BEA WebLogic Server®

Understanding Domain Configuration

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CHAPTER 1

Introduction and Roadmap

This document describes WebLogic Server® domains and how they are configured. A domain is the basic administration unit for WebLogic Server. A domain consists of one or more WebLogic Server instances (and their associated resources) that you manage with a single Administration Server.

The following sections describe the contents and organization of this guide—*Understanding Domain Configuration*.

Document Scope and Audience

This document is written mainly for J2EE system architects, application developers, and system administrators who are developing or deploying Web-based applications on one or more WebLogic server domains.

The topics in this document are relevant during the design and development phases of a software project. This document does not address production phase administration, monitoring, or performance tuning topics. For links to WebLogic Server documentation and resources for these topics, see "Related Documentation" on page 1-2.

It is assumed that the reader is familiar with J2EE, basic concepts of XML, and general networking and application management concepts.

Guide to this Document

- This chapter, "Introduction and Roadmap", introduces the purpose, organization, and context of this guide.
- Chapter 2, "Understanding WebLogic Server Domains," introduces WebLogic Server domains.
- Chapter 3, "Domain Configuration Files," describes the configuration and directories that maintain the on-disk representation of a domain and its contents.
- Chapter 4, "Managing Configuration Changes," describes change management features in WebLogic Server.

Related Documentation

For information about system administration tasks and the various tools you can use to perform them, see:

- the System Administration documentation page
- *Overview of WebLogic Server System Administration*
- *Monitoring and Managing with the J2EE Management APIs*
- *WebLogic Server MBean Reference*
- *WebLogic SNMP Management Guide*

For more detailed information about tools you can use to create and configure WebLogic Server domains, see:

- *Creating WebLogic Domains Using the Configuration Wizard*
- *WebLogic Scripting Tool*
- *Developing Custom Management Utilities with JMX*
- *WebLogic Server Command Reference*
- *Administration Console Online Help*

For a reference to the XML Schema used to persist domain configuration in WebLogic Server, see the *WebLogic Server Domain Configuration Schema Reference*.

WebLogic Server 9.0 introduced several new and important changes to WebLogic Server domain configuration. For more information, see *What's New in WebLogic Server 9.0*.

Samples and Tutorials

In addition to this document, BEA Systems provides code samples and tutorials that are relevant to domain configuration and administration.

The BEA WebLogic Server Examples are optionally installed at *WL_HOME*`/samples/server/examples/src/examples`, where *WL_HOME* is the top-level directory of your WebLogic Server installation. These examples are also available from the Start menu on Windows machines. These examples include:

- WebLogic Scripting Tool Online Scripts example, which shows how to use the WebLogic Scripting Tool (WLST) to interact and configure a running WebLogic Administration server.
- The Clustering example, which leads you through the process of creating and configuring a new cluster of server instances in a domain using the WebLogic Configuration Wizard and Administration Console.

The Avitek Medical Records Sample Application is a WebLogic Server sample application suite that concisely demonstrates all aspects of the J2EE platform. It includes:

- a demonstration of the use of JMX to extend a security realm

CHAPTER 2

Understanding WebLogic Server Domains

The following sections introduce WebLogic Server domains and their contents:

What Is a Domain?

A WebLogic Server administration **domain** is a logically related group of WebLogic Server resources. Domains include a special 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 WebLogic Server instances called **Managed Servers**. You deploy Web applications, EJBs, and other resources onto the Managed Servers and use the Administration Server for configuration and management purposes only.

Multiple Managed Servers can be grouped into **clusters**, which enable you to balance loads and provide failover protection for critical applications, while using a single Administration Server simplifies the management of the Managed Server instances.

System administration in WebLogic Server is based on the J2EE Management model, in which each instance of a Web application server resource type is represented by a J2EE Managed Object (JMO). In WebLogic Server, each JMO is a wrapper for a corresponding MBean. You accomplish many WebLogic Server administration tasks by accessing MBeans, either directly

using JMX, or through a JMX client like the WebLogic Administration Console or WebLogic Scripting Tool (WLST). For more information, see *Monitoring and Managing with the J2EE Management APIs* and *WebLogic Server MBean Reference*.

Organizing Domains

How you organize your 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 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.
- Size. You might find that domains organized in small units that 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.

A domain can consist of an Administration Server and one or more Managed Servers, or of a single standalone server that both acts as Administration Server and runs deployed applications.

- **Domain with Separate Managed Servers**: A simple production environment can consist of a domain with several Managed Servers that host applications, and an Administration Server to perform management operations. In this configuration, applications and resources are deployed to individual Managed Servers; similarly, clients that access the application connect to an individual Managed Server.

  Production environments that require increased application performance, throughput, or availability should configure two or more of Managed Servers as a cluster. Clustering allows multiple Managed Servers to operate as a single unit to host applications and resources. For more information about the difference between standalone and clustered Managed Servers, see "Managed Servers and Managed Server Clusters" on page 2-5.

