Oracle® Fusion Middleware

Understanding Oracle WebLogic Server 12.1.3

12*c* (12.1.3)

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This document provides an overview of Oracle WebLogic Server 12.1.3 features and describes how you can use them to create enterprise-ready solutions.

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Oracle Fusion Middleware Understanding Oracle WebLogic Server 12.1.3, 12*c* (12.1.3)

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Preface

This preface describes the document accessibility features and conventions used in this guide—*Understanding Oracle WebLogic Server 12.1.3*.

Documentation Accessibility

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Conventions

The following text conventions are used in this document:

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

1 Introduction

This chapter provides an overview of Oracle WebLogic Server 12.1.3 features and describes how you can use them to create enterprise ready-solutions.

This chapter includes the following sections:

1.1 Product Overview

Oracle WebLogic Server is a scalable, enterprise-ready Java Platform, Enterprise Edition (Java EE) application server. The WebLogic Server infrastructure supports the deployment of many types of distributed applications and is an ideal foundation for building applications based on Service Oriented Architectures (SOA). SOA is a design methodology aimed at maximizing the reuse of application services. See "Oracle SOA - Service-Oriented Architecture."

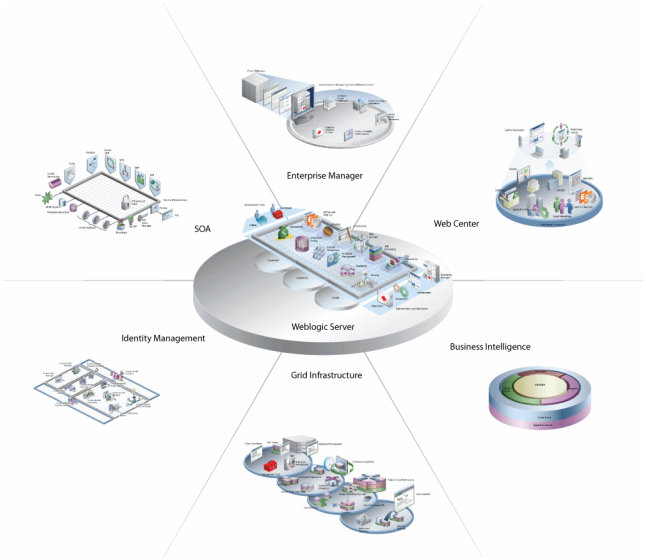
The WebLogic Server complete implementation of the Java EE 6.0 specification provides a standard set of APIs for creating distributed Java applications that can access a wide variety of services, such as databases, messaging services, and connections to external enterprise systems. End-user clients access these applications using Web browser clients or Java clients. It also supports the Spring Framework, a programming model for Java applications which provides an alternative to aspects of the Java EE model. See Section 1.2, "Programming Models."

In addition to the Java EE implementation, WebLogic Server enables enterprises to deploy mission-critical applications in a robust, secure, highly available, and scalable environment. These features allow enterprises to configure clusters of WebLogic Server instances to distribute load, and provide extra capacity in case of hardware or

other failures. New diagnostic tools allow system administrators to monitor and tune the performance of deployed applications and the WebLogic Server environment itself. You can also configure WebLogic Server to monitor and tune application throughput automatically without human intervention. Extensive security features protect access to services, keep enterprise data secure, and prevent malicious attacks.

Figure 1–1 shows how WebLogic Server fits into the overall Oracle Fusion Middleware stack.

Figure 1–1 Oracle Fusion Middleware Overview



1.2 Programming Models

WebLogic Server provides complete support for the Java EE 6.0 specification at http://www.oracle.com/technetwork/java/javaee/tech/index-jsp-142185.html. For more information, see the following WebLogic Server programming guides:

- Web Applications provide the basic Java EE mechanism for deployment of dynamic Web pages based on the Java EE standards of servlets and JavaServer Pages (JSP). Web applications are also used to serve static Web content such as HTML pages and image files.
- Web Services provide a shared set of functions that are available to other systems on a network and can be used as a component of distributed Web-based applications.
- XML capabilities include data exchange, and a means to store content independent of its presentation, and more.
- Java Messaging Service (JMS) enables applications to communicate with one another through the exchange of messages. A message is a request, report, and/or event that contains information needed to coordinate communication between different applications.
- Java Database Connectivity (JDBC) provides pooled access to DBMS resources.
- Resource Adapters provide connectivity to Enterprise Information Systems (EISes).

- Enterprise JavaBeans (EJB) provide Java objects to encapsulate data and business logic.
- Remote Method Invocation (RMI) is the Java standard for distributed object computing, allowing applications to invoke methods on a remote object locally.
- Security APIs allow you to integrate authentication and authorization into your Java EE applications. You can also use the Security Provider APIs to create your own custom security providers.
- WebLogic Tuxedo Connectivity (WTC) provides interoperability between WebLogic Server applications and Tuxedo services. WTC allows WebLogic Server clients to invoke Tuxedo services and Tuxedo clients to invoke EJBs in response to a service request.
- Coherence provides distributed caching and data grid capabilities for WebLogic Server applications.
- Overview of WebLogic Server Application Development describes developer tools and best practices for coding WebLogic Server applications.

In addition, WebLogic Server supports applications developed using the Spring Framework, an open source application framework for the Java platform. *Developing and Administering Spring Applications for Oracle WebLogic Server* provides an overview of Spring and WebLogic Server support for developing and deploying Spring applications. It also gives examples of how to write Spring applications for WebLogic Server. See also SpringSource at http://www.springsource.org/.

1.3 High Availability

The following WebLogic Server features and tools support the deployment of highly-available and scalable applications:

- WebLogic Server clusters provide scalability and reliability for your applications by distributing the work load among multiple instances of WebLogic Server. Incoming requests can be routed to a WebLogic Server instance in the cluster based on the volume of work being processed. In case of hardware or other failures, session state is available to other cluster nodes that can resume the work of the failed node. In addition, you can implement clusters so that services may be hosted on a single machine with options to migrate the service to another node in the event of failure.

  In addition to replicating HTTP session state across servers within a cluster, WebLogic Server can also replicate HTTP session state across multiple clusters, thereby expanding availability and fault tolerance in multiple geographic regions, power grids, and Internet service providers.
- Coherence clusters provide scalability and fault tolerance by distributing data across any number of cluster members ensuring that data is always available and easily accessed by any application hosted in WebLogic Server.

  In addition, Web applications can choose to use a Coherence data grid for storing and replicating HTTP session state to improve scalability, fault tolerance, and performance.
- Work Managers prioritize work based on rules you define and by monitoring actual run time performance statistics. This information is then used to optimize the performance of your application. Work Managers may be applied globally to a WebLogic Server domain or to a specific application or component.

- Overload protection gives WebLogic Server the ability to detect, avoid, and recover from overload conditions.
- Network channels facilitate the effective use of network resources by segregating network traffic into channels based on the type of traffic.
- WebLogic Server persistent store is a built-in, high-performance storage solution for WebLogic Server subsystems and services that require persistence. For example, it can store persistent JMS messages or temporarily store messages sent using the Store-and-Forward feature. The persistent store supports persistence to a file-based store or to a JDBC-enabled database.
- Store-and-forward services enable WebLogic Server to deliver messages reliably between applications that are distributed across WebLogic Server instances. If the message destination is not available at the moment the messages are sent, either because of network problems or system failures, then the messages are saved on a local server instance and are forwarded to the remote destination once it becomes available.
- Enterprise-ready deployment tools facilitate deployment and migration of applications from the development phase to a production environment.
- Production redeployment enables enterprises to deploy a new version of their application without interrupting work in progress on the older version.

1.4 Diagnostic Framework

The WebLogic Diagnostic Framework is a monitoring and diagnostic service that lets you create, collect, analyze, archive, and access diagnostic data generated by a running server and its deployed applications. This data provides insight into the runtime performance of WebLogic Server instances and deployed applications and lets you isolate and diagnose faults and performance bottlenecks when they occur.

1.5 Security

The WebLogic Server security architecture provides a comprehensive, flexible security infrastructure designed to address the security challenges of making applications available on the Web. WebLogic security can be used standalone to secure WebLogic Server applications or as part of an enterprise-wide, security management system that represents a best-in-breed security management solution. See "Overview of the WebLogic Security Service."

1.6 Client Options

In addition to support for browser-based Web application clients, WebLogic Server also supports a variety of client types for creating rich GUI applications or simple command-line utilities. These client types include: RMI-IIOP, T3, Java SE clients, Java EE thin clients, CORBA/IDL clients, and C++ clients that communicate with BEA Tuxedo. See *Developing Stand-alone Clients for Oracle WebLogic Server*.

1.7 Integration with Oracle WebLogic Suite

WebLogic Server provides the core application server runtime within the integrated Oracle WebLogic Suite Java infrastructure. This integrated infrastructure enhances application performance, improves application availability, and enables predictable and reliable application scalability with high quality of service. WebLogic Suite

includes highly productive development tools based on Oracle JDeveloper and Oracle Enterprise pack for Eclipse, and fully integrated management for large-scale administration and operations with Oracle Enterprise Manager. Taken together, the development, runtime and management capabilities of WebLogic Suite provide the foundation for implementing mission-critical enterprise applications.

WebLogic Suite contains the following server-side components:

- Oracle WebLogic Server
- Oracle Coherence

  Oracle Coherence enables organizations to predictably scale mission-critical applications by providing fast and reliable access to frequently used data. By automatically and dynamically partitioning data in memory across multiple servers, Oracle Coherence enables continuous data availability and transactional integrity, even in the event of a server failure.

  WebLogic Server includes a Coherence container that simplifies the management and deployment of Coherence clusters and Coherence-based applications.
- Oracle TopLink

  Oracle TopLink builds high-performance applications that store persistent object-oriented data in a relational database. It successfully transforms object-oriented data into either relational data or Extensible Markup Language (XML) elements.

  Oracle TopLink is an advanced, object-persistence and object-transformation framework that provides development tools and run time capabilities that reduce development and maintenance efforts, and increase enterprise application functionality.

  Oracle TopLink includes support for EJB 3.0 in Java EE and Java SE environments, as well as support for EJB 2.n container-managed persistence (CMP). You can integrate Oracle TopLink with a variety of application servers, including Oracle WebLogic Server, OC4J, SunAS, JBoss, and IBM WebSphere.

1.8 Integration with Other Systems

WebLogic Server provides a variety of tools to integrate your applications with disparate systems. These tools include Web Services, Resource Adapters, the JMS .NET client, the JMS C client, tooling for integrating JMS providers options, Advanced Queuing, and RMI.

1.9 Integration with Web Servers

Plug-ins are provided with your WebLogic Server installation that allow WebLogic Server to operate with Web servers from Apache and Microsoft. Typically, these Web servers serve static HTML content while requests for dynamic Web content such as JSPs are directed to the WebLogic Server environment.

1.10 WebLogic Server API Examples and Sample Application

Code examples demonstrating Java EE APIs and other WebLogic Server features are provided with your WebLogic Server installation. To work with these examples, select the custom installation option when installing WebLogic Server, and select to install the Server Examples. To access the code examples, launch the `startWebLogicEx.cmd` or `startWebLogicEx.sh` script from *`ORACLE_HOME`*`/user_projects/domains/wl_server`,

where *ORACLE_HOME* is the directory you specified as the Oracle Home when you installed Oracle WebLogic. As they become available, you can also download additional examples.

Along with the code examples, two versions of a complete sample application, called Avitek Medical Records (or MedRec), are installed when you install the examples, as described above.

The original MedRec (which was included in previous versions of WebLogic Server) is a WebLogic Server sample application suite that concisely demonstrates all aspects of the Java EE platform. MedRec is designed as an educational tool for all levels of Java EE developers. It showcases the use of each Java EE component and illustrates best practice design patterns for component interaction and client development. MedRec also illustrates best practices for developing applications on WebLogic Server.

The Spring version of MedRec, called MedRec-Spring is MedRec recast using the Spring Framework. If you are developing Spring applications on WebLogic Server, you should review the MedRec-Spring sample application. In order to illustrate how Spring can take advantage of the enterprise features of WebLogic Server, MedRec was rearchitected to replace core Java EE components with their Spring counterparts. The functionality in the original version of MedRec is reimplemented using Spring in MedRec-Spring. Refer to the MedRec-Spring sample for details.

To launch MedRec, run `startWebLogic.cmd` or `startWebLogic.sh` script from *ORACLE_HOME*`/user_projects/domains/medrec`, where *ORACLE_HOME* is the directory you specified as the Oracle Home when you installed Oracle WebLogic Server.

To launch MedRec-Spring, run the `startWebLogic.cmd` or `startWebLogic.sh` script from *ORACLE_HOME*`/user_projects/domains/medrec-spring`, where *ORACLE_HOME* is the directory you specified as the Oracle Home when you installed Oracle WebLogic Server.

1.11 Upgrade

Tools and documentation are provided to help you migrate applications implemented on earlier versions of WebLogic Server to the current WebLogic Server environment. See the *Upgrading Oracle WebLogic Server*.

2 System Administration

This chapter provides an overview of system administration for the WebLogic Server 12.1.3 component of your development and production environments.

This chapter includes the following sections:

2.1 Overview of WebLogic Server System Administration

System administration of WebLogic Server includes a wide range of tasks: creating WebLogic Server domains, deploying applications, migrating domains from development environments to production environments, monitoring and managing the performance of the runtime system, configuring and managing security for applications and system resources, and diagnosing and troubleshooting problems.

WebLogic Server provides several tools for system administrators to help with these tasks, including the browser-based WebLogic Server Administration Console, the WebLogic Scripting Tool (WLST), a scripting language for automation of WebLogic system administration tasks based on Jython, SNMP, the Configuration Wizard, and command-line utilities.

Because the WebLogic Server management system is based on Java EE and other standards, it integrates with systems that are frequently used to manage other software and hardware components. In addition, WebLogic Server implements the Java EE Java Management Extension (JMX) specification, which allows programmatic access to the WebLogic Server management system. Using this API, you can create custom administration utilities or automate frequent tasks using Java classes.

The following sections provide an overview of system administration for the WebLogic Server component of your development or production environments:

- Section 2.2, "Choosing the Appropriate Technology for Your Administrative Tasks"
- Section 2.3, "Summary of System Administration Tools and APIs"

For information about installing WebLogic Server, see the *Installing and Configuring Oracle WebLogic Server and Coherence*.

For information about using Fusion Middleware administration tools, such as the Oracle Enterprise Manager Fusion Middleware Control, Oracle Fusion Middleware command-line tools, and the Fusion Middleware Control MBean Browser, see

"Overview of Oracle Fusion Middleware Administration Tools" in *Administering Oracle Fusion Middleware*.

2.2 Choosing the Appropriate Technology for Your Administrative Tasks

Table 2–1 describes common system administration tasks and associated technologies.

Table 2–1 Choosing the Appropriate Management Technology

To do this...	Use this technology...
Create domains	The Configuration Wizard guides you through the process of creating or extending a domain for your target environment. See Creating WebLogic Domains Using the Configuration Wizard. To automate the creation of domains, use the WebLogic Scripting Tool, which is a command-line scripting interface based on Jython. See "Creating Domains Using WLST Offline" in *Understanding the WebLogic Scripting Tool*. Or create domain configuration XML files that conform to the WebLogic Server schema. See "Domain Configuration Files" in *Understanding Domain Configuration for Oracle WebLogic Server*.
Migrate domains from development environments to production environments	Domain Template Builder's `pack` command archives a snapshot of a domain into a JAR file. The `unpack` command expands the archive and creates the necessary start scripts and certain security and configuration files. See *Creating Templates and Domains Using the Pack and Unpack Commands*.
Track changes in a domain's configuration	In environments that you allow configuration changes to active domains, WebLogic Server automatically maintains a versioned archive of configuration files. See "Configuration File Archiving" in *Understanding Domain Configuration for Oracle WebLogic Server*. To receive real-time notifications that a domain's configuration has been modified, enable the configuration auditing feature. See "Configuring the WebLogic Auditing Provider" in *Administering Security for Oracle WebLogic Server*. For tightly controlled production environments, configure the run-time domain to be read-only (see "Restricting Configuration Changes" in *Understanding Domain Configuration for Oracle WebLogic Server*). You can change the read-only setting if you need to roll in changes that have been tested and approved in a staging environment, or you can modify and test your staging environment, and then use a Web server to re-route requests from your production environment to the staging environment.
Configure connections to databases or other systems	Within individual applications, you can define your own data sources or database connections using JDBC, or connect to external systems using resource adapters. When you deploy such an application, WebLogic Server creates the data sources and connections for you. See: ■ "Configuring WebLogic JDBC Resources" in *Administering JDBC Data Sources for Oracle WebLogic Server* ■ "Understanding Resource Adapters" in *Developing Resource Adapters for Oracle WebLogic Server* If you have not defined your own data sources or connections within an application, you can use the WebLogic Server Administration Console or the WebLogic Scripting Tool to create the resources. See *Oracle WebLogic Server Administration Console Online Help* or "Using the WebLogic Scripting Tool" in *Understanding the WebLogic Scripting Tool*.

Table 2–1 (Cont.) Choosing the Appropriate Management Technology

To do this...	Use this technology...
Manage the server life cycle	The Node Manager is a utility for remote control of Administration Servers and Managed Servers. It runs separately from WebLogic Server and lets you start up and shut down Administration Servers and Managed Servers. While use of Node Manager is optional, it provides additional life cycle benefits if your WebLogic Server environment hosts applications with high availability requirements. See "Using Node Manager to Control Servers" in the *Administering Node Manager for Oracle WebLogic Server*. To start Administration Servers or Managed Servers without using Node Manager, use the WebLogic Scripting Tool or scripts that WebLogic Server installs. See "Starting and Stopping Servers" in *Administering Server Startup and Shutdown for Oracle WebLogic Server*.
Configure Coherence Clusters	The WebLogic Server Administration Console provides a graphical user interface for configuring and managing Coherence clusters; configuring and managing cluster members; and deploying Coherence applications. See the *Administration Console Help*. If you prefer a command-line interface, use the WebLogic Scripting Tool. See "Using the WebLogic Scripting Tool" in *Understanding the WebLogic Scripting Tool*.
Modify or add services to an active domain	The WebLogic Server Administration Console provides a graphical user interface for modifying or adding services to an active domain. See the *Administration Console Help*. You can also modify or add services to an active domain using Fusion Middleware Control. See the *Oracle Fusion Middleware Control Help for WebLogic Server*. If you prefer a command-line interface, use the WebLogic Scripting Tool in interactive mode. See "Using the WebLogic Scripting Tool" in *Understanding the WebLogic Scripting Tool*.
Monitor application server services and resources	Monitor the performance of services such as the EJB container, servlet container, and JDBC data sources from the WebLogic Server Administration Console or through Fusion Middleware Control. Configure watch rules and notifications in the WebLogic Diagnostics Framework to automatically notify administrators of monitoring data events or integrate automated systems through JMX or JMS. See "Configuring Watches and Notifications" in *Configuring and Using the Diagnostics Framework for Oracle WebLogic Server*. If you use SNMP in your operations center, you can enable WebLogic Server to send SNMP notifications for run-time events that you define. See *Monitoring Oracle WebLogic Server with SNMP*.
Deploy applications	The WebLogic Server Administration Console provides a series of Web-based deployment assistants that guide you through the deployment process. See *Administration Console Help*. You can also deploy applications through Fusion Middleware Control. See *Oracle Fusion Middleware Control Help for WebLogic Server*. To automate the deployment of applications, use the WebLogic Scripting Tool. See "Deployment Commands" in *WLST Command Reference for WebLogic Server*. You can also use the deployment API to write Java programs that deploy applications. See *Deploying Applications with the WebLogic Deployment API*. For information about additional deployment utilities and APIs, see "Deployment Tools" in *Deploying Applications to Oracle WebLogic Server*.

