# BEA WebLogic Server™

## Programming WebLogic Management Services with JMX

Release 8.1 Beta
Revised: August 23, 2002

Programming WebLogic Management Services with JMX

| Part Number | Document Revised | Software Version |
|---|---|---|
| N/A | August 23, 2002 | BEA WebLogic Server Version 8.1 Beta |

# Contents

# About This Document

This document describes how to use the BEA WebLogic Server™ management APIs to configure and monitor WebLogic Server domains, clusters, and server instances.

The document is organized as follows:

- Chapter 1, "Overview of WebLogic JMX Services," which describes the WebLogic Server management interface and provides overviews of WebLogic Server MBeans, MBean home interfaces, and the distributed management architecture.
- Chapter 2, "Accessing WebLogic Server MBeans," which describes how to access WebLogic Server MBeans from a client application.
- Chapter 3, "Accessing and Changing Configuration Information," which provides examples for retrieving and modifying the configuration of WebLogic Server resources.
- Chapter 4, "Using WebLogic Server MBean Notifications," which describes how to listen and respond to WebLogic Server MBean notifications in a client application.
- Chapter 5, "Accessing Runtime Information," which provides examples for retrieving and modifying runtime information about WebLogic Server domains and server instances.
- Chapter 6, "Monitoring WebLogic Server MBeans," which describes how to monitor WebLogic Server MBean attributes from a monitor MBean.

**Note:** The WebLogic Security Service provides MBeans and tools for generating additional MBeans that manage security on a WebLogic Server. These MBeans are called Security MBeans and their usage model is different from the one described in this document. For information on Security MBeans, refer to the *Developing Security Services for WebLogic Server* guide.

## Audience

This document is written for independent software vendors (ISVs) and other developers who are interested in creating custom applications that use BEA WebLogic Server facilities to monitor and configure applications and server instances. It assumes that you are familiar with the BEA WebLogic Server platform and the Java programming language, but not necessarily with Java Management Extensions (JMX).

While the document describes how to access and use the Managed Beans (MBeans) that WebLogic Server provides, it does not describe how to create your own, additional MBeans. For information about creating and using MBeans in addition to the ones that WebLogic Server provides, refer to the JMX 1.0 specification, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html

## e-docs Web Site

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

## How to Print the Document

You can print a copy of this document from a Web browser, one main topic at a time, by using the File→Print option on your Web browser.

A PDF version of this document is available on the WebLogic Server documentation Home page on the e-docs Web site (and also on the documentation CD). You can open the PDF in Adobe Acrobat Reader and print the entire document (or a portion of it) in book format. To access the PDFs, open the WebLogic Server documentation Home page, click Download Documentation, and select the document you want to print.

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

## Related Information

The BEA corporate Web site provides all documentation for WebLogic Server. The following BEA WebLogic Server documentation contains information that is relevant to understanding how to use the WebLogic Server management services.

- BEA WebLogic Server Documentation (available online):
  - *Administration Guide*
  - *Programming Guides*
  - WebLogic Server API
- The Sun Microsystems, Inc. Java site at `http://java.sun.com/`
- The JMX 1.0 specification and API documentation at http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html

## Contact Us!

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

In your e-mail message, please indicate the software name and version you are using, as well as the title and document date of your documentation. If you have any questions about this version of BEA WebLogic Server, or if you have problems installing and running BEA WebLogic Server, contact BEA Customer Support through BEA WebSupport at http://www.bea.com. You can also contact Customer Support by using the contact information provided on the Customer Support Card, which is included in the product package.

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

- Your name, e-mail address, phone number, and fax number
- Your company name and company address

- Your machine type and authorization codes
- The name and version of the product you are using
- A description of the problem and the content of pertinent error messages

## Documentation Conventions

The following documentation conventions are used throughout this document.

| Convention | Item |
|---|---|
| **boldface text** | Indicates terms defined in the glossary. |
| Ctrl+Tab | Indicates that you must press two or more keys simultaneously. |
| *italics* | Indicates emphasis or book titles. |
| `monospace text` | Indicates code samples, commands and their options, data structures and their members, data types, directories, and file names and their extensions. Monospace text also indicates text that you must enter from the keyboard.<br>*Examples*:<br>`#include <iostream.h> void main ( ) the pointer psz`<br>`chmod u+w *`<br>`\tux\data\ap`<br>`.doc`<br>`tux.doc`<br>`BITMAP`<br>`float` |
| **`monospace boldface text`** | Identifies significant words in code.<br>*Example*:<br>`void` **`commit`** `( )` |
| *`monospace italic text`* | Identifies variables in code.<br>*Example*:<br>`String` *`expr`* |

| Convention | Item |
|---|---|
| UPPERCASE TEXT | Indicates device names, environment variables, and logical operators.<br>*Example*s:<br>LPT1<br>SIGNON<br>OR |
| `{ }` | Indicates a set of choices in a syntax line. The braces themselves should never be typed. |
| `[ ]` | Indicates optional items in a syntax line. The brackets themselves should never be typed.<br>*Example*:<br>`buildobjclient [-v] [-o name ] [-f` *`file-list`*`]...`<br>`[-l` *`file-list`*`]...` |
| `\|` | Separates mutually exclusive choices in a syntax line. The symbol itself should never be typed. |
| `...` | Indicates one of the following in a command line:<br>■ That an argument can be repeated several times in a command line<br>■ That the statement omits additional optional arguments<br>■ That you can enter additional parameters, values, or other information<br>The ellipsis itself should never be typed.<br>*Example*:<br>`buildobjclient [-v] [-o name ] [-f` *`file-list`*`]...`<br>`[-l` *`file-list`*`]...` |
| .<br>.<br>. | Indicates the omission of items from a code example or from a syntax line. The vertical ellipsis itself should never be typed. |

CHAPTER

# 1 Overview of WebLogic JMX Services

To provide open and extensible management services, WebLogic Server implements the Sun Microsystems, Inc. Java Management Extensions (JMX) 1.0 specification. All WebLogic Server resources are managed through these JMX-based services, and third-party services and applications that run within WebLogic Server can be managed through them as well.

The WebLogic Server Administration Console and the `weblogic.Admin` utility use WebLogic JMX APIs to implement their management services. You can also use these APIs to build your own, specialized management utilities. For example, you can build a management utility that uses JMX APIs to monitor your application's use of JDBC connection pools. If usage falls outside a set of allowable parameters, your utility can use the APIs to adjust the size or configuration of the connection pools. Your utility could also include code that sends an email to alert a system administrator of the configuration change.

WebLogic Server implements the JMX 1.0 specification and adds its own set of convenience methods and other extensions to take advantage of the WebLogic Server distributed environment. This topic provides an overview of the WebLogic Server JMX services:

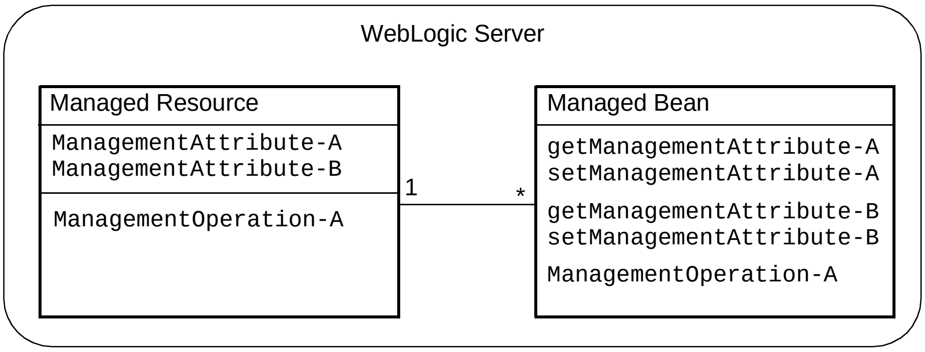
- "WebLogic Server Managed Resources and MBeans" on page 1-2
- "MBean Servers and the MBeanHome Interface" on page 1-16
- "Notifications and Monitoring" on page 1-20
- "The Administration Console and the weblogic.Admin Utility" on page 1-20

To view the JMX 1.0 specification, download it from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The API documentation is included in the archive that you download.

## WebLogic Server Managed Resources and MBeans

Subsystems within WebLogic Server (such as JMS Provider and JDBC Container) and the items that they control (such as JMS servers and JDBC connection pools) are called **WebLogic Server managed resources**. Each managed resource includes a set of attributes that can be configured and monitored for management purposes. For example, each JDBC connection pool includes attributes that define its name, the name of its driver, its initial capacity, and its cache size. Some managed resources provide additional methods (operations) that can be used for management purposes. The WebLogic JMX services expose these management attributes and operations through one or more managed beans (MBeans). An **MBean** is a concrete Java class that is developed per JMX specifications. It can provide getter and setter operations for each management attribute within a managed resource along with additional management operations that the resource makes available. (See Figure 1-1.)

**Figure 1-1 Managed Resources and Managed Beans**



WebLogic Server MBeans that expose attributes and operations for configuration a managed resource are called **Configuration MBeans** while MBeans that provide information about the runtime state of a managed resource are called **Runtime MBeans**. The functions of configuring resources and viewing data about the runtime state of resources are sufficiently different in a WebLogic Server domain that Configuration MBeans and Runtime MBeans are distributed and maintained differently.

This section contains the following subsections:

- "Basic Organization of a WebLogic Server Domain" on page 1-3
- "MBeans for Configuring Managed Resources" on page 4
- "MBeans for Viewing the Runtime State of Managed Resources" on page 1-12
- "Security MBeans" on page 1-15
- "Non-WebLogic Server MBeans" on page 1-16

## Basic Organization of a WebLogic Server 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 applications, EJBs, and other resources that you develop onto the Managed Servers and use the Administration Server for configuration and management purposes only.

Using multiple Managed Servers enables you to balance loads and provide failover protection for critical applications, while using single Administration Server simplifies the management of the Managed Server instances. For more information about domains, refer to "Overview of WebLogic System Administration" in the *WebLogic Server Administration Guide*.

## MBeans for Configuring Managed Resources

To support the WebLogic Server model of centralizing management responsibilities on the Administration Server, the Administration Server hosts Configuration MBeans for all managed resources on all server instances in the domain. In addition, the Administration Server saves changes to configuration data so that it is available when you shutdown and restart a server instance.

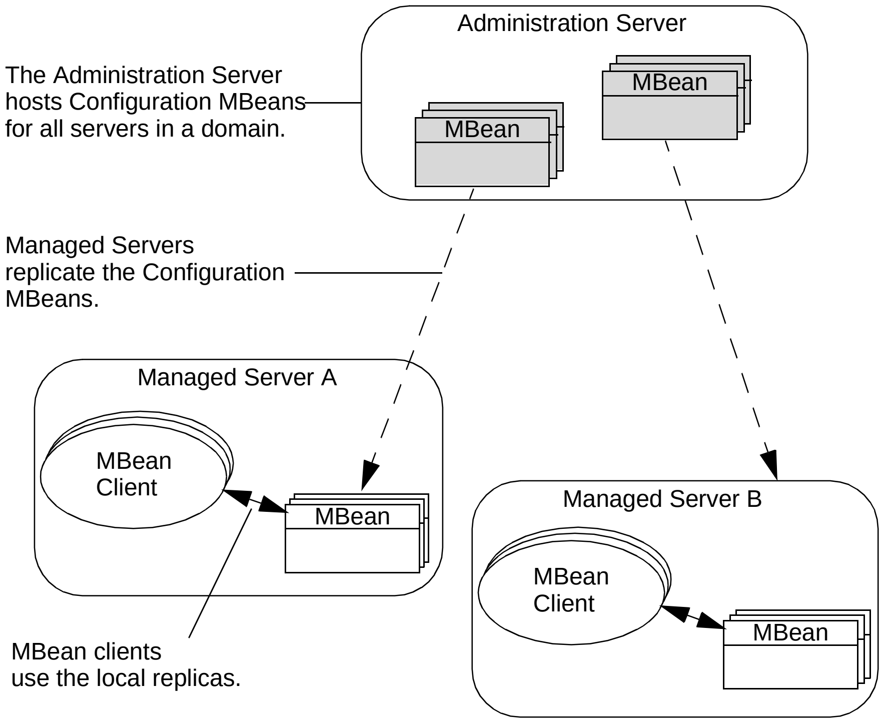
This section contains the following subsections:

- "Replicating Configuration MBeans" on page 1-5
- "The Lifecycle of Configuration MBeans" on page 1-8
- "Replication of MBeans for Managed Server Independence" on page 1-11
- "Documentation for Configuration MBean APIs" on page 1-11

## Replicating Configuration MBeans

To enhance performance and enable flexibility when configuring distributed resources, each Managed Server creates local replicas of the Configuration MBeans for its own managed resources. Objects that interact with MBeans (MBean clients) use the replicas on the local server instead of initiating remote calls to the Administration Server. (See Figure 1-2.)

**Figure 1-2 MBean Replication**


Administration Server
The Administration Server hosts Configuration MBeans for all servers in a domain.
MBean
MBean
Managed Servers replicate the Configuration MBeans.
Managed Server A
MBean Client
MBean
Managed Server B
MBean Client
MBean
MBean clients use the local replicas.

The Configuration MBeans on the Administration Server are called **Administration MBeans**, and the replicas on the Managed Servers are called **Local Configuration MBeans**.