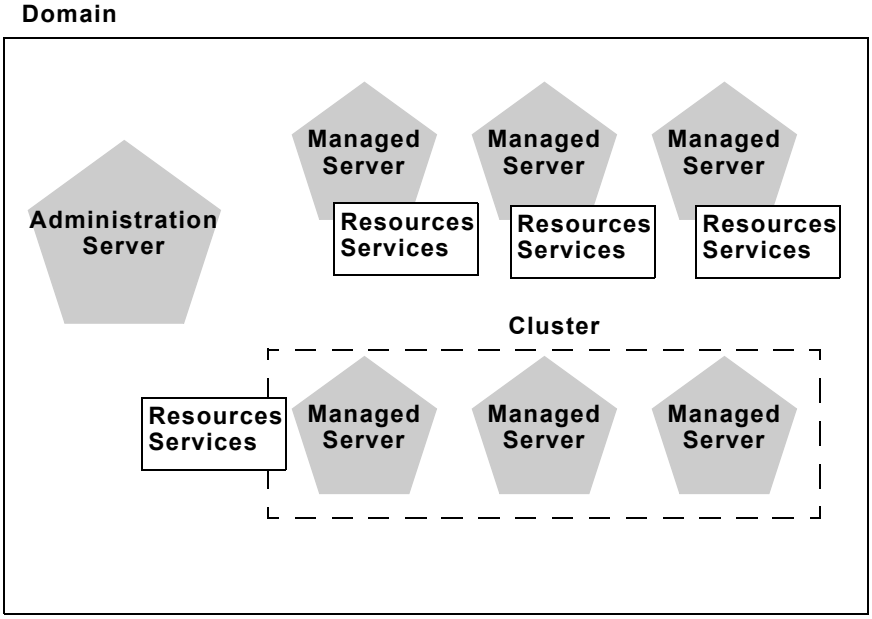
- **Standalone Server Domain**: For development or test environments, you may want to deploy a single application and server independently from servers in a production domain. In this case, you can deploy a simple domain consisting of a single server instance that acts as an Administration Server, and also hosts the applications you are developing. The `wl_server` domain that you can install with WebLogic Server is an example of a standalone server domain.

Note: In production environments, BEA recommends that you deploy applications only on Managed Servers in the domain; the Administration Server should be reserved for management tasks.

Contents of a Domain

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

The following figure shows a production environment that contains an Administration Server, three standalone Managed Servers, and a cluster of three Managed Servers.



Administration Server

Each WebLogic Server domain must have one server instance that acts as the Administration Server. You use the Administration Server, programmatically or through the Administration Console or WLST, to configure all other server instances and resources in the domain.

Role of the Administration Server

Before you start the Managed Servers in a domain, you start the Administration Server. When you start a standalone or clustered Managed Server, it contacts the Administration Server for its configuration information. In this way, the Administration Server operates as the central control entity for the configuration of the entire domain.

When the Administration Server starts, it loads the `config.xml` file for the domain. Unless you specify another directory when you create a domain, `config.xml` is stored in:

BEA_HOME`/user_projects/domains/`*mydomain*`/config`

where *mydomain* is a domain-specific directory, with the same name as the domain. The `config.xml` file refers to other configuration files, which are located in subdirectories of the domain's `config` directory.

Each time the Administration Server starts successfully, a backup configuration file named `config-booted.jar` is created in the domain directory. In the unlikely event that the configuration files should be corrupted during the lifetime of the server instance, it is possible to revert to this previous configuration.

What Happens if the Administration Server Fails?

The failure of an Administration Server for a domain does not affect the operation of Managed Servers in the domain. If an Administration Server for a domain becomes unavailable while the server instances it manages—clustered or otherwise—are up and running, those Managed Servers continue to run. If the domain contains clustered server instances, the load balancing and failover capabilities supported by the domain configuration remain available, even if the Administration Server fails. If an Administration Server stops running while the Managed Servers in the domain continue to run, each Managed Server periodically attempts to reconnect to the Administration Server.

If an Administration Server fails because of a hardware or software failure on its host machine, other server instances on the same machine may be similarly affected. However, the failure of an Administration Server itself does not interrupt the operation of Managed Servers in the domain. Also, you can start a Managed Server even if the Administration Server is not running. In this

case, the Managed Server uses a local copy of its configuration files for its starting configuration and then periodically attempts to connect with the Administration Server. When it does connect, it synchronizes its configuration state with that of the Administration Server.

For instructions on re-starting an Administration Server, see Avoiding and Recovering From Server Failure in *Managing Server Startup and Shutdown*.

Managed Servers and Managed Server Clusters

In a domain, server instances other than the Administration Server are referred to as Managed Servers. Managed Servers host the components and associated resources that constitute your applications—for example, JSPs and EJBs. When a Managed Server starts up, it connects to the domain's Administration Server to obtain configuration and deployment settings.

Note: Managed Servers in a domain can start up independently of the Administration Server if the Administration Server is unavailable. See "Managed Server Independence Mode" in Managing Server Startup and Shutdown for more information.

Two or more Managed Servers can be configured as a WebLogic Server *cluster* to increase application scalability and availability. In a WebLogic Server 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 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 a WebLogic Server cluster, see "Understanding WebLogic Server Clustering" in *Using WebLogic Server Clusters.*

Resources and Services

In addition to the Administration Server and Managed Servers, a domain also contains the resources and services required by Managed Servers and hosted applications deployed in the domain.

The domain configuration includes information about the networked computer environment in which the domain runs, such as:

- Machine definitions 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 Using Node Manager to Control Servers in *Managing Server Startup and Shutdown*.

- Network channels, an optional resource that can be used to define default ports, protocols, and protocol settings. 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 *Configuring WebLogic Server Environments*.

The domain configuration also includes information about resources and services associated with applications hosted on the domain. Examples of these resources and services include:

- application components, such as EJBs
- security providers
- resource adapters
- JDBC data sources
- JMS servers or other messaging resources
- store-and-forward service
- persistent store
- startup classes
- diagnostics and monitoring services

Resources and services can be limited to one or more Managed Servers in the domain, rather than being available to the domain as a whole. You can deploy resources and services to selected Managed Servers or to a cluster.