Table 2–1 (Cont.) Choosing the Appropriate Management Technology

To do this...	Use this technology...
Modify applications in an active domain	To modify the configuration of a deployed application, use a text editor or IDE to modify the deployment descriptor. Then either redeploy the application or use the deployment API to upload the modified deployment descriptor and cause the application container to re-read the deployment descriptor. See *Deploying Applications to Oracle WebLogic Server*.
Monitor activity within applications	Determine which data points you want to monitor and then instrument one or more beans to expose this data through JMX. See *Developing Manageable Applications Using JMX for Oracle WebLogic Server*. Alternatively, use the WebLogic Server Diagnostics Service to insert instrumentation code into a running application and monitor its methods or monitor transactions that involve the application. Use this technology to discover the cause of problems that cannot otherwise be discovered by scanning the available monitoring metrics. If you determine that the problem is within your application, you can prevent the problem from recurring by using JMX to expose attributes that indicate the application's health state is degrading. See *Configuring and Using the Diagnostics Framework for Oracle WebLogic Server*.
Optimize the performance of your application and maintain service level agreements.	Work Managers configure how your application prioritizes the execution of its work. Based on rules you define and by monitoring actual run-time performance, WebLogic Server can optimize the performance of your application and maintain service level agreements. See "Using Work Managers to Optimize Scheduled Work" in *Administering Server Environments for Oracle WebLogic Server*.
Configure and secure administration communications	You can separate administration traffic from application traffic in your domain by enabling the administration port. In production environments, separating the two forms of traffic ensures that critical administration operations (starting and stopping servers, changing a server's configuration, and deploying applications) do not compete with high-volume application traffic on the same network connection. The administration port only accepts communications that use SSL, and therefore secures your administrative requests. See "Administration Port and Administrative Channel" in *Administering Server Environments for Oracle WebLogic Server*.
Configure logging and view log files	Many WebLogic Server operations generate logs of their activity. Each server has its own log as well as a standard HTTP access log. These log files can be configured and used in a variety of ways to monitor the health and activity of your servers and applications. By default, WebLogic Server uses the standard JDK logging APIs to filter and write the messages to log files. See "Understanding WebLogic Logging Services" in *Configuring Log Files and Filtering Log Messages for Oracle WebLogic Server*. Alternatively, you can configure WebLogic Server to use the Jakarta Project Log4j APIs to distribute log messages. See Log4j and the Commons Logging API in *Configuring Log Files and Filtering Log Messages for Oracle WebLogic Server*.

2.3 Summary of System Administration Tools and APIs

WebLogic Server includes several of its own standards-based, extensible utilities that you can use to create, manage, and monitor domains, or you can use WebLogic Server's management APIs to create custom management utilities.

Table 2–2 describes the utilities that are included with WebLogic Server.

Table 2–2 Management Utilities

Utility	Description
WebLogic Server Administration Console	The WebLogic Server Administration Console is a Web application hosted by the Administration Server. Use it to manage and monitor an active domain. The management capabilities include: ■ Configuring active domains ■ Stopping and starting servers ■ Monitoring server health and performance ■ Monitoring application performance ■ Viewing server logs ■ Control (start, stop, and restart) managed Coherence servers ■ Create and configure Coherence clusters Through the WebLogic Server Administration Console, system administrators can easily perform all WebLogic Server management tasks without having to learn the JMX API or the underlying management architecture. The Administration Server persists changes to attributes in the `config.xml` file for the domain you are managing. See: ■ "Overview of Administration Consoles" ■ WebLogic Server Administration Console Online Help (The online help is also available from the WebLogic Server Administration Console by clicking on the **Help** link located in the tool bar at the top of the Console.)
Fusion Middleware Control	WebLogic Server can also be managed through Fusion Middleware Control. Fusion Middleware Control provides management support for all Fusion Middleware components, including WebLogic Server. Use Fusion Middleware Control to manage WebLogic Server when using other Fusion Middleware products in addition to WebLogic Server. WebLogic Server support includes the following subsets of functionality: ■ Manage WebLogic Server clusters, server instances, and domains ■ Deploy and redeploy applications and manage application deployments ■ Create and configure JDBC data sources ■ Manage WebLogic Server messaging (JMS) ■ Create and configure users and groups ■ Create and configure server templates See: ■ *Administering Oracle WebLogic Server with Fusion Middleware Control* ■ *Fusion Middleware Control Help for WebLogic Server*
Enterprise Manager Cloud Control	Some components of WebLogic Server can also be managed through the Cloud Control component of Enterprise Manager. See *Oracle Cloud Control Help for WebLogic Server*.

Table 2–2 (Cont.) Management Utilities

Utility	Description
WebLogic Scripting Tool	The WebLogic Scripting Tool (WLST) is a command-line scripting interface that you use to manage and monitor active or inactive WebLogic Server domains. The WLST scripting environment is based on the Java scripting interpreter Jython. In addition to WebLogic scripting functions, you can use common features of interpreted languages, including local variables, conditional variables, and flow control statements. You can extend the WebLogic scripting language by following the Jython language syntax. See `http://www.jython.org`. See *Understanding the WebLogic Scripting Tool*.
Configuration Wizard	The Configuration Wizard creates the appropriate directory structure for a WebLogic Server domain, a `config.xml` file, and scripts you can use to start the servers in your domain. The wizard uses templates to create domains, and you can customize these templates to duplicate your own domains. You can also use the Configuration Wizard to add or remove services from an existing, inactive domain. You can run the Configuration Wizard through a graphical user interface (GUI) or in a text-based command-line environment. This command-line environment is called *console mode*—do not confuse this mode with the WebLogic Server Administration Console. You can also create user-defined domain configuration templates for use by the Configuration Wizard. See *Creating WebLogic Domains Using the Configuration Wizard*.
Configuration Template Builder	The Configuration Template Builder provides the capability to easily create your own domain templates, to enable, for example, the definition and propagation of a standard domain across a development project, or to enable the distribution of a domain along with an application that has been developed to run on that domain. The templates you create with the Configuration Template Builder are used as input to the Configuration Wizard as the basis for creating a domain that is customized for your target environment. See *Creating Domain Templates Using the Domain Template Builder*.
Apache Ant tasks	You can use two Ant tasks provided with WebLogic Server to help you perform common configuration tasks in a development environment. Ant is a Java-based build tool similar to Make. The configuration tasks let you start and stop WebLogic Server instances as well as create and configure WebLogic Server domains. When combined with other WebLogic Ant tasks, you can create powerful build scripts for demonstrating or testing your application with custom domains. See "Using Ant Tasks to Configure a WebLogic Server Domain" in *Developing Applications for Oracle WebLogic Server*.
SNMP Agents	WebLogic Server includes the ability to communicate with enterprise-wide management systems using Simple Network Management Protocol (SNMP). WebLogic Server SNMP agents let you integrate management of WebLogic Servers into an SNMP-compliant management system that gives you a single view of the various software and hardware resources of a complex, distributed system. See *Monitoring Oracle WebLogic Server with SNMP*.

Table 2–3 describes APIs that you can use to create your own management utilities.

Table 2–3 Management APIs

API	Description
JMX	Java Management Extensions (JMX) is the Java EE solution for monitoring and managing resources on a network. Like SNMP and other management standards, JMX is a public specification and many vendors of commonly used monitoring products support it. The WebLogic Server Administration Console, WebLogic Scripting Tool, and other WebLogic Server utilities use the JMX APIs. See *Developing Custom Management Utilities Using JMX for Oracle WebLogic Server*.
Java EE Management API	The Java EE Management APIs (JSR-77) enable a software developer to create a single Java program that can discover and browse resources, such as JDBC connection pools and deployed applications, on any Java EE Web application server. The APIs are part of the Java EE Management Specification, which requires all Java EE Web application servers to describe their resources in a standard data model. See *Developing Java EE Management Applications for Oracle WebLogic Server*.
Deployment API	The WebLogic Server deployment API implements and extends the JSR-88 deployment specification. All WebLogic Server deployment tools, such as the WebLogic Server Administration Console and wldeploy Ant task, use the deployment API to configure, deploy, and redeploy applications in a domain. You can use the deployment API to build your own WebLogic Server deployment tools, or to integrate WebLogic Server configuration and deployment operations with an existing JSR-88-compliant tool. See *Deploying Applications with the WebLogic Deployment API*.
WebLogic Diagnostic Service APIs	The WebLogic Diagnostic Service includes a set of standardized APIs that enable dynamic access and control of diagnostic data, as well as improved monitoring that provides visibility into the server. The interfaces are standardized to facilitate future enhancement and integration of third-party tools, while maintaining the integrity of the server code base. The service is well suited to the server and the server's stack product components and targets operations and administrative staff as primary users. See *Configuring and Using the Diagnostics Framework for Oracle WebLogic Server*.
Logging APIs	By default, WebLogic Server uses the standard JDK logging APIs to filter and write the messages to log files. See Understanding WebLogic Logging Services in *Configuring Log Files and Filtering Log Messages for Oracle WebLogic Server*. Alternatively, you can configure WebLogic Server to use the Jakarta Project Log4j APIs to distribute log messages. For more information, see Log4j and the Commons Logging API in *Configuring Log Files and Filtering Log Messages for Oracle WebLogic Server*.

2.4 Roadmap for Administering the WebLogic Server System

Table 2–4 Roadmap for Administering the WebLogic Server System

Major Task	Subtasks and Additional Information
Understanding WebLogic Server system administration	■ Overview of WebLogic Server domains ■ Overview of WebLogic Server clusters ■ Overview of WebLogic security ■ "Overview of Administration Consoles" ■ *Developing Custom Management Utilities Using JMX for Oracle WebLogic Server* ■ *Tuning Performance of Oracle WebLogic Server*
Installing or upgrading WebLogic Server	■ *Installing and Configuring Oracle WebLogic Server and Coherence* ■ *Creating WebLogic Domains Using the Configuration Wizard* ■ Oracle Fusion Middleware Supported System Configurations ■ *What's New in Oracle WebLogic Server* ■ Release Notes for Oracle WebLogic Server ■ "WebLogic Server Compatibility" ■ *Upgrading Oracle WebLogic Server*
Configuring a server environment	■ "Summary of System Administration Tools and APIs" ■ Managing configuration changes ■ *Oracle WebLogic Server Administration Console Online Help* ■ *Understanding the WebLogic Scripting Tool* ■ *Creating Domain Templates Using the Domain Template Builder*
Learning about server startup and shutdown	■ Overview of starting and stopping servers ■ Understanding the life cycle of WebLogic Server instances ■ Server startup command-line reference ■ Quick Reference for starting and stopping servers
Starting or stopping a WebLogic Server instance	■ Using shell scripts ■ Using the Administration Console ■ Using the WebLogic Scripting Tool (WLST) ■ Using Node Manager to control remote servers ■ Using the Quick Reference
Configuring Coherence clusters	■ Configuring and Managing Coherence Clusters ■ Developing Coherence Applications ■ Securing Coherence in WebLogic Server
Configuring security	■ Overview of WebLogic Server security ■ *Administering Security for Oracle WebLogic Server* ■ *Securing a Production Environment for Oracle WebLogic Server* ■ *Securing Resources Using Roles and Policies for Oracle WebLogic Server*

Table 2–4 (Cont.) Roadmap for Administering the WebLogic Server System

Major Task	Subtasks and Additional Information
Managing server and network communications	■ Configuring network resources ■ Configuring Web Server functionality ■ *Using Oracle WebLogic Server Proxy Plug-Ins 12.1.3*
Configuring system resources	■ *Administering JDBC Data Sources for Oracle WebLogic Server* ■ *Administering JMS Resources for Oracle WebLogic Server* ■ Configuring WebLogic transactions ■ Configuring the WebLogic Tuxedo Connector ■ Configuring the persistent store
Configuring and deploying applications	■ *Deploying Applications to Oracle WebLogic Server* ■ Configuring Web applications ■ Configuring XML resources ■ Configuring resource adapters ■ *Understanding WebLogic Web Services for Oracle WebLogic Server*
Monitoring your domain	■ *Configuring and Using the Diagnostics Framework for Oracle WebLogic Server* ■ *Monitoring Oracle WebLogic Server with SNMP* ■ *Configuring Log Files and Filtering Log Messages for Oracle WebLogic Server* ■ *Developing Java EE Management Applications for Oracle WebLogic Server* ■ Using the Monitoring Dashboard
Configuring server environments for high availability	■ Understanding cluster architectures ■ Setting up WebLogic Server clusters ■ Using session replication across clusters ■ Using Work Managers to prioritize application execution ■ Avoiding and managing overload
Understanding the WebLogic persistent store	■ Using the WebLogic persistent store ■ Configuring custom persistent stores ■ Tuning the WebLogic persistent store
Troubleshooting	■ Viewing the WebLogic Server Error Message Catalog ■ *Tuning Performance of Oracle WebLogic Server* ■ Troubleshooting common problems with clustering ■ *Administering Node Manager for Oracle WebLogic Server*
Reference	■ *Administration Console Accessibility Notes for Oracle WebLogic Server* ■ *Command Reference for Oracle WebLogic Server* ■ *SNMP MIB for Oracle WebLogic Server* ■ *WLST Command Reference for WebLogic Server* ■ *MBean Reference for Oracle WebLogic Server*

3 Overview of Administration Consoles

This chapter introduces and describes the Administration Console and Fusion Middleware Control for WebLogic Server 12.1.3.

This chapter includes the following sections:

- Section 3.1, "Using the WebLogic Server Administration Console"
- Section 3.2, "Using Fusion Middleware Control"

3.1 Using the WebLogic Server Administration Console

The section introduces the WebLogic Server Administration Console.

It includes the following sections:

- Section 3.1.1, "About the WebLogic Server Administration Console"
- Section 3.1.2, "Starting the WebLogic Server Administration Console"
- Section 3.1.3, "Elements of the WebLogic Server Administration Console"
- Section 3.1.4, "Using the Change Center"

3.1.1 About the WebLogic Server Administration Console

The WebLogic Server Administration Console is a Web browser-based, graphical user interface that you use to manage a WebLogic Server domain. A WebLogic Server domain is a logically related group of WebLogic Server resources that you manage as a unit. A domain includes one or more WebLogic Servers and may also include WebLogic Server clusters. Clusters are groups of WebLogic Servers instances that work together to provide scalability and high-availability for applications. You deploy and manage your applications as part of a domain.

One instance of WebLogic Server in each domain is configured as an Administration Server. The Administration Server provides a central point for managing a WebLogic Server domain. All other WebLogic Server instances in a domain are called Managed Servers. In a domain with only a single WebLogic Server instance, that server functions both as Administration Server and Managed Server. The Administration Server hosts the WebLogic Server Administration Console, which is a Web application accessible from any supported Web browser with network access to the Administration Server. Managed Servers host applications.

Use the WebLogic Server Administration Console to:

- Configure, start, and stop WebLogic Server instances
- Configure WebLogic Server clusters

- Configure WebLogic Server services, such as database connectivity (JDBC) and messaging (JMS)
- Configure security parameters, including managing users, groups, and roles
- Configure and deploy your applications
- Monitor server and application performance
- View server and domain log files
- View application deployment descriptors
- Edit selected run-time application deployment descriptor elements
- Control (start, stop, and restart) managed Coherence servers
- Create and configure Coherence clusters

3.1.1.1 WebLogic Server Administration Console Online Help

The WebLogic Server Administration Console includes a complete help system. It has two parts:

- How do I...?, which documents procedures for tasks you can perform through using the WebLogic Server Administration Console.
- WebLogic Server Administration Console Reference, which provides reference information for each page in the WebLogic Server Administration Console, including descriptions of the attributes you can set using the WebLogic Server Administration Console.

You can access the WebLogic Server Administration Console online help either through the WebLogic Server Administration Console itself, or in *Oracle WebLogic Server Administration Console Online Help*.

3.1.1.2 Console Errors

Messages (including information, warning, and error messages) can be generated and logged in the course of using the WebLogic Server Administration Console. You can view WebLogic Server logs from the **Diagnostics** > **Log Files** page of the WebLogic Server Administration Console.

3.1.2 Starting the WebLogic Server Administration Console

This section contains instructions for starting the WebLogic Server Administration Console.

To use the WebLogic Server Administration Console, use one of the supported Web browsers for your environment. See "Supported Configurations" in *What's New in Oracle WebLogic Server*. If your Web browser is not a supported browser, you may experience functional or formatting problems when using the WebLogic Server Administration Console.

To start the WebLogic Server Administration Console:

1. Start an Administration Server.
2. Open one of the supported Web browsers to the following URL:

   `http://hostname:`*`port`*`/console`

   where *`hostname`* is the DNS name or IP address of the Administration Server and *`port`* is the listen port on which the Administration Server is listening for requests

(port 7001 by default). If you have configured a domain-wide administration port, use that port number. If you configured the Administration Server to use Secure Socket Layer (SSL) you must add *s* after `http` as follows:

`https://`*`hostname`*`:`*`port`*`/console`

> **Note:** A domain-wide administration port always uses SSL.

3. When the login page appears, enter the user name and the password you used to start the Administration Server (you may have specified this user name and password during the installation process) or enter a user name that belongs to one of the following security groups: Administrators, Operators, Deployers, or Monitors. These groups provide various levels of access to system administration functions in the WebLogic Server Administration Console.

   Using the security system, you can add or delete users to one of these groups to provide controlled access to the Console.