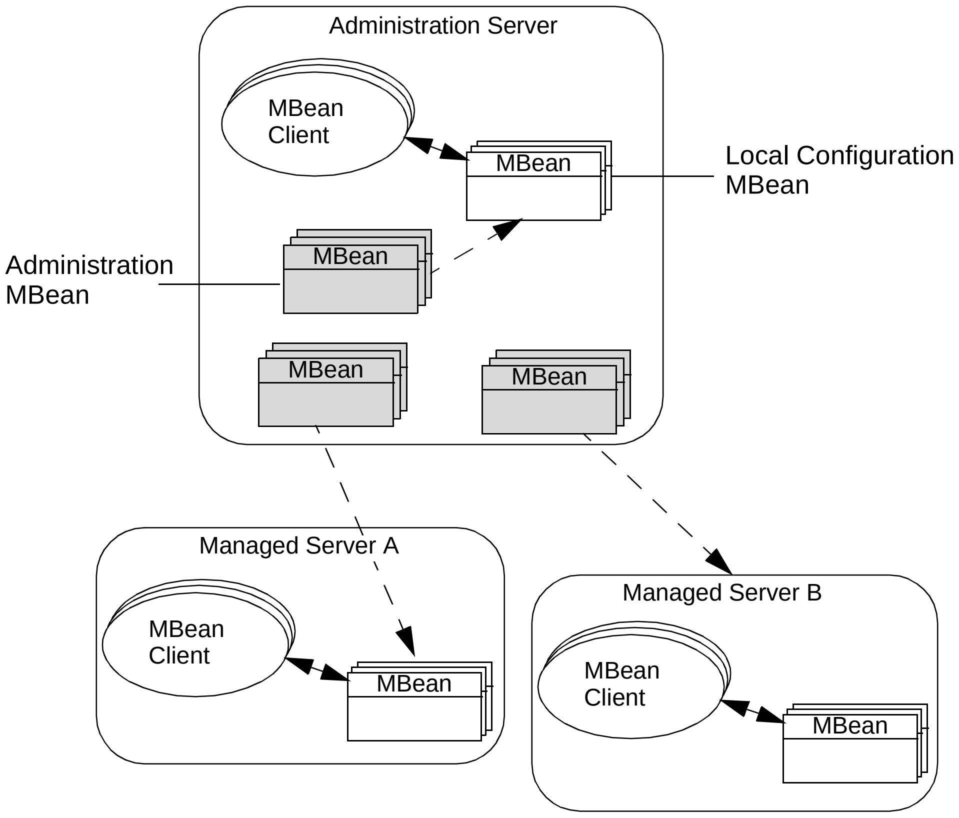
In addition to enhancing performance, this distribution of MBeans enables you to choose between making permanent or temporary changes to a server's configuration:

- Changes that you make to an Administration MBean are saved in a configuration file called `config.xml` and are available across server sessions. You can change an Administration MBean through the Administration Console, the `weblogic.Admin` command utility, or by using one of the MBean's setter methods.
- Changes that you make to a Local Configuration MBean are not saved to `config.xml` and apply only to the current server session. You can change a Local Configuration MBean through the `weblogic.Admin` command utility, by using one of the MBean's setter methods, or by using options of the

`weblogic.Server` startup command. The `weblogic.Server` options modify the values in the Local Configuration MBean, overriding the values from the Administration MBean. You cannot use the Administration Console to view or modify Local Configuration MBeans.

While the Administration Server always hosts Administration MBeans, it can potentially host Local Configuration MBeans as well. For example, if you set up managed resources on the Administration Server, it must host both the Administration MBeans for all server instances in the domain along with the Local Configuration MBeans associated with the resource. MBean clients on the Administration Server use the Local Configuration MBean. (See Figure 1-3.)

**Figure 1-3 Local Configuration MBean on Administration Server**

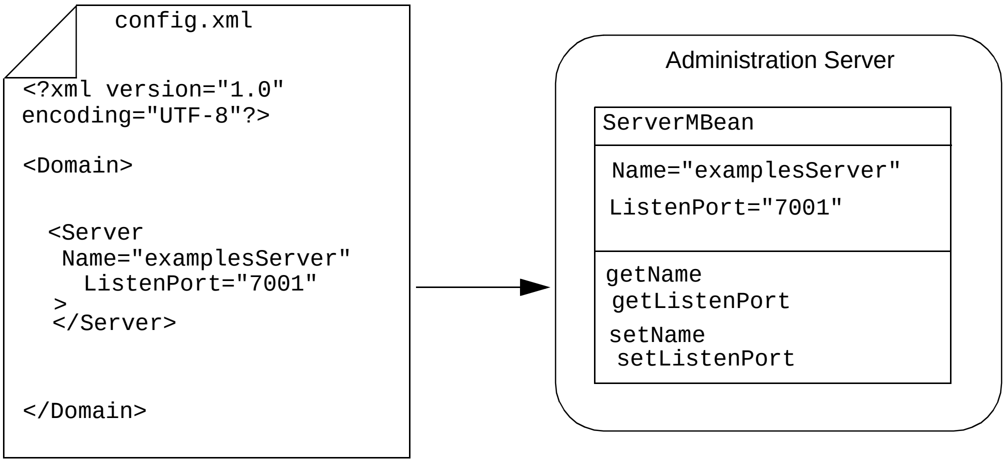


## The Lifecycle of Configuration MBeans

This section describes how Administration MBeans and Local Configuration MBeans are initialized, how changes to configuration data is propagated throughout the WebLogic Server system, and how attribute values can be changed so that they are available when you restart server instances:

1. The lifecycle of a Configuration MBean begins when you start the Administration Server. During its startup cycle, the Administration Server initializes all the Administration MBeans for the domain with data from the domain's `config.xml` file. (See Figure 1-4.)

**Figure 1-4 Initializing Configuration MBeans**

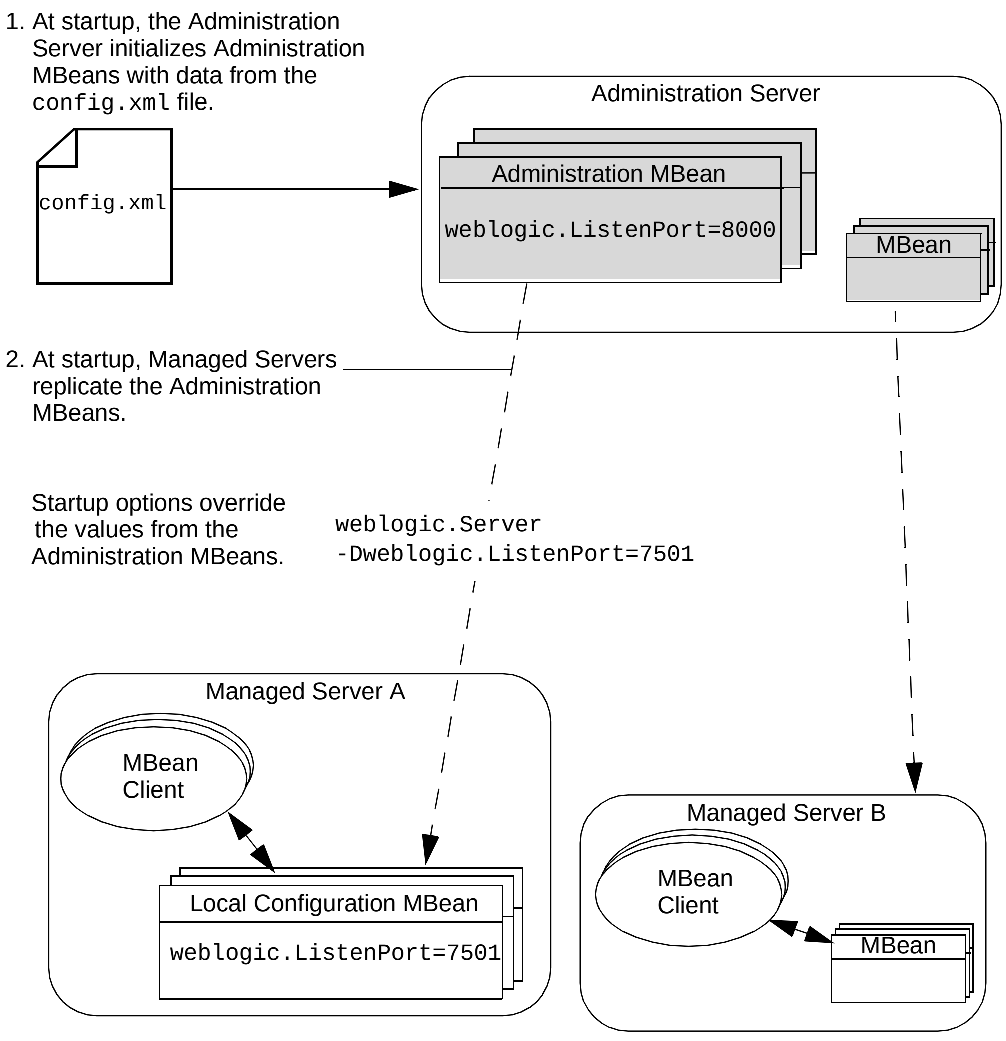


The Administration Server reads data from the `config.xml` file only during its startup cycle.

2. When a Managed Server starts, it contacts the Administration Server for its configuration data. By default, it creates replicas of the Administration MBeans that configure its local resources. However, you can use arguments in the server's startup command to override values of the Administration MBeans.

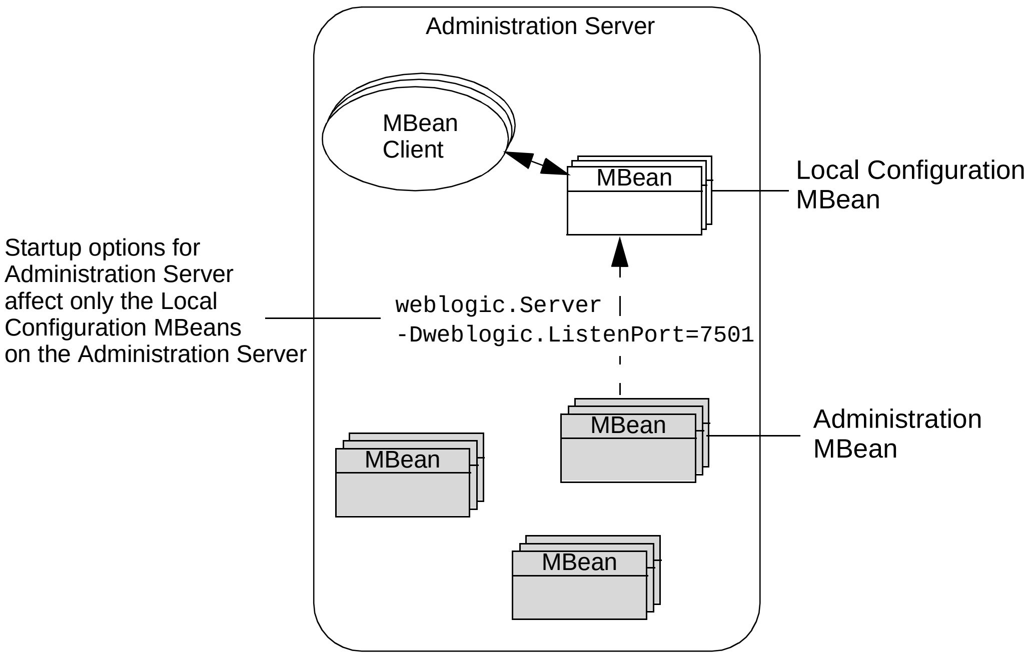
   For example, for Managed Server A, the `config.xml` file states that its listen port is 8000. When you use the `weblogic.Server` command to start Managed Server A, you include the `-Dweblogic.ListenPort=7501` startup option to change the listen port for the current server session. The Managed Server creates a replica of the Administration MBeans, but substitutes `7501` as the value of its listen port. When you restart Managed Server A, it will revert to using the value from the `config.xml` file, `8000`. (See Figure 1-5.)

**Figure 1-5 Overriding Administration MBean Values**


1. At startup, the Administration Server initializes Administration MBeans with data from the config.xml file.
config.xml
Administration Server
Administration MBean
weblogic.ListenPort=8000
MBean
2. At startup, Managed Servers replicate the Administration MBeans.
Startup options override the values from the Administration MBeans.
weblogic.Server
-Dweblogic.ListenPort=7501
Managed Server A
MBean Client
Local Configuration MBean
weblogic.ListenPort=7501
Managed Server B
MBean Client
MBean

When you start an Administration Server, any startup command arguments that you use to override the values in `config.xml` affect only the values of the Local Configuration MBeans on the Administration Server. The command arguments do not affect the values of the Administration MBeans and therefore do not affect subsequent server sessions. (See Figure 1-6.)

**Figure 1-6 Overriding Values on the Administration Server**


Administration Server
MBean Client
MBean
Local Configuration MBean
Startup options for Administration Server affect only the Local Configuration MBeans on the Administration Server
weblogic.Server
-Dweblogic.ListenPort=7501
MBean
Administration MBean
MBean
MBean

3. If you change a value in an Administration MBean, and if the corresponding Managed Server is running, the Administration Server propagates the change to the Local Configuration MBean. Depending on the attribute, the underlying resource might not be able to accept the new value until it restarts. The WebLogic Server Javadoc indicates whether a managed resource can accept new values for an attribute during the current session. Even if a managed resource can accept new values, depending on the frequency with which the resource checks for configuration changes, the resource might not use the updated value immediately.