Domain Restrictions

A WebLogic Server environment may consist of a single domain that includes all the Managed Servers required to host applications, or multiple domains. You might choose to create multiple domains divided by organizational units, system administrator responsibilities, application boundaries, or other considerations. In designing your domain configuration, note the following restrictions:

- Each domain requires its own Administration Server for performing management activities. When you use the Administration Console to perform management and monitoring tasks, you can switch back and forth between domains, but in doing so, you are connecting to different Administration Servers.

- All Managed Servers in a cluster must reside in the same domain; you cannot split a cluster over multiple domains.
- All Managed Servers in a domain must run the same version of the WebLogic Server software. The Administration Server may run either the same version as the Managed Servers in the domain, or a later service pack.

If you have created multiple domains, each domain must reference its own database schema. You cannot share a configured resource or subsystem between domains. For example, if you create a JDBC connection pool in one domain, you cannot use it with a Managed Server or cluster in another domain. Instead, you must create a similar connection pool in the second domain. Furthermore, two or more system resources cannot have the same name.

CHAPTER 3

Domain Configuration Files

This section describes how a domain is represented in the file system. It includes the following sections:

Overview of Domain Configuration Files

WebLogic Server management and configuration services are accessed with the Java Management Extensions (JMX) API. The configuration of a domain is stored in XML files in the configuration directories under the domain directory. The files in these configuration directories act as a persistent store for the managed objects that WebLogic Server creates and modifies during its executing using the JMX API. The purpose of the configuration files is to store changes to managed configuration objects so that they are available when WebLogic Server is restarted.

The central configuration file for the domain is *DOMAIN_NAME*`/config/config.xml` file. It specifies the name of the domain and the configuration parameter settings for each server instance, cluster, resource, and service in the domain. The configuration for some major subsystems of the domain is stored in subdirectories of the *DOMAIN_NAME*`/config` directory in separate configuration files that are incorporated by reference into the central `config.xml` file.

The domain directory also contains default script files, such as `startWebLogic.cmd` and `startWebLogic.sh`, that you can use to start the domain's Administration Server and Managed Servers. For details about these configuration files and script files, see "Domain Directory Contents" on page 3-5.

config.xml

The central configuration file for the domain is the `/domains/`*`DOMAIN_NAME`*`/config/config.xml` file. It specifies the name of the domain and the configuration parameter settings for each server instance, cluster, resource, and service in the domain.

The namespace for `config.xml` is `http://www.bea.com/ns/weblogic/90/domain` and the XML schemas (there are two—one for the main `config.xml` and one for the security subsection) are located at:

`http://www.bea.com/ns/weblogic/90/domain.xsd`

`http://www.bea.com/ns/weblogic/90/security.xsd`

These schemas are also located in a JAR file in the file system at `BEA_HOME/weblogic90/server/lib/schema/weblogic-domain-binding.jar`; the schema's pathname within the JAR file is `META-INF/schemas/schema-0.xsd`. The XML Schema enables the use of XML editing tools to modify and validate the `config.xml` file.

For a reference guide to the domain configuration XML Schema, see the *WebLogic Server Domain Configuration Schema Reference*.

Editing Configuration Files

In most circumstances, you should not directly modify the `config.xml` file or the other configuration files. Instead, use the Administration Console or one of the other tools described in Summary of System Administration Tools and APIs in *Overview of WebLogic Server System Administration* to modify the domain's configuration. The configuration changes will then be reflected in the configuration files.

Directly modifying configuration files may be appropriate if you choose to place configuration files and other components of your installation under source control, managing them using WLST.

Warning: You cannot edit configuration files while WebLogic Server is executing, since WebLogic Server rewrites the files periodically. Your changes will be lost and, depending on your platform, you could cause WebLogic Server failures.

Since the WebLogic Server configuration files are well-formed XML files, it is possible to modify them using XSLT or to script certain repetitive changes using an XML parser application such as Apache Xerces, or JDOM. Be sure to test any scripts you create thoroughly and always make a backup copy of each configuration file before you make any changes to it.

Security Credentials in Configuration Files

Security credentials for domain security and the embedded LDAP server are stored in the `config.xml` file in encrypted form. If you create your `config.xml` file by hand, you need to locate these credentials, encrypt them, and copy the encrypted credential into your `config.xml` file.

For information about WebLogic Server's encryption utility, see encrypt in the *WebLogic Server Command Reference*. Once you have encrypted the credentials, include the encrypted values in your `config.xml` file in elements as in Listing 3-1:

Listing 3-1 Configuring Encrypted Credentials

```
<security-configuration>
   <credential-encrypted>{3DES}encypted-value-here</credential-encrypted>
</security-configuration>
<embedded-ldap>
   <credential-encrypted>{3DES}encypted-value-here</credential-encrypted>
</embedded-ldap>
```

Subsidiary Configuration Files

Prior to WebLogic Server 9.0, the `config.xml` file was a repository for all configuration information. Now several WebLogic Server subsystems are configured in subsidiary configuration files that are referred to by the central `config.xml` file. These subsidiary configuration files reside in subdirectories of the `/domains/`*`DOMAIN_NAME`*`/config` directory. For more information about these subsidiary configuration files, see "Domain Directory Overview" on page 3-4 and "Domain Directory Contents" on page 3-5.

