and load servlets, and link to libraries.

Note: Do not use the `system` user for message-driven beans that connect to JMS destinations because `system` prevents the message-driven bean from connecting to a destination in another domain.

For more information on security principal users, see Defining Users.

See the following instructions to create the ACL, specify principals, and set permissions:

1. Start the WebLogic Server Administration Console.
2. Go to the Security—ACLs node in the left pane of the Administration Console.
3. In the right pane of the Administration Console, click the Create a New ACL link.

   The ACL Configuration window appears.
4. Specify the name of WebLogic Server resource that you want to protect with an ACL in the New ACL Name field.

   For example, create an ACL for a JMS destination named `topic`.
5. Click Create.
6. Click the Add a New Permission link.
7. Specify the `receive` permission for the `topic` JMS destination resource.
8. Specify the `run-as-principal` user as having the specified permission to the resource.
9. Click Apply.

Handling Exceptions

Message-driven bean methods should not throw an application exception or a `RemoteException`, even in `onMessage()`. If any method throws such an exception, WebLogic Server immediately removes the EJB instance without calling `ejbRemove()`. However, from the client perspective the EJB still exists, because future messages are forwarded to a new bean instance that WebLogic Server creates.

Invoking a Message-Driven Bean

When a JMS Queue or Topic receives a message, WebLogic Server calls an associated message-driven bean as follows:

1. WebLogic Server obtains a new bean instance.

   WebLogic Server uses the `max-beans-in-free-pool` attribute, set in the `weblogic-ejb-jar.xml` file, to determine if a new bean instance is available in the free pool.

2. If a bean instance is available in the free pool, WebLogic Server uses that instance. If no bean instance is available in the free pool, because the `max-beans-in-free-pool` attribute is at `maxBeans` (maximum setting), WebLogic Server waits until a bean instance is free. See "max-beans-in-free-pool" on page 11-55 for more information about this attribute.

   If no bean instance is located in the free pool, WebLogic Server creates a new instance by calling the bean's `ejbCreate()` method and then the bean's `setMessageDrivenContext()` to associate the instance with a container context. The bean can use elements of this context as described in "Using the Message-Driven Bean Context" on page 3-8.

3. WebLogic Server calls the bean's `onMessage()` method to implement the business logic when the bean's associated JMS Queue or Topic receives a message.

   See "Implementing Business Logic with onMessage()" on page 3-8.

Note: These instances can be pooled.

Creating and Removing Bean Instances

The WebLogic Server container calls the message-driven bean's `ejbCreate()` and `ejbRemove()` methods, to create or remove an instance of the bean class. Each message-driven bean must have at least one `ejbCreate()` and `ejbRemove()` method.

The WebLogic Server container uses these methods to handle the create and remove functions when a bean instance is created, upon receipt of a message from a JMS Queue or Topic or removed, once the transaction commits. WebLogic Server receives a message from a JMS queue or Topic.

As with other EJB types, the `ejbCreate()` method in the bean class should prepare any resources that are required for the bean's operation. The `ejbRemove()` method should release those resources, so that they are freed before WebLogic Server removes the instance.

Message-driven beans should also perform some form of regular clean-up routine *outside* of the `ejbRemove()` method, because the beans cannot rely on `ejbRemove()` being called under all circumstances (for example, if the EJB throws a runtime exception).

Deploying Message-Driven Beans in WebLogic Server

Deploy the message-driven bean on WebLogic Server either when the server is first started or on a running server. For instructions on deploying the bean, see "Deploying EJBs at WebLogic Server Startup" on page 8-1 or "Deploying EJBs on a Running WebLogic Server" on page 8-3.

Using Transaction Services with Message-Driven Beans

As with other types of EJB, message-driven beans can demarcate transaction boundaries either on their own (using bean-managed transactions), or by having the WebLogic Server container manage transactions (container-managed transactions). In either case, a message-driven bean does not receive a transaction context from the

client that sends a message. WebLogic Server always calls a bean's `onMessage()` method by using the transaction context specified in the bean's deployment descriptor file.

Because no client provides a transaction context for calls to a message-driven bean, beans that use container-managed transactions must be deployed with the `Required` or `NotSupported` `trans-attribute` specified for the `container-transaction` element in the `ejb-jar.xml` file.

The following sample code from the `ejb-jar.xml` file shows how to specify the bean's transaction context.

Figure 3-4 Sample XML stanza from an ejb-jar.xml file:

```
<assembly-descriptor>
       <container-transaction>
              <method>

<ejb-name>MyMessageDrivenBeanQueueTx</ejb-name>
                     <method-name>*</method-name>
              </method>
       <trans-attribute>NotSupported</trans-attribute>
       </container-transaction>
</assembly-descriptor>
```

Message Receipts

The receipt of a JMS message that triggers a call to an EJB's `onMessage()` method is not generally included in the scope of a transaction. However, it is handled differently for bean-managed and container-managed transactions.

- For EJBs that use bean-managed transactions, the message receipt is always outside the scope of the bean's transaction.
- For EJBs that use container-managed transaction demarcation, WebLogic Server includes the message receipt as part of the bean's transaction only if the bean's `transaction-type` element in the `ejb-jar.xml` file is set to `Required`.

Message Acknowledgment

For message-driven beans that use container-managed transaction demarcation, WebLogic Server automatically acknowledges a message when the EJB transaction commits. If the EJB uses bean-managed transactions, both the receipt and the acknowledgment of a message occur outside the EJB transaction context. WebLogic Server automatically acknowledges messages for EJBs with bean-managed transactions, but you can configure acknowledgment semantics using the `acknowledge-mode` deployment descriptor element defined in the `ejb-jar.xml` file.

Message-Driven Bean Migratable Service

WebLogic Server supports migratable and recovery services for message-driven beans. To provide these migratable and recovery services, WebLogic JMS uses the migration framework provided by WebLogic Server to respond to migration requests and bring a JMS server back online after a failure. Once the JMS server migrates to an available server, you should manually migrate the associated message-driven beans from a failed server in a WebLogic Server cluster to the same available server. The Message-driven bean can only use the Migratable Service when they are on clustered servers At this time, the Migratable Service cannot span multiple clusters.

If WebLogic Server does not migrate the message-driven bean along with the JMS Server to an available server in the cluster, the JMS destination will be flooded with messages. To expedite message-driven bean recovery until the original server recovers, the message-driven bean marks itself as migratable and WebLogic Server implements the Migratable Service process. After you migrate the bean to another server, it connects to its JMS server and continues to pull messages from the JMS destination on behalf of the failed server.

Enabling the Message-Driven Bean Migratable Service

To enable the message-driven bean Migratable Service:

1. Configure the message-driven bean as described in “Developing and Configuring Message-Driven Beans” on page 3-4.

2. Specify the message-driven bean's JMS destination type as either topic or queue by setting the `destination-type` element in the `ejb-jar.xml` file. For instructions, see JMS Destination Tasks.
3. Specify one of the following deployment schemes for the JMS destination:
   - Simple destination - EJB container deploys the message-driven bean with the JMS destination when the JMS destination isn't distributed.
   - Distributed destination - EJB container deploys the message-driven bean with the JMS destination on every server when the JMS destination is distributed.

   For instructions, see JMS Distributed Destination Tasks.
4. Use the WebLogic Server Administration Console, configure a JMS server. For instructions see JMS Server Tasks.

   A JMS server is deployed on a server in a WebLogic Server cluster and handles requests for a set of JMS destinations.
5. Configure JMS migratable targets for the JMS server. For instructions, see Server --> Control --> JMS Migration Configuration.

Migrating Message-Driven Beans

To migrate message-driven bean from a failed server in a WebLogic Server cluster to an available server:

1. Start the WebLogic Server Administration Console.
2. Specify one of the following deployment schemes for the JMS destination:
   - Simple destination - EJB container deploys the message-driven bean with the JMS destination when the JMS destination isn't distributed.
   - Distributed destination - EJB container deploys the message-driven bean with the JMS destination on every server when the JMS destination is distributed.

Because the message-driven bean can detect the migration target for the JMS server, you do not need to change the migration target for the message-driven bean.

However, the message-driven bean must be deployed in the cluster or all of the servers on the JMS server migration target lists because message-driven bean is not possible during migration.The message-driven bean is deployed with the a JMS destination on all servers in the migration target list, and remain inactive when the JMS destination is inactive.

When WebLogic Server activates a message-driven bean, it detects the JMS server and starts pulling the message from the JMS destination that is specified for the bean.

As of WebLogic Server 7.0, you can deploy an MDB that supports container-managed transactions against a foreign JMS provider. If the MDB is configured with a "transaction-type" attribute of "Container" and a "trans-attribute" of "Required", then WLS will use XA to automatically enlist the foreign JMS provider in a transaction.

If the foreign JMS provider does not support XA, then you cannot deploy an MDB that supports container-managed transactions with that provider. Furthermore, if the JMS provider does support XA, you must ensure that the JMS connection factory that you specify in the `weblogic-ejb-jar.xml` file supports XA—each JMS provider has a different way to specify this.

See the white paper, "Using Foreign JMS Providers with WLS Message Driven Beans" (`jmsmdb.doc`) on http://dev2dev.bea.com/resourcelibrary/whitepapers.jsp?highlight=whitepapers for an example of how to configure an MDB to use a foreign provider.

4 The WebLogic Server EJB Container and Supported Services

The following sections describe the WebLogic Server EJB container and various aspects of EJB behavior in terms of the features and services that the container provides.

- EJB Container
- EJB Lifecycle in WebLogic Server
- Using max-beans-in-free-pool
- EJBs in WebLogic Server Clusters
- Database Insert Support
- Batch Operations
- Resource Factories
- Using EJB Links

For information on the specific topic of container-managed persistence, see Chapter 5, "WebLogic Server Container-Managed Persistence Service - Basic Features," and Chapter 6, "WebLogic Server Container-Managed Persistence Service - Advanced Features."

EJB Container

The EJB container is a runtime container for deployed EJBs. It is automatically created when WebLogic Server is started. During the entire life cycle of an EJB object, from its creations to removal, it lives in the container. The EJB container provides a standard set of services, including caching, concurrency, persistence, security, transaction management, locking, environment, memory replication, and clustering for the EJB objects that live in the container.

You can deploy multiple beans in a single container. For each session and entity bean deployed in a container, the container provides a home interface. The home interface allows a client to create, find, and remove entity objects that belong to the entity bean as well as to execute home business methods which are not specific to a particular entity bean object. A client can look up the entity bean's home interface through the Java Naming and Directory Interface (JNDI) or by following an EJB reference, which is preferred. The container is responsible for making the entity bean's home interface available in the JNDI name space. For instructions on looking up the home interface through JNDI, see Programming WebLogic JNDI.

EJB Lifecycle in WebLogic Server

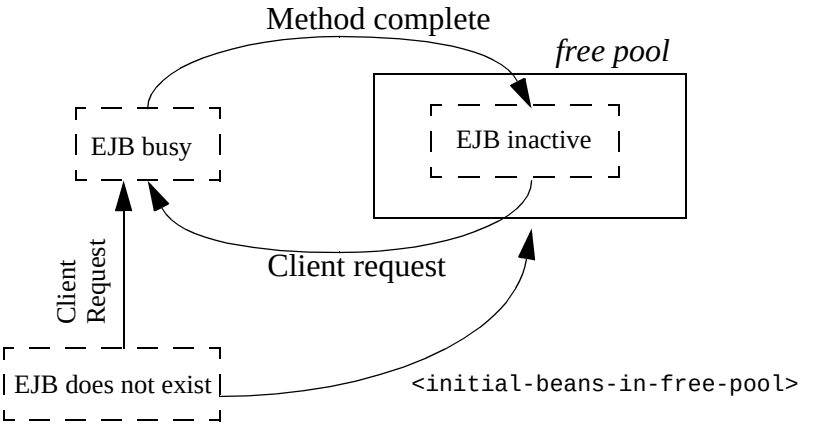
The following sections provide information about how the container supports caching services. They describe the life cycle of EJB instances in WebLogic Server, from the perspective of the server. These sections use the term *EJB instance* to refer to an actual instance of the EJB bean class. *EJB instance* does not refer to the logical instance of the EJB as seen from the point of view of a client.

Stateless Session EJB Life Cycle

WebLogic Server uses a *free pool* to improve performance and throughput for stateless session EJBs. The free pool stores *unbound* stateless session EJBs. Unbound EJB instances are instances of a stateless session EJB class that are not processing a method call.

The following figure illustrates the WebLogic Server free pool, and the processes by which stateless EJBs enter and leave the pool. Dotted lines indicate the "state" of the EJB from the perspective of WebLogic Server.

Figure 4-1 WebLogic Server free pool showing stateless session EJB life cycle



Initializing Stateless Session EJB Instances

By default, no stateless session EJB instances exist in WebLogic Server at startup time. As clients access individual beans, WebLogic Server initializes new instances of the EJB. However, if you want inactive instances of the EJB to exist in WebLogic Server when it is started, specify how many in the `initial-beans-in-free-pool` deployment descriptor element, in the `weblogic-ejb-jar.xml` file.

This can improve initial response time when clients access EJBs, because initial client requests can be satisfied by activating the bean from the free pool (rather than initializing the bean and then activating it). By default, `initial-beans-in-free-pool` is set to 0.

Note: The maximum size of the free pool is limited either by available memory, or the value of the `max-beans-in-free-pool` deployment element.

Activating and Pooling Stateless Session EJBs

When a client calls a method on a stateless session EJB, WebLogic Server obtains an instance from the free pool. The EJB remains active for the duration of the client's method call. After the method completes, the EJB instance is returned to the free pool. Because WebLogic Server unbinds stateless session beans from clients after each method call, the actual bean class instance that a client uses may be different from invocation to invocation.

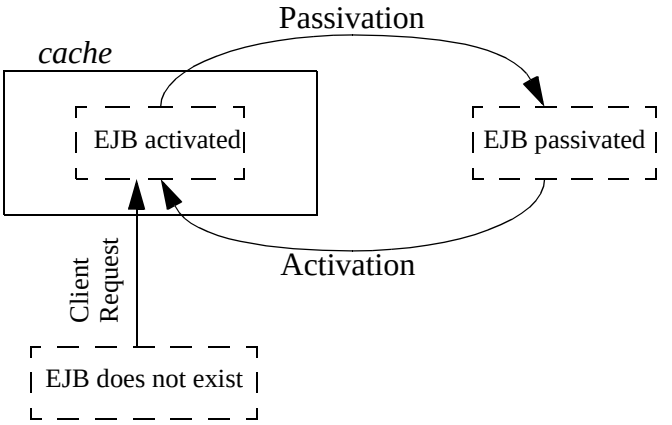
If all instances of an EJB class are active and `max-beans-in-free-pool` has been reached, new clients requesting the EJB class will be blocked until an active EJB completes a method call. If the transaction times out (or, for non-transactional calls, if five minutes elapse), WebLogic Server throws a `RemoteException` for a remote client or an `EJBException` for a local client.

Stateful Session EJB Life Cycle

WebLogic Server uses a cache of bean instances to improve the performance of stateful session EJBs. The cache stores active EJB instances in memory so that they are immediately available for client requests. Active EJBs consist of instances that are currently in use by a client, as well as instances that were recently in use, as described in the following sections. The cache is unlike the free pool insofar as stateful session beans in the cache are bound to a particular client, while the stateless session beans in the free pool have no client association.

The following figure illustrates the WebLogic Server cache, and the processes by which stateful EJBs enter and leave the cache. Dotted lines indicate the state of the EJB from the perspective of WebLogic Server.

Figure 4-2 WebLogic Server cache showing stateful session EJB life cycle



Activating and Using Stateful Session EJB Instances

No stateful session EJB instances exist in WebLogic Server at startup time. As clients look up and obtain references to individual beans, WebLogic Server initializes new instances of the EJB class and stores them in the cache.

Passivating Stateful Session EJBs

To achieve high performance, WebLogic Server reserves the cache for EJBs that clients are currently using and EJBs that were recently in use. When EJBs no longer meet these criteria, they become eligible for *passivation*. Passivation is the process by which WebLogic Server removes an EJB from cache while preserving the EJB's state on disk. While passivated, EJBs use minimal WebLogic Server resources and are not immediately available for client requests (as they are while in the cache).

Note: Stateful session EJBs must abide by certain rules to ensure that bean fields can be serialized to persistent storage. See "Stateful Session EJB Requirements" on page 4-7 for more information.

The `max-beans-in-cache` deployment element in the `weblogic-ejb-jar.xml` file provides some control over when EJBs are passivated.

If max-beans-in-cache is reached and EJBs in the cache are not being used, WebLogic Server passivates some of those beans. This occurs even if the unused beans have not reached their idle-timeout-seconds limit. If max-beans-in-cache is reached and all EJBs in the cache are being used by clients, WebLogic Server throws a CacheFullException.

Note: When an EJB becomes eligible for passivation, it does not mean that WebLogic Server passivates the bean immediately. In fact, the bean may not be passivated at all. Passivation occurs only when the EJB is eligible for passivation and there is pressure on server resources, or when WebLogic Server performs regular cache maintenance.

You can specify the explicit passivation of stateful EJBs that have reached idle-timeout-seconds by setting the cache-type element in the weblogic-ejb-jar.xml file. This setting has two values: least recently used (LRU) and not recently used (NRU).

If you specify LRU, the container passivates the bean when idle-timeout-seconds is reached.

If you specify NRU, the container passivates the bean when there is pressure in the cache and idle-timeout-seconds determines how often the container checks to see how full the cache is.

Removing Stateful Session EJB Instances

The max-beans-in-cache and idle-timeout-seconds deployment elements also exert control over when stateful session EJBs are removed from the cache or from disk:

- *For cached EJB instances*: When WebLogic Server detects that EJB classes are approaching their max-beans-in-cache limit, WebLogic Server takes EJB instances that have not been used for idle-timeout-seconds and removes them from the cache (rather than passivating them to disk). Removing, rather than passivating, the instance ensures that "inactive" EJBs do not consume cache or disk resources in WebLogic Server.

  If a stateful session bean is idle for *longer* than idle-timeout-seconds, WebLogic Server may remove the instance from memory as regular cache maintenance, even if the EJB class is max-beans-in-cache limit has not been reached.

Note: Setting `idle-timeout-seconds` to 0 stops WebLogic Server from removing EJBs that are idle for a period of time. However, EJBs may still be passivated if cache resources become scarce.

- *For passivated EJB instances*: After a stateful session EJB instance is passivated, a client must use the EJB instance before `idle-timeout-seconds` is reached. Otherwise, WebLogic Server removes the passivated instance from disk.

Stateful Session EJB Requirements

The EJB developer must ensure that a call to the `ejbPassivate()` method leaves a stateful session bean in a condition where WebLogic Server can serialize its data and passivate the bean's instance. During passivation, WebLogic Server attempts to serialize any fields that are not declared `transient`. This means that you must ensure that all non-`transient` fields represent serializable objects, such as the bean's remote or home interface.

Using max-beans-in-free-pool

In general, you should not set the `max-beans-in-free-pool` element for stateless session beans. The only reason to set `max-beans-in-free-pool` is to limit access to an underlying resource. For example, if you use stateless session EJBs to implement a legacy connection pool, you do not want to allocate more bean instances than the number of connections that can support your legacy system. When you ask the free pool for a bean instance, there are three possible scenarios that you can follow:

- **Option 1:** An instance is available in the pool. WebLogic Server makes that instance available and you proceed with processing.
- **Option 2:** No instance is available in the pool, but the number of instances in use is less then `max-beans-in-free-pool`. WebLogic Server allocates a new bean instance and gives it to you.
- **Option 3:** No instances are available in the pool and the number of instances in use is already `max-beans-in-free-pool`. You wait until either your transaction times out or a bean instance that already exists in the pool becomes available.

By default, `max-beans-in-free-pool` is set to 1000. Essentially, it means that Option 3 should never happen because you will always just allocate a new bean instance. However, you are limited by the number of executable threads. In most cases, each thread needs, at most, a single bean instance.

Special Use of max-beans-in-free-pool

The following options describe special cases when `max-beans-in-free-pool` can be set to `0`:

- **Stateless Session Beans**: WebLogic Server always creates a new instance for stateless session beans.
- **Stateful Session Beans:** Not applicable for stateful session beans. These beans are not pooled.
- **Message-Driven Beans:** Illegal instances of message-driven beans are created and registered as JMS listeners during deployment. WebLogic Server never creates new instances at runtime. So, `max-beans-in-free-pool` must be set to less then zero (`< 0`.)

Note:

EJBs in WebLogic Server Clusters

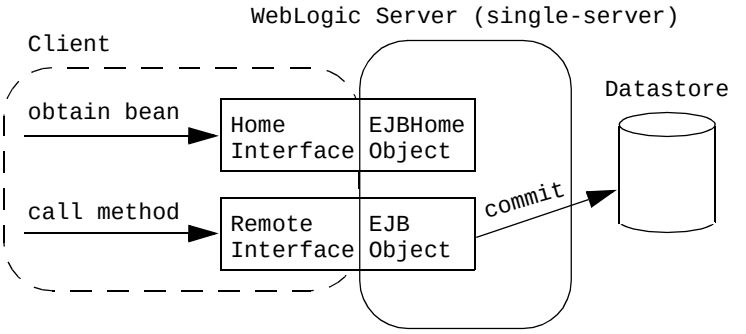
This section providers information on how the EJB container supports clustering services. It describes the behavior of EJBs and their associated transactions in a WebLogic Server cluster, and explains key deployment descriptors that affect EJB behavior in a cluster.

EJBs in a WebLogic Server cluster use modified versions of two key structures: the Home object and the EJB object. In a single server (unclustered) environment, a client looks up an EJB through the EJB's home interface, which is backed on the server by a

corresponding Home object. After referencing the bean, the client interacts with the bean's methods through the remote interface, which is backed on the server by an EJB object.

The following figure shows EJB behavior in a single server environment.

Figure 4-3 Single server behavior



Note: Failover of EJBs work only between a *remote* client and the EJB.

Clustered EJB Home Objects

In a WebLogic Server cluster, the client-side representation of the Home object can be replaced by a cluster-aware "stub." The cluster-aware home stub has knowledge of EJB Home objects on all WebLogic Servers in the cluster. The clustered home stub provides load balancing by distributing EJB lookup requests to available servers. It can also provide failover support for lookup requests, because it routes those requests to available servers when other servers have failed.

All EJB types — stateless session, stateful session, and entity EJBs — can have cluster-aware home stubs. Whether or not a cluster-aware home stub is created is determined by the `home-is-clusterable` deployment element in `weblogic-ejb-jar.xml`.

Clustered EJBObjects

In a WebLogic Server cluster, the server-side representation of the EJBObject can also be replaced by a replica-aware EJBObject stub. This stub maintains knowledge about all copies of the EJBObject that reside on servers in the cluster. The EJBObject stub can provide load balancing and failover services for EJB method calls. For example, if a client invokes an EJB method call on a particular WebLogic Server and the server goes down, the EJBObject stub can failover the method call to another, running server.

Whether or not an EJB can use a replica-aware EJBObject stub depends on the type of EJB deployed and, for entity EJBs, the cache strategy selected at deployment time.

Session EJBs in a Cluster

This section describes cluster capabilities and limitations for stateful and stateless session EJBs.

Stateless Session EJBs

Stateless session EJBs can have both a cluster-aware home stub and a replica-aware EJBObject stub. By default, WebLogic Server provides failover services for EJB method calls, but only if a failure occurs *between* method calls. For example, failover is automatically supported if a failure occurs after a method completes, or if the method fails to connect to a server. When failures occur while an EJB method is in progress, WebLogic Server does not automatically fail over from one server to another.

This default behavior ensures that database updates within an EJB method are not "duplicated" due to a failover scenario. For example, if a client calls a method that increments a value in a datastore and WebLogic Server fails over to another server before the method completes, the datastore would be updated twice for the client's single method call.

If methods are written in such a way that repeated calls to the same method do not cause duplicate updates, the method is said to be "idempotent." For idempotent methods, WebLogic Server provides two `weblogic-ejb-jar.xml` deployment properties, one at the bean level and one at the method level.

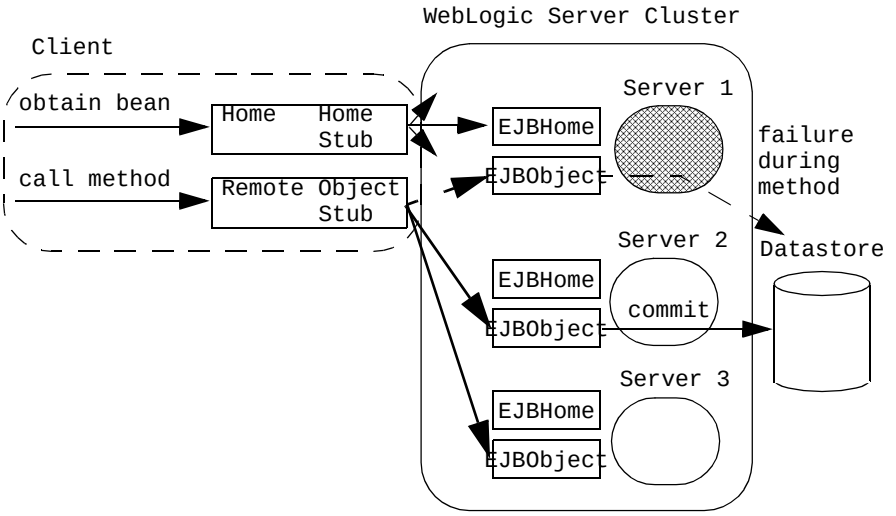
At the bean level, if you set `stateless-bean-methods-are-idempotent` to “true”, WebLogic Server assumes that the method is idempotent and *will* provide failover services for the EJB method, even if a failure occurs during a method call.

At the method level, you can use the `idempotent-methods` deployment property to accomplish the same thing:

```
<idempotent-methods>
        <method>
                <description>...</description>
                <ejb-name>...</ejb-name>
                <method-intf>...</method-intf>
                <method-name>...</method-name>
                <method-params>...</method-params>
        </method>
</idempotent-methods>
```

The following figure illustrates stateless session EJBs in a WebLogic Server clustered environment.

Figure 4-4 Stateless session EJBs in a clustered server environment



Stateful Session EJBs

To enable stateful session EJBs to use cluster-aware home stubs, set `home-is-clusterable` to "true." This provides failover and load balancing for stateful EJB lookups. Stateful session EJBs configured this way use replica-aware EJBObject stubs. For more information on in-memory replication for stateful session EJBs, see "In-Memory Replication for Stateful Session EJBs" on page 4-13.

Note: Load balancing and failover are discussed extensively in *Using WebLogic Server Clusters*. See these three sections: "EJB and RMI Objects", "Load Balancing for EJBs and RMI Objects" and "Replication and Failover for EJBs and RMIs".

In-Memory Replication for Stateful Session EJBs

The following sections describe how the EJB Container supports replication services. The WebLogic Server EJB container supports clustering for stateful session EJBs. Whereas in WebLogic Server 5.1 only the `EJBHome` object is clustered for stateful session EJBs, the EJB container can also replicate the state of the EJB across clustered WebLogic Server instances.

Replication support for stateful session EJBs is transparent to clients of the EJB. When a stateful session EJB is deployed, WebLogic Server creates a cluster-aware `EJBHome` stub and a replica-aware `EJBObject` stub for the stateful session EJB. The `EJBObject` stub maintains a list of the primary WebLogic Server instances on which the EJB instance runs, as well as the name of a secondary WebLogic Server to use for replicating the bean's state.

Each time a client of the EJB commits a transaction that modifies the EJB's state, WebLogic Server replicates the bean's state to the secondary server instance. Replication of the bean's state occurs directly in memory, for best performance in a clustered environment.

Should the primary server instance fail, the client's next method invocation is automatically transferred to the EJB instance on the secondary server. The secondary server becomes the primary WebLogic Server for the EJB instance, and a new secondary server handles possible additional failovers. Should the EJB's secondary server fail, WebLogic Server enlists a new secondary server instance from the cluster.

Clients of a stateful session EJB are therefore guaranteed to have quick access to the latest committed state of the EJB, except under the special circumstances described in "Limitations of In-Memory Replication" on page 4-14. For more information on the use of replication groups, see Using Replication Groups.

Requirements and Configuration for In-Memory Replication

To replicate the state of a stateful session EJB in a WebLogic Server cluster, make sure that the cluster is homogeneous for the EJB class. In other words, deploy the same EJB class to every WebLogic Server instance in the cluster, using the same deployment descriptor. In-memory replication is not supported for heterogeneous clusters.

By default, WebLogic Server does not replicate the state of stateful session EJB instances in a cluster. This models the behavior released with WebLogic Server Version 6.0. To enable replication, set the `replication-type` deployment parameter in the `weblogic-ejb-jar.xml` deployment file to `InMemory`.

Figure 4-5 XML sample enabling replication

```
<stateful-session-clustering>

       ...

       <replication-type>InMemory</replication-type>

</stateful-session-clustering>
```

Limitations of In-Memory Replication

By replicating the state of a stateful session EJB, clients are generally guaranteed to have the last committed state of the EJB, even if the primary WebLogic Server instance fails. However, in the following rare failover scenarios, the last committed state may not be available:

- A client commits a transaction involving a stateful EJB, but the primary WebLogic Server fails before the EJB's state is replicated. In this case, the client's next method invocation works against the previous committed state.
- A client creates an instance of a stateful session EJB and commits an initial transaction, but the primary WebLogic Server fails before the EJB's initial state can be replicated. The client's next method invocation fails to locate the bean instance, because the initial state could not be replicated. The client needs to recreate the EJB instance, using the clustered `EJBHome` stub, and restart the transaction.
- Both the primary and secondary servers fail. The client needs to recreate the EJB instance and restart the transaction.

Entity EJBs in a Cluster

As with all EJB types, entity EJBs can utilize cluster-aware home stubs once you set `home-is-clusterable` to "true."

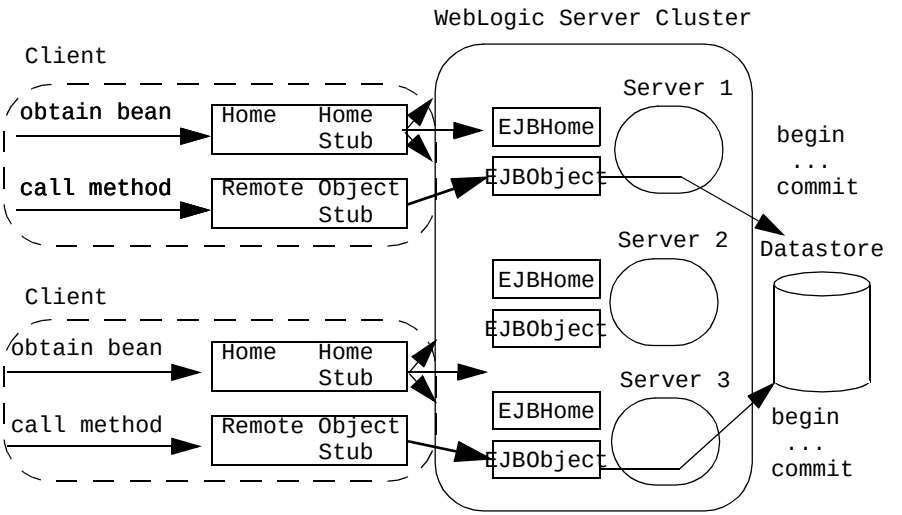
Read-Write Entity EJBs in a Cluster

`read-write` entity EJBs in a cluster behave similarly to entity EJBs in a non-clustered system, in that:

- Multiple clients can use the bean in transactions.
- `ejbLoad()` is always called at the beginning of each transaction when `cache-between-transactions` is set to `false`.
- `ejbStore()` behavior is governed by the rules described in "ejbLoad() and ejbStore() Behavior for Entity EJBs" on page 6-11.

Figure 4-6 shows read-write entity EJBs in a WebLogic Server clustered environment. The three arrows on Home Stub point to all three servers and show multiple client access.

Figure 4-6 Read-write entity EJBs in a clustered server environment



Note: In the preceding figure, the set of three arrows for both home stubs refers to the EJBHome on each server.

`read-write` entity EJBs support automatic failover on a safe exception, if `home-is-clusterable` is set to true. For example, failover is automatically supported if there is a failure after a method completes, or if the method fails to connect to a server.

Cluster Address

When you configure a cluster, you supply a cluster address that identifies the Managed Servers in the cluster. The cluster address is used in entity and stateless beans to construct the host name portion of URLs. If the cluster address is not set, EJB handles may not work properly. For more information on cluster addresses, see Using WebLogic Server Clusters.

Transaction Management

The following sections provide information on how the EJB container supports transaction management services. They describe EJBs in several transaction scenarios. EJBs that engage in distributed transactions (transactions that make updates in multiple datastores) guarantee that all branches of the transaction commit or roll back as a logical unit.

The current version of WebLogic Server supports Java Transaction API (JTA), which you can use to implement distributed transactional applications.

Also, two-phase commit is supported for both 1.1 and 2.0 EJBs. The **two-phase commit protocol** is a method of coordinating a single transaction across two or more resource managers. It guarantees data integrity by ensuring that transactional updates are committed in all participating databases, or are fully rolled back out of all the databases, reverting to the state prior to the start of the transaction.

Transaction Management Responsibilities

Session EJBs can rely on their own code, their client's code, or the WebLogic Server container to define transaction boundaries. EJBs can use container- or client-demarcated transaction boundaries, but they cannot define their own transaction boundaries unless they observe certain restrictions.

- In **bean-managed transactions**, the EJB' code manages the transaction demarcation. If bean- or client-managed transactions are required, you must provide the java code and use the `javax.transaction.UserTransaction` interface. The EJB or client can then access a `UserTransaction` object through JNDI and specify transaction boundaries with explicit calls to `tx.begin()`, `tx.commit()`, `tx.rollback()`. See "Using javax.transaction.UserTransaction" on page 4-17 for more information on defining transaction boundaries.
- In **container-managed transactions**, the WebLogic Server EJB container manages the transaction demarcation. For EJBs that use container-managed transactions (or EJBs that mix container and bean-managed transactions) you can use several deployment elements to control the transactional requirements for individual EJB methods. For more information about the deployment descriptors, see *Programming WebLogic EJB*.

Note: If the EJB provider does not specify a transaction attribute for a method in the `ejb-jar.xml` file, WebLogic Server uses the *`supports`* attribute by default.

The sequence of transaction events differs between container-managed and bean-managed transactions.

Using javax.transaction.UserTransaction

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");
```

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 datastore.

Once you create a database connection within a transaction context, that connection becomes "reserved" until the transaction either commits or rolls back. To maintain performance and throughput for your applications, always ensure that your transaction completes quickly, so that the database connection can be released and made available to other client requests. See "Preserving Transaction Resources" on page 2-8 for more information.

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

Restriction for Container-Managed EJBs

You cannot use the `javax.transaction.UserTransaction` method within an EJB that uses container-managed transactions.

Transaction Isolation Levels

There are two ways to begin a transaction: explicitly with a user transaction or automatically using the EJB container. To do this you set the isolation level for the transaction. The isolation level defines how concurrent transactions accessing a persistent store are isolated from one another for read purposes.

Setting User Transaction Isolation Levels

You set the isolation level for user transactions in the beans java code. When the application runs, the transaction is explicitly started. See Figure 4-7 for a code sample of how to set the level.

Figure 4-7 Sample Java Code setting user transaction isolation levels

```
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 TRANSACTION_READ_COMMITED

Transaction tx = TxHelper.getTransaction();
       tx.setProperty (TxConstants.ISOLATION_LEVEL, new Integer
        (Connection.TRANSACTION_READ_COMMITED));

//perform transaction work

       tx.commit();
```

Setting Container-Managed Transaction Isolation Levels

You set the isolation level for container-managed transactions in the `transaction-isolation` element of the `weblogic-ejb-jar.xml` deployment file. WebLogic Server passes this value to the underlying database. The behavior of the transaction depends both on the EJB's isolation level setting and the concurrency control of the underlying persistent store. For more information on setting container-managed transaction isolation levels, see Programming WebLogic JTA.

Limitations of TransactionSerializable

Many datastores provide limited support for detecting serialization problems, even for a single user connection. Therefore, even if you set `transaction-isolation` to `TransactionSerializable`, you may experience serialization problems due to the limitations of the datastore.

Refer to your RDBMS documentation for more details about isolation level support.

Special Note for Oracle Databases

Oracle uses optimistic concurrency. As a consequence, even with a setting of `TransactionSerializable`, Oracle does not detect serialization problems until commit time. The message returned is:

```
java.sql.SQLException: ORA-08177: can't serialize access for this
transaction
```

Even if you use the `TransactionSerializable` setting for an EJB, you may receive exceptions or rollbacks in the EJB client if contention occurs between clients for the same rows. To avoid these problems, make sure that the code in your client application catches and examines the SQL exceptions, and that you take the appropriate action to resolve the exceptions, such as restarting the transaction.

In addition, use WebLogic Server's optimistic concurrency strategy with a ReadCommitted isolation level.

You specify the locking mechanism that the EJB uses by setting the concurrency-strategy deployment parameter in `weblogic-ejb-jar.xml`. You set concurrency-strategy at the individual EJB level, so that you can mix locking mechanisms within the EJB container.

The following excerpt from `weblogic-ejb-jar.xml` shows how to set an optimistic concurrency strategy for an EJB.

```
<entity-descriptor>
              <entity-cache>
              ...

<concurrency-strategy>Optimistic</concurrency-strategy>
              </entity-cache>
              ...
</entity-descriptor>
```

With WebLogic Server, set the isolation level for transactions as follows:

- `TransactionReadCommittedForUpdate` for methods on which this option is defined. When set, every `SELECT` query from that point on will have `FOR UPDATE` added to acquired locks on the selected rows. Consequently, if Oracle cannot lock the rows affected by the query immediately, then it waits until the rows are free. This condition remains in effect until the transaction does a `COMMIT` or `ROLLBACK`.

- `TransactionReadCommittedForUpdateNoWait` for methods on which the option is defined. When set, every `SELECT` query from that point on will have `FOR_UPDATE_NOWAIT` added to acquire locks on the selected rows. Consequently, if Oracle cannot lock the rows affected by the query immediately, then Oracle terminates the query before completion. This condition remains in effect until the transaction does a `COMMIT` or `ROLLBACK`.

  Note: `FOR_UPDATE_NOWAIT` affects container-managed beans only.

Distributing Transactions Across Multiple EJBs

WebLogic Server does support transactions that are distributed over multiple datasources; a single database transaction can span multiple EJBs on multiple servers. You can explicitly enable support for these types of transactions by starting a transaction and invoking several EJBs. Or, a single EJB can invoke other EJBs that implicitly work within the same transaction context. The following sections describe these scenarios.

Calling Multiple EJBs from a Single Transaction Context

In the following code fragment, a client application obtains a `UserTransaction` object and uses it to begin and commit a transaction. The client invokes two EJBs within the context of the transaction. The transaction attribute for each EJB is set to `Required`:

Figure 4-8 Beginning and committing a transaction

```
import javax.transaction.*;

...

u = (UserTransaction)
jndiContext.lookup("javax.transaction.UserTransaction");

u.begin();

account1.withdraw(100);

account2.deposit(100);

u.commit();

...
```

In the above code fragment, updates performed by the "account1" and "account2" EJBs occur within the context of a single `UserTransaction`. The EJBs commit or roll back as a logical unit. This is true regardless of whether "account1" and "account2" reside on the same WebLogic Server, multiple WebLogic Servers, or a WebLogic Server cluster.

The only requirement for wrapping EJB calls in this manner is that both "account1" and "account2" must support the client transaction. The beans' `trans-attribute` element must be set to `Required`, `Supports`, or `Mandatory`.

Encapsulating a Multi-Operation Transaction

You can also use a "wrapper" EJB that encapsulates a transaction. The client calls the wrapper EJB to perform an action such as a bank transfer. The wrapper EJB responds by starting a new transaction and invoking 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 EJB's `trans-attribute` element is set to `Required` or `RequiresNew`. The `trans-attribute` element is set in the `ejb-jar.xml` file. All EJBs invoked by the wrapper EJB must be able to support the transaction context (their `trans-attribute` elements must be set to `Required`, `Supports`, or `Mandatory`).

Distributing Transactions Across EJBs in a WebLogic Server Cluster

WebLogic Server provides additional transaction performance benefits for EJBs that reside in a WebLogic Server cluster. When a single transaction utilizes multiple EJBs, WebLogic Server attempts to use EJB instances from a single WebLogic Server instance, rather than using EJBs from different servers. This approach minimizes network traffic for the transaction.

In some cases, a transaction can use EJBs that reside on multiple WebLogic Server instances in a cluster. This can occur in heterogeneous clusters, where all EJBs have not been deployed to all WebLogic Server instances. In these cases, WebLogic Server uses a multitier connection to access the datastore, rather than multiple direct connections. This approach uses fewer resources, and yields better performance for the transaction.

However, for best performance, the cluster should be homogeneous — all EJBs should reside on all available WebLogic Server instances.

Database Insert Support

WebLogic Server allows you to control when and how the EJB container inserts newly created beans into the database.You specify your preference by setting the `delay-database-insert-until` deployment descriptor element in the `weblogic-cmp-rdbms-jar.xml` file. This element allows you to choose:

- To delay the database insert until after the EJB Container performs either an `ejbCreate` or `ejbPostCreate`, as described in "Delay-Database-Insert-Until" on page 4-23.
- To insert multiple entries into the database in one SQL statement, as described in "Batch Operations" on page 4-24.

Delay-Database-Insert-Until

The permitted values for the `delay-database-insert-until` element are:

- `ejbCreate` - This method performs a database insert immediately after `ejbCreate`.
- `ejbPostCreate` - This method performs an insert immediately after `ejbPostCreate` (default).

Figure 4-9 Sample xml specifying delay-database-insert-until