> **Note:** If you have your browser configured to send HTTP requests to a proxy server, then you may need to configure your browser to not send Administration Server HTTP requests to the proxy. If the Administration Server is on the same machine as the browser, then ensure that requests sent to localhost or 127.0.0.1 are not sent to the proxy.

3.1.2.1 Enabling the WebLogic Server Administration Console

By default, the WebLogic Server Administration Console is enabled. If you disable it, you can re-enable it using the WebLogic Scripting Tool (WLST). Start the Administration Server, then invoke WLST and use the following commands:

Example 3–1 Using WLST to Re-enable the Console

```
connect("username","password")
edit()
startEdit()
cmo.setConsoleEnabled(true)
save()
activate()
The following attribute(s) have been changed on MBeans which require server re-start.
MBean Changed : com.bea:Name=mydomain,Type=Domain Attributes changed :
ConsoleEnabled
Activation completed
disconnect()
exit()
```

For information about using WLST, see *Understanding the WebLogic Scripting Tool*.

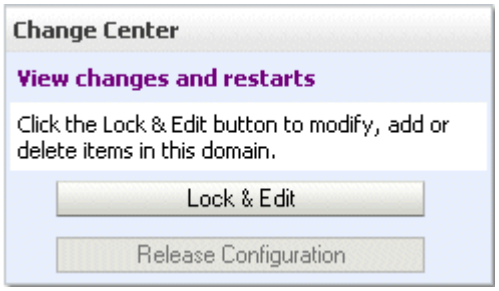
3.1.3 Elements of the WebLogic Server Administration Console

The WebLogic Server Administration Console user interface includes the following panels:

3.1.3.1 Change Center

This is the starting point for using the WebLogic Server Administration Console to make changes in WebLogic Server. See Section 3.1.4, "Using the Change Center."

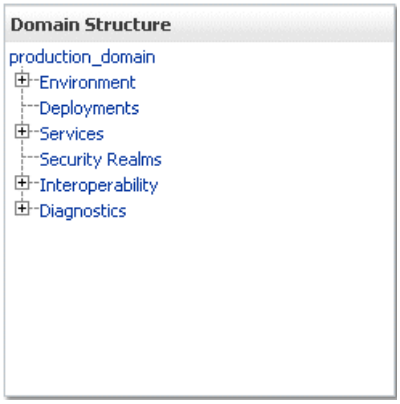
Figure 3–1 Change Center



3.1.3.2 Domain Structure

This panel contains a tree structure you can use to navigate to pages in the WebLogic Server Administration Console. Select any of the nodes in the Domain Structure tree to view that page. Click a + (plus) icon in the Domain Structure to expand a node and a - (minus) icon to collapse the node.

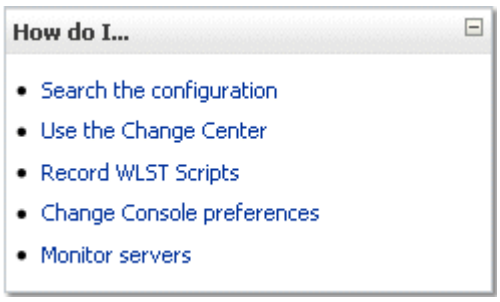
Figure 3–2 Domain Structure



3.1.3.3 How do I...

This panel includes links to online help tasks that are relevant to the current Console page.

Figure 3–3 How do I...

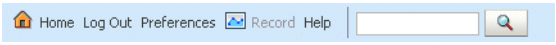


3.1.3.4 Tool Bar

The tool bar at the top of the Console includes the following elements:

Tool Bar Element	Description
Welcome message	Indicates user name with which you have logged into the Console.
Connected to:	The IP address and port you used to connect to the Console.
Home	A link to the top page of the Console.
Log Out	Click to log out of the Console.
Preferences	A link to a page where you can change some Console behavior.
Record	Starts recording your configuration actions as a series of WebLogic Scripting Tool (WLST) commands. Writes the commands to a separate file that you can replay in WLST. See "Record WLST Scripts" in *Oracle WebLogic Server Administration Console Online Help*.
Help	A link to the WebLogic Server Administration Console Online Help.
Search	A text field in which you can enter a string to find any WebLogic Server Configuration MBeans that contain the string you specified in their name.

Figure 3–4 Tool Bar



3.1.3.5 Breadcrumb Navigation

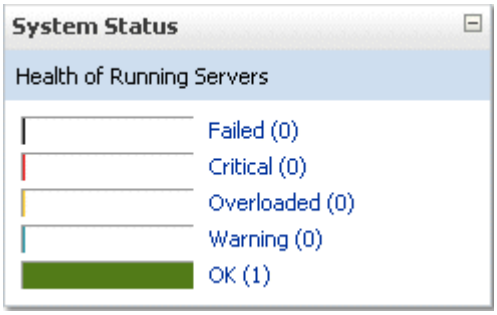
A series of links that show the path you have taken through the WebLogic Server Administration Console's pages. You can click on any of the links to return to a previously-visited page.

Figure 3–5 Breadcrumb Navigation

3.1.3.6 System Status

The System Status panel reports on the number of information, error, and warning messages that have been logged. You can view these messages in the server log files, which you can access from the WebLogic Server Administration Console at **Diagnostics** > **Log Files**.

Figure 3–6 System Status



3.1.4 Using the Change Center

The starting point for using the WebLogic Server Administration Console to make changes in your WebLogic Server domain is the Change Center. The Change Center provides a way to lock a domain configuration so you can make changes to the configuration while preventing other accounts from making changes during your edit session. See Section 3.1.4.3, "How Change Management Works."

The domain configuration locking feature is always enabled in production domains. It can be enabled or disabled in development domains. It is disabled by default when you create a new development domain. See "Enable and disable the domain configuration lock" in *Oracle WebLogic Server Administration Console Online Help*.

To change a production domain's configuration, you must:

1. Locate the Change Center in the upper left of the WebLogic Server Administration Console screen.
2. Click the **Lock & Edit** button to lock the configuration edit hierarchy for the domain.
3. Make the changes you desire on the relevant page of the Console. Click **Save** on each page where you make a change.
4. When you have finished making all the desired changes, click **Activate Changes** in the Change Center.

As you make configuration changes using the WebLogic Server Administration Console, you click Save (or in some cases Finish) on the appropriate pages. This does not cause the changes to take effect immediately. The changes take effect when you click Activate Changes in the Change Center. At that point, the configuration changes are distributed to each of the servers in the domain. If the changes are acceptable to each of the servers, then they take effect. If any server cannot accept a change, then all of the changes are rolled back from all of the servers in the domain. The changes are left in a pending state; you can then either edit the pending changes to resolve the problem or revert the pending changes.

3.1.4.1 Undoing Changes

You can revert any pending (saved, but not yet activated) changes by clicking Undo All Changes in the Change Center. You can revert any individual change by going to the appropriate page in the WebLogic Server Administration Console and restoring the attribute to its previous value.

3.1.4.2 Releasing the Configuration Lock

You release the configuration lock as follows:

- Before you make changes, click **Release Configuration** in the Change Center to release the lock explicitly.
- After you save changes, click **Activate Changes** or **Undo All Changes** in the Change Center to release the lock implicitly.

Stopping the Administration Server does not release the configuration lock. When the Administration Server starts again, the configuration lock is in the same state it was in when the Administration Server was shut down, and any pending changes are preserved.

3.1.4.3 How Change Management Works

To provide a secure, predictable means for distributing configuration changes in a domain, WebLogic Server imposes a change management process that loosely resembles a database transaction. The configuration of a domain is represented on the file system by a set of XML configuration files, centralized in the `config.xml` file, and at run time by a hierarchy of Configuration MBeans. When you edit the domain configuration, you edit a separate hierarchy of Configuration MBeans that resides on the Administration Server. To start the edit process, you obtain a lock on the edit hierarchy to prevent other people from making changes. When you finish making changes, you save the changes to the edit hierarchy. The changes do not take effect, however, until you activate them, distributing them to all server instances in the domain. When you activate changes, each server determines whether it can accept the change. If all servers are able to accept the change, they update their working configuration hierarchy and the change is completed.

For more information about change management, see "Managing Configuration Changes" in *Understanding Domain Configuration for Oracle WebLogic Server*.

3.1.4.4 Dynamic and Non-Dynamic Changes

Some changes you make in the WebLogic Server Administration Console take place immediately when you activate them. Other changes require you to restart the server or module affected by the change. These latter changes are called *non-dynamic changes*. Non-dynamic changes are indicated in the WebLogic Server Administration Console with this warning icon:

Changes to dynamic configuration attributes become available once they are activated, without restarting the affected server or system restart. These changes are made available to the server and run-time hierarchies once they are activated. Changes to non-dynamic configuration attributes require that the affected servers or system resources be restarted before they become effective.

If a change is made to a non-dynamic configuration setting, no changes to dynamic configuration settings will take effect until after restart. This is to assure that a batch of updates having a combination of dynamic and non-dynamic attribute edits will not be partially activated.

Note that WebLogic Server's change management process applies to changes in domain and server configuration data, not to security or application data.

3.1.4.5 Viewing Changes

You can view any changes that you have saved, but not yet activated, by clicking the View Changes and Restarts link in the Change Center. The View Changes and Restarts link presents two tabs, Change List and Restart Checklist:

- The Change List page presents all changes that have been saved, but not yet activated.
- The Restart Checklist lists all servers for which non-dynamic changes have been activated, but which require restarts before the changes become effective.

3.2 Using Fusion Middleware Control

WebLogic Server can also be managed through Fusion Middleware Control. Fusion Middleware Control provides management support for all Fusion Middleware

components, including WebLogic Server. Use Fusion Middleware Control to manage WebLogic Server when using other Fusion Middleware products in addition to WebLogic Server.

3.2.1 Fusion Middleware Control Online Help

Fusion Middleware Control includes a complete help system. It has two parts:

- **How do I...?**, which documents procedures for tasks you can perform using Fusion Middleware Control.
- **Help For This Page**, which provides reference information for each page, including descriptions of the attributes.

To access the Fusion Middleware Control help, select **Help** from the user profile menu at the top of the page. You can then select either **How Do I?** or **Help For This Page**.

For more information on using Fusion Middleware Control, see "Getting Started Using Oracle Enterprise Manager Fusion Middleware Control" in *Administering Oracle Fusion Middleware*.

For more information on managing WebLogic Server using Fusion Middleware Control, see the *Oracle Fusion Middleware Control Help for WebLogic Server* and *Administering Oracle WebLogic Server with Fusion Middleware Control*.

4

WebLogic Server Domains

This chapter describes WebLogic Server domains, logically related groups of resources for Oracle WebLogic Server 12.1.3.

This chapter includes the following sections:

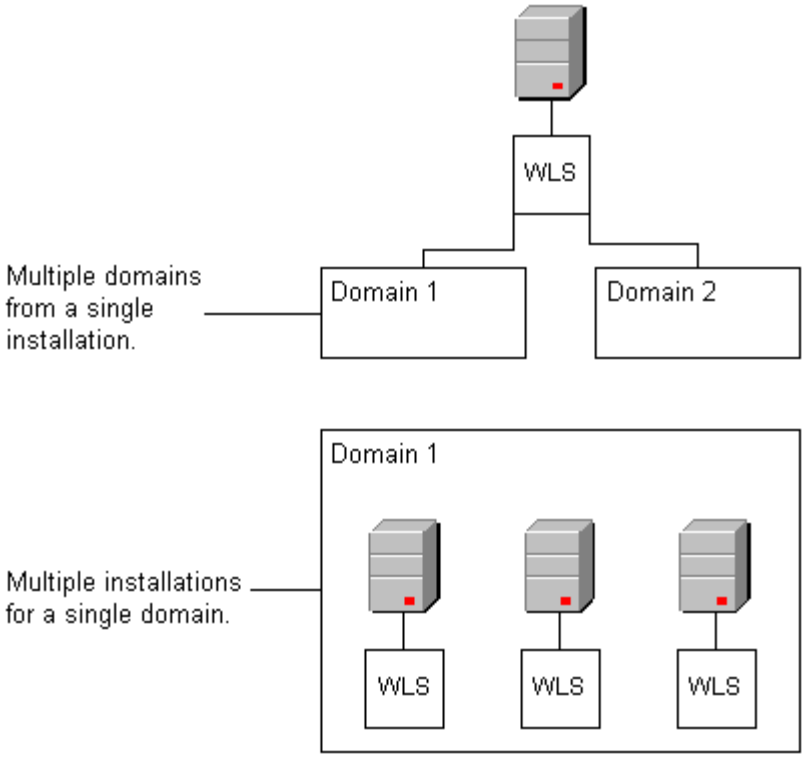
4.1 Understanding Domains

An Oracle WebLogic Server administration **domain** is a logically related group of Oracle WebLogic Server resources. Domains include a special Oracle WebLogic Server instance called the **Administration Server**, which is the central point from which you configure and manage all resources in the domain. Usually, you configure a domain to include additional Oracle WebLogic Server instances called **Managed Servers**. You deploy Web applications, EJBs, Web services, and other resources onto the Managed Servers and use the Administration Server for configuration and management purposes only.

4.2 Organizing Domains

You can use a single Oracle WebLogic Server installation to create and run multiple domains, or you can use multiple installations to run a single domain. See Figure 4–1.

Figure 4–1 Oracle WebLogic Server Installations and Domains



How you organize your Oracle WebLogic Server installations into domains depends on your business needs. You can define multiple domains based on different system administrators' responsibilities, application boundaries, or geographical locations of the machines on which servers run. Conversely, you might decide to use a single domain to centralize all Oracle WebLogic Server administration activities.

Depending on your particular business needs and system administration practices, you might decide to organize your domains based on criteria such as:

- Logical divisions of applications. For example, you might have one domain devoted to end-user functions such as shopping carts and another domain devoted to back-end accounting applications.
- Physical location. You might establish separate domains for different locations or branches of your business. Each physical location requires its own Oracle WebLogic Server installation.
- Size. You might find that domains organized in small units can be managed more efficiently, perhaps by different system administrators. Contrarily, you might find that maintaining a single domain or a small number of domains makes it easier to maintain a consistent configuration.

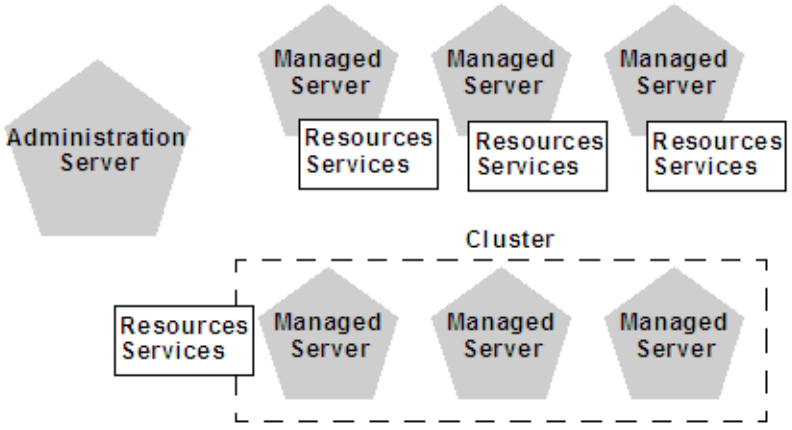
For development or test environments, you can create a simple domain that consists of a single server instance. This single instance acts as an Administration Server and hosts the applications that you are developing. The wl_server domain that you can install with Oracle WebLogic Server is an example of this type of domain.

4.3 Contents of a Domain

Figure 4–2 shows a production environment that contains an Administration Server, three stand-alone Managed Servers, and a cluster of three Managed Servers.

Although the scope and purpose of a domain can vary significantly, most Oracle WebLogic Server domains contain the components described in this section.

Figure 4–2 Contents of a Domain



4.3.1 Administration Server

The Administration Server operates as the central control entity for the configuration of the entire domain. It maintains the domain's configuration documents and distributes changes in the configuration documents to Managed Servers. You can also use the Administration Server as a central location from which to monitor all resources in a domain.

To interact with the Administration Server, you can use any of the administration tools listed in "Section 2.3, "Summary of System Administration Tools and APIs". " See "System Administration" for information about modifying the domain's configuration.

Each Oracle WebLogic Server domain must have one server instance that acts as the Administration Server.

For more information about the Administration Server and its role in the Oracle WebLogic Server JMX management system, see "System Administration".

4.3.2 Managed Servers and Managed Server Clusters

Managed Servers host business applications, application components, Web services, and their associated resources. To optimize performance, Managed Servers maintain a read-only copy of the domain's configuration document. When a Managed Server starts up, it connects to the domain's Administration Server to synchronize its configuration document with the document that the Administration Server maintains.

For production environments that require increased application performance, throughput, or high availability, you can configure two or more Managed Servers to operate as a **cluster**. A cluster is a collection of multiple Oracle WebLogic Server instances running simultaneously and working together to provide increased scalability and reliability. In a cluster, most resources and services are deployed identically to each Managed Server (as opposed to a single Managed Server), enabling failover and load balancing. A single domain can contain multiple Oracle WebLogic Server clusters, as well as multiple Managed Servers that are not configured as clusters. The key difference between clustered and non-clustered Managed Servers is

support for failover and load balancing. These features are available only in a cluster of Managed Servers. For more information about the benefits and capabilities of an Oracle WebLogic Server cluster, see "Understanding WebLogic Server Clustering" in *Administering Clusters for Oracle WebLogic Server*.

4.3.3 Managed Coherence Servers and Coherence Clusters

Managed Coherence Servers provide in-memory distributed caching for applications. A Managed Server that is configured to be a Coherence cluster member is a Managed Coherence Server. Coherence is integrated within WebLogic server as a container subsystem. The use of a container aligns the lifecycle of a Coherence member with the lifecycle of a Managed Server: starting or stopping a server JVM starts and stops a Coherence cluster member.

A domain can contain a single Coherence cluster that can be associated with Multiple WebLogic Server clusters. Managed Coherence servers that are part of a WebLogic Server cluster inherit their Coherence settings from the WebLogic Server cluster. WebLogic Server clusters are typically used to setup Coherence tiers that organize Managed Coherence servers based on their role in the Coherence cluster.

For details on configuring and managing Coherence clusters, see *Administering Clusters for Oracle WebLogic Server*.

4.3.4 Resources and Services

In addition to the Administration Server and Managed Servers, a domain also contains the resources and services that Managed Servers and deployed applications require.