Configuration File Archiving

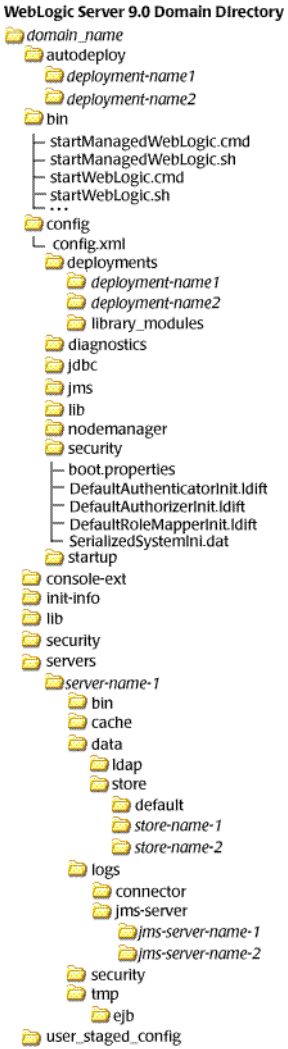
You can configure WebLogic Server to make backup copies of the configuration files. This facilitates recovery in cases where configuration changes need to be reversed or the unlikely case that configuration files become corrupted. When the Administration Server starts up, it saves a JAR file named `config-booted.jar` that contains the configuration files. When you make changes to the configuration files, the old files are saved in the `configArchive` directory under the domain directory, in a JAR file with a sequentially-numbered name like `config-1.jar`.

Whether to back up configuration files is specified by the `DomainMBean.ConfigBackupEnabled` attribute, whose default value is false. The number of configuration archive files retained is specified by the `DomainMBean.ArchiveConfigurationCount` attribute, whose default value is 0.

Domain Directory Overview

WebLogic Server installs the domain directory by default within the *`BEA_HOME`*`/user_projects/domains` directory. Figure 3-1 is an overview of the domain directory tree hierarchy within the `domains` directory. The *`domain-name`*, *`deployment-name`*, and *`server-name`* directory names are not literal, but are replaced in any actual case with whatever specific names are appropriate; the other directory names are literal. This overview shows only directories, not files within the directories. In any actual particular domain directory tree, this whole hierarchy might not be present.

Figure 3-1 Domain Directory Structure



Domain Directory Contents

This section describes the contents of the domain directory and its subfolders. Note that the *domain-name*, *server-name*, and *deployment-name* directory names are not literal, but are replaced with whatever specific names is appropriate; other directory names are literal.

domain-name

The name of this directory is the name of the domain.

autodeploy

This directory provides a quick way to deploy applications in a development server. When the WebLogic Server instance is running in development mode, it automatically deploys any applications or modules that you place in this directory.

The files you place in this directory can be J2EE applications, such as:

- An EAR file
- A WAR, EJB JAR, RAR, or CAR archived module
- An exploded archive directory for either an application or a module

bin

This directory contains scripts that are used in the process of starting and stopping the Administration Server and the Managed Servers in the domain. These scripts are generally provided as `.sh` files for UNIX and `.cmd` files for Windows. The `bin` directory can optionally contain other scripts of domain-wide interest, such as scripts to start and stop database management systems, full-text search engine processes, etc. For more information, see *Managing Server Startup and Shutdown*.

config

This directory contains the current configuration and deployment state of the domain. The central domain configuration file, `config.xml`, resides in this directory.

config/diagnostics

This directory contains system modules for instrumentation in the WebLogic Diagnostic Framework. For more information, see *Configuring and Using the WebLogic Diagnostic Framework*.

config/jdbc

This directory contains system modules for JDBC: global JDBC modules that can be configured directly from JMX (as opposed to JSR-88). For more information, see *Database Connectivity (JDBC)*.

config/jms

This directory contains system modules for JMS: global JMS modules that can be configured directly from JMX (as opposed to JSR-88). For more information, see *Messaging (JMS)*.

config/nodemanager

This directory holds configuration information for connection to the Node Manager. For more information, see Using Node Manager to Control Servers in *Managing Server Startup and Shutdown*.

config/security

This directory contains system modules for the security framework. It contains one security provider configuration extension for each kind of security provider in the domain's current realm. For more information, see *Understanding WebLogic Security*.

config/startup

This directory contains system modules that contain startup plans. Startup plans are used to generate shell scripts that can be used as part of server startup.

configArchive

This directory contains a set of JAR files that save the domain's configuration state. Just before pending changes to the configuration are activated, the domain's existing configuration state, consisting of the `config.xml` file and the other related configuration files, is saved in a versioned JAR file with a name like `config.jar#1`, `config.jar#2`, etc.

The maximum number of versioned JAR files to be kept is specified by the `archiveConfigurationCount` attribute of `DomainMBean`. Once this maximum number is reached, the oldest conversion archive is deleted before a new one is created.

init-info

This directory contains files used for WebLogic domain provisioning. You should not modify any files in this directory.

lib

Any JAR files you put in this directory are added to the system classpath of each server instance in the domain when the server's Java virtual machine starts.

pending

This directory contains domain configuration files representing configuration changes that have been requested, but not yet activated. Once the configuration changes have been activated, the configuration files are deleted from this directory. For more information, see "Managing Configuration Changes" on page 4-1.

security

This directory holds those security-related files that are the same for every WebLogic Server instance in the domain:

- `SerializedSystemIni.dat`

This directory also holds security-related files that are only needed by the domain's Administration Server:

- `DefaultAuthorizerInit.ldift`
- `DefaultAuthenticatorInit.ldift`
- `DefaultRoleMapperInit.ldift`

For more information, see *Understanding WebLogic Security*.