4. Periodically, the Administration Server determines whether Administration MBeans have been changed and writes any changes back to `config.xml`. Changes also are written to `config.xml` when the Administration Server shuts down or when MBean attributes are modified by a WebLogic Server utility such as the Administration Console or `weblogic.Admin`.
5. Local Configuration MBeans are destroyed when you shut down Managed Servers. Administration MBeans are destroyed when you shut down the Administration Server.

## Replication of MBeans for Managed Server Independence

Managed Server Independence (MSI) is a feature that enables a Managed Server to start if the Administration Server is unavailable. If a Managed Server is configured for MSI, in addition to its Local Configuration MBeans, it also contains a copy of all Administration MBeans for the domain.

Do not interact with these Administration MBeans on a Managed Server. They reflect the last known configuration for the domain and are used only for starting the Managed Server in MSI mode. Modifying an Administration MBean on a Managed Server can cause the Managed Server's configuration to be inconsistent with the Administration Server, which will lead to unpredictable results. In addition, Managed Servers are not aware of the Administration MBeans on other Managed Servers.

For more information on MSI, refer to "Starting a Managed Server When the Administration Server Is Not Accessible" in the *Configuring and Managing WebLogic Server* guide.

## Documentation for Configuration MBean APIs

To view the documentation for Configuration MBeans, do the following:

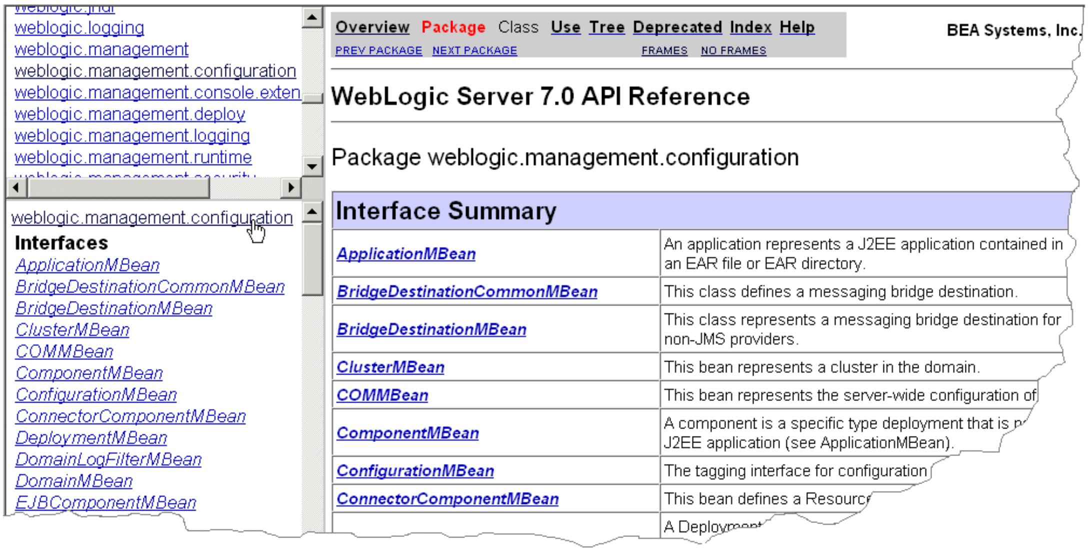
1. Open the WebLogic Server Javadoc.
2. In the top left pane of the Web browser, click `weblogic.management.configuration`.

   The lower left pane displays links for the package.

3. In the lower left pane, click `weblogic.management.configuration` again.

   The right pane displays the package summary. (See Figure 1-7.)

**Figure 1-7 Javadoc for the configuration Package**


weblogic.jndi
weblogic.logging
weblogic.management
weblogic.management.configuration
weblogic.management.console.exten
weblogic.management.deploy
weblogic.management.logging
weblogic.management.runtime

weblogic.management.configuration
**Interfaces**
*ApplicationMBean*
*BridgeDestinationCommonMBean*
*BridgeDestinationMBean*
*ClusterMBean*
*COMMBean*
*ComponentMBean*
*ConfigurationMBean*
*ConnectorComponentMBean*
*DeploymentMBean*
*DomainLogFilterMBean*
*DomainMBean*
*EJBComponentMBean*

Overview Package Class Use Tree Deprecated Index Help
PREV PACKAGE NEXT PACKAGE FRAMES NO FRAMES
BEA Systems, Inc.

WebLogic Server 7.0 API Reference

Package weblogic.management.configuration

**Interface Summary**

| | |
|---|---|
| *ApplicationMBean* | An application represents a J2EE application contained in an EAR file or EAR directory. |
| *BridgeDestinationCommonMBean* | This class defines a messaging bridge destination. |
| *BridgeDestinationMBean* | This class represents a messaging bridge destination for non-JMS providers. |
| *ClusterMBean* | This bean represents a cluster in the domain. |
| *COMMBean* | This bean represents the server-wide configuration of |
| *ComponentMBean* | A component is a specific type deployment that is J2EE application (see ApplicationMBean). |
| *ConfigurationMBean* | The tagging interface for configuration |
| *ConnectorComponentMBean* | This bean defines a Resourc |
| | A Deployment |

4. Click on an interface name to view its API documentation.

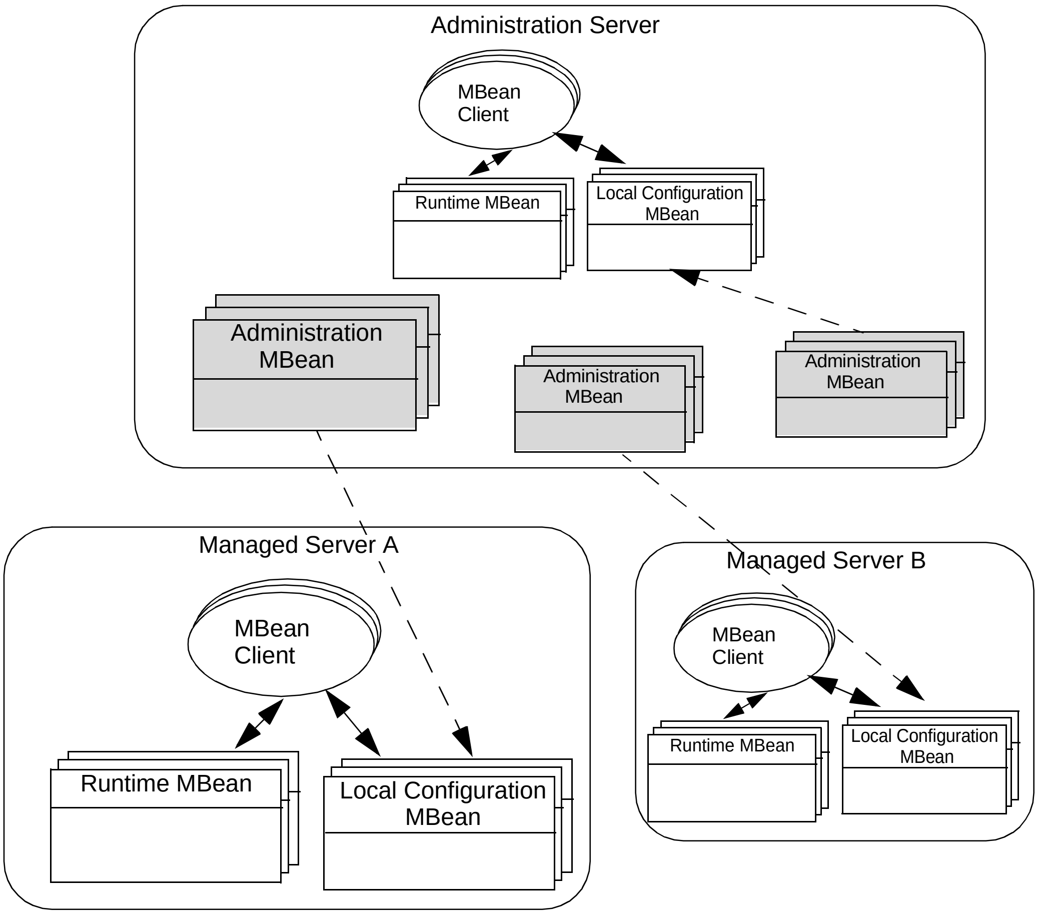
## MBeans for Viewing the Runtime State of Managed Resources

WebLogic Server managed resources provide performance metrics and other information about their runtime state through one or more Runtime MBeans. Runtime MBeans are not replicated like Configuration MBeans, and they exist only on the same server instance as their underlying managed resources.

Because Runtime MBeans contain only transient data, they do not save their data in the `config.xml` file. When you shut down a server instance, all runtime statistics and metrics from the Runtime MBeans are destroyed.

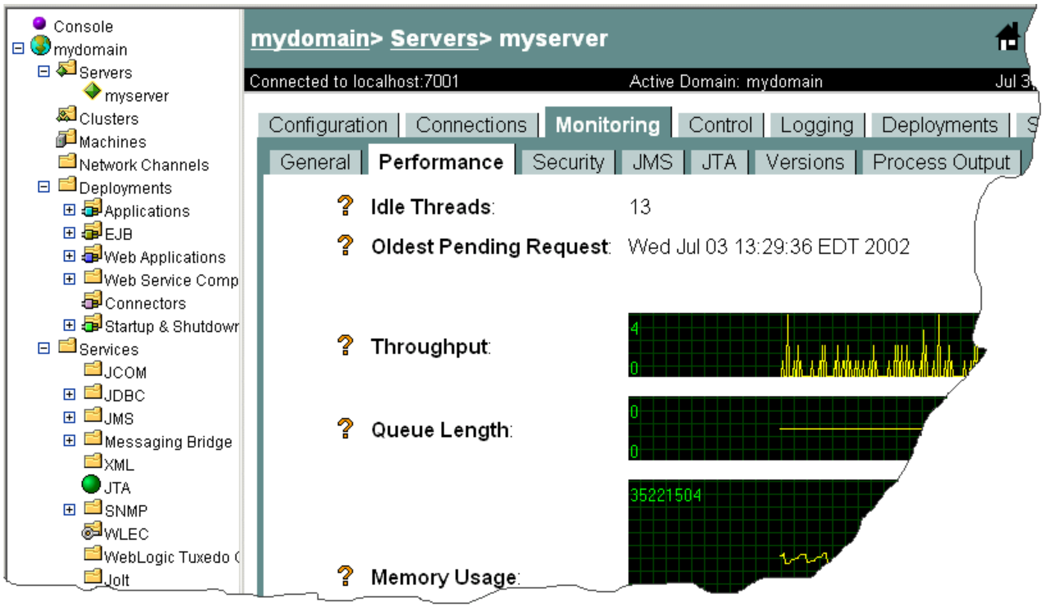
The following figure (Figure 1-8) illustrates how Runtime MBeans, Administration MBeans, and Local Configuration MBeans are distributed throughout a domain.

**Figure 1-8 Distribution of MBeans**



You can use the Administration Console, the `weblogic.Admin` utility, or MBean APIs to view the values. (See Figure 1-9.)

**Figure 1-9 Viewing Runtime Metrics from the Administration Console**



Idle Threads: 13
Oldest Pending Request: Wed Jul 03 13:29:36 EDT 2002
Throughput:
Queue Length:
Memory Usage:

You can also use these interfaces to change some runtime values. For example, the `weblogic.management.runtime.DeployerRuntimeMBean` activates and deactivates a deployed module by changing its runtime state.

## Documentation for Runtime MBean APIs

To view the documentation for Runtime MBeans, do the following:

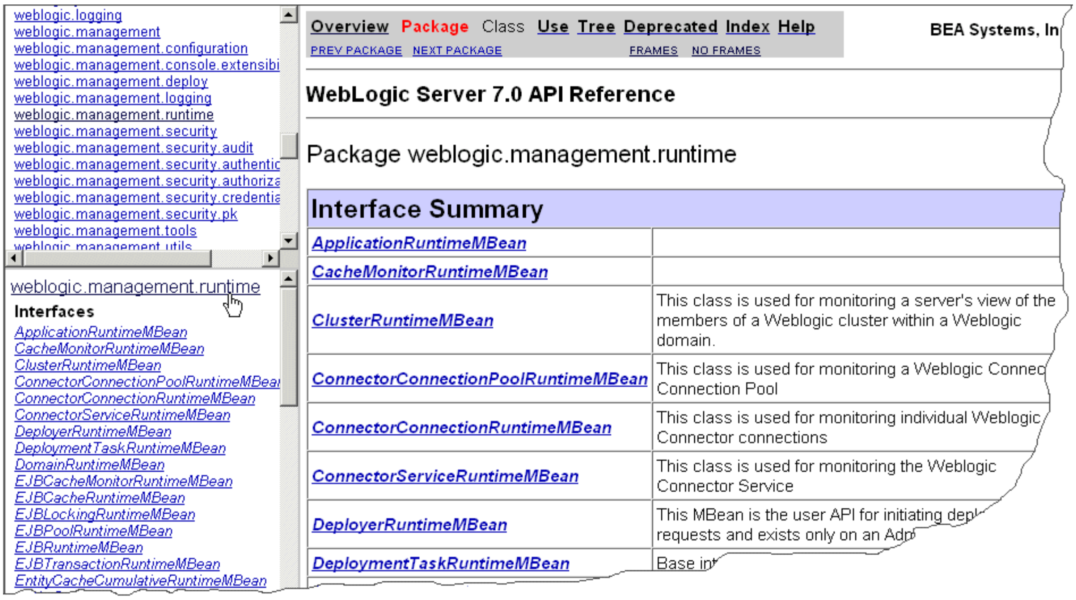
1. Open the WebLogic Server Javadoc.
2. In the top left pane of the Web browser, click `weblogic.management.runtime`.