Managed Servers can use the following resources:

- Machine definitions that identify a particular, physical piece of hardware. A machine definition is used to associate a computer with the Managed Servers it hosts. This information is used by Node Manager in restarting a failed Managed Server, and by a clustered Managed Server in selecting the best location for storing replicated session data. For more information about Node Manager, see "Node Manager Overview" in the *Administering Node Manager for Oracle WebLogic Server*.
- Network channels that define default ports, protocols, and protocol settings that a Managed Server uses to communicate with clients. After creating a network channel, you can assign it to any number of Managed Servers and clusters in the domain. For more information, see "Configuring Network Resources" in *Administering Server Environments for Oracle WebLogic Server*.
- Virtual hosting, which defines a set of host names to which Oracle WebLogic Server instances (servers) or clusters respond. When you use virtual hosting, you use DNS to specify one or more host names that map to the IP address of a server or cluster. You also specify which Web applications are served by each virtual host.

Applications can use the following resources and services:

- Security providers, which are modular components that handle specific aspects of security, such as authentication and authorization.
- Resource adapters, which are system libraries specific to Enterprise Information Systems (EIS) and provide connectivity to an EIS.
- Diagnostics and monitoring services.
- JDBC data sources, which enable applications to connect to databases.
- Mail sessions.

- XML entity caches and registry of XML parsers and transformer factories.
- Messaging services such as JMS servers and store-and-forward services.
- Persistent store, which is a physical repository for storing data, such as persistent JMS messages. It can be either a JDBC-accessible database or a disk-based file.
- Startup classes, which are Java programs that you create to provide custom, system-wide services for your applications.
- Work Managers, which determine how an application prioritizes the execution of its work based on rules you define and by monitoring actual run-time performance. You can create Work Mangers for entire Oracle WebLogic Server domains or for specific application components.
- Work Contexts, which enable applications to pass properties to a remote context without including the properties in a remote call.

4.4 Roadmap for Understanding WebLogic Server Domains

Table 4–1 Roadmap for Understanding WebLogic Server Domains

Major Task	Subtasks and Additional Information
Learning more about WebLogic Server domains	■ What to do if the Administration Server fails ■ Domain restrictions ■ Domain configuration files ■ Overview of change management ■ "System Administration"
Creating domains	■ *Creating WebLogic Domains Using the Configuration Wizard* ■ Overview of the Configuration Wizard ■ Extending WebLogic domains ■ *Creating Templates and Domains Using the Pack and Unpack Commands* ■ Creating WebLogic domains using WLST offline
Configuring domains	■ Configuring existing WebLogic domains ■ *Understanding Domain Configuration for Oracle WebLogic Server* ■ Managing configuration changes
Working with domain templates	■ Creating Domain Templates Using the Domain Template Builder ■ Creating and using a domain template (offline)
Examples	■ WLST offline sample scripts In addition, sample scripts are provided that configure WebLogic domain resources using WLST offline and online on the Oracle Technology Network site.
Reference	■ *Domain Template Reference* ■ Domain configuration schema ■ Domain security schema

5 WebLogic Server Clustering

This chapter introduces WebLogic Server clusters, groups of server instances running simultaneously and working together to provide increased scalability and reliability for WebLogic Server 12.1.3.

This chapter includes the following sections:

5.1 Overview of WebLogic Server Clusters

A WebLogic Server cluster consists of multiple WebLogic Server server instances running simultaneously and working together to provide increased scalability and reliability. A cluster appears to clients to be a single WebLogic Server instance. The server instances that constitute a cluster can run on the same machine, or be located on different machines. You can increase a cluster's capacity by adding additional server instances to the cluster on an existing machine, or you can add machines to the cluster to host the incremental server instances. Each server instance in a cluster must run the same version of WebLogic Server.

5.2 Relationship Between Clusters and Domains

A cluster is part of a particular WebLogic Server domain.

A domain is an interrelated set of WebLogic Server resources that are managed as a unit. A domain includes one or more WebLogic Server instances, which can be clustered, non-clustered, or a combination of clustered and non-clustered instances. A domain can include multiple clusters. A domain also contains the application components deployed in the domain, and the resources and services required by those application components and the server instances in the domain. Examples of the

resources and services used by applications and server instances include machine definitions, optional network channels, connectors, and startup classes.

You can use a variety of criteria for organizing WebLogic Server instances into domains. For instance, you might choose to allocate resources to multiple domains based on logical divisions of the hosted application, geographical considerations, or the number or complexity of the resources under management. For additional information about domains see *Understanding Domain Configuration for Oracle WebLogic Server*.

In each domain, one WebLogic Server instance acts as the Administration Server—the server instance which configures, manages, and monitors all other server instances and resources in the domain. Each Administration Server manages one domain only. If a domain contains multiple clusters, each cluster in the domain has the same Administration Server. All server instances in a cluster must reside in the same domain; you cannot "split" a cluster over multiple domains. Similarly, you cannot share a configured resource or subsystem between domains.

Clustered WebLogic Server instances behave similarly to non-clustered instances, except that they provide failover and load balancing. The process and tools used to configure clustered WebLogic Server instances are the same as those used to configure non-clustered instances. However, to achieve the load balancing and failover benefits that clustering enables, you must adhere to certain guidelines for cluster configuration.

5.3 Relationship Between Coherence and WebLogic Server Clusters

Coherence clusters consist of multiple managed Coherence server instances that work together to distribute data in-memory to increase application scalability, availability, and performance. A client interacts with the data in a local cache and the distribution and backup of the data is automatically performed across cluster members.

Coherence clusters are different than WebLogic Server clusters. They use different clustering protocols and are configured separately. A WebLogic Server domain can contain a single Coherence cluster. Multiple WebLogic Server clusters can be associated with a Coherence cluster.

For details on configuring and managing Coherence clusters, see *Administering Clusters for Oracle WebLogic Server*.

5.4 Benefits of Clustering

A WebLogic Server cluster provides these benefits:

- Scalability

  The capacity of an application deployed on a WebLogic Server cluster can be increased dynamically to meet demand. You can add server instances to a cluster without interruption of service—the application continues to run without impact to clients and end users.

- High-Availability

  In a WebLogic Server cluster, application processing can continue when a server instance fails. You "cluster" application components by deploying them on multiple server instances in the cluster—so, if a server instance on which a component is running fails, another server instance on which that component is deployed can continue application processing.

5.5 Key Capabilities of Clusters

This section defines, in non-technical terms, the key clustering capabilities that enable scalability and high availability.

- Application Failover

  Simply put, failover means that when an application component doing a particular "job"—some set of processing tasks—becomes unavailable for any reason, a copy of the failed object finishes the job.

- Migration

  WebLogic Server supports automatic and manual migration of a clustered server instance from one machine to another. A Managed Server that can be migrated is referred to as a migratable server. This feature is designed for environments with requirements for high availability.

- Load Balancing

  Load balancing is the even distribution of jobs and associated communications across the computing and networking resources in your environment.

5.6 Objects That Can Be Clustered

A clustered application or application component is one that is available on multiple WebLogic Server instances in a cluster. If an object is clustered, failover and load balancing for that object is available. Deploy objects homogeneously—to every server instance in your cluster—to simplify cluster administration, maintenance, and troubleshooting.

Web applications can consist of different types of objects, including Enterprise Java Beans (EJBs), servlets, and Java Server Pages (JSPs). Each object type has a unique set of behaviors related to control, invocation, and how it functions within an application. For this reason, the methods that WebLogic Server uses to support clustering—and hence to provide load balancing and failover—can vary for different types of objects. The following types of objects can be clustered in a WebLogic Server deployment:

- Servlets
- JSPs
- EJBs
- Remote Method Invocation (RMI) objects
- Java Messaging Service (JMS) destinations
- Coherence cluster and managed Coherence servers
- Timer services

5.7 Objects That Cannot Be Clustered

The following APIs and internal services cannot be clustered in WebLogic Server:

- File services including file shares

5.8 Overview of Dynamic Clusters

Dynamic clusters consist of server instances that can be dynamically scaled up to meet the resource needs of your application. A dynamic cluster uses a single server

template to define configuration for a specified number of generated (dynamic) server instances.

When you create a dynamic cluster, the dynamic servers are preconfigured and automatically generated for you, enabling you to easily scale up the number of server instances in your dynamic cluster when you need additional server capacity. You can simply start the dynamic servers without having to first manually configure and add them to the cluster.

For more information about dynamic clusters, see "Dynamic Clusters" in *Administering Clusters for Oracle WebLogic Server*.

5.9 Roadmap for Clustering in WebLogic Server

Table 5–1 Roadmap for Clustering in WebLogic Server

Major Task	Subtasks and Additional Information
Learning more about WebLogic Server clustering	■ Clustering servlets and JSPs ■ Clustering EJBs and RMI objects ■ JMS and clustering ■ Coherence clustering ■ Dynamic clusters
Configuring a cluster	■ Understanding cluster configuration ■ Communications in a cluster ■ Cluster architectures ■ Setting up WebLogic Server clusters ■ Clustering best practices ■ Setting up Coherence clusters
Learning more about load balancing and failover in a cluster	■ Load balancing in a cluster ■ Failover and replication in a cluster ■ Configuring BIG-IP hardware with clusters ■ Configuring F5 load balancers for MAN/WAN failover ■ Configuring Radware load balancers for MAN/WAN failover
Migrating servers and services in a cluster	■ Whole server migration ■ Service migration
Troubleshooting	■ Troubleshooting common problems ■ Troubleshooting multicast configuration
Reference	■ The WebLogic cluster API

6 Developing Applications in WebLogic Server

This chapter describes application development in WebLogic Server 12.1.3.

This chapter includes the following sections:

6.1 WebLogic Server and the Java EE Platform

WebLogic Server implements Java Platform, Enterprise Edition (Java EE) Version 6.0 technologies (see http://www.oracle.com/technetwork/java/javaee/overview/index.html). Java EE is the standard platform for developing multi-tier enterprise applications based on the Java programming language. The technologies that make up Java EE were developed collaboratively by several software vendors. For background information on Java EE 6 application development, refer to the Java EE 6 Tutorial at: http://docs.oracle.com/javaee/6/tutorial/doc/.

An important aspect of the Java EE programming model is the introduction of metadata annotations. Annotations simplify the application development process by allowing a developer to specify within the Java class itself how the application component behaves in the container, requests for dependency injection, and so on. Annotations are an alternative to deployment descriptors that were required by older versions of enterprise applications (Java EE 1.4 and earlier).

Starting in Java EE 5 and continuing in Java EE 6, the focus has been ease of development. There is less code to write – much of the boilerplate code has been removed, defaults are used whenever possible, and annotations are used extensively to reduce the need for deployment descriptors.

- EJB 3.1 provides simplified programming and packaging model changes. The mandatory use of Java interfaces from previous versions has been removed, allowing plain old Java objects to be annotated and used as EJB components. The simplification is further enhanced through the ability to place EJB modules directly inside of Web applications, removing the need to produce archives to store the Web and EJB components and combine them together in an EAR file.
- Java EE 6 includes simplified Web services support and the latest Web services APIs, making it an ideal implementation platform for Service-Oriented Architectures (SOA).

- Constructing Web applications is made easier with JavaServer Faces (JSF) technology and the JSP Standard Tag Library (JSTL). Java EE 6 supports rich thin-client technologies such as AJAX, for building applications for Web 2.0.

WebLogic Server Java EE applications are based on standardized, modular components. WebLogic Server provides a complete set of services for those modules and handles many details of application behavior automatically, without requiring programming. Java EE defines module behaviors and packaging in a generic, portable way, postponing run-time configuration until the module is actually deployed on an application server.

Java EE includes deployment specifications for Web applications, EJB modules, Web services, enterprise applications, client applications, and connectors. Java EE does not specify *how* an application is deployed on the target server—only how a standard module or application is packaged. For each module type, the specifications define the files required and their location in the directory structure.

Java is platform independent, so you can edit and compile code on any platform, and test your applications on development WebLogic Servers running on other platforms. For example, it is common to develop WebLogic Server applications on a PC running Windows or Linux, regardless of the platform where the application is ultimately deployed.

For more information, refer to the Java EE specification at:
http://www.oracle.com/technetwork/java/javaee/tech/index-jsp-142185.html.

6.2 Overview of Java EE Applications and Modules

A WebLogic Server Java EE application consists of one of the following modules or applications running on WebLogic Server:

- Web application modules—HTML pages, servlets, JavaServer Pages, and related files. See "Web Application Modules" in *Developing Applications for Oracle WebLogic Server*.
- Enterprise Java Beans (EJB) modules—entity beans, session beans, and message-driven beans. See "Enterprise JavaBean Modules" in *Developing Applications for Oracle WebLogic Server*.
- Connector modules—resource adapters. See "Connector Modules" in *Developing Applications for Oracle WebLogic Server*.
- Enterprise applications—Web application modules, EJB modules, resource adapters and Web Services packaged into an application. See "Enterprise Applications" in *Developing Applications for Oracle WebLogic Server*.
- Web services—See "WebLogic Web Services" in *Developing Applications for Oracle WebLogic Server*.

A WebLogic application can also include the following WebLogic-specific modules:

- JDBC and JMS modules—See "JMS and JDBC Modules" in *Developing Applications for Oracle WebLogic Server*.
- Coherence Grid modules—See "Packaging Coherence Applications" in *Developing Oracle Coherence Applications for Oracle WebLogic Server*.
- WebLogic Diagnostic FrameWork (WLDF) modules—See "WebLogic Diagnostic Framework Modules" in *Developing Applications for Oracle WebLogic Server*.

6.3 Roadmap for Developing Applications in WebLogic Server

Table 6–1 Roadmap for Developing Applications in WebLogic Server

Major Task	Subtasks and Additional Information
Learning more about application development	■ XML deployment descriptors ■ Deployment plans ■ Best practices for developing WebLogic Server applications ■ Understanding application life cycle events ■ Understanding production redeployment ■ Understanding WebLogic Server application classloading ■ Overview of shared Java EE libraries and optional packages
Setting up your development environment	■ Starting and stopping WebLogic Server ■ Use the "split development directory" to develop your applications
Designing your application	■ Using shared Java EE libraries and optional packages to share code among deployed applications ■ Programming JSF and JSTL applications ■ Using life cycle listeners ■ Using the HTTP publish-subscribe server ■ Using Coherence to cache data ■ Using Coherence to cache HTTP session data ■ *Developing Applications with the WebLogic Security Service* ■ Internationalize or localize your application ■ Using threads in WebLogic Server ■ Using WebSockets in WebLogic Server ■ *Adding WebLogic Logging Services to Applications Deployed on Oracle WebLogic Server* ■ *Developing Stand-alone Clients for Oracle WebLogic Server* ■ Designing manageable applications
Building your application	■ *Developing Applications for Oracle WebLogic Server* ■ Deploying your "split development directory" application on WebLogic Server ■ Using Ant tasks to compile Java code
Using development tools	■ Development software ■ Ant ■ *Oracle WebLogic Server Administration Console Online Help* ■ *Command Reference for Oracle WebLogic Server* ■ *Creating WebLogic Domains Using the Configuration Wizard* ■ EJBGen ■ *Creating Domain Templates Using the Domain Template Builder* ■ *Understanding the WebLogic Scripting Tool*
Moving your application to a production environment	■ Preparing your application or module for deployment ■ Configuring your application for production deployment ■ Updating your deployed application (production redeployment)

Table 6–1 (Cont.) Roadmap for Developing Applications in WebLogic Server

Major Task	Subtasks and Additional Information
Application examples	■ "Java EE 6 Examples" ■ "Additional API Examples" ■ "Avitek Medical Records" A complete and functional Java EE application including source code. The MedRec (Spring) sample application demonstrates Spring 3.0.x application development practices.
Java EE API programming guides	■ *Developing Custom Management Utilities Using JMX for Oracle WebLogic Server* ■ *Developing Manageable Applications Using JMX for Oracle WebLogic Server* ■ *Developing Security Providers for Oracle WebLogic Server* ■ *Developing and Administering Spring Applications for Oracle WebLogic Server* ■ *Solution Guide for Oracle TopLink* ■ *Developing Web Applications, Servlets, and JSPs for Oracle WebLogic Server* ■ *Developing Java EE Management Applications for Oracle WebLogic Server* ■ *Developing Enterprise JavaBeans for Oracle WebLogic Server* ■ *Developing JDBC Applications for Oracle WebLogic Server* ■ *Developing JMS Applications for Oracle WebLogic Server* ■ *Developing JNDI Applications for Oracle WebLogic Server* ■ *Developing JTA Applications for Oracle WebLogic Server* ■ *Developing Resource Adapters for Oracle WebLogic Server* ■ *Developing RMI Applications for Oracle WebLogic Server* ■ *Developing XML Applications for Oracle WebLogic Server* ■ *Developing Stand-alone Clients for Oracle WebLogic Server* ■ *Deploying Applications with the WebLogic Deployment API* ■ *Developing JCOM Applications for Oracle WebLogic Server* ■ *Developing JSP Tag Extensions for Oracle WebLogic Server* ■ *Developing Applications with the WebLogic Security Service* ■ *Developing JAX-WS Web Services for Oracle WebLogic Server* ■ *Developing CommonJ Applications for Oracle WebLogic Server* ■ *Adding WebLogic Logging Services to Applications Deployed on Oracle WebLogic Server* ■ *Administering Clusters for Oracle WebLogic Server* ■ *Developing Oracle WebLogic Tuxedo Connector Applications for Oracle WebLogic Server*
Javadoc and API reference	■ Java Platform, Enterprise Edition (Java EE) Version 6.0 ■ Java Platform, Standard Edition (Java SE) Version 6.0 ■ *JMS C API Reference for Oracle WebLogic Server* ■ *Java API Reference for Oracle WebLogic Server* ■ *Microsoft .NET Messaging API for Oracle WebLogic Server*

Table 6–1 (Cont.) Roadmap for Developing Applications in WebLogic Server

Major Task	Subtasks and Additional Information
General reference	■ XML deployment descriptors ■ WebLogic JSP cache, process, and repeat tags ■ WebLogic JSP form validation tags ■ *Command Reference for Oracle WebLogic Server* ■ *MBean Reference for Oracle WebLogic Server* ■ *WebLogic Server Error Message Catalog*

7

Deploying Applications in WebLogic Server

This chapter describes application deployment in WebLogic Server 12.1.3.