```
<delay-database-insert-until>ejbPostCreate</delay-database-insert
-until> -->
```

By default, the database insert occurs after the client calls the `ejbPostCreate` method. The EJB container delays inserting the new bean when you specify either the `ejbCreate` or `ejbPostCreate` options for the `delay-database-insert-until` element in the `weblogic-cmp-rdbms-jar.xml` file. Setting either of these options specifies the precise time at which the EJB Container inserts a new bean that uses RDBMS CMP into the database.

You must specify that the EJB Container delaying the database insert until after `ejbPostCreate` when a `cmr-field` is mapped to a `foreign-key column` that does not allow null values. In this case, set the `cmr-field` to a non-null value in `ejbPostCreate` before the bean is inserted into the database.

Note: You may not set the `cmr-fields` during a `ejbCreate` method call, before the primary key of the bean is known.

BEA recommends that you specify the delay the database insert until after `ejbPostCreate` if the `ejbPostCreate` method modifies the bean's persistent field. Doing so yields better performance by avoiding an unnecessary store operation.

For maximum flexibility, avoid creating related beans in their `ejbPostCreate` method. Creating these additional instances may make delaying the database insert impossible if database constraints prevent related beans from referring to a bean that has not yet been created.

Batch Operations

Multiple instances of same type of container-managed persistence (cmp) entity beans are often changed in a single transaction. Each cmp entity bean instance is often an entry in a database table, and the EJB container will make a database update for every cmp entity bean instance. Sometimes, a transaction needs to update thousands of cmp entity bean instances, so it will cause thousands of database roundtrips. This is not a very efficient process, and becomes a performance bottleneck.

Application developers often have to take the performance impact or use SQL statements directly to update entries in the database; neither solution is desirable.

The EJB batch operations features solves this problem by updating multiple entries in a database table in one SQL statement. Batch operations support increases the performance of container-managed persistence (CMP) bean creation by enabling the EJB container to perform multiple database inserts, deletes or updates for CMP beans in one SQL statement, thereby economizing network roundtrips.

To permit batch database inserts, updates or deletes, set the `enable-batch-operations` element in the `weblogic-cmp-rdbms-jar.xml` file to `True`.

Database Operation Ordering

The batch operations feature includes database operation ordering functionality that can prevent constraint errors by sorting database dependency between batch inserts, updates and deletes. For example, performing an update before an insert or after a delete triggers a constraint error.

With database ordering feature enabled, the EJB container sorts out these dependencies, and sends batch operations to the database in such way that does not cause any database exceptions. To enable this database ordering, set the `order-database-operations` element of `weblogic-cmp-rdbms-jar.xml` to `True`.

Enabling database ordering instructs the EJB container to do two things:

- Delay all database operations to commit time
- Order database operations at commit time

For more information on the `order-database-operations` element, see "order-database-operations" on page 12-42.

Batch Operations Guidelines and Limitations

When using batch operations, you must set the boundary for the transaction, as batch operations only apply to the inserts, updates or deletes between `transaction begin` and `transaction commit`.

Note: Batch operations only work with drivers that support the `addBatch()` and `executeBatch()` methods. If the EJB container detects unsupported drivers, it reports that batch operations are not supported and disables batch operations.

There are several limitations on using batch operations:

- The total number of entries created in a single batch operation cannot exceed the `max-beans-in-cache` setting, which is specified in the `weblogic-ejb-jar.xml` file. See "max-beans-in-cache" on page 11-54 for more information on this element.
- If you set the `dbms-column-type` element in the `weblogic-cmp-rdbms-jar.xml` file to either `OracleBlob` or `OracleClob`, batch operation automatically turns off because you will not save much time if a

Blob or Clob column exist in the database table. In this case, WebLogic Server performs one insert per bean, which is the default behavior.

For more information on the `enable-batch-operations` element, see "enable-batch-operations" on page 12-25.

Resource Factories

The following sections provide information on how the EJB container supports resource services. In WebLogic Server, EJBs can access JDBC connection pools by directly instantiating a JDBC pool driver. However, it is recommended that you instead bind a JDBC datasource resource into the WebLogic Server JNDI tree as a resource factory.

Using resource factories enables the EJB to map a resource factory reference in the EJB deployment descriptor to an available resource factory in a running WebLogic Server. Although the resource factory reference must define the type of resource factory to use, the actual name of the resource is not specified until the bean is deployed.

The following sections explain how to bind JDBC datasource and URL resources to JNDI names in WebLogic Server.

Note: WebLogic Server also supports JMS connection factories.

Setting Up JDBC Data Source Factories

Follow these steps to bind a `javax.sql.DataSource` resource factory to a JNDI name in WebLogic Server. Note that you can set up either a transactional or non-transactional JDBC datasource as necessary.

With a non-transactional data source, the JDBC connection operates in auto commit mode, committing each insert and update operation to the database immediately, rather than as part of a container-managed transaction.

With a transactional data source, multiple insert and update operations in a method can be submitted as a single, container-managed transaction that either commits or rolls back as a logical unit.

Note: Entity beans that use container-managed persistence should always use a transactional data source, rather than a non-transactional data source, to preserve data consistency.

To create a JDBC data source factory:

1. Set up a JDBC connection pool in the Administration Console. See Managing JDBC Connectivity in the Administration Console Online Help for more information.
2. Start WebLogic Server.
3. Start WebLogic Server Administration Console.
4. In the left pane of the Console, click the Services node and expand JDBC.
5. Select JDBC Data Source Factory and click the Configure a New JDBC Data Source Factory option in the right pane.
6. Enter values in the Name, User Name, URL, Driver Class Name, and Factory Name, attribute fields.
7. Enter any connection properties in the Properties attribute field.

   a. *For non-transactional JDBC datasources*, enter:

   `weblogic.jdbc.DataSource.`*`jndi_name`*`=`*`pool_name`*

   where *`jndi_name`* is the full WebLogic Server JNDI name to bind to the datasource and *`pool_name`* is the name of the WebLogic Server connection pool you created in step 1.

   For example, to set up a non-transactional connection pool for demonstration purposes, you might enter:

   ```
   weblogic.jdbc.DataSource.weblogic.jdbc.demoPool=demoPool
   ```

   This binds a datasource for the “demoPool” pool to the JNDI name, “weblogic.jdbc.demoPool”.

   b. *For transactional JDBC datasources*, select Tx Data Sources from the left pane of the Administration Console, click Configure a New JDBC Tx Data Source in the right pane, and enter:

`weblogic.jdbc.TXDataSource.`*`jndi_name=pool_name`*

where *`jndi_name`* is the full WebLogic Server JNDI name to bind to the transactional datasource and *`pool_name`* is the name of the WebLogic Server connection pool you created in step 1.

For example, to set up a transactional connection pool for demonstration purposes, you might enter:

```
weblogic.jdbc.TXDataSource.weblogic.jdbc.jts.demoPool=demoPool
```

This binds a transactional datasource for the "demoPool" pool to the JNDI name, "weblogic.jdbc.jts.demoPool".

8. Click Create to create the JDBC Data Source Factory. The new Data Source Factory is added under the JDBC Data source Node in the left pane.
9. Click Apply to save the changes.
10. Bind the JNDI name of the datasource to the EJB's local JNDI environment by doing one of the following:
    - Map an existing EJB resource factory reference to the JNDI name.
    - Directly edit the `resource-description` element in the `weblogic.ejb-jar.xml` deployment file. See "Specifying and Editing the EJB Deployment Descriptors" on page 7-5 for instructions on editing deployment descriptors.

Setting Up URL Connection Factories

To set up a URL connection factory in WebLogic Server, bind a URL string to a JNDI name using these instructions:

1. In a text editor, open the `config.xml` file for the instance of the WebLogic Server you are using and set the `URLResource` attribute for the following `config.xml` elements:
    - `WebServer`
    - `VirtualHost:`
2. Set the `URLResource` attribute for the `WebServer` element using the following syntax:

```
<WebServer URLResource="weblogic.httpd.url.testURL=http://
localhost:7701/testfile.txt" DefaultWebApp="default-tests"/>
```

3. Set the `URLResource` attribute for the `VirtualHost` element, when virtual hosting is required, using the following syntax:

```
<VirtualHostName=guestserver" targets="myserver,test_web_server
"URLResource="weblogic.httpd.url.testURL=http://
localhost:7701/testfile.txt" VirtualHostNames="guest.com"/>
```

4. Save the changes in the `config.xml` file and reboot WebLogic Server.

Using EJB Links

WebLogic Server fully supports EJB links as defined in the EJB 2.0 Specification. You can link an EJB reference that is declared in one application component to an enterprise bean that is declared in the same J2EE application.

To create an `ejb-link`:

1. Specify the link to the EJB using the optional `ejb-link` deployment descriptor element of the `ejb-ref` element of the referencing application component.

   The value of the `ejb-link` element must be the `ejb-name` of the target EJB. The target EJB can be in any EJB JAR file in the same J2EE application as the referencing application component.

   Because ejb-names are not required to be unique across EJB JAR files, you may need to provide the qualified path for the link.

2. Use the following syntax to provide the path name for the EJBs within the same J2EE application.

   ```
   <ejb-link>../products/product.jar#ProductEJB</ejb-link>
   ```

   This reference provides the path name of the EJB JAR file that contains the referenced EJB with the appended `ejb-name` of the target bean separated from the path by "#". The path name is relative to the referencing application component JAR file.

- For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

CHAPTER

5 WebLogic Server Container-Managed Persistence Service - Basic Features

The following sections describe the basic features of the container-managed persistence (CMP) service available with the WebLogic Server EJB container, where "basic" refers to features developers should be familiar with in order to write an EJB application and get it running. For a discussion of advanced CMP features, see Chapter 6, "WebLogic Server Container-Managed Persistence Service - Advanced Features."

- "Overview of Container Managed Persistence Service" on page 5-2
- "Using Primary Keys" on page 5-4
- "Container-Managed Persistence Relationships" on page 5-7
- "Using EJB QL for EJB 2.0" on page 5-14
- "Using Dynamic Queries" on page 5-27
- "BLOB and CLOB DBMS Column Support for the Oracle DBMS" on page 5-29
- "Cascade Delete" on page 5-30
- "Flushing the CMP Cache" on page 5-32

- "Java Data Types for CMP Fields" on page 5-33
- "EJB Concurrency Strategy" on page 5-35
- "Automatic Database Detection" on page 5-41

Overview of Container Managed Persistence Service

WebLogic Server's container is responsible for providing a uniform interface between the EJB and the server. The container creates new instances of the EJBs, manages these bean resources, and provides persistent services such as, transactions, security, concurrency, and naming at runtime. In most cases, EJBs from earlier version of WebLogic Server run in the container. However, see the Migration Guide for information on when you would need to migrate your bean code. See "prompt> java weblogic.ejbc -normi c:%SAMMPLES_HOME%\server\src\examples\ejb\basic\containerManaged\build\std_ejb_basic_containerManaged.jar" on page 10-34 for instructions on using the conversion tool.

WebLogic Server's container-managed persistence (CMP) model handles persistence of CMP entity beans automatically at runtime by synchronizing the EJB's instance fields with the data in the database.

EJB Persistence Services

WebLogic Server provides persistence services for entity beans. An entity EJB can save its state in any transactional or non-transactional persistent storage ("bean-managed persistence"), or the container can save the EJB's non-transient instance variables automatically ("container-managed persistence"). WebLogic Server allows both choices and a mixture of the two.

If an EJB will use container-managed persistence, you specify the type of persistence services that the EJB uses in the `weblogic-ejb-jar.xml` deployment file. High-level definitions for automatic persistence services are stored in the persistence-type and

persistence-use elements. The `persistence-type` element defines one or more automatic services that the EJB can use. The `persistence-use` element defines which service the EJB uses at deployment time.

Automatic persistence services use additional deployment files to specify their deployment descriptors, and to define entity EJB finder methods. For example, WebLogic Server RDBMS-based persistence services obtain deployment descriptors and finder definitions from a particular bean using the bean's `weblogic-cmp-rdbms-jar.xml` file, described in "Using WebLogic Server RDBMS Persistence" on page 5-3.

Third-party persistence services cause other file formats to configure deployment descriptors. However, regardless of the file type, you must reference the configuration file in the persistence-type and persistence-use elements in `weblogic-ejb-jar.xml`.

Note: Configure container-managed persistence beans with a connection pool with maximum connections greater than 1. WebLogic Server's container-managed persistence service sometimes needs to get two connections simultaneously.

Using WebLogic Server RDBMS Persistence

To use WebLogic Server RDBMS-based persistence service with your EJBs:

1. Create a dedicated XML deployment file.
2. Define the persistence elements for each EJB that will use container-managed persistence.
3. For help creating deployment descriptor files, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

If you use WebLogic Server's tool, prompt> java weblogic.ejbc -normi c:%SAMMPLES_HOME%\server\src\examples\ejb\basic\containerManaged\build\std_ejb_basic_containerManaged.jar to create this file, it is named `weblogic-cmp-rdbms-jar.xml`. If you create the file from scratch, you can save it to a different filename. However, you must ensure that the `persistence-type` and `persistence-use` elements in `weblogic-ejb-jar.xml` refer to the correct file.

`weblogic-cmp-rdbms-jar.xml` defines the persistence deployment descriptors for EJBs using WebLogic Server RDBMS-based persistence services.

In each `weblogic-cmp-rdbms-jar.xml` file you define the following persistence options:

- EJB connection pools or data source for EJB 2.0 CMP
- EJB field to database element mappings
- Query Language
  - WebLogic Query Language (WLQL) for EJB 1.1 CMP
  - WebLogic EJB-QL with WebLogic QL extension for EJB 2.0 CMP (optional)
- Finder method definitions (CMP 1.1)
- Foreign key mappings for relationships
- WebLogic Server-specific deployment descriptors for queries

Using Primary Keys

The primary key is an object that uniquely identifies an entity bean within its home. The container must be able to manipulate the primary key of an entity bean. Each entity bean class may define a different class for its primary key, but multiple entity beans can use the same primary key class. The primary key is specified in the deployment descriptor for the entity bean. You can specify a primary key class for an entity bean with container-managed persistence by mapping the primary key to either a single field or to multiple fields in the entity bean class.

Every entity object has a unique identity within its home. If two entity objects have the same home and the same primary key, they are considered identical. A client can invoke the `getPrimaryKey()` method on the reference to an entity object's remote interface to determine the entity object's identity within its home. The object identify associated with the a reference does not change during the lifetime of the reference. Therefore, the `getPrimaryKey()` method always returns the same value when called on the same entity object reference. A client that knows the primary key of an entity object can obtain a reference to the entity object by invoking the `findByPrimaryKey(key)` method on the bean's home interface.

Primary Key Mapped to a Single CMP Field

In the entity bean class, you can have a primary key that maps to a single CMP field. You use the `primkey-field` element, a deployment descriptor in the `ejb-jar.xml` file, to specify the container-managed field that is the primary key. The `prim-key-class` element must be the primary key field's class.

Primary Key Class That Wraps Single or Multiple CMP Fields

You can have a primary key class that maps to single or multiple fields. The primary key class must be `public`, and have a `public` constructor with no parameters. You use the `prim-key-class` element, a deployment descriptor in the `ejb-jar.xml` file to specify the name of the entity bean's primary key class. You can only specify the the class name in this deployment descriptor element. All fields in the primary key class must be declared public. The fields in the class must have the same name as the primary key fields in the `ejb-jar.xml` file.

Anonymous Primary Key Class

If your entity EJB uses an anonymous primary key class, you must subclass the EJB and add a `cmp-field` of type `java.lang.Integer` to the subclass. Enable automatic primary key generation for the field so that the container fills in field values automatically, and map the field to a database column in the `weblogic-cmp-rdbms-jar.xml` deployment descriptor.

Finally, update the `ejb-jar.xml` file to specify the EJB subclass, rather than the original EJB class, and deploy the bean to WebLogic Server.

If you use the original EJB (instead of the subclass) with an anonymous primary key class, WebLogic Server displays the following error message during deployment:

```
In EJB ejb_name, an 'Unknown Primary Key Class' ( <prim-key-class>
== java.lang.Object ) MUST be specified at Deployment time (as
something other than java.lang.Object).
```

Hints for Using Primary Keys

Some hints for using primary keys with WebLogic Server include:

- Do not make the primary key class a container-managed field.

  Although `ejbCreate` specifies the primary key class as a return type:

- Do not construct a new primary key class with an `ejbCreate`. Instead, allow the container to create the primary key class internally.
- Set the values of the primary key cmp-fields using the `setXXX` methods within the `ejbCreate` method.
- Do not use a cmp field of the type `BigDecimal` as a primary key field for CMP beans. The `boolean BigDecimal.equals (object x)` method considers two `BigDecimal` equal only if they are equal in value and scale. This is because there are differences in precision between the Java language and different databases. For example, the method does not consider `7.1` and `7.10` to be equal. Consequently, this method will most likely return false or cause the CMP bean to fail.

  If you need to use `BigDecimal` as the primary key, you should:

  a. Implement a primary key class.

  b. In this primary key class, implement the `boolean equal (Object x)` method.

  c. In the equal method, use `boolean BigDecimal.compareTo(BigDecimal val)`.

Mapping to a Database Column

WebLogic Server supports mapping a database column to a `cmp-field` and a `cmr-field` concurrently. The `cmp-field` is read-only in this case. If the `cmp-field` is a primary key field, specify that the value for the field be set when the `create()` method is invoked by using the `setXXX` method for the `cmp-field`.

Container-Managed Persistence Relationships

The entity bean relies on container-managed persistence to generate the methods that perform persistent data access for the entity bean instances. The generated methods transfer data between entity bean instances and the underlying resource manager. Persistence is handled by the container at runtime. The advantage of using container-managed persistence is that the entity bean can be logically independent of the data source in which the entity is stored. The container manages the mapping between the logical and physical relationships at runtime and manages their referential integrity.

Persistent fields and relationships make up the entity bean's abstract persistence schema. The deployment descriptors indicate that the entity bean uses container-managed persistence, and these descriptors are used as input to the container for data access.

Entity beans can have relationships with other beans. These relationships can be either bidirectional or unidirectional. For example, you can have bidirectional or unidirectional relationships for each of the three types of relationship mappings identified below, such as unidirectional one-to-one relationships or bidirectional one-to-one relationships.

You specify relationships in the `ejb-jar.xml` file and `weblogic-cmp-rdbms-jar.xml`. You specify container-managed field mappings in the `weblogic-cmp-rdbms-jar.xml` file.

WebLogic Server supports three types of relationship mappings that are managed by WebLogic container-managed persistence (CMP):

- One-to-one
- One-to-many
- Many-to-many

One-to-One Relationships

A WebLogic Server one-to-one relationship involves the physical mapping from a foreign key in one bean to the primary key in another bean. For more information on primary keys, see "Using Primary Keys" on page 5-4.

The following example shows a one-to one relationship mapped between an employee bean and another employee bean, the employee's manager.

Figure 5-1 Sample mapping of a one-to-one relationship

```
<weblogic-rdbms-relation>
       <relation-name>employee-manager</relation-name>
       <weblogic-relationship-role>
              <relationship-role-map>
                     <column-map>
                            <foreign-key-column>manager-id
                            </foreign-key-column>
                            <key-column>id</key-column>
                     </column-map>
              </relationship-role-map>
              <relationship-role-name>employee
              </relationship-role-name>
       </weblogic-relationship-role>
</weblogic-rdbms-relation>
```

In Figure 5-1, there is a `foreign-key-column`, called `manager-id` in the table. This is the field to which the bean on the employee side of the relationship is mapped. Also, there is a `foreign-key-column` that refers to the primary key column (`key-column`) called `id`, in the table to which the bean on the manager side of the relationship is mapped.

If either of the beans in the relationship is mapped to multiple tables, then the table for that bean that contains the foreign key or primary key must also be specified in the `relationship-role-map` element. For more information on `relationship-role-map`, see "relationship-role-map" on page 12-47.

One-to-Many Relationships

A WebLogic Server one-to-many relationship involves the physical mapping from a foreign key in one bean to the primary key of another. However, in a one-to-many relationship, the foreign key is always contained in the role that occupies the "many" side of the relationship. In a one-to-many relationship, the foreign key is always associated with the bean that is on the many side of the relationship. This means that the specification of the relationship-role-name in the following sample is redundant, but it is included for uniformity.

The following example shows a one-to many relationship mapped between an employees bean and a departments bean.

Figure 5-2 Sample mapping of a one-to-many relationship

```
<weblogic-rdbms-relation>
       <relation-name>employee-department</relation-name>
       <weblogic-relationship-role>
              <relationship-role-map>
                     <column-map>
                            <foreign-key-column>dept-id
                            </foreign-key-column>
                            <key-column>id</key-column>
                     </column-map>
              </relationship-role-map>
              <relationship-role-name>employee
              </relationship-role-name>
       </weblogic-relationship-role>
</weblogic-rdbms-relation>
```

In Figure 5-2, there is a `foreign key column`, called `dept-id` in the table. This is the field to which the bean on the employees side of the relationship is mapped. Also, there is a `foreign-key-column` that refers to the primary key column (`key-column`) called `id`, in the table to which the bean on the departments side of the relationship is mapped.

Many-to-Many Relationships

A WebLogic Server many-to-many relationship involves the physical mapping of a join table. Each row in the join table contains two foreign keys that maps to the primary keys of the entities involved in the relationship.

The following example shows a many-to many relationship mapped between a bean called friends and a bean called employees.

Figure 5-3 Sample mapping of a many-to-many relationship

```
<weblogic-rdbms-relation>
       <relation-name>friends</relation-name>
       <table-name>FRIENDS</table-name>
       <weblogic-relationship-role>
              <relationship-role-name>friend
                     </relationship-role-name>
              <relationship-role-name>
                     <<column-map>
                            <foreign-key-column>first-friend-id
                                   </foreign-key-column>
                            <key-column>id</key-column>
                     </column-map
              </relationship-role-map>
       <weblogic-relationship-role>
              <weblogic-relationship-role>
                     <relationship-role-name>second-friend
                            </relationship-role-name>
                     <relationship-role-map>
                            <column-map>
                                   <foreign-key-column>second-
                                   friend-id</foreign-key-column>
                                   <key-column>id</key-column>
                     </column-map>
              </relationship-role-map>
       </weblogic-relationship-role>
</weblogic-rdbms-relation>
```

In Figure 5-3, the `FRIENDS` join table has two columns, called `first-friend-id` and `second-friend-id,` Each column contains a foreign key that designates a particular employee who is a friend of another employee. The primary key column (`key-column`) of the employee table is called `id`. For this example, assume that the employee bean is mapped to a single table. If the employee bean is mapped to multiple tables, then the table containing the primary key column (`key-column`) must be specified in the `relationship-role-map`.

Unidirectional Relationships

Unidirectional relationships only navigate in one direction. For example, if entity A and entity B are in a one-to-one, unidirectional relationship and the direction is from entity A to entity B, than entity A is aware of entity B, but entity B is unaware of entity A. This type of relationship is implemented when you specify a cmr-field deployment descriptor element for the entity bean from which navigation can take place and no related `cmr-field` element is specified for the target entity bean.

You specify the `cmr-field` element in the `weblogic-cmp-rdbms-jar.xml` file. For more information on how to specify deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

Bidirectional Relationships

Bidirectional relationships navigate in both directions. These types of container-managed relationships can exist only between beans whose abstract persistence schemas are defined in the same `EJB-jar` file and therefore managed by the same container. For example, if entity A and entity B are in a one-to-one bidirectional relationship, both are aware of each other.

Removing Beans in Relationships

When a bean with a relationship to another bean is removed, the container automatically removes the relationship.

Local Interfaces

WebLogic Server provides support for local interfaces for session and entity beans. Local interfaces allow enterprise javabeans to work together within the same EJB container using different semantics and execution contexts. The EJBs are usually co-located within the same EJB container and execute within the same Java Virtual

Machine (JVM). This way, they do not use the network to communicate and avoid the over-head of a Java Remote Method Invocation-Internet Inter-ORB Protocol (RMI-IIOP) connection.

EJB relationships with container-managed persistence are now based on the EJB's local interface. Any EJB that participates in a relationship must have a local interface. Local interface objects are lightweight persistent objects. They allow you to do more fine grade coding than do remote objects. Local interfaces also use pass-by-reference. The getter is in the local interface.

In earlier versions of WebLogic Server, you can base relationships on remote interfaces. However, CMP relationships that use remote interfaces should probably not be used in new code.

The EJB container makes the local home interface accessible to local clients through JNDI. To reference a local interface you need to have a local JNDI name. The objects that implement the entity beans' local home interface are called `EJBLocalHome` objects. You can specify either a `jndi-name` or `local-jndi-name` in the weblogic-ejb-jar.xml file. For more information on how to specify deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5

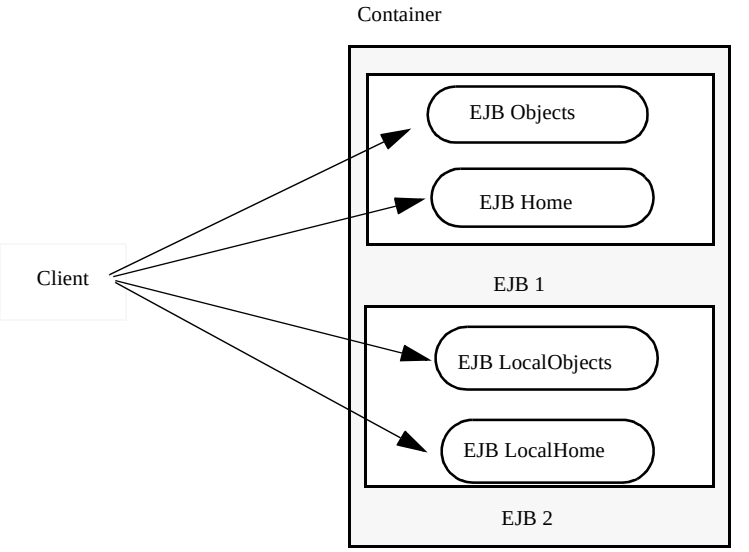
In earlier versions of WebLogic Server, `ejbSelect` methods were used to return remote interfaces. Now you can specify a `result-type-mapping` element in the `ejb-jar.xml` file that indicates whether the result returned by the query will be mapped to a local or remote object.

Using the Local Client

A local client of a session bean or entity bean can be another EJB, such as a session bean, entity bean, or message-driven bean. A local client can be a servlet as long as it is included as part of the same EAR file and as long as the EAR file is not remote. Clients of a local bean must be part of an EAR or a standalone JAR.

A local client accesses a session or entity bean through the bean's local interface and local home interfaces. The container provides classes that implement the bean's local and local home interfaces. The objects that implement these interfaces are local Java objects. The following diagram shows the container with a local client and local interfaces.

Figure 5-4 Local client and local interfaces



WebLogic Server provides support for both local and uni-directional remote relationships between EJBs. If the EJBs are on the same server and are part of the same JAR file, they can have local relationships. If the EJBs are not on the same server, the relationships must be remote. For a relationship between local beans, multiple column mappings are specified if the key implementing the relation is a compound key. For a remote bean, only a single column-map is specified, since the primary key of the remote bean is opaque. No column-maps are specified if the role just specifies a group-name. No group-name is specified if the relationship is remote.

Changes to the Container for Local Interfaces

Changes made to the structure of the container to accommodate local interfaces include the following additions:

- EJB local home
- New model for handling exceptions that propagates the correct exception to the client.

Using EJB QL for EJB 2.0

EJB Query Language (QL) is a portable query language that defines finder methods for 2.0 entity EJBs with container-managed persistence. Use this SQL-like language to select one or more entity EJB objects or fields in your query. Because of the declaration of CMP fields in a deployment descriptor, you can create queries in the deployment descriptor for any finder method other than `findByPrimaryKey()`. `findByPrimaryKey` is automatically handled by the container. The search space for an EJB QL query consists of the EJB's schema as defined in `ejb-jar.xml` (the bean's collection of container-managed fields and their associated database columns).

EJB QL Requirement for EJB 2.0 Beans

The deployment descriptors must define each finder query for EJB 2.0 entity beans by using an EJB QL query string. You cannot use WebLogic Query Language (WLQL) with EJB 2.0 entity beans. WLQL is intended for use with EJB 1.1 CMP. For more information on WLQL, see CROSS REF TO 1.1 CHAPTER.

Migrating from WLQL to EJB QL

If you have used previous versions of WebLogic Server, your container-managed entity EJBs may use WLQL for finder methods. This section provides a quick reference to common WLQL operations. Use this table to map the WLQL syntax to EJB QL syntax.

Sample WLQL Syntax	Equivalent EJB QL Syntax
`(= operand1 operand2)`	WHERE operand1 = operand2
`(< operand1 operand2)`	WHERE operand1 < operand2
`(> operand1 operand2)`	WHERE operand1 > operand2
`(<= operand1 operand2)`	WHERE operand1 <= operand2

Sample WLQL Syntax	Equivalent EJB QL Syntax
(>= operand1 operand2)	WHERE operand1 >= operand2
(! operand)	WHERE NOT operand
(& expression1 expression2)	WHERE expression1 AND expression2
(| expression1 expression2)	WHERE expression1 OR expression2
(like *text_string*%)	WHERE operand LIKE '*text_string%*'
(isNull operand)	WHERE operand IS NULL
(isNotNull operand)	WHERE operand IS NOT NULL

Using EJB 2.0 WebLogic QL Extension for EJB QL

WebLogic Server has an SQL-like language, called WebLogic QL, that extends the standard EJB QL. This language works with the finder expressions and is used to query EJB objects from the RDBMS. You define the `query` in the `weblogic-cmp-rdbms-jar.xml` deployment descriptor using the `weblogic-ql` element.

There must be a query element in the `ejb-jar`.file that corresponds to the `weblogic-ql` element in the `weblogic-cmp-rdbms-jar.xml` file. However, the `weblogic-cmp-rdbms-jar.xml` query element overrides the `ejb-jar.xml` query element.

Using SELECT DISTINCT

The EJB WebLogic QL extension SELECT DISTINCT allows your database to filter duplicate queries. Using SELECT DISTINCT means that the EJB container's resources are not used to sort through duplicated results when SELECT DISTINCT is specified in the EJB QL query.

If you specify a `sql-select-distinct` element with the value `TRUE` in a `weblogic-ql` element's XML stanza for an EJB 2.0 CMP bean, then the generated SQL STATEMENT for the database query will contain a DISTINCT clause.

You specify the `sql-select-distinct` element in the `weblogic-cmp-rdbms-jar.xml` file. However, you cannot specify `sql-select-distinct` if you are running an isolation level of `READ_C0MMITED_FOR_UPDATE` on an Oracle database. This is because a query on Oracle cannot have both a `sql-select-distinct` and a `READ_C0MMITED_FOR_UPDATE`. If there is a chance that this isolation level will be used, for example in a session bean, do not use the `sql-select-distinct` element.

Using ORDERBY

The EJB WebLogic QL extension ORDERBY is a keyword that works with the Finder method to specify the CMP field selection sequence for your selections.

Figure 5-5 WebLogic QL ORDERBY extension showing order by id.

```
ORDERBY

       SELECT OBJECT(A) from A for Account.Bean

              ORDERBY A.id
```

Note: ORDERBY defers all sorting to the DBMS. Thus, the order of the retrieved result depends on the particular DBMS installation on top of which the bean is running

Also, you can specify an ORDERBY with ascending [ASC] or descending [desc] order for multiple fields as follows:.

Figure 5-6 WebLogic QL ORDERBY extension showing order by id. with ASC and DESC

```
ORDERBY <field> [ASC|DESC], <field> [ASC|DESC]

       SELECT OBJECT(A) from A for Account.Bean, OBJECT(B) from B
for Account.Bean

              ORDERBY A.id ASC; B.salary DESC
```

Using SubQueries

WebLogic Server supports the use of the following features with subqueries in EJB QL:

- Subquery return type
  - Single `cmp-fields`
  - Aggregate functions
  - Beans with simple primary keys
- Subqueries as comparison operands
- Correlated subqueries
- Uncorrelated subqueries
- DISTINCT clauses with subqueries

The relationship between WebLogic QL and subqueries is similar to the relationship between SQL queries and subqueries. Use WebLogic QL subqueries in the WHERE clause of an outer WebLogic QL query. With a few exceptions, the syntax for a subquery is the same as a WebLogic QL query.

To specify WebLogic QL, see "Using EJB 2.0 WebLogic QL Extension for EJB QL" on page 5-15. Use those instructions with a SELECT statement that specifies a subquery as shown the following sample.

The following query selects all above average students as determined by the provided grade number:

```
SELECT OBJECT(s) FROM studentBean AS s WHERE s.grade > (SELECT
AVG(s2.grade) FROM StudentBean AS s2)
```

Note that in the above query the subquery, `(SELECT AVG(s2.grade) FROM StudentBean AS s2)`, has the same syntax as an EJB QL query.

You can create nested subqueries.The depth is limited by the underlying database's nesting capabilities.

In a WebLogic QL query, the identifiers declared in the FROM clauses of the main query and all of its subqueries must be unique. This means that a subquery may not re-declare a previously declared identifier for local use within that subquery.

For example, the following example is not legal because employee bean is being declared as emp in both the query and the subquery:

```
SELECT OBJECT(emp)
       FROM EmployeeBean As emp
              WHERE emp.salary=(SELECT MAX(emp.salary) FROM
                     EmployeeBean AS emp WHERE employee.state=MA)
```

Instead, this query should be written as follows:

```
SELECT OBJECT(emp)
       FROM EmployeeBean As emp
              WHERE emp.salary=(SELECT MAX(emp2.salary) FROM
                     EmployeeBean AS emp2 WHERE emp2.state=MA)
```

The above examples correctly declares the subquery's employee bean to have a different identifier from the main query's employee bean.

Subquery Return Types

The return type of a WebLogic QL subquery can be one of a number of different types, such as:

Single cmp-field Type Subqueries

WebLogic Server supports a return type consisting of a `cmp-field`. The results returned by the subquery may consists of a single value or collection of values. An example of a subquery that returns value(s) of the type `cmp-field` is as follows:

```
SELECT emp.salary FROM EmployeeBean AS emp WHERE emp.dept =
'finance'
```

This subquery selects all of the salaries of employees in the finance department.

Aggregate Functions

WebLogic Server supports a return type consisting of an aggregate of a `cmp-field`. As an aggregate always consist of a single value, the value returned by the aggregate is always a single value. An example of a subquery that return a value of the type aggregate (MAX) of a `cmp-field` is as follows:

```
SELECT MAX(emp.salary) FROM EmployeeBean AS emp WHERE emp.state=MA
```

This subquery selects the single highest employee salary in Massachusetts.

For more information on aggregate functions, see "Using Aggregate Functions" on page 5-22.

Beans with Simple Primary Key

WebLogic Server supports a return type consisting of a `cmp-bean` with a simple primary key.

Note: Beans with compound primary keys are NOT supported. Attempts to designate the return type of a subquery to a bean with a compound primary key will result in a failure when you compile the query.

An example of a subquery that returns the value(s) of the type bean with a simple primary key is as follows:

```
SELECT OBJECT(emp) FROM EMployeeBean As emp WHERE
emp.department.budget>1,000,000
```

This subquery provides a list of all employee in departments with budgets greater than $1,000,000.

Subqueries as Comparison Operands

Use subqueries as the operands of comparison operators. WebLogic QL supports subqueries as the operands of the following *Comparison Operators*: *[NOT]IN*, *[NOT]EXISTS*, and the following *Arithmetic Operators:* <, >, <=, >=, =, <> *with ANY and ALL*.

[NOT]IN

The [NOT]IN comparison operator tests whether the left-had operand is or is not a member of the subquery operand on the right-hand side.

An example of a subquery which is the right-hand operand of the NOT IN operator is as follows:

```
SELECT OBJECT(item)
       FROM ItemBean AS item
              WHERE item.itemId NOT IN
                     (SELECT oItem2.item.itemID
                                   FROM OrderBean AS orders2,
IN(orders2.orderItems)oIttem2
```

The subquery selects all items from all orders.

The main query's NOT IN operator selects all the items that are not in the set returned by the subquery. So the end result is that the main query selects all unordered items.

[NOT]EXISTS

The [NOT]EXISTS comparison operator tests whether the set returned by the subquery operand is or is not empty.

An example of a subquery which is the operand of the NOT EXISTS operand is as follows:

```
SELECT (cust) FROM CustomerBean AS cust
       WHERE NOT EXISTS
              (SELECT order.cust_num FROM OrderBean AS order
                     WHERE cust.num=order_num)
```

This is an example of a query with a correlated subquery. See "Correlated and UnCorrelated Subqueries" on page 5-21 for more information. This query returns all customers that have not placed an order.`SELECT (cust) FROM CustomerBean AS cust`

```
       WHERE cust.num NOT IN
              (SELECT order.cust_um FROM OrderBean AS order
                     WHERE cust.num=order_num)
```

Arithmetic Operators

Use arithmetic operators for comparison when the right-hand subquery operand returns a single value. If the right hand subquery instead returns multiple values, then the qualifiers ANY or ALL must precede the subquery.

An example of a subquery which uses the '=' operator is as follows:

```
SELECT OBJECT (order)
       FROM OrderBean AS order, IN(order.orderItems)oItem
              WHERE oItem.quantityOrdered =
                     (SELECT MAX (subOItem.quantityOrdered)
                            FROM Order ItemBean AS subOItem
                                   WHERE subOItem,item itemID = ?1)
AND oItem.item.itemId = ?1
```

For a given itemId, the subquery returns the maximum quantity ordered of that item. Note that this aggregate returned by the subquery is a single value as required by the '=' operator.

For the same given itemId, the main query's '=' comparison operator checks which order's OrderItem.quantity Ordered equals the maximum quantity returned by the subquery. The end result is that the query returns the OrderBean that contains the maximum quantity of a given item that has been ordered.

Use arithmetic operators in conjunction with ANY or ALL, when the right-hand subquery operand may return multiple values.

An example of a subquery which uses ANY and ALL is as follows:

```
SELECT OBJECT (order)
       FROM OrderBean AS order, IN(order.orderItems)oItem
              WHERE oItem.quantityOrdered > ALL
                     (SELECT subOItem.quantityOrdered
                            FROM OrderBean AS suborder IN
(subOrder.orderItems)subOItem
                                   WHERE subOrder,orderId = ?1)
```

For a given orderId, the subquery returns the set of orderItem.quantityOrdered of each item ordered for that orderId. The main query's '>' ALL operator looks for all orders whose orderItem.quantityOrdered exceeds all values in the set returned by the subquery. The end result is that the main query returns all orders in which all orderItem.quantityOrdered exceeds every orderItem.quantityOrdered of the input order.

Note that since the subquery can return multi-valued results that they '>'ALL operator is used rather then the '>' operator.

All of the arithmetic operators, <, >, <= >=, =, <> are use, as in the above examples.

Correlated and UnCorrelated Subqueries

WebLogic Server supports both correlated and Uncorrelated subqueries.

UnCorrelated Subqueries

Uncorrelated subqueries may be evaluated independently of the outer query. An example of an uncorrelated subquery is as follows:

```
SELECT OBJECT(emp) FROM EmployeeBean AS emp
       WHERE emp.salary>
       (SELECT AVG(emp2.salary) FROM EmployeeBean AS emp2)
```

This example of a uncorrelated subquery selects the employees whose salaries are above average. This examples uses the '>' arithmetic operator.

Correlated

Correlated subqueries are subqueries in which values from the outer query are involved in the evaluation of the subquery. An example of a correlated subquery is as follows:

```
SELECT OBJECT (mainOrder) FROM OrderBean AS mainOrder
       WHERE 10>
```

```
        (SELECT COUNT (DISTINCT subOrder.ship_date)
FROM OrderBean AS subOrder
WHERE subOrder.ship_date>mainOrder.ship_date
AND mainOrder.ship_date IS NOT NULL
```

This example of a correlated subquery selects the last 10 shipped Orders. This example uses the NOT IN operator.

Note: Keep in mind that correlated subqueries can involve more processing overhead the uncorrelated subqueries.

DISTINCT Clause with Subqueries

Use the DISTINCT clause in a subquery to enable an SQL SELECT DISTINCT in the subquery's generated SQL. Using a DISTINCT clause in a subquery is different from using one in a main query because the EJB container enforces the DISTICNT clause in a main query; whereas the DISTICT clause in the subquery is enforced by the generated SQL, SELECT DISTINCT. An example of a DISTINCT clause in a subquery is as follows:

```
SELECT OBJECT (mainOrder) FROM OrderBean AS mainOrder
       WHERE 10>
              (SELECT COUNT (DISTINCT subOrder.ship_date)
       FROM OrderBean AS subOrder
       WHERE subOrder.ship_date>mainOrder.ship_date
       AND mainOrder.ship_date IS NOT NULL
```

This example of a selects the last 10 shipped Orders.

Using Aggregate Functions

WebLogic Server supports aggregate functions with WebLogic QL. You only use these functions as SELECT clause targets, not as other parts of a query, such as a WHERE clause. The aggregate functions behave like SQL functions. They are evaluated over the range of the beans returned by the WHERE conditions of the query

To specify WebLogic QL, see "Using EJB 2.0 WebLogic QL Extension for EJB QL" on page 5-15. Use those instructions with a SELECT statement that specifies an aggregate function as shown in the samples shown in the following table.

A list of the supported functions and sample statements follow:

Aggregate Function	Description	Sample Statement
MIN(x)	Returns the minimum value of this field.	SELECT MIN(t.price) FROM TireBean AS t WHERE t.size=?1 This statement selects the lowest price for a tire of a given input size.
MAX(x)	Returns the maximum value of this field.	SELECT MAX(s.customer_count) FROM SalesRepBean AS s WHERE s.city='Los Angeles' This statement selects the maximum number of customers served by any single sales representative in Los Angeles.
AVG([DISTINCT] x)	Returns the average value of this field	SELECT AVG(b.price) FROM BookBean AS b WHERE b.category='computer_science' This statement selects the Average Price of a book in the Computer Science category.
SUM([DISTINCT] x)	Returns the sum of this field.	SELECT SUM(s.customer_count) FROM SalesRepBean AS s WHERE s.city='Los Angeles' This statement retrieves the total number of customers served by sales representatives in Los Angeles.
COUNT([DISTINCT] x)	Returns the number of occurrences of a field.	SELECT COUNT(s.deal.amount) FROM SalesRepBean AS s, IN(deal)s WHERE s.deal.status='closed' AND s.deal.amount>=1000000 This statement retrieves the number of closed deals for at lease 1 million dollars.

You can return aggregate functions in ResultSets as described below.

Using Queries that Return ResultSets

WebLogic Server supports `ejbSelect()` queries that return the results of multi-column queries in the form of a `java.sql.ResultSet`. To support this feature, WebLogic Server now allows you to use the SELECT clause to specify a comma delimited list of target fields as shown in the following query:

```
SELECT emmp.name, emp.zip FROM EmployeeBean AS emp
```

This query returns a java.sqlResultSet with rows whose columns are the values Employee's Name and Employee's Zip.

To specify WebLogic QL, see "Using EJB 2.0 WebLogic QL Extension for EJB QL" on page 5-15. Use those instructions with a query specifying a ResultSet as shown in the above query to specify WebLogic QL, see "Using EJB 2.0 WebLogic QL Extension for EJB QL" on page 5-15. Use those instructions with a SELECT statement that specifies an aggregate query like the samples shown in the following table.

.

ResultSets created in EJB QL can only return `cmp-field` values or aggregates of `cmp-field` values, they cannot return beans.

In addition, you can create powerful queries, as described in the following example, when you combine `cmp-fields` and aggregate functions.

The following rows (beans) show the salaries of employees in different locations:

CMP fields showing salaries of employees in California

Name	Location	Salary
Matt	CA	110,000
Rob	CA	100,000

CMP fields showing salaries of employees in Arizona

Name	Location	Salary
Dan	AZ	120,000
Dave	AZ	80,000

CMP fields showing salaries of employees in Texas

Name	Location	Salary
Curly	TX	70,000
Larry	TX	180,000
Moe	TX	80,00

Note: Each row represents a bean.

The following SELECT statement shows a query that uses ResultSets and the aggregate function (AVG) along with a GROUP BY statement and an ORDER BY statement using a descending sort to retrieve results from a multi-column query.

```
SELECT e.location, AVG(e.salary)
       FROM Finder EmployeeBean AS e
              GROUP BY e.location
                     ORDER BY 2 DESC
```

The query shows the average salary in of employees at each location in descending order. The number, 2 means that the ORDERBY sort is on the second item in the SELECT statement. The GROUP BY clause specifies the AVEAGE salary of employees with a matching e.location attribute.

The ResultSet, in descending order is as follows:

Location	Average
TX	110,000
AZ	100,000

Location	Average
CA	105,000

Note: You can only use integers as ORDERBY arguments in queries that return ResultSets. WebLogic Server does not support the use of integers as ORDERBY arguments in any Finder or `ejbselect()` that returns beans.

EJB QL Error-Reporting Enhancements

Compiler error messages in EJB QL provide a visual aid to identify which part of the query is in error and allow the reporting of more than one error per compilation.

Visual Indicator of Error in Query

When an error is reported, EJB QL indicates the location of the problem within these symbols: =>> <<=. These symbols are highlighted in red in the following sample compiler error report.

```
ERROR: Error from appc: Error while reading
'META-INF/FinderEmployeeBeanRDBMS.xml'. The error was:

Query:

EJB Name: FinderEmployeeEJB

Method Name: findThreeLowestSalaryEmployees

Parameter Types: (java.lang.String)

Input EJB Query: SELECT OBJECT(e) FROM FinderEmployeeBean e WHERE
f.badField = '2' O

R (e.testId = ?1) ORDERBY e.salary

SELECT OBJECT(e ) FROM FinderEmployeeBean e
WHERE =>> f.badField <<= = '2' OR ( e.testId = ?1 ) ORDERBY e.salary

Invalid Identifier in EJB QL expression:

Problem, the path expression/Identifier 'f.badField' starts with an
identifier: 'f'. The identifier 'f', which can be either a range
variable identifier or a collection member identifier, is required
```

```
to be declared in the FROM clause of its query or in the FROM clause
of a parent query.

'f' is not defined in the FROM clause of either its query or in any
parent query.

Action, rewrite the query paying attention to the usage of
'f.badField'.
```

Multiple Errors Reported after a Single Compilation

If a query contains multiple errors, EJB QL is now capable of reporting more than one of these after a single compilation. Previously, the compiler could only report one error per compilation. Reporting of subsequent errors required recompilation.

Note: The compiler is not guaranteed to report all errors after a single compilation.

Using Dynamic Queries

Dynamic queries allow you to construct and execute EJB-QL queries programmatically in your application code. Queries are expressions that allow you to request information of EJB objects from the RDBMS. This feature is only available for use with EJB 2.0 CMP beans. Using dynamic queries provides the following benefits:

- Allows you to create and execute new queries without having to update and deploy an EJB.
- Allows you to reduce the size of the EJB's deployment descriptor file. This is because finder queries can be dynamically created instead of statically defined in the deployment descriptors.

Enabling Dynamic Queries

To enable dynamic queries:

1. Specify the `enable-dynamic-queries` element in the EJB's `weblogic-ejb-jar.xml` deployment descriptor file as follows:

```
<enable-dynamic-queries>True</enable-dynamic-queries>
```

2. For instructions on how to add or edit the `enable-dynamic-queries` element, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

3. Set standard method permissions to control access to dynamic queries by specifying the `method-permission` element in the `ejb-jar.xml` deployment descriptor file.

   Setting `method-permission` for the `createQuery()` method of the `weblogic.ejb.QueryHome` interface controls access to the `weblogic.ejb.Query` object necessary to executes the dynamic queries.

   If you specify `method-permission` for the `createQuery()` method, the `method-permission` settings apply to the execute and find methods of the `Query` class.

Executing Dynamic Queries

The following code sample demonstrates how to execute a dynamic query.