   The lower left pane displays links for the package.

3. In the lower left pane, click `weblogic.management.runtime` again.

   The right pane displays the package summary. (See Figure 1-10.)

**Figure 1-10 Javadoc for the runtime Package**



weblogic.logging
weblogic.management
weblogic.management.configuration
weblogic.management.console.extensibi
weblogic.management.deploy
weblogic.management.logging
weblogic.management.runtime
weblogic.management.security
weblogic.management.security.audit
weblogic.management.security.authentic
weblogic.management.security.authoriza
weblogic.management.security.credentia
weblogic.management.security.pk
weblogic.management.tools
weblogic.management.utils

weblogic.management.runtime

**Interfaces**

*ApplicationRuntimeMBean*
*CacheMonitorRuntimeMBean*
*ClusterRuntimeMBean*
*ConnectorConnectionPoolRuntimeMBea*
*ConnectorConnectionRuntimeMBean*
*ConnectorServiceRuntimeMBean*
*DeployerRuntimeMBean*
*DeploymentTaskRuntimeMBean*
*DomainRuntimeMBean*
*EJBCacheMonitorRuntimeMBean*
*EJBCacheRuntimeMBean*
*EJBLockingRuntimeMBean*
*EJBPoolRuntimeMBean*
*EJBRuntimeMBean*
*EJBTransactionRuntimeMBean*
*EntityCacheCumulativeRuntimeMBean*

Overview Package Class Use Tree Deprecated Index Help
PREV PACKAGE NEXT PACKAGE FRAMES NO FRAMES
BEA Systems, In

**WebLogic Server 7.0 API Reference**

Package weblogic.management.runtime

| Interface Summary | |
|---|---|
| *ApplicationRuntimeMBean* | |
| *CacheMonitorRuntimeMBean* | |
| *ClusterRuntimeMBean* | This class is used for monitoring a server's view of the members of a Weblogic cluster within a Weblogic domain. |
| *ConnectorConnectionPoolRuntimeMBean* | This class is used for monitoring a Weblogic Connec Connection Pool |
| *ConnectorConnectionRuntimeMBean* | This class is used for monitoring individual Weblogic Connector connections |
| *ConnectorServiceRuntimeMBean* | This class is used for monitoring the Weblogic Connector Service |
| *DeployerRuntimeMBean* | This MBean is the user API for initiating dep requests and exists only on an Adm |
| *DeploymentTaskRuntimeMBean* | Base in |

4. Click on an interface name to view its API documentation.

## Security MBeans

The WebLogic Security Service provides MBeans and tools for generating additional MBeans that manage security on a WebLogic Server. These MBeans are called Security MBeans and their usage model is different from the one described in this document. For information on Security MBeans, refer to the *Developing Security Services for WebLogic Server* guide.

## Non-WebLogic Server MBeans

WebLogic Server provides hundreds of MBeans, many of which are used to configure and monitor EJBs, Web applications, and other deployable J2EE modules. If you want to use additional MBeans to configure your applications or services, you can create your own MBeans.

Any MBeans that you create can take advantage of the full set of JMX 1.0 features, as defined by the JMX specification (which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html).

However, only MBeans that are provided by WebLogic Server can use the WebLogic Server extensions to JMX. For example, any MBeans that you create for your applications cannot save data in the `config.xml` file and they cannot use the type-safe interface as described in the next section, "MBean Servers and the MBeanHome Interface."

## MBean Servers and the MBeanHome Interface

Within a WebLogic Server instance, the actual work of registering and providing access to MBeans is delegated to an MBean Server subsystem. The MBean Server on a Managed Server registers and provides access only to the Local Configuration MBeans and Runtime MBeans on the current Managed Server. The MBean Server on an Administration Server registers and provides access to the domain's Administration MBeans as well as the Local Configuration MBeans and Runtime MBeans on the Administration Server.

**Note:** On a Managed Server that is configured for MSI, the MBean Server also registers the Administration MBean replicas that the server uses to start if the Administration Server is not available. Do not interact with these Administration MBean replicas. For more information, refer to "Replication of MBeans for Managed Server Independence" on page 1-11.

To access the MBean Server subsystem, you use the `weblogic.management.MBeanHome` interface. From `MBeanHome`, you can use any of the following interfaces to interact with the MBean Server and its MBeans (see Figure 1-11):

- `javax.management.MBeanServer`, which is the standard JMX interface for interacting with MBeans. You can use this interface to look up MBeans that are registered in an MBean Server, determine the set of operations available for an MBean, and determine the type of data that each operation returns. If you invoke MBean operations through the `MBeanServer` interface, you must use standard JMX methods. For example:

  - `MBeanHome.getMBeanServer.getAttribute(`*`MBeanObjectName`*`,` *`attributeName`*`)`
  - `MBeanHome.getMBeanServer.setAttribute(`*`MBeanObjectName`*`,` *`attributeName`*`)`
  - `MBeanHome.getMBeanServer.invoke(`*`MBeanObjectName`*`,` *`operationName`*`,` *`params`*`,` *`signature`*`)`

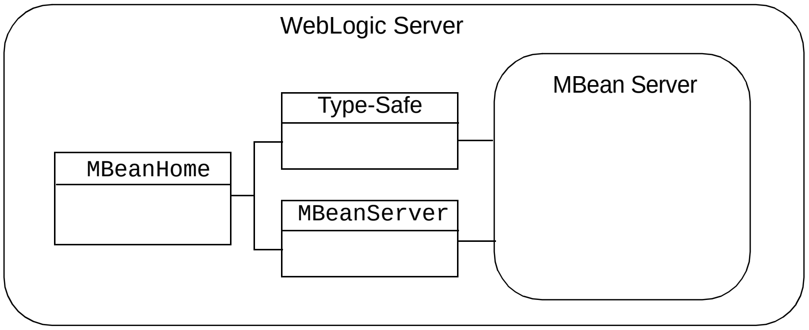
  For a complete list of `MBeanServer` APIs, refer to view the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

  The `MBeanServer` interface is your only option for interacting with MBeans that you have created and registered (non-WebLogic MBeans).

- A WebLogic Server type-safe interface that makes it appear as though you can invoke an MBean's methods directly. You can use this interface to look up MBeans that are registered in an MBean Server and invoke get, set, and other operations on the MBean. For example:

  ```
  wlMBean = MBeanHome.getMBean(WebLogicObjectName)
  wlMBean.getAttribute
  wlMBean.setAttribute
  wlMBean.operationName
  ```

**Figure 1-11 MBeans Servers and Their Interfaces**



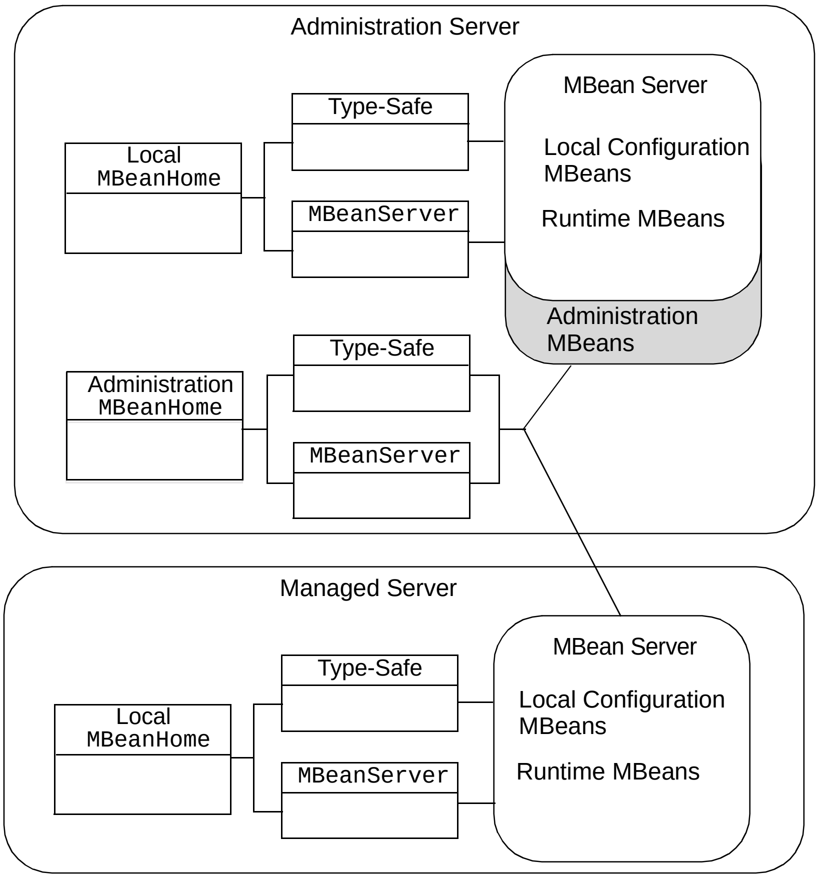
## Local MBeanHome and the Administration MBeanHome

All instances of WebLogic Server provide a **local `MBeanHome`** interface through which you can access the MBeans that are hosted in the server instance's MBean Server.

For Managed Servers and Administration Servers, the local `MBeanHome` interface provides access to the Local Configuration MBeans and Runtime MBeans for the current server only.

The Administration Server provides an additional instance of the `MBeanHome` interface. This **Administration `MBeanHome`** provides access to Administration MBeans along with all other MBeans on all server instances in the domain. While the Administration `MBeanHome` provides a single access point for all MBeans in the domain, you must sort through the lookup results to find an MBean for a specific WebLogic Server instance. In addition, it uses RMI to contact MBeans on Managed Servers, which uses more network resources and might take longer than using a local `MBeanServer` or `MBeanHome` interface. (See Figure 1-12.)

**Figure 1-12 Local and Administration MBeanHome Interfaces**



The local `MBeanHome` and the Administration `MBeanHome` are two instances of the same interface class, so the APIs for the two types of `MBeanHome` differ only in the name of the `MBeanHome` instance and in the set of MBeans that you can access.

## Notifications and Monitoring

Depending on your management needs, you can use MBean APIs to view MBean attributes only upon request, or you can use the WebLogic Server notification and monitoring facilities, which automatically broadcast reports (JMX notifications) when MBean attributes change.

To use these facilities, you can do the following:

- Create a JMX listener, which listens for and reports all attribute changes within an MBean that you specify. For example, you could use a listener with some additional logic to send an email to a System Administrator any time a user changes the configuration of a deployed component. For information about using listeners, refer to Chapter 4, "Using WebLogic Server MBean Notifications."
- Create a JMX monitor, which listens for and reports only the changes to specific MBean attributes that fall outside a set of parameters that you set. For example, you could use a monitor with some additional logic to send an email to a System Administrator when the number of open thread pools exceeds a specified limit. For more information, refer to Chapter 6, "Monitoring WebLogic Server MBeans."

## The Administration Console and the weblogic.Admin Utility

Even if you are developing applications to use the WebLogic Server JMX implementation, you will probably use the WebLogic Server Administration Console and the `weblogic.Admin` utility for some management tasks. In some cases, you might use these interfaces to familiarize yourself with some area of WebLogic Server management services before developing your JMX applications.