This chapter includes the following sections:

7.1 Overview of the Deployment Process

The term *application deployment* refers to the process of making an application or module available for processing client requests in a WebLogic Server domain. Application deployment generally involves the following tasks:

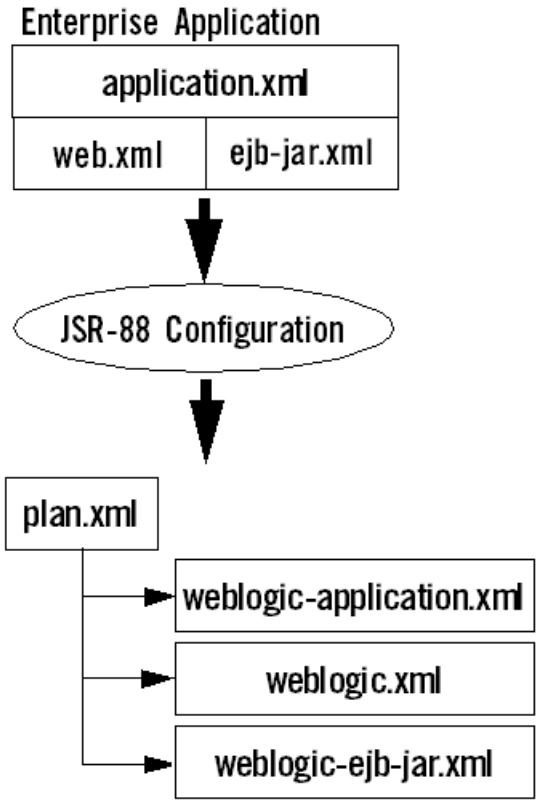
- "Preparing Applications and Modules for Deployment"
- "Configuring Applications for Production Deployment"
- "Exporting an Application for Deployment to New Environments"
- "Deploying Applications and Modules with weblogic.Deployer"
- "Redeploying Applications in a Production Environment"
- "Managing Deployed Applications"

7.2 Java EE 6 Deployment Implementation

WebLogic Server implements the Java EE 6 specification. Java EE 6 includes a deployment specification, JSR-88, that describes a standard API used by deployment tools and application server providers to configure and deploy applications to an application server.

WebLogic Server implements both the JSR-88 Service Provider Interface (SPI) plug-in and model plug-in to comply with the Java EE deployment specification. You can use a basic Java EE deployment API deployment tool with the WebLogic Server plug-ins (without using WebLogic Server extensions to the API) to configure, deploy, and redeploy Java EE applications and modules to WebLogic Server. The WebLogic Server configuration generated by a Java EE deployment API configuration process is stored in a deployment plan and one or more generated WebLogic Server deployment descriptor files, as shown in Figure 7–1.

Figure 7–1 Configuring Applications with the Java EE Deployment API



WebLogic Server deployment descriptors are generated as needed to store WebLogic Server configuration data.

The WebLogic Server deployment plan generated by a Java EE deployment API deployment tool identifies the WebLogic Server deployment descriptors that were generated for the application during the configuration session.

Although the Java EE deployment API provides a simple, standardized way to configure applications and modules for use with a Java EE-compliant application server, the specification does not address many deployment features that were available in previous WebLogic Server releases. For this reason, WebLogic Server provides important extensions to the Java EE deployment API specification to support capabilities described in "WebLogic Server Deployment Features" in *Deploying Applications to Oracle WebLogic Server*.

7.3 Fast Track Deployment Guide

This section provides basic instructions for quickly deploying Java EE applications and modules, JSP and HTML files, and Coherence modules. It also provides pointers to tools for system administrators. The deployment procedures on this page are recommended for use in development environments only; the procedures are not recommended for use in production environments. For additional information on developing and deploying applications on WebLogic Server, see *Developing Applications for Oracle WebLogic Server* and *Deploying Applications to Oracle WebLogic Server*.

Complete the *Installing and Configuring Oracle WebLogic Server and Coherence* before using these Fast Track procedures.

7.3.1 Java EE Deployment

To deploy a Java EE application or module:

1. Make sure that the Java EE application or module does not require additional resources such as named JDBC data sources or JMS queues. If the application requires external resources, you must configure them in the target WebLogic Server domain before deploying the application.
2. Copy the archive file or exploded archive directory for the Java EE application or module into the `/autodeploy` directory of the examples server domain directory, *`ORACLE_HOME`*`/user_projects/domains/wl_server/autodeploy`.
3. Start the Examples WebLogic Server instance.
4. Access the application using either a Java client or the configured URI for the application.

7.3.1.1 Auto-Deployment

When running in development mode, WebLogic Server automatically deploys applications copied into the /autodeploy subdirectory of the domain directory. Auto-deployment is a simple and quick method of deploying an application for testing or evaluation. See "Auto-Deploying Applications in Development Domains" in *Deploying Applications to Oracle WebLogic Server*.

7.3.1.2 Deploying Multiple Applications

When you use the WebLogic Server Administration Console to deploy multiple applications, upon installing the applications, they are listed in the Console's Deployments page in the "distribute Initializing" state. After activating changes, they are listed in the "Prepared" state. To deploy the applications, select the application names on the Deployments page and click **Start**.

7.3.2 System Administrator Tools

System Administrators can use the following tools to get started:

- WebLogic Server Administration Console

  The WebLogic Server Administration Console is a browser-based Web application that allows you to configure and monitor your WebLogic Server domain, server instances, and running applications and their associated resources. You can also use the WebLogic Server Administration Console to create new server instances and clusters and tune application descriptors. For more information, see *Oracle WebLogic Server Administration Console Online Help*.

  After you log into the Console using the credentials you provided during installation, click the **Help** button or **How do I ...?** links for additional information.

- Configuration Wizard

  Use the WebLogic Server Configuration Wizard to create new domains, and to create templates for automating domain configuration. For more information, see *Creating WebLogic Domains Using the Configuration Wizard*.

7.3.3 JSP/HTML Deployment

To deploy a simple JSP or HTML file:

1. Make sure your JSP file does not reference a tag library or other external resources—such resources require additional deployment steps that are beyond the scope of these Fast Track procedures. HTML files do not have this restriction.
2. Copy your JSP or HTML file into the *EXAMPLES_HOME*/wl_server/examples/build/mainWebApp directory, where *EXAMPLES_HOME* represents the directory in which the WebLogic Server code examples are configured.
3. Start the Examples WebLogic Server instance.
4. In a Web browser, request the JSP or HTML file using the following URL:

   `http://localhost:port/myFile`

   where:

   `localhost` is the host name of the machine running WebLogic Server.

   `port` is the port number where WebLogic Server is listening for requests (7001 by default).

   `myFile` is the full name, including the .jsp or .html extension, of the JSP or HTML file you copied in step 2.

The JSP or HTML file has been automatically deployed from a directory preconfigured to target the Examples Server. mainWebApp is deployed by default and you can place your own JSP and HTML files into the mainWebApp exploded directory in order to quickly view or test them.

7.3.4 Coherence Deployment

WebLogic Server supports the deployment of Coherence applications that are packaged as Grid ARchive (GAR) modules. GAR modules contain the artifacts that are required for a Coherence application. GAR modules are deployed as standalone modules, packaged within enterprise applications, and as shared libraries. For details on packaging and deploying Coherence applications, see "Deploying Coherence Applications" in *Developing Oracle Coherence Applications for Oracle WebLogic Server*.

7.4 Roadmap for Deploying Applications in WebLogic Server

Table 7–1 Roadmap for Deploying Applications in WebLogic Server

Major Task	Subtasks and Additional Information
Learning more about application deployment	■ Deployment terminology ■ Java EE 6 deployment implementation ■ WebLogic Server deployment features ■ Understanding the deployment configuration process ■ Overview of the export process ■ Best practices for deploying applications
Packaging applications	■ Preparing applications and modules for deployment ■ Archive file and exploded archive deployments ■ Using the wlpackage Ant task ■ Preparing Coherence applications for deployment

Table 7–1 (Cont.) Roadmap for Deploying Applications in WebLogic Server

Major Task	Subtasks and Additional Information
Using deployment tools	■ Overview of deployment tasks ■ weblogic.Deployer utility ■ WebLogic.Plan generator command-line reference ■ WebLogic Maven plug-in for deployment ■ wldeploy Ant task
Advanced topics	■ Overview of common deployment scenarios ■ Configuring applications for deployment ■ Redeploying a production application ■ *Deploying Applications with the WebLogic Deployment API* ■ Exporting an application for deployment to new environments ■ Distributing an application to a production environment ■ Changing the deployment order ■ Taking an application offline ■ Managing deployed applications
Reference	■ Understanding the WebLogic deployment API

8

WebLogic Server Data Sources

This chapter describes WebLogic Java Database Connectivity (JDBC) data sources for WebLogic Server 12.1.3.

This chapter includes the following sections:

8.1 Understanding JDBC Data Sources

In WebLogic Server, you can configure database connectivity by configuring JDBC data sources and multi data sources and then targeting or deploying the JDBC resources to servers or clusters in your WebLogic domain.

Oracle WebLogic Server provides three types of data sources:

- Generic Data Sources—Generic data sources and their connection pools provide connection management processes that help keep your system running efficiently.You can set options in the data source to suit your applications and your environment.
- GridLink Data Sources—An event-based data source that adaptively responds to state changes in an Oracle RAC instance.
- Multi data sources—An abstraction around a group of generic data sources that provides load balancing or failover processing.

WebLogic Server also supports Java EE DataSources, which can be programmatically defined for a more flexible and portable method of database connectivity. For more information on Java EE DataSources, see "Using DataSource Resource Definitions" in *Developing JDBC Applications for Oracle WebLogic Server*.

8.2 Understanding Generic Data Sources

Generic data sources provide database access and database connection management. Each data source contains a pool of database connections that are created when the data source is created and at server startup. Applications reserve a database connection from the data source by looking up the data source on the JNDI tree or in the local application context and then calling `getConnection()`. When finished with

the connection, the application should call `connection.close()` as early as possible, which returns the database connection to the pool for other applications to use.

8.3 Understanding GridLink Data Sources

A single GridLink data source provides connectivity between WebLogic Server and an Oracle Database service, which may include multiple Oracle RAC clusters. It uses the Oracle Notification Service (ONS) to adaptively respond to state changes in an Oracle RAC instance. An Oracle Database service represents a workload with common attributes that enables administrators to manage the workload as a single entity. You scale the number of GridLink data sources as the number of services increases in the data base, independent of the number of nodes in the cluster.

A GridLink data source includes the features of generic data sources plus the following support for Oracle RAC:

- Fast Connection Failover
- Runtime Connection Load Balancing
- Graceful Handling for Oracle RAC Outages
- GridLink Affinity
- SCAN Addresses
- Secure Communication using Oracle Wallet

8.4 Understanding JDBC Multi Data Sources

A multi data source is an abstraction around a group of data sources that is bound to the JDNDI tree or local application context just like data sources are bound to the JNDI tree. Applications look up a multi data source on the JNDI tree or in the local application context (`java:comp/env`) just as they do for data sources, and then request a database connection. The multi data source determines which data source to use to satisfy the request depending on the algorithm selected in the multi data source configuration: load balancing or failover.

8.5 Roadmap for WebLogic Server Data Sources

Table 8–1 Roadmap for WebLogic Server Data Sources

Major Task	Subtasks and Additional Information
Learning more about WebLogic Server data source	■ Understanding JDBC resources in WebLogic Server ■ Data source configuration files ■ JMX and WLST access for JDBCA resources ■ Overview of clustered JDBC resources ■ Multi data source features ■ Using WebLogic JDBC in an application

Table 8–1 (Cont.) Roadmap for WebLogic Server Data Sources

Major Task	Subtasks and Additional Information
Configuring JDBC	■ Configuring JDBC data sources ■ Using GridLink data sources ■ Configuring JDBC multi data sources ■ Advanced configuration for Oracle drivers ■ JDBC data source transaction options ■ Using roles and policies to secure JDBC data sources
Java EE DataSources	■ Using DataSource resource definitions
Managing JDBC	■ Managing data sources ■ Monitoring data sources ■ Monitoring GridLink JDBC resources
Performance and tuning	■ Tuning JDBC applications ■ Tuning data source connection pools
Using WebLogic Server with Oracle RAC	■ Using WebLogic Server with Oracle RAC ■ Using multi data sources with Oracle RAC ■ Using connect-time failover with Oracle RAC ■ Using fast connection failover with Oracle RAC
Using JDBC drivers	■ Overview of third-party JDBC drivers ■ Derby Derby is an all-Java DBMS product included in the WebLogic Server distribution that is intended solely to support demonstration of WebLogic Server examples. Documentation is not shipped with the product; it is available at http://db.apache.org/derby/manuals/index.html. For more information about Derby, see http://db.apache.org/derby.

9 WebLogic Server Messaging

This chapter describes the Java Messaging System (JMS) in WebLogic Server 12.1.3.

This chapter includes the following sections:

9.1 Overview of JMS and WebLogic Server

The WebLogic Server implementation of JMS is an enterprise-class messaging system that is tightly integrated into the WebLogic Server platform. It fully supports the JMS 1.1 Specification, available at `http://www.oracle.com/technetwork/java/jms/index.html`, and also provides numerous WebLogic JMS Extensions that go beyond the standard JMS APIs.

9.2 Java Message Service

An enterprise messaging system enables applications to asynchronously communicate with one another through the exchange of messages. A message is a request, report, and/or event that contains information needed to coordinate communication between different applications. A message provides a level of abstraction, allowing you to separate the details about the destination system from the application code.

The Java Message Service (JMS) is a standard API for accessing enterprise messaging systems that is implemented by industry messaging providers. Specifically, JMS:

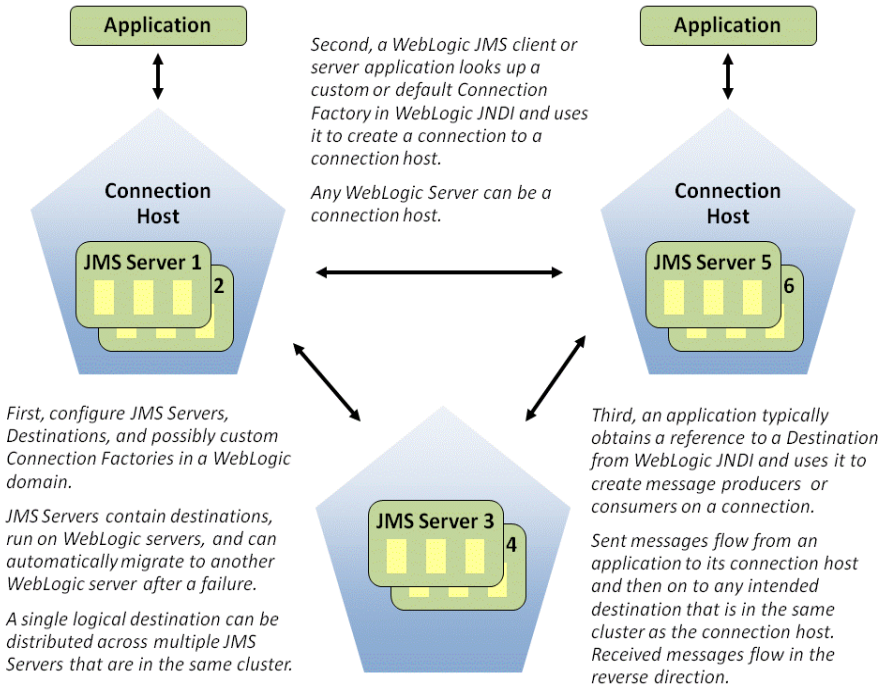
- Enables Java applications that share a messaging system to exchange messages
- Simplifies application development by providing a standard interface for creating, sending, and receiving messages

WebLogic JMS supports both client and server applications; in addition to Java, it has client libraries for C APIs and Microsoft .NET. WebLogic JMS accepts messages from *producer* applications and delivers them to *consumer* applications. For more information on JMS API programming with WebLogic Server, see *Developing JMS Applications for Oracle WebLogic Server*. For information on JMS API programming for WebLogic Server hosted consumer applications, see *Developing Message-Driven Beans for Oracle WebLogic Server*.

9.2.1 WebLogic JMS Architecture and Environment

Figure 9–1 illustrates the WebLogic JMS architecture.

Figure 9–1 WebLogic JMS Architecture



In Figure 9–1, A1 and B1 are connection factories, and B2 is a queue.

The major components of the WebLogic JMS architecture include:

- JMS server: a managed message container for a set of JMS queues and topics. Destination configuration is located in JMS XML modules that can target one or more JMS servers, and a single logical destination can be distributed across multiple JMS servers. A JMS server's primary responsibility for its targeted destinations is to maintain information on what persistent store is used for any persistent messages that arrive on the destinations, and to maintain the states of durable subscribers created on the destinations. You can configure one or more JMS servers per domain, multiple JMS servers may run on the same WebLogic server, and a JMS server can manage one or more JMS modules. For more information, see "Overview of JMS Server" in *Administering JMS Resources for Oracle WebLogic Server.*
- JMS connection hosts and connection factories: any WebLogic server in a cluster can act as a JMS connection host for JMS applications. A JMS application gains access to WebLogic JMS by (a) obtaining a connection factory reference from JNDI, (b) obtaining a connection from this factory, and finally (c) using the connection to send or receive messages. JMS messages flow from an application, through its connection host, and then to any destination on a JMS server that is in the same cluster as the connection host. An application can use either default connection factories or custom connection factories that are configured using a JMS module.
- JMS destinations: hold JMS messages and are hosted on JMS servers. WebLogic JMS applications typically obtain JMS destination references via JNDI and then send and receive messages to these destinations using their respective JMS connections. A single logical WebLogic destination can be configured to be distributed across multiple JMS servers within the same cluster. A WebLogic JMS

client can transparently communicate with any WebLogic JMS destination that is hosted in the same cluster as the client's connection host.

- JMS modules: contain configuration resources, such as standalone queue and topic destinations, distributed destinations, and connection factories, and are defined by XML documents that conform to the `weblogic-jms.xsd` schema. For more information, see "What are JMS Configuration Resources?" in *Administering JMS Resources for Oracle WebLogic Server*.
- Client JMS applications: either produce messages to destinations or consume messages from destinations.
- JNDI (Java Naming and Directory Interface): provides a lookup facility for JMS connection factories and destinations.
- WebLogic persistent storage: a server instance's default store, a user-defined file store, or a user-defined JDBC-accessible store for storing persistent message data.