```
InitialContext ic=new InitialContext();
FooHome fh=(FooHome)ic.lookup("fooHome");
QueryHome qh=(QueryHome)fh;
Sring ejbql="SELECT OBJECT(e)FROM EmployeeBean e WHERE
e.name='rob'"
Query query=qh.createQuery();
query.setMaxElements(10)
Collection results=query.find(ejbql);
```

BLOB and CLOB DBMS Column Support for the Oracle DBMS

WebLogic Server supports Oracle Binary Large Object (BLOB) and Character Large Object (CLOB) DBMS columns with EJB CMP. BLOBs and CLOBs are data types used for efficient storage and retrieval of large objects. CLOBs are string or char objects; BLOBs are binary or serializable objects such as pictures that translate into large byte arrays.

BLOBs and CLOBs map a string variable, a value of `OracleBlob` or `OracleClob`, to a BLOB or CLOB column. WebLogic Server maps CLOBs only to the data type `java.lang.string`. At this time, no support is available for mapping `char` arrays to a CLOB column.

To enable BLOB/CLOB support:

1. In the bean class, declare the variable.
2. Edit the XML by declaring the `dbms-column-type` deployment descriptor in the weblogic-cmp-rdbms jar.xml file.
3. Create the BLOB or CLOB in the Oracle database.

Using BLOB or CLOB may slow performance because of the size of the BLOB or CLOB object.

Specifying a BLOB Using the Deployment Descriptor

The following XML code shows how to specify a BLOB object using the `dbms-column` element in `weblogic-cmp-rdbms-jar-xml` file.

Figure 5-7 Specifying a BLOB object

```
<field-map>
       <cmp-field>photo</cmp-field>
       <dbms-column>PICTURE</dbms-column>
       <dbms_column-type>OracleBlob</dbms-column-type>
```

```
</field-map>
```

Specifying a CLOB Using the Deployment Descriptors

The following XML code shows how to specify a CLOB object using the `dbms-column` element in the `weblogic-cmp-rdbms-jar-xml` file.

Figure 5-8 Specifying a CLOB object

```
<field-map>
       <cmp-field>description</cmp-field>
       <dbms-column>product_description</dbms-column>
       <dbms_column-type>OracleClob</dbms-column-type>

</field-map>
```

Cascade Delete

Use the cascade delete mechanism to remove entity bean objects. When cascade delete is specified for a particular relationship, the lifetime of one entity object depends on another. You can specify cascade delete for one-to-one and one-to-many relationships; many-to-many relationships are not supported. The `cascade delete()` method uses the delete features in WebLogic Server, and the `database cascade delete()` method instructs WebLogic Server to use the underlying database's built-in support for cascade delete.

To enable this feature, you must recompile the bean code for the changes to the deployment descriptors to take effect.

Use one of the following two methods to enable cascade delete.

Cascade Delete Method

With the `cascade delete()` method you use WebLogic Server to remove objects. If an entity is deleted and the `cascade delete` element is specified for a related entity bean, then the removal is cascaded and any related entity bean objects are also removed.

To specify cascade delete, use the `cascade-delete` element in the `ejb-jar.xml` deployment descriptor elements. This is the default method. Make no changes to your database settings, and WebLogic Server will cache the entity objects for removal when the cascade delete is triggered.

Specify cascade delete using the `cascade-delete` element in the `ejb-jar.xml` file as follows:

Figure 5-9 Specifying a cascade delete

```
<ejb-relation>
       <ejb-relation-name>Customer-Account</ejb-relation-name>
       <ejb-relationship-role>
              <ejb-relationship-role-name>Account-Has-Customer
              </ejb-relationship-role-name>
              <multiplicity>one</multiplicity>
              <cascade-delete/>
       </ejb-relationship-role>
</ejb-relation>
```

Note: This `cascade delete()` method can only be specified for a `ejb-relationship-role` element contained in an `ejb-relation` element if the other `ejb-relationship-role` element in the same `ejb-relation` element specifies a `multiplicity` attribute with a value of `one`.

Database Cascade Delete Method

The `database cascade delete()` method allows an application to take advantage of a database's built-in cascade delete support, and possibly improve performance. If the `db-cascade-delete` element is not already specified in the `weblogic-cmp-rdbms-jar.xml` file, do not enable any of the database's cascade delete functionality, because this will produce incorrect results in the database.

The db-cascade-delete element in the weblogic-cmp-rdbms-jar.xml file specifies that a cascade delete operation will use the built-in cascade delete facilities of the underlying DBMS. By default, this feature is turned off and the EJB container removes the beans involved in a cascade delete by issuing an individual SQL DELETE statement for each bean.

If db-cascade-delete element is specified in the weblogic-cmp-rdbms-jar.xml, the cascade-delete element must be specified in the ejb-jar.xml.

When db-cascade-delete is enabled, additional database table setup is required. For example, the following setup for the Oracle database table will cascade delete all of the employees if the dept is deleted in the database.

Figure 5-10 Oracle table setup for cascade delete

```
CREATE TABLE dept
  (deptno   NUMBER(2) CONSTRAINT pk_dept PRIMARY KEY,
   dname    VARCHAR2(9) );
CREATE TABLE emp
  (empno    NUMBER(4) PRIMARY KEY,
   ename    VARCHAR2(10),
   deptno   NUMBER(2)   CONSTRAINT fk_deptno
            REFERENCES dept(deptno)
            ON DELETE CASCADE );
```

Flushing the CMP Cache

Updates made by a transaction must be reflected in the results of queries, finders, and ejbSelects issued during the transactions. Because this requirement can slow performance, a new option enables you to specify that the cache be flushed before the query for the bean is executed.

If this option is turned off, which is the default behavior, the results of the current transactions are not reflected in the query. If this option is turned on, the container flushes all changes for cached transactions written to the database before executing the new query. This way, the changes show up in the results.

To enable this option, in `weblogic-cmp-rdbms-jar.xml` file set the `include-updates` element to `true`.

Figure 5-11 Specifying that results of transactions be reflected in the query

```
<weblogic-query>
       <query-method>
       <method-name>findBigAccounts</method_name>
       <method-params>
              <method-param>double</method-param>
       </method-params>
       </query-method>
       <weblogic-ql>WHERE BALANCE>10000 ORDERBY NAME</weblogic-ql>
       <include-updates>true</include-updates>
</weblogic-query>
```

The default is `false`, which provides the best performance. Updates made to the cached transaction are reflected in the result of a query; no changes are written to the database, and you do not see the changes in the query result.

Whether you use this feature depends on whether performance is more important than current and consistent data.

Java Data Types for CMP Fields

The following table provides a list of the Java data types for CMP fields used in WebLogic Server and shows how they map to the Oracle extensions for the standard SQL data types.

Table 5-1 Java data types for CMP fields

Java Types for CMP Fields	Oracle Data Types
boolean	SMALLINT
byte	SMALLINT
char	SMALLINT
double	NUMBER
float	NUMBER
int	INTEGER
long	NUMBER
short	SMALLINT
java.lang.String	VARCHAR/VARCHAR2
java.lang.Boolean	SMALLINT
java.lang.Byte	SMALLINT
java.lang.Character	SMALLINT
java.lang.Double	NUMBER
java.lang.Float	NUMBER
java.lang.Integer	INTEGER
java.lang.Long	NUMBER
java.lang.Short	SMALLINT
java.sql.Date	DATE
java.sql.Time	DATE
java.sql.Timestamp	DATE
java.math.BigDecimal	NUMBER
byte[]	RAW, LONG RAW

Java Types for CMP Fields	Oracle Data Types
serializable	**RAW, LONG RAW**

Do not use the SQL CHAR data type for database columns that are mapped to CMP fields. This is especially important for fields that are part of the primary key, because padding blanks that are returned by the JDBC driver can cause equality comparisons to fail when they should not. Use the SQL VARCHAR data type instead of SQL CHAR.

A CMP field of type `byte[]` cannot be used as a primary key unless it is wrapped in a user-defined primary key class that provides meaningful `equals()` and `hashCode()` methods. This is because the `byte[]` class does not provide useful equals and hashCode.

EJB Concurrency Strategy

The concurrency strategy specifies how the EJB container should manage concurrent access to an entity bean. Although the `Database` option is the default concurrency strategy for WebLogic Server, you may want to specify other options for your entity bean depending on the type of concurrency access the bean requires. WebLogic Server provides the following concurrency strategy options:

Concurrency Option	Description
`Exclusive`	Places an exclusive lock on cached entity EJB instances when the bean is associated with a transaction. Other requests for the EJB instance are block until the transaction completes. This option was the default locking behavior for WebLogic Server versions 3.1 through 5.1
`Database`	Defers locking requests for an entity EJB to the underlying datastore. WebLogic Server allocates a separate entity bean instance and allows locking and caching to be handled by the database. This is the default option.

Concurrency Option	Description
`Optimistic`	Holds no locks in the EJB container or database during a transaction. The EJB container verifies that none the data updated by the transaction has changed before committing the transaction. If any updated data changed, the EJB container rolls back the transaction.
`ReadOnly`	Used only for read-only entity beans. Activates a new instance for each transaction so that requests proceed in parallel. WebLogic Server calls `ejbLoad()` for `ReadOnly` beans are based on the `read-timeout-seconds` parameter.

Concurrency Strategy for Read-Write EJBs

You can use the `Exclusive`, `Database`, and ReadOnly concurrency strategies for `read-write` EJBs. WebLogic Server loads EJB data into the cache at the beginning of each transaction, or as described in "Using cache-between-transactions to Limit Calls to ejbLoad()" on page 6-10. WebLogic Server calls `ejbStore()` at the successful commit of a transaction.

Specifying the Concurrency Strategy

You specify the locking mechanism that the EJB uses by setting the `concurrency-strategy` deployment parameter in `weblogic-ejb-jar.xml`. You set `concurrency-strategy` at the individual EJB level, so that you can mix locking mechanisms within the EJB container.

The following excerpt from `weblogic-ejb-jar.xml` shows how to set the concurrency strategy for an EJB. In the following sample XML, the code specifies the default locking mechanism, `Database`.

Figure 5-12 Sample XML specifying the concurrency strategy

```
<entity-descriptor>
        <entity-cache>
```

```
        ...
        <concurrency-strategy>Database</concurrency-strategy>
        </entity-cache>
        ...
</entity-descriptor>
```

If you do not specify a `concurrency-strategy`, WebLogic Server performs database locking for entity EJB instances.

A description of each concurrency strategy is covered in the following sections.

Exclusive Concurrency Strategy

The `Exclusive` concurrency strategy was the default in WebLogic Server 5.1 and 4.5.1. This locking method provides reliable access to EJB data, and avoids unnecessary calls to `ejbLoad()` to refresh the EJB instance's persistent fields. However, exclusive locking does not provide the best model for concurrent access to the EJB's data. Once a client has locked an EJB instance, other clients are blocked from the EJB's data even if they intend only to read the persistent fields.

The EJB container in WebLogic Server can use exclusive locking mechanism for entity EJB instances. As clients enlist an EJB or EJB method in a transaction, WebLogic Server places an exclusive lock on the EJB instance for the duration of the transaction. Other clients requesting the same EJB or method are blocked until the current transaction completes.

Database Concurrency Strategy

The `Database` concurrency strategy is the default option for WebLogic Server and the *recommended* mechanism for EJB 1.1 and EJB 2.0 beans. It improves concurrent access for entity EJBs. The WebLogic Server container defers locking services to the underlying database. Unlike exclusive locking, the underlying data store can provide finer granularity for locking EJB data, and deadlock detection.

With the database locking mechanism, the EJB container continues to cache instances of entity EJB classes. However, the container does not cache the intermediate state of the EJB instance between transactions. Instead, WebLogic Server calls `ejbLoad()` for each instance at the beginning of a transaction to obtain the latest EJB data. The request to commit data is subsequently passed along to the database. The database, therefore, handles all lock management and deadlock detection for the EJB's data.

Deferring locks to the underlying database improves throughput for concurrent access to entity EJB data, while also providing deadlock detection. However, using database locking requires more detailed knowledge of the underlying datastore's lock policies, which can reduce the EJB's portability among different systems.

When using the Database concurrency strategy instead of Optimistic with the `caching-between-transactions` element set to `"True,"` you will receive a warning message from the compiler indicating that `cache-between-transactions` should be disabled. If this condition exists, WebLogic Server automatically disables `caching-between-transactions`.

Optimistic Concurrency Strategy

The `Optimistic` concurrency strategy does not hold any locks in the EJB container or the database while the transaction is in process. When you specify this option, The EJB container makes sure that the data being updated by a transaction has not changed. It performs a "smart update" by checking the fields before it commits the transaction.

To verify that you want the data checked for validity, enable optimistic checking by setting the `verify-columns` deployment descriptor element in the `weblogic-cmp-rdbms-jar.xml` file. The `verify-columns` element specifies that the columns in a table be checked for validity when you use the optimistic concurrency strategy.

1. Set the `verify-columns` element as follows to check the data:

- Specify Read to check all columns in the table that have been read during the transaction.
- Specify Modified to check only the columns that have been updated by the current transaction.
- Specify Version to check that a version column exists in the table and that this column is used to implement optimistic concurrency.

A version column must be created with an initial value of 0, and must increment by 1 whenever the row is modified.

- Specify Timestamp to check that a timestamp column exists in the table and that this column is used to implement optimistic concurrency.

  The EJB container manages the version and timestamp columns and ensures that these columns are kept up to date.

2. Specify the version and timestamp columns using the `optimistic-column` deployment descriptor element in the `weblogic-cmp-rdbms-jar.xml` file. Mapping this column to a cmp field is optional.
3. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

If the EJB is mapped to multiple tables, optimistic checking is only performed on the tables that are updated during the transaction.

Note: By default, caching between transactions is not enabled for this feature. You must explicitly enable it. See "Using cache-between-transactions to Limit Calls to ejbLoad()" on page 6-10for instructions.

ReadOnly Concurrency Strategy

WebLogic Server provides support for concurrent access to read-only entity beans. This caching strategy activates an instance of a read-only entity bean for each transaction so that requests may be processed in parallel.

Previously, read-only entity beans used the exclusive locking concurrency strategy. This strategy places an exclusive lock on cached entity bean instances when the bean is associated with a transaction. Other requests for the entity bean instance are block until the transaction completes.

To avoid reading from the database, WebLogic Server copies the state for an EJB 2.0 CMP bean from the existing instance in the cache. For this release, the default concurrency strategy for read-only entity beans is the `ReadOnly` option.

You can specify read-only entity bean caching at the application-level or the component-level.

To enable read-only entity bean caching:

1. Specify the `ReadOnly` option in the `concurrency-strategy` deployment descriptor element for either a JAR file or an EAR file.
   - Specify the concurrency-strategy element for application-level caches (EARS) in the `weblogic-application.xml` file.
   - Specify the concurrency-strategy element for component-level caches (JARS) in the `weblogic-ejb-jar.xml` file.
2. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

Read-Only Entity Beans

WebLogic Server continues to support read-only entity beans with the `read-timeout` element set in the deployment descriptor. If the `ReadOnly` option is selected in the `concurrency strategy` element and the `read-timeout-seconds` element is set in the `weblogic-ejb-jar.xml` file, when a read-only bean is invoked, WebLogic Server checks whether the cached data is older than the `read-timeout` setting. If it is, the bean's `ejbLoad` is called. Otherwise, the cached data is used. So, previous versions of read-only entity beans will work in this version of WebLogic Server.

Restrictions for ReadOnly Concurrency Strategy

Entity EJBs using the `read-only` concurrency strategy must observe the following restrictions:

- They cannot require updates to the EJB data, because WebLogic Server never calls `ejbStore()` for read-only entity EJBs.
- The EJB's method calls must be idempotent. See "Session EJBs in a Cluster" on page 4-10 for more information.

Because the bean's underlying data may be updated by an external source, calls to `ejbLoad()` are governed by the deployment parameter, `read-timeout-seconds`.

Automatic Database Detection

As application developers develop their entity beans, the underlying table schema must change. With the automatic database detection feature enabled, the WebLogic Server EJB container automatically changes the underlying table schema as entity beans change, ensuring that tables always reflect the most recent value of deployment descriptor values.

Even if a table already exists, if any container-managed persistence fields have been added or deleted for that table, the container will recreate the table during deployment. To ensure that the container only changes tables it created, container-created tables include an extra column, called `wls_temp`.

Note: Use this feature during development only, not during production.

Enabling Automatic Database Detection

Enable this feature using the `create-default-dbms-tables` element in `weblogic-cmp-rdbms-jar.xml`. The precise behavior of this feature varies, depending on the value of the element. The following table summarizes how behavior varies depending on the value:

Table 5-2 Automatic Database Detection values for <create-default-dbms-tables>

Setting <create-default-dbms-tables> to this value	Results in this behavior:
`DropAndCreate`	The container drops and creates the table during deployment if columns have changed. Data is not saved.
`DropAndCreateAlways`	The container drops and creates the table during deployment whether or not columns have changed. Data is not saved.

Table 5-2 Automatic Database Detection values for <create-default-dbms-tables>

Setting <create-default-dbms-tables> to this value	Results in this behavior:
`CreateOrAlterTable`	The container creates the table if it does not yet exist. If the table does exist, the container alters the table schema. Data is saved. **Note:** Do not choose this option if either of the following is true: ■ A new column is specified as a primary key ■ A column with null values is specified as the new primary key column

Behavior When Type Conflict Detected

If the database type WebLogic Server detects differs from the database type defined in the deployment descriptor, WebLogic Server will issue a warning and give preference to the type defined in the deployment descriptor.

CHAPTER

6 WebLogic Server Container-Managed Persistence Service - Advanced Features

The following sections describe the advanced features of the container-managed persistence (CMP) service available with the WebLogic Server EJB container, where "advanced" refers to performance-related or special-purpose features. For a discussion of basic CMP features, see Chapter 5, "WebLogic Server Container-Managed Persistence Service - Basic Features."

Performance-related features:

- "Read-Only Multicast Invalidation" on page 6-2
- "Read-Mostly Pattern" on page 6-3
- "Relationship Caching with Entity Beans" on page 6-4
- "Combined Caching with Entity Beans" on page 6-7
- "Caching Between Transactions" on page 6-8
- "ejbLoad() and ejbStore() Behavior for Entity EJBs" on page 6-11
- "Groups" on page 6-13

Special-purpose features:

- "Automatic Primary Key Generation" on page 6-15
- "Automatic Table Creation" on page 6-19
- "Using Oracle SELECT HINTS" on page 6-23
- "Multiple Table Mapping" on page 6-24

Read-Only Multicast Invalidation

Read-only multicast invalidation is an efficient means of invalidating cached data.

Invalidate a read-only entity bean by calling the following `invalidate()` method on either the `CachingHome` or `CachingLocalHome` interface:

Figure 6-1 Sample code showing CachingHome and CachingLocalHome interfaces

```
package weblogic.ejb;

public interface CachingHome {

    public void invalidate(Object pk) throws RemoteException;
    public void invalidate (Collection pks) throws RemoteException;
    public void invalidateAll() throws RemoteException;

public interface CachingLocalHome {

    public void invalidate(Object pk) throws RemoteException;
    public void invalidate (Collection pks) throws RemoteException;
    public void invalidateAll() throws RemoteException

}
```

The following example codes shows how to cast the home to CachingHome and then call the method:

Figure 6-2 Sample code showing how to cast the home and call the method

```
import javax.naming.InitialContext;
import weblogic.ejb.CachingHome;
```

```
Context initial = new InitialContext();
Object o = initial.lookup("CustomerEJB_CustomerHome");
CustomerHome customerHome = (CustomerHome)o;

CachingHome customerCaching = (CachingHome)customerHome;
customerCaching.invalidateAll();
```

When the `invalidate()` method is called, the read-only entity beans are invalidated in the local server, and a multicast message is sent to the other servers in the cluster to invalidate their cached copies. The next call to an invalidated read-only entity bean causes `ejbLoad` to be called. `ejbLoad()` reads the most current version of the persistent data from the underlying datastore

WebLogic Server calls the `invalidate()` method after the transaction update has completed. If the invalidation occurs during a transaction update, the previous version may be read if the isolation level does not permit reading uncommitted data.

Read-Mostly Pattern

WebLogic Server does not support a read-mostly cache strategy setting in `weblogic-ejb-jar.xml`. However, if you have EJB data that is only occasionally updated, you can create a "read-mostly pattern" by implementing a combination of `read-only` and `read-write` EJBs.

For an example of the read-mostly pattern, see the Read Mostly example in your WebLogic Server distribution:

%SAMPLES_HOME%`/server/config/examples/ejb/extensions/readMostly`

WebLogic Server provides an automatic `invalidate()` method for the Read-Mostly pattern. With this pattern, Read-Only entity bean and a Read-Write entity bean are mapped to the same data. To read the data, you use the Read-Only entity bean; to update the data, you use the Read-Write entity bean.

In a read-mostly pattern, a `read-only` entity EJB retrieves bean data at intervals specified by the `read-timeout-seconds` deployment descriptor element specified in the `weblogic-ejb-jar.xml` file. A separate `read-write` entity EJB models the same data as the `read-only` EJB, and updates the data at required intervals.

When creating a read-mostly pattern, use the following suggestions to reduce data consistency problems:

- For all `read-only` EJBs, set `read-timeout-seconds` to the same value for all beans that may be updated in the same transaction.
- For all `read-only` EJBs, set `read-timeout-seconds` to the smallest timeframe that yields acceptable performance levels.
- Ensure that all `read-write` EJBs in the system update only the smallest portion of data necessary; avoid beans that write numerous, unchanged fields to the datastore at each `ejbStore()`.
- Ensure that all `read-write` EJBs update their data in a timely fashion; avoid involving `read-write` beans in long-running transactions that may span the `read-timeout-seconds` setting for their `read-only` counterparts.

  If you are running EJB 2.0, you can accomplish the same thing using optimistic concurrency functionality. See "Optimistic Concurrency Strategy" on page 5-38.

In a WebLogic Server cluster, clients of the `read-only` EJB benefit from using cached EJB data. Clients of the `read-write` EJB benefit from true transactional behavior, because the `read-write` EJB's state always matches the state of its data in the underlying datastore. See "Entity EJBs in a Cluster" on page 4-14 for more information.

Relationship Caching with Entity Beans

Relationship caching improves the performance of entity beans by loading related beans into the cache and avoiding multiple queries by issuing a join query for the related bean.

Specifying Relationship Caching

To specify relationship caching:

1. Set the `relationship-caching` deployment descriptor element in the bean's `weblogic-cmp-rdbms-jar.xml` file.
2. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

   The XML code shown below specifies entity beans with the following relationships

`customerBean`	has a `one-to-many` relationship with	`accountBean`
`accountBean`	has a `one-to-one` relationship with	`addressBean`
`customerBean`	has a `one-to-one` relationship with	`phoneBean`

The following XML example code shows how to specify relationship-caching:

```
<relationship-caching>
       <caching-name>cacheMoreBeans</caching-name>
       <caching-element>
              <cmr-field>accounts<</cmr-field>
              <group-name>acct_group</group-name>
              <caching-element>
                     <cmr-field>address</cmr-field>
                     <group-name>addr_group</group-name>
              </caching-element>
       </caching-element>

       <caching-element>
              <cmr-field>phone</cmr-field>
              <group-name>phone_group</group-name>
       </caching-element>
</relationship-caching>
```

`The accounts` and `phone` fields are container-managed relationship (cmr) fields in the `customerBean` table; the `address` field is a cmr field in the `accountBean` table; and the `addr_group` and `phone_group` are groups in the `addressBean` and `phoneBean`.

Using nested `caching-element` deployment descriptors enables the bean to load more than one level of related beans. In the above sample XML code, `addressBean` is the second level related bean because it is nested in the `accountBean`. Currently, there is no limitation on the number of `caching-elements` that you can specify. However, setting too many `caching-element` levels could have an impact on the performance of the current transaction.

Enabling Relationship Caching

To enable relationship caching:

1. Specify a `caching-name` deployment descriptor element in the `weblogic-query` element of the `weblogic-cmp-rdbms-jar.xml` file.

   If a `caching-name` element is specified in a weblogic-query XML element, when the finder query is executed, WebLogic Server loads the related `accountBean` and `phoneBean` as well as the account's `addressBeans` into the cache.

2. Make sure that the `finder-load-bean` element, specified in the `weblogic-ejb-jar.xml` file, in the bean that specifies an relationship (for example, `customerBean` in the above sample XML code) is not set to `False` or relationship caching will not be enabled. The `finder-load-bean` element's default is `True`.

3. Specify a `database-type` deployment descriptor element in the bean's `weblogic-cmp-rdbms-jar.xml` file. This is because relationship caching uses outer joins for queries and outer joins don't have standard syntax for all databases.

4. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

Since relationship caching uses join queries, and a join query might duplicate results for a table in the ResultSet, the number of `caching-element` deployment descriptors specified in the `relationship-caching` element will have a direct impact on the number of duplicate results in the ResultSet. For one-to-many relationships, do not specify too many `caching-element` deployment descriptors in the `relationship-caching` element because the number of duplicate results might multiply for each `caching-element` deployment descriptor

The `relationship-caching` deployment descriptor element is specified in the `weblogic-cmp-rdbms-jar.xml` file

Relationship Caching Limitations

The relationship caching feature has the following limitations:

1. Relationship caching only works with `one-to-one` and `one-to-many` relationships.
2. When using `weblogic-ql`, this feature only works with finder methods that return references to either `EJBObject` or `EJBLocalObject` beans.
3. If you enable relationship caching for a finder or a select method, the result of the query will always be a distinct set even if the `distinct` keyword is not specified. This is because there is no way to identify the duplicate in the ResultSet is the result of the original data or the result of the outer join.

Combined Caching with Entity Beans

Combined caching allows multiple entity beans that are part of the same J2EE application to share a single runtime cache. Previously, you had to configure a separate cache for each entity bean that was part of an application. This caused some usability and performance problems in that it took more time to configure caches for each entity bean and more memory to run the application. This feature will help solve those problems.

To configure an application level cache:

1. Verify that the `weblogic-application.xml` file is located in the META-INF directory of the EAR file.
2. Provide an entry in the `weblogic-application.xml` file as follows:

```
<weblogic-application>
 <ejb>
    <entity-cache>
        <entity-cache-name>large_account</entity-cache-name>
        <max-cache-size>
            <megabytes>1</megabytes>
        </max-cache-size>
    </entity-cache>
 </ejb>
</weblogic_application>
```

   Use the `entity-cache` element to define a named application level cache that will be used to cache entity bean instances at runtime. There are no restrictions on the number of different entity beans that may reference an individual cache.

The sub elements of `entity-cache` have the same basic meaning as they do in the `weblogic-ejb-jar.xml` deployment descriptor file.

3. Specify an `entity-descriptor` element in `weblogic-ejb-jar.xml` file.

   Use the `entity-descriptor` element to configure an entity bean to use an application level cache.

For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

The `weblogic-application.xml` deployment descriptor is documented in full in the "Application.xml Deployment Descriptor Elements" section of *Developing WebLogic Server Applications*.

Caching Between Transactions

Use caching between transactions or long tern caching to enable the EJB container to cache an entity bean's persistent data between transactions. You can enable caching between transactions if the entity bean's concurrency strategy is set to either `Exclusive`, `ReadOnly`, or `Optimistic`. See "Specifying the Concurrency Strategy" on page 5-36 for instructions on setting an entity bean's concurrency strategy.

Caching Between Transactions with Exclusive Concurrency

When you enable long term caching for an entity bean with an `Exclusive` concurrency strategy the EJB container must have exclusive update access to the underlying data. This means that another application outside of the EJB container must not be updating the data. If you deploy an EJB with an Exclusive concurrency strategy in a cluster, long term caching is disabled automatically because any node in the cluster may update the data. This would make long term caching impossible.

In previous versions of WebLogic Server, this feature was controlled by the `db-is-shared` element of `weblogic-ejb-jar.xml`.

Note: Exclusive concurrency is a single-server feature. Do not attempt to use it with clustered servers.

Caching Between Transactions with ReadOnly Concurrency

When you disable long term caching for an entity bean with a `ReadOnly` concurrency strategy it ignores the value of the `caching-between-transactions` setting because the EJB container always performs long term caching of read-only data.

Caching Between Transactions with Optimistic Concurrency

When you enable long term caching for an entity bean with an `Optimistic` concurrency strategy the EJB container reuses the cached values from previous transactions. The container ensures that the updates are transactionally consistent by checking for optimistic conflicts at the end of the transaction. See "Optimistic Concurrency Strategy" on page 5-38 for instructions on setting optimistic checking.

In addition, notifications for updates of optimistic data are broadcast to other cluster members to help avoid optimistic conflicts.

Enabling Caching Between Transactions

To enable caching between transactions:

1. Set the `caching-between-transactions` element in the `weblogic-ejb-jar.xml` file by choosing one of the following options:
   - Specify `True` to enable the EJB container performs long term caching of the data.

- Specify `False` to enable the EJB container performs short caching of the data. This is the default setting.

2. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

Using cache-between-transactions to Limit Calls to ejbLoad()

WebLogic Server's default behavior of calling `ejbLoad()` at the start of each transaction works well for environments where multiple sources may update the datastore. Because multiple clients (including WebLogic Server) may be modifying an EJB's underlying data, an initial call to `ejbLoad()` notifies the bean that it needs to refresh its cached data and ensures that it works against the most current version of the data.

In the special circumstance where only a single WebLogic Server transaction ever accesses a particular EJB concurrently, such as when you use exclusive concurrency for a single server; not a cluster, calling `ejbLoad()` by default is unnecessary. Because no other clients or systems update the EJB's underlying data, WebLogic Server's cached version of the EJB data is always up-to-date. Calling `ejbLoad()` in this case simply creates extra overhead for WebLogic Server clients that access the bean.

To avoid unnecessary calls to `ejbLoad()` in the case of a single WebLogic Server transaction accessing a particular EJB, WebLogic Server provides the `cache-between-transactions` deployment parameter. By default, `cache-between-transactions` is set to "false" for each EJB in the bean's `weblogic-ejb-jar.xml` file, which ensures that `ejbLoad()` is called at the start of each transaction. Where only a single WebLogic Server transaction ever accesses an EJB's underlying data concurrently, you can set `d` to "true" in the bean's `weblogic-ejb-jar.xml` file. When you deploy an EJB with `cache-between-transactions` set to "true," the single instance of WebLogic Server calls `ejbLoad()` for the bean only when:

- A client first references the EJB
- The EJB's transaction is rolled back

Restrictions and Warnings for cache-between-transactions

Setting `cache-between-transactions` to "true" overrides WebLogic Server's default `ejbLoad()` container-managed-persistence (behavior, regardless of whether the EJB's underlying data is updated by one WebLogic Server instance or multiple clients. If you incorrectly set `cache-between-transactions` to "true" and multiple clients (database clients, other WebLogic Server instances, and so forth) update the bean data, you run the risk of losing data integrity.

Do not set `cache-between-transactions` to "true" if you set the entity bean's `concurrency strategy` to the "Database" option. Weblogic Server ignores this setting because with database concurrency specified, the EJB container continues to cache instances of entity bean classes. However, the container does not cache the state of the EJB instance between transactions. Instead, WebLogic Server calls `ejbLoad()` for each instance at the beginning of a transaction to obtain the latest EJB data. This means that setting `cache-between-transactions` to "true" which prevents WebLogic Server from calling `ejbload()` at the beginning of each transaction is invalid.

Also, due to the limitations of exclusive concurrency, you cannot set `cache-between-transactions` to "true" in a WebLogic Server cluster when using exclusive concurrency. However, you can set this element to true when using either optimistic or readonly concurrency.

ejbLoad() and ejbStore() Behavior for Entity EJBs

WebLogic Server reads and writes the persistent fields of entity EJBs using calls to `ejbLoad()` and `ejbStore()`. By default, WebLogic Server calls `ejbLoad()` and `ejbStore()` in the following manner:

1. A transaction is initiated for the entity EJB. The client may explicitly initiate a new transaction and invoke the bean, or WebLogic Server may initiate a new transaction in accordance with the bean's method transaction attributes.

2. WebLogic Server calls `ejbLoad()` to read the most current version of the bean's persistent data from the underlying datastore.
3. When the transaction commits, WebLogic Server calls `ejbStore()` to write persistent fields back to the underlying datastore.

This simple process of calling `ejbLoad()` and `ejbStore()` ensures that new transactions always use the latest version of the EJB's persistent data, and always write the data back to the datastore upon committing. In certain circumstances, however, you may want to limit calls to `ejbLoad()` and `ejbStore()` for performance reasons. Alternately, you may want to call `ejbStore()` more frequently to view the intermediate results of uncommitted transactions.

WebLogic Server provides several deployment descriptor elements in the `weblogic-ejb-jar.xml` and `weblogic-cmp-rdbms-jar.xml` files that enable you to configure `ejbLoad()` and `ejbStore()` behavior.

Warning for is-modified-method-name

Using the `is-modified-method-name` element can improve performance by avoiding unnecessary calls to `ejbStore()`. However, it places a greater burden on the EJB developer to identify correctly when updates have occurred. If the specified `is-modified-method-name` returns an incorrect flag to WebLogic Server, data integrity problems can occur, and they may be difficult to track down.

If entity EJB updates appear "lost" in your system, start by ensuring that the value for all `is-modified-method-name` elements return "true" under every circumstance. In this way, you can revert to WebLogic Server's default `ejbStore()` behavior and possibly correct the problem.

Using delay-updates-until-end-of-tx to Change ejbStore() Behavior

By default, WebLogic Server updates the persistent store of all beans in a transaction only at the completion (commit) of the transaction. This generally improves performance by avoiding unnecessary updates and repeated calls to `ejbStore()`.

If your datastore uses an isolation level of `READ_UNCOMMITTED`, you may want to allow other database users to view the intermediate results of in-progress transactions. In this case, the default WebLogic Server behavior of updating the datastore only at transaction completion may be unacceptable.

You can disable the default behavior by using the `delay-updates-until-end-of-tx` deployment descriptor element. This element is set in the `weblogic-ejb-jar.xml` file. When you set this element to "false," WebLogic Server calls `ejbStore()` after each method call, rather than at the conclusion of the transaction.

Setting `delay-updates-until-end-of-tx` to false does not cause database updates to be "committed" to the database after each method invoke; they are only sent to the database. Updates are committed or rolled back in the database only at the conclusion of the transaction.

Groups

In container-managed persistence, you use groups to specify certain persistent attributes of an entity bean. A field-group represents a subset of the cmp and CMR-fields of a bean. You can put related fields in a bean into groups that are faulted into memory together as a unit. You can associate a group with a query or relationship, so that when a bean is loaded as the result of executing a query or following a relationship, only the fields mentioned in the group are loaded.

A special group named "default" is used for queries and relationships that have no group specified. By default, the default group contains all of a bean's CMP-fields and any CMR-fields that add a foreign key to the persistent state of the bean.

A field can belong to multiple groups. In this case, the `getXXX()` method for the field will fault in the first group that contains the field.

Specifying Field Groups

Field groups are specified in the `weblogic-rdbms-cmp-jar.xml` file as follows:

```
<weblogic-rdbms-bean>
       <ejb-name>XXXBean</ejb-name>
       <field-group>
              <group-name>medical-data</group-name>
              <cmp-field>insurance</cmp-field>
              <cmr-field>doctors</cmr-fields>
       </field-group>
</weblogic-rdbms-bean>
```

You use field groups when you want to access a subset of fields.

Using Groups

The field group is an optimizing element that should be used with care because it is possible to corrupt the database.

For example,

You have the following CMP fields: A, B, and C.

A and B belong to the same group.

You set up the following scenario:

```
getA() // loads A and B
modify A
// then an external process modifies the row getC()
```

Because C is not in the group, there are two possibilities:

- The container will load C and any the other fields as well. In this case, the modification that was made to A will be lost.
- The container will load C and only C. When the transaction commits, the new value for A that was assigned during the transaction might overwrite the newer value in the database.
- In both cases, the database will be corrupted because you told the container that within this transaction, that only A and B would be read; however, C also was read. The correct step to take would have been to add C to the group or to specify no groups at all.

Automatic Primary Key Generation

WebLogic Server supports an automatic primary key generation feature for container-managed persistence (CMP).

Note: This feature is supported for the EJB 2.0 CMP container only, there is no automatic primary key generation support for EJB 1.1 CMP. For 1.1 beans, you must use bean-managed-persistence (BMP.)

Generated key support is provided in two ways:

- **Using DBMS primary key generation**. A set of deployment descriptors are specified at compile time to generate container code that is used in conjunction with a supported database to provide key generation support.

  With this option, the container defers all key generation to the underlying database. To enable this feature, you specify the name of the supported DBMS and the generator name, if required by the database. The CMP code handles all details of implementing this feature.

  For more information on this feature, see "Specifying Primary Key Support for Oracle" on page 6-16 and "Specifying Primary Key Support for Microsoft SQL Server" on page 6-17.

- **Using Bean Provider Designated Named Sequence table**. A user-named and user-created database table has a schema specified by WebLogic Server. The container uses this table to generate the keys.

  With this option, you name a table that holds the current primary key value. The table consists of a single row with a single column as defined by the following statement:

```
CREATE table_name (SEQUENCE int)
INSERT into table_name VALUES (0)
```

Note: For instructions on creating a table in Oracle, use the Oracle database documentation.

In the `weblogic-cmp-rdbms-jar.xml` file, set the `key_cache_size` element to specify how many primary key values a database SELECT and UPDATE will fetch at one time. The default value of `key_cache_size` is `1`. BEA recommends that you set this element to a value of `>1`, to minimize database accesses and to

improve performance. For more information in this feature, see "Specifying Primary Key Named Sequence Table Support" on page 6-18.

At this time, WebLogic Server only provides DBMS primary key generation support for Oracle and Microsoft SQL Server. However, you can use named sequence tables with other unsupported databases. Also, this feature is intended for use with simple (non-compound) primary keys.

Valid Key Field Types

In the abstract 'get' and 'set' methods of the bean, you can declare the field to be either of these two types:

- `java.lang.Integer`
- `java.lang.Long`

Specifying Primary Key Support for Oracle

Generated primary key support for Oracle databases uses Oracle's `SEQUENCE` feature. This feature works with a `Sequence` entity in the Oracle database to generate unique primary keys. The Oracle `SEQUENCE` is called when a new number is needed.

Once the `SEQUENCE` already exists in the database, you specify automatic key generation in the XML deployment descriptors. In the `weblogic-cmp-rdbms-jar.xml` file, you specify automatic key generation as follows:

Figure 6-3 Specifying automatic key generation for Oracle

```
<automatic-key-generation>
       <generator-type>Oracle</generator-type>
       <generator_name>test_sequence</generator-name>
       <key-cache-size>10</key-cache-size>
</automatic-key-generator>
```

Specify the name of the `Oracle SEQUENCE` to be used, using the `generator-name` element. If the `Oracle SEQUENCE` was created with a `SEQUENCE INCREMENT` value, then you must specify a `key-cache-size`. This value must match the Oracle `SEQUENCE INCREMENT` value. If these two values are different, then you will most likely have duplicate key problems.

Warning: Do not use the generator type `USER_DESIGNATED_TABLE` with Oracle, as doing so can cause the following exception:

```
javax.ejb.EJBException: nested exception is:
java.sql.SQLException: Automatic Key Generation Error:
attempted to UPDATE or QUERY NAMED SEQUENCE TABLE
NamedSequenceTable, but encountered SQLException
java.sql.SQLException: ORA-08177: can't serialize access
for this transaction.
```

USER_DESIGNATED_TABLE mode sets the TX ISOLATION LEVEL to SERIALIZABLE which can cause problems with Oracle.

Instead, use the AutoKey option Oracle.

Specifying Primary Key Support for Microsoft SQL Server

Generated primary key support for Microsoft SQL Server databases uses SQL Server's `IDENTITY` column. When the bean is created and a new row is inserted in the database table, SQL Server automatically inserts the next primary key value into the column that was specified as an `IDENTITY` column.

Note: For instructions on creating a table in Microsoft SQL Server, see the Microsoft SQL Server database documentation.

Once the `IDENTITY` column is created in the database table, you specify automatic key generation in the XML deployment descriptors. In the `weblogic-cmp-rdbms-jar.xml` file, you specify automatic key generation as follows:

Figure 6-4 Specifying automatic key generation for Microsoft SQL

```
<automatic-key-generation>
       <generator-type>SQLServer</generator-type>
</automatic-key-generator>
```

The generator-type element lets you specify the primary key generation method that you want to use.

Specifying Primary Key Named Sequence Table Support

Generated primary key support for unsupported databases uses a Named SEQUENCE TABLE to hold key values. The table must contain a single row with a single column that is an integer, SEQUENCE INT. This column will hold the current sequence value.

Note: For instructions on creating the table, see the documentation for the specific database product.

To use Named Sequence Table support, make sure that the underlying database supports the transaction isolation level, TransactionSerializable. You specify this option for the isolation-level element, in the weblogic-ejb.xml file. The TransactionSerializable option specifies that simultaneously executing a transaction multiple times has the same effect as executing the transaction multiple times in a serial fashion. If the database doesn't support the transaction isolation level, TransactionSerializable, then you cannot use Named Sequence Table support.

Note: See the documentation for the underlying database to determine the type of isolation level support it provides and see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5 for instructions on setting the isolation level.

Once the NamedSequenceTable exists in the database, you specify automatic key generation by using the XML deployment descriptors in the weblogic-cmp-rdbms-jar.xml file, as follows:

Figure 6-5 Specifying automatic key generation for named sequence table support

```
<automatic-key-generation>
       <generator-type>NamedSequenceTable</generator-type>
       <generator_name>MY_SEQUENCE_TABLE_NAME</generator-name>
       <key-cache-size>100</key-cache-size>
</automatic-key-generator>
```

Specify the name of the SEQUENCE TABLE to be used, with the generator-name element. Using the key-cache-size element, specify the optional size of the key cache that tells you how many keys the container will fetch in a single DBMS call.

For improved performance, BEA recommends that you set this value to `>1`, a number greater than one. This setting reduces the number of calls to the database to fetch the next key value.

Also, it is recommended that you define one `NAMED SEQUENCE` table per bean type. Beans of different types should not share a common `NAMED SEQUENCE` table. This reduces contention for the key table.

Automatic Table Creation

You can specify that WebLogic Server automatically create tables based on the descriptions in the XML deployment descriptor files and the bean class, if the table does not already exist. Tables are created for all beans and relationship join tables, if the relationships in the JAR files have joins. You explicitly turn on this feature by defining it in the deployment descriptors per each RDBMS deployment, for all beans in the JAR file.

If you enable automatic table creation, WebLogic Serve examines the value of the `database-type` element in `weblogic-cmp-rdbms-jar.xml` to determine the correct syntax and datatype conversions to use to create a table in your database. WebLogic Server uses the vendor-specific `CREATE TABLE` syntax and datatype conversions for the following databases and vendors:

- Informix
- Oracle
- PointBase
- SQL Server
- Sybase

For all other database systems, WebLogic Server makes a best attempt to create the new table using a basic syntax and the datatype conversions shown in the following table:

Table 6-1 Generic Java Field to DBMS Column Type Conversion

Java Type	DBMS Column Type
boolean	INTEGER
byte	INTEGER
char	CHAR
double	DOUBLE PRECISION
float	FLOAT
int	INTEGER
long	INTEGER
short	INTEGER
java.lang.string	VARCHAR (150)
java.lang.BigDecimal	DECIMAL (38, 19)
java.lang.Boolean	INTEGER
java.lang.Byte	INTEGER
java.lang.Character	CHAR (1)
java.lang.Double	DOUBLE PRECISION
java.lang.Float	FLOAT
java.lang.Integer	INTEGER
java.lang.Long	INTEGER
java.lang.Short	INTEGER
java.sql.Date	DATE
java.sql.Time	DATE
java.sql.Timestamp	DATETIME
byte[ ]	RAW (1000)

Java Type	DBMS Column Type
Any serializable Class that is not a valid SQL type:	RAW (1000)

If, based on the descriptions in the deployment files, a field cannot be successfully mapped to an appropriate column type in the database, the `CREATE TABLE` fails, an error is thrown, and you must create the table yourself.

Automatic table creation is not recommended for use in a production environment. It is better suited for the development phase of design and prototype work. A production environment may require the use of more precise table schema definitions, for example; the declaration of foreign key constraints.

To define automatic table creation:

1. In the `weblogic-cmp-rdbms-jar.xml` file, set the `create-default-dbms-tables` element to `True` to explicitly turn on automatic table creation for all beans in the JAR file. Use the following syntax:

   ```
   <create-default-dbms-tables>True</create-default-dbms-tables>
   ```

2. Specify the correct database system or database vendor name in the `database-type` element of `weblogic-cmp-rdbms-jar.xml`. `CREATE TABLE` syntax and datatype mapping is provide for the following `database-type` values: `Informix`, `Oracle`, `POINTBASE`, `SQLServer`, and `Sybase`. All other DBMS systems use a basic syntax and the datatype conversions shown in the table above.

Automatic Database Detection

As application developers develop their entity beans, the underlying table schema must change. With the automatic database detection feature enabled, the WebLogic Server EJB container automatically changes the underlying table schema as entity beans change, ensuring that tables always reflect the most recent value of deployment descriptor values.

Even if a table already exists, if any container-managed persistence fields have been added or deleted for that table, the container will recreate the table during deployment. To ensure that the container only changes tables it created, container-created tables include an extra column, called `wls_temp`.

Note: Use this feature during development only, not during production.

Enabling Automatic Database Detection

Enable this feature using the `create-default-dbms-tables` element in `weblogic-cmp-rdbms-jar.xml`. The precise behavior of this feature varies, depending on the value of the element. The following table summarizes how behavior varies depending on the value:

Table 6-2 Automatic Database Detection values for <create-default-dbms-tables>

Setting <create-default-dbms-tables> to this value	Results in this behavior:
`DropAndCreate`	The container drops and creates the table during deployment if columns have changed. Data is not saved.
`DropAndCreateAlways`	The container drops and creates the table during deployment whether or not columns have changed. Data is not saved.
`CreateOrAlterTable`	The container creates the table if it does not yet exist. If the table does exist, the container alters the table schema. Data is saved. **Note:** Do not choose this option if either of the following is true: ■ A new column is specified as a primary key ■ A column with null values is specified as the new primary key column

Behavior When Type Conflict Detected

If the database type WebLogic Server detects differs from the database type defined in the deployment descriptor, WebLogic Server will issue a warning and give preference to the type defined in the deployment descriptor.

Using Oracle SELECT HINTS

WebLogic Server supports an EJB QL extension that allows you to pass INDEX usage hints to the Oracle Query optimizer. With this extension, you can provide a hint to the database engine. For example, if you know that the database you are searching can benefit from an ORACLE_SELECT_HINT, you can define an ORACLE_SELECT_HINT clause that will take ANY string value and then insert that String value after the SQL SELECT statement as a hint to the database.

To use this option, declare a query that uses this feature in the `weblogic-ql` element. This element is found in the `weblogic-cmp-rdbms-jar.xml` file. The `weblogic-ql` element specifies a query that contains a WebLogic specific extension to the EJB-QL language.

The WebLogic QL keyword and usage is as follows:

```
SELECT OBJECT(a) FROM BeanA AS a WHERE a.field > 2 ORDERBY a.field
SELECT_HINT '/*+ INDEX_ASC(myindex) */'
```

This statement generates the following SQL with the optimizer hint for Oracle:

```
SELECT /*+ INDEX_ASC(myindex) */ column1 FROM .... (etc)
```

In the WebLogic QL ORACLE_SELECT_HINT clause, whatever is between the single quotes (' ') is what gets inserted after the SQL SELECT. It is the query writer's responsibility to make sure that the data within the quotes makes sense to the Oracle database.“get” and “set” Method Restrictions

WebLogic Server uses a series of accessor methods. The names of these methods begin with *set* and *get*. WebLogic Server uses these methods to read and modify container-managed fields. These container-generated classes must begin with "get" or "set" and use the actual name of a persistent field defined in `ejb-jar.xml`. The methods are also declared as `public`, `protected`, and `abstract`.

Multiple Table Mapping

Multiple table mapping allows you to map a single EJB to multiple DBMS tables within a single database for EJB 2.0 CMP beans. You configure this feature by mapping multiple DBMS tables and columns to the EJB and its fields in the EJB's `weblogic-cmp-rdbms-xml` file. This includes the following types of mappings:

- EJB container-managed persistence (cmp) fields - These fields describe which of the EJB's cmp-fields are mapped to which DBMS tables.
- EJB container-managed relationship (cmr) fields - These fields describes which of the EJBs DBMS tables contain the foreign key columns required for mapping the relationships in the DBMS.

When enabling multiple table mappings, the following requirements apply:

- All tables included in the EJB's deployment unit must have primary key columns that are identical in number and type. The columns should not have the same names.
- If the EJB is a participant in a container-managed relationship and the relationship requires that the DBMS tables maintain foreign keys, then those foreign keys will reside on only one of the EJB's multiple tables.

Previously, you could associate an EJB with a single table and a list of fields and columns. Now, you can associate sets of fields and columns for as many tables as the EJB maps to.

Restrictions for multiple mapped tables on a single bean

Tables that are mapped to a single entity bean must not have referential integrity constraints declared between their primary keys. Doing so may result in a runtime error upon bean removal.

Multiple Table Mappings for cmp-fields

Configure multiple table mappings for `cmp-fields`, in a `weblogic-rdbms-bean` stanza of the EJB's `weblogic-cmp-rdbms-xml` file, as follows:

1. Specify the following elements in the `weblogic-cmp-rdbms-jar.xml` file:
   - table-field-map element
   - `table-name` element
   - `field-map` element
2. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

The following sample XML shows an EJB that maps to a single DBMS table:

Figure 6-6 Mapping a single DBMS table

```
<table-name>TableName</table-name>
       <field-map>
              <cmp-field>name</cmp-field>
              <dbms-column>name_in_tablename</dbms-column>
       </field-map>

       <field-map>
              <cmp-field>street_address</cmp-field>
              <dbms-column>street_address_in_tablename
                     </dbms_column>
       </field-map>
       <field-map>
              <cmp-field>phone</cmp-field>
              <dbms-column>phone_in_tablename</dbms-column>
       </field-map>
```

The following sample XML shows an EJB that maps to two different tables:

Figure 6-7 Mapping to two DBMS tables

```
<table-map>
   <table-name>TableName_1</table-name>
       <field-map>
       <!--Note 'name'is the primary key field of this EJB -->
              <cmp-field>name</cmp-field>
              <dbms-column>name_in_tablename_1</dbms-column>
       </field-map>
```

```
        <field-map>
                <cmp-field>street_address</cmp-field>
                <dbms-column>street_address_in_tablename_1
                        </dbms-column>
        </field-map>
    </table-map>
    <table-map>
                <table-name>TableName_2</table-name>
                <field-map>
        <!--Note 'name'is the primary key field of this EJB -->
                        <cmp-field>name</cmp-field>

<dbms-column>name_in_tablename_2</dbms-column>
                </field-map>
                <field-map>
                <cmp-field>phone</cmp-field>
                <dbms-column>phone_in_tablename_2</dbms-column>
        </field-map>
</table-map>
```

Note: As shown in the above XML sample for a table mapping, you must map the primary key field to each table's primary key column.

Multiple Table Mappings for cmr-fields

Configure multiple table mappings for `cmr-fields`, in a `weblogic-relationship-role` stanza of the EJB's `weblogic-cmp-rdbms-xml` file, as follows:

1. Specify the following elements in the `weblogic-cmp-rdbms-jar.xml` file:
   - `column-map` element
   - `foreign-key-column` element
   - `key-column` element
   - `foreign-key-table` element
   - `primary-key-table` element
2. For instructions on specifying deployment descriptors, see "Specifying and Editing the EJB Deployment Descriptors" on page 7-5.

Note: Multiple table mappings for cmr-fields require that the foreign key needed to maintain a relationship be only one of the tables that constitutes the EJB.

In previous versions, the name of the DBMS table that contains the foreign keys is implicit and uniquely determined; with multiple table mappings the table that contains the foreign keys must be explicitly specified. For example, a foreign key to key column mappings that is required for a one-to-one or many-to-one relationship.

The following sample XML shows multiple table mapping for `cmr-fields` for an EJB with an one-to-one relationship with another EJB:

Figure 6-8 Mapping EJBs with an one-to-one relationship

```
<column-map>
       <foreign-key-column>forfeign_key_1</foreign-key-column>
       <key-column>key_1</key-column>
</column-map>
       <foreign-key-column>foreign_key_2</foreign-key-column>
       <key-column>key_2</key-column>
</column-map>
```

The following sample XML shows the multiple table mapping for `cmr-fields` for an EJB with explicitly named foreign key columns:

Figure 6-9 Mapping foreign key columns in a relationship-role-name stanza

```
<relationship-role-map>
       <foreign-key-table>
              <table-name>TableName_2</table-name>
       </foreign-key-table>
       <column-map>
              <foreign-key-column>foreign_key_1
       </foreign-key-column>
              <key-column>key_11</key-column>
       </column-map>
       <column-map
              <foreign-key-column>foreign_key_2
</foreign-key-column>
              <key-column>key_12</key-column>
       </column-map>
       <column-map
              <foreign-key-column>foreign_key_1
</foreign-key-column>
              <key-column>key_21</key-column>
       </column-map>
       <column-map
```

```
            <foreign-key-column>foreign_key_2
</foreign-key-column>
            <key-column>key_22</key-column>
       </column-map>
</relationship-role-map>
```

When mapping many-to-many relationships, consider the following:

- The `table-name` element that you specify in the `weblogic-rdbms-relation` element refers to a separate join table that you use to maintain foreign key - primary key pairs between related beans.
- In the `table-column-map` element's `column-map`, the `foreign-key-column` element value refers to the DBMS column in the EJB table and the key-column element refers to the DBMS column name in the join table which you specify by the value in the `table-name` element.

CHAPTER

7 Packaging EJBs for the WebLogic Server Container

The following sections describe how to package EJBs into a WebLogic Server container for deployment. They includes a description of the contents of a deployment package, including the source files, deployment descriptors, and the deployment mode.

- Required Steps for Packaging EJBs
- Reviewing the EJB Source File Components
- WebLogic Server EJB Deployment Files
- Specifying and Editing the EJB Deployment Descriptors
- Creating the Deployment Files
- Referencing Other EJBs and Resources
- Packaging EJBs into a Deployment Directory
- Compiling EJB Classes and Generating EJB Container Classes
- Loading EJB Classes into WebLogic Server
- Specifying an ejb-client.jar
- Manifest Class-Path

Required Steps for Packaging EJBs

Packaging EJBs for deployment to WebLogic Server in an EJB container involves the following steps:

1. Review the EJB source file components.
2. Create the EJB deployment files.
3. Edit the EJB deployment descriptors.
4. Set the deployment mode.
5. Generate the EJB container classes.
6. Package the EJBs into a JAR or EAR file.
7. Load EJB classes into WebLogic Server.

Reviewing the EJB Source File Components

To implement entity and session beans, use the following components:

Component	Description
Bean Class	The *bean class* implements the bean's business and life cycle methods.
Remote Interface	The *remote interface* defines the beans's business methods that can be accessed from applications outside of the bean's EJB container.
Remote Home Interface	The *remote home interface* defines the bean's life cycle methods that can be accessed from applications outside of the bean's EJB container.

Component	Description
Local Interface	The *local interface* defines the bean's business methods that can be used by other beans that are co-located in the same EJB container.
Local Home Interface	The *local home interface* defines the bean's life cycle methods that can be used by other beans that are co-located in the same EJB container.
Primary Key	The *primary key class* provides a pointer into the database. Only entity beans need a primary key.

WebLogic Server EJB Deployment Files

Use the following WebLogic Server deployment files to specify the deployment descriptor elements for the EJB.

- `ejb-jar.xml`
- `weblogic-ejb-jar.xml`
- `weblogic-cmp-rdbms-jar.xml` (optional, for container-managed persistence (CMP) entity beans only)

The deployment files become part of the EJB deployment when the bean is compiled. The XML deployment descriptor files should contain the minimum deployment descriptor settings for the EJB. Once the file exists, it can later be edited using the instructions in "Specifying and Editing the EJB Deployment Descriptors" on page 7-5. The deployment descriptor files must conform to the correct version of the Document Type Definition (DTD) for each file you use. All element and sub element (attribute) names for each of the EJB XML deployment descriptor files are described in the file's Document Type Definition (DTD) file. For a description of each file, see the following sections.

ejb-jar.xml

The `ejb-jar.xml` file contains the Sun Microsystem-specific EJB DTD. The deployment descriptors in this file describe the enterprise bean's structure and declares its internal dependences and the application assembly information, which describes how the enterprise bean in the `ejb-jar` file is assembled into an application deployment unit. For a description of the elements in this file, see the JavaSoft specification.

weblogic-ejb-jar.xml

The `weblogic-ejb-jar.xml` file contains the WebLogic Server-specific EJB DTD that defines the concurrency, caching, clustering, and behavior of EJBs. It also contains descriptors that map available WebLogic Server resources to EJBs. WebLogic Server resources include security role names and data sources such as JDBC pools, JMS connection factories, and other deployed EJBs. For a description of the elements in this file, see Chapter 11, "The weblogic-ejb-jar.xml Deployment Descriptor."

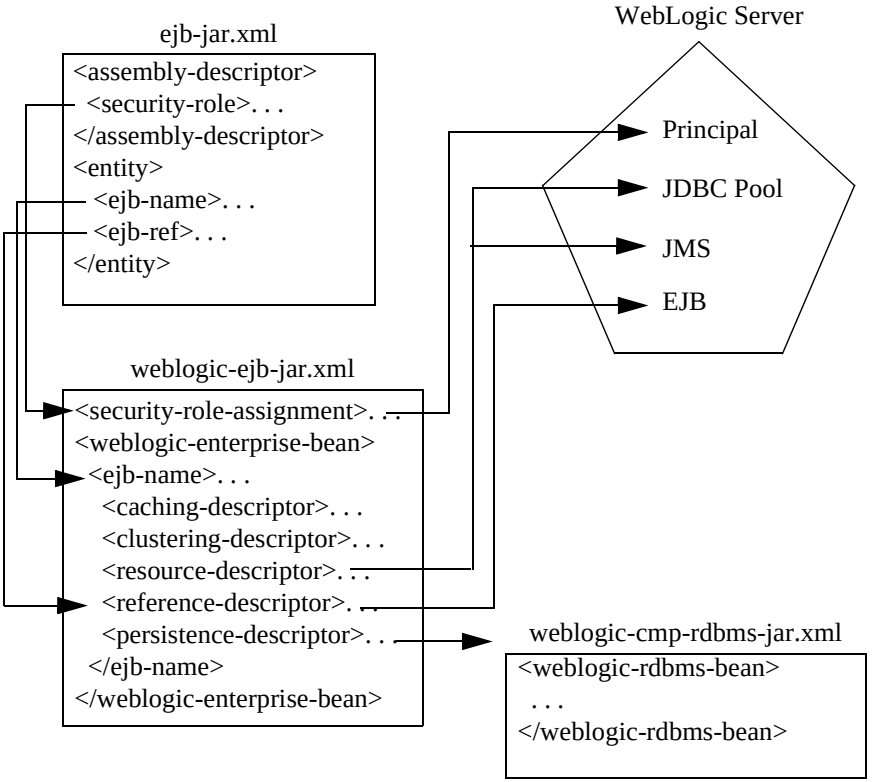
weblogic-cmp-rdbms.xml

The `weblogic-cmp-rdbms.xml` file contains the WebLogic Server-specific EJB DTD that defines container-managed persistence services. Use this file to specify how the container handles synchronizing the entity beans's instance fields with the data in the database. For a description of the elements in this file, see Chapter 12, "The weblogic-cmp-rdbms- jar.xml Deployment Descriptor."

Relationships Among the Deployment Files

Descriptors in `weblogic-ejb-jar.xml` are linked to EJB names in `ejb-jar.xml`, to resource names in a running WebLogic Server, and to persistence type data defined in `weblogic-cmp-rdbms-jar.xml` (for entity EJBs using container-managed persistence). The following diagram shows the relationship among the deployment files and WebLogic Server.

Figure 7-1 The relationship among the components of the deployment files.



Specifying and Editing the EJB Deployment Descriptors

You specify or edit EJB deployment descriptors by any of the following methods:

- Using a text editor to manually edit the bean's deployment files. For instructions on manually editing the deployment files, see "Manually Editing EJB Deployment Descriptors" on page 7-6.

- Using the `Builder` tool to edit deployment descriptors in a GUI environment. See "Builder" on page 10-6.
- Using a WebLogic Server command line utility tool called `DDConverter` to convert EJB 1.1 deployment descriptors to EJB 2.0 XML. For instructions on using the `DDConverter` tool, see "DDConverter" on page 10-7.

Creating the Deployment Files

You create the basic XML deployment files for the EJB that conforms to the correct version of the Document Type Definition (DTD) for each file. You can use an existing EJB deployment file as a template or copy one from the EJB examples in your WebLogic Server distribution:

```
SAMPLES_HOME\server\config\examples\applications
```

Manually Editing EJB Deployment Descriptors

To edit XML deployment descriptor elements manually:

1. Use an ASCII text editor that does not reformat the XML or insert additional characters that could invalidate the file.
2. Open the XML deployment descriptor file that you want to edit.
3. Type in your changes. Use the correct case for file and directory names, even if your operating system ignores the case.
4. To use the default value for an optional element, either omit the entire element definition or specify a blank value, as in:

```
<max-beans-in-cache></max-beans-in-cache>
```

Referencing Other EJBs and Resources

An EJB can look up and use other EJBs deployed in WebLogic Server by specifying an EJB reference in the deployment descriptor. The requirements for creating an EJB reference differ depending on whether the referenced EJB is external to the calling EJB (deployed independently of the calling EJB's application EAR file) or deployed as part of the same application EAR file.

Referencing External EJBs

To reference an external EJB, you add a `<reference-descriptor>` stanza to the calling EJB's `weblogic-ejb-jar.xml` file. The following XML code shows a sample stanza that references an external EJB:

Figure 7-2 Sample XML code referencing an external EJB

```
<reference-descriptor>
   <ejb-reference-description>
      <ejb-ref-name>AdminBean</ejb-ref-name>
      <jndi-name>payroll.AdminBean</jndi-name>
   </ejb-reference-description>
76</reference-descriptor>
```

In the sample stanza, the `ejb-ref-name` element specifies the name that the calling EJB uses to look up the external EJB. The `jndi-name` element specifies the global JNDI name to use when looking up the specified `ejb-ref-name`.

Referencing Application-Scoped EJBs

When you deploy multiple EJBs as part of the same EAR file, WebLogic Server adds the EJB names to the application's local JNDI tree. EJBs and other components of the application can look up other application-scoped components directly in the JNDI tree relative to `java:comp/env`.

An EJB that references other EJBs deployed as part of the same EAR file does not need to specify a global JNDI name in the `weblogic-ejb-jar.xml` file. In fact, you can omit the `weblogic-ejb-jar.xml` file entirely if you do not need other WebLogic-specific features of the deployment descriptor.

To reference an EJB deployed as part of the same EAR file, add an `<ejb-local-ref>` stanza to the calling EJB's `ejb-jar.xml` deployment descriptor file. For example:

Figure 7-3 Sample XML code referencing an EJB in the same EAR file

```
<ejb-local-ref>
   <description>Reference to application EJB</description>
   <ejb-ref-name>ejb1</ejb-ref-name>
   <ejb-ref-type>Session</ejb-ref-type>
   <local-home>mypackage.ejb1.MyHome</home>
   <local>mypackage.ejb1.MyRemote</local>
   <ejb-link>ejb1.jar#myejb</ejb-link>
</ejb-local-ref>
```

In this example, the `ejb-ref-name` element indicates the name the calling EJB uses to look up the application-scoped EJB. The `ejb-link` element maps the indicated `<ejb-ref-name>` to the other EJB deployed in the EAR file. Note that this example qualifies the `<ejb-link>` name with the filename that stores the second EJB. Qualifying the EJB name in this manner is necessary when two or more EJBs in the EAR file use the same name; the filename qualifier ensures a unique reference.

For more information about EJB links, see "Using EJB Links" on page 4-29.

Referencing Application-Scoped JDBC DataSources

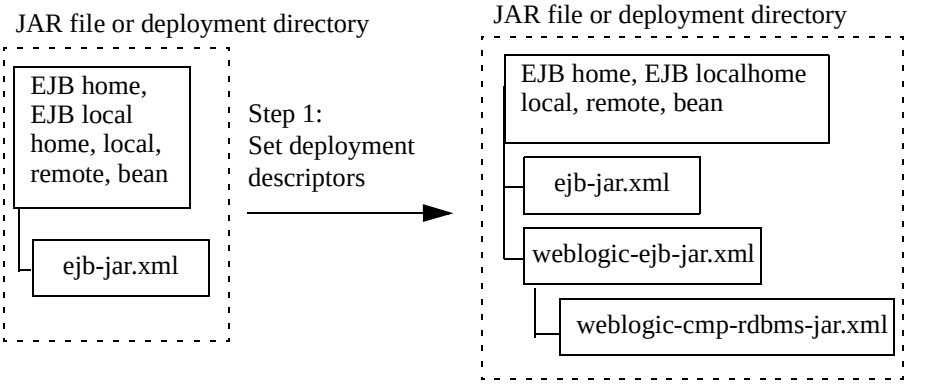
EJBs can also access JDBC DataSources that are deployed as part of the same EAR file. DataSources that are identified in the `weblogic-application.xml` deployment descriptor can be accessed locally from `java:comp/env` (without referencing the DataSource's global JNDI name). See Configuring Application-Scoped Resources in *Configuring Web Applications* for more information.

Packaging EJBs into a Deployment Directory

The deployment process begins with a JAR file or a deployment directory that contains the compiled EJB interfaces and implementation classes created by the EJB provider. Regardless of whether the compiled classes are stored in a JAR file or a deployment directory, they must reside in subdirectories that match their Java package structures.

The EJB provider should also supply an EJB compliant `ejb-jar.xml` file that describes the bundled EJB(s). The `ejb-jar.xml` file and any other required XML deployment file must reside in a top-level `META-INF` subdirectory of the JAR or deployment directory. The following diagram shows the first stage of packaging the the EJB and the deployment descriptor files into a deployment directory or JAR file.

Figure 7-4 Packaging the EJB classes and deployment descriptors into a deployment directory



As is, the basic JAR or deployment directory *cannot* be deployed to WebLogic Server. You must first create and configure the WebLogic-specific deployment descriptor elements in the `weblogic-ejb-jar.xml` file, and add that file to the deployment directory or `ejb.jar` file. For more information on creating the deployment descriptor files, see "WebLogic Server EJB Deployment Files" on page 7-3.

If you are deploying an entity EJB that uses container-managed persistence, you must also add the WebLogic -specific deployment descriptor elements for the bean's persistence type. For WebLogic Server container-managed persistence (CMP) services, the file is generally named `weblogic-cmp-rdbms-jar.xml`. You require a separate file for each bean that uses CMP. If you use a third-party persistence vendor,

the file type as well as its contents may be different from `weblogic-cmp-rdbms-jar.xml`; refer to your persistence vendor's documentation for details.

If you do not have any of the deployment descriptor files needed for your EJB, you must manually create one. The best method is to copy an existing file and edit the settings to conform to the needs of your EJB. Use the instructions in "Specifying and Editing the EJB Deployment Descriptors" on page 7-5 to create the files.

ejb.jar file

You create the `ejb.jar` file with the Java Jar utility (`javac`). This utility bundles the EJB classes and deployment descriptors into a single Java ARchive (JAR) file that maintains the directory structure. The `ejb-jar` file is the unit that you deploy to WebLogic Server.

Compiling EJB Classes and Generating EJB Container Classes

For part of the process of building your deployment unit, you need to compile your EJB classes, add your deployment descriptors to the deployment unit, and generate the container classes used to access the deployment unit.

1. Compile the EJB classes using `javac` compiler from the command line.
2. Add the appropriate XML deployment descriptor files to the compiled unit using the guidelines in "WebLogic Server EJB Deployment Files" on page 7-3.
3. Generate the container classes that are used to access the bean using `appc`.

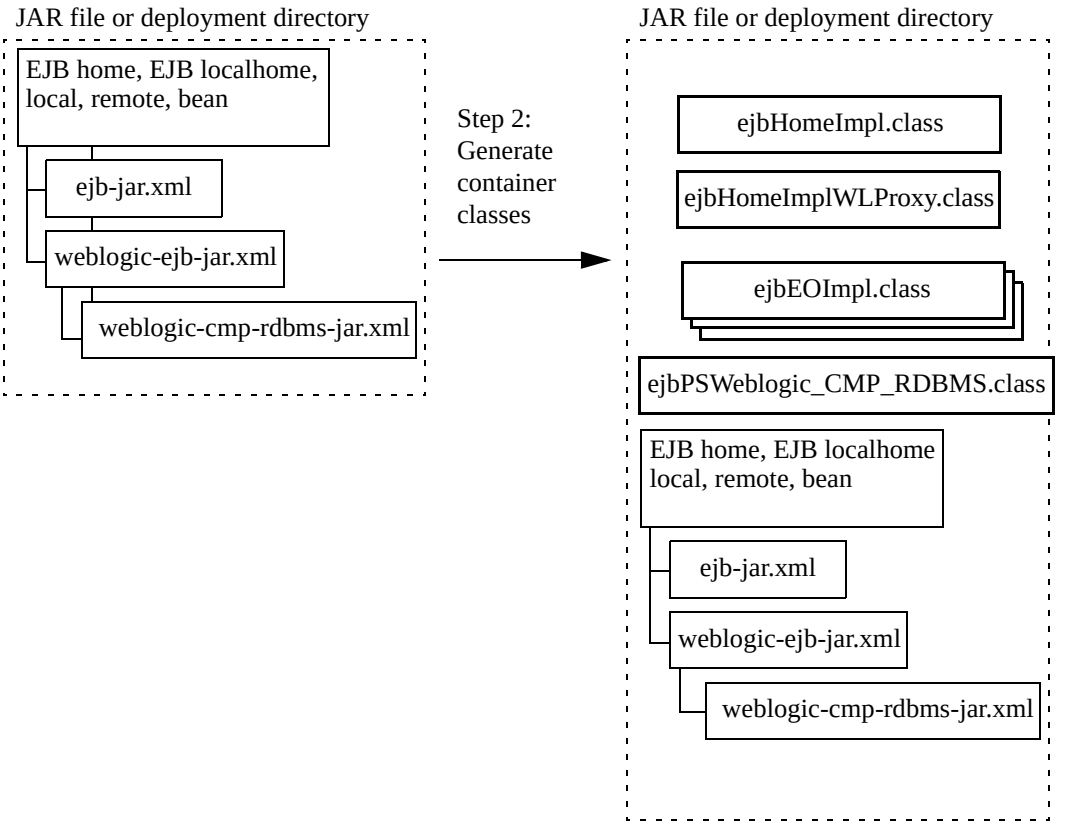
   Container classes include both the internal representation of the EJB that WebLogic Server uses, as well as implementation of the external interfaces (home, local, and/or remote) that clients use.

The appc compiler generates container classes according to the deployment descriptors you have specified in WebLogic-specific XML deployment descriptor files. For example, if you indicate that your EJBs will be used in a cluster, appc creates special cluster-aware classes that will be used for deployment.

You can also use appc directly from the command line by supplying the required options and arguments. See "appc" on page 10-3 for more information.

The following figure shows the container classes added to the deployment unit when the JAR file is generated.

Figure 7-5 Generating EJB container classes



Once you have generated the deployment unit, you can designate the file extension as either a JAR, EAR, or WAR archive.

Possible Generated Class Name Collisions

Although infrequent, when you generate classes with `appc`, you may encounter a generated class name collision which could result in a `ClassCaastException` and other undesireable behavior. This is because the names of the generated classes are based on three keys: the bean class name, the bean class package, and the ejb-name for the bean. This problem occurs when you use an EAR file that contains multiple JAR files and at least two of the JAR files contains an EJB with both the same bean class, package, or classname and both of those EJBs have the same ejb-name in their respective JAR files. If you experience this problem, change the `ejb-name` of one of the beans to make it unique.

Since the `ejb-name` is one of the keys on which the file name is based and the `ejb-name` must be unique within a JAR file, this problem never occurs with two EJBs in the same JAR file. Also, since each EAR file has its own classloader, this problem never occurs with two EJBs in different EAR files.

Loading EJB Classes into WebLogic Server

Classloaders in Weblogic Server are hierarchical. When you start WebLogic Server, the Java system classloader is active and is the parent of all subsequent classloaders that WebLogic Server creates. When WebLogic Server deploys an application, it automatically creates two new classloaders: one for EJBs and one for Web applications. The EJB classloader is a child of the Java system classloader and the Web application classloader is a child of the EJB classloader.

For more information on classloading, see “Classloader Overview” and “About Application Classloaders” in *Developing WebLogic Server Applications*.

Specifying an ejb-client.jar

WebLogic Server supports the use of `ejb-client.jar` files.

The `ejb-client.jar` always contains the home and remote interfaces and the primary key class, for entity beans. WebLogic Server adds these classes to the `ejb-client.jar` and then determines which additional files to load by checking which files these classes and any files they refer to reference. However, if the file is referenced in your classpath, WebLogic Server will not add it to `ejb-client.jar`. This enables WebLogic Server to add necessary custom classes to the `ejb-client.jar`; but restrict the generic classes such as `java.lang.String`.

Also, `ejb-client.jar` contains a copy of any classes from the `ejb-jar` file that are referenced by the home and remote interfaces and the primary key classhome and remote interfaces and the primary key class.

For example, the `ShoppingCart` remote interface might have a method that returns an `Item` class. Because this remote interface references this class, and it is located in the `ejb-jar` file, it will be included in the `EJB client.jar`.

Create an `ejb-client.jar` file by specify this feature in the bean's `ejb-jar.xml` deployment descriptor file and then generating the `ejb-client.jar` file using `weblogic.appc`. An `ejb-client.jar` contains the class files that a client program needs to call the EJBs contained in the `ejb-jar` file. The files are the classes required to compile the client. If you specify this feature, WebLogic Server automatically creates the `ejb-client.jar`.

To specify an `ejb-client.jar`:

1. Compile the bean's Java classes into a directory, using the `javac` compiler from the command line.
2. Add the EJB XML deployment descriptor files to the compiled unit using the guidelines in "WebLogic Server EJB Deployment Files" on page 7-3.
3. Edit the `ejb-client-jar` deployment descriptor in the bean's `ejb-jar.xml` file, as follows, to specify support for `ejb-client.jar`:

```
<ejb-client-jar>ShoppingCartClient.jar</ejb-client-jar>
```

4. Generate the container classes that are used to access the bean using `weblogic.appc` and create the `ejb-client.jar` using the following command:

```
$ java weblogic.appc <ShoppingCart.jar>
```

   Container classes include both the internal representation of the EJB that WebLogic Server uses, as well as implementation of the external interfaces (home, local, and/or remote) that clients use.

The `ejb-client.jar` always contains the home and remote interfaces and the primary key class, for entity beans. Also, it contains a copy of any classes from the `ejb-jar` file that are referenced by these interfaces. For example, the `ShoppingCart` remote interface might have a method that returns an `Item` class. Because this remote interface references this class, and it is located in the `ejb-jar` file, it will be included in the `EJB client.jar`.

External clients can include the `ejb-client.jar` in their classpath. Web applications would include the `ejb-client.jar` in their `/lib` directory.

Manifest Class-Path

Use the manifest file to specify that a JAR file can reference another JAR file. Standalone EJBs cannot use the Manifest Class-Path. It is only supported for components that are deployed within an EAR file. The clients should reference the `client.jar` in the classpath entry of the manifest file.

To use the manifest file to reference another JAR file:

1. Specify the name of the referenced JAR file in a Class-Path header in the referencing JAR file's Manifest file.

   The referenced JAR file is named using a URL relative to the URL of the referencing JAR file.

2. Name the manifest file META-INF/MANIFEST.MF in the JAR file

3. The Class-Path entry in the Manifest file is as follows:

   `Class-Path: AAyy.jar BByy.jar CCyy.jar.`

Note: The entry is a list of JAR files separated by spaces.

To place the home/remote interfaces for the EJB in the classpath of the calling component:

1. Use `appc` to compile the EJB into a JAR file.
2. Create a `client.jar` file. For instructions on using the `client.jar`, see "Specifying an ejb-client.jar" on page 7-13.
3. Place the `client.jar`, along with all the clients of the bean in an EAR.
4. Reference the EAR in the manifest file.

.

8 Deploying EJBs to WebLogic Server

The following sections provides instructions for deploying EJBs to WebLogic Server at WebLogic Server startup or on a running WebLogic Server. You can create, modify, and deploy EJBs in one or more instance of WebLogic Server. You can set up your EJB deployment, and map EJB references to actual resource factories, roles, and other EJBs available on a server by editing the XML deployment descriptor files.

- Deploying EJBs at WebLogic Server Startup
- Deploying EJBs on a Running WebLogic Server
- Deploying New EJBs into a Running Environment
- Undeploying Deployed EJBs
- Updating Deployed EJBs
- Deploying Compiled EJB Files
- Deploying Uncompiled EJB Files

Deploying EJBs at WebLogic Server Startup

To deploy EJBs automatically when WebLogic Server starts:

1. Follow the instructions in "Specifying and Editing the EJB Deployment Descriptors" on page 7-5 to ensure that your deployable EJB JAR file or deployment directory contains the required WebLogic Server XML deployment files.
2. Use a text editor or the EJB Deployment Descriptor Editor in the Administration Console to edit the XML deployment descriptor elements, as necessary.
3. Follow the instructions in "Compiling EJB Classes and Generating EJB Container Classes" on page 7-10 to compile implementation classes required for WebLogic Server.

   Compiling the container classes places the JAR file in the deployment directory. If you want the EJB to automatically deploy when WebLogic Server starts, place the EJB you want to deploy in the following directory:

   `mydomain\applications`\DefaultWebApp directory

   If your EJB JAR file is located in a different directory, make sure that you copy it to this directory if you want to deploy it at startup.
4. Start WebLogic Server.

   When you boot WebLogic Server, it automatically attempts to deploy the specified EJB JAR file or deployment directory.
5. Launch the Administration Console.
6. In the left pane, click Deployments and then the EJB node.

   A list of the EJB deployments for the server displays under the node.

Deploying EJBs in Different Applications

When you deploy EJBs with remote calls to each other in different applications, you cannot use `call-by-reference` to invoke the EJBs. Instead, you use `pass-by-value`. You should place components that commonly interact with each other in the same application where `call-by-reference` can be used. By default, EJB methods called from within the same server pass arguments by reference. This increases the performance of method invocation because parameters are not copied. `Pass-by-value` is always necessary when EJBs are called remotely (not from within the server).

Deploying EJBs on a Running WebLogic Server

Although placing the EJB JAR file or deployment directory in the `wlserver/config/mydomain/applications` directory allows the EJB to be immediately deployed, if you make a change to the deployed EJB, you must redeploy the EJB for the changes to take effect.

Automatic deployment is provided for situations where rebooting WebLogic Server is not feasible and is for development purposes only. Using automatic deployment only deploys the updated EJB to the Administration Server and does not deploy the EJB to any Managed Server on the domain. Using automatic deployment features, you can:

- Deploy a newly developed EJB to a running development system
- Remove a deployed EJB to restrict access to data
- Update a deployed EJB implementation class to fix a bug or test a new feature

Whether you deploy or update the EJB from the command line or the Administration Console, you use the automatic deployment features. The following sections describe automatic deployment concepts and procedures.

EJB Deployment Names

When you deploy an EJB JAR file or deployment directory, you specify a name for the deployment unit. This name is a shorthand reference to the EJB deployment that you can later use to undeploy or update the EJB.

When you deploy an EJB, WebLogic Server implicitly assigns a deployment name that matches the path and filename of the JAR file or deployment directory. You can use this assigned name to undeploy or update the bean after the server has started.

Note: The EJB deployment name remains active in WebLogic Server until the server is rebooted. Undeploying an EJB does not remove the associated deployment name, because you may later re-use that name to deploy the bean.

Deploying New EJBs into a Running Environment

To deploy an EJB JAR file or deployment directory that has not been deployed to WebLogic Server:

1. Start the WebLogic Server Administration Console.
2. Select the Domain in which you will be working.
3. In the left pane of the Console, click Deployments.
4. In the left pane of the Console, click EJB. A table displays in the right pane of the Console showing all the deployed EJBs.
5. Select the Configure a new EJB option.
6. Locate the EAR, WAR or JAR file you would like to configure. You can also configure an exploded application or component directory. Note that WebLogic Server will deploy all components it finds in and below the specified directory.
7. Click [select] to the left of a directory or file to choose desired file and proceed to the next step.
8. Select a Target Server from among Available Servers.
9. Enter a name for the EJB or application in the provided field.
10. Click Configure and Deploy to install the EJB or application. The Console will display the Deploy panel, which lists deployment status and deployment activities for the EJB.
11. Using the available tabs, enter the following information:
    - Configuration—Edit the staging mode and enter the deployment order.
    - Targets—Indicate the Targets-Server for this configured EJB or application by moving the server from the Available list to the Chosen list.
    - Deploy—Deploy the EJB or application to all or selected targets or undeploy it from all or selected targets.
    - Monitoring—Enable session monitoring for the EJB or application.
    - Notes—Enter notes related to the EJB or application.

Viewing Deployed EJBs

To view deployed EJBs:

1. Start the Administration Console.
2. Click the Deployments node in the left pane and then choose the EJB sub-node. A list of EJBs deployed on your domain displays under EJB and in the right pane.

Undeploying Deployed EJBs

Undeploying an EJB effectively prohibits all clients from using the EJB. When you undeploy the EJB, the specified EJB's implementation class is immediately marked as unavailable in the server. WebLogic Server automatically removes the implementation class and propagates an `UndeploymentException` to all clients that were using the bean.

Undeployment does not automatically remove the specified EJB's public interface classes. Implementations of the home interface, remote interface, and any support classes referenced in the public interfaces, remain in the server until all references to those classes are released. At that point, the public classes may be removed due to normal Java garbage collection routines.

Similarly, undeploying an EJB does not remove the deployment name associated with the `ejb.jar` file or deployment directory. The deployment name remains in the server to allow for later updates of the EJB.

Undeploying EJBs

To undeploy a deployed EJB, use the following steps:

From the WebLogic Server Administration Console:

1. Select the component in the left panel.

2. In the component Deployments table, select the component to undeploy.
3. Click Apply.

Undeploying an EJB does not remove the EJB deployment name from WebLogic Server. The EJB remains undeployed for the duration of the server session, as long as you do not change it once it had been undeployed. You cannot re-use the deployment name with the `deploy` argument until you reboot the server. You can re-use the deployment name to `update` the deployment, as described in the following section.

Updating Deployed EJBs

When you update the contents of an `ejb.jar` file or deployment directory that has been deployed to WebLogic Server, those updates are not reflected in WebLogic Server until:

- You reboot the server (if the JAR or directory is to be automatically deployed), or
- You *update* the EJB deployment using the WebLogic Server Administration Console.

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

The Update Process

When you update the currently-loaded implementation, classes 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 implementation classes.

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

Note: You can update only the EJB implementation classes, as described in "Loading EJB Classes into WebLogic Server" on page 7-12. You cannot update the EJB's public interfaces, or any support classes that are used by the public interfaces. If you make any changes to the EJB's public classes and attempt to update the EJB, WebLogic Server displays an incompatible class change error when a client next uses the EJB instance.

Updating the EJB

To update or redeploy the EJB implementation class, use the following steps:

From the WebLogic Server Administration Console:

1. Choose EJB from the Deployments node in the left pane of the Console.
2. Click the EJB you want to update from the list.
3. In the displayed table, click the name of the EJB you wish to update.
4. Update the Name and Deployed status as needed.
5. Click Apply.

You can update only the EJB implementation class, not the public interfaces or public support classes

Deploying Compiled EJB Files

To create compiled EJB 2.0 JAR or EAR files:

1. Compile your EJB classes and interfaces using `javac`.
2. Package the EJB classes and interfaces into a valid JAR or EAR file.
3. Use the `weblogic.appc` compiler on the JAR file to generate WebLogic Server container classes. For instructions on using appc, see "appc" on page 10-3.

To create compiled EJBs from previous versions of WebLogic Server:

1. Run `weblogic.appc` against the ejb JAR file to generate EJB 2.0 container-classes.
2. Copy the compiled ejb JAR files into

   `mydomain\applications\DefaultWebApp directory`

Note: You should manually recompile any EJBs from previous versions before deploying then to the EJB container. Otherwise, WebLogic Server automatically recompiles the EJBs and if there are errors, the output from the compile is sent to a separate log file.

If you change the contents of a compiled `ejb.jar` file in `applications` (by repackaging, recompiling, or copying over the existing `ejb.jar`), WebLogic Server automatically attempts to redeploy the `ejb.jar` file using the automatic deployment feature.

Note: Because the automatic redeployment feature uses dynamic deployment, WebLogic Server can only redeploy an EJB's implementation classes. You cannot redeploy an EJB's public interfaces.

Deploying Uncompiled EJB Files

The WebLogic Server container also enables you to automatically deploy JAR files that contain uncompiled EJB classes and interfaces. An uncompiled EJB file has the same structure as a compiled file, with the following exceptions:

- You do not have to compile individual class files and interfaces.
- You do not have to use `weblogic.appc` on the packaged JAR file to generate WebLogic Server container classes.

The `.java` or `.class` files in the JAR file must still be packaged in subdirectories that match their Java package hierarchy. Also, as with all `ejb.jar` files, you must include the appropriate XML deployment files in a top-level `META-INF` directory.

After you package the uncompiled classes, simply copy the JAR into the `wlserver\config\mydomain\applications` directory. If necessary, WebLogic Server automatically runs `javac` (or a compiler you specify) to compile the `.java`

files, and runs `weblogic.appc` to generate container classes. The compiled classes are copied into a new JAR file in `mydomain\applications\DefaultWebApp`, and deployed to the EJB container.

Should you ever modify an uncompiled ejb `.jar` in the `applications` directory (either by repackaging or copying over the JAR file), WebLogic Server automatically recompiles and redeploys the JAR using the same steps.

Note: Because the automatic redeployment feature uses dynamic deployment, WebLogic Server can only redeploy an EJB's implementation classes. You cannot redeploy an EJB's public interfaces.

9 EJB Runtime Monitoring

The runtime information collected for an EJB is substantial and can be very useful for tuning and debugging the EJB. This section discusses each of the runtime monitoring attributes and statistics collected and points you to some basic guidelines for tuning your EJB based on the information.

It is important to note that some runtime counts are only collected to calculate a ratio and are not useful in isolation. For example, the cache hit count is useless without the context of the cache access count. Together, however, one can calculate the cache hit ratio, which can be a very valuable statistic. However, some runtime attributes are useful by themselves, such as the cached beans current count, which is useful to measure the current usage of the cache.

Note: Every application is different so you should not consider these guidelines definitive.

Runtime Cache Attributes

This section gives detailed information on runtime cache attributes, including the following:

- "Cached Beans Current Count" on page 9-2
- "Cache Access Count" on page 9-2
- "Cache Hit Count" on page 9-2

- "Cache Miss Count" on page 9-2
- "Activation Count" on page 9-3
- "Passivation Count" on page 9-3
- "Cache Miss Ratio" on page 9-3

Cached Beans Current Count

Returns the total number of beans from this EJB Home currently in the EJB cache. This information may be useful to calculate the current percentage of the configured cache capacity being utilized.

Cache Access Count

Returns the total number of attempts to access a bean from the cache. This information is useful for giving context to other counts such as cache hits.

Cache Hit Count

Returns the total number of times an attempt to access a bean from the cache succeeded. This information is useful for determining the effectiveness of the EJB cache.

Cache Miss Count

Returns the total number of times an attempt to access a bean from the cache failed. This information is useful for determining the effectiveness of the EJB cache.

Activation Count

Returns the total number of beans from this EJB Home that have been activated.

Passivation Count

Returns the total number of beans from this EJB Home that have been passivated.

Cache Miss Ratio

The cache miss ratio is a ratio of the number of times a container cannot find a bean in the cache (cache miss) to the number of times it attempts to find a bean in the cache (cache access). In general, the lower your cache miss ratio, the better your EJB will perform. The amount of time saved by getting a bean from the cache depends on the cost of the bean's ejbActivate method as well as the bean's cache-between-transactions setting. When a cache miss occurs, a bean must be obtained from the free pool and its ejbActivate method must be called. The more expensive it is to invoke ejbActivate, the more the cache miss will hurt performance. If the EJB is configured with cache-between-transactions set to true, the cache miss will also force the EJB container to make an extra call to the database to load the bean.

For information on what to tune in response to the cache miss ratio statistic, see "Cache Miss Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#cache_miss_ratio.

Runtime Lock Manager Attributes

This section gives detailed information on runtime lock manager attributes, including the following:

- "Lock Entries Current Count" on page 9-4
- "Lock Manager Access Count" on page 9-4

- "Waiter Total Count" on page 9-4
- "Timeout Total Count" on page 9-4
- "Lock Waiter Ratio" on page 9-5
- "Lock Timeout Ratio" on page 9-5

Lock Entries Current Count

Returns the current number of lock entries in the lock manager. This information isn't really useful for tuning an EJB but it may be helpful in detecting stale lock entries.

Lock Manager Access Count

Returns the total number of attempts to obtain a lock on a bean. This includes attempts to obtain a lock on a bean that is already locked on behalf of the client. This information is useful for giving context to the waiter and timeout total counts.

Waiter Total Count

Returns the total number Threads that have waited for a lock on a bean. This information is useful to calculate the lock waiter ratio.

Timeout Total Count

Returns the total number of threads that have timed out waiting for a lock on a bean. This information is useful to calculate the lock timeout ratio.

Lock Waiter Ratio

This is the ratio of the number of times a thread had to wait to obtain a lock on a bean to the total amount of lock requests issued. For best performance, you want the lock waiter ratio to be as low as possible.

For information on what to tune in response to the lock waiter ratio statistic, see "Lock Waiter Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#lock_waiter_ratio.

Lock Timeout Ratio

This is the ratio of timeouts to accesses for the lock manager. Timeouts are very detrimental to performance and therefore, you should strive to keep your lock timeout ratio to an absolute minimum. Timeouts hurt performance on several levels. First, each thread waiting for a lock is one less thread that the server can be using to service other requests. Second, a lock timeout will result in an exception that will roll back the current transaction, erasing any work already done in the transaction and causing the current request to fail.

For information on what to tune in response to the lock timeout ratio statistic, see "Lock Timeout Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#lock_timeout_ratio.

Runtime Free Pool Attributes

This section gives detailed information on runtime free pool attributes, including the following:

- "Access Total Count" on page 9-6
- "Miss Total Count" on page 9-6
- "Destroyed Total Count" on page 9-6
- "Pooled Beans Current Count" on page 9-6

- "Beans In Use Current Count" on page 9-7
- "Waiter Current Count" on page 9-7
- "Pool Timeout Total Count" on page 9-7
- "Pool Miss Ratio" on page 9-7
- "Destroyed Bean Ratio" on page 9-8
- "Pool Timeout Ratio" on page 9-8

Access Total Count

Returns the total number of times an attempt was made to get an instance from the free pool. This information is useful for giving context to the other free pool counts.

Miss Total Count

Returns the total number of times a failed attempt was made to get an instance from the free pool. An Attempt to get a bean from the pool will fail if there are no available instances in the pool. This information is useful for calculating the pool miss ratio.

Destroyed Total Count

Returns the total number of times a bean instance from this pool was destroyed due to a non-application Exception being thrown from it. This information is useful for calculating the destroyed bean ratio.

Pooled Beans Current Count

Returns the current number of available bean instances in the free pool. This information is useful for tracking demand for your EJB. For example, this can be important when investigating an abnormal pool miss ratio.

Beans In Use Current Count

Returns the number of bean instances currently in use from the free pool. This information is useful for tracking demand for your EJB. For example, this can be important when investigating an abnormal pool miss ratio.

Waiter Current Count

Returns the number of Threads currently waiting for an available bean instance from the free pool. This information may be useful, for example, for investigating the cause of poor application performance at a particular time.

Pool Timeout Total Count

Returns the total number of Threads that have timed out waiting for an available bean instance from the free pool. This information is useful for calculating the pool timeout ratio.

Pool Miss Ratio

The pool miss ratio is a ratio of the number of times a request was made to get a bean from the pool when no beans were available, to the total number of requests for a bean made to the pool. The consequence of a pool miss is different for different types of beans.

A pool miss for a stateless session bean will cause the requesting thread to wait for a bean to become available in the pool. The maximum time a thread will wait is equal to the transaction timeout value for the bean.

Entity beans and message-driven beans will never wait for an instance to become available. Instead, a pool miss will cause the pool to create a new bean instance to service the request. Pool misses come at a cost since the executing thread will either have to wait for a bean to become available or have to wait for a new bean to be created. As such, it is best to try to keep your pool miss ratio to a minimum.

For information on what to tune in response to the pool miss ratio statistic, see "Pool Miss Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#pool_miss_ratio.

Destroyed Bean Ratio

The destroyed bean ratio is a ratio of the number of beans destroyed to the total number of requests for a bean. The EJB specification mandates that the EJB container destroys a bean when non-application exceptions are thrown from the bean during execution. Destroying beans comes at a cost, however, because destroyed beans will likely have to be replaced with new bean instances. As a result, you should keep your destroyed bean ratio to a minimum.

For information on what to tune in response to the destroyed bean ratio statistic, see "Destroyed Bean Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#destroyed_bean_ratio.

Pool Timeout Ratio

The pool timeout ratio is a ratio of requests that have timed out waiting for a bean from the pool to the total number of requests made. This ratio is only valid for stateless session beans because it is the only type of bean that will wait for a bean to become available.

Other types of beans will automatically create a new instance to service a request rather than waiting. For best performance, the pool timeout ratio should be as small as possible.

For information on what to tune in response to the pool timeout ratio statistic, see "Pool Timeout Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#pool_timeout_ratio.

Runtime Transaction Attributes

Note: Runtime transaction attributes are not exposed in the 8.1 Beta 1 Administration Console.

This section gives detailed information on runtime transaction attributes, including the following:

- "Transactions Committed Total Count" on page 9-9
- "Transactions Rolled Back Total Count" on page 9-9
- "Transactions Timed Out Total Count" on page 9-9
- "Transaction Rollback Ratio" on page 9-10
- "Transaction Timeout Ratio" on page 9-10

Transactions Committed Total Count

Returns the total number of transactions that have been committed for this EJB. This information is useful for calculating transaction commit ratio.

Transactions Rolled Back Total Count

Returns the total number of transactions that have been rolled back for this EJB. This information is useful for calculating transaction commit ratio.

Transactions Timed Out Total Count

Returns the total number of transactions that have timed out for this EJB. This information is useful in calculating transaction timeout ratio.

Transaction Rollback Ratio

The transaction rollback ratio is the ratio of transactions that have rolled back to the number of total transactions involving the EJB. This information is useful for several reasons. First, it may be useful for signaling a problem with an application. For example, an unexpectedly high rollback ratio may be caused by a problem with a resource used by the application. It may also be useful in gauging the efficiency of an application. A high transaction rollback ratio may mean that a lot of work is being done only to eventually be rolled back, which is inefficient.

For information on what to tune in response to the transaction rollback ratio statistic, see "Transaction Rollback Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#transaction_rollback_ratio.

Transaction Timeout Ratio

The transaction timeout ratio is the ratio of transactions that have timed out to the total number of transactions involving an EJB. Timeouts can be especially concerning because they are a signal of inefficiency.

Every EJB request uses valuable server resources such as threads and bean instances. A timed out transaction means that server resources were tied up in vein. The transaction timeout ratio is a good indicator of a problem with an application.

For information on what to tune in response to the transaction timeout ratio statistic, see "Transaction Timeout Ratio" in the *WebLogic Server Performance and Tuning Guide* at http://e-docs.bea.com/wls/docs81b/perform/EJBTuning.html#transaction_timeout_ratio.

JMS Attributes

This section gives detailed information on JMS attributes, including the following:

■ "JMSConnection Alive" on page 9-11

JMSConnection Alive

The JMSConnection Alive field tells you whether the EJB container has successfully connected to the JMS destination source and that therefore the message-driven bean is receiving messages. If this field's value displays as `false`, check the server log for possible reasons for connection failure.

CHAPTER

10 WebLogic Server EJB Tools

BEA provides several tools you can use to help you create and configure EJBs. They are discussed in the following sections:

- Ant Tasks
- appc (`weblogic.appc`)
- Builder
- DDConverter (`weblogic.ejb.utils.DDConverter`)
- Deployer (`weblogic.Deployer`)
- EJBGen
- ejbc (`weblogic.ejbc`)

Ant Tasks

You can use the WebLogic Ant utilities to create skeleton deployment descriptors. These utilities are Java classes shipped with your WebLogic Server distribution. The Ant task looks at a directory containing an EJB and creates deployment descriptors based on the files it finds there. Because the Ant utility does not have information about all desired configurations and mappings for your EJB, the skeleton deployment descriptors the utility creates are incomplete. After the utility creates the skeleton

deployment descriptors, you can use a text editor, an XML editor, or the Administration Console to edit the deployment descriptors and complete the configuration of your EJB.

For more information on using Ant utilities to create deployment descriptors, see "Tools for Deploying" in *WebLogic Server Deployment and Packaging*.

appc

The appc compiler generates and compiles the classes needed to deploy EJBs and JSPs to WebLogic Server. It also validates the deployment descriptors for compliance with the current specifications at both the individual module level and the application level. The application-level checks include checks between the application-level deployment descriptors and the individual modules as well as validation checks across the modules.

appc Syntax

Use the following syntax to run `appc`:

```
prompt>java weblogic.appc [options] <ear, jar, or war file or
directory>
```

appc Options

The following are the available `appc` options:

Option	Description
`-print`	Prints the standard usage message.
`-version`	Prints `jspc` version information.
`-output <file>`	Specifies an alternate output archive or directory. If not set, the output is placed in the source archive or directory.
`-forceGeneration`	Forces generation of EJB and JSP classes. Without this flag, the classes may not be regenerated (if determined to be unnecessary).
`-lineNumbers`	Adds line numbers to generated class files to aid in debugging.
`-basicClientJar`	Does not include deployment descriptors in client JARs generated for EJBs.

`-idl`	Generates IDL for EJB remote interfaces.
`-idlOverwrite`	Always overwrites existing IDL files.
`-idlVerbose`	Displays verbose information for IDL generation.
`-idlNoValueTypes`	Does not generate valuetypes and the methods/attributes that contain them.
`-idlNoAbstractInterfaces`	Does not generate abstract interfaces and methods/attributes that contain them.
`-idlFactories`	Generates factory methods for valuetypes.
`-idlVisibroker`	Generates IDL somewhat compatible with Visibroker 4.5 C++.
`-idlOrbix`	Generates IDL somewhat compatible with Orbix 2000 2.0 C++.
`-idlDirectory <dir>`	Specifies the directory where IDL files will be created (default: target directory or JAR)
`-idlMethodSignatures <>`	Specifies the method signatures used to trigger IDL code generation.
`-iiop`	Generates CORBA stubs for EJBs.
`-iiopDirectory <dir>`	Specifies the directory where IIOP stub files will be written (default: target directory or JAR)
`-keepgenerated`	Keeps the generated .java files.
`-compiler <javac>`	Selects the Java compiler to use.
`-g`	Compiles debugging information into a class file.
`-O`	Compiles with optimization on.
`-nowarn`	Compiles without warnings.
`-verbose`	Compiles with verbose output.
`-deprecation`	Warns about deprecated calls.
`-normi`	Passes flags through to Symantec's sj.
`-J<option>`	Passes flags through to Java runtime.

`-classpath <path>`	Selects the classpath to use during compilation.
`-advanced`	Prints advanced usage options.

appc Ant Task

You can use the following Ant task to invoke the `appc` compiler:

```
<taskdef name="appc"
classname="weblogic.ant.taskdefs.j2ee.Appc"/>
```

appc and EJBs

`weblogic.appc` performs the following EJB-related functions:

- Generates WebLogic Server container classes for the EJBs.
- Checks all EJB classes and interfaces for compliance with the EJB specification.
- Checks deployment descriptors for potential configuration problems. For example, if there is a cmp field declared in `ejb-jar.xml`, `appc` verifies that the column is mapped in the `weblogic-cmp-rdbms.xml` deployment descriptor.
- Runs each EJB container class through the RMI compiler to create RMI descriptors necessary to dynamically generate stubs and skeletons.

By default, `appc` uses `javac` as a compiler. For faster performance, specify a different compiler (such as Symantec's `sj`) using the command-line `-compiler` flag or via the Administration Console. See Configuring Compiler Options at http://e-docs.bea.com/wls/docs81b/ConsoleHelp/ejb.html#configuring_compiler_options.

For the location of the public version of `weblogic-ejb-jar.xml`, see Chapter 11, "The weblogic-ejb-jar.xml Deployment Descriptor." For the location of the public version of `weblogic-cmp-rdbms-jar.xml`, see Chapter 12, "The weblogic-cmp-rdbms- jar.xml Deployment Descriptor."

Advantages of Using appc

The appc tool offers the following benefits:

- The flexibility of compiling an entire application, rather than compiling individual modules separately and combining them into an EAR after the fact.
- Validation checks across all modules and validation of application-level deployment descriptors against the various modules, because WebLogic Server has access to all modules during EAR compilation.

  Previously, a user wanting to compile all modules within an .ear file had to extract the individual components of an .ear and manually execute the appropriate compiler (jspc or ejbc) to prepare the module for deployment. appc automates this process and makes additional pre-deployment validation checks not previously possible.
- It is easy to identify and correct errors appc produces.

  If an error occurs while running appc from the command line, appc exits with an error message.

  By contrast, if you defer compilation to the time of deployment and a compilation error occurs, the server fails the deployment and goes on with its work. To determine why deployment failed, you must examine the server output, fix the problem and then redeploy.
- By running appc prior to deployment, you potentially reduce the number of time a bean is compiled.

  For example, if you deploy a .jar file to a cluster of 3 servers, the .jar file is copied to each of the three servers for deployment. If the .jar file wasn't precompiled, each of the three servers will have to compile the file during deployment.

Builder

WebLogic Builder is a graphical tool for assembling a J2EE application module, creating and editing its deployment descriptors, and deploying it to a WebLogic server.

WebLogic Builder provides a visual editing environment for editing an application's deployment descriptor XML files. You can view these XML files as you visually edit them in WebLogic Builder, but you won't need to make textual edits to the XML files.

Use WebLogic Builder to do the following development tasks:

- Generate deployment descriptor files for a J2EE module
- Edit a module's deployment descriptor files
- Compile and validate deployment descriptor files
- Deploy a J2EE module to a server

WebLogic Builder is discussed in detail in the WebLogic Builder document. The section called "Working with EJBs" may be particularly useful to you.

DDConverter

The `DDConverter` is a command line tool that converts earlier versions EJB deployment descriptors into EJB deployment descriptors that conform to this version of WebLogic Server. The WebLogic Server EJB container supports both the EJB 1.1 and EJB 2.0 specifications including the EJB 1.1 and EJB 2.0 document type definitions (DTD). Each WebLogic Server EJB deployment includes standard deployment descriptors in the following files:

- `ejb-jar.xml`

  This XML file contains the J2EE-specific EJB deployment descriptors.

- `weblogic-ejb-jar-.xml`

  This XML file contains the WebLogic-specific EJB deployment descriptors.

- `weblogic-cmp-rdbms-jar.xml`

  This XML file contains the WebLogic-specific container-managed persistence (CMP) deployment descriptors.

Conversion Options Available with DDConverter

The `DDConverter` command line tool includes the following conversion options:

- Converting beans from earlier versions of WebLogic Server (WLS).
- Converting CMP and non-CMP beans from earlier version of the EJB specification.

The following table lists the various conversion options for the DDconverter:

Table 10-1

Conversion Options for the DDConverter tool

WLS		EJB non-CMP		EJB CMP	
From	**To**	**From**	**To**	**From**	**To**
WLS 4.5	WLS 8.1	See **Note 1**		EJB CMP 1.0	EJB CMP 1.1
				Note: Use the DDConverter command line option `-EJBVer` for converting EJB CMP 1.0 to EJB CMP 1.1. See "DDConverter Options" on page 10-11 for a description of this option.	
WLS 4.5	WLS 8.1	EJB 1.1	EJB 2.0	EJB CMP 1.0	EJB CMP 2.0

Table 10-1

Conversion Options for the DDConverter tool

WLS		EJB non-CMP		EJB CMP	
From	**To**	**From**	**To**	**From**	**To**
WLS 5.x	WLS 8.1	EJB 1.1	EJB 2.0	**Note:** Although WLS 5.x CMP 1.1 beans and WLS 8.1 CMP 1.1 beans differ, WLS 5.1 CMP 1.1 beans can run in WebLogic Server 8.1 without any changes to source code.	
WLS 6.x	WLS 8.1	EJB 1.1	EJB 2.0	EJB CMP 1.1	EJB CMP 2.0
WLS 7.0	WLS 8.1	EJB 1.1	EJB 2.0	EJB CMP 1.1	EJB CMP 2.0

Note: Converting non-CMP EJB 1.0 beans to non-CMP EJB 1.1 beans is not necessary because the EJB 1.1 non-CMP deployment descriptors are the same as the EJB 2.0 non-CMP deployment descriptors.

You should always recompile the beans after you use the DDConverter. We recommend that you use `weblogic.appc` and then deploy the new generated JAR file. Recompiling the bean makes sure that the code is compliant with the EJB Specification and saves you time because you can skip the recompile process during server startup.

- When converting WLS 4.5 EJB 1.0 beans to WLS 8.1 EJB 1.1 beans, the input to `DDConverter` is the WebLogic 4.5 deployment descriptor text. The output is a JAR file that only includes the WebLogic 8.1 deployment descriptors. Run `weblogic-appc` to see if you need to make any additional changes to the source code following the steps in "Using DDConverter to Convert EJBs" on page 10-10. See the first row in the Conversion Options for the DDConverter tool table.
- When converting WLS 4.5 EJB 1.1 beans to WLS 8.1 EJB 2.0 beans, the input to `DDConverter` is the WebLogic Server 4.5 deployment descriptor text. The output is a JAR file that only includes the WebLogic 8.1 deployment descriptors. Run `weblogic-appc` to see if you need to make any additional changes to the

source code, follow the steps in "Using DDConverter to Convert EJBs" on page 10-10. See the second row in the Conversion Options for the DDConverter tool table.

- You can deploy WLS 5.x EJB 1.1 beans to WLS 8.1 without any making changes to the source code because WLS 8.1 is backward compatible. WLS 8.1 detects, recompiles, and then deploys beans from previous versions of WLS. However, we recommend that you use the DDConverter to upgrade the WLS 5.x EJB 1.1 beans to WLS 8.1 EJB 2.0 beans.

  When converting WLS 5.x EJB 1.1 beans to WLS 8.1 EJB 2.0 beans, the input to `DDConverter` is the WebLogic 5.1 JAR file. This file contains the deployment descriptor files and class files. The output goes to a JAR file that includes the WebLogic 8.1 deployment descriptor files and all necessary class files. See the third row in the Conversion Options for the DDConverter tool table.

  You can convert non-CMP beans to EJB 2.0 beans with little or no changes to the source code. To do this, run weblogic.appc on the `output.jar` file and then deploy the generated JAR file. With CMP beans, you must make changes to the source code using the steps in "Using DDConverter to Convert EJBs" on page 10-10.

Using DDConverter to Convert EJBs

To convert earlier versions of EJBs for use in WebLogic Server:

1. Input the EJB's deployment descriptor file into the `DDConverter` using the command line format shown in "DDConverter Syntax" on page 10-11.

   The output is a JAR file.

2. Extract the XML deployment descriptors from the JAR file.
3. Modify the source code according to the JavaSoft EJB Specification.
4. Compile the modified java file with the extracted XML deployment descriptors, using `weblogic.appc` to create a JAR file.
5. Deploy the JAR file.

DDConverter Syntax

```
prompt> java weblogic.ejb20.utils.DDConverter [options] file1
[file2...]
```

DDConverter Arguments

`DDConverter` takes the argument *`file1 [file2...],`* where file is one of the following:

- A text file containing EJB 1.0-compliant deployment descriptors.
- A JAR file containing EJB 1.1 compliant deployment descriptors.

`DDConverter` uses the `beanHomeName` property of EJBs in the text deployment descriptor to define new `ejb-name` elements in the resultant `ejb-jar.xml` file.

DDConverter Options

The following table lists the DDConverter command-line options:

Option	Description
`-d` destDir	Specifies the destination directory for the output of the JAR files. This is a required option.
`-c` jar name	Specifies a JAR file in which you combine all beans in the source files.
`-EJBVer` *`output EJB version`*	Specifies the output EJB version number, such as 2.0 or 1.1. The default is 2.0.
`-log` log file	Specifies a file into which the log information can be placed instead of the `ddconverter.log`.
`-verboseLog`	Specifies that extra information on the conversion be placed in the `ddconverter.log`.

`-help`	Prints a list of all options available for the `DDConverter` tool.

DDConverter Examples

The following example converts a WLS 5.x EJB 1.1 bean into a WLS 8.1 EJB 2.0 bean.

The JAR file is created in the *`destDir`* subdirectory:

```
prompt> java weblogic.ejb20.utils.DDConverter -d destDir
Employee.jar
```

Where the `Employee` bean is a WLS 5.x EJB 1.1 JAR file.

DDInit

DDInit examines the contents of a staging directory and builds the standard J2EE and WebLogic-specific deployment descriptors based on the EJB classes.

DDInit Ant Tasks

`weblogic.ant.taskdefs.ejb20.DDInit` creates the deployment descriptors for Enterprise JavaBeans 2.0.

`weblogic.ant.taskdefs.ejb.DDInit` creates the deployment descriptors for Enterprise JavaBeans 1.1.

Deployer

The `weblogic.Deployer` command-line tool is a Java-based deployment tool that provides a command line interface to the WebLogic Server deployment API. This tool was developed for administrators and developers who need to initiate deployment from the command line, a shell script, or any automated environment other than Java.

For instructions on using weblogic.Deployer and a list of the commands, see Deploying Using weblogic.Deployer.

EJBGen

`EJBGen` is an Enterprise JavaBeans 2.0 code generator. You can annotate your Bean class file with javadoc tags and then use `EJBGen` to generate the Remote and Home classes and the deployment descriptor files for an EJB application, reducing to one the number of EJB files you need to edit and maintain.

If you have installed BEA WebLogic 8.1 examples, see *SAMPLES_HOME*`\server\src\examples\ejb20\ejbgen` for an example application called Bands that uses EJBGen.

EJBGen Syntax

```
javadoc -docletpath weblogic.jar -doclet
weblogic.tools.ejbgen.EJBGen (YourBean).java
```

If you do not have `weblogic.jar` in your classpath, add the path to `weblogic.jar` as follows:

```
javadoc -docletpath <path_to_weblogic.jar> weblogic.jar -doclet
weblogic.tools.ejbgen.EJBGen (YourBean).java
```

If you are invoking EJBGen for an EJB that has relationships with other EJBs, invoke the related EJBs by naming them, following your EJB, in the invocation, as follows:

```
javadoc -docletpath weblogic.jar -doclet
weblogic.tools.ejbgen.EJBGen (YourBean).java (RelatedBean).java
```

EJBGen includes the following options.

Option	Definition
`-d [directory]`	The directory under which all the files will be created.
`-ignorePackage`	If this flag is set, EJBGen will ignore the package name of the Java files it generates and will create those in the output directory as specified by the -d flag (or in the current directory if no -d was specified).
`-pfd1`	If this flag is set, EJBGen will generate deployment descriptors compatible with the Public Final Draft 1 of the EJB 2.0 specification. You should use this flag if you are using any version anterior to Weblogic 6.1.
`-ejbPrefix [string] (default: "")`	The prefix to use when generating the EJB class.
`-ejbSuffix [string] (default: "Bean" or "EJB")`	The suffix to use when generating the EJB class.
`-localHomePrefix [string] (default: "")`	The prefix to use when generating the local EJB class.
`-localHomeSuffix [string] (default: "LocalHome")`	The suffix to use when generating the local EJB class.
`-remoteHomePrefix [string] (default: "")`	The prefix to use when generating the remote EJB home class.
`-remoteHomeSuffix [string] (default: "Home")`	The suffix to use when generating the remote EJB home class.
`-remotePrefix [string] (default: "")`	The prefix to use when generating the remote EJB class.
`-remoteSuffix [string] (default: "")`	The suffix to use when generating the remote EJB class.

Option	Definition
`-localPrefix [string] (default: "")`	The prefix to use when generating the local EJB class.
`-localSuffix [string] (default: "Local")`	The suffix to use when generating the local EJB class.
`-valueObjectPrefix [string] (default: "")`	The prefix to use when generating the value object class.
`-valueObjectSuffix [string] (default: "Value")`	The suffix to use when generating the value object class.
`-jndiPrefix [string] (default: "")`	The prefix to use for `@remote-jndi-name` and `@local-jndi-name`
`-jndiSuffix [string] (default: "")`	The suffix to use for `@remote-jndi-name` and `@local-jndi-name`
`-checkTags`	If invoked with this option, EJBGen will not generate any classes but will search the classes supplied on the command line for tags that are not valid EJBGen tags.
`-docTags`	Print out all the tags known by EJBGen. Note that even though this option does not need any source file, you still need to specify an existing .java class on the command line, or Javadoc will emit an error message even though it recognized the flag.
`-docTag tagName`	Print out the detailed documentation for this tag, including all the recognized attributes. Note that even though this option does not need any source file, you still need to specify an existing .java class on the command line, or Javadoc will emit an error message even though it recognized the flag.

Option	Definition
-docTagsHtml	Same as -docTags, but generate an HTML document.
-propertyFile [fileName]	The name of a property file that EJBGen will read to define substitution variables. See the substitution variable documentation
-valueBaseClass [className]	Removed. Use the variable value.baseClass.
-noValueClasses	If specified, value classes will not be generated.

EJBGen Example

This example shows a Bean file annotated so that EJBGen will generate the Remote and Home interfaces and the deployment descriptor files. AccountBean.java is the main bean class. It is a CMP EJB 2.0 Entity bean:

```
/**

 * @ejbgen:entity
*   ejb-name = AccountEJB-OneToMany
*   data-source-name = examples-dataSource-demoPool
*   table-name = Accounts
*   prim-key-class = java.lang.String

 *

 * @ejbgen:jndi-name

 *   local = one2many.AccountHome


 * @ejbgen:finder

 *   signature = "Account findAccount(double balanceEqual)"
*   ejb-ql = "WHERE balance = ?1"

 *
```

```
 * @ejbgen:finder

 *   signature = "Collection findBigAccounts(double
balanceGreaterThan)"

 *   ejb-ql = "WHERE balance > ?1"

 *

 * @ejbgen:relation

 *   name = Customer-Account
*   target-ejb = CustomerEJB-OneToMany
*   multiplicity = many
*   cmr-field = customer

 *

 */

abstract public class AccountBean implements EntityBean {


  /**

   * @ejbgen:cmp-field column = acct_id

   * @ejbgen:primkey-field

   * @ejbgen:remote-method transaction-attribute = Required

   */

  abstract public String getAccountId();

  abstract public void setAccountId(String val);

  // ....

}
```

As you can see from this example, there are two types of tags: class tags and method tags, depending on where you can use them.

Once you finish editing your file, you invoke EJBGen through the following javadoc command:

```
javadoc -docletpath weblogic.tools.ejbgen.EJBGen.ejbgen -doclet
EJBGen AccountBean.java
```

When javadoc exits, it will have generated the following files for you:

- Account.java
- AccountHome.java
- ejb-jar.xml
- weblogic-ejb-jar.xml
- weblog-cmp-rdbms-jar.xml

EJBGen Tags

Use the following tags to annotate your Bean file.

@ejbgen:automatic-key-generation

Where: Class

Applicable on: Entity bean

Attribute	Description	Required
cache-size	The size of the key cache.	Yes
name	The name of the generator.	Yes
type	The type of the generator.	Yes

@ejbgen:cmp-field

Where: Method

Applicable on: Entity bean

Attribute	Description	Required
column	The column where this CMP field will be mapped.	Yes
column-type	The type of this column. (OracleClob|OracleBlob)	No

Attribute	Description	Required
ordering-number (0..n)	The number where this field must appear in signatures and constructors. For this ordering to work, all CMR and CMP fields must have this attribute to a distinct numeric value.	No

@ejbgen:cmr-field

*Where:*Method

Applicable on: Entity

Attribute	Description	Required
ordering-number (0..n)	The number where this field must appear in signatures and constructors. For this ordering to work, all CMR and CMP fields must have this attribute to a distinct numeric value.	No

@ejbgen:create-default-rdbms-tables

Where: Class

Applicable on: Entity bean

@ejbgen:ejb-client-jar

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
file-name	The name of the client jar to generate. If more than one EJB's have this tag, only one of the specified jar files will be included in the deployment descriptor.	Yes

@ejbgen:ejb-local-ref

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
home	Local class of the bean.	No
jndi-name	The JNDI name of the reference.	No
link	Link of the bean.	No
local	Home class of the bean.	No
name	Name of the reference.	No
type	(Entity|Session)	No

@ejbgen:ejb-ref

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
home	Remote class of the bean.	No
jndi-name	The JNDI name of the reference.	No
link	Link of the bean.	No
name	Name of the reference.	No
remote	Home class of the bean.	No
type	(Entity|Session)	No

@ejbgen:entity

Where: Class

Applicable on: Entity beans

Attribute	Description	Required
ejb-name	The name of this Entity bean.	Yes
prim-key-class	null	Yes
abstract-schema-name	The abstract schema name for this EJB. If not specified, the ejb-name value will be used.	No
concurrency-strategy	(Optimistic|ReadOnly|Exclusive|Database) Defines the concurrency strategy for this bean.	No
data-source-name	The name of the DataSource (as it was declared in your config.xml).	No
db-is-shared	(True|False)	No
default-transaction	The transaction attribute to be applied to all methods that do not have a more specific transaction attribute setting.	No
delay-database-insert-until	(ejbCreate|ejbPostCreate)	No
delay-updates-until-end-of-tx	(True|False) Whether updates will be sent after the transaction has committed.	No
idle-timeout-seconds	Maximum duration an EJB should stay in the cache.	No
invalidation-target	The ejb-name of a read-only Entity bean that should be invalidated when this Container-Managed Persistence Entity EJB has been modified.	No
max-beans-in-cache	The maximum number of beans in the cache.	No
persistence-type	(cmp|bmp) The type of this Entity bean (default: cmp).	No
prim-key-class-nogen	(True|False). If this keyword is specified, EJBGen will not generate the primary key class (it is assumed that you are providing it yourself).	No

Attribute	Description	Required
read-timeout-seconds	The number of seconds between each ejbLoad() call on a Read-Only Entity bean.	No
reentrant	(True|False)	No
run-as	Specifies the role-name for this EJB.	No
run-as-identity-principal	The name of the principal in case the role maps to several principals.	No
table-name	The Java class of the primary key. In case of a compound primary key, this class will be generated by EJBGen.	No
trans-timeout-seconds	The transaction timeout (in seconds).	No
use-caller-identity	(True|False) Whether this EJB uses caller's identity.	No

@ejbgen:env-entry

*Where:*Class

Applicable on: All types of beans

Attribute	Description	Required
name	The name of this environment entry.	Yes
type	The Java type for this environment entry (must be fully qualified, even if java.lang).	Yes
value	The value for this environment entry.	Yes

@ejbgen:finder

***Where:* Class**

Applicable on: Entity beans

Attribute	Description	Required
ejb-ql	The EJB QL request as it will appear in the deployment descriptor.	Yes
signature	It must match exactly the signature as you want it generated on the Home class. EJBGen will add the conformant exceptions, but you must make sure that you specify the fully qualified type of each parameter, even if it belongs to java.lang.	Yes
isolation-level	The type of transaction isolation for this method.	No
transaction-attribute	The transaction attribute for this local method. If not specified, the default transaction attribute will be used. Methods with this tag will be generated on the Local class.	No
weblogic-ejb-ql	The Weblogic EJB QL request as it will appear in the deployment descriptor. Note: if this request is needed, you need to enclose both EJBQL and Weblogic EJBQL within double quotes.	No

@ejbgen:jndi-name

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
local	The local JNDI name of this EJB. It not specified, no local interfaces will be generated.	No
remote	The remote JNDI name of this EJB. It not specified, no remote interfaces will be generated.	No

@ejbgen:local-home-method

Where: Method

Applicable on: Entity and Session beans

Attribute	Description	Required
transaction-attribute	The transaction attribute for this local method. If not specified, the default transaction attribute will be used. Methods with this tag will be generated on the Local class.	No

@ejbgen:local-method

Where: Method

Applicable on: Entity and Session beans

Attribute	Description	Required
isolation-level	The type of transaction isolation for this method.	No
transaction-attribute	The transaction attribute for this local method. If not specified, the default transaction attribute will be used. Methods with this tag will be generated on the Local class.	No

@ejbgen:message-driven

Where: Class

Applicable on: Message-Driven beans

Attribute	Description	Required
destination-jndi-name	The JNDI name of the destination.	Yes
ejb-name	The name of this Message-Driven bean.	Yes
acknowledge-mode	(auto-acknowledge|dups-ok-acknowledge) The acknowledgement mode.	No

Attribute	Description	Required
default-transaction	The transaction attribute to be applied to all methods that do not have a more specific transaction attribute setting.	No
destination-type	(javax.jms.Queue|javax.jms.Topic).	No
durable	(True|False) If the destination-type is `Topic`, setting this attribute to `True` will make the subscription durable.	No
initial-beans-in-free-pool	The initial number of beans in the free pool.	No
max-beans-in-free-pool	The maximum number of beans in the free pool.	No
message-selector	The JMS message selector.	No
run-as	Specifies the role-name for this EJB.	No
run-as-identity-principal	The name of the principal in case the role maps to several principals.	No
trans-timeout-seconds	The transaction timeout (in seconds).	No
use-caller-identity	(True|False) Whether this EJB uses caller's identity.	No

@ejbgen:primkey-field

Where: Method

Applicable on: Entity beans

@ejbgen:relation

Where: Class

Applicable on: Entity beans

Attribute	Description	Required
multiplicity	(one|many)	Yes
name	The name of the relationship. Make sure you use the same name on both ends of a relationship for the roles to be generated properly (note that this constraint applies to unidirectional as well).	Yes
target-ejb	The EJB name of the target of this relationship.	Yes
cascade-delete	(True|False)	No
cmr-field	The CMR field where this relationship will be kept. This field is optional. If it not present, the relationship is unidirectional. If it is present, the attribute fk-column must be specified as well.	No
fk-column	Only needed in a relationship having at least one One side. In that case, the non-One side EJB must declare a column that it will use to store the primary key of its counterpart.	No
joint-table	Only needed in a Many-Many relationship. It must be the name of an existing table that will be used to hold the joint table containing the relationships. In case you are using a compound primary key, you need to specify a set of corresponding foreign keys separated by a comma.	No
role-name	The name of this role (such as `ParentHasChildren`). If no role name is given, EJBGen will generate one for you. Note that you have to specify a role-name if you are going to inherit relations.	No

@ejbgen:remote-home-method

Where: Method

Applicable on: Entity and Session beans

Attribute	Description	Required
transaction-attribute	The transaction attribute for this remote method. If not specified, the default transaction attribute will be used. Methods with this tag will be generated on the Remote class.	No

@ejbgen:remote-method

Where: Method

Applicable on: Entity and Session beans

Attribute	Description	Required
isolation-level	The type of transaction isolation for this method.	No
transaction-attribute	The transaction attribute for this remote method. If not specified, the default transaction attribute will be used. Methods with this tag will be generated on the Remote class.	No

@ejbgen:resource-env-ref

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
name	Name of the resource environment reference.	Yes
type	Type of the environment resource references (e.g. javax.jms.Queue).	Yes
jndi-name	JNDI name of the resource.	No

@ejbgen:resource-ref

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
auth	(Application|Container)	Yes
jndi-name	JNDI name of the resource.	Yes
name	Name of the resource.	Yes
type	Type of the resource (e.g. javax.sql.DataSource).	Yes
sharing-scope	(Shareable|Unshareable)	No

@ejbgen:role-mapping

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
principals	The names of the principals in this role (separated by commas).	Yes
role-name	The name of the role	Yes

@ejbgen:select

Where: Method

Applicable on: Entity beans

Attribute	Description	Required
ejb-ql	The EJB-QL defining this select method. Note: the method name must start with ejbSelect.	Yes

Attribute	Description	Required
result-type-mapping	(Remote|Local) Whether the returned objects are mapped to EJBLocalObject or EJBObject.	No
weblogic-ejb-ql	The Weblogic EJB QL request as it will appear in the deployment descriptor. Note: if this request is needed, you need to enclose both EJBQL and Weblogic EJBQL within double quotes.	No

@ejbgen:session

Where: Class

Applicable on: Session beans

Attribute	Description	Required
ejb-name	The name of this Session bean.	Yes
call-router-class-name	Class name to be used for routing home method calls	No
default-transaction	The transaction attribute to be applied to all methods that do not have a more specific transaction attribute setting.	No
idle-timeout-seconds	Maximum duration an EJB should stay in the cache.	No
initial-beans-in-free-pool	The initial number of beans in the free pool.	No
is-clusterable	(True|False) Whether this bean is clusterable	No
load-algorithm	(RoundRobin|Random|WeightBased) The name of the algorithm used to balance replicas of this home	No
max-beans-in-cache	The maximum number of beans in the cache.	No
max-beans-in-free-pool	The maximum number of beans in the free pool.	No
methods-are-idempotent	(True|False) Whether the methods for this stateless session bean are idempotent or not.	No

Attribute	Description	Required
run-as	Specifies the role-name for this EJB.	No
run-as-identity-principal	The name of the principal in case the role maps to several principals.	No
trans-timeout-seconds	The transaction timeout (in seconds).	No
type	(Stateless|Stateful) The type of the Session bean. If this attribute is not specified, EJBGen will guess the right type by looking at the ejbCreate() methods on your class.	No
use-caller-identity	(True|False) Whether this EJB uses caller's identity.	No

@ejbgen:value-object

Where: Class

Applicable on: All types of beans

Attribute	Description	Required
reference	(Local|Value) Specify what objects the value object class should reference when accessing other EJB's.	Yes

ejbc

Note: `ejbc` is deprecated

Use the `weblogic.ejbc` tool for generating and compiling EJB container classes. If you compile JAR files for deployment into the EJB container, you must use `weblogic.ejbc` to generate the container classes.

weblogic.ejbc does the following:

- Places the EJB classes, interfaces, and XML deployment descriptor files in a specified JAR file.
- Checks all EJB classes and interfaces for compliance with the EJB specification.
- Generates WebLogic Server container classes for the EJBs.
- Runs each EJB container class through the RMI compiler to create client-side dynamic proxies and server-side byte code.

Note: ejbc accepts both JAR files and exploded directories as input.

If you specify an output JAR file, ejbc places all generated files into the JAR file.

By default, ejbc uses javac as a compiler. For faster performance, specify a different compiler (such as Symantec's sj) using the -compiler flag or via the Administration Console. See CROSS REF TO ONLINE HELP PAGE.

Although versions of the WebLogic-specific XML deployment descriptor files are published on or web site for your convience, an internal version is shipped with the product for use by weblogic.ejbc.

For the location of the public version of weblogic-ejb-jar.xml, see "EJB Deployment Descriptors" on page 11-1; for the location of the public version of weblogic-cmp-rdbms-jar.xml, see "EJB Deployment Descriptors" on page 12-2.

Advantages of Using ejbc

The ejbc tool offers the following benefits:

- It is easy to identify and correct errors ejbc produces.

  If an error occurs while running ejbc from the command line, ejbc exits with an error message.

  By contrast, if you defer compilation to the time of deployment and a compilation error occurs, the server fails the deployment and goes on with its work. To determine why deployment failed, you must examine the server output, fix the problem and then redeploy.

- By running `ejbc` prior to deployment, you potentially reduce the number of time a bean is compiled.

  For example, if you deploy a `.jar` file to a cluster of 3 servers, the `.jar` file is copied to each of the three servers for deployment. If the `.jar` file wasn't precompiled, each of the three servers will have to compile the file during deployment.

ejbc Syntax

```
prompt> java weblogic.ejbc [options] <source directory or jar file>
        <target directory or jar file>
```

Note: If you output to a JAR file, the output JAR name must be different from the input JAR name.

ejbc Arguments

Argument	Description
<*source directory or jar file*>	Specifies the exploded source directory or JAR file containing the compiled EJB classes, interfaces, and XML deployment files.
<*target directory or jar file*>	Specifies the destination JAR file or deployment directory in which `ejbc` places the output JAR. If you specify an output JAR file, `ejbc` places the original EJB classes, interfaces, and XML deployment files in the JAR, as well as the new container classes that `ejbc` generates.

ejbc Options

Option	Description
`-help`	Prints a list of all options available for the compiler.
`-version`	Prints `ejbc` version information.
`-dispatchPolicy <queueName>`	Specifies a configured execute queue that the EJB should use for obtaining execute threads in WebLogic Server. For more information, see Using Execute Queues to Control Thread Usage.
`-idl`	Generates CORBA Interface Definition Language for remote interfaces.
-J	Specifies the heap size for `weblogic.ejbc`. Use as follows: `java weblogic.ejbc -J-mx256m input.jar output.jar`
`-idlOverwrite`	Overwrites existing IDL files.
`-idlVerbose`	Displays verbose information while generating IDL.
`-idlDirectory <dir>`	Specifies the directory where `ejbc` creates IDL files. By default, `ejbc` uses the current directory.
`-keepgenerated`	Saves the intermediate Java files generated during compilation.
`-compiler <compiler name>`	Sets the compiler for `ejbc` to use.
`-normi`	Passed through to Symantec's java compiler, `sj`, to stop generation of RMI stubs. Otherwise `sj` creates its own RMI stubs, which are unnecessary for the EJB.
`-classpath <path>`	Sets a CLASSPATH used during compilation. This overrides the system or shell CLASSPATH.

ejbc Examples

The following example uses the `javac` compiler against an input JAR file in `c:\%SAMPLES_HOME%\server\src\examples\ejb\basic\containerManaged\build`. The output JAR file is placed in `c:\%SAMPLES_HOME%\server\config\examples\applications`.