This section contains the following subsections:

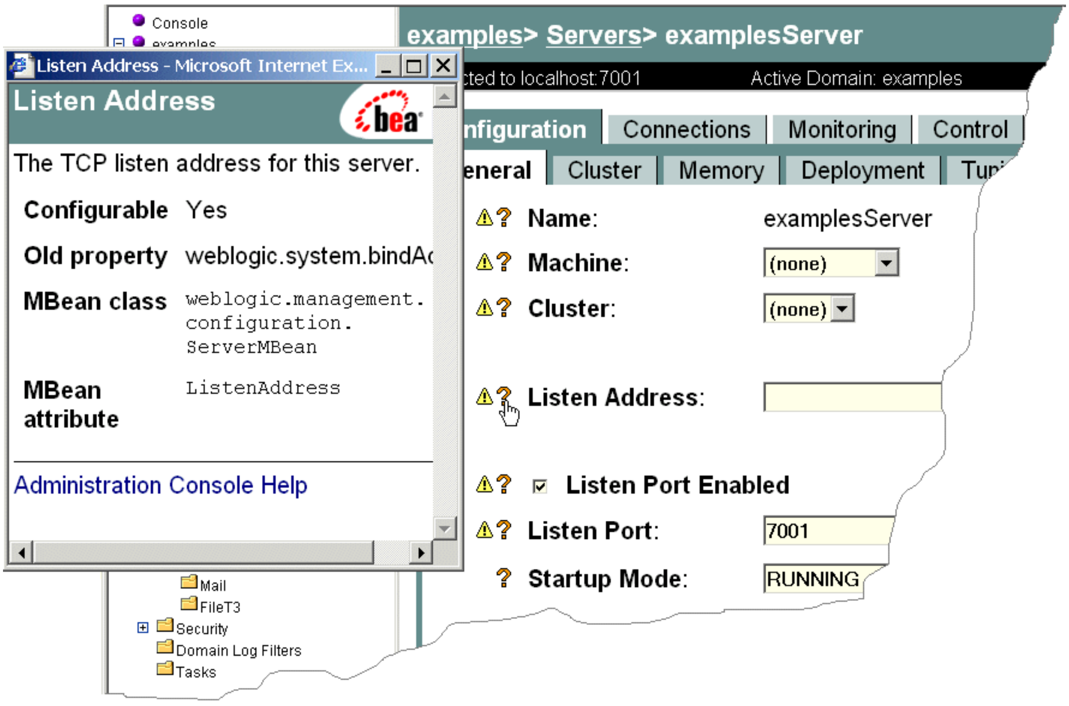
- "The Administration Console" on page 1-21
- "The weblogic.Admin Utility" on page 1-23

## The Administration Console

The Administration Console is a Web application with servlets that invoke the WebLogic Server JMX APIs. Almost all of the values that the Administration Console presents are attributes of Administration MBeans and Runtime MBeans. Because the Administration Console does not read or write Local Configuration MBeans, it is possible that it reports a value that a server instance is not currently using. For example, if you use a `weblogic.Server` startup option to override the configured listen port, the Administration Console reports the value that is in the `config.xml` file, not the overriding value.

To determine which MBean attribute the Administration Console is presenting, click the question mark next to a field. A help window displays the associated MBean class, attribute, and Javadoc description. (See Figure 1-13.)

**Figure 1-13 Viewing MBean Associations from the Administration Console**



Listen Address

The TCP listen address for this server.

| | |
|---|---|
| Configurable | Yes |
| Old property | weblogic.system.bindAd |
| MBean class | weblogic.management.configuration.ServerMBean |
| MBean attribute | ListenAddress |

| | |
|---|---|
| Name: | examplesServer |
| Machine: | (none) |
| Cluster: | (none) |
| Listen Address: | |
| ☑ Listen Port Enabled | |
| Listen Port: | 7001 |
| Startup Mode: | RUNNING |

The caution icon (yellow triangle with an exclamation point) indicates that an attribute is not dynamic. If you modify such an attribute, the underlying managed resource cannot use the new value until you restart the server.

If you modify a dynamic value from the Administration Console (such as Startup Mode in Figure 1-13), the console updates the corresponding Administration MBean For information on how this change is propagated to the Local Configuration MBean, refer to "The Lifecycle of Configuration MBeans" on page 1-8.

## The weblogic.Admin Utility

The `weblogic.Admin` utility provides several commands that create, get and set values for, invoke operations on, and delete instances of Administration and Configuration MBeans. It also provides commands to get values and invoke operations on Runtime MBeans. You could create shell scripts that use this utility instead of creating JMX applications to programmatically interact with the WebLogic Server management services, however, the performance of a JMX application is superior to a shell script that invoke command-line utilities.

You can also use the `weblogic.Admin` utility to verify object names of MBeans and to get and set attributes from a command line before committing to writing JMX code. Subsequent sections in this document provide examples of using the `weblogic.Admin` utility as part of your JMX development.

For more information, refer to "MBean Management Command Reference" in the *WebLogic Server Command Line Reference*.

CHAPTER

# 2 Accessing WebLogic Server MBeans

All JMX tasks—viewing or changing MBean attributes, using notifications, and monitoring changes—use the same process for accessing MBeans.

This topic contains the following sections:

## Main Steps for Accessing MBeans

The main steps for accessing MBeans in WebLogic Server are as follows:

1. Use a `weblogic.management.MBeanHome` interface to access the MBean Server.

   You can use the local `MBeanHome` interface from any instance of WebLogic Server to access the MBeans that are registered and active on the current server instance. If you want access to all MBeans in the domain, you can use the Administration `MBeanHome` interface on the Administration Server instead of the local `MBeanHome` interface.

2. Use one of the following interfaces to retrieve, look up, and invoke operations on MBeans:

   - The standard JMX `javax.management.MBeanServer` interface, which can retrieve and invoke operations on WebLogic Server MBeans or on MBeans that you create.
   - A type-safe interface that WebLogic Server provides. This interface, which is a WebLogic Server extension to JMX, can retrieve and invoke operations only on the MBeans that WebLogic Server provides.

   In most cases, you use these interfaces to retrieve a list of MBeans and then filter the list to retrieve and invoke operations on a specific MBean. However, if you know the `WebLogicObjectName` of an MBean, you can retrieve an MBean directly by name.

## Determining Which Interfaces to Use

When accessing MBeans, you must make two choices about which interfaces you use:

1. Whether to use the `MBeanHome` interface on a local server instance or the Administration `MBeanHome` to access the MBean Server. The `MBeanHome` interface that you choose determines the set of MBeans you can access.

   The following table lists typical considerations for determining whether to use the local `MBeanHome` interface or the Administration `MBeanHome` interface.

| **If your application manages...** | **Retrieve this `MBeanHome` interface...** |
|---|---|
| Administration MBeans | Administration `MBeanHome` |
| Multiple WebLogic Server instances in a domain | Administration `MBeanHome` |
| A single WebLogic Server instance in a domain | Local `MBeanHome`<br>Using the local interface saves you the trouble of filtering MBeans to find those that apply to the single server. Using the local interface also uses fewer network hops to access MBeans, because you are connecting directly to the Managed Server. |

2. Whether to use the standard JMX `MBeanServer` interface or the WebLogic Server type-safe interface to access and invoke operations on MBeans.

   The following table lists typical considerations for determining whether to use the `MBeanServer` interface or the type-safe interface.

| **If your application...** | **Use this interface...** |
|---|---|
| Interacts only with WebLogic Server MBeans. | The WebLogic Server type-safe interface |
| Might need to run on J2EE platforms other than WebLogic Server | `MBeanServer` |
| Interacts with non-WebLogic Server MBeans | `MBeanServer` |

## Accessing an MBeanHome Interface

The simplest process for retrieving a local `MBeanHome` interface or an Administration `MBeanHome` interface is to use the WebLogic Server `Helper` class. If you are more comfortable with a standard J2EE approach, you can use the Java Naming and Directory Interface (JNDI) to retrieve `MBeanHome`.

This section contains the following subsections:

- Using the Helper APIs to Retrieve an MBeanHome Interface
- Using JNDI to Retrieve an MBeanHome Interface

### Using the Helper APIs to Retrieve an MBeanHome Interface

WebLogic Server provides the `weblogic.management.Helper` APIs to simplify the process of retrieving `MBeanHome` interfaces.

To use the `Helper` APIs, collect the following information:

- The username and password of a user who has permission to invoke MBean operations.
- If you are accessing a local `MBeanHome` interface, the name of the target server (as defined in the domain configuration) and the URL of the target server.
- If you are accessing the Administration `MBeanHome`, the URL of the Administration Server.

After you collect the information, use one of the following APIs:

- To retrieve a local `MBeanHome`:
  ```
  Helper.getMBeanHome(java.lang.String user, java.lang.String
  password, java.lang.String serverURL, java.lang.String
  serverName)
  ```

- To retrieve the Administration MBeanHome:
  `Helper.getAdminMBeanHome(java.lang.String user, java.lang.String password, java.lang.String adminServerURL)`

For more information about the APIs, refer to the `Helper` Javadoc.

## Example: Retrieving a Local MBeanHome Interface

The following example (Listing 2-1) is a class that uses the `Helper` API to obtain the local `MBeanHome` interface for a server named `peach`.

**Listing 2-1 Retrieving a Local MBeanHome Interface**

```
public void find(String host,
                     int port,
                   String username
                     String password){

        String url = "t3://" + host +
                     ":" + port;

        try {
            localHome = (MBeanHome)Helper.getMBeanHome(username,
                                                       password,
                                                       url,
                                                       "peach");
            System.out.println("Local MBeanHome " +
                                 "found using the Helper class");
        } catch (IllegalArgumentException iae) {
            System.out.println("Illegal Argument Exception: " + iae);
        }
    }
```

# Using JNDI to Retrieve an MBeanHome Interface

While the `Helper` APIs provide a simple way to obtain an `MBeanHome` interface, you might be more familiar with the standard approach of using JNDI to retrieve the `MBeanHome`. From the JNDI tree of a Managed Server, you can access the server's local `MBeanHome` interface. From the JNDI tree of the Administration Server, you can access the Administration `MBeanHome` as well as the local `MBeanHome` interface for any server instance in the domain.

To use JNDI to retrieve an `MBeanHome` interface, do the following:

1. Use `weblogic.jndi.Environment` methods to set an initial context.

   If your application and the `MBeanHome` that you want to retrieve are running in the same JVM, the following API is sufficient for setting an initial context: `Environment.getInitialContext()`

   If your application and the `MBeanHome` are in different JVMs, you must use `Environment` methods to set the initial context with the following properties:

   - The URL of the WebLogic Server instance that hosts the `MBeanHome` you want to retrieve.
   - The username and password of a user who has permission to access the MBean.

   For example, the following lines of code set the initial context to a host named `peach`:

   ```
   Environment env = new Environment();
       env.setProviderUrl("t3://peach:7001");
       env.setSecurityPrincipal("weblogic");
       env.setSecurityCredentials("weblogic");
       Context ctx = env.getInitialContext();
   ```

   For more information about `weblogic.jndi.Environment`, refer to the WebLogic Server Javadoc.

2. Use `javax.naming.Context.lookup(String name)` to retrieve the `MBeanHome` interface.

   Supply one of the following values for the `name` argument depending on which `MBeanHome` interface you are retrieving:

   - To retrieve the local `MBeanHome` for the current context, use the following value:
     `MBeanHome.LOCAL_JNDI_NAME`
   - If the current context is an Administration Server, you can supply the following value to retrieve the local `MBeanHome` of any server instance in the domain:
     `weblogic.management.home.`*`relevantServerName`*

where `relevantServerName` is the name of a server as defined in the domain configuration.

- If the current context is an Administration Server, you can supply the following value to retrieve the Administration `MBeanHome`:
  `MBeanHome.ADMIN_JNDI_NAME`

  The Administration `MBeanHome` interface provides access to all Local Configuration, Administration, and Runtime MBeans in the domain.

  For more information about `javax.naming.Context.lookup(String name)`, refer to the JNDI Javadoc.

The following sections provide examples for retrieving `MBeanHome` interfaces:

- Example: Retrieving the Administration MBeanHome from an External Client
- Example: Retrieving a Local MBeanHome from an Internal Client

## Example: Retrieving the Administration MBeanHome from an External Client

The following example (Listing 2-2) shows how an application running in a separate JVM would look up the Administration `MBeanHome` interface. In the example, `weblogic` is a user who has permission to view and modify MBean attributes. For information about permissions to view and modify MBeans, refer to "Protecting System Administration Operations" in the *WebLogic Server Administration Guide*.

**Listing 2-2 Retrieving the Administration MBeanHome from an External Client**

```
import javax.naming.Context;
import javax.naming.InitialContext;
import javax.naming.AuthenticationException;
import javax.naming.CommunicationException;
import javax.naming.NamingException;
import weblogic.jndi.Environment;
import weblogic.management.MBeanHome;

...

  public static void main(String[] args) {

   MBeanHome home = null;
   //domain variables
   String url = "t3://localhost:7001";

   String username = "weblogic";
   String password = "weblogic";

   //Setting an initial context.
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

    //Retrieving the Administration MBeanHome interface
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the Admin MBeanHome: " + home + " from the Admin
server");

    } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }
```

## Example: Retrieving a Local MBeanHome from an Internal Client

If your client application resides in the same JVM as the Administration Server (or the WebLogic Server instance you want to manage), the JNDI lookup for the `MBeanHome` is simpler. Listing 2-3 shows how a servlet running in the same JVM as the Administration Server would look up the local `MBeanHome` for a server instance named `melon`.

**Listing 2-3 Retrieving a Local MBeanHome from an Internal Client**

```
import java.io.PrintWriter;
import java.io.IOException;
import javax.servlet.http.HttpServlet;
import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;
import javax.servlet.ServletException;
import weblogic.logging.NonCatalogLogger;
import weblogic.jndi.Environment;
import weblogic.management.MBeanHome;
import javax.naming.Context;

public class MyServlet extends HttpServlet {

public void findInternal() {
      Environment env = new Environment();

      try {

         //Setting the initial context
         ctx = env.getInitialContext();

         //Retrieving the server-specific MBeanHome interface
         home = (MBeanHome)ctx.lookup(weblogic.management.home.melon);
         System.out.println("Got the Server-specific MBeanHome: " + home);

     } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

}
```

## Using the MBeanServer Interface to Access MBeans

A standard JMX approach for interacting with MBeans is to use the `javax.management.MBeanServer` interface to look up MBeans that are within the scope of the `MBeanHome` interface. Then you use the `MBeanServer` interface to get or set MBean attributes or to invoke MBean operations.