9.3 Roadmap for WebLogic Server Messaging

Table 9–1 Roadmap for WebLogic Server Messaging

Major Task	Subtasks and Additional Information
Learning more about WebLogic Server messaging	■ WebLogic JMS architecture and environment ■ JMS configuration resources ■ Overview of JMS servers ■ Overview of JMS modules ■ Environment-related system resources for WebLogic JMS ■ Understanding the messaging models ■ Understanding the JMS API ■ Value-added public JMS API extensions
Getting started with WebLogic JMS	■ Overview of JMS programming ■ Best practices for JMS beginners and advanced users ■ Developing a basic JMS application ■ Overview of JMS resource configuration ■ Value-added WebLogic Server JMS features ■ Integrating remote and foreign JMS providers ■ "Sample Applications and Code Examples" ■ Troubleshooting WebLogic JMS
Using new WebLogic JMS features	■ Developing advanced pub/sub applications ■ Interoperating with Oracle advanced queueing ■ *Developing JMS .NET Client Applications for Oracle WebLogic Server*
Programming WebLogic messaging	■ *Developing JMS Applications for Oracle WebLogic Server* ■ Developing advanced pub/sub applications ■ *Developing Message-Driven Beans for Oracle WebLogic Server*
Understanding clients for WebLogic messaging	■ Understanding JMS clients ■ WebLogic Server client types and features

Table 9–1 (Cont.) Roadmap for WebLogic Server Messaging

Major Task	Subtasks and Additional Information
Configuring WebLogic messaging	■ Best practices for JMS beginners and advanced users ■ *Administering JMS Resources for Oracle WebLogic Server* ■ Integrating remote and foreign JMS providers ■ *Administering the Store-and-Forward Service for Oracle WebLogic Server* ■ *Administering the WebLogic Messaging Bridge for Oracle WebLogic Server*
Using the WebLogic Server Administration Console to configure WebLogic messaging	■ Configuring JMS servers ■ Configuring JMS system modules and resources ■ Configuring store-and-forward for JMS messages ■ Configuring and managing messaging bridges
Performance and tuning	■ Tuning WebLogic JMS ■ Tuning WebLogic JMS store-and-forward ■ Tuning WebLogic messaging bridge ■ Tuning message-driven beans ■ Tuning logging last resource
Reference	■ Javadoc for WebLogic JMS extensions ■ MBean reference ■ JMS schema ■ Java Message Service Specification ■ *JMS C API Reference for Oracle WebLogic Server*

10

Understanding WebLogic Server Security

This chapter introduces the WebLogic Server security service and methods for securing your WebLogic Server 12.1.3 environments.

This chapter includes the following sections:

10.1 Java EE 6 Security Feature Support in WebLogic Server

WebLogic Server supports the following security features of Java EE 6:

- Java Authorization Contract for Containers (JACC) 1.4

  The JACC specification defines a contract between a Java EE application server and an authorization policy provider. All Java EE containers support this contract.

  The JACC specification defines `java.security.Permission` classes that satisfy the Java EE authorization model. The specification defines the binding of container access decisions to operations on instances of these permission classes. It defines the semantics of policy providers that use the new permission classes to address the authorization requirements of the Java EE platform, including the definition and use of roles.

- Java Authentication Service Provider Interface for Containers (JASPIC) 1.0

  The JASPIC specification defines a service provider interface (SPI) by which authentication providers that implement message authentication mechanisms may be integrated in client or server message-processing containers or runtimes. Authentication providers integrated through this interface operate on network messages provided to them by their calling container. The authentication providers transform outgoing messages so that the source of the message can be authenticated by the receiving container, and the recipient of the message can be authenticated by the message sender. Authentication providers authenticate incoming messages and return to their calling container the identity established as a result of the message authentication.

10.2 Overview of the WebLogic Server Security Service

WebLogic Server includes a security architecture that provides a unique and secure foundation for applications that are available via the Web. By taking advantage of the security features in WebLogic Server, enterprises benefit from a comprehensive, flexible security infrastructure designed to address the security challenges of making applications available on the Web. WebLogic security can be used standalone to secure WebLogic Server applications or as part of an enterprise-wide, security management system that represents a best-in-breed, security management solution.

The key features of the WebLogic Security Service include:

- A comprehensive and standards-based design.
- End-to-end security for WebLogic Server-hosted applications, from the mainframe to the Web browser.
- Legacy security schemes that integrate with WebLogic Server security, allowing companies to leverage existing investments.
- Security tools that are integrated into a flexible, unified system to ease security management across the enterprise.
- Easy customization of application security to business requirements through mapping of company business rules to security policies.
- A consistent model for applying security policies to Java EE and application-defined resources.
- Easy updates to security policies. This release includes usability enhancements to the process of creating security policies as well as additional expressions that control access to WebLogic resources.
- Easy adaptability for customized security solutions.
- A modularized architecture, so that security infrastructures can change over time to meet the requirements of a particular company.
- Support for configuring multiple security providers, as part of a transition scheme or upgrade path.
- A separation between security details and application infrastructure, making security easier to deploy, manage, maintain, and modify as requirements change.
- Default WebLogic security providers that provide you with a working security scheme out of the box. This release supports additional authentication stores such as databases and gives the option to configure an external RDBMS system as a datastore to be used by select security providers.
- Customization of security schemes using custom security providers.
- Unified management of security rules, security policies, and security providers through the WebLogic Server Administration Console.
- Support for standard Java EE security technologies such as the Java Authentication and Authorization Service (JAAS), Java Secure Sockets Extensions (JSSE), Java Cryptography Extensions (JCE), and Java Authorization Contract for Containers (JACC).
- A foundation for Web services security including support for Security Assertion Markup Language (SAML) 1.1 and 2.0.
- Capabilities which allow WebLogic Server to participate in single sign-on (SSO) with Web sites, Web applications, and desktop clients

- A framework for managing public keys which includes a certificate lookup, verification, validation, and revocation as well as a certificate registry.

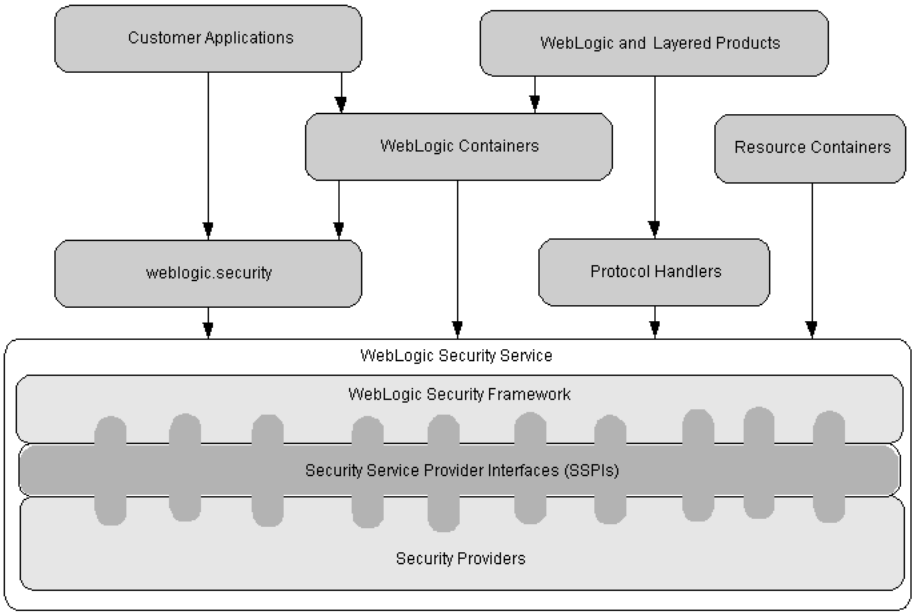
10.3 WebLogic Server Security Service Architecture

This section provides a description of the architecture of the WebLogic Security Service. The architecture comprises three major components, which are discussed in the following sections:

10.3.1 WebLogic Security Framework

Figure 10–1 shows a high-level view of the WebLogic Security Framework. The framework comprises interfaces, classes, and exceptions in the weblogic.security.service package.

Figure 10–1 WebLogic Security Service Architecture



The primary function of the WebLogic Security Framework is to provide a simplified application programming interface (API) that can be used by security and application developers to define security services. Within that context, the WebLogic Security Framework also acts as an intermediary between the WebLogic containers (Web and EJB), the Resource containers, and the security providers.

10.3.2 Single Sign-on with the WebLogic Server Security Framework

Single Sign-On (SSO) is the ability to require a user to sign on to an application only once and gain access to many different application components, even though these components may have their own authentication schemes. Single sign-on enables users to login securely to all their applications, Web sites and mainframe sessions with just one identity. The Security Assertion Markup Language (SAML) and Windows Integrated Authentication features provide Web-based single sign-on (SSO) functionality for WebLogic Server applications.

10.3.3 SAML Token Profile Support in WebLogic Web Services

The WebLogic Web services and the WebLogic Security Framework support the generation, consumption, and validation of SAML 1.1 and 2.0 assertions. When using SAML assertions, a web service passes a SAML assertion and the accompanying proof material to the WebLogic Security Framework.If the SAML assertion is valid and trusted, the framework returns an authenticated Subject with a trusted principal back to the web service. WebLogic Web services and the WebLogic Security Framework support the following SAML assertions:

- Sender-Vouches - The asserting party (different from the subject) vouches for the verification of the subject. The receiver must have a trust relationship with the asserting party.
- Holder-of-Key - The purpose of SAML token with "holder-of-key" subject confirmation is to allow the subject to use an X.509 certificate that may not be trusted by the receiver to protect the integrity of the request messages.

  Conceptually, the asserting party inserts an X.509 public certificate (or other key info) into a SAML assertion. (More correctly, the asserting party binds a key to a subject.) In order to protect this embedded certificate, the SAML assertion itself must be signed by the asserting entity. For WebLogic Server, the Web service client signs the SAML assertion with its private key. That is, the signature on the assertion is the signature of the SAML authority, and is not based on the certificate contained in, or identified by, the assertion.
- Bearer - The subject of the assertion is the bearer of the assertion, subject to optional constraints on confirmation using attributes that may be included in the `<SubjectConfirmationData>` element of the assertion.

10.3.4 The Security Service Provider Interfaces (SSPIs)

Security in WebLogic Server is based on a set of Security Service Provider Interfaces (SSPIs). The SSPIs can be used by developers and third-party vendors to develop security providers for the WebLogic Server environment. SSPIs are available for Adjudication, Auditing, Authentication, Authorization, Credential Mapping, Identity Assertion, Role Mapping, and Certificate Lookup and Validation.

The SSPIs allow customers to use custom security providers for securing WebLogic Server resources. Customers can use the SSPIs to develop custom security providers or they can purchase customer security providers from third-party vendors.

For more information on developing custom security providers, see *Developing Security Providers for Oracle WebLogic Server*.

10.3.5 WebLogic Security Providers

Security providers are modules that "plug into" a WebLogic Server security realm to provide security services to applications. They call into the WebLogic Security Framework on behalf of applications.

If the security providers supplied with the WebLogic Server product do not fully meet your security requirements, you can supplement or replace them with custom security providers. You develop a custom security provider by:

- Implementing the appropriate security service provider interfaces (SSPIs) from the `weblogic.security.spi` package to create runtime classes for the security provider.
- Creating an MBean Definition File (MDF) and using the WebLogic MBeanMaker utility to generate an MBean type, which is used to configure and manage the security provider.

For more information, see *Developing Security Providers for Oracle WebLogic Server*.

10.4 Managing WebLogic Server Security

This section covers the following topics:

- Section 10.4.1, "Security Realms"
- Section 10.4.2, "Security Policies"

10.4.1 Security Realms

A security realm comprises mechanisms for protecting WebLogic resources. Each security realm consists of a set of configured security providers, users, groups, security roles, and security policies. A user must be defined in a security realm in order to access any WebLogic resources belonging to that realm. When a user attempts to access a particular WebLogic resource, WebLogic Server tries to authenticate and authorize the user by checking the security role assigned to the user in the relevant security realm and the security policy of the particular WebLogic resource.

10.4.2 Security Policies

Security policies replace access control lists (ACLs) and answer the question "Who has access to a WebLogic resource?" A security policy is created when you define an association between a WebLogic resource and one or more users, groups, or security roles. You can optionally define date and time constraints for a security policy. A WebLogic resource has no protection until you assign it a security policy.

You assign security policies to any of the defined WebLogic resources (for example, an EJB resource or a JNDI resource) or to attributes or operations of a particular instance of a WebLogic resource (an EJB method or a servlet within a Web application). If you assign a security policy to a type of WebLogic resource, all new instances of that resource inherit that security policy. Security policies assigned to individual resources or attributes override security policies assigned to a type of WebLogic resource.

10.5 Oracle Platform Security Services (OPSS)

Oracle Platform Security Services (OPSS) provides enterprise product development teams, systems integrators (SIs), and independent software vendors (ISVs) with a standards-based, portable, integrated, enterprise-grade security framework for Java Standard Edition (Java SE) and Java Enterprise Edition (Java EE) applications.

OPSS provides an abstraction layer in the form of standards-based application programming interfaces (APIs) that insulates developers from security and identity management implementation details. With OPSS, developers don't need to know the details of cryptographic key management or interfaces with user repositories and other identity management infrastructures. With OPSS, in-house developed applications, third-party applications, and integrated applications all benefit from the same uniform security, identity management, and audit services across the enterprise.

OPSS is not a component of WebLogic Server and is not available in a standalone WebLogic Server installation. OPSS is available from the Oracle Fusion Middleware infrastructure software, and may be used with WebLogic Server in domains that are based upon, or extended with, the Oracle JRF template. For more information, see *Installing and Configuring the Oracle Fusion Middleware Infrastructure*. For information about the Oracle JRF domain template, see "Oracle JRF Template" in *Domain Template Reference*.

10.6 Security for Coherence

Coherence is secured using both WebLogic Server security components and Coherence-specific security components. The components include:

- SSL for authentication between Coherence cluster members
- SSL for authentication between extend clients (external to WebLogic Server) and a Coherence cluster
- WebLogic Server policies and roles for authorizing Coherence services and caches
- Identity assertion between extend clients and Coherence clusters

For details on configuring Coherence security, see "Securing Coherence in WebLogic Server" in the *Oracle Coherence Security Guide*.

10.7 Roadmap for Securing WebLogic Server

Table 10–1 Roadmap for Securing WebLogic Server

Major Task	Subtasks and Additional Information
Learning more about fundamental security concepts	■ Auditing ■ Authentication ■ Security Assertion Markup Language (SAML) ■ Single sign-on (SSO) ■ Authorization ■ Identity and trust ■ Secure Sockets Layer (SSL) ■ WebLogic security framework ■ Single sign-on with the WebLogic Server security framework ■ SAML token support in WebLogic Web services ■ Security Service Provider Interfaces (SSPIs) ■ WebLogic security providers
Administering WebLogic Server security	■ Security management concepts ■ Customizing the default security configuration ■ Migrating security data ■ Managing the embedded LDAP server ■ Managing the RDBMS security store ■ Configuring keystores ■ Configuring SSL ■ Configuring cross-domain security ■ Using compatibility security ■ Secure WebLogic resources using roles and policies ■ Exploring security options for cluster architectures ■ Configuring Security for Coherence
Authenticating users	■ Authenticating users defined in an LDAP server ■ Authenticating against an RDBMS system ■ Authenticating against a Windows NT domain ■ Authenticating a remote user ■ Using SAML ■ Configuring Single Sign-on (SSO) ■ Configuring single sign-on with Microsoft clients ■ Configuring single sign-on with Web browsers and HTTP clients ■ Using Kerberos ■ Using multiple authentication providers ■ Configuring password composition rules ■ Managing users and groups ■ Using Java Authentication SPI for Containers (JASPIC)

Table 10–1 (Cont.) Roadmap for Securing WebLogic Server

Major Task	Subtasks and Additional Information
Configuring SSL	■ Setting up SSL: main steps ■ Configuring keystores ■ Creating a keystore: example ■ X.509 certificate revocation checking
Configuring authorization	■ Securing WebLogic resources using roles and policies ■ Configuring an authorization provider ■ Using multiple authorization providers ■ Using JAAS authorization ■ Configuring a role mapping provider ■ Using Java Authorization Contract Containers (JACC)
Learning more about security realms	■ Introduction to security realms ■ Users ■ Groups ■ Security roles ■ Security policies ■ Security providers
Programming applications for security	■ Programming security for WebLogic Server ■ Configuring resource adapter security ■ WebLogic Web service security topics
Best practices	■ Securing a production environment

11

WebLogic Server Web Services

This chapter offers an introduction to WebLogic Server Web services for Oracle WebLogic Server 12.1.3.

This chapter includes the following sections:

11.1 Overview of Web Services

A Web service is a self-contained application that can be described, published, and invoked over a network, such as a corporate intranet or the Internet. Because you access Web services using standard Web protocols such as Extensible Markup Language (XML) and HTTP, the diverse and heterogeneous applications on the Web (which typically already understand XML and HTTP) can access Web services and communicate with each other automatically.

Major benefits of Web services include:

- Interoperability among distributed applications that span diverse hardware and software platforms
- Easy, widespread access to applications through firewalls using Web protocols
- A cross-platform, cross-language data model (XML) that facilitates developing heterogeneous distributed applications

11.2 Anatomy of a Web Service

Web services are characterized by three factors:

- What they do (the business functionality they expose)
- How they can be accessed (the set of published interfaces necessary to use the exposed functionality)
- Where they are (the Web site which exposes that functionality)

What the Web service can do (that is, the functionality it implements) is described in a standard XML vocabulary called Web Services Description Language (WSDL). For example, a banking Web service may implement functions to check an account, print a statement, and deposit and withdraw funds. These functions are described in a WSDL

file that any consumer can invoke to access the banking Web service. As a result, a consumer does not have to know anything more about a Web service than the WSDL file that describes what it can do.

A Web service client (or consumer)--such as, a desktop application or a Java Platform, Enterprise Edition portlet-- invokes a Web service by submitting a request in the form of an XML document to the Web service. The Web service processes the request and returns the result to the Web service client in an XML document.

The Web service client can send a request in the form of a Simple Object Access Protocol (SOAP) message. SOAP is an XML messaging framework designed to allow heterogeneous applications to exchange structured information in a distributed environment. In turn, the Web service processes the request and returns the response in a SOAP message.

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

To secure the message exchange, the Web service may require credentials to access the service, for example a username and a password, or encrypt the response.