servers

This directory contains one subdirectory for each WebLogic Server instance in the domain. For more information, see "A Server's Root Directory" on page 3-10.

servers/*server-name*

This directory is the server directory for the WebLogic Server instance with the same name as the directory.

servers/*server-name*/bin

This directory holds executable or shell files that can be or must be different for each server. The server environment script (`setServerEnv.sh` or `setServerEnv.cmd`) is an example of a file that resides here because it can differ from one WebLogic Server instance to the next, for example, depending on whether the server instance has its own startup plan.

servers/*server-name*/cache

This directory holds directories and files that contain cached data. By "cached" here we mean that the data is a copy, possibly in a processed form (compiled, translated, or reformatted), of other data.

servers/*server-name*/cache/EJBCompilerCache

This directory is a cache for compiled EJBs.

servers/*server-name*/data

This directory holds files that maintain persistent per-server state used to run the WebLogic Server instance, other than security state, as opposed to temporary, cached or historical information. Files in this directory are important data that must be retained as the WebLogic Server instance is brought up, is brought down, crashes, restarts, or is upgraded to a new version.

servers/*server-name*/data/ldap

This directory holds the embedded LDAP database. The runtime security state for the WebLogic Server instance is persisted in this directory.

servers/*server-name*/data/store

This directory holds WebLogic persistent stores. For each persistent store, there is a subdirectory that holds the files that represent the persistent store. The name of the subdirectory is the name of the persistent store. By convention there is one store named `default`.

servers/*server-name*/logs

This directory holds logs and diagnostic information. This information is historical in nature. It is not crucial to the operation of the server, and can be deleted (while the WebLogic Server instance is down, at least) without affecting proper operation. However, the information can be quite useful for debugging or auditing purposes and should not be deleted without good reason.

servers/*server-name*/logs/diagnostic_images

This directory holds information created by the Server Image Capture component of the WebLogic Diagnostic Framework. For more information, see *Configuring and Using the WebLogic Diagnostic Framework*.

servers/*server-name*/logs/jmsServers

This directory contains one subdirectory for each JMS server in the WebLogic Server instance. Each such subdirectory contains the logs for that JMS server. The name of the subdirectory is the name of the JMS server.

servers/*server-name*/logs/connector

This directory is the default base directory for connector module (JCA ResourceAdapter) logs.

servers/*server-name*/security

This directory holds security-related files that can be or must be different for each WebLogic Server instance. The file `boot.properties` is an example of a file that resides here because it can differ from one server to the next. This directory also maintains files related to SSL keys.

servers/*server-name*/tmp

This directory holds temporary directories and files that are created while a server instance is running. For example, a JMS paging directory is automatically created here unless another location is specified. Files in this directory must be left alone while the server is running, but may be freely deleted when the server instance is shut down.

tmp

This directory stores temporary files used in the change management process. You should not modify any files in this directory.

user_staged_config

By default, configuration information is automatically copied from the Administration Server to each Managed Server. If instead you prefer to stage configuration changes manually, you can use this directory as an alternative to the `config` directory.

A Server's Root Directory

All instances of WebLogic Server use a *server root directory* to store runtime data and to provide the context for any relative pathnames in the server's configuration. You can specify the path and name of the server root directory for each server instance. You can specify a common server root directory for multiple server instances hosted on a single computer or you can specify a different server root directory for each server. A domain may have one or more server root directories.

Specifying a Server Root Directory

You can specify the path for the server root directory by one of the following means:

- Use the `-Dweblogic.RootDirectory=`*`path`* option when starting a WebLogic Server instance from command line. For example the following command:

  ```
  java -Dweblogic.RootDirectory=c:\MyServerRootDirectory weblogic.Server
  ```

  starts a WebLogic Server instance and uses `c:\MyServerRootDirectory` as the server root directory.

- If you use Node Manager to start a WebLogic Server instance, you can specify a server root directory with the Root Directory attribute in the Administration Console on the **Environment: Servers: <*servername*>: Configuration: Server Start** tab.

If you do not use one of the above means to specify a server root directory, the path and name of the server root directory depend on whether a server instance is a Managed Server or the Administration Server and whether or not you use Node Manager to start the server instance. These variations are discussed in the next sections.

Server Root Directory for an Administration Server

An Administration Server uses its server root directory as a repository for the domain's configuration data (such as `config.xml`) and security resources (such as the default, embedded LDAP server).

To determine the root directory for an Administration Server, WebLogic Server does the following:

- If the server's startup command includes the `-Dweblogic.RootDirectory=`*`path`* option, then the value of *`path`* is the server root directory.

- If `-Dweblogic.RootDirectory=`*`path`* is not specified, then the working directory is the server root directory. However, if you are upgrading a domain created under WebLogic Server 6.x, then the server root directory is the parent of the working directory.

If WebLogic Server cannot find a `config.xml` file, then it offers to create one. You can use this method to create a new domain. For more information, see Using the weblogic.Server Command Line to Create a Domain in the *WebLogic Server Command Reference*.

Server Root Directory for a Managed Server Started with Node Manager

If you use the Node Manager to start a Managed Server, the root directory is located on the computer that hosts the Node Manager process. To determine the location of the server's root directory, WebLogic Server does the following:

- If you specified a root directory in the Administration Console on the Environment→Servers→*server-name*→Configuration→Server Start page, then the directory you specified is the server root directory.
- If you did not specify a root directory in the Administration Console, then the server root directory is:
  *BEA_HOME**WL_HOME*\common\nodemanager
  where:
  - *BEA_HOME* is the directory where you installed one or BEA products, including WebLogic Server
  - *WL_HOME* is the directory in which you installed WebLogic Server on the Node Manager's host computer (weblogic90 by default).