The example class in Listing 2-4 uses JNDI to retrieve the Administration `MBeanHome` interface. Then it retrieves the `MBeanServer` interface and uses a query to look up all instances of `JDBCConnectionPoolMBean` in the domain.

For the complete list of `MBeanServer` methods, refer to the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

**Listing 2-4 Using the MBeanServer Interface**

```
import javax.naming.Context;
import javax.naming.InitialContext;
import javax.naming.AuthenticationException;
import javax.naming.CommunicationException;
import javax.naming.NamingException;
import javax.management.MBeanServer;
import weblogic.jndi.Environment;
import weblogic.management.MBeanHome;
import weblogic.management.RemoteMBeanServer;

...

  public static void main(String[] args) {

   MBeanHome home = null;
   RemoteMBeanServer homeServer = null;

   //domain variables
   String url = "t3://localhost:7001";

   String username = "weblogic";
   String password = "weblogic";
   //Setting an initial context.
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

    //Retrieving the Administration MBeanHome interface
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the Admin MBeanHome: " + home + " from the Admin
server");

    } catch (Exception e) {
      System.out.println("Exception caught: " + e);

    //Retrieving the MBeanServer interface
    homeServer = home.getMBeanServer();

    //Retrieving a list of MBeans with object names that include
    //"JDBCConnectionPool"
   java.util.Set JDBCMBeans = homeServer.queryNames(new
                    ObjectName("mydomain:Type=JDBCConnectionPool,*"), query);
   //where "query" could be any object that implements the JMX
   //javax.managementQueryExp

   for (Iterator itr = JDBCMBeans.iterator(); itr.hasNext(); ) {
            WebLogicMBean mbean = (WebLogicMBean)itr.next();
             System.out.println("Matches to the MBean query:" + mbean);
    }
}
```

## Using the Type-Safe Interface to Access MBeans

A simpler approach for accessing MBeans is to use methods of the `MBeanHome` interface. These methods look up WebLogic Server MBeans and return a type-safe interface that you can use to get and set attributes and invoke MBean operations.

This section contains the following subsections:

- "Retrieving a List of All MBeans" on page 2-12
- "Retrieving MBeans By Type and Selecting From the List" on page 2-13

## Retrieving a List of All MBeans

You can use the `MBeanHome.getAllMBeans` method to look up the object names of MBeans that are within the scope of the `MBeanHome` interface that you retrieve. For example, if you retrieve the Administrative `MBeanHome`, using `getAllMBeans()` returns a list of all MBeans in the domain.

The example code in Listing 2-5 retrieves all MBeans in the domain. It then uses `weblogic.management.WebLogicMBean.getName()` to retrieve the `Name` value of the `WebLogicObjectName`.

**Listing 2-5 Retrieving All MBeans in a Domain**

```
public void displayMBeans() {

        Set allMBeans = home.getAllMBeans();
        System.out.println("Size: " + allMBeans.size());
        for (Iterator itr = allMBeans.iterator(); itr.hasNext(); ) {
            WebLogicMBean mbean = (WebLogicMBean)itr.next();
            WebLogicObjectName objectName = mbean.getObjectName();
            System.out.println(objectName.getName() +
                               " is a(n) " +
                               mbean.getType());
        }
    }
```

For more information about the `MBeanHome.getAllMBeans` method, refer to WebLogic Server Javadoc.

## Retrieving MBeans By Type and Selecting From the List

Instead of retrieving a list of all MBeans in the scope of `MBeanHome`, you can retrieve only the list of MBeans that match a specific type. **Type** indicates the type of resource that the MBean manages and whether the MBean is an Administration, Local Configuration, or Runtime MBean. For more information about types of MBeans, refer to the next section, "WebLogicObjectNames for WebLogic Server MBeans" on page 2-16.

The example class in Listing 2-6 retrieves a list of all `ServerRuntime` MBeans in a domain, and then iterates through the list to select the `ServerRuntime` for a server named `Server1`.

**Listing 2-6 Selecting from a List of MBeans**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.ServerRuntimeMBean;
import weblogic.management.WebLogicObjectName;

public class serverRuntimeInfo3 {

  public static void main(String[] args) {

       MBeanHome home = null;

//domain variables
   String url = "t3://localhost:7001";
   String serverName = "Server1";
   String username = "weblogic";
   String password = "weblogic";

   ServerRuntimeMBean serverRuntime = null;
   Set mbeanSet = null;
   Iterator mbeanIterator = null;

//Setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

// Getting the Administration MBeanHome.
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the Admin MBeanHome: " + home );
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

   /* Here we use the getMBeansByType method to get the set of ServerRuntime mbeans
     * Then we iterate through the set. We retrieve the ServerRuntimeMbean we are
     * interested in by comparing the name to the name of the server.
     */

  try {
     mbeanSet = home.getMBeansByType("ServerRuntime");
     mbeanIterator = mbeanSet.iterator();
     while(mbeanIterator.hasNext()) {
    serverRuntime = (ServerRuntimeMBean)mbeanIterator.next();
    if(serverRuntime.getName().equals(serverName)) {
     System.out.println("we have got the serverRuntimembean: " + serverRuntime +
      " for: " + serverName);
   }
}
```

For more information about the `MBeanHome.getMBeansByType` method, refer to WebLogic Server Javadoc.

## WebLogicObjectNames for WebLogic Server MBeans

Each WebLogic Server MBean is registered in the MBean Server under a name that conforms to the `weblogic.management.WebLogicObjectName` conventions. If you know the `WebLogicObjectName` of an MBean, after you retrieve an `MBeanHome` interface, you can retrieve an MBean directly by name.

The MBean's `WebLogicObjectName` uses the following conventions to provide a unique identification for a given MBean across all domains:

*`domain`*`:Name=`*`name`*`,Type=`*`type`*`[,`*`attr`*`=`*`value`*`]...`

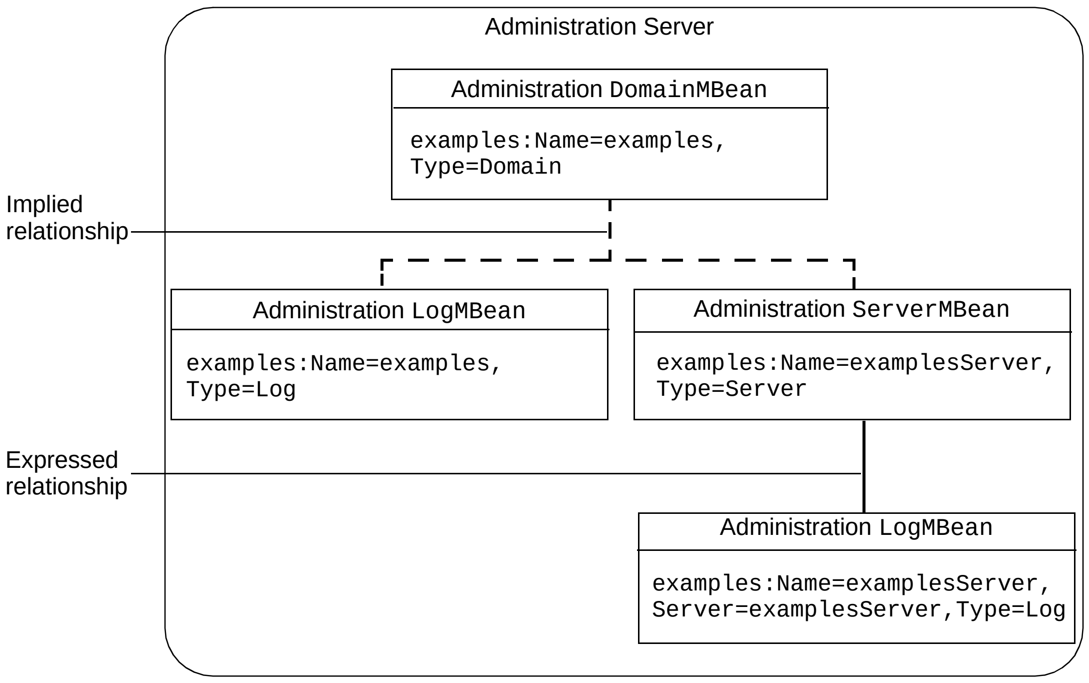
The following table describes each name component.

| This Component | Specifies |
|---|---|
| *`domain`* | The name of the WebLogic Server administration domain. |
| `Name=`*`name`* | The string that you provided when you created the associated resource. For example, when you create a JDBC connection pool, you must provide a name for that pool, such as `MyPool1`. The `JDBCConnectionPoolMBean` that represents `MyPool1` uses `Name=MyPool1` in its JMX object name.<br>The `WebLogicObjectName.getName` method returns this value for any given MBean. |

| **This Component** | **Specifies** |
|---|---|
| `Type=`*`type`* | Refers to the interface class of which the MBean is an instance. All WebLogic Server MBeans are an instance of one of the interface classes defined in the `weblogic.management.configuration` or `weblogic.management.runtime` packages. For Configuration MBeans, type also refers to whether an instance is an Administration MBean or a Local Configuration MBean. For a complete list of all WebLogic Server MBean interface classes, refer to the WebLogic Server Javadoc for the `weblogic.management.configuration` or `weblogic.management.runtime` packages.<br><br>To determine the value that you provide for the `Type` component, do the following:<br><br>1. Find the MBean's interface class and remove the `MBean` suffix from the class name. For example, for an MBean that is an instance of the `weblogic.management.runtime.JDBCConnectionPoolRuntimeMBean`, use `JDBCConnectionPoolRuntime`.<br>2. For a Local Configuration MBean, append `Config` to the name. For example, for a Local Configuration MBean that is an instance of the `weblogic.management.configuration.JDBCConnectionPoolMBean` interface class, use `JDBCConnectionPoolConfig`. For the corresponding Administration MBean instance, use `JDBCConnectionPool`. |
| `Location=`*`servername`* | All Runtime and Local Configuration MBeans include a `Location` component that specifies the name of the server on which that MBean is located. Administration MBeans do not include this component.<br><br>For example, for the `ServletRuntime` MBean that runs on a server named `myserver`, the `WebLogicObjectName` includes the following components:<br><br>`mydomain:Name=myServlet,Type=ServletRuntime,Location=myserver`<br><br>The `WebLogicObjectName.getLocation` method returns this value for any given MBean. |

| This Component | Specifies |
|---|---|
| *TypeOfParentMBean=NameOfParentMBean* | Runtime, Local Configuration, or Administration MBeans that have a child relationship with a parent MBean use this extra attribute in their object names to identify the relationship.<br><br>**Note:** With the exception of `DomainMBean`, all MBeans are direct or indirect children of the domain's `DomainMBean`. Because this parent-child relationship applies to all MBeans, it is not expressed in `WebLogicObjectName`.<br><br>For example, an instance of `LogMBean` is used by a domain to configure the domain-wide log file. Each WebLogic Server instance also maintains its own instance of `LogMBean` to configure its server-specific log file. The `LogMBean` that a domain uses does not express a child relationship, while the `LogMBean` that a server instance uses expresses its child relationship with the server's `ServerMBean`. (See Figure 2-1.)<br><br>To express the name of the Administration `LogMBean` that `examplesServer` uses to maintain its log file, use the following name:<br><br>`examples:Name=examplesServer,Server=examplesServer,Type=Log`<br><br>To express the name of the Local Configuration `LogMBean` that `examplesServer` uses to maintain its log file, use the following name:<br><br>`examples:Location=examplesServer,Name=examplesServer,ServerConfig=examplesServer,Type=LogConfig`<br><br>By convention, WebLogic Server child MBeans use the same value for the `Name` component as the parent MBean. For example, the `LogMBean` that is a child of the `examplesServer` `Server` MBean uses `Name=examplesServer` in its `WebLogicObjectName`. WebLogic Server cannot follow this convention when a parent MBean has multiple children of the same type.<br><br>To determine whether the `WebLogicObjectName` of an MBean expresses a parent-child relations, use the `WebLogicObjectName.getParent` method or the `weblogic.Admin GET` command. |

**Figure 2-1 Parent-Child Relation of LogMBean Instances**


Administration Server
Administration DomainMBean
examples:Name=examples, Type=Domain
Implied relationship
Administration LogMBean
examples:Name=examples, Type=Log
Administration ServerMBean
examples:Name=examplesServer, Type=Server
Expressed relationship
Administration LogMBean
examples:Name=examplesServer, Server=examplesServer,Type=Log

## Using weblogic.Admin to Find the WebLogicObjectName

If you are unsure which values to supply for an MBean's `WebLogicObjectName`, you can use the `weblogic.Admin` utility to find the `WebLogicObjectName`. The utility can return information only for WebLogic Server MBeans that are on an active server instance.

For example, to find the `WebLogicObjectName` for the Administration instance of the `LogMBean` in the `examples` domain, enter the following command on the `examplesServer` Administration Server, where the Administration Server is listening on port 8001 and `weblogic` is the name and password of a user who has permission to view MBean attributes:

```
java weblogic.Admin -url http://localhost:8001 -username weblogic
-password weblogic GET -pretty -type Log
```

The command returns the output in Listing 2-7. Notice that the command returns two MBeans of type `Log` on the Administration Server. The first MBean, `examples:Name=examplesServer,Server=examplesServer,Type=Log`, has a child relationship with the `ServerMBean` of `examplesServer`; this relationship indicates that the MBean is the `LogMBean` that configures the server-specific log file. The second MBean, `examples:Name=examples,Type=Log`, has no child relationship, which indicates that it configures the domain-wide log file.

**Listing 2-7 Output from weblogic.Admin**