11.3 Web Service Standards

Web services rely on a set of XML-based industry standards, including the following:

- XML, a data format that allows uniform communication between Web services consumers and Web services providers
- XML Schema, a framework that describes XML vocabularies used in business transactions
- SOAP, a protocol for exchanging structured information in the implementation of Web services
- WSDL, an XML-based language providing a model for describing Web services
- WS-Policy, a framework that provides a flexible and extensible grammar for describing the capabilities, requirements, and general characteristics of Web services using policies

11.4 Roadmap for Web Services

Table 11–1 Roadmap for Web Services

Major Task	Subtasks and Additional Information
Learning more about WebLogic Web Services	■ Features and standards supported by WebLogic Web Services ■ Overview of WebLogic Web Services ■ Choose between JAX-WS and RESTful Web service ■ Overview of Web services security
Using the samples (for WebLogic Web service developers)	■ Sample application and code examples ■ JAX-WS Web service example ■ Examples of developing JAX-WS Web service clients ■ JAX-RPC Web service examples ■ JDeveloper Web service tutorials (search on "Web Services") ■ JDeveloper how-tos (search on "Web Services")
Developing Web services using JAX-WS	■ Starting from Java ■ Starting from WSDL ■ Programming the JWS file ■ Using JAX binding ■ Invoking a Web service ■ Invoking a Web service asynchronously ■ Using Web services reliable messaging ■ Managing Web service persistence ■ Configuring message buffering for Web services ■ Managing Web services in a cluster ■ Using Web services atomic transactions ■ Publishing a Web service endpoint ■ Using callbacks ■ Optimizing binary data transmissions using MTOM/XOP ■ Using XML catalogs ■ Handling exceptions using SOAP ■ Creating and using SOAP message handlers ■ Programming RESTful Web services ■ Programming stateful JAX-WS Web services using HTTP session

Table 11–1 (Cont.) Roadmap for Web Services

Major Task	Subtasks and Additional Information
Developing RESTful Web services	■ Standards to use for RESTful Web Service development on WebLogic Server ■ Learning about RESTful Web Service development ■ Defining the root resource class ■ Defining the relative URI of the root resource class ■ Customizing request and response message types ■ More advanced RESTful Web Service tasks ■ Creating and configuring a client instance ■ Creating a Web resource instance ■ Sending requests to the resource ■ Receiving a response from a resource ■ Learning more about monitoring RESTful Web Services ■ Monitoring RESTful Web Services using WLST ■ Updating the version of Jersey JAX-RS RI ■ Using server-sent events
Developing Web services using JAX-RPC	■ Starting from Java ■ Starting from WSDL ■ Programming the JWS file ■ Understanding data binding ■ Invoking a Web service ■ Invoking a Web service asynchronously ■ Using Web services reliable messaging ■ Creating conversational Web services ■ Using the asynchronous features together ■ Creating buffered Web services ■ Using callbacks to notify client of events ■ Using JMS transport as the connection protocol ■ Creating and using SOAP message handlers ■ Using database Web services
Deploying and administering WebLogic Web services	■ Packaging and deploying RESTful Web services ■ Developing JAX-WS Web services ■ Developing JAX-RPC Web services
Securing WebLogic Web services	■ Using WebLogic Web services security policies
Interoperability with WebLogic Web services	■ Interoperability with Microsoft WCF/.NET ■ Interoperability between WebLogic Web services security and Oracle WSM security

12 Enterprise JavaBeans (EJBs)

This chapter introduces Enterprise JavaBeans for WebLogic Server 12.1.3.

This chapter includes the following sections:

12.1 Understanding EJBs

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

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

12.1.1 EJB Documentation in WebLogic Server

For more information about using EJBs with WebLogic Server, see:

- For information about all the new features in EJB 3.1, see "Enterprise Java Beans (EJBs)" in *What's New in Oracle WebLogic Server*.
- For instructions on how to program, package, and deploy 3.1 EJBs on WebLogic Server, see *Developing Enterprise JavaBeans for Oracle WebLogic Server*.
- For instructions on how to organize and build WebLogic Server EJBs in a split directory environment, see *Developing Applications for Oracle WebLogic Server*.
- For more information on programming and packaging 2.x EJBs, see *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

12.1.2 Additional EJB Information

To learn more about EJB concepts, such as the benefits of enterprise beans, the types of enterprise beans, and their life cycles, then visit the following Web sites:

- Enterprise JavaBeans 3.1 Specification (JSR-318) at http://jcp.org/en/jsr/summary?id=318
- The "Enterprise Beans" chapter of the Java EE 6 Tutorial at http://docs.oracle.com/javaee/6/tutorial/doc/bnblr.html
- Introducing the Java EE 6 Platform: Part 3 (EJB Technology, Even Easier to Use) at http://www.oracle.com/technetwork/articles/javaee/javaee6overview-part3-139660.html#ejbeasy

12.1.3 Session EJBs Implement Business Logic

Session beans implement business logic. A session bean instance serves one client at a time. There are three types of session beans: stateful, stateless, and singleton.

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

12.1.3.1 Stateful Session Beans

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

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

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

12.1.3.2 Stateless Session Beans

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

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

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

12.1.3.3 Singleton Session Beans

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

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

Example: An Internet application that provides a central counter service. A stateless singleton bean can be called from a Java client, with the count being consistently incremented by 1 as the client is invoked multiple times.

12.1.4 Message-Driven Beans Implement Loosely Coupled Business Logic

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

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

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

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

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

12.2 EJB Anatomy and Environment

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

- Section 12.2.1, "EJB Components"
- Section 12.2.2, "The EJB Container"
- Section 12.2.3, "Embeddable EJB Container"
- Section 12.2.4, "EJB Metadata Annotations"

- Section 12.2.5, "Optional EJB Deployment Descriptors"

12.2.1 EJB Components

The composition of a bean varies by bean type. Table 12–1 defines the classes that make up each type of EJB, and defines the purpose of the class type.

> **Note:** The EJB 2.1 and earlier API required that Local and Remote clients access the stateful or stateless session bean by means of the session bean's local or remote home and the local or remote component interfaces. These interfaces remain available for use with EJB 3.x; however, the EJB 2.1 Remote and Local client view is not supported for singleton session beans.
>
> For more information see "Create EJB Classes and Interfaces" in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

Table 12–1 Components of EJB 3.1

EJB Component	Description	Stateless Session	Stateful Session	Singleton Session	MDB
Remote business interface	The remote business interface exposes business logic to remote clients—clients running in a separate application from the EJB. It defines the business methods a remote client can call.	Yes	Yes	Yes	No
Local business interface	The local business interface exposes business logic to local clients—those running in the same application as the EJB. It defines the business methods a local client can call.	Yes	Yes	Yes	No
Local No-interface	The no-interface view a variation of the Local view that exposes the public methods of the bean class without the use of a separate business interface.	Yes	Yes	Yes	Yes
Bean class	The bean class implements business logic.	Yes	Yes	Yes	Yes

12.2.2 The EJB Container

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

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

12.2.3 Embeddable EJB Container

Unlike traditional Java EE server-based execution, embeddable usage allows client code and its corresponding enterprise beans to run within the same virtual machine and class loader. This provides better support for testing, offline processing (for example, batch jobs), and the use of the EJB programming model in desktop applications.

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

For more information about the Embedded Enterprise Bean Container, see "Using an Embedded EJB Container in Oracle WebLogic Server" in *Developing Enterprise JavaBeans for Oracle WebLogic Server*.

12.2.4 EJB Metadata Annotations

The WebLogic Server EJB 3.1 programming model uses the Java EE 6 metadata annotations feature in which you create an annotated EJB 3.1 bean file, and then use the WebLogic compile tool `weblogic.appc` (or its Ant equivalent `wlappc`) to compile the bean file into a Java class file and generate the associated EJB artifacts, such as the required EJB interfaces and optional deployment descriptors.

For more information, see "Programming the Annotated EJB Class" in *Developing Enterprise JavaBeans for Oracle WebLogic Server*.

12.2.5 Optional EJB Deployment Descriptors

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

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

WebLogic Server EJB 2.x has three deployment descriptors:

- `ejb-jar.xml`—The standard Java EE deployment descriptor. All beans must be specified in an `ejb-jar.xml`. An `ejb-jar.xml` can specify multiple beans that will be deployed together.
- `weblogic-ejb-jar.xml`—WebLogic Server-specific deployment descriptor that contains elements related to WebLogic Server features such as clustering, caching, and transactions. This file is required if your beans take advantage of WebLogic Server-specific features. Like `ejb-jar.xml`, `weblogic-ejb-jar.xml` can specify multiple beans that will be deployed together.
- `weblogic-cmp-jar.xml`—WebLogic Server-specific deployment descriptor that contains elements related to container-managed persistence for entity beans. Entity beans that use container-managed persistence must be specified in a `weblogic-cmp-jar.xml` file.

For descriptions of the WebLogic Server EJB 2.x deployment descriptors, refer to "Deployment Descriptor Schema and Document Type Definitions Reference" in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

12.3 EJBs Clients and Communications

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

12.3.1 Accessing EJBs

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

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

Dependency injection is the simplest way of obtaining an enterprise bean reference. Clients that run within a Java EE server-managed environment, JavaServer Faces web applications, JAX-RS web services, other enterprise beans, or Java EE application clients, support dependency injection using the `javax.ejb.EJB` annotation.

Applications that run outside a Java EE server-managed environment, such as Java SE applications, must perform an explicit lookup. JNDI supports a global syntax for identifying Java EE components to simplify this explicit lookup. For more information see, "Programming Access to EJB Clients" in *Developing Enterprise JavaBeans for Oracle WebLogic Server*.

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

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

12.3.2 EJB Communications

WebLogic Server EJBs use:

- T3—To communicate with remote objects. T3 is a WebLogic-proprietary remote network protocol that implements the Remote Method Invocation (RMI) protocol.
- RMI—To communicate with remote objects. RMI enables an application to obtain a reference to an object located elsewhere in the network, and to invoke methods on that object as though it were co-located with the client on the same JVM locally in the client's virtual machine.

  An EJB with a remote interface is an RMI object. An EJB's remote interface extends `java.rmi.remote`. For more information on WebLogic RMI, see *Developing RMI Applications for Oracle WebLogic Server*.
- HTTP—An EJB can obtain an HTTP connection to a Web server external to the WebLogic Server environment by using the `java.net.URL` resource connection

factory. For more information, see "Configuring EJBs to Send Requests to an URL" in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

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

12.4 Securing EJBs

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

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

For more information about security and EJBs:

- "Security Fundamentals" in *Understanding Security for Oracle WebLogic Server* has introductory information about authentication, authorization and other security topics.
- "Securing Enterprise JavaBeans (EJBs)" in *Developing Applications with the WebLogic Security Service* provides instructions for configuring authentication and authorization for EJBs.
- *Securing Resources Using Roles and Policies for Oracle WebLogic Server* contains instructions for on configuring authentication and authorization for your EJBs using the WebLogic Server Administration Console.

12.5 Roadmap for EJBs in WebLogic Server

Table 12–2 Roadmap for EJBs in WebLogic Server

Major Task	Subtasks and Additional Information
Understanding EJB 3.1	■ Changes between versions 3.0 and 3.1 ■ New EJB 3.1 Features ■ WebLogic Server value-added EJB 3.0 features
Simple EJB examples	■ Example of a simple stateless EJB ■ Example of a simple stateful EJB ■ Example of an interceptor class ■ Packaged EJB 3.1 examples in WebLogic Server ■ Example of invoking an entity from a session bean
Iterative EJB developing	■ Overview of the EJB development process ■ Creating a source directory ■ Programming access to EJB clients ■ Programming and configuring transactions ■ Programming the EJB interface ■ Programming the EJB timer service ■ Programming the annotated EJB class ■ Programming optional interceptors ■ Compiling Java source code ■ Optionally creating and editing deployment descriptors ■ Packaging EJBs ■ Deploying EJBs
Programming the annotated EJB class	■ Overview of metadata annotations and EJB bean files ■ Programming the bean file: requirements and changes from 2.x ■ Programming the bean file: typical steps ■ Complete list of metadata annotations by function
Deployment guidelines for EJBs	■ Before you deploy an EJB ■ Understanding and performing deployment tasks ■ Deployment guidelines for EJBs
Using an embedded EJB container in Oracle WebLogic Server	■ Overview of the embeddable EJB container ■ EJB 3.1 Lite functionality supported in the embedded EJB container
Configuring the Persistence Provider in Oracle WebLogic Server	■ Overview of Oracle TopLink ■ Specifying a persistence provider ■ Using Oracle TopLink in Oracle WebLogic Server ■ Using a newer version of OpenJPA in Oracle WebLogic Server ■ Using JPA 2.1 with Oracle TopLink in WebLogic Server

Table 12–2 (Cont.) Roadmap for EJBs in WebLogic Server

Major Task	Subtasks and Additional Information
Reference	■ EJB metadata annotations reference
Using Oracle Kodo with Oracle WebLogic Server **Note:** Oracle TopLink, a JPA 2.0 persistence provider, is now the default JPA provider, replacing Kodo, which was the default provider in previous releases. For more information, see "Configuring the Persistence Provider in Oracle WebLogic Server."	■ Overview of Oracle Kodo ■ Creating an Oracle Kodo application ■ Using different Oracle Kodo versions ■ Configuring persistence ■ Deploying an Oracle Kodo application ■ Configuring an Oracle Kodo application ■ Kodo Persistence configuration schema reference
Information about EJB 2.x	■ *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*

13

Monitoring, Diagnosing, and Troubleshooting

This chapter describes monitoring, diagnosing, and troubleshooting in WebLogic Server 12.1.3.

This chapter includes the following sections:

13.1 WebLogic Server Diagnostics Framework

The WebLogic Diagnostics Framework (WLDF) is a monitoring and diagnostic framework that defines and implements a set of services that run within WebLogic Server processes and participate in the standard server life cycle. Using WLDF, you can create, collect, analyze, archive, and access diagnostic data generated by a running server and the applications deployed within its containers. This data provides insight into the run-time performance of servers and applications and enables you to isolate and diagnose faults when they occur.

WLDF includes several components for collecting and analyzing data:

- Integration with JavaHotSpot—If WebLogic Server is configured with Java HotSpot VM, WebLogic Server events can optionally be propagated to the Java Flight Recorder, a performance monitoring and profiling tool. WebLogic Server provides specific integration points with Java Flight Recorder:
  - WebLogic Server events are propagated to Java Flight Recorder for inclusion in a common data set for runtime or post-incident analysis.
  - The flight recording data is also included in WLDF diagnostic image captures, enabling you to capture flight recording snapshots based on WLDF watch rules. This full set of functionality enables you to capture and analyze runtime system information for both the JVM and the Fusion Middleware components running on it, in a single view
- Diagnostic Image Capture—Creates a diagnostic snapshot from the server that can be used for post-failure analysis. The diagnostic image capture includes Java Flight Recorder data, if it is available, that can be viewed in Java Mission Control.

- Built-in Diagnostic Modules—Provide a simple and easy-to-use mechanism for performing basic health and performance monitoring of a WebLogic Server instance. The built-in diagnostic modules collect data from key WebLogic Server run-time MBeans that monitor the main components of a server instance, such as the WebLogic Server run-time, JDBC, JMS, and Java EE containers hosting servlets and EJBs.
- Archive—Captures and persists data events, log records, and metrics from server instances and applications.
- Instrumentation—Adds diagnostic code to WebLogic Server instances and the applications running on them to execute diagnostic actions at specified locations in the code. The Instrumentation component provides the means for associating a diagnostic context with requests so they can be tracked as they flow through the system. The WebLogic Server Administration Console includes a Request Performance page, which shows real-time and historical views of method performance information that has been captured through the WLDF instrumentation capabilities, serving as a tool that can help identify performance problems in applications.
- Harvester—Captures metrics from run-time MBeans, including WebLogic Server MBeans and custom MBeans, which can be archived and later accessed for viewing historical data.
- Watches and Notifications—Provides the means for monitoring server and application states and sending notifications based on criteria set in the watches.
- Monitoring Dashboard—The Monitoring Dashboard provides views and tools for graphically presenting diagnostic data about servers and applications running on them. The underlying functionality for generating, retrieving, and persisting diagnostic data is provided by the WebLogic Diagnostics Framework. The Monitoring Dashboard provides additional tools for presenting that data in charts and graphs.

  The diagnostic data displayed by the Monitoring Dashboard consists of runtime MBean attributes with numeric or Boolean values that are useful to measure, either as their current values or as their changes over time. These values, referred to in the Monitoring Dashboard as metrics, originate from one or more runtime MBean instances from one or more servers in the domain.

WLDF provides a set of standardized application programming interfaces (APIs) that enable dynamic access and control of diagnostic data, as well as improved monitoring that provides visibility into the server. Independent Software Vendors (ISVs) can use these APIs to develop custom monitoring and diagnostic tools for integration with WLDF.

WLDF enables dynamic access to server data through standard interfaces, and the volume of data accessed at any given time can be modified without shutting down and restarting the server.

13.2 Logging Services

WebLogic logging services provide facilities for writing, viewing, filtering, and listening for log messages. These log messages are generated by WebLogic Server instances, subsystems, and Java EE applications that run on WebLogic Server or in client JVMs. WebLogic Server subsystems use logging services to provide information about events such as the deployment of new applications or the failure of one or more subsystems. A server instance uses them to communicate its status and respond to

specific events. For example, you can use WebLogic logging services to report error conditions or listen for log messages from a specific subsystem.

By default, WebLogic logging services use an implementation based on the Java Logging APIs. However, you can reconfigure WebLogic logging services to use Log4j instead. In addition, WebLogic Server also provides the Server Logging Bridge, which provides a lightweight mechanism for applications that currently use Java Logging or Log4J Logging to have their log messages redirected to WebLogic logging services. Applications can use the Server Logging Bridge with their existing configuration; no code changes or programmatic use of the WebLogic Logging APIs is required.

13.3 SNMP Support

With SNMP, a manager sends a request for information about managed resources to an agent. The agent gathers the requested data and returns a response. You can also configure agents to issue unsolicited reports (notifications) to managers when they detect predefined thresholds or conditions on a managed resource.

To request data about a specific managed resource, a manager must be able to uniquely identify the resource. In SNMP, each type of managed resource is described in a Management Information Base (MIB) as a managed object with a unique object identifier (OID). Individual organizations define their specific managed objects in MIB modules. Both manager and agent must have access to the same MIB module to communicate about specific managed resources.

13.4 Custom JMX Applications

To integrate custom management systems with the WebLogic Server management system, WebLogic Server provides standards-based interfaces that are fully compliant with the Java Management Extensions (JMX) specification. Software vendors can use these interfaces to monitor WebLogic Server MBeans, to change the configuration of a WebLogic Server domain, and to monitor the distribution (activation) of those changes to all server instances in the domain. While JMX clients can perform all WebLogic Server management functions without using Oracle's proprietary classes, Oracle recommends that remote JMX clients use WebLogic Server protocols (such as T3) to connect to WebLogic Server instances.

13.5 Java EE Management APIs

The Java EE Management specification describes a standard data model for monitoring and managing the run-time state of any Java EE Web application server and its resources. It includes standard mappings of the model through a Java EE Management EJB Component (MEJB).

The Java EE Management APIs enable a software developer to create a single Java program that can discover and browse resources, such as JDBC connection pools and deployed applications, on any Java EE Web application server. The APIs are part of the Java EE Management Specification, which requires all Java EE Web application servers to describe their resources in a standard data model.