The server root directory for a Managed Server started with Node Manager directory contains a subdirectory for each Managed Server instance. The name of the subdirectory is the name of the server as defined in the domain configuration.

Server Root Directory for a Managed Server Not Started with Node Manager

If you do not use the Node Manager to start a Managed Server (and therefore use the `java weblogic.Server` command or a script that calls that command), WebLogic Server does the following to determine the root directory:

- If the server's startup command includes the `-Dweblogic.RootDirectory=`*path* option, then the value of *path* is the server's root directory.
- If `-Dweblogic.RootDirectory=`*path* is not specified, then the working (current) directory is the root directory. For example, if you run the `weblogic.Server` command from `c:\config\MyManagedServer`, then `c:\config\MyManagedServer` is the root directory.

To make it easier to maintain your domain configurations and applications across upgrades of WebLogic Server software, it is recommended that the server root directory not be the same as the installation directory for the WebLogic Server software.

CHAPTER 4

Managing Configuration Changes

To provide a secure, predictable means for distributing configuration changes in a domain, WebLogic Server imposes a change management process that loosely resembles a two-phase commit database transaction. The following sections describe configuration change management:

Overview of Change Management

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 runtime 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. 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.

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

Changes Requiring Server Restart

Some configuration changes can take effect on the fly, while others require the affected servers to be restarted before they take effect. Configuration changes that can take effect without a server restart are sometimes referred to as *dynamic* changes; configuration changes that require a server restart are sometimes referred to as *non-dynamic* changes. In the Administration Console, an attribute that requires a server restart for changes to take effect is marked with this icon:

Edits to dynamic configuration attributes become available once they are activated, without restarting the affected server or system resource. These edits are made available to the server and runtime hierarchies once they are activated. Edits to non-dynamic configuration attributes require that the affected servers or system resources be restarted before they become effective.

If an edit is made to a non-dynamic configuration setting, no edits 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.

Configuration Change Tools

As described in Summary of System Administration Tools and APIs in *Overview of WebLogic Server System Administration*, you can use a variety of different WebLogic Server tools to make configuration changes:

- Administration Console
- WebLogic Scripting Tool
- JMX APIs

Whichever tool you use to make configuration changes, WebLogic Server handles the change process in basically the same way.

For more detailed information about how configuration changes are carried out through JMX and Configuration MBeans, see Understanding WebLogic Server MBeans in *Developing Custom*

Management Utilities with JMX. For more detailed information about making configuration changes with WLST, see Editing Configuration MBeans in *WebLogic Scripting Tool*.

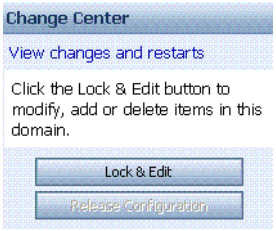
Configuration Auditing

Using the WebLogic Auditing provider or another auditing security provider, you can record audit information about changes made to your WebLogic Server configuration. See Configuration Auditing in *Securing WebLogic Server*.

Change Management in the Administration Console

The WebLogic Administration Console centralizes the configuration change management process in the Change Center pane:

Figure 4-1 Change Center



If you want to use the Administration Console to make configuration changes, you must first click the Lock & Edit button in the Change Center. When you click Lock & Edit, you obtain a lock on the editable hierarchy of Configuration MBeans for all servers in the domain (the edit tree).

As you make configuration changes using the Administration Console, you click Save (or in some cases Finish) on the appropriate pages. This does not cause the changes to take effect immediately; instead, when you click Save, you are saving the change to the edit tree and to the *DOMAIN_NAME*`/pending/config.xml` file and related configuration files. 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. (Note, however, that some changes require a server to be restarted.) 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.

Configuration Change Management Process

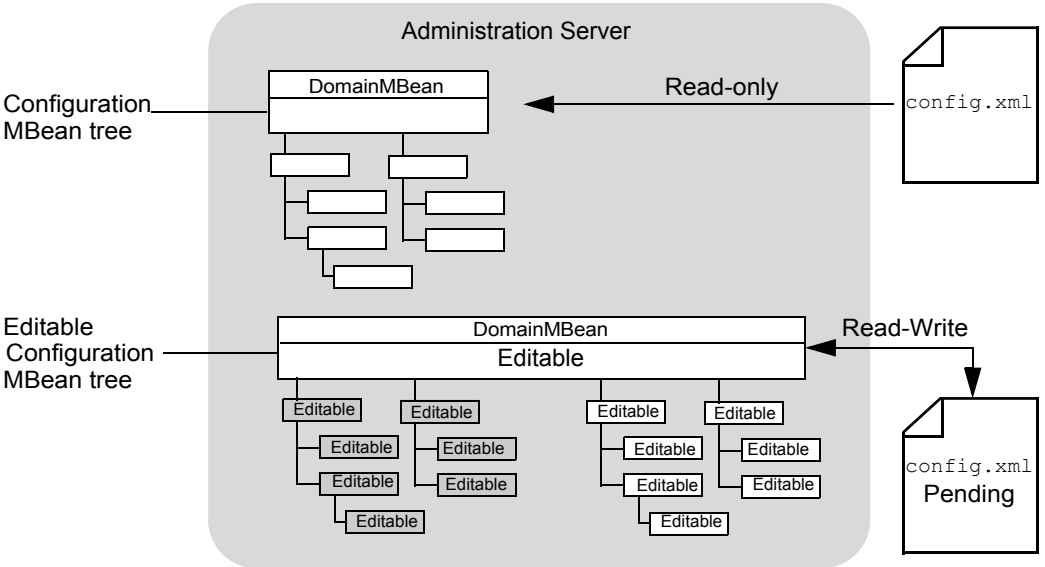
Configuration changes happen in basically the same way, regardless of the JMX tool you choose to use (the Administration Console, WLST, or JMX APIs). The following steps describe the process in detail, starting from when you first boot the domain's Administration Server:

1. When the Administration Server starts, it reads the domain's configuration files, including `config.xml` file and any subsidiary configuration files referred to by the `config.xml` file and uses the data to instantiate the following MBean trees in memory:
   - A read-only tree of Configuration MBeans that contains the current configuration of resources that are on the Administration Server.
   - An editable tree of all Configuration MBeans for all servers in the domain.

   Note: The Administration Server also instantiates a Runtime MBean tree and a DomainRuntime MBean tree, but these are not used for configuration management.
2. To initiate a configuration change, you do the following:
   a. Obtain a lock on the current configuration.
   b. Make any changes you desire, using the tool of your choice (the Administration Console, WLST, the JMX APIs, etc.)
   c. Save your changes to a pending version of the `config.xml` file, using the Save button in the Administration Console; using the WLST `save` command; or using the `save` operation on the `ConfigurationManagerMBean`.
3. The Configuration Manager service saves all data from the edit MBean tree to a separate set of configuration files in a directory named `pending`. See Figure 4-2.

   The `pending` directory is immediately below the domain's root directory. For example, if your domain is named `mydomain`, then the default pathname of the pending `config.xml` file is `mydomain/pending/config.xml`.

Figure 4-2 The Administration Server's Pending config.xml File



4. Make additional changes or undo changes that you have already made.
5. When you are ready, activate your changes in the domain, using the Activate Changes button in the Administration Console's Change Center; using the WLST `activate` command; or using the `activate` operation on the `ConfigurationManagerMBean`.

   When you activate changes (see Figure 4-3):

   a. For each server instance in the domain, the Configuration Manager service copies the pending configuration files to a `pending` directory in the server's root directory.

      If a Managed Server shares its root directory with the Administration Server, `ConfigurationManagerMBean` does not copy the pending configuration files; the Managed Server uses the Administration Server's pending file.

   b. Each server instance compares its current configuration with the configuration in the pending file.

   c. Subsystems within each server vote on whether they can consume the new configuration.

      If any subsystem indicates that it cannot consume the changes, the entire activation process is rolled back and the `ConfigurationManagerMBean` emits an exception. You can modify your changes and retry the change activation, or you can abandon your

lock, in which case the edit Configuration MBean tree and the pending configuration files are reverted to the configuration in the read-only Configuration MBean tree and configuration files.

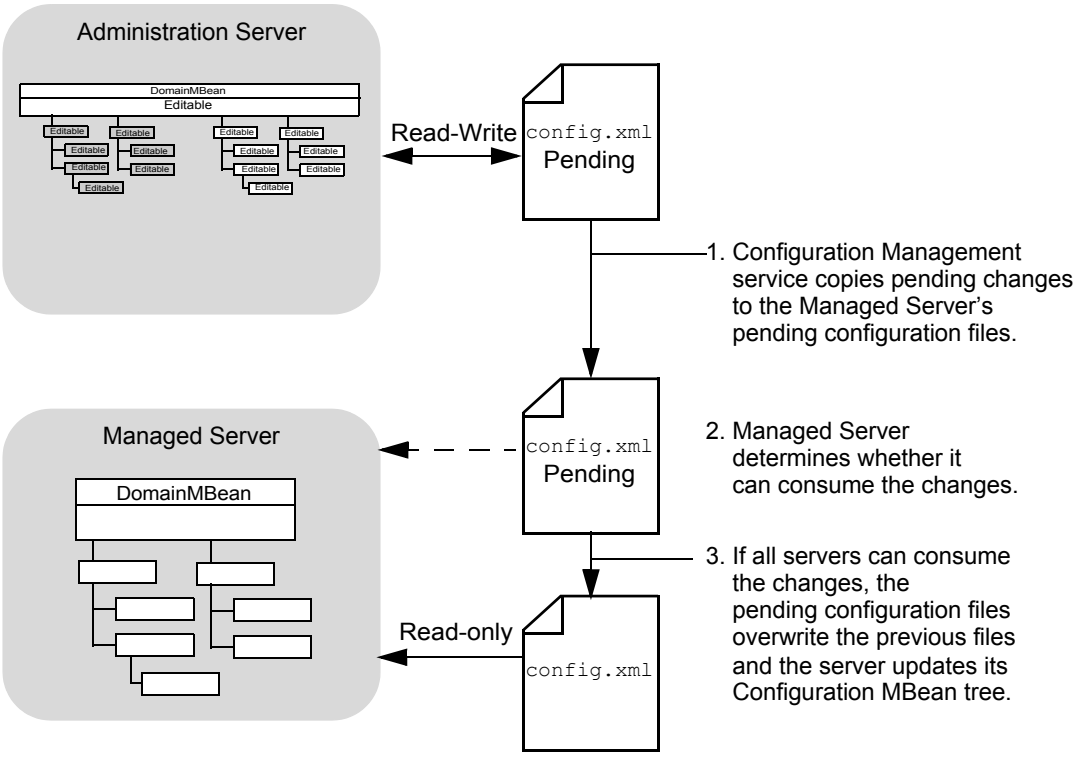
d. If all subsystems on all servers can consume the change, the Configuration Manager service replaces the read-only configuration files on each server instance in the domain with the pending configuration files.

e. Each server instance updates its beans and its read-only Configuration MBean tree according to the changes in the new configuration files. In cases that include one or more changes that require the server to be restarted, this occurs the next time the server is restarted.

f. The pending configuration files are then deleted from the `pending` directory.