```
prompt> java weblogic.ejbc -compiler javac
c:\%SAMPLES_HOME%\server\samples\src\examples\ejb\basic\container
Managed\build\std_ejb_basic_containerManaged.jar
c:%SAMPLES_HOME%\server\config\examples\ejb_basic_containerManage
d.jar
```

The following example checks a JAR file for compliance with the EJB 1.1 specification and generates WebLogic Server container classes, but does not generate RMI stubs:

```
prompt> java weblogic.ejbc -normi
c:%SAMMPLES_HOME%\server\src\examples\ejb\basic\containerManaged\
build\std_ejb_basic_containerManaged.jar
```

CHAPTER

11 The weblogic-ejb-jar.xml Deployment Descriptor

The following sections describe the EJB 2.0 deployment descriptor elements found in the `weblogic-ejb-jar.xml` file, the weblogic-specific XML document type definitions (DTD) file. Use these definitions to create the WebLogic-specific `weblogic-ejb-jar.xml` file that is part of your EJB deployment.

For information on the EJB 1.1 deployment descriptor elements see Chapter 13, "Important Information for EJB 1.1 Users."

- EJB Deployment Descriptors
- DOCTYPE Header Information
- 2.0 weblogic-ejb-jar.xml Deployment Descriptor File Structure
- 2.0 weblogic-ejb-jar.xml Deployment Descriptor Elements

EJB Deployment Descriptors

The EJB deployment descriptors contain structural and application assembly information for an enterprise bean. You specify this information by specifying values for the deployment descriptors in three EJB XML DTD files. These files are:

- ejb-jar.xml
- weblogic-ejb-jar.xml
- weblogic-cmp-rdbms-jar.xml

You package these three XML files with the EJB and other classes into a deployable EJB component, usually a JAR file, called ejb.jar.

The ejb-jar.xml file is based on the deployment descriptors found in Sun Microsystems's ejb.jar.xml file. The other two XML files are weblogic-specific files that are based on the deployment descriptors found in weblogic-ejb-jar.xml and weblogic-cmp-rdbms-jar.xml.

DOCTYPE Header Information

When you edit or create XML deployment files, it is critical to include the correct DOCTYPE header for the deployment file. In particular, using an incorrect PUBLIC element within the DOCTYPE header can result in parser errors that may be difficult to diagnose.

WebLogic provides a public location for you to access the correct text for the WebLogic Server-specific DTD file, weblogic-ejb-jar.xml. However, an identical version of this DTD file is embedded in WebLogic Server for internal use. weblogic.appc uses this file when the XML parser checks the sequence of the deployment descriptors files.

The correct text for the PUBLIC elements for the WebLogic Server-specific weblogic-ejb-jar.xml file are as follows.

XML File	PUBLIC Element String
weblogic-ejb-jar.xml	'-//BEA Systems, Inc.//DTD WebLogic 8.1.0 EJB//EN' 'http://www.bea.com/servers/wls810/dtd/weblogic-ejb-jar.dtd'
weblogic-ejb-jar.xml	'-//BEA Systems, Inc.//DTD WebLogic 7.0.0 EJB//EN' 'http://www.bea.com/servers/wls700/dtd/weblogic-ejb-jar.dtd'

XML File	PUBLIC Element String
`weblogic-ejb-jar.xml`	`‘-//BEA Systems, Inc.//DTD WebLogic 6.0.0 EJB//EN‘ ‘http://www.bea.com/servers/wls600/dtd/weblogic-ejb-jar.dtd‘`
`weblogic-ejb-jar.xml`	`‘-//BEA Systems, Inc.//DTD WebLogic 5.1.0 EJB//EN’ ‘http://www.bea.com/servers/wls510/dtd/weblogic-ejb-jar.dtd’`

The correct text for the `PUBLIC` elements for the Sun Microsystem-specific `ejb-jar.xml` file are as follows.

XML File	PUBLIC Element String
`ejb-jar.xml`	`‘-//Sun Microsystems, Inc.//DTD Enterprise JavaBeans 2.0//EN’ ‘`
`ejb-jar.xml`	`‘-//Sun Microsystems, Inc.//DTD Enterprise JavaBeans 1.1//EN’ ‘http://www.java.sun.com/j2ee/dtds/ejb-jar_1_1.dtd’`

For example, the entire `DOCTYPE` header for a `weblogic-ejb-jar.xml` file is as follows:

```
<!DOCTYPE weblogic-ejb-jar PUBLIC
'-//BEA Systems, Inc.//DTD WebLogic 8.1.0 EJB//EN'
'http://www.bea.com/servers/wls810/dtd/weblogic-ejb-jar.dtd'>
```

XML files with incorrect header information may yield error messages similar to the following, when used with a tool that parses the XML (such as `appc`):

```
SAXException: This document may not have the identifier ‘identifier_name’
```

`identifier_name` generally includes the invalid text from the `PUBLIC` element.

Document Type Definitions (DTDs) for Validation

The contents and arrangement of elements in your XML files must conform to the Document Type Definition (DTD) for each file you use. WebLogic Server ignores the DTDs embedded within the `DOCTYPE` header of XML deployment files, and instead uses the DTD locations that were installed along with the server. However, the `DOCTYPE` header information must include a valid URL syntax in order to avoid parser errors.

Note: Most browsers do not display the contents of files having the `.dtd` extension. To view the DTD file contents in your browser, save the links as text files and view them with a text editor.

weblogic-ejb-jar.xml

The following links provide the public locations for `weblogic-ejb-jar.xml` DTDs, by version number.

- For `weblogic-ejb-jar.xml` 8.1 DTD:

  `http://www.bea.com/servers/wls810/dtd/weblogic-ejb-jar.dtd` contains the DTD used for creating `weblogic-ejb-jar.xml`, which defines EJB properties used for deployment to WebLogic Server.

- For `weblogic-ejb-jar.xml` 7.0 DTD:

  `http://www.bea.com/servers/wls700/dtd/weblogic-ejb-jar.dtd` contains the DTD used for creating `weblogic-ejb-jar.xml`, which defines EJB properties used for deployment to WebLogic Server.

- For `weblogic-ejb-jar.xml` 6.0 DTD:

  `http://www.bea.com/servers/wls600/dtd/weblogic-ejb-jar.dtd` contains the DTD used for creating `weblogic-ejb-jar.xml`, which defines EJB properties used for deployment to WebLogic Server.

- For `weblogic-ejb-jar.xml` 5.1 DTD:

  http://www.bea.com/servers/wls510/dtd/weblogic-ejb-jar.dtd

  contains the DTD used for creating `weblogic-ejb-jar.xml`, which defines EJB properties used for deployment to WebLogic Server.

ejb-jar.xml

The following links provide the public DTD locations for the `ejb-jar.xml` deployment files used with WebLogic Server:

- For `ejb-jar.xml` 2.0 DTD:

  `http://www.java.sun.com/dtd/ejb-jar_2_0.dtd` contains the DTD for the standard `ejb-jar.xml` deployment file, required for all EJBs. This DTD is maintained as part of the JavaSoft EJB 2.0 specification; refer to the JavaSoft specification for information about the elements used in `ejb-jar.dtd`.

- For `ejb-jar.xml` 1.1 DTD:

  `ejb-jar.dtd` contains the DTD for the standard `ejb-jar.xml` deployment file, required for all EJBs. This DTD is maintained as part of the JavaSoft EJB 1.1 specification; refer to the JavaSoft specification for information about the elements used in `ejb-jar.dtd`.

Note: Refer to the appropriate JavaSoft EJB specification for a description of the `ejb-jar.xml` deployment descriptors.

2.0 weblogic-ejb-jar.xml Deployment Descriptor File Structure

The WebLogic Server `weblogic-ejb-jar.xml` deployment descriptor file describes the elements that are unique to WebLogic Server.

The top level elements in the WebLogic Server 8.1 `weblogic-ejb-jar.xml` are as follows:

- `description`
- weblogic-version
- `weblogic-enterprise-bean`
  - `ejb-name`

    - entity-descriptor | stateless-session-descriptor | stateful-session-descriptor | message-driven-descriptor
    - transaction-descriptor
    - reference-descriptor
    - enable-call-by-reference
    - clients-on-same-server
    - `jndi-name`
- security-role-assignment
- transaction-isolation

2.0 weblogic-ejb-jar.xml Deployment Descriptor Elements

- “allow-concurrent-calls” on page 11-10
- “cache-between-transactions” on page 11-11
- “cache-type” on page 11-12
- “client-authentication” on page 11-13
- “client-cert-authentication” on page 11-14
- “clients-on-same-server” on page 11-15
- “concurrency-strategy” on page 11-16
- “confidentiality” on page 11-18
- “connection-factory-jndi-name” on page 11-19
- “delay-updates-until-end-of-tx” on page 11-20
- “description” on page 11-21

- "destination-jndi-name" on page 11-22
- "ejb-local-reference-description" on page 11-26
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- "enable-call-by-reference" on page 11-27
- "entity-cache" on page 11-29
- "entity-clustering" on page 11-32
- "entity-descriptor" on page 11-33
- "concurrency-strategy" on page 11-16
- "cache-between-transactions" on page 11-11
- "delay-updates-until-end-of-tx" on page 11-20
- "destination-jndi-name" on page 11-22
- "finders-load-bean" on page 11-35
- "home-call-router-class-name" on page 11-36
- "home-is-clusterable" on page 11-37
- "home-load-algorithm" on page 11-38
- "idle-timeout-seconds" on page 11-41
- "initial-beans-in-free-pool" on page 11-44
- "is-modified-method-name" on page 11-48
- "isolation-level" on page 11-49
- "jndi-name" on page 11-52
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- "method" on page 11-57
- "method-intf" on page 11-58
- "method-name" on page 11-59
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- "persistence" on page 11-62
- "persistence-type" on page 11-63
- "persistence-use" on page 11-65
- "persistent-store-dir" on page 11-66
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- "stateful-session-cache" on page 11-81
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- "stateless-bean-call-router-class-name" on page 11-84
- "stateless-bean-is-clusterable" on page 11-85
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- "trans-timeout-seconds" on page 11-93
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- "weblogic-ejb-jar" on page 11-97
- "weblogic-enterprise-bean" on page 11-98

allow-concurrent-calls

Range of values:	`True | False`
Default value:	`False`
Requirements:	Requires the server to throw a `RemoteException` when a stateful session bean instance is currently handling a method call and another (concurrent) method call arrives on the server.
Parent elements:	`weblogic-enterprise-bean` `stateful-session-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `allow-concurrent-calls` element specifies whether a stateful session bean instance allows concurrent method calls. By default, `allows-concurrent-calls` is `False`. However, when this value is set to `True`, the EJB container blocks the concurrent method call and allows it to proceed when the previous call has completed.

Example

See "stateful-session-descriptor" on page 11-83.

cache-between-transactions

Range of values:	`True | False`
Default value:	`False`
Requirements:	Optional element. Valid only for entity EJBs.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`, `persistence`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `cache-between-transactions` element, formerly the `db-is-shared` element, specifies whether the EJB container will cache the persistent data of an entity bean across (between) transactions.

The `cache-between-transactions` element applies only to entity beans. When it is set to `True`, WebLogic Server assumes that EJB data can be modified between transactions and reloads the data at the beginning of each transaction. When set to `False`, WebLogic Server assumes that it has exclusive access to the EJB data in the persistent store.

A Read-Only bean ignores the value of the `cache-between-transactions` element because WebLogic Server always performs long term caching of Read-Only data.

See "Caching Between Transactions" on page 6-8 for more information.

Example

See "persistence" on page 11-62.

cache-type

Range of values:	`NRU	LRU`
Default value:	`NRU`
Requirements:	
Parent elements:	`weblogic-enterprise-bean` `stateful-session-cache`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `cache-type` element specifies the order in which EJBs are removed from the cache. The values are:

- Least recently used (LRU)
- Not recently used (NRU)

  The minimum cache size for NRU is 8. If max-beans-in-cache is less than 3, WebLogic Server uses a value of 8 for `cache-type`.

Example

The following example shows the structure of the `cache-type` element.

```
<stateful-session-cache>
<cache-type>NRU</cache-type>
</stateful-session-cache>
```

client-authentication

Range of values:	`none | supported | required`
Default value:	
Requirements:	n/a
Parent elements:	`weblogic-enterprise-bean` `iiop-security-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `client-authentication` element specifies whether the EJB supports or requires client authentication.

Example

See "iiop-security-descriptor" on page 11-43.

client-cert-authentication

Range of values:	`none | supported | required`
Default value:	
Requirements:	n/a

Parent elements:	`weblogic-enterprise-bean`
	`iiop-security-descriptor`
	`transport-requirements`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `client-cert-authentication` element specifies whether the EJB supports or requires client certificate authentication at the transport level.

Example

See “transport-requirements” on page 11-92.

clients-on-same-server

Range of values:	`True | False`
Default value:	`False`
Requirements:	n/a
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `clients-on-same-server` attribute determines whether WebLogic Server sends JNDI announcements for this EJB when it is deployed. When this attribute is "False" (the default), a WebLogic Server cluster automatically updates its JNDI tree to indicate the location of this EJB on a particular server. This ensures that all clients can access the EJB, even if the client is not collocated on the same server.

You can set `clients-on-same-server` to `True` when you know that all clients that will access this EJB will do so from the same server on which the bean is deployed. In this case, a WebLogic Server cluster does not send JNDI announcements for this EJB when it is deployed. Because JNDI updates in a cluster utilize multicast traffic, setting `clients-on-same-server` to `True` can reduce the startup time for very large clusters.

See Optimization for Collocated Objects in *Using WebLogic Server Clusters* for more information on collocated EJBs.

Example

The following example enables pass-by-value for EJB methods:

```
<weblogic-enterprise-bean>
```

```
        <ejb-name>AccountBean</ejb-name>
        ...
        <clients-on-same-server>True</clients-on-same-server>
</weblogic-enterprise-bean>
```

concurrency-strategy

Range of values:	`Exclusive | Database | ReadOnly | Optimistic`
Default value:	`Database`
Requirements:	Optional element. Valid only for entity EJBs.
Parent elements:	`weblogic-enterprise-bean, entity-descriptor, entity-cache`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `concurrency-strategy` element specifies how the container should manage concurrent access to an entity bean. Set this element to one of four values:

- `Exclusive` causes WebLogic Server to place an exclusive lock on cached entity EJB instances when the bean is associated with a transaction. Other requests for the EJB instance are block until the transaction completes. This option was the default locking behavior for WebLogic Server versions 3.1 through 5.1.
- `Database` causes WebLogic Server to defer locking requests for an entity EJB to the underlying datastore. With the `Database` concurrency strategy, WebLogic Server allocates a separate entity bean instance and allows locking and caching to be handled by the database. This is the default option.

- `ReadOnly` used for read-only entity beans. Activates a new instance for each transaction so that requests proceed in parallel. WebLogic Server calls `ejbLoad()` for `ReadOnly` beans are based on the `read-timeout-seconds` parameter.
- `Optimistic` holds no locks in the EJB container or database during a transaction. The EJB container verifies that none of the data updated by a transaction has changed before committing the transaction. If any updated data changed, the EJB container rolls back the transaction.

See"EJB Concurrency Strategy" on page 5-35 for more information on the `Exclusive` and `Database` locking behaviors. See"Read-Only Multicast Invalidation" on page 6-2 for more information about `read-only` entity EJBs.

Example

The following entry identifies the `AccountBean` class as a read-only entity EJB:

```
<weblogic-enterprise-bean>
       <ejb-name>AccountBean</ejb-name>
       <entity-descriptor>
              <entity-cache>

<concurrency-strategy>ReadOnly</concurrency-strategy>
              </entity-cache>
       </entity-descriptor>
</weblogic-enterprise-bean>
```

confidentiality

Range of values:	`none | supported | required`
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-enterprise-bean`
	`iiop-security-descriptor`
	`transport-requirements n`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `confidentiality` element specifies the transport confidentiality requirements for the EJB. Using the `confidentiality` element ensures that the data is sent between the client and server in such a way as to prevent other entities from observing the contents.

Example

See "transport-requirements" on page 11-92.

connection-factory-jndi-name

Range of values:	`valid name`
Default value:	`weblogic.jms.MessageDrivenBeanConnectionFactory` in `config.xml`
Requirements:	Requires the server to throw a `RemoteException` when a stateful session bean instance is currently handling a method call and another (concurrent) method call arrives on the server.
Parent elements:	`weblogic-enterprise-bean` `message-driven-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `connection-factory-jndi-name` element specifies the JNDI name of the JMS ConnectionFactory that the MessageDriven Bean should look up to create its queues and topics. If this element is not specified, the default is the `weblogic.jms.MessageDrivenBeanConnectionFactory` in `config.xml`.

Example

The following example shows the structure of the `connection-factory-jndi-name` element:

```
<message-driven-descriptor>

<connection-factory-jndi-name>weblogic.jms.MessageDrivenBean
ConnectionFactory</connection-factory-jndi-name>

</message-driven-descriptor>
```

delay-updates-until-end-of-tx

Range of values:	`True | False`
Default value:	`True`
Requirements:	Valid only for entity EJBs.
Parent elements:	`weblogic-enterprise-bean, entity-descriptor, persistence`
Deployment file:	`weblogic-ejb-jar.xml`

Function

Set the `delay-updates-until-end-of-tx` element to `True` (the default) to update the persistent store of all beans in a transaction at the completion of the transaction. This setting generally improves performance by avoiding unnecessary updates. However, it does not preserve the ordering of database updates within a database transaction.

If your datastore uses an isolation level of `TransactionReadCommittedUncommitted`, you may want to allow other database users to view the intermediate results of in-progress transactions. In this case, set `delay-updates-until-end-of-tx` to `False` to update the bean's persistent store at the conclusion of each method invoke. See "ejbLoad() and ejbStore() Behavior for Entity EJBs" on page 6-11 for more information.

Note: Setting `delay-updates-until-end-of-tx` to False does not cause database updates to be "committed" to the database after each method invoke; they are only sent to the database. Updates are committed or rolled back in the database only at the conclusion of the transaction.

Example

The following example shows a `delay-updates-until-end-of-tx` stanza.

```
<entity-descriptor>
       <persistence>

<delay-updates-until-end-of-tx>False</delay-updates-until-end-of-
tx>
       </persistence>
</entity-descriptor>
```

description

Range of values:	n/a
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-enterprise-bean`,
	`transaction-isolation`
	`method`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `description` element is used to provide text that describes the parent element.

Example

The following example specifies the `description` element.

```
<dscription>Contains a description of parent element</description>
```

destination-jndi-name

Range of values:	Valid JNDI name
Default value:	n/a
Requirements:	Required in `message-driven-descriptor`.
Parent elements:	`weblogic-enterprise-bean` `message-driven-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

`The destination-jndi-name` element specifies the JNDI name used to associate a message-driven bean with an actual JMS Queue or Topic deployed in the WebLogic Server JNDI tree.

Example

See "message-driven-descriptor" on page 11-56.

ejb-name

Range of values:	Name of an EJB defined in `ejb-jar.xml`
Default value:	n/a
Requirements:	Required element in method stanza. The name must conform to the lexical rules for an NMTOKEN.
Parent elements:	`weblogic-enterprise-bean` `method`
Deployment file:	`weblogic-ejb-jar.xml`

Function

`ejb-name` specifies the name of an EJB to which WebLogic Server applies isolation level properties. This name is assigned by the `ejb-jar` file's deployment descriptor. The name must be unique among the names of the enterprise beans in the same `ejb.jar` file. The enterprise bean code does not depend on the name; therefore the name can be changed during the application-assembly process without breaking the enterprise bean's function. There is no built-in relationship between the `ejb-name` in the deployment descriptor and the JNDI name that the deployer will assign to the enterprise bean's home.

Example

See "method" on page 11-57.

ejb-reference-description

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `reference-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `ejb-reference-description` element maps the JNDI name in the WebLogic Server of an EJB that is referenced by the bean in the `ejb-reference` element.

- `ejb-ref-name` specifies a resource reference name. This is the reference that the EJB provider places within the `ejb-jar.xml` deployment file.
- `jndi-name` specifies the JNDI name of an actual resource factory available in WebLogic Server.

Example

The `ejb-reference-description` stanza is shown here:

```
<ejb-reference-description>
       <ejb-ref-name>AdminBean</ejb-ref-name>
              <jndi-name>payroll.AdminBean</jndi-name>
       </ejb-reference-description>
```

ejb-ref-name

Range of values:	n/a
Default value:	n/a
Requirements:	Optional element.

Parent elements:	`weblogic-enterprise-bean`
	`reference-description`
	`ejb-reference-description`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `ejb-ref-name` element specifies a resource reference name. This element is the reference that the EJB provider places within the `ejb-jar.xml` deployment file.

Example

The `ejb-ref-name` stanza is shown here:

```
<reference-descriptor>
       <ejb-reference-description>
              <ejb-ref-name>AdminBean</ejb-ref-name>
              <jndi-name>payroll.AdminBean</jndi-name>
       </ejb-reference-description>
</reference-descriptor>
```

ejb-local-reference-description

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `reference-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `ejb-local-reference-description` element maps the JNDI name of an EJB in the WebLogic Server that is referenced by the bean in the `ejb-local-ref` element.

Example

The following example shows the `ejb-local-reference-description` element.

```
<ejb-local-reference-description>
        <ejb-ref-name>AdminBean</ejb-ref-name>
        <jndi-name>payroll.AdminBean</jndi-name>
</ejb-local-reference-description>
```

enable-call-by-reference

Range of values:	`True | False`
Default value:	`False`
Requirements:	Optional element.

Parent elements:	`weblogic-enterprise-bean`
	`reference-descriptor`
	`ejb-reference-description`

Deployment file:	`weblogic-ejb-jar.xml`

Function

By default, EJB methods called from within the same server pass arguments by reference. This increases the performance of method invocation because parameters are not copied.

If you set `enable-call-by-reference` to `False`, parameters to the EJB methods are copied (pass-by-value) in accordance with the EJB 1.1 specification. Pass by value is always necessary when the EJB is called remotely (not from within the server).

Example

The following example enables pass-by-value for EJB methods:

```
<weblogic-enterprise-bean>
       <ejb-name>AccountBean</ejb-name>
       ...
       <enable-call-by-reference>False</enable-call-by-reference>
</weblogic-enterprise-bean>
```

enable-dynamic-queries

Range of values:	`True | False`
Default value:	`True`
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The optional enable-dynamic-queries element must be set to `True` to enable dynamic queries. Dynamic queries are only available for use with EJB 2.0 CMP beans.

Example

The following example enables dynamic queries:

```
<enable-dynamic-queries>True</enable-dynamic-queries>
```

entity-cache

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	The `entity-cache` stanza is optional, and is valid only for entity EJBs.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `entity-cache` element defines the following options used to cache entity EJB instances within WebLogic Server:

- `max-beans-in-cache`
- `idle-timeout-seconds`
- `read-timeout-seconds`
- `concurrency-strategy`

See"EJB Lifecycle in WebLogic Server" on page 4-2 for a general discussion of the caching services available in WebLogic Server.

Example

The `entity-cache` stanza is shown here:

```
<entity-descriptor>
        <entity-cache>
                <max-beans-in-cache>...</max-beans-in-cache>
                <idle-timeout-seconds>...</idle-timeout-seconds>
```

```
                    <read-timeout-seconds>...<read-timeout-seconds>
                    <concurrency-strategy>...</concurrency-strategy>
                </entity-cache>
                <persistence>...</persistence>
                <entity-clustering>...</entity-clustering>
        </entity-descriptor>
```

entity-cache-name

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	The value you specify for `entity-cache-name` must match the name assigned to an application level entity cache in the weblogic-application.xml file.

Parent elements:	`weblogic-enterprise-bean,`
	`entity-descriptor`
	`entity-cache-ref`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `entity-cache-name` element refers to an application level entity cache that the entity bean uses. An application level cache is a cache that may be shared by multiple entity beans in the same application.

For more information about the `weblogic-application.xml` file, see the application deployment descriptors.

Example

See "entity-cache-ref" on page 11-31.

entity-cache-ref

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	The `entity-cache-name` element in the `entity-cache-ref` stanza must contain the name of the application level cache.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `entity-cache-ref` element refers to an application level entity cache which can cache instances of multiple entity beans that are part of the same application. Application level entity caches are declared in the `weblogic-application.xml` file.

Use the "concurrency-strategy" on page 11-16 to define the type of concurrency you want the bean to use. The `concurrency-strategy` must be compatible with the application level cache's caching strategy. For example, an Exclusive cache only supports banes with a `concurrency-strategy` of Exclusive. While a MultiVersion cache supports the Database, ReadOnly, and Optimistic concurrency strategies.

Example

The `entity-cache-ref` stanza is shown here:

```
<entity-cache-ref>
       <entity-cache-name>AllEntityCache</entity-cache-name>
       <concurrency-strategy>ReadOnly</concurrency-strategy>
       <estimated-bean-size>20</estimated-bean-size>
</entity-cache-ref>
```

entity-clustering

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element. Valid only for entity EJBs in a cluster.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `entity-clustering` element uses the following options to specify how an entity bean will be replicated in a WebLogic cluster:

- `home-is-clusterable`
- `home-load-algorithm`
- `home call-router-class-name`

Example

The following excerpt shows the structure of a `entity-clustering` stanza:

```
<entity-clustering>
       <home-is-clusterable>True</home-is-clusterable>
```

```
        <home-load-algorithm>random</home-load-algorithm>

<home-call-router-class-name>beanRouter</home-call-router-class-n
ame>

</entity-clustering>
```

entity-descriptor

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	One `entity-descriptor` stanza is required for each entity EJB in the *.jar*.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `entity-descriptor` element specifies the following deployment parameters that are applicable to an entity bean:

- `pool`
- `entity-cache`
- `persistence`
- `entity-clustering`

Example

The following example shows the structure of the `entity-descriptor` stanza:

```
<entity-descriptor>
```

```
        <entity-cache>...</entity-cache>
        <persistence>...</persistence>
        <entity-clustering>...</entity-clustering>
</entity-descriptor>
```

estimated-bean-size

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	n/a
Parent elements:	`weblogic-enterprise-bean` `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `estimated-bean-size-` element specifies the estimated average size of the instances of an entity bean in bytes. This is the average number of byte of memory that is consumed by each instance.

Use the `estimated-bean-size` element when the application level cache you use to cache beans is also specified in terms of bytes and megabytes.

Although you may not know the exact number of bytes consumed by the entity bean instances, specifying a size allows you to give some relative weight to the beans that share a cache. at one time.

For example, suppose bean A ad bean B share a cache, called AB-cache, that has a size of 1000 bytes and the size of A is 10 bytes and the size of B is 20 bytes, then the cache can hold at most 100 instances of A and 50 instances of B. If 100 instance s of A are cached, this implies that 0 instances of B are cached.

Example

See "entity-cache-ref" on page 11-31.

finders-load-bean

Range of values:	`True | False`
Default value:	`True`
Requirements:	Optional element. Valid only for CMP entity EJBs.
Parent elements:	`weblogic-enterprise-bean, entity-descriptor, persistence`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `finders-load-bean` element determines whether WebLogic Server loads the EJB into the cache after a call to a finder method returns a reference to the bean. If you set this element to `True`, WebLogic Server immediately loads the bean into the cache if a reference to a bean is returned by the finder. If you set this element to `False`, WebLogic Server does not automatically load the bean into the cache until the first method invocation; this behavior is consistent with the EJB 1.1 specification.

Example

The following entry specifies that EJBs are loaded into the WebLogic Server cache automatically when a finder method returns a reference to the bean:

```
<entity-descriptor>
```

```
            <persistence>
                  <finders-load-bean>True</finders-load-bean>
            </persistence>
      </entity-descriptor>
```

home-call-router-class-name

Range of values:	Valid router class name
Default value:	null
Requirements:	Optional element. Valid only for entity EJBs, stateful session EJBs, and stateless session EJBs in a cluster.
Parent elements:	`weblogic-enterprise-bean, entity-descriptor, entity-clustering` and `weblogic-enterprise-bean stateful-session-descriptor stateful-session-clustering`
Deployment file:	`weblogic-ejb-jar.xml`

Function

`home-call-router-class-name` specifies the name of a custom class to use for routing bean method calls. This class must implement `weblogic.rmi.extensions.CallRouter()`. If specified, an instance of this class is called before each method call. The router class has the opportunity to choose a server to route to based on the method parameters. The class returns either a server name or null, which indicates that the current load algorithm should select the server.

Example

See "entity-clustering" on page 11-32 and "stateful-session-clustering" on page 11-82.

home-is-clusterable

Range of values:	`True | False`
Default value:	`True`
Requirements:	Optional element. Valid only for entity EJBs and stateful session EJBs in a cluster.
Parent elements:	`weblogic-enterprise-bean, entity-descriptor, entity-clustering` and `weblogic-enterprise-bean stateful-session-descriptor stateful-session-clustering`
Deployment file:	`weblogic-ejb-jar.xml`

Function

When `home-is-clusterable` is `True`, the EJB can be deployed from multiple WebLogic Servers in a cluster. Calls to the home stub are load-balanced between the servers on which this bean is deployed, and if a server hosting the bean is unreachable, the call automatically fails over to another server hosting the bean.

Example

See "entity-clustering" on page 11-32.

home-load-algorithm

Range of values:	`round-robin | random | weight-based`
Default value:	Value of `weblogic.cluster.defaultLoadAlgorithm`
Requirements:	Optional element. Valid only for entity EJBs and stateful session EJBs in a cluster.

Parent elements:	`weblogic-enterprise-bean,`
	`  entity-descriptor,`
	`  entity-clustering`
	`and`
	`weblogic-enterprise-bean`
	`  stateful-session-descriptor`
	`  stateful-session-clustering`

Deployment file:	`weblogic-ejb-jar.xml`

Function

`home-load-algorithm` specifies the algorithm to use for load balancing between replicas of the EJB home. If this element is not defined, WebLogic Server uses the algorithm specified by the server element, `weblogic.cluster.defaultLoadAlgorithm`.

You can define `home-load-algorithm` as one of the following values:

- `round-robin`: Load balancing is performed in a sequential fashion among the servers hosting the bean.
- `random`: Replicas of the EJB home are deployed randomly among the servers hosting the bean.
- `weight-based`: Replicas of the EJB home are deployed on host servers according to the servers' current workload.

Example

See "entity-clustering" on page 11-32 and "stateful-session-clustering" on page 11-82.

idempotent-methods

Range of values:	`n/a`
Default value:	`n/a`
Requirements:	Clustering must be enabled for the EJB.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `idempotent-methods` element defines list of methods which are 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-methods for a method, the EJB stub can automatically recover from any failure as long as it can reach another server hosting the EJB.

To enable clustering, see "entity-clustering" on page 11-32, "stateful-session-clustering" on page 11-82, and "stateless-clustering" on page 11-88.

The methods on stateless session bean homes and read-only entity beans are automatically set to be idempotent. It is not necessary to explicitly specify them as idempotent.

Example

The `method` stanza can contain the elements shown here:

```
<idempotent-method>
       <method>
              <description>...</description>
              <ejb-name>...</ejb-name>
              <method-intf>...</method-intf>
              <method-name>...</method-name>
              <method-params>...</method-params>
       </method>
</idempotent-method>
```

identity-assertion

Range of values:	`none | supported | required`
Default value:	
Requirements:	n/a
Parent elements:	`weblogic-enterprise-bean` `iiop-security-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `identity-assertion` element specifies whether the EJB supports or requires identity assertion.

Example

See "iiop-security-descriptor" on page 11-43.

idle-timeout-seconds

Range of values:	`1` to *`maxSeconds`*
Default value:	`600`
Requirements:	Optional element

Parent elements:	`weblogic-enterprise-bean,`
	`entity-descriptor,`
	`entity-cache`
	and
	`weblogic-enterprise-bean,`
	`stateful-session-descriptor,`
	`stateful-session-cache`

Deployment file:	`weblogic-ejb-jar.xml`

Function

`idle-timeout-seconds` defines the maximum length of time a stateful EJB should remain in the cache. After this time has elapsed, WebLogic Server removes the bean instance if the number of beans in cache approaches the limit of `max-beans-in-cache`. The removed bean instances are passivated. See "EJB Lifecycle in WebLogic Server" on page 4-2 for more information.

Example

The following entry indicates that the stateful session EJB, `AccountBean`, should become eligible for removal if `max-beans-in-cache` is reached and the bean has been in cache for 20 minutes:

```
<weblogic-enterprise-bean>
       <ejb-name>AccountBean</ejb-name>
       <stateful-session-descriptor>
              <stateful_session-cache>
                     <max-beans-in-cache>200</max-beans-in-cache>

<idle-timeout-seconds>1200</idle-timeout-seconds>
              </stateful-session-cache>
       </stateful-session-descriptor>
</weblogic-enterprise-bean>
```

iiop-security-descriptor

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	weblogic-enterprise-bean
Deployment file:	weblogic-ejb-jar.xml

Function

The `iiop-security-descriptor` element specifies security configuration parameters at the bean-level. These parameters determine the IIOP security information contained in the IOR.

Example

The `iiop-security-descriptor` stanza can contain the elements shown here

```
<iiop-security-descriptor>
       <transport-requirements>...</transport-requirements>
       <client-authorization>suppoted<client-authentication>
       <identity-assertion>supported</identity-assertion>
</iiop-security-description>
```

initial-beans-in-free-pool

Range of values:	`0` to *`maxBeans`*
Default value:	`0`
Requirements:	Optional element. Valid for stateless session, entity, and message-driven EJBs.
Parent elements:	`weblogic-enterprise-bean, stateless-session-descriptor, message-bean-descriptor, entity-descriptor pool`
Deployment file:	`weblogic-ejb-jar.xml`

Function

If you specify a value for `initial-beans-in-free-pool`, you set the initial size of the pool. WebLogic Server populates the free pool with the specified number of bean instances for every bean class at startup. Populating the free pool in this way improves initial response time for the EJB, because initial requests for the bean can be satisfied without generating a new instance.

Example

See "pool" on page 11-67.

initial-context-factory

Range of values:	`True | False`
Default value:	`weblogic.jndi.WLInitialContextFactory`
Requirements:	Requires the server to throw a `RemoteException` when a stateful session bean instance is currently handling a method call and another (concurrent) method call arrives on the server.
Parent elements:	`weblogic-enterprise-bean` `message-driven-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `initial-context-factory` element specifies the initial contextFactory that the container will use to create its connection factories. If initial-context-factory is not specified, the default will be `weblogic.jndi.WLInitialContextFactory`.

Example

The following example specifies the `initial-context-factory` element.

```
<message-driven-descriptor>

<initial-context-factory>weblogic.jndi.WLInitialContextFactory
</initial-context-factory>

</message-driven-descriptor>
```

integrity

Range of values:	`none | supported | required`
Default value:	
Requirements:	n/a.

Parent elements:	`weblogic-enterprise-bean`
	`iiop-security-descriptor`
	`transport-requirements`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `integrity` element specifies the transport integrity requirements for he EJB. Using the integrity element ensures that the data is sent between the client and server in such a way that it cannot be changed in transit.

Example

See "transport-requirements" on page 11-92.

invalidation-target

Range of values:	
Default value:	
Requirements:	The target `ejb-name` must be a Read-Only entity EJB and this element can only be specified for an EJB 2.0 container-managed persistence entity EJB.
Parent elements:	`weblogic-enterprise-bean` `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The invalidation-target element specifies a Read-Only entity EJB that should be invalidated when this container-managed persistence entity EJB has been modified.

Example

The following entry specifies that the EJB named `StockReaderEJB` should be invalidated when the EJB has been modified.

```
<invalidation-target>
       <ejb-name>StockReaderEJB</ejb-name>
</invalidation-target>
```

is-modified-method-name

Range of values:	Valid entity EJB method name
Default value:	None
Requirements:	Optional element. Valid only for entity EJBs.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`, `persistence`
Deployment file:	`weblogic-ejb-jar.xml`

Function

`is-modified-method-name` specifies a method that WebLogic Server calls when the EJB is stored. The specified method must return a `boolean` value. If no method is specified, WebLogic Server always assumes that the EJB has been modified and always saves it.

Providing a method and setting it as appropriate can improve performance for EJB 1.1-compliant beans, and for beans that use bean-managed persistence. However, any errors in the method's return value can cause data inconsistency problems.

Note: `isModified()` is no longer required for 2.0 CMP entity EJBs based on the EJB 2.0 specification However, it still applies to BMP and 1.1 CMP EJBs. When you deploy EJB 2.0 entity beans with container-managed persistence, WebLogic Server automatically detects which EJB fields have been modified, and writes only those fields to the underlying datastore.

Example

The following entry specifies that the EJB method named `semidivine` will notify WebLogic Server when the EJB has been modified:

```
<entity-descriptor>
       <persistence>

<is-modified-method-name>semidivine</is-modified-method-name>
       </persistence>
</entity-descriptor>
```

isolation-level

Range of values:	`Serializable | ReadCommitted | ReadUncommitted | RepeatableRead`
Default value:	n/a
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean, transaction-isolation`
Deployment file:	`weblogic-ejb-jar.xml`

Function

`isolation-level` specifies the isolation level for all of the EJB's database operations. The following are possible values for `isolation-level`:

- `TransactionReadCommittedUncommitted`: The transaction can view uncommitted updates from other transactions.
- `TransactionReadCommitted`: The transaction can view only committed updates from other transactions.
- `TransactionRepeatableRead`: 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.

- `TransactionSerializable`: Simultaneously executing this transaction multiple times has the same effect as executing the transaction multiple times in a serial fashion.

Refer to your database documentation for more information on the implications and support for different isolation levels.

Example

See "transaction-isolation" on page 11-91.

jms-polling-interval-seconds

Range of values:	n/a
Default value:	10 seconds
Requirements:	n/a
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `jms-polling-interval-seconds` specifies the number of seconds between each attempt to reconnect to the JMS destination. Each message-driven bean listens on an associated JMS destination. If the JMS destination is located on another WebLogic Server instance or a foreign JMS provider, then the JMS destination may become unreachable. In this case, the EJB container automatically attempts to reconnect to the JMS Server. Once the JMS Server is up again, the message-driven bean can again receive messages.

Example

The following entry specifies the jms polling intervals for message-driven beans:

```
<jms-polling-interval-seconds>5</jms-polling-interval seconds>
```

jms-client-id

Range of values:	n/a
Default value:	The default client identifier is the `ejb-name` for this EJB.
Requirements:	The `jms-client-id` is necessary for durable subscriptions to JMS topics.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `jms-client-id` specifies an associated id for the JMS consumers. A message-driven bean with a durable subscription needs an associated client id. If you use a separate connection factory, you can set the client id on the connection factory. In this case, the message-driven bean uses this client id.

If the associated connection factory does not have a client id or if you use the default connection factory, then the message-driven bean used the jms-client-id value as its client id.

Example

The following entry specifies an associated id for JMS consumers:

```
<jms-client-id>MyClientID</jms-client-id>
```

jndi-name

Range of values:	Valid JNDI name
Default value:	n/a
Requirements:	Required in `resource-description` and `ejb-reference-description`.

Parent elements:	`weblogic-enterprise-bean`
	and
	`weblogic-enterprise-bean`
	`reference-descriptor`
	`resource-description`
	and
	`weblogic-enterprise-bean`
	`reference-descriptor`
	`ejb-reference-description`

Deployment file:	`weblogic-ejb-jar.xml`

Function

`jndi-name` specifies the JNDI name of an actual EJB, resource, or reference available in WebLogic Server.

Example

See "resource-description" on page 11-75 and "ejb-reference-description" on page 11-24.

local-jndi-name

Range of values:	Valid JNDI name
Default value:	n/a
Requirements:	Required if the bean has a local home.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `local-jndi-name` element specifies a jndi-name for a bean's local home. If a bean has both a remote and a local home, then it must have two JNDI names; one for each home.

Example

The following example shows the specifies the `local-jndi-name` element.

```
<local-jndi-name>weblogic.jndi.WLInitialContext
</local-jndi-name>
```

max-beans-in-cache

Range of values:	1 to *maxBeans*
Default value:	1000
Requirements:	Optional element
Parent elements:	weblogic-enterprise-bean, entity-descriptor, entity-cache and weblogic-enterprise-bean stateful-session-descriptor stateful-session-cache
Deployment file:	weblogic-ejb-jar.xml

Function

The max-beans-in-cache element specifies the maximum number of objects of this class that are allowed in memory. When max-bean-in-cache is reached, WebLogic Server passivates some EJBs that have not recently been used by a client. max-beans-in-cache also affects when EJBs are removed from the WebLogic Server cache, as described in"EJB Concurrency Strategy" on page 5-35.

Example

The following entry enables WebLogic Server to cache a maximum of 200 instances of the AccountBean class:

```
<weblogic-enterprise-bean>
        <ejb-name>AccountBean</ejb-name>
        <entity-descriptor>
```

```
                    <entity-cache>
                        <max-beans-in-cache>200</max-beans-in-cache>
                    </entity-cache>
                </entity-descriptor>
            </weblogic-enterprise-bean>
```

max-beans-in-free-pool

Range of values:	`0` to *`maxBeans`*
Default value:	*`max Int`*
Requirements:	Optional element. Valid only for stateless session EJBs.
Parent elements:	`weblogic-enterprise-bean, stateless-session-descriptor, message-bean-descriptor, entity-descriptor pool`
Deployment file:	`weblogic-ejb-jar.xml`

Function

WebLogic Server maintains a free pool of EJBs for every stateless session bean and message-driven bean class. The `max-beans-in-free-pool` element defines the size of this pool. By default, `max-beans-in-free-pool` has no limit; the maximum number of beans in the free pool is limited only by the available memory. See "Stateless Session EJB Life Cycle" on page 4-2 and "Differences Between Message-Driven Beans and Stateless Session EJBs" on page 3-3 for more information.

Example

See "pool" on page 11-67.

message-driven-descriptor

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `message-driven-descriptor` element associates a message-driven bean with a JMS destination in WebLogic Server. This element specifies the following deployment parameters:

- `pool`
- `destination-jndi-name`
- `initial-context-factory`
- `provider-url`
- `connection-factory-jndi-name`

Example

The following example shows the structure of the `message-driven-descriptor` stanza:

```
<message-driven-descriptor>
       <destination-jndi-name>...</destination-jndi-name>
</message-driven-descriptor>
```

method

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element. You can specify more than one `method` stanza to configure multiple EJB methods.
Parent elements:	`weblogic-enterprise-bean` `transaction-isolation`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `method` element defines a method or set of methods for an enterprise bean's home or remote interface.

Example

The `method` stanza can contain the elements shown here:

```
<method>
       <description>...</description>
       <ejb-name>...</ejb-name>
       <method-intf>...</method-intf>
```

```
        <method-name>...</method-name>
        <method-params>...</method-params>
</method>
```

method-intf

Range of values:	`Home | Remote`
Default value:	n/a
Requirements:	Optional element.

Parent elements:	`weblogic-enterprise-bean`
	`transaction-isolation`
	`method`

Deployment file:	`weblogic-ejb-jar.xml`

Function

`method-intf` specifies the EJB interface to which WebLogic Server applies isolation level properties. Use this element only if you need to differentiate between methods having the same signature in the EJB's home and remote interface.

Example

See "method" on page 11-57.

method-name

Range of values:	Name of an EJB defined in `ejb-jar.xml | *`
Default value:	n/a
Requirements:	Required element in method stanza.

Parent elements:	`weblogic-enterprise-bean`
	`transaction-isolation`
	`method`

Deployment file:	`weblogic-ejb-jar.xml`

Function

`method-name` specifies the name of an individual EJB method to which WebLogic Server applies isolation level properties. Use the asterisk (*) to specify all methods in the EJB's home and remote interfaces.

If you specify a `method-name`, the method must be available in the specified `ejb-name`.

Example

See "method" on page 11-57.

method-param

Range of values:	Fully qualified Java type of a method parameter
Default value:	n/a
Requirements:	Required element in `method-params`.

Parent elements:	`weblogic-enterprise-bean`
	`transaction-isolation`
	`method`
	`method-params`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `method-param` element specifies the fully qualified Java type name of a method parameter.

Example

See "method-params" on page 11-61.

method-params

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional stanza.

Parent elements:	`weblogic-enterprise-bean`
	`transaction-isolation`
	`method`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `method-params` stanza contains one or more elements that define the Java type name of each of the method's parameters.

Example

The `method-params` stanza contains one or more `method-param` elements, as shown here:

```
<method-params>
        <method-param>java.lang.String</method-param>
        ...
</method-params>
```

persistence

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Required only for entity EJBs that use container-managed persistence services.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `persistence` element defines the following options that determine the persistence type, transaction commit behavior, and `ejbLoad()` and `ejbStore()` behavior for entity EJBs in WebLogic Server:

- `is-modified-method-name`
- `delay-updates-until-end-of-tx`
- `finders-load-bean`
- `persistence-type`
- `db-is-shared`
- `persistence-use`

Example

The following example specifies the `persistence` element.

```
<entity-descriptor>
       <persistence>
```

```
<is-modified-method-name>...</is-modified-method-name>

<delay-updates-until-end-of-tx>...</delay-updates-until-end-of-tx
>
              <finders-load-beand>...</finders-load-bean>
              <persistence-type>...</persistence-type>
              <db-is-shared>False</db-is-shared>
              <persistence-use>...</persistence-use>
       </persistence>
</entity-descriptor>
```

persistence-type

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Required only for entity EJBs that use container-managed persistence services.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`, `persistence`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `persistence-type` element defines a persistence service that the entity EJB can use. You can define multiple `persistence-type` stanzas in `weblogic-ejb-jar.xml` for testing your EJB with multiple persistence services. Only the persistence type defined in `persistence-use` is actually used during deployment.

`persistence-type` includes several elements that identify the persistence types:

- type-identifier
- type-version
- type-storage

Example

The following excerpt shows a sample `persistence-type` stanza:

```
<persistence>
       <persistence-type>

<type-identifier>WebLogic_CMP_RDBMS</type-identifier>
              <type-version>5.1.0</type-version>

<type-storage>META-INF\weblogic-cmp-rdbms-jar.xml</type-storage>
       </persistence-type>
</persistence>
```

persistence-use

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Required only for entity EJBs that use container-managed persistence services.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`, `persistence`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `persistence-use` element is similar to persistence-type, but it defines the persistence service actually used during deployment. `persistence-use` uses the type-identifier and type-version elements defined in a `persistence-type` to identify the service.

Example

To deploy an EJB using the WebLogic Server RDBMS-based persistence service defined in persistence-type, use the following `persistence-use` stanza:

```
<persistence-use>
       <type-identifier>WebLogic_CMP_RDBMS</type-identifier>
       <type-version>5.1.0</type-version>
</persistence-use>
```

persistent-store-dir

Range of values:	Fully qualified filesystem path
Default value:	n/a
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `stateful-session-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `persistent-store-dir` element specifies a file system directory where WebLogic Server stores the state of passivated stateful session bean instances.

Example

See "stateful-session-descriptor" on page 11-83.

pool

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `stateless-session-descriptor, message-bean-descriptor, entity-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `pool` element configures the behavior of the WebLogic Server free pool for stateless session and message-driven EJBs. The options are:

- `max-beans-in-free-pool`
- `initial-beans-in-free-pool`

Example

The `pool` stanza can contain the elements shown here:

```
<stateless-session-descriptor>
       <pool>
              <max-beans-in-free-pool>500</max-beans-in-free-pool>

<initial-beans-in-free-pool>250</initial-beans-in-free-pool>
       </pool>
</stateless-session-descriptor>
```

principal-name

Range of values:	valid WebLogic Server principal name
Default value:	n/a
Requirements:	At least one `principal-name` is required in the security-role-assignment stanza. You may define more than one `principal-name` for each role-name.
Parent elements:	`weblogic-enterprise-bean` `security-role-assignment`
Deployment file:	`weblogic-ejb-jar.xml`

Function

`principal-name` specifies the name of an actual WebLogic Server principal to apply to the specified `role-name`.

Example

See "security-role-assignment" on page 11-80.

provider-url

Range of values:	valid name
Default value:	n/a
Requirements:	Used in conjunction with `initial-context-factory` and `connection-factory-jndi-name`.
Parent elements:	`weblogic-enterprise-bean` `message-driven-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `provider-url` element specifies the URL provider to be used by the `InitialContext`. Typically, this is the host port and is used in conjunction with `initial-context-factory` and `connection-factory-jndi-name`.

Example

The following example specifies the `provider-url` element.