13.6 Roadmap for Monitoring, Diagnosing, and Troubleshooting in WebLogic Server

Table 13–1 Roadmap for Monitoring, Diagnosing, and Troubleshooting in WebLogic Server

Major Task	Subtasks and Additional Information
Learning more about WLDF components	■ Data creation, collection, and instrumentation ■ Archive ■ Watch and notification ■ Data accessor ■ Monitoring dashboard and request performance pages ■ Diagnostic image capture ■ Understanding WLDF configuration
Learning more about WebLogic logging services	■ Use WebLogic logging services for your application logging ■ Using message catalogs with WebLogic Server ■ Logging components and environment ■ Terminology ■ Overview of the logging process ■ Best practices for integrating Java logging or Log4j with WebLogic logging services ■ Server log files and domain log files ■ Server and subsystem logs ■ Log message format ■ Message attributes ■ Message severity ■ Viewing WebLogic logging services ■ Configuring WebLogic logging services ■ Filtering WebLogic Server log messages ■ Subscribing to messages ■ Using the Server Logging Bridge
Using the Monitoring Dashboard	■ About the monitoring dashboard interface ■ Understanding how metrics are collected and presented ■ The parts of a chart

Table 13–1 (Cont.) Roadmap for Monitoring, Diagnosing, and Troubleshooting in WebLogic Server

Major Task	Subtasks and Additional Information
Using SNMP with WebLogic Server	■ WebLogic Server SNMP agents ■ Security for SNMP ■ MIB module for WebLogic Server ■ Monitoring custom MBeans ■ WebLogic Server notifications ■ SNMP proxies ■ WebLogic SNMP command-line utility
Creating JMX applications to manage WebLogic Server	■ Developing custom management utilities with JMX ■ Developing manageable applications with JMX ■ Programming WebLogic deployment
Learning more about the Java EE Management APIs	■ JMO hierarchy ■ JMO object names ■ Optional features of JMOs ■ Accessing JMOs ■ Accessing the MEJB on WebLogic Server ■ WebLogic Server extensions

14 Sample Applications and Code Examples

This chapter describes code examples and sample applications that offer several approaches to learning about and working with WebLogic Server 12.1.3. These examples and sample applications are available through performing a custom installation and selecting to install the Server Examples.

This chapter includes the following sections:

14.1 Overview

This section provides an overview of installing and using the WebLogic Server code examples.

This section contains the following topics:

14.1.1 Installing the WebLogic Server Code Examples

When performing an installation of WebLogic Server, select the **Complete Installation** type to obtain the WebLogic Server and Coherence examples. For more information about installing WebLogic Server, see *Installing and Configuring Oracle WebLogic Server and Coherence*.

If you do not automatically launch the Quickstart Configuration Wizard from the installation program, but instead choose to configure the code examples and sample domains later, you can run the QuickStart Configuration Wizard manually. For more information, see "Running the QuickStart Configuration Wizard" in *Creating WebLogic Domains Using the Configuration Wizard*.

14.1.2 Starting the WebLogic Server Samples Domain

Start the examples server using one of the following procedures. In these procedures, *DOMAIN_HOME* represents the location where the samples domain is configured on your machine; for example, `C:\ORACLE_HOME\user_projects\domains`.

On Windows: Use a command shell and navigate to the *DOMAIN_HOME*`\wl_server` directory. Enter the following command:

```
startWebLogic.cmd
```

On UNIX Bourne Shell: Navigate to the *DOMAIN_HOME*`/wl_server` directory. Enter the following command:

```
sh ./startWebLogic.sh
```

Note: By default, the examples server uses port 7001 to listen for incoming connections. The MedRec server also uses the same listen port by default, which means that you cannot run both domains at the same time without changing one of the listen ports. If you want to run both domains at the same time, use the Oracle WebLogic Server Administration Console to change the listen port of the examples server to something other than 7001, and then restart it. You can then run the MedRec server using its default listen port at the same that you run the examples server.

14.1.3 Running the WebLogic Server Code Examples

Review the instructions provided with the code examples for information about building, deploying and running the code examples. When you start the WebLogic Server samples domain, a browser is automatically launched that displays a Web page from which you can browse the samples and obtain instructions for building, deploying, and running them.

14.2 Conventions

The following conventions are used throughout the instructions for the WebLogic Server code examples:

- The instructions generally are for Windows command shells. If you are using a UNIX or Linux-based shell, substitute `/` for `\` in path names.
- *ORACLE_HOME* represents the directory you specified as the Oracle Home when you installed WebLogic Server; for example, `C:\Oracle\Middleware\Oracle_Home`.
- *WL_HOME* represents the top-level installation directory for Oracle WebLogic Server. The default path is *ORACLE_HOME*`/wlserver`. (However, you are not required to install WebLogic Server in the Oracle Home directory.)
- *EXAMPLES_HOME* represents the directory in which the WebLogic Server code examples are configured. The default path is *ORACLE_HOME*`\user_projects\applications`.
- *DOMAIN_HOME* represents the directory in which the WebLogic Server sample domains are configured. The default path is *ORACLE_HOME*`\user_projects\domains`.

Source files for the code examples are separated from the domain configuration files, just as they should be in a real-world scenario. They are installed in the *EXAMPLES_HOME* directory.

The *DOMAIN_HOME*\wl_server directory contains the WebLogic Server examples domain; it contains your applications and the XML configuration files that define how your applications and Oracle WebLogic Server will behave, as well as startup and environment scripts.

The *EXAMPLES_HOME*\wl_server\examples\build directory contains client and server classes required by the examples and Derby database.

The *WL_HOME*\common\derby directory contains Derby, a demonstration database that the examples are configured to use. It also contains scripts that start and stop the database. For more information about Derby, see http://db.apache.org/derby.

14.3 Java EE New Examples

These code examples demonstrate new features for JAX-RS 2.0, JPA 2.1, and WebSocket 1.0. The examples are grouped in the following categories:

- JAX-RS 2.0: Uses and introduces asynchronous processing, filter and interceptor, and Server-Sent Events (SSE) Jersey support.
- JPA 2.1: Uses the Criteria Update and Criteria Delete API and the Stored Procedures API
- WebSocket: Demonstrates processing JSON-format data, using CDI and EJBs in WebSocket endpoints, enabling a server to echo text sent by a client, and enabling fallback to HTTP long polling as an alternative for WebSocket messaging.

14.4 Java EE 6 Examples

Oracle WebLogic Server fully supports the Java Platform, Enterprise Edition (Java EE) 6 specification. The Java EE 6 examples demonstrate how to implement Java EE 6 APIs and Oracle WebLogic Server-specific features. The examples are grouped in the following categories:

- Bean Validation: Use bean validation with JPA entities, JPA from Java SE, and JSF managed beans.
- Context and Dependency Injection (CDI): Introduces CDI with type-safe dependency injection, interceptors, and producers.
- Data Source: Use the `@DataSourceDefinition` annotation.
- EJB 3.1: Use asynchronous methods, a calendar-based timer, simplified programming model and packaging in a WAR file, portable global JNDI names, and singleton session beans.
- Java API for RESTful Web Services (JAX-RS) 1.1: Build RESTful Web services with JAX-RS.
- Java EE Connector Architecture 1.6: Use the Java EE Connector Architecture to connect two applications together using a stock trading application.
- JPA 2.0: Use the JPA Criteria Query API and the `@ElementCollection` mapping type.
- JSF 2.0: Incorporate Ajax in Web applications, create bookmarkable Web applications, and use Facelets and templating.

- Servlet 3.0: Use annotations for servlets, filters, and listeners, handle file uploads with multipart files, and use asynchronous servlet and request handling, programmatic security, and servlet Web fragments.

14.5 Additional API Examples

These examples demonstrate how to implement additional Java EE APIs and Oracle WebLogic Server-specific features. The examples are grouped in the following categories:

- Database Connectivity: Use DataSources, MultiDataSources, and Rowsets.
- EJB: Create stateless, stateful, entity, and message-driven EJBs, and more.
- Internationalization: Internationalize an application using simple message catalogs.
- Messaging: Use JMS topics, queues, and message-driven beans.
- Resource Adapter: Use an entity EJB to interact with a Java EE Connector Architecture resource adapter.
- Security: Use the Java Authentication and Authorization Service, SAML, and outbound and two-way SSL.
- Transactions: Use JTA to perform distributed transactions using the two phase commit protocol across two XA resources.
- Web Application: Create simple servlets and JSPs, use the HTTP Publish-Subscribe server, and more.
- Web Services: Create a variety of Web Services using JWS annotations.
- XML: Use the STAX API and XMLBeans
- Cluster: Cluster an EJB and use HTTP session state replication.
- Coherence: Use the Coherence container to host Coherence applications
- WebLogic Scripting Tool: Use the WebLogic Scripting Tool (WLST) to configure and manage a running WebLogic Administration Server.
- Split Development: Use the WebLogic split development directory structure to build, package, and deploy Enterprise Applications.
- Service Component Architecture: Use WebLogic SCA, a lightweight Spring 2.5 (or higher) container, in a shopping cart application that demonstrates many of its key features.
- Spring: Use Spring-simplified configuration in a Spring-based Web application.

14.6 Avitek Medical Records

Avitek Medical Records (or "MedRec") is a comprehensive educational sample application that demonstrates WebLogic Server and Java EE features, as well as best practices. Avitek Medical Records is optionally installed with the WebLogic Server installation. You can start MedRec from the *ORACLE_HOME*`/user_projects/domains/medrec` directory, where *ORACLE_HOME* is the directory you specified as the Oracle Home when you installed Oracle WebLogic Server.

The sample application, MedRec (Spring) demonstrates Spring 3.0.x application development practices.

14.7 Derby Open-Source Database

Derby is an open source relational database management system based on Java, JDBC, and SQL standards. It is bundled with WebLogic Server for use by the sample applications and code examples as a demonstration database. For more information about Derby, see http://db.apache.org/derby.

15

WebLogic Server Compatibility

This chapter describes WebLogic Server 12.1.3 compatibility.

Oracle attempts to support binary and source-level compatibility between WebLogic Server 12*c* (12.1.3) and versions 10.3, 10.3.x, 12.1.1, and 12.1.2 in the areas of persistent data, generated classes, and API compatibility. In some cases, it is impossible to avoid incompatibilities. Where incompatibilities arise, they are fully documented in the *Upgrading Oracle WebLogic Server*.

This chapter includes the following sections:

15.1 Java EE 6 Compatibility

WebLogic Server 12*c* (12.1.3) is Java EE 6 compatible. This compatibility allows a Java EE 6 compliant application to be developed on one operating system platform, and deployed for production on another, without requiring Java EE 6 application code changes. Oracle ensures this compatibility of Java EE 6 application portability within a WebLogic Server release level.

15.2 Generated Classes Compatibility

With one exception, upgrading to WebLogic Server 12*c* (12.1.3) does not require you to recompile applications in order to create new generated classes.

The current version of the EJBGen utility recognizes only JDK 5.0 or later metadata annotation-style EJBGen tags and not the old Javadoc-style tags. This means that source files that use the Javadoc-style tags must be upgraded to use the equivalent annotation, and then recompiled using the updated version of EJBGen.

15.3 Compatibility Within a Domain

The following topics provide key information regarding compatibility within WebLogic domains:

- WebLogic Version Compatibility
- Hardware, Operating System, and JVM Platform Compatibility
- Node Manager Compatibility

15.3.1 About WebLogic Server Version Numbers

Within a WebLogic domain, the Administration Server, Managed Server instances, and the domain itself each have a WebLogic Server version number. The version number contains five decimal places, for example WebLogic Server 12.1.3.0.0. The meaning of each decimal place is described below:

- The first two decimal places together describe the Major Version number, for example "12.1" in **12.1**.3.0.0. The WebLogic Server 12.1 Major Version release is also branded as the WebLogic Server 12*c* Major Version release.
- The first three decimal places together describe the Minor Version number, for example "12.1.3" in **12.1.3**.0.0. WebLogic Server 12.1.1 (or 12.1.1.0.0) was the first Minor Version release of the WebLogic Server 12.1 Major Version release. WebLogic Server 12.1.2 (or 12.1.2.0.0) is the second Minor Version release of the WebLogic Server 12.1 Major Version release.
- According to the version conventions, a Patch Set release for WebLogic Server 12.1.3.0.0 would increment the fourth decimal place, for example **12.1.3.1**.0. However, as of WebLogic Server 12.1.3, there are no specific plans for a Patch Set release. This information is provided for definitional purposes only.
- Patch Set Update releases are named uniquely by incrementing the fifth decimal place, for example **12.1.3.0.1**. This convention is used for Patch Set Update naming purposes, for example naming downloads available on My Oracle Support. However, the application of a Patch Set Update does not change the version number of an existing WebLogic Server installation as referenced in the oraInventory used by WebLogic Server 12.1.3 installers.

You can obtain the version number and Patch Set level of a WebLogic Server instance or domain several different ways. For example:

- For an Administration Server or Managed Server instance, you can view the version message sent to `stdout` when the server is started. For example:

```
<Version: WebLogic Server 12.1.3.0.0  Sun Jun 3 Sun Jan 12 00:23:18
 PST 2014 1573558 >
```

- For a domain, you can view the value of the `<domain-version>` element in the domain configuration file, `config.xml`. For example:

```
<domain-version>12.1.3.0.0</domain-version>
```

15.3.2 WebLogic Version Compatibility

Within a WebLogic domain, the Administration Server, all Managed Server instances, and the WebLogic domain must be at the same WebLogic Server Major and Minor Version. This means that in WebLogic Server 12.1.3, the Administration Server, Managed Servers, and the WebLogic domain must all be at version 12.1.3. Note the following guidelines for maintaining consistency in Patch Set Update and Interim or One-off Patch levels within a domain.

Note: Versions of WebLogic Server prior to 12.1.2 have slightly different compatibility allowances regarding specific WebLogic Server versions that are supported in a given domain. For information, see *Upgrading Oracle WebLogic Server*.

- In general, the best practice is for all server instances within a domain to be at the same Patch Set Update (PSU) and Interim or One-off Patch level during steady-state operation. However, there may be cases where server instances are required to run at different PSUs and Interim or One-off Patch levels within a domain. The primary examples include:
  - When applying PSUs, Interim or One-off Patches in rolling fashion across server instances in the domain. In such cases, the maintenance should be applied to the Administration Server first, so that the Administration Server is at the same PSU and Interim or One-off Patch level (or higher) than its Managed Servers. For information, see "About Rolling Upgrade" in *Upgrading Oracle WebLogic Server*.
  - When there are specific requirements to run Managed Servers within a domain at different PSU and Interim or One-off Patch levels in steady-state operation. In such cases, the Administration Server should be at the highest PSU level, so that the Administration Server is at the same PSU level or higher than all of the Managed Servers. If Managed Servers within a domain are running with different Interim or One-off Patches, it will not be possible to apply a consistent set of Interim or One-off Patches to the Administration Server. Because this maintenance complexity may be difficult to manage, the general best practice is to use the same PSU and Interim or One-off Patch level across all servers in the domain.
- Server instances within a cluster or domain can run on any hardware and operating systems as long as the hardware and operating systems are listed on the Oracle Fusion Middleware Supported System Configurations page on Oracle Technology Network. However, note that running clustered Managed Server instances on different hardware and operating systems may impact load balancing and performance. In general, the best practice is to run all Managed Servers within a cluster on the same hardware and operating system.
- If the WebLogic domain is part of an Oracle Enterprise Manager Cloud Control installation, additional requirements exist regarding the combinations of hardware, operating system, and JVMs, that may be configured in the domain. For more information, see *Oracle Enterprise Manager Cloud Control Administrator's Guide*.

For more information about WebLogic domains, see *Understanding Domain Configuration for Oracle WebLogic Server* (note especially the section "Domain Restrictions," which provides additional details about domain compatibility).

15.3.3 Hardware, Operating System, and JVM Platform Compatibility

WebLogic Server instances within a domain can run on any hardware, operating system, and JVM platform as long as the hardware, operating systems, and JVMs are supported for the current version of WebLogic Server. For details, see the Oracle Fusion Middleware Supported System Configurations page on the Oracle Technology Network.

Important: Although this platform compatibility support extends to Managed Server instances within a cluster, Oracle strongly recommends that clusters be homogeneous with respect to the underlying hardware, operating system, and JVM. Managed Server instances running in the same cluster are assumed to be equivalent, so running clustered server instances on mixed platforms may have a negative impact on load balancing and performance. If you must operate a cluster on a mixed platform, Oracle strongly recommends that you understand the load balancing and performance implications.

15.3.4 Node Manager Compatibility

As a best practice, Oracle recommends that the version of Node Manager used in a WebLogic domain should match the version of the Administration Server.

If you are running a version of WebLogic Server prior to 12.1.2, see *Upgrading Oracle WebLogic Server* for additional Node Manager compatibility information that may be applicable to your environment. For more information about Node Manager compatibility, see *Administering Node Manager for Oracle WebLogic Server*.

15.4 Persistent Data Compatibility

When moving from WebLogic Server 10.0 to 12*c* (12.1.3), there are changes required to configuration files. Upgrade tooling in WebLogic Server 10.0 and later automatically converts the configuration files for you.

15.5 API Compatibility

WebLogic Server 10.0, 10.3.x, 12.1.1, and 12.1.2 applications deployed on WebLogic Server 12*c* (12.1.3) will function without modification. Exceptions to this rule include cases where APIs were deprecated in prior WebLogic Server releases and removed, or where API behavior was changed in order to conform to a specification or to fix incorrect behavior. In certain circumstances, a correction may cause your application to behave differently.

15.6 Protocol Compatibility

Interoperability between WebLogic Server 12*c* (12.1.3) and WebLogic Server 10.0, 10.3.x, 12.1.1, and 12.1.2 is supported in the following scenarios:

- A WebLogic Server 10.0, 10.3.x, 12.1.1, and 12.1.2 client can invoke RMI-based applications hosted on a WebLogic Server 12*c* (12.1.3) server using IIOP, T3, T3S, HTTP, and HTTPS. JMS applications can be invoked using T3, T3S, HTTP, and HTTPS.
- A WebLogic Server 12*c* (12.1.3) client can invoke RMI-based applications hosted on a WebLogic Server 10.0, 10.3.x, 12.1.1, and 12.1.2 server using IIOP, T3, T3S, HTTP, and HTTPS. JMS applications can be invoked using T3, T3S, HTTP, and HTTPS.
- A WebLogic Proxy Plug-In can proxy to the latest patch set release of a 10.0, 10.3.x, 12.1.1, and 12.1.2 server.