```
---------------------------
MBeanName:
"examples:Name=examplesServer,Server=examplesServer,Type=Log"
        CachingDisabled: true
        FileCount: 7
        FileMinSize: 500
        FileName: examplesServer\examplesServer.log
        FileTimeSpan: 24
        Name: examplesServer
        Notes:
        NumberOfFilesLimited: false
        ObjectName: examplesServer
        Registered: false
        RotationTime: 00:00
        RotationType: none
        Type: Log

---------------------------
MBeanName: "examples:Name=examples,Type=Log"
        CachingDisabled: true
        FileCount: 7
        FileMinSize: 500
        FileName: ./logs/wl-domain.log
        FileTimeSpan: 24
        Name: examples
        Notes:
```

```
NumberOfFilesLimited: false
ObjectName: examples
Registered: false
RotationTime: 00:00
RotationType: none
Type: Log
```

To view the Local Configuration MBean instances of `LogMBean`, append `Config` to the value of the `type` argument:

```
java weblogic.Admin -url http://localhost:8001 -username weblogic
-password weblogic GET -pretty -type LogConfig
```

The command returns output in Listing 2-8. Notice that the `WebLogicObjectName` of the Local Configuration MBeans includes a `Location` component.

**Listing 2-8 Local Configuration MBeans**

```
---------------------------
MBeanName:
"examples:Location=examplesServer,Name=examplesServer,ServerConfi
g=examplesServer,Type=LogConfig"
        CachingDisabled: true
        FileCount: 7
        FileMinSize: 500
        FileName: examplesServer\examplesServer.log
        FileTimeSpan: 24
        Name: examplesServer
        Notes:
        NumberOfFilesLimited: false
        ObjectName: examplesServer
        Registered: false
        RotationTime: 00:00
        RotationType: none
        Type: LogConfig

---------------------------
MBeanName:
"examples:Location=examplesServer,Name=examples,Type=LogConfig"
        CachingDisabled: true
        FileCount: 7
        FileMinSize: 500
        FileName: ./logs/wl-domain.log
        FileTimeSpan: 24
        Name: examples
        Notes:
        NumberOfFilesLimited: false
        ObjectName: examples
        Registered: false
        RotationTime: 00:00
        RotationType: none
        Type: LogConfig
```

CHAPTER

# 3 Accessing and Changing Configuration Information

WebLogic Server managed resources are configured from the values in Local Configuration MBeans, which are replicas of the Administration MBeans on the Administration Server.

If you want to programmatically view or change the configuration data for managed resources, you must first use the `MBeanServer` interface or the WebLogic Server type-safe interface to retrieve Local Configuration MBeans or Administration MBeans. Then you use APIs in the `weblogic.management.configuration` package to view or change the configuration data. For information about viewing the API documentation, refer to "Documentation for Configuration MBean APIs" on page 1-11.

**Note:** The values in the Local Configuration MBeans can differ from the Administration MBeans if you use a startup option to override the Administration MBean values, or if you use an API to change values in a Local Configuration MBean directly. For more information about the distribution of configuration data in a WebLogic Server domain, refer to "WebLogic Server Managed Resources and MBeans" on page 1-2.

This topic provides examples for programmatically retrieving and modifying the configuration of WebLogic Server resources using the `weblogic.Admin` utility, the JMX `MBeanServer` APIs, and the WebLogic Server type-safe interface:

- "Example: Using weblogic.Admin to Configure the Message Level for Standard Out" on page 3-3
- "Example: Using MBeanServer to Configure the Message Level for Standard Out" on page 3-4
- "Example: Using the Type-Safe Interface to Retrieve Information About a JMS Configuration" on page 3-6

## Example: Using weblogic.Admin to Configure the Message Level for Standard Out

This example uses `weblogic.Admin` to find the `WebLogicObjectName` of the Local Configuration MBean instance of `weblogic.management.configuration.ServerMBean`. Then it sets the level of messages that a server instance named `peach` sends to standard out. Because it sets the value of a Local Configuration MBean, the updated value applies only to the current server session.

**Listing 3-1 Configuring the Message Level**

```
C:\myWLDomains\mydomain>java weblogic.Admin -url http://peach:8001 -username
weblogic -password weblogic GET -pretty -type ServerConfig

---------------------------
MBeanName: "mydomain:Location=peach,Name=peach,Type=ServerConfig"
        AcceptBacklog: 50
        AdministrationPort: 0
...

        StdoutDebugEnabled: false
        StdoutEnabled: true
        StdoutFormat: standard
        StdoutLogStack: true
        StdoutSeverityLevel: 16
C:\myWLDomains\mydomain>java weblogic.Admin -url http://peach:8001 -username
weblogic -password weblogic SET -mbean
 mydomain:Location=peach,Name=peach,Type=ServerConfig
 -property StdoutSeverityLevel 64

Ok
```

The `weblogic.Admin` utility returns the string `Ok` to indicate that the `SET` command succeeded.

## Example: Using MBeanServer to Configure the Message Level for Standard Out

The class in this example uses the Local Configuration MBean instance of `weblogic.management.configuration.ServerMBean` to temporarily change the level of messages that a server instance named `peach` sends to standard out. It uses the standard JMX `MBeanServer` interface to change the `ServerMBean` configuration.

The class as written runs on the Administration Server and uses the Administration `MBeanHome` to retrieve the Local Configuration MBean for `peach`, but you could modify it to run on a local server and use the local server's `MBeanHome` to retrieve `ServerMBean`.

Instead of retrieving a list of all MBeans and then filtering the list to find the local `ServerMBean` for a specific server instance, this example uses the MBean naming conventions to construct the `WebLogicObjectName` for the `ServerMBean`. For more information about naming conventions, refer to "WebLogicObjectNames for WebLogic Server MBeans" on page 2-16.

In the example, `weblogic` is a user who has permission to view attributes of the `ServerMBean`. For information about permissions to view and modify MBeans, refer to "Protecting System Administration Operations" in the *WebLogic Server Administration Guide*.

**Listing 3-2 Configuring EJB Deployment Descriptors**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import javax.management.MBeanServer;

import weblogic.jndi.Environment;
import weblogic.management.MBeanHome;
import weblogic.management.WebLogicMBean;
import weblogic.management.WebLogicObjectName;

public class changeStandardOut {
  public static void main(String[] args) {

    MBeanHome home = null;
    MBeanServer homeServer = null;

   //domain variables
   String url = "t3://localhost:7001";
   String username = "weblogic";
   String password = "weblogic";

//setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

//getting the Administration MBeanHome
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

// Constructing a WebLogicObjectName for the local ServerMBean
// that is associated with the server instance named peach.
   String mbeanName = "examples:Location=peach,Name=peach,Type=ServerConfig";
    WebLogicObjectName objName = new WebLogicObjectName(mbeanName);

// Retrieving the MBeanServer interface.
    homeServer = home.getMBeanServer();

// Using MBeanServer to set the value of the StdoutSeverityLevel attribute
    homeServer.setAttribute(mbeanName,StdoutSeverityLevel,64);

//  Providing feedback that operation succeeded.
   System.out.println("Changed standard out severity level to: " +
   homeServer.getAttribute(mbeanName,StdoutSeverityLevel));

     } catch (Exception e) {
       System.out.println("Caught exception: " + e);
      }

  }
}
```

## Example: Using the Type-Safe Interface to Retrieve Information About a JMS Configuration

The example in this section collects all the JMS-related configuration information in a domain. To retrieve JMS-related Administration MBeans, it uses the `getMBeansByType` method of the Administration `MBeanHome`.

You could add more functionality to this program by using the get and set methods of the JMS-related Administration MBeans that the program retrieves.

**Listing 3-3 Retrieving Information About a JMS Configuration**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.ServerRuntimeMBean;


public class getJMSInfo {

  public static void main(String[] args) {

   MBeanHome home = null;
   String url = "t3://localhost:7001";
   String username = "weblogic";
   String password = "weblogic";
   WebLogicMBean bean = null;

//setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();
    System.out.println("got the IC");

//getting the Administration MBeanHome
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the MBeanHome " + home);
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

/*Getting the Administration MBeans. The getMBeansByType method
* retrieves Administration MBeans because there is no "Config"
* or "Runtime" suffix in the value that is passed.
* For example, "JMSConnectionFactory" retrieves an Administration
* MBean, while "JMSConnectionFactoryConfig" retrieves a Configuration
* MBean.
   Set myset = home.getMBeansByType("JMSConnectionFactory");
   Iterator iter = myset.iterator();
   System.out.println("Iterating over: ");
   while(iter.hasNext()) {
    bean = (WebLogicMBean) iter.next();
    System.out.println("Got the server mbean: " + bean);
   }

   myset = home.getMBeansByType("JMSServer");
   iter = myset.iterator();
   System.out.println("Iterating over: ");
   while(iter.hasNext()) {
    bean = (WebLogicMBean) iter.next();
    System.out.println("Got the config mbean: " + bean);
   }

   myset = home.getMBeansByType("JMSSessionPool");
   iter = myset.iterator();
   System.out.println("Iterating over: ");
   while(iter.hasNext()) {
    bean = (WebLogicMBean) iter.next();
    System.out.println("Got the runtime mbean: " + bean);
   }

   myset = home.getMBeansByType("JMSQueue");
   iter = myset.iterator();
   System.out.println("Iterating over: ");
   while(iter.hasNext()) {
    bean = (WebLogicMBean) iter.next();
    System.out.println("Got the runtime mbean: " + bean);
   }
   myset = home.getMBeansByType("JMSConnectionFactory");
   iter = myset.iterator();
   System.out.println("Iterating over: ");
   while(iter.hasNext()) {
    bean = (WebLogicMBean) iter.next();
    System.out.println("Got the runtime mbean: " + bean);
   }