```
<message-driven-descriptor>
<provider-url>WeblogicURL:Port</provider-url>
</message-driven-descriptor>
```

read-timeout-seconds

Range of values:	`0` to *`maxSeconds`*
Default value:	`600`
Requirements:	Optional element. Valid only for entity EJBs.
Parent elements:	`weblogic-enterprise-bean`, `entity-descriptor`, `entity-cache`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `read-timeout-seconds` element specifies the number of seconds between `ejbLoad()` calls on a `Read-Only` entity bean. By default, `read-timeout-seconds` is set to 600, and WebLogic Server calls `ejbLoad()` only when the bean is brought into the cache.

Example

The following entry causes WebLogic Server to call `ejbLoad()` for instances of the `AccountBean` class only when the instance is first brought into the cache:

```
<weblogic-enterprise-bean>
       <ejb-name>AccountBean</ejb-name>
       <entity-descriptor>
              <entity-cache>

<read-timeout-seconds>0</read-timeout-seconds>
              </entity-cache>
```

```
        </entity-descriptor>
    </weblogic-enterprise-bean>
```

reference-descriptor

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `reference-descriptor` element maps references in the `ejb-jar.xml` file to the JNDI names of actual resource factories and EJBs available in WebLogic Server.

Example

The `reference-descriptor` stanza contains one or more additional stanzas to define resource factory references and EJB references. The following shows the organization of these elements:

```
<reference-descriptor>
        <resource-description>
                ...
        </resource-description>
        <ejb-reference-description>
```

```
                ...
        </ejb-reference-description>
</reference-descriptor>
```

relationship-description

This element is no longer supported in WebLogic Server.

replication-type

Range of values:	`InMemory | None`
Default value:	`None`
Requirements:	Optional element. Valid only for stateful session EJBs in a cluster.

Parent elements:	`weblogic-enterprise-bean`
	`stateful-session-descriptor`
	`stateful-session-clustering`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `replication-type` element determines whether WebLogic Server replicates the state of stateful session EJBs across WebLogic Server instances in a cluster. If you select `InMemory`, the state of the EJB is replicated. If you select `None`, the state is not replicated.

See "In-Memory Replication for Stateful Session EJBs" on page 4-13 for more information.

Example

See "stateful-session-clustering" on page 11-82.

res-env-ref-name

Range of values:	A valid resource environment reference name from the `ejb-jar.xml` file
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-enterprise-bean`
	`reference-descriptor`
	`resource-env-description`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `res-env-ref-name` element specifies the name of a resource environment reference.

Example

See "resource-description" on page 11-75.

res-ref-name

Range of values:	A valid resource reference name from the `ejb-jar.xml` file
Default value:	n/a
Requirements:	Required element if the EJB specifies resource references in `ejb-jar.xml`

Parent elements:	`weblogic-enterprise-bean`
	`reference-descriptor`
	`resource-description`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `res-ref-name` element specifies the name of a `resourcefactory` reference. This is the reference that the EJB provider places within the `ejb-jar.xml` deployment file.

Example

See "resource-description" on page 11-75.

resource-description

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `reference-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `resource-description` element maps a resource reference defined in `ejb-jar.xml` to the JNDI name of an actual resource available in WebLogic Server.

Example

The `resource-description` stanza can contain additional elements as shown here:

```
<reference-descriptor>
       <resource-description>
              <res-ref-name>. . .</res-ref-name>
              <jndi-name>...</jndi-name>
       </resource-description>
       <ejb-reference-description>
              <ejb-ref-name>. . .</ejb-ref-name>
              <jndi-name>. . .</jndi-name>
       </ejb-reference-description>
```

```
</reference-descriptor>
```

resource-env-description

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean` `reference-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `resource-env-description` element maps a resource environment reference defined in `ejb-jar.xml` to the JNDI name of an actual resource available in WebLogic Server.

Example

The `resource-env-description` stanza can contain additional elements as shown here:

```
<reference-descriptor>
       <resource-env-description>
              <res-env-ref-name>. . .</res-env-ref-name>
              <jndi-name>...</jndi-name>
       <reference-env-description>
</reference-descriptor>
```

role-name

Range of values:	An EJB role name defined in `ejb-jar.xml`
Default value:	n/a
Requirements:	Required element in `security-role-assignment`.
Parent elements:	`weblogic-enterprise-bean` `security-role-assignment`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `role-name` element identifies an application role name that the EJB provider placed in the `ejb-jar.xml` deployment file. Subsequent `principal-name` elements in the stanza map WebLogic Server principals to the specified `role-name`.

Example

See "security-role-assignment" on page 11-80.

security-permission

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	.
Parent elements:	n/a
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `security-permission` element specifies a security permission

Example

The `security-permission` stanza can contain one or more of the following elements:

```
<security-permission> </security-permission>
```

security-permission-spec

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	n/a
Parent elements:	security-permission
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `security-permission` element specifies a single security permission based on the Security policy file syntax.

Example

The `security-permission-spec` stanza can contain one or more of the following elements:

```
<security-permission>
<security-permission-spec>grant</security-permission-spec>
</security-permission>
```

security-role-assignment

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Required element if `ejb-jar.xml` defines application roles.
Parent elements:	`n/a`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `security-role-assignment` element maps application roles in the `ejb-jar.xml` file to the names of security principals available in WebLogic Server.

Example

The `security-role-assignment` stanza can contain one or more of the following elements:

```
<security-role-assignment>
        <role-name>PayrollAdmin</role-name>
        <principal-name>Tanya</principal-name>
        <principal-name>system</principal-name>
        ...
</security-role-assignment>
```

stateful-session-cache

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	The `stateful-session-cache` stanza is optional, and is valid only for stateful session EJBs.
Parent elements:	`weblogic-enterprise-bean`, `stateful-session-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `stateful-session-cache` element defines the following options used to cache stateful session EJB instances within WebLogic Server.

- `max-beans-in-cache`
- `idle-timeout-seconds`
- `cache-type`

See"EJB Lifecycle in WebLogic Server" on page 4-2 for a general discussion of the caching services available in WebLogic Server.

Example

The following example shows how to specify the `stateful-session-cache` element

```
<stateful-session-cache>
        <max-beans-in-cache>...</max-beans-in-cache>
        <idle-timeout-seconds>...</idle-timeout-seconds>
        <read-timeout-seconds>...<read-timeout-seconds>
```

```
</stateful-session-cache>
```

stateful-session-clustering

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element. Valid only for stateful session EJBs in a cluster.
Parent elements:	`weblogic-enterprise-bean`, `stateful-session-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `stateful-session-clustering` stanza element specifies the following options that determine how WebLogic Server replicates stateful session EJB instances in a cluster:

- `home-is-clusterable`
- `home-load-algorithm`
- `home-call-router-class-name`
- `replication-type`

Example

The following excerpt shows the structure of a `entity-clustering` stanza:

```
<stateful-session-clustering>
       <home-is-clusterable>True</home-is-clusterable>
       <home-load-algorithm>random</home-load-algorithm>
```

```
<home-call-router-class-name>beanRouter</home-call-router-class-n
ame>

       <replication-type>InMemory</replication-type>

</stateful-session-clustering>
```

stateful-session-descriptor

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	One `stateful-session-descriptor` stanza is required for each stateful session EJB in the `.jar`.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `stateful-session-descriptor` element specifies the following deployment parameters that are applicable for stateful session EJBs in WebLogic Server:

- `stateful-session-cache`
- `persistent-store-dir`
- `stateful-session-clustering`
- `allow-concurrent-calls`

Example

The following example shows the structure of the `stateful-session-descriptor` stanza:

```
<stateful-session-descriptor>
       <stateful-session-cache>...</stateful-session-cache>
              <persistence>...</persistence>
       <allow-concurrent-calls>...</allow-concurrent-calls>

<persistent-store-dir>/weblogic/myserver</persistent-store-dir>

<stateful-session-clustering>...</stateful-session-clustering>
</stateful-session-descriptor>
```

stateless-bean-call-router-class-name

Range of values:	Valid router class name
Default value:	n/a
Requirements:	Optional element. Valid only for stateless session EJBs in a cluster.

Parent elements:	`weblogic-enterprise-bean`,
	`stateless-session-descriptor`
	`stateless-clustering`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `stateless-bean-call-router-class-name` element specifies the name of a custom class to use for routing bean method calls. This class must implement `weblogic.rmi.extensions.CallRouter()`. If specified, an instance of this class is called before each method call. The router class has the opportunity to choose a server to route to based on the method parameters. The class returns either a server name or null, which indicates that the current load algorithm should select the server.

Example

See "stateless-clustering" on page 11-88.

stateless-bean-is-clusterable

Range of values:	`True | False`
Default value:	`True`
Requirements:	Optional element. Valid only for stateless session EJBs in a cluster.

Parent elements:	`weblogic-enterprise-bean,`
	`stateless-session-descriptor`
	`stateless-clustering`

Deployment file:	`weblogic-ejb-jar.xml`

Function

When `stateless-bean-is-clusterable` is `True`, the EJB can be deployed from multiple WebLogic Servers in a cluster. Calls to the home stub are load-balanced between the servers on which this bean is deployed, and if a server hosting the bean is unreachable, the call automatically fails over to another server hosting the bean.

Example

See "stateless-clustering" on page 11-88.

stateless-bean-load-algorithm

Range of values:	`round-robin | random | weight-based`
Default value:	Value of `weblogic.cluster.defaultLoadAlgorithm`
Requirements:	Optional element. Valid only for stateless session EJBs in a cluster.

Parent elements:	`weblogic-enterprise-bean`,
	`stateless-session-descriptor`
	`stateless-clustering`

Deployment file:	`weblogic-ejb-jar.xml`

Function

`stateless-bean-load-algorithm` specifies the algorithm to use for load balancing between replicas of the EJB home. If this property is not defined, WebLogic Server uses the algorithm specified by the server property, `weblogic.cluster.defaultLoadAlgorithm`.

You can define `stateless-bean-load-algorithm` as one of the following values:

- `round-robin`: Load balancing is performed in a sequential fashion among the servers hosting the bean.
- `random`: Replicas of the EJB home are deployed randomly among the servers hosting the bean.
- `weight-based`: Replicas of the EJB home are deployed on host servers according to the servers' current workload.

Example

See "stateless-clustering" on page 11-88.

stateless-bean-methods-are-idempotent

Range of values:	`True | False`
Default value:	`False`
Requirements:	Optional element. Valid only for stateless session EJBs in a cluster.

Parent elements:	`weblogic-enterprise-bean`,
	`stateless-session-descriptor`
	`stateless-clustering`

Deployment file:	`weblogic-ejb-jar.xml`

Function

Set `stateless-bean-methods-are-idempotent` to `True` only if the bean is written such 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 completed on the failed server. Setting this property to `True` makes it possible for the bean stub to recover automatically from any failure as long as another server hosting the bean can be reached.

Example

See "stateless-clustering" on page 11-88.

stateless-clustering

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element. Valid only for stateless session EJBs in a cluster.
Parent elements:	`weblogic-enterprise-bean`, `stateless-session-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `stateless-clustering` element specifies the following options that determine how WebLogic Server replicates stateless session EJB instances in a cluster:

- `stateless-bean-is-clusterable`
- `stateless-bean-load-algorithm`
- `stateless-bean-call-router-class-name`
- `stateless-bean-methods-are-idempotent`

Example

The following excerpt shows the structure of a `stateless-clustering` stanza:

```
<stateless-clustering>

<stateless-bean-is-clusterable>True</stateless-bean-is-clusterable>

<stateless-bean-load-algorithm>random</stateless-bean-load-algorithm>
```

```
<stateless-bean-call-router-class-name>beanRouter</stateless-bean
-call-router-class-name>


<stateless-bean-methods-are-idempotent>True</stateless-bean-metho
ds-are-idempotent>

</stateless-clustering>
```

stateless-session-descriptor

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	One `stateless-session-descriptor` element is required for each stateless session EJB in the JAR file.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `stateless-session-descriptor` element defines deployment parameters, such as caching, clustering, and persistence for stateless session EJBs in WebLogic Server.

Example

The following example shows the structure of the `stateless-session-descriptor` stanza:

```
<stateless-session-descriptor>
```

```
        <pool>...</pool>
        <stateless-clustering>...</stateless-clustering>
</stateless-session-descriptor>
```

transaction-descriptor

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-bean`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `transaction-descriptor` element specifies options that define transaction behavior in WebLogic Server. Currently, this stanza includes only one element: `trans-timeout-seconds`.

Example

The following example shows the structure of the `transaction-descriptor` stanza:

```
<transaction-descriptor>
        <trans-timeout-seconds>20</trans-timeout-seconds>
<transaction-descriptor>
```

transaction-isolation

Range of values:	n/a (XML stanza)
Default value:	n/a (XML stanza)
Requirements:	Optional element.
Parent elements:	`weblogic-enterprise-jar`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `transaction-isolation` element defines method-level transaction isolation settings for an EJB.

Example

The `transaction-isolation` stanza can contain the elements shown here:

```
<transaction-isolation>
       <isolation-level>Serializable</isolation-level>
       <method>
              <description>...</description>
              <ejb-name>...</ejb-name>
              <method-intf>...</method-intf>
              <method-name>...</method-name>
              <method-params>...</method-params>
       </method>
</transaction-isolation>
```

transport-requirements

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	weblogic-enterprise-bean, iiop-security-descriptor
Deployment file:	weblogic-ejb-jar.xml

Function

The transport-requirements element provides the transport requirements for the EJB.

Example

The transport-requirements stanza can contain the elements shown here

```
<iiop-security-descriptor>
       <transport-requirements>
              <confidentiality>supported</confidentiality>
              <integrity>supported</integrity>
              <client-cert-authorization>suppoted
                     </client-cert-authentication>
       </transport-requirements>
</iiop-security-description>
```

trans-timeout-seconds

Range of values:	`0` to *`max`*
Default value:	`30`
Requirements:	Optional element. Valid for any type of EJB.
Parent elements:	`weblogic-enterprise-bean`, `transaction-descriptor`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `trans-timeout-seconds` element specifies the maximum duration for an EJB's container-initiated transactions. If a transaction lasts longer than `trans-timeout-seconds`, WebLogic Server rolls back the transaction.

Example

See "transaction-descriptor" on page 11-90.

type-identifier

Range of values:	Valid string
Default value:	n/a
Requirements:	Required only for entity EJBs that use container-managed persistence services.
Parent elements:	`weblogic-enterprise-bean, entity-descriptor, persistence, persistence-type` and `weblogic-enterprise-bean, entity-descriptor, persistence, persistence-use`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `type-identifier` element contains text that identifies an entity EJB persistence type. WebLogic Server RDBMS-based persistence uses the identifier, `WebLogic_CMP_RDBMS`. If you use a different persistence vendor, consult the vendor's documentation for information on the correct `type-identifier`.

Example

See "persistence-type" on page 11-63 for an example that shows the complete `persistence-type` definition for WebLogic Server RDBMS-based persistence.

type-storage

Range of values:	Valid string
Default value:	n/a
Requirements:	Required only for entity EJBs that use container-managed persistence services.

Parent elements:	`weblogic-enterprise-bean`,
	`entity-descriptor`,
	`persistence`
	`persistence-type`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `type-storage` element defines the full path of the file that stores data for this persistence type. The path must specify the file's location relative to the top level of the EJB's JAR deployment file or deployment directory.

WebLogic Server RDBMS-based persistence generally uses an XML file named `weblogic-cmp-rdbms-jar.xml` to store persistence data for a bean. This file is stored in the `META-INF` subdirectory of the JAR file.

Example

See "persistence-type" on page 11-63 for an example that shows the complete `persistence-type` definition for WebLogic Server RDBMS-based persistence.

type-version

Range of values:	Valid string
Default value:	n/a
Requirements:	Required only for entity EJBs that use container-managed persistence services.

Parent elements:	`weblogic-enterprise-bean,`
	`  entity-descriptor,`
	`  persistence`
	`  persistence-type`
	`and`
	`weblogic-enterprise-bean,`
	`  entity-descriptor,`
	`  persistence`
	`  persistence-use`

Deployment file:	`weblogic-ejb-jar.xml`

Function

The `type-version` element identifies the version of the specified persistence type.

Note: If you use WebLogic Server RDBMS-based persistence, the specified version must *exactly* match the RDBMS persistence version for the WebLogic Server release. Specifying an incorrect version results in the error:

```
weblogic.ejb.persistence.PersistenceSetupException: Error
initializing the CMP Persistence Type for your bean: No installed
Persistence Type matches the signature of (identifier
'Weblogic_CMP_RDBMS', version 'version_number').
```

Example

See persistence-type for an example that shows the complete `persistence-type` definition for WebLogic Server RDBMS-based persistence.

weblogic-ejb-jar

Range of values:	N/A
Default value:	N/A
Requirements:	N/A
Parent elements:	N/A
Deployment file:	`weblogic-ejb-jar.xml`

Function

`weblogic-ejb-jar` is the root element of the weblogic component of the EJB deployment descriptor.

weblogic-enterprise-bean

Range of values:	
Default value:	
Requirements:	
Parent elements:	`weblogic-ejb-jar`
Deployment file:	`weblogic-ejb-jar.xml`

Function

The `weblogic-enterprise-bean` element contains the deployment information for a bean that is available in WebLogic Server.

CHAPTER

12 The weblogic-cmp-rdbms-jar.xml Deployment Descriptor

The following sections describe the EJB 2.0 deployment descriptor elements found in the `weblogic-cmp-rdbms-jar.xml` file, the weblogic-specific XML document type definitions (DTD) file. Use these definitions to create the WebLogic-specific `weblogic-cmp-rdbms-jar.xml` file that is part of your EJB deployment.

The following sections provide a complete reference of the WebLogic-specific XML including the DOCTYPE header information. Use these deployment descriptor elements to specify container-managed-persistence (CMP).

For information on the EJB 1.1 deployment descriptor elements see Chapter 13, "Important Information for EJB 1.1 Users."

- EJB Deployment Descriptors
- DOCTYPE Header Information
- 2.0 weblogic-cmp-rdbms-jar.xml Deployment Descriptor File Structure
- 2.0 weblogic-cmp-rdbms-jar.xml Deployment Descriptor Elements

EJB Deployment Descriptors

The EJB deployment descriptors provide structural and application assembly information for an enterprise bean. You specify this information by specifying values for the deployment descriptors in three EJB XML DTD files. These files are:

- `ejb-jar.xml`
- `weblogic-ejb-jar.xml`
- `weblogic-cmp-rdbms-jar.xml`

You package these three XML files with the EJB and other classes into a deployable EJB component, usually a JAR file, called `ejb.jar`.

The `ejb-jar.xml` file is based on the deployment descriptors found in Sun Microsystems's `ejb.jar.xml` file. The other two XML files are weblogic-specific files that are based on the deployment descriptors found in `weblogic-ejb-jar.xml` and `weblogic-cmp-rdbms-jar.xml`.

DOCTYPE Header Information

When editing or creating XML deployment files, it is critical to include the correct `DOCTYPE` header for each deployment file. In particular, using an incorrect `PUBLIC` element within the `DOCTYPE` header can result in parser errors that may be difficult to diagnose. The correct text for the `PUBLIC` element for each XML deployment file is as follows.

The correct text for the `PUBLIC` element for the WebLogic Server-specific `weblogic-cmp-rdbms-jar.xml` files are as follows.

XML File	PUBLIC Element String
`weblogic-cmp-rdbms -jar.xml`	`'-// BEA Systems, Inc.//DTD WebLogic 8.1.0 EJB RDBMS Persistence//EN' 'http://www.bea.com/servers/wls810/dtd/weblogic-rdbms20-persistence-810.dtd'`

XML File	PUBLIC Element String
`weblogic-cmp-rdbms -jar.xml`	`'-// BEA Systems, Inc.//DTD WebLogic 7.0.0 EJB RDBMS Persistence//EN' 'http://www.bea.com/servers/wls700/dtd/weblogic-rdbms 20-persistence-700.dtd'`
`weblogic-cmp-rdbms -jar.xml`	`'-// BEA Systems, Inc.//DTD WebLogic 6.0.0 EJB RDBMS Persistence//EN' 'http://www.bea.com/servers/wls600/dtd/weblogic-rdbms 20-persistence-600.dtd'`

The correct text for the `PUBLIC` elements for the Sun Microsystem-specific `ejb-jar` files are as follows.

XML File	PUBLIC Element String
`ejb-jar.xml`	`'-//Sun Microsystems, Inc.//DTD Enterprise JavaBeans 2.0//EN' '`
`ejb-jar.xml`	`'-//Sun Microsystems, Inc.//DTD Enterprise JavaBeans 1.1//EN' 'http://www.java.sun.com/j2ee/dtds/ejb-jar_1_1.dtd'`

For example, the entire `DOCTYPE` header for a `weblogic-cmp-rdbms-jar.xml` file is as follows:

```
<!DOCTYPE weblogic-cmp-rdbms-jar PUBLIC
'-//BEA Systems, Inc.//DTD WebLogic 8.1.0 EJB RDBMS
Persistence//EN'
'http://www.bea.com/servers/wls810/dtd/weblogic-rdbms20-persisten
ce-810.dtd '>
```

XML files with incorrect header information may yield error messages similar to the following, when used with a tool that parses the XML (such as `appc`):

```
SAXException: This document may not have the identifier 'identifier_name'
```

`identifier_name` generally includes the invalid text from the `PUBLIC` element.

Document Type Definitions (DTDs) for Validation

The contents and arrangement of elements in your XML files must conform to the Document Type Definition (DTD) for each file you use. WebLogic Server utilities ignore the DTDs embedded within the `DOCTYPE` header of XML deployment files, and instead use the DTD locations that were installed along with the server. However, the DOCTYPE header information must include a valid URL syntax in order to avoid parser errors.

Note: Most browsers do not display the contents of files having the `.dtd` extension. To view the DTD file contents in your browser, save the links as text files and view them with a text editor.

weblogic-cmp-rdbms-jar.xml

The following links provide the public locations for `weblogic-cmp-rdbms-jar.xml` DTDs, by version number.

The following links provide the public DTD locations for the `weblogic-cmp-rdbms-jar.xml` deployment files used with WebLogic Server:

- For `weblogic-cmp-rdbms-jar.xml` 8.1 DTD:

  `http://www.bea.com/servers/wls810/dtd/weblogic-rdbms20-persistence-810.dtd`

- For `weblogic-cmp-rdbms-jar.xml` 7.0 DTD:

  `http://www.bea.com/servers/wls700/dtd/weblogic-rdbms-persistence-700.dtd`

- For `weblogic-cmp-rdbms-jar.xml` 6.0 DTD:

  `http://www.bea.com/servers/wls600/dtd/weblogic-rdbms-persistence-600.dtd`

ejb-jar.xml

The following links provide the public locations for the `ejb-jar.xml` DTDs used with WebLogic Server:

- For `ejb-jar.xml` 2.0 DTD:

`http://www.java.sun.com/dtd/ejb-jar_2_0.dtd` contains the DTD for the standard `ejb-jar.xml` deployment file, required for all EJBs. This DTD is maintained as part of the JavaSoft EJB 2.0 specification; refer to the JavaSoft specification for information about the elements used in `ejb-jar.dtd`.

- For `ejb-jar.xml` 1.1 DTD:

  `ejb-jar.dtd` contains the DTD for the standard `ejb-jar.xml` deployment file, required for all EJBs. This DTD is maintained as part of the JavaSoft EJB 1.1 specification; refer to the JavaSoft specification for information about the elements used in `ejb-jar.dtd`.

Note: Refer to the appropriate JavaSoft EJB specification for a description of the `ejb-jar.xml` deployment descriptors.

2.0 weblogic-cmp-rdbms-jar.xml Deployment Descriptor File Structure

The `weblogic-cmp-rdbms-jar.xml` file defines deployment descriptors for a entity EJBs that uses WebLogic Server RDBMS-based persistence services. The EJB container uses a version of `weblogic-cmp-rdbms-jar.xml` that is different from the XML shipped with WebLogic Server Version 6.x.

You can continue to use the earlier `weblogic-cmp-rdbms-jar.xml` DTD for EJB 1.1 beans that you will deploy on the WebLogic Server Version 8.1. However, if you want to use any of the new CMP 2.0 features, you must use the new DTD described below.

The top-level element of the WebLogic Server 8.1 `weblogic-cmp-rdbms-jar.xml` consists of a `weblogic-rdbms-jar` stanza:

```
description

weblogic-version

weblogic-rdbms-jar

       weblogic-rdbms-bean
              ejb-name
              data-source-name
              table-map
```

```
        field-group
        relationship-caching
        weblogic-query
        delay-database-insert-until
        automatic-key-generation
        check-exists-on-method

weblogic-rdbms-relation
        relation-name
        table-name
        weblogic-relationship-role
create-default-dbms-tables
validate-db-schema-with
database-type
```

2.0 weblogic-cmp-rdbms-jar.xml Deployment Descriptor Elements

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- "caching-element" on page 12-10
- "caching-name" on page 12-11
- "check-exists-on-method" on page 12-12
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- "database-type" on page 12-17
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- "delay-database-insert-until" on page 12-23
- "ejb-name" on page 12-24
- "enable-batch-operations" on page 12-25
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- "key-column" on page 12-36
- "max-elements" on page 12-37
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- "order-database-operations" on page 12-42
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- "query-method" on page 12-44
- "relation-name" on page 12-45

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- "relationship-role-map" on page 12-47
- "relationship-role-name" on page 12-48
- "sql-select-distinct" on page 12-49
- "table-map" on page 12-50
- "table-name" on page 12-52
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- "validate-db-schema-with" on page 12-54
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- "weblogic-relationship-role" on page 12-61

automatic-key-generation

Range of values:	n/a
Default value:	n/a
Requirements:	Optional.
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `automatic-key-generation` element specifies the use of the Sequence/Key Generation feature.

Example

The `XML` stanza can contain the elements shown here:

```
<automatic-key-generation>
       <generator-type>Oracle</generator-type>
       <generator-name>test_sequence</generator-name>
       <key-cache-size>10</key-cache-size>
</automatic-key-generation>



<automatic-key-generation>
       <generator-type>SQL-SERVER</generator-type>
</automatic-key-generation>



<automatic-key-generation>
       <generator-type>NamedSequenceTable</generator-type>
       <generator-name>MY_SEQUENCE_TABLE_NAME</generator-name>
```

```
        <key-cache-size>100</key-cache-size>
</automatic-key-generation>
```

caching-element

Range of values:	n/a
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-rdbms-jar`
	`weblogic-rdbms-bean`
	`relationship-caching`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `caching-element` descriptor specifies the container-managed relationship (`cmr-field`) for the related bean, and the `group-name` in the related bean. If `group-name` is not specified, the default `group-name` (load all fields) is used. For more information about `group-name`, see "group-name" on page 12-33.

For more information about relationship caching, see "Relationship Caching with Entity Beans" on page 6-4.

Example

See "relationship-caching" on page 12-46:

caching-name

Range of values:	Valid name
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-rdbms-jar`
	`weblogic-rdbms-bean`
	`relationship-caching`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `caching-name` element specifies the name of a relationship cache. For more information about relationship caching, see "Relationship Caching with Entity Beans" on page 6-4.

Example

See "relationship-caching" on page 12-46:

check-exists-on-method

Range of values:	`True | False`
Default value:	`True`
Requirements:	.
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `check-exists-on method` element specifies that WebLogic Server notify the application that a business method is invoked on a CMP entity bean that has been removed if the value is set to "True."

By default, WebLogic RDBMS CMP only checks that an entity bean actually exists in the underlying database when it needs to read or write data to the RDBMS. This provides most applications with higher performance and a sufficient level of checking. For example, when the value of a cmp-field is passed to an application for a bean that has been removed, it throws a `NoSuchObjectException` or `NoSuchObjectLocalException` error immediately while an

Example

The following example specifies that WebLogic Server notify the application that a business method is invoked on a CMP entity bean that has been removed.

```
<check-exists-on-method>True</check-exists-on-method>
```

cmp-field

Range of values:	Valid name
Default value:	n/a
Requirements:	Field is case sensitive and must match the name of the field in the bean and must also have a `cmp-entry` entry in the `ejb-jar.xml`.

Parent elements:	`weblogic-rdbms-bean`
	`  field-map`
	`weblogic-rdbms-relation`
	`  field-group`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

This name specifies the mapped field in the bean instance which should be populated with information from the database.

Example

See "field-map" on page 12-28.

cmr-field

Range of values:	Valid name
Default value:	n/a
Requirements:	The field referenced in `cmr-field` must have a matching `cmr-field` entry in the `ejb-jar.xml`.
Parent elements:	`weblogic-rdbms-relation` `field-group`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `cmr-field` element specifies the name of a container-managed relationship field (cmr-field.)

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>
       <weblogic-rdbms-relation>
              <field-group>employee</field-group>
                           <cmp-field>employee stock
purchases</cmp-field>
                           <cmr-field>stock options</cmr-field>
       </weblogic-rdbms-relation>
</weblogic-rdbms-jar>
```

column-map

Range of values:	n/a.
Default value:	n/a
Requirements:	The `key-column` element is not specified, if the `foreign-key-column` refers to a remote bean.
Parent elements:	`weblogic-rdbms-bean` `weblogic-relationship-role`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

This element represents the mapping of a foreign key column in one table in the database to a corresponding primary key. The two columns may or may not be in the same table. The tables to which the column belong are implicit from the context in which the `column-map` element appears in the deployment descriptor.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>
       <weblogic-rdbms-bean>
              <column-map

<foreign-key-column>account-id</foreign-key-column>
                            <key-column>id</key-column>
              </column-map>


  </weblogic-rdbms-bean>
</weblogic-rdbms-jar>
```

create-default-dbms-tables

Range of values:	True | False | DropAndCreate | DropAndCreateAlways | CreateOrAlterTable
Default value:	False
Requirements:	Use this element only for convenience during the development and prototyping phases. This is because the Table Schema in the DBMS CREATE statement used will be the container's best approximation of the definition. A production environment most likely, will require a more precise schema definition.
Parent elements:	`weblogic-rdbms-jar`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `create-default-dbms-table` element serves two functions:

- It turns on or off a feature that automatically creates a default table based on the descriptions in the deployment files and the bean class. When set to `False`, this feature is turned off and table will not automatically be generated. When set to `True`, this feature is turned on and the table is automatically created. If `TABLE CREATION` fails, a `Table Not Found` error is thrown and the table must be created by hand.
- It determines whether and how the EJB container drops and recreates tables whose underlying schema has changed:
  - When set to `DropAndCreate`, the container drops and creates the table during deployment if columns have changed and table data is not saved.
  - When set to `DropAndCreateAlways`, the container drops and creates the table during deployment whether or not columns have changed and data is not saved.
  - When set to `CreateOrAlterTable`, the container creates the table if it does not yet exist. If the table does exist, the container alters the table schema. Table data is saved.

Warning: Do not choose this option if a new column is specified as a primary key or if a column with null values is specified as the new primary key column.

Example

The following example specifies the `create-default-dbms-tables` element.

```
<create-default-dbms-tables>True</create-default-dbms-tables>
```

database-type

Range of values:	DB2| Informix| Oracle| SQLServer| Sybase| POINTBASE.
Default value:	NA
Requirements:	NA.
Parent elements:	`weblogic-rdbms-jar`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `database-type` element specifies the database used as the underlying dbms.

Example

The following example specifies the underlying dbms.

```
<database-type>POINTBASE</database-type>
```

data-source-name

Range of values:	Valid name of the data source used for all data base connectivity for this bean.
Default value:	n/a
Requirements:	Must be defined as a standard WebLogic Server JDBC data source for database connectivity. For more information on datasources, see Programming WebLogic JDBC.
Parent elements:	weblogic-rdbms-bean
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `data-source-name` that specifies the JDBC data source name to be used for all database connectivity for this bean.

Example

See "table-name" on page 12-52.

db-cascade-delete

Range of values:	
Default value:	n/a
Requirements:	Only supported for Oracle database. Can only be specified for one-to-one or one-to-many relationships.
Parent elements:	`weblogic-rdbms-bean` `weblogic-relationship-role`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `db-cascade-delete` element specifies whether the database cascade feature is turned on. If this element is not specified, WebLogic Server assumes that database cascade delete is not specified.

Example

See "Cascade Delete Method" on page 5-31.

dbms-column

Range of values:	Valid name
Default value:	n/a
Requirements:	`dbms-column` is case maintaining, although not all database are case sensitive.
Parent elements:	`weblogic-rdbms-bean` `field-map`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The name of the database column to which the field should be mapped.

Example

See "field-map" on page 12-28.

dbms-column-type

Range of values:	Valid name
Default value:	n/a
Requirements:	
Parent elements:	`weblogic-rdbms-bean` `field-map`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `dbms-column-type` element maps the current field to a Blob or Clob in an Oracle database or a LongString or SybaseBinary in a Sybase database. This element can be one of the following:

- OracleBlob
- OracleCLob
- LongString
- SybaseBinary

Example

```
<field-map>
       <cmp-field>photo</cmp-field>
       <dbms-column>PICTURE</dbms-column>
       <dbms_column-type>OracleBlob</dbms-column-type>

</field-map>
```

description

Range of values:	n/a
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-rdbms-jar`
	`weblogic-rdbms-bean`
	`weblogic-query`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `description` element is used to provide text that describes the parent element.

Example

The following example specifies the `description` element.

```
<dscription>Contains a description of parent element</description>
```

delay-database-insert-until

Range of values:	`ejbCreate | ejbPostCreate | commit`
Default value:	`ejbPostCreate`
Requirements:	Database insert is delayed until after `ejbPostCreate` when a `cmr-field` is mapped to a `foreign-key column` that does not allow null values. In this case, the `cmr-field` must be set to a non-null value in `ejbPostCreate` before the bean is inserted into the database. The `cmr-fields` may not be set during `ejbCreate`, before the primary key of the bean is known.
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `delay-database-insert-until` element specifies the precise time when a new bean that uses RDBMS CMP is inserted into the database.

It is advisable to delay the database insert until after the `ejbPostCreate` method modifies the persistent fields of the bean. This can yield better performance by avoiding an unnecessary store operation.

For maximum flexibility, you should avoid creating related beans in your `ejbPostCreate` method. This may make delaying the database insert impossible if database constraints prevent related beans from referring to a bean that has not yet been created.

Example

The following example specifies the `delay-database-insert-until` element.

```
<delay-database-insert-until>ejbPostCreate</delay-database-insert
-until>
```

ejb-name

Range of values:	Valid name of an EJB.
Default value:	n/a
Requirements:	Must match the `ejb-name` of the cmp entity bean defined in the `ejb-jar.xml`.
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The name that specifies an EJB as defined in the ejb-cmp-rdbms.xml. This name must match the `ejb-name` of a cmp entity bean contained in the `ejb-jar.xml`.

Example

See "table-name" on page 12-52.

enable-batch-operations

Range of values:	`True | False`
Default value:	`True`
Requirements:	n/a
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

This element allows or disallows the EJB container to perform batch operations, including batch inserts, batch updates and batch deletes.

If this element is set to `True`, the EJB delays database operations in a transaction until commit time.

Example

The following XML sample demonstrates use of the `enable-batch-operations` element:

```
<enable-batch-operations>True</enable-batch-operations>
```

enable-tuned-updates

Range of values:	`True/False`
Default value:	`True`
Requirements:	
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `enable-tuned-updates` element specifies that when `ejbStore` is called that the EJB container automatically determine which container-managed fields have been modified and then writes only those fields back to the database.

Example

The following examples shows how to specify the `enable-tuned-updates` element.

```
<enable-tuned-updates>True</enable-tuned-updates>
```

field-group

Range of values:	Valid name
Default value:	A special group named `default` is used for finders and relationships that have no group specified.
Requirements:	The default group contains all of a bean's cmp-fields, but none of its cmr-fields.
Parent elements:	`weblogic-rdbms-relation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `field-group` element represents a subset of the cmp and cmr-fields of a bean. Related fields in a bean can be put into groups that are faulted into memory together as a unit. A group can be associated with a finder or relationship, so that when a bean is loaded as the result of executing a finder or following a relationship, only the fields specified in the group are loaded.

A field may belong to multiple groups. In this case, the `getXXX` method for the field faults in the first group that contains the field.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-bean>
       <ejb-name>XXXBean</ejb-name>
       <field-group>
              <group-name>medical-data</group-name>
              <cmp-field>insurance</cmp-field>
              <cmr-field>doctors</cmr-fields>
       </field-group>
</weblogic-rdbms-bean>
```

field-map

Range of values:	Valid name
Default value:	n/a
Requirements:	Field mapped to the column in the database must correspond to a cmp field in the bean.
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The name of the mapped field for a particular column in a database that corresponds to a cmp field in the bean instance.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>
       <weblogic-rdbms-bean>

       <field-map>
              <cmp-field>accountId</cmp-field>
                     <dbms-column>id</dbms-column>
       </field-map>

       <field-map>
              <cmp-field>balance</cmp-field>
                     <dbms-column>bal</dbms-column>
       </field-map>

    <field-map>
              <cmp-field>accountType</cmp-field>
                     <dbms-column>type</dbms-column>
       </field-map>
```

```
  </weblogic-rdbms-bean>
</weblogic-rdbms-jar>
```

foreign-key-column

Range of values:	Valid name
Default value:	n/a
Requirements:	Must correspond to a column of a foreign key.
Parent elements:	`weblogic-rdbms-bean` `column-map`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `foreign-key-column` element represents a column of a foreign key in the database.

Example

See “column-map” on page 12-15.

foreign-key-table

Range of values:	Valid name
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-rdbms-jar`
	`weblogic-rdbms-relation`
	`weblogic-relationship-role`
	`relationship-role-map`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `foreign-key-table` element specifies the name of a DBMS table that contains a foreign key.

Example

See "relationship-role-map" on page 12-47.

generator-name

Range of values:	n/a
Default value:	n/a
Requirements:	Optional.
Parent elements:	`weblogic-rdbms-bean` `automatic-key-generation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `generator-name` element is used to specify the name of the generator.

For example;

- If the `generator-type` element is `Oracle`, then the `generator-name` element would be the name of the `ORACLE_SEQUENCE` to be used.
- If the `generator-type` element is `NamedSequenceTable`, then the `generator-name` element would be the name of the `SEQUENCE_TABLE` to be used.

Example

See "automatic-key-generation" on page 12-9.

generator-type

Range of values:	n/a
Default value:	n/a
Requirements:	Optional
Parent elements:	`weblogic-rdbms-bean` `automatic-key-generation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The generator-type element specifies the key generation method to use. The options include:

- `Oracle`
- `SQLServer`
- `NamedSequenceTable`

Example

See "automatic-key-generation" on page 12-9.

group-name

Range of values:	Valid name
Default value:	n/a
Requirements:	n/a

Parent elements:	`weblogic-rdbms-relation`
	`field-group`
	`weblogic-rdbms-bean`
	`finder`
	`finder-query`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `group-name` element specifies the name of a field group.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>
       <weblogic-rdbms-relation>
                     <field-group>employee</field-group>
                            <cmp-field>employee stock
purchases</cmp-field>
                            <cmr-field>stock options</cmr-field>
                                   <group-name>financial
data</group-name>
```

```
        </weblogic-rdbms-relation>
</weblogic-rdbms-jar>
```

include-updates

Range of values:	`True | False`
Default value:	`False`
Requirements:	The default value, which is `False`, provides the best performance.
Parent elements:	weblogic-rdbms-bean weblogic-query
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The include-updates element specifies that updates made during the current transaction must be reflected in the result of a query. If this element is set to `True`, the container will flush all changes made by the current transaction to disk before executing the query.

The default value is `False` for beans that use optimistic concurrency. The default value is `True` for beans that use other concurrency types, such as database, or exclusive.

Example

The `XML` stanza can contain the elements shown here:

```
<include-updates>False</include_updates>
```

key-cache-size

Range of values:	n/a
Default value:	1
Requirements:	Optional
Parent elements:	`weblogic-rdbms-bean` `automatic-key-generation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The key-cache-size element specifies the optional size of the primary key cache available in the automatic primary key generation feature.

Example

See "automatic-key-generation" on page 12-9.

key-column

Range of values:	Valid name
Default value:	n/a
Requirements:	Must correspond to a column of a primary key.
Parent elements:	`weblogic-rdbms-bean` `column-map`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `key-column` element represents a column of a primary key in the database.

Example

See "column-map" on page 12-15.

max-elements

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	weblogic-rdbms-bean weblogic-query
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

`max-elements` specifies the maximum number of elements that should be returned by a multi-valued query. This element is similar to the `maxRows` feature in JDBC.

Example

The `XML` stanza can contain the elements shown here:

```
<max-elements>100</max-elements>

      <!ELEMENT max-element (PCDATA)>
```

method-name

Range of values:	n/a
Default value:	n/a
Requirements:	The '*' character may not be used as a wildcard.
Parent elements:	`weblogic-rdbms-bean` `query-method`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `method-name` element specifies the name of a finder or `ejbSelect` method.

Example

See "weblogic-query" on page 12-57.

method-param

Range of values:	Valid name
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-bean` `method-params`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `method-param` element contains the fully qualified Java type name of a method parameter.

Example

The `XML` stanza can contain the elements shown here:

```
<method-param>java.lang.String</method-param>
```

method-params

Range of values:	list of valid names
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-bean` `query-method`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `method-params` element contains an ordered list of the fully-qualified Java type names of the method parameters.

Example

See "weblogic-query" on page 12-57.

optimistic-column

Range of values:	n/a
Default value:	n/a
Requirements:	Although not all databases are case sensitive, this element is case maintaining.
Parent elements:	`weblogic-rdbms-bean` `table-map`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `optimistic-column` element denotes a database column that contains a version or timestamp value used to implement optimistic concurrency. For more information on optimistic concurrency, see "Optimistic Concurrency Strategy" on page 5-38.

Example

The following sample XML shows the use of the `optimistic-column` element.

```
<optimistic-column>ROW_VERSION</optimistic-column>
```

order-database-operations

Range of values:	True | False
Default value:	True
Requirements:	
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

Determines whether the EJB container delays all database operations in a transaction until commit time, automatically sorts the database dependency between the operations, and sends these operations to the database in such a way to avoid any database constraint errors.

If enable-batch-operations is set to `True`, the container automatically sets `order-database-operations` to `True`.

Example

The following sample XML demonstrates the use of the `order-database-operations` element.

```
<order-database-operations>True</order-database-operations>
```

primary-key-table

Range of values:	n/a
Default value:	n/a
Requirements:	Although not all databases are case sensitive, this element is case maintaining.

Parent elements:	`weblogic-rdbms-jar`
	`weblogic-rdbms-relation`
	`weblogic-relationship-role`
	`relationship-role-map`

Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `primary-key-table` element specifies the name of a DBMS table that contains a primary key. For more information about primary keys, see "Using Primary Keys" on page 5-4.

In the following XML stanza The bean on the `primary-key` side of a one-to-one relationship, called `Pk_bean` is mapped to multiple tables, but the bean on the `foreign-key` side of the relationship, called `Fk_Bean` is mapped to one table, called `Fk_BeanTable`. The foreign-key columns are named `Fk_column_1` and `Fk_column_2`.

Example

The following sample XML shows the use of the `primary-key-table` element.

```
<relationship-role-map
<primary-key-table->Pk_BeanTable_1</primary-key-table>
<column-map>
<foreign-key-column>Fk_column_1</foreign-key-column>
<key-column>Pk_table1_pkColumn_1</key-column>
```

```
</column-map>
<column-map>
<foreign-key-column>Fk_column_2</foreign-key-column>
<key-column>Pk_table1_pkColumn_2</key-column>
</column-map>
</relationship-role-map>
```

query-method

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `query-method` element specifies the method that is associated with a `weblogic-query`. It also uses the same format as the `ejb-jar.xml` descriptor.