6. You can retain your lock to make additional changes or release it so that others can update the configuration. You can configure a timeout period that causes the Configuration Manager service to abandon a lock.

Figure 4-3 Activating Changes in Managed Servers



Configuration Locks

When you start an edit session, whether you use the Administration Console, WLST, or the Management APIs, you obtain a lock on the Configuration MBean edit tree.

The configuration change lock does not by itself prevent you from making conflicting configuration edits using the same administrator user account. For example, if you obtain a configuration change lock using the Administration Console, and then use the WebLogic Scripting Tool with the same user account, you will access the same edit session that you opened in the Administration Console and you will not be locked out of making changes with the Scripting Tool. You can reduce the risk that such a situation might occur by maintaining separate administrator user accounts for each person with an administrative role. Similar problems can still occur, however, if you have multiple instances of the same script using the same user account.

To reduce further the risk of this situation, you can obtain an *exclusive* configuration change lock. When you have an exclusive configuration lock, a subsequent attempt to start an edit session by the same owner will wait until the edit session lock is released. To obtain an exclusive configuration lock using WLST, use `true` for the exclusive argument in the `startEdit` command:

```
wls:/mydomain/edit> startEdit(60000, 120000, true)
```

To obtain an exclusive configuration lock using the Management API, use `true` for the exclusive parameter in the `ConfigurationMBean.startEdit` operation:

```
Object [] startEdit(60000, 120000, true)
```

You cannot modify the domain configuration using the compatibility MBean server when either of the following is true:

- there is an existing editing session, or
- there are pending changes saved, but not yet activated from a previous edit session.

For information about the compatibility MBean server, which is used with the deprecated `weblogic.management.MBeanHome` interface, see Deprecated MBeanHome and Type-Safe Interfaces in *Developing Custom Management Utilities with JMX*.

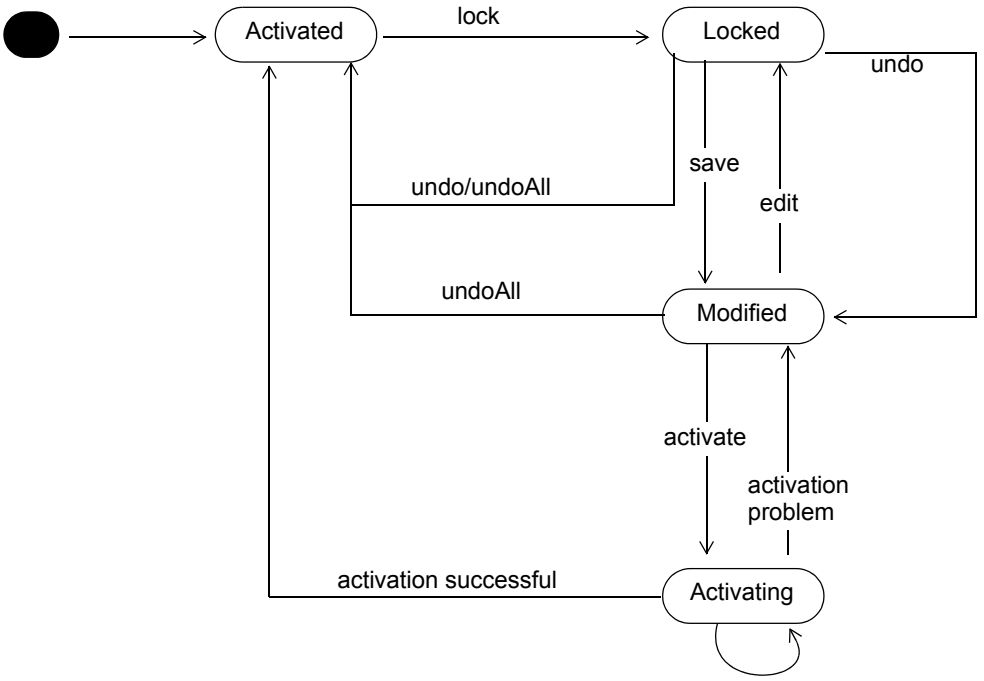
Resolving Change Conflicts

In the event that you have saved more than one change set without activating them and one change would invalidate a prior change, the Change Management service requires you to manually resolve the invalidation before it will save your changes.

Configuration Management State Diagram

The Configuration Management service follows a series of states, which are described in Figure 4-4.

Figure 4-4 Configuration Management State Diagram



Restricting Configuration Changes

You can block configuration changes by setting a domain to be read-only. Do this by setting the `EditMBeanServerEnabled` attribute of the `JMXMBean` configuration MBean to false, using either WLST or the Management APIs.

Note that once you have set your domain to be read-only, you can no longer edit its configuration using the Administration Console, WLST online, or the Management APIs. To make the domain editable again, you must either edit the `config.xml` file directly in a text editor, or use WLST offline, and then restart the affected servers.

You should also establish appropriate access controls to the domain's configuration, limiting access to users with the proper security roles. In addition, using the WebLogic Auditing provider

or another auditing security provider, you can record audit information about changes made to your WebLogic Server configuration. See Configuration Auditing in *Securing WebLogic Server*.

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