Example

See "weblogic-query" on page 12-57.

relation-name

Range of values:	Valid name
Default value:	n/a
Requirements:	Must match the `ejb-relation-name` of an ejb-relation in the associated `ejb-jar.xml` deployment descriptor file. The ejb-relation-name is optional, but is required for each relationship defined in the associated `ejb-jar.xml` deployment descriptor file
Parent elements:	`weblogic-rdbms-relation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `relation-name` element specifies the name of a relation.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>
       <weblogic-rdbms-relation>
              <relation-name>stocks-holders</relation-name>
                     <table-name>stocks</table-name>
       </weblogic-rdbms-relation>
</weblogic-rdbms-jar>
```

relationship-caching

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-jar` `weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `relation-caching` element specifies relationship caching. For more information about relationship caching, see "Relationship Caching with Entity Beans" on page 6-4.

Example

The `XML` stanza can contain the elements shown here:

```
<relationship-caching>
       <caching-name>cacheMoreBeans</caching-name>
       <caching-element>
              <cmr-field>accounts<</cmr-field>
              <group-name>acct_group</group-name>
              <caching-element>
                     <cmr-field>address</cmr-field>
                     <group-name>addr_group</group-name>
              </caching-element>
       </caching-element>

       <caching-element>
              <cmr-field>phone</cmr-field>
              <group-name>phone_group</group-name>
```

```
        </caching-element>
</relationship-caching>
```

relationship-role-map

Range of values:	Valid name
Default value:	n/a
Requirements:	The name must match the `ejb-relationship-role-name` of an `ejb-relationship-role` in the associated `ejb-jar.xml` descriptor file.
Parent elements:	`weblogic-rdbms-relation` `weblogic-relationship-role`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `relationship-role-map` element specifies foreign-key-column to key-column mapping for beans involved in a relationship.

Example

The `XML` stanza can contain the elements shown here:

```
<relationship-role-map
       <foreign-key-table->Fk_BeanTable_2</foreign-key-table>
       <column-map>
              <foreign-key-column>Fk_column_1</foreign-key-column>
              <key-column>Pk_table_pkColumn_1</key-column>
       </column-map>
       <column-map>
              <foreign-key-column>Fk_column_2</foreign-key-column>
              <key-column>Pk_table_pkColumn_2</key-column>
```

```
        </column-map>
</relationship-role-map>
```

relationship-role-name

Range of values:	Valid name
Default value:	n/a
Requirements:	The name must match the `ejb-relationship-role-name` of an `ejb-relationship-role` in the associated `ejb-jar.xml` descriptor file.
Parent elements:	`weblogic-rdbms-relation` `weblogic-relationship-role`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `relationship-role-name` element specifies the name of a relationship role. The bean on the foreign-key side of the a one-to-one relationship called Fk_Bean, as shown in the following XML stanza, is mapped to multiple tables. The table that has the foreign-key columns must be specified in the `foreign-key-table` element. See "foreign-key-table" on page 12-30.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>

        <weblogic-rdbms-relation>

                <weblogic-relationship-role>stockholder</weblogic-
relationship-role>
```

```
<relationship-role-name>stockholders</relationship- role-name>
       </weblogic-rdbms-relation>
</weblogic-rdbms-jar>
```

sql-select-distinct

Note: This element is deprecated. To achieve the same functionality, use the `SELECT DISTINCT` clause directly in finder queries.See "Using SELECT DISTINCT" on page 5-15.

Range of values:	`True | False`
Default value:	`False`
Requirements:	The Oracle database does not allow you to use a SELECT DISTINCT in conjunction with a FOR UPDATE clause. Therefore, you cannot use the `sql-select-distinct` element if any bean in the calling chain has a method with a `transaction-isolation` element set to the `isolation-level` sub element with a value of `TRANSACTION_READ_COMMITED_FOR_UPDATE` You specify the `transaction-isolation` element in the `weblogic-ejb-jar.xml` file.
Parent elements:	`weblogic-query`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `sql-select-distinct` element controls whether the generated SQL SELECT statement will contain a a DISTINCT qualifier. Using the DISTINCT qualifier caused the database to return unique rows.

Example

The XML example contains the element shown here:

```
<sql-select-distinct>True</sql-select-distinct>
```

table-map

Range of values:	n/a
Default value:	n/a
Requirements:	Each `table-map element` must contain a mapping for the bean's primary key fields.
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `table-map` element specifies a mapping between the cmp-fields of a bean and the columns of a table for all of the `cmp-fields` mapped to that table. If you map a CMP bean to `n` DBMS tables, then you must specify `n table-map` elements for the bean, one for each n DBMS table.

When you map a CMP bean to multiple tables, each table contains a row that maps to a particular bean instance. Consequently, all tables will contain the same number of rows at any point in time. In addition, each table contains the same set of homogeneous primary key values. Therefore, each table must have the same number of primary key columns and corresponding primary key columns in different tables must have the same type, although they may have different names.

Each table-map element must specify a mapping from the primary key column(s) for a particular table to the primary key field(s) of the bean. You can only map non-primary key fields to a single table.

Example

The XML stanza can contain the elements shown here:

```
<table-map>
       <table-nme>DeptTable</table-name>

       <field-map>
              <cmp-field>deptId1</cmp-field>
              <dbms-column>t1_deptId1_column</dbms-column>
       </field-map>
       <field-map>
              <cmp-field>deptId2</cmp-field>
              <dbms-column>t1_deptId2_column</dbms-column>
       </field-map>
       <field-map>
              <cmp-field>location</cmp-field>
              <dbms-column>location_column</dbms-column>
       </field-map>
              <cmp-field>budget</cmp-field>
              <dbms-column>budget</dbms-column>
       </field-map>
       <fieldmap
</table-map>
```

table-name

Range of values:	Valid, fully qualified SQL name of the source table in the database.
Default value:	n/a
Requirements:	`table-name` must be set in all cases.
Parent elements:	`weblogic-rdbms-bean` `weblogic-rdbms-relation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The fully qualified SQL name of the table. The user defined for the `data-source` for this bean must have read and write privileges for this table, but does not necessarily need schema modification privileges.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms.jar>
  <weblogic-rdbms-bean>
    <ejb-name>containerManaged</ejb-name>

<data-source-name>examples-dataSource-demoPool</data-source-name>
    <table-name>ejbAccounts</table-name>


</weblogic-rdbms-bean>
</weblogic-rdbms-jar>
```

use-select-for-update

Range of values:	True | False
Default value:	False
Requirements:	n/a
Parent elements:	weblogic-rdbms-bean
Deployment file:	weblogic-cmp-rdbms-jar.xml

Function

Enforces pessimistic concurrency on a per-bean basis. Specifying `True` causes `SELECT ... FOR UPDATE` to be used whenever the bean is loaded from the database. This is different from the transaction isolation level of `TransactionReadCommittedForUpdate` in that this is set at the bean level rather than the transaction level.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms.jar>
  <weblogic-rdbms-bean>
    <ejb-name>containerManaged</ejb-name>
    <use-select-for-update>True</use-select-for-update>
</weblogic-rdbms-bean>
</weblogic-rdbms-jar>
```

validate-db-schema-with

Range of values:	`MetaData | TableQuery`
Default value:	`TableQuery`
Requirements:	`n/a`
Parent elements:	`weblogic-rdbms-jar`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `validate-db-schema-with` element specifies that container-managed persistence checks that beans have been mapped to a valid database schema during deployment.

If you specify `MetaData` WebLogic Server uses the JDBC metadata to validate the schema.

If you specify `TableQuery`, the default setting, WebLogic Server queries the tables directly to verify that they have the schema expected by CMP runtime.

Example

The `XML` stanza can contain the elements shown here:

```
<validate-db-schema-with>TableQuery</validate-db-schema-with>
```

verify-columns

Range of values:	`Read	Modified	Version	Timestamp.`
Default value:	`none`
Requirements:	`table-name` must be set in all cases.
Parent elements:	`weblogic-rdbms-bean` `table-map`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `verify-columns` element specifies the columns in a table that you want WebLogic Server to check for validity when you use the `optimistic` concurrency strategy. WebLogic Server checks columns at the end of a transaction, before committing it to the database, to make sure that no other transaction has modified the data.

See "Optimistic Concurrency Strategy" on page 5-38 for more information.

Example

The `XML` stanza can contain the elements shown here:

```
<verify-columns>Modified</verify-columns>
```

weblogic-ql

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-bean` `weblogic-query`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `weblogic-ql` element specifies a query that contains a WebLogic specific extension to the ejb-ql language. You should specify queries that only use standard EJB-QL language features in the `ejb-jar.xml` deployment descriptor.

Example

See "weblogic-query" on page 12-57.

weblogic-query

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-bean`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `weblogic-query` element allows you to associate WebLogic specific attributes with a query, as necessary. For example, `weblogic-query` can be used to specify a query that contains a WebLogic specific extension to EJB-QL. Queries that do not take advantage of WebLogic extensions to EJB-QL should be specified in the `ejb-jar.xml` deployment descriptor.

Also, the `weblogic-query` element is used to associate a `field-group` with the query if the query retrieves an entity bean that should be pre-loaded into the cache by the query.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-query>
        <query-method>
          <method-name>findBigAccounts</method-name>
          <method-params>
                              <method-param>double</method-param>
```

```
            </method-params>
          <query-method>
                                  <weblogic-ql>WHERE BALANCE>10000
ORDERBY NAME</weblogic-ql>
               </weblogic-query>
```

weblogic-rdbms-bean

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-jar`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `weblogic-rdbms-bean` represents a single entity bean that is managed by the WebLogic RDBMS CMP persistence type.

Example

The `XML` structure of `weblogic-rdbms-bean` is:

```
weblogic-rdbms-bean
       ejb-name
       data-source-name
              table-map
       field-group
       relationship-caching
       weblogic-query
```

```
dalay-database-insert-until
automatic-key-generation
check-exists-on-method
```

weblogic-rdbms-jar

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	n/a
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `weblogic-rdbms-jar` element is the root level element of a WebLogic RDBMS CMP deployment descriptor. This element contains the deployment information for one or more entity beans and an optional set of relations.

Example

The `XML` structure of weblogic-rdbms-jar is:

```
weblogic-rdbms-jar
       weblogic-rdbms-bean
       weblogic-rdbms-relation
       create-default-dbms-tables
       validate-db-schema-with
       database-type
```

weblogic-rdbms-relation

Range of values:	n/a
Default value:	n/a
Requirements:	n/a
Parent elements:	`weblogic-rdbms-jar`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `weblogic-rdbms-relation` element represents a single relationship that is managed by the WebLogic CMP persistence type. deployment descriptor. WebLogic Server supports the following three relationship mappings:

- For one-to-one relationships, the mapping is from a foreign key in one bean to the primary key of the other bean. For more information on one-to-one relationships, see "One-to-One Relationships" on page 5-8.
- For one-to-many relationships, the mapping is also from a foreign key in one bean to the primary key of another bean. For more information on one-to-many relationships, see "One-to-Many Relationships" on page 5-9.
- For many-to-many relationships, the mapping involves a join table. Each row in the join table contains two foreign keys that map tot he primary keys of the entities involved in the relation. for more information on one-to-one relationships, see "Many-to-Many Relationships" on page 5-9.

Example

The `XML` structure of a `weblogic-rdbms-relation` showing a one-to-one relationship follows:

```
<weblogic-rdbms-relation>
       <relation-name>employee-manager</relation-name>
       <weblogic-relationship-role>
              <relationship-role-name>employee
                     </relationship-role-name>
              <relationship-role-name>
                     <<column-map>
                            <foreign-key-column>manager-id
                                   </foreign-key-column>
                            <key-column>id</key-column>
                     </column-map>
              <relationship-role-name>
       </weblogic-relationship-role>
</weblogic-rdbms-relation>
```

weblogic-relationship-role

Range of values:	Valid name
Default value:	n/a
Requirements:	The mapping of a role to a table is specified in the associated `weblogic-rdbms-bean` and `ejb-relation` elements.
Parent elements:	`weblogic-rdbms-jar` `weblogic-rdbms-relation`
Deployment file:	`weblogic-cmp-rdbms-jar.xml`

Function

The `weblogic-relationship-role` element is used to express a mapping from a foreign key to a primary key. Only one mapping is specified for one-to-one relationships when the relationship is local. However, with a many-to-many relationship, you must specify two mappings

Multiple column mappings are specified for a single role, it the key is complex. No `column-map` is specified if the role is just specifying a group-name.

Example

The `XML` stanza can contain the elements shown here:

```
<weblogic-rdbms-jar>
       <weblogic-rdbms-relation>
              <relation-name>stocks-holders</relation-name>
                     <table-name>stocks</table-name>
                     <weblogic-relationship-role>stockholder
</weblogic-relationship-role>
       </weblogic-rdbms-relation>
</weblogic-rdbms-jar>
```

CHAPTER

13 Important Information for EJB 1.1 Users

BEA strongly recommends that new users implement their distributed business applications using EJB 2.0 beans. However, if your existing application implements EJB 1.1 beans, please read the following sections, which contain important design and implementation information specific to EJB 1.1. This section includes a detailed reference to EJB 1.1 deployment descriptors.

- "Writing for RDBMS Persistence for EJB 1.1 CMP" on page 2
- "Using WebLogic Query Language (WLQL) for EJB 1.1 CMP" on page 4
- "Using SQL for CMP 1.1 Finder Queries" on page 8
- "Tuned EJB 1.1 CMP Updates in WebLogic Server" on page 9
- "Using is-modified-method-name to Limit Calls to ejbStore()" on page 10
- "5.1 weblogic-ejb-jar.xml Deployment Descriptor File Structure" on page 11
- "5.1 weblogic-ejb-jar.xml Deployment Descriptor Elements" on page 11
- "1.1 weblogic-cmp-rdbms-jar.xml Deployment Descriptor File Structure" on page 24
- "1.1 weblogic-cmp-rdbms-jar.xml Deployment Descriptor Elements" on page 25

Writing for RDBMS Persistence for EJB 1.1 CMP

Clients use finder methods to query and receive references to entity beans that fulfill query conditions. This section describes how to write finders for WebLogic-specific 1.1 EJBs that use RDBMS persistence. You use EJB QL, a portable query language, to define finder queries for 2.0 EJBs with container-managed persistence. For more information about on EJB QL, see "Using EJB QL for EJB 2.0" on page 5-14.

WebLogic Server provides an easy way to write finders.

1. Write the method signature of a finder in the `EJBHome` interface.
2. Define the finder's query expressions in the `ejb-jar.xml` deployment file.

`appc` creates implementations of the finder methods at deployment time, using the queries in `ejb-jar.xml`.

The key components of a finder for RDBMS persistence are:

- The finder method signature in `EJBHome`.
- A `query` stanza defined within `ejb-jar.xml`.
- An optional `finder-query` stanza within `weblogic-cmp-rdbms-jar.xml`.

The following sections explain how to write EJB finders using XML elements in WebLogic Server deployment files.

Finder Signature

Specify finder method signatures using the form `find`*`MethodName`*`()`. Finder methods defined in `weblogic-cmp-rdbms-jar.xml` must return a Java collection of EJB objects or a single object.

Note: You can also define a `findByPrimaryKey(primkey)` method that returns a single object of the associated EJB class.

finder-list Stanza

The `finder-list` stanza associates one or more finder method signatures in `EJBHome` with the queries used to retrieve EJB objects. The following is an example of a simple `finder-list` stanza using WebLogic Server RDBMS-based persistence:

```
<finder-list>
     <finder>
          <method-name>findBigAccounts</method-name>
          <method-params>
               <method-param>double</method-param>
          </method-params>
          <finder-query><![CDATA[(> balance $0)]]></finder-query>
     </finder>
</finder-list>
```

Note: If you use a non-primitive data type in a `method-param` element, you must specify a fully qualified name. For example, use `java.sql.Timestamp` rather than `Timestamp`. If you do not use a qualified name, `appc` generates an error message when you compile the deployment unit.

finder-query Element

The `finder-query` element defines the WebLogic Query Language (WLQL) expression you use to query EJB objects from the RDBMS. WLQL uses a standard set of operators against finder parameters, EJB attributes, and Java language expressions. See "Using WebLogic Query Language (WLQL) for EJB 1.1 CMP" on page 13-4 for more information on WLQL.

Note: Always define the text of the `finder-query` value using the XML `CDATA` attribute. Using `CDATA` ensures that any special characters in the WLQL string do not cause errors when the finder is compiled.

A CMP finder can load all beans using a single database query. So, 100 beans can be loaded with a single database round trip. A bean-managed persistence (BMP) finder must do one database round trip to get the primary key values of the beans selected by the finder. As each bean is accessed, another database access is also typically required, assuming the bean wasn't already cached. So, to access 100 beans, a BMP might do 101 database accesses.

Using WebLogic Query Language (WLQL) for EJB 1.1 CMP

WebLogic Query Language (WLQL) for EJB 1.1 CMP allows you to query 1.1 entity EJBs with container-managed persistence. In the `weblogic-cmp-rdbms-jar.xml` file, each `finder-query` stanza must include a WLQL string that defines the query used to return EJBs. Use WLQL for EJBs and their corresponding deployment files that are based on the EJB 1.1 specification.

Note: For queries to 2.0 EJBs, see "Using EJB QL for EJB 2.0" on page 5-14. Using the weblogic-ql query completely overrides the ejb-ql query.

WLQL Syntax

WLQL strings use the prefix notation for comparison operators, as follows:

```
(operator operand1 operand2)
```

Additional WLQL operators accept a single operand, a text string, or a keyword.

WLQL Operators

The following are valid WLQL operators.

Operator	Description	Sample Syntax
=	Equals	(= operand1 operand2)
<	Less than	(< operand1 operand2)
>	Greater than	(> operand1 operand2)
<=	Less than or equal to	(<= operand1 operand2)
>=	Greater than or equal to	(>= operand1 operand2)
!	Boolean not	(! operand)
&	Boolean and	(& operand)
|	Boolean or	(| operand)
like	Wildcard search based on % symbol in the supplied *text_string* or an input parameter	(like *text_string*%)
isNull	Value of single operand is null	(isNull operand)
isNotNull	Value of single operand is not null	(isNotNull operand)
orderBy	Orders results using specified database columns **Note:** Always specify a database column name in the orderBy clause, rather than a persistent field name. WebLogic Server does not translate field names specified in orderBy.	(orderBy '*column_name*')
desc	Orders results in descending order. Used only in combination with orderBy.	(orderBy '*column_name* desc')

WLQL Operands

Valid WLQL operands include:

- Another WLQL expression
- A container-managed field defined elsewhere in the `weblogic-cmp-rdbms-jar.xml` file

  Note: You cannot use RDBMS column names as operands in WLQL. Instead, use the EJB attribute (field) that maps to the RDBMS column, as defined in the attribute-map in `weblogic-cmp-rdbms-jar.xml`.

- A finder parameter or Java expression identified by `$`*n*, where *n* is the number of the parameter or expression. By default, `$`*n* maps to the *n*th parameter in the signature of the finder method. To write more advanced WLQL expressions that embed Java expressions, map `$`*n* to a Java expression.

  Note: The *$n* notation is based on an array that begins with 0, *not* 1. For example, the first three parameters of a finder correspond to `$0`, `$1`, and `$2`. Expressions need not map to individual parameters. Advanced finders can define more expressions than parameters.

Examples of WLQL Expressions

The following example code shows excerpts from the `weblogic-cmp-rdbms-jar.xml` file that use basic WLQL expressions.

- This example returns all EJBs that have the `balance` attribute greater than the `balanceGreaterThan` parameter specified in the finder. The finder method signature in EJBHome is:

  ```
  public Enumeration findBigAccounts(double balanceGreaterThan)
       throws FinderException, RemoteException;
  ```

  The sample `<finder>` stanza is:

  ```
  <finder>
       <method-name>findBigAccounts</method-name>
       <method-params>
  ```

```
        <method-param>double</method-param>
    </method-params>
    <finder-query><![CDATA[(> balance $0)]]></finder-query>
</finder>
```

Note that you must define the `balance` field n the attribute map of the EJB's persistence deployment file.

Note: Always define the text of the `finder-query` value using the XML `CDATA` attribute. Using `CDATA` ensures that any special characters in the WLQL string do not cause errors when the finder is compiled.

- The following example shows how to use compound WLQL expressions. Also note the use of single quotes (') to distinguish strings:

  ```
  <finder-query><![CDATA[(& (> balance $0) (! (= accountType
  'checking')))]]></finder-query>
  ```

- The following example finds all the EJBs in a table. It uses the sample finder method signature:

  ```
  public Enumeration findAllAccounts()
      throws FinderException, RemoteException
  ```

  The sample `<finder>` stanza uses an empty WLQL string:

  ```
  <finder>
      <method-name>findAllAccounts</method-name>
      <finder-query></finder-query>
  </finder>
  ```

- The following query finds all EJBs whose `lastName` field starts with "M":

  ```
  <finder-query><![CDATA[(like lastName M%)]]></finder-query>
  ```

- This query returns all EJBs that have a null `firstName` field:

  ```
  <finder-query><![CDATA[(isNull firstName)]]></finder-query>
  ```

- This query returns all EJBs whose balance field is greater than 5000, and orders the beans by the database column, id:

  ```
  <finder-query><![CDATA[WHERE >5000 (orderBy 'id' (> balance
  5000))]]></finder-query>
  ```

- This query is similar to the previous example, except that the EJBs are returned in descending order:

```
<finder-query><![CDATA[(orderBy 'id desc' (>
))]]></finder-query>
```

Using SQL for CMP 1.1 Finder Queries

WebLogic Server allows you to use a SQL string instead of the standard WLQL query language to write SQL for a CMP 1.1 finder query. The SQL statement retrieves the values from the database for the CMP 1.1 finder query. Use SQL to write a CMP 1.1 finder query when a more complicated finder query is required and you cannot use WLQL.

For more information on WLQL, see "Using WebLogic Query Language (WLQL) for EJB 1.1 CMP" on page 13-4.

To specify this SQL finder query:

1. In the `weblogic-cmp-rdbms-jar.xml` file write a SQL query using the `finder-sql` element in the `weblogic-cmp-rdbms-jar.xml` file as follows.

   `findBigAccounts(double cutoff)` as follows:

   ```
   <finder-sql><![CDATA{balance >$0]]></finder-sql>
   ```

   Use values like $0, or $1 in the SQL string to reference the parameters to the finder method. The WebLogic Server Container replaces the $ parameters but will not interpret the SQL query.

2. The Container emits the following SQL:

   ```
   SELECT <columns> FROM table WHERE balance > ?
   ```

   The SQL should be the WHERE clause of an SQL statement. The Container prepends the SELECT and FROM clauses. The WHERE clause may contain arbitrary SQL.

If you use characters in your SQL query that may confuse an XML parser, such as the.greater than (>) symbol and the less than (<) symbol, make sure that you declare the SQL query using the CDATA format shown in the preceding sample SQL statement.

You can use any amount of vendor-specific SQL in the SQL query.

Tuned EJB 1.1 CMP Updates in WebLogic Server

EJB container-managed persistence (CMP) automatically support tuned updates because the container receives `get` and `set` callbacks when container-managed EJBs are read or written. Tuning EJB 1.1 CMP beans helps improve their performance.

WebLogic Server now supports tuned updates for EJB 1.1 CMP. When `ejbStore` is called, the EJB container automatically determines which container-managed fields have been modified in the transaction. Only modified fields are written back to the database. If no fields are modified, no database updates occur.

With previously versions of WebLogic Server, you could to write an `isModified` method that notified the container whether the EJB 1.1 CMP bean had been modified. `isModified` is still supported in WebLogic Server, but we recommend that you no longer use `isModified` methods and instead allow the container to determine the update fields.

This feature is enabled for EJB 2.0 CMP, by default. To enable tuned EJB 1.1 CMP updates, make sure that you set the following deployment descriptor element in the `weblogic-cmp-rdbms-jar.xml` file to `true`.

```
<enable-tuned-updates>true</enable-tuned-updates>
```

You can disable tuned CMP updates by setting this deployment descriptor element as follows:

```
<enable-tuned-updates>false</enable-tuned-updates>
```

In this case, `ejbStore` always writes all fields to the database.

Using is-modified-method-name to Limit Calls to ejbStore()

The `is-modified-method-name` deployment descriptor element applies to EJB 1.1 container-managed-persistence (CMP) beans only. This element is found in the `weblogic-ejb-jar.xml` file. WebLogic Server CMP implementation automatically detects modifications of CMP fields and writes only those changes to the underlying datastore. We recommend that you do not use `is-modified-method-name` with bean-managed-persistence (BMP) because you would need to create both the `is-modified-method-name` element. and the `ejbstore` method.

By default, WebLogic Server calls the `ejbStore()` method at the successful completion (commit) of each transaction. `ejbStore()` is called at commit time regardless of whether the EJB's persistent fields were actually updated, and results in a DBMS update. WebLogic Server provides the `is-modified-method-name` element for cases where unnecessary calls to `ejbStore()` may result in poor performance.

To use `is-modified-method-name`, EJB providers must first develop an EJB method that "cues" WebLogic Server when persistent data has been updated. The method must return "false" to indicate that no EJB fields were updated, or "true" to indicate that some fields were modified.

The EJB provider or EJB deployment descriptors then identify the name of this method by using the value of the `is-modified-method-name` element. WebLogic Server calls the specified method name when a transaction commits, and calls `ejbStore()` only if the method returns "true." For more information on this element, see "is-modified-method-name" on page 11-48.

5.1 weblogic-ejb-jar.xml Deployment Descriptor File Structure

The WebLogic Server 5.1 `weblogic-ejb-jar.xml` file defines the EJB document type definitions (DTD)s you use with EJB 1.1 beans. These deployment descriptor elements are WebLogic-specific. The top level elements in the WebLogic Server 5.1 `weblogic-ejb-jar.xml` are as follows:

- `description`
- `weblogic-version`
- `weblogic-enterprise-bean`
  - `ejb-name`
  - `caching-descriptor`
  - `persistence-descriptor`
  - `clustering-descriptor`
  - `transaction-descriptor`
  - `reference-descriptor`
  - `jndi-name`
  - `transaction-isolation`
- `security-role-assignment`

5.1 weblogic-ejb-jar.xml Deployment Descriptor Elements

The following sections describe WebLogic-Server 5.1 `weblogic-ejb-jar.xml` deployment descriptor elements.

caching-descriptor

The `caching-descriptor` stanza affects the number of EJBs in the WebLogic Server cache as well as the length of time before EJBs are passivated or pooled. The entire stanza, as well as each of its elements, is optional. WebLogic Server uses default values where no elements are defined.

The following is a sample `caching-descriptor` stanza that shows the caching elements described in this section:

```
<caching-descriptor>
   <max-beans-in-free-pool>500</max-beans-in-free-pool>
   <initial-beans-in-free-pool>50</initial-beans-in-free-pool>
   <max-beans-in-cache>1000</max-beans-in-cache>
   <idle-timeout-seconds>20</idle-timeout-seconds>
   <cache-strategy>Read-Write</cache-strategy>
   <read-timeout-seconds>0</read-timeout-seconds>
</caching-descriptor>
```

max-beans-in-free-pool

Note: This element is valid only for stateless session EJBs.

WebLogic Server maintains a free pool of EJBs for every bean class. This optional element defines the size of the pool. By default, `max-beans-in-free-pool` has no limit; the maximum number of beans in the free pool is limited only by the available memory. See "Activating and Using Stateful Session EJB Instances" on page 4-5 in "The WebLogic Server EJB Container and Supported Services" on page 4-1 for more information.

initial-beans-in-free-pool

Note: This element is valid only for stateless session EJBs.

If you specify a value for `initial-bean-in-free-pool`, WebLogic Server populates the free pool with the specified number of bean instances at startup. Populating the free pool in this way improves initial response time for the EJB, since initial requests for the bean can be satisfied without generating a new instance.

`initial-bean-in-free-pool` defaults to 0 if the element is not defined.

max-beans-in-cache

Note: This element is valid only for stateful session EJBs and entity EJBs.

This element specifies the maximum number of objects of this class that are allowed in memory. When `max-bean-in-cache` is reached, WebLogic Server passivates some EJBs that have not been recently used by a client. `max-beans-in-cache` also affects when EJBs are removed from the WebLogic Server cache, as described in "Removing Stateful Session EJB Instances" on page 4-6.

The default value of `max-beans-in-cache` is 100.

idle-timeout-seconds

`idle-timeout-seconds` defines the maximum length of time a stateful EJB should remain in the cache. After this time has elapsed, WebLogic Server may remove the bean instance if the number of beans in cache approaches the limit of `max-beans-in-cache`. See "EJB Lifecycle in WebLogic Server" on page 4-2 for more information.

`idle-timeout-seconds` defaults to 600 if you do not define the element.

cache-strategy

The `cache-strategy` element can be one of the following:

- `Read-Write`
- `Read-Only`

The default value is `Read-Write`.

read-timeout-seconds

The `read-timeout-seconds` element specifies the number of seconds between `ejbLoad()` calls on a `Read-Only` entity bean. By default, `read-timeout-seconds` is set to 600 seconds. If you set this value to 0, WebLogic Server calls `ejbLoad` only when the bean is brought into the cache.

persistence-descriptor

The `persistence-descriptor` stanza specifies persistence options for entity EJBs. The following shows all elements contained in the `persistence-descriptor` stanza:

```
<persistence-descriptor>
   <is-modified-method-name>. . .</is-modified-method-name>
   <delay-updates-until-end-of-tx>. .
.</delay-updates-until-end-of-tx>
   <persistence-type>
      <type-identifier>. . .</type-identifier>
      <type-version>. . .</type-version>
      <type-storage>. . .</type-storage>
   </persistence-type>
   <db-is-shared>. . .</db-is-shared>
   <stateful-session-persistent-store-dir>
      . . .
   </stateful-session-persistent-store-dir>
   <persistence-use>. . .</persistence-use>
</persistence-descriptor>
```

is-modified-method-name

`is-modified-method-name` specifies a method that WebLogic Server calls when the EJB is stored. The specified method must return a `boolean` value. If no method is specified, WebLogic Server always assumes that the EJB has been modified and always saves it.

Providing a method and setting it as appropriate can improve performance. However, any errors in the method's return value can cause data inconsistency problems.

delay-updates-until-end-of-tx

Set this property to `true` (the default), to update the persistent store of all beans in a transaction at the completion of the transaction. This generally improves performance by avoiding unnecessary updates. However, it does not preserve the ordering of database updates within a database transaction.

If your datastore uses an isolation level of `TransactionReadCommittedUncommitted`, you may want to allow other database users to view the intermediate results of in-progress transactions. In this case, set `delay-updates-until-end-of-tx` to `false` to update the bean's persistent store at the conclusion of each method invoke. See "ejbLoad() and ejbStore() Behavior for Entity EJBs" on page 6-11 for more information.

Note: Setting `delay-updates-until-end-of-tx` to false does not cause database updates to be "committed" to the database after each method invoke; they are only sent to the database. Updates are committed or rolled back in the database only at the conclusion of the transaction.

persistence-type

A `persistence-type` defines a persistence service that can be used by an EJB. You can define multiple `persistence-type` entries in `weblogic-ejb-jar.xml` for testing with multiple persistence services. Only the persistence type defined in "persistence-use" on page 13-17 is used during deployment.

`persistence-type` includes several elements that define the properties of a service:

- `type-identifier` contains text that identifies the specified persistence type. For example, WebLogic Server RDBMS persistence uses the identifier, `WebLogic_CMP_RDBMS`.

- `type-version` identifies the version of the specified persistence type.

Note: The specified version must *exactly* match the RDBMS persistence version for the WebLogic Server release. Specifying an incorrect version results in the error:

```
weblogic.ejb.persistence.PersistenceSetupException: Error
initializing the CMP Persistence Type for your bean: No installed
Persistence Type matches the signature of (identifier
'Weblogic_CMP_RDBMS', version 'version_number').
```

- `type-storage` defines the full path of the file that stores data for this persistence type. The path must specify the file's location relative to the top level of the EJB's JAR deployment file or deployment directory.

  WebLogic Server RDBMS-based persistence generally uses an XML file named `weblogic-cmp-rdbms-jar.xml` to store persistence data for a bean. This file is stored in the `META-INF` subdirectory of the JAR file.

The following shows an example `persistence-type` stanza with values appropriate for WebLogic Server RDBMS persistence:

```
<persistence-type>

    <type-identifier>WebLogic_CMP_RDBMS</type-identifier>

    <type-version>5.1.0</type-version>

    <type-storage>META-INF\weblogic-cmp-rdbms-jar.xml</type-stora
ge>

</persistence-type>
```

db-is-shared

The `db-is-shared` element applies only to entity beans. When set to `true` (the default value), WebLogic Server assumes that EJB data could be modified between transactions and reloads data at the beginning of each transaction. When set to `false`, WebLogic Server assumes that it has exclusive access to the EJB data in the persistent store. See "Using cache-between-transactions to Limit Calls to ejbLoad()" on page 6-10 for more information.

stateful-session-persistent-store-dir

`stateful-session-persistent-store-dir` specifies the file system directory where WebLogic Server stores the state of passivated stateful session bean instances.

persistence-use

The `persistence-use` property is similar to `persistence-type`, but it defines the persistence service actually used during deployment. `persistence-use` uses the `type-identifier` and `type-version` elements defined in a `persistence-type` to identify the service.

For example, to actually deploy an EJB using the WebLogic Server RDBMS-based persistence service defined in `persistence-type`, the `persistence-use` stanza would resemble:

```
<persistence-use>
   <type-identifier>WebLogic_CMP_RDBMS</type-identifier>
   <type-version>5.1.0</type-version>
</persistence-use>
```

clustering-descriptor

The `clustering-descriptor` stanza defines the replication properties and behavior for EJBs deployed in a WebLogic Server cluster. The `clustering-descriptor` stanza and each of its elements are optional, and are not applicable to single-server systems.

The following shows all elements contained in the `clustering-descriptor` stanza:

```
<clustering-descriptor>
   <home-is-clusterable>. . .</home-is-clusterable>
   <home-load-algorithm>. . .</home-load-algorithm>
   <home-call-router-class-name>. .
.</home-call-router-class-name>
   <stateless-bean-is-clusterable>. .
.</stateless-bean-is-clusterable>
```

```
   <stateless-bean-load-algorithm>. .
.</stateless-bean-load-algorithm>

   <stateless-bean-call-router-class-name>. .
.</stateless-bean-call-router-class-name>

   <stateless-bean-methods-are-idempotent>. .
.</stateless-bean-methods-are-idempotent>

</clustering-descriptor>
```

home-is-clusterable

You can set this element to either `true` or `false`. When `home-is-clusterable` is true, the EJB can be deployed from multiple WebLogic Servers in a cluster. Calls to the home stub are load-balanced between the servers on which this bean is deployed, and if a server hosting the bean is unreachable, the call automatically fails over to another server hosting the bean.

home-load-algorithm

`home-load-algorithm` specifies the algorithm to use for load balancing between replicas of the EJB home. If this property is not defined, WebLogic Server uses the algorithm specified by the server property, `weblogic.cluster.defaultLoadAlgorithm`.

You can define `home-load-algorithm` as one of the following values:

- `round-robin`: Load balancing is performed in a sequential fashion among the servers hosting the bean.
- `random`: Replicas of the EJB home are deployed randomly among the servers hosting the bean.
- `weight-based`: Replicas of the EJB home are deployed on host servers according to the servers' current workload.

home-call-router-class-name

`home-call-router-class-name` specifies the custom class to use for routing bean method calls. This class must implement `weblogic.rmi.extensions.CallRouter()`. If specified, an instance of this class is

called before each method call. The router class has the opportunity to choose a server to route to based on the method parameters. The class returns either a server name or null, which indicates that the current load algorithm should select the server.

stateless-bean-is-clusterable

This property is similar to `home-is-clusterable`, but it is applicable only to stateless session EJBs.

stateless-bean-load-algorithm

This property is similar to `home-load-algorithm`, but it is applicable only to stateless session EJBs.

stateless-bean-call-router-class-name

This property is similar to `home-call-router-class-name`, but it is applicable only to stateless session EJBs.

stateless-bean-methods-are-idempotent

You can set this element to either `true` or `false`. Set `stateless-bean-methods-are-idempotent` to `true` only if the bean is written such 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 completed on the failed server. Setting this property to `true` makes it possible for the bean stub to automatically recover from any failure as long as another server hosting the bean can be reached.

Note: This property is applicable only to stateless session EJBs.

transaction-descriptor

The `transaction-descriptor` stanza contains elements that define transaction behavior in WebLogic Server. Currently, this stanza includes only one element:

```
<transaction-descriptor>
```

```
    <trans-timeout-seconds>20</trans-timeout-seconds>
<transaction-descriptor>
```

trans-timeout-seconds

The `trans-timeout-seconds` element specifies the maximum duration for the EJB's container-initiated transactions. If a transaction lasts longer than `trans-timeout-seconds`, WebLogic Server rolls back the transaction.

If you specify no value for `trans-timeout-seconds`, container-initiated transactions timeout after five minutes, by default.

reference-descriptor

The `reference-descriptor` stanza maps references in the `ejb-jar.xml` file to the JNDI names of actual resource factories and EJBs available in WebLogic Server.

The `reference-descriptor` stanza contains one or more additional stanzas to define resource factory references and EJB references. The following shows the organization of these elements:

```
<reference-descriptor>
   <resource-description>
      <res-ref-name>. . .</res-ref-name>
      <jndi-name>. . .</jndi-name>
   </resource-description>
   <ejb-reference-description>
      <ejb-ref-name>. . .</ejb-ref-name>
      <jndi-name>. . .</jndi-name>
   </ejb-reference-description>
</reference-descriptor>
```

resource-description

The following elements define an individual `resource-description`:

- `res-ref-name` specifies a resource reference name. This is the reference that the EJB provider places within the `ejb-jar.xml` deployment file.
- `jndi-name` specifies the JNDI name of an actual resource factory available in WebLogic Server.

ejb-reference-description

The following elements define an individual `ejb-reference-description`:

- `ejb-ref-name` specifies an EJB reference name. This is the reference that the EJB provider places within the `ejb-jar.xml` deployment file.
- `jndi-name` specifies the JNDI name of an actual EJB available in WebLogic Server.

enable-call-by-reference

By default, EJB methods called from within the same server pass arguments by reference. This increases the performance of method invocation since parameters are not copied.

If you set `enable-call-by-reference` to `false`, parameters to EJB methods are copied (pass by value) in accordance with the EJB 1.1 specification. Pass by value is always necessary when the EJB is called remotely (not from within the server).

jndi-name

The `jndi-name` element specifies a jndi-name for a bean, resource, or reference.

transaction-isolation

The `transaction-isolation` stanza specifies the transaction isolation level for EJB methods. The stanza consists of one or more `isolation-level` elements that apply to a range of EJB methods. For example:

```
<transaction-isolation>
       <isolation-level>Serializable</isolation-level>
       <method>
              <description>...</description>
              <ejb-name>...</ejb-name>
              <method-intf>...</method-intf>
              <method-name>...</method-name>
              <method-params>...</method-params>
       </method>
</transaction-isolation>
```

The following sections describe each element in `transaction-isolation`.

isolation-level

`isolation-level` defines a valid transaction isolation level to apply to specific EJB methods. The following are possible values for `isolation-level`:

- `TransactionReadCommittedUncommitted`: The transaction can view uncommitted updates from other transactions.
- `TransactionReadCommitted`: The transaction can view only committed updates from other transactions.
- `TransactionRepeatableRead`: 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.
- `TransactionSerializable`: Simultaneously executing this transaction multiple times has the same effect as executing the transaction multiple times in a serial fashion.

Refer to your database documentation for more information on the implications and support for different isolation levels.

method

The `method` stanza defines the EJB methods to which an isolation level applies. `method` defines a range of methods using the following elements:

- `description` is an optional element that describes the method.
- `ejb-name` identifies the EJB to which WebLogic Server applies isolation level properties.
- `method-intf` is an optional element that indicates whether the specified method(s) reside in the EJB's home or remote interface. The value of this element must be "Home" or "Remote". If you do not specify `method-intf`, you can apply an isolation to methods in both interfaces.
- `method-name` specifies either the name of an EJB method or an asterisk (*) to designate all EJB methods.
- `method-params` is an optional stanza that lists the Java types of each of the method's parameters. The type of each parameter must be listed in order, using individual `method-param` elements within the `method-params` stanza.

For example, the following method stanza designates all methods in the "AccountBean" EJB:

```
<method>
        <ejb-name>AccountBean</ejb-name>
        <method-name>*</method-name>
</method>
```

The following stanza designates all methods in the remote interface of "AccountBean:"

```
<method>
        <ejb-name>AccountBean</ejb-name>
        <method-intf>Remote</method-intf>
        <method-name>*</method-name>
```

```
</method>
```

security-role-assignment

The `security-role-assignment` stanza maps application roles in the `ejb-jar.xml` file to the names of security principals available in WebLogic Server.-

`security-role-assignment` can contain one or more pairs of the following elements:

- `role-name` is the application role name that the EJB provider placed in the `ejb-jar.xml` deployment file.
- `principal-name` specifies the name of an actual WebLogic Server principal.

1.1 weblogic-cmp-rdbms-jar.xml Deployment Descriptor File Structure

`weblogic-cmp-rdbms-jar.xml` defines deployment elements for a single entity EJB that uses WebLogic Server RDBMS-based persistence services.

The top-level element of the WebLogic Server 1.1 `weblogic-cmp-rdbms-jar.xml` consists of a `weblogic-enterprise-bean` stanza:

```
description

weblogic-version

<weblogic-enterprise-bean>

   <pool-name>finance_pool</pool-name>

   <schema-name>FINANCE_APP</schema-name>

   <table-name>ACCOUNT</table-name>

   <attribute-map>

      <object-link>
```

```
            <bean-field>accountID</bean-field>
            <dbms-column>ACCOUNT_NUMBER</dbms-column>
         </object-link>
         <object-link>
            <bean-field>balance</bean-field>
            <dbms-column>BALANCE</dbms-column>
         </object-link>
      </attribute-map>
      <finder-list>
         <finder>
            <method-name>findBigAccounts</method-name>
            <method-params>
               <<method-param>double</method-param>
            </method-params>
         <finder-query><![CDATA[(> balance $0)]]></finder-query>
         <finder-expression>. . .</finder-expression>
         </finder>
      </finder-list>
   </weblogic-enterprise-bean>
```

1.1 weblogic-cmp-rdbms-jar.xml Deployment Descriptor Elements

RDBMS Definition Elements

This section describes the RDBMS definition elements.

pool-name

`pool-name` specifies name of the WebLogic Server connection pool to use for this EJB's database connectivity. See Using connection pools for more information.

schema-name

`schema-name` specifies the schema where the source table is located in the database. This element is required only if you want to use a schema that is not the default schema for the user defined in the EJB's connection pool.

Note: This field is case sensitive, although many SQL implementations ignore case.

table-name

`table-name` specifies the source table in the database. This element is required in all cases.

Note: The user defined in the EJB's connection pool must have read and write privileges to the specified table, though not necessarily schema modification privileges. This field is case sensitive, although many SQL implementations ignore case.

EJB Field-Mapping Elements

This section describes the EJB field-mapping elements.

attribute-map

The `attribute-map` stanza links a single field in the EJB instance to a particular column in the database table. The `attribute-map` must have exactly one entry for each field of an EJB that uses WebLogic Server RDBMS-based persistence.

object-link

Each `attribute-map` entry consists of an `object-link` stanza, which represents a link between a column in the database and a field in the EJB instance.

bean-field

`bean-field` specifies the field in the EJB instance that should be populated from the database. This element is case sensitive and must precisely match the name of the field in the bean instance.

The field referenced in this tag must also have a `cmp-field` element defined in the `ejb-jar.xml` file for the bean.

dbms-column

`dbms-column` specifies the database column to which the EJB field is mapped. This tag is case sensitive, although many databases ignore the case.

Note: WebLogic Server does not support quoted RDBMS keywords as entries to `dbms-column`. For example, you cannot create an attribute map for column names such as “create” or “select” if those names are reserved in the underlying datastore.

Finder Elements

This section describes the finder elements.

finder-list

The `finder-list` stanza defines the set of all finders that are generated to locate sets of beans.

`finder-list` must contain exactly one entry for each finder method defined in the home interface, except for `findByPrimarykey`. If an entry is not provided for `findByPrimaryKey`, one is generated at compilation time.

Note: If you do provide an entry for `findByPrimaryKey`, WebLogic Server uses that entry without validating it for correctness. In most cases, you should omit an entry for `findByPrimaryKey` and accept the default, generated method.

finder

The `finder` stanza describes a finder method defined in the home interface. The elements contained in the `finder` stanza enable WebLogic Server to identify which method in the home interface is being described, and to perform required database operations.

method-name

`method-name` defines the name of the finder method in the home interface. This tag must contain the exact name of the method.

method-params

The `method-params` stanza defines the list of parameters to the finder method being specified in method-name.

Note: WebLogic Server compares this list against the parameter types for the finder method in the EJB's home interface; the order and type for the parameter list must exactly match the order and type defined in the home interface.

method-param

`method-param` defines the fully-qualified name for the parameter's type. The type name is evaluated into a `java.lang.Class` object, and the resultant object must precisely match the respective parameter in the EJB's finder method.

You can specify primitive parameters using their primitive names (such as "double" or "int"). If you use a non-primitive data type in a `method-param` element, you must specify a fully qualified name. For example, use `java.sql.Timestamp` rather than `Timestamp`. If you do not use a qualified name, `appc` generates an error message when you compile the deployment unit.

finder-query

`finder-query` specifies the WebLogic Query Language (WLQL) string that is used to retrieve values from the database for this finder.

Note: Always define the text of the `finder-query` value using the XML `CDATA` attribute. Using `CDATA` ensures that any special characters in the WLQL string do not cause errors when the finder is compiled.

finder-expression

`finder-expression` specifies a Java language expression to use as a variable in the database query for this finder.

Future versions of the WebLogic Server EJB container will use the EJB QL query language (as required by the EJB 2.0 specification). EJB QL does not provide support for embedded Java expressions. Therefore, to ensure easier upgrades to future EJB containers, create entity EJB finders *without* embedding Java expressions in WLQL.

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