   myset = home.getMBeansByType("JMSConnectionConsumer");
   iter = myset.iterator();
   System.out.println("Iterating over: ");
   while(iter.hasNext()) {
    bean = (WebLogicMBean) iter.next();
    System.out.println("Got the runtime mbean: " + bean);
   }
  }
}
```

CHAPTER

# 4 Using WebLogic Server MBean Notifications

To report changes in configuration and runtime information, all WebLogic Server MBeans emit JMX notifications. A **notification** is a JMX object that describes a state change or some other specific condition that has occurred in an underlying resource.

You can create Java classes called **listeners** that listen for these notifications. For example, your application can include a listener that receives notifications when applications are deployed, undeployed, or redeployed.

This topic includes the following sections:

- "WebLogic Server Notification Types" on page 4-2
- "Listening for Notifications: Main Steps" on page 4-3

## WebLogic Server Notification Types

WebLogic Server MBeans implement the `javax.management.NotificationBroadcaster` interface to emit different types of notification objects depending on the type of event that occurs:

- When an MBean's attribute value changes, it emits a `javax.management.AttributeChangeNotification` object.
- When an MBean's `add`*`AttributeName`* method is called, it emits a `weblogic.management.AttributeAddNotification` object.
- When an MBean's `remove`*`AttributeName`* method is called, it emits a `weblogic.management.AttributeRemoveNotification` object.

In addition, when MBeans have been registered or unregistered, the WebLogic Server JMX services emit notifications of type `javax.management.MBeanServerNotification`.

For more information about the `javax.management` notification types, refer to the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation..

For more information about the `weblogic.management` notification types, refer to the Javadoc for AttributeAddNotification and AttributeRemoveNotification.

## WebLogic Server Log Notifications

When a WebLogic Server resource generates a log message, its MBeans emit a notification of type `weblogic.management.WebLogicLogNotification`. You can use the `WebLogicLogNotification` API to extract parts of the log message, including the transaction ID, user ID, and version number associated with the message.

For more information about log notifications, refer to the *Using WebLogic Logging Services* guide.

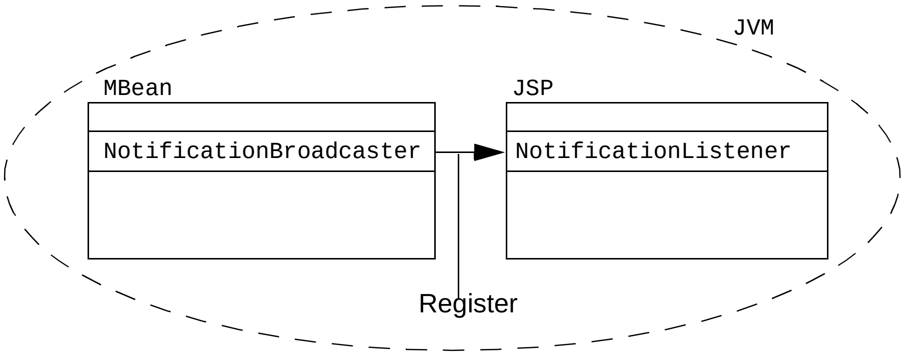
## Listening for Notifications: Main Steps

To listen for the notifications that MBeans emit, do the following:

1. Create a listener class in your application.
2. Register the class with the MBeans whose notifications you want to receive.
3. Optionally implement and register a `NotificationFilter` class, which provides additional control over which notifications the listener receives.

Figure 4-1 shows a basic system in which a JSP contains a `NotificationListener` that is registered with an MBean's implementation of the `NotificationBroadcaster` interface.

**Figure 4-1 Monitoring Notifications from a JSP**



This section contains the following subsections:

- Creating a Notification Listener
- Registering a Notification Listener

For a complete explanation of JMX notifications and how they work, download the JMX 1.0 specification from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html.

## Creating a Notification Listener

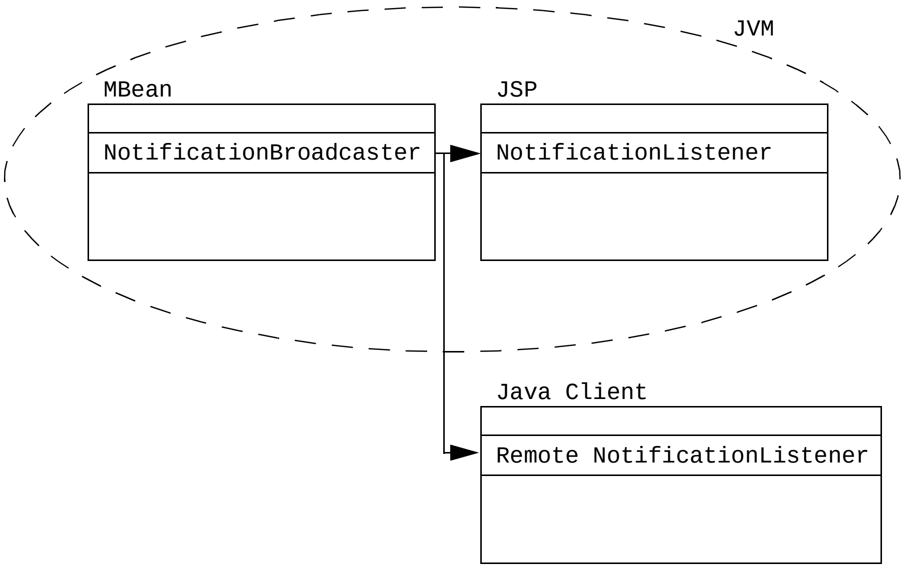
To create a notification listener for a client that runs within the same JVM as WebLogic Server, create a class that implements `javax.management.NotificationListener`. Your implementation must include the `NotificationListener.handleNotification()` method.

For more information on `NotificationListener`, refer to the `javax.management.Notification` Javadoc in the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

To create a notification listener for a client that runs in a JVM that is separate from WebLogic Server, create a class that implements `weblogic.management.RemoteNotificationListener`. `RemoteNotificationListener` extends `javax.management.NotificationListener` and `java.rmi.Remote`, making MBean notifications available to external clients via RMI. Your implementation must include the `RemoteNotificationListener.handleNotification()` method. For more information, refer to `RemoteNotificationListener` Javadoc.

After you implement `RemoteNotificationListener`, you register your listener with MBeans whose notifications you want to receive. (See Figure 4-2.)

**Figure 4-2 Monitoring Notifications from a Separate JVM**



The following example creates a remote listener that prints output when `NotificationBroadcaster` broadcasts a `WebLogicLogNotification` message that indicates an application has been deployed or undeployed.

**Listing 4-1 Notification Listener**

```
import javax.management.Notification;
import javax.management.NotificationFilter;
import javax.management.NotificationListener;
import javax.management.Notification.*;
import weblogic.management.RemoteNotificationListener;
import weblogic.management.logging.WebLogicLogNotification;

public class myListener implements
                RemoteNotificationListener {

public void handleNotification(Notification notification, Object obj) {

        WebLogicLogNotification wln = (WebLogicLogNotification)notification;
        /*
         * These are all the attributes you can get on a
         * WebLogicLogNotification
         */

        System.out.println("\n\nmessage id = " + wln.getMessageId());
        System.out.println("server name = " + wln.getServername());
        System.out.println("machine name = " + wln.getMachineName());
        System.out.println("severity = " + wln.getSeverity());
        System.out.println("type = " + wln.getType());
        System.out.println("timestamp = " + wln.getTimeStamp());
        System.out.println("message = " + wln.getMessage());
        System.out.println("thread id = " + wln.getThreadId());
        System.out.println("user id = " + wln.getUserId());
        System.out.println("transaction id = " + wln.getTransactionId());
        System.out.println("version = " + wln.getVersion());

      int messageId = wln.getMessageId();

        /* These are the messageIDs of the messages broadcast when an
         * application is deployed/undeployed/redeployed
         * 160004 is for undeployment
         * 160003 is for deployment
         */

        if(messageId == 160004)
          System.out.println(\n\nwln.getMessage());
        else if (messageId == 160003)
          System.out.println(wln.getMessage());
        else;

    }
}
```

## Registering a Notification Listener

Because all WebLogic Server MBeans implement the `javax.management.NotificationBroadcaster` interface, you can register a `NotificationListener` with any MBean.

Registering a `NotificationListener` can be accomplished by calling the MBean's `addNotificationListener()` method. However, in most cases it is preferable to use the `addNotificationListener()` method of the `MBeanServer` interface, which saves the trouble of looking up a particular MBean simply for registration purposes.

The following example uses `MBeanServer.addNotificationListener()` to register the listener from Listing 4-1 with the `LogBroadcasterRuntimeMBean`.

**Listing 4-2 Registering a Listener**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.LogBroadcasterRuntimeMBean;
import weblogic.management.WebLogicObjectName;
import javax.management.*;
import javax.management.Notification;
import weblogic.management.RemoteMBeanServer;

/* This class is to be registered as a startup class with the server that
 * receives the Log Notifications
 */

public class logger {

  public static void main(String[] args) {

   MBeanHome home = null;
   LogBroadcasterRuntimeMBean logBroadcaster = null;
   RemoteMBeanServer rmbs = null;

   //domain variables
   String serverName = "MyServer";
   String domainName = "myDomain";

   try {
    Context ctx = new InitialContext();

   //Get a local MBeanHome
    home = (MBeanHome) ctx.lookup("weblogic.management.home." + serverName);
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

   //Use MBeanHome to get MBeanServer
   try {
     rmbs = home.getMBeanServer();
   } catch(Exception e) {
   System.out.println("Caught exception: " + e);
      }

   try {
     /* The LogBroadcasterRuntimeMBean is only responsible for emitting
      * notifications for log messages. All notifications generated are
      * of the type WebLogicLogNotification. There is only one
      * LogBroadcasterRuntimeMBean per server.
      */

     WebLogicObjectName oname = new WebLogicObjectName(domainName +      "
       :Name=TheLogBroadcaster,Type=LogBroadcasterRuntime,Location="
       + serverName);
     myListener listener = new myListener();

     rmbs.addNotificationListener(oname, listener, null, null);
     System.out.println("\n[myListener]: Listener registered
                         for the LogBroadcasterRuntimeMBean ...");
   } catch(Exception e) {
   System.out.println("Exception: " + e);
     }
  }
}
```

CHAPTER

# 5 Accessing Runtime Information

WebLogic Server includes a large number of MBeans that provide information about the runtime state of managed resources. If you want to create applications that view and modify this runtime data, you must first use the `MBeanServer` interface or the WebLogic Server type-safe interface to retrieve Runtime MBeans. Then you use APIs in the `weblogic.management.runtime` package to view or change the runtime data. For information about viewing the API documentation, refer to "Documentation for Runtime MBean APIs" on page 1-14.

This topic provides examples for retrieving and modifying runtime information about WebLogic Server domains and server instances:

- "Determining the Active Domain and Servers" on page 5-2
- "Example: Viewing and Changing the Runtime State of a WebLogic Server Instance" on page 5-5
- "Example: Viewing Runtime Information About Clusters" on page 5-16

## Determining the Active Domain and Servers

The Administration `MBeanHome` interface includes APIs that you can use to determine the name of the currently active domain and the name of all server instances that are currently active.

The example class in Listing 5-1 does the following:

1. Retrieves the Administration `MBeanHome` interface.
2. Uses `MBeanHome.getActiveDomain().getName()` to retrieve the name of the domain.
3. Uses the `getMBeansByType` method to retrieve the set of all `ServerRuntime` MBeans in the domain.
4. Iterates through the set and compares the names of the `ServerRuntimeMBean` instances with the name of the WebLogic Server instance. If the instance is active, it prints the name of the server.

In the following example, `weblogic` is the username and password for a user who has permission to view and modify MBean attributes. For information about permissions to modify MBeans, refer to "Protecting System Administration Operations" in the *WebLogic Server Administration Guide*.

The code in this example must run on the Administration Server.

**Listing 5-1 Determining the Active Domain and Servers**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.ServerRuntimeMBean;
import weblogic.management.WebLogicObjectName;
import weblogic.management.MBeanHome;
```

```
public class getActiveDomainAndServers {

  public static void main(String[] args) {

    MBeanHome home = null;

//url of the Administration Server
   String url = "t3://localhost:7001";
   String username = "weblogic";
   String password = "weblogic";
   ServerRuntimeMBean serverRuntime = null;
   int count = 0;

   Set mbeanSet = null;
   Iterator mbeanIterator = null;

//setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();
    System.out.println("got the IC");

//getting the Administration MBeanHome
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

//getting the name of the active domain
    try {
     System.out.println("Active Domain: " + home.getActiveDomain().getName() );
   } catch (Exception e) {
      System.out.println("Exception: " + e);
     }

//getting the names of servers in the domain
   System.out.println("Active Severs: ");
      mbeanSet = home.getMBeansByType("ServerRuntime");
      mbeanIterator = mbeanSet.iterator();
      while(mbeanIterator.hasNext()) {
    serverRuntime = (ServerRuntimeMBean)mbeanIterator.next();
//printing the names of active servers
    if(serverRuntime.getState().equals("Running")) {
     System.out.println("Name: " + serverRuntime.getName());
     System.out.println("ListenAddress: " + serverRuntime.getListenAddress());
     System.out.println("ListenPort: " + serverRuntime.getListenPort());
     count++;
    }
     }
     System.out.println("Number of servers active in the domain: " + count);
  }
}
```

## Using weblogic.Admin to Determine Active Domains and Servers

While you can use the example code in Listing 5-1 to determine active domains and servers from a JMX application, you can use the `weblogic.Admin` utility to accomplish a similar task from the command line or a script.

The following command returns the name of the currently active domain, where `peach` hosts the domain's Administration Server and `weblogic` is the name and password of a user who has permission to view MBean attributes:

```
java weblogic.Admin -url peach:8001 -username weblogic -password
weblogic GET -type DomainRuntime -property Name
```

The command output includes the `WebLogicObjectName` of the `DomainRuntimeMBean` and the value of its `Name` attribute:

```
{MBeanName="examplesDomain:Location=peach,Name=examplesDomain,Ser
verRuntime=peach,Type=DomainRuntime"{Name=examplesDomain}}
```

To see a list of all server instances that are currently active, you use ask the Administration Server to retrieve all `ServerRuntime` MBeans that are registered in its Administration `MBeanHome` interface. (Only active server instances register `ServerRuntime` MBeans with the Administration `MBeanHome` interface.)

You must specify the `-adminurl` argument to instruct the `GET` command to use the Administration Server's Administration `MBeanHome` interface:

```
java weblogic.Admin -adminurl peach:8001 -username weblogic
-password weblogic GET -type ServerRuntime -property State
```

The command output includes the `WebLogicObjectName` of all `ServerRuntime` MBeans and the value of each `State` attribute:

```
---------------------------
MBeanName:
"MedRec:Location=MedRecMS2,Name=MedRecMS2,Type=ServerRuntime"
        State: RUNNING

---------------------------
MBeanName:
"MedRec:Location=MedRecServer,Name=MedRecServer,Type=ServerRuntim
e"
        State: RUNNING

---------------------------
MBeanName:
"MedRec:Location=MedRecMS1,Name=MedRecMS1,Type=ServerRuntime"
        State: RUNNING
```

## Example: Viewing and Changing the Runtime State of a WebLogic Server Instance

The `weblogic.management.runtime.ServerRuntimeMBean` interface provides runtime information about a WebLogic Server instance. For example, it indicates which listen ports and addresses a server is using. It also includes operations that change the lifecycle state of a server. (For information about server states, refer to "Server Lifecycle" in the *Configuring and Managing WebLogic Server* guide.)

This section provides examples of finding ServerRuntimeMBean and using it to change the state of a server instance. Each example illustrates a different way of retrieving ServerRuntimeMBean:

- "Using a Local MBeanHome and getRuntimeMBean()" on page 5-6
- "Using the Administration MBeanHome and getMBean()" on page 5-11
- "Using the Administration MBeanHome and getMBeansByType()" on page 5-9
- "Using the MBeanServer Interface" on page 5-14

You cannot use the weblogic.Admin utility to change the value of Runtime MBean attributes.

## Using a Local MBeanHome and getRuntimeMBean()

Each WebLogic Server instance hosts its own MBeanHome interface, which provides access to the Local Configuration and Runtime MBeans on the server instance. As opposed to using the Administration MBeanHome interface, using the local MBeanHome saves you the trouble of filtering MBeans to find those that apply to the current server. It also uses fewer network hops to access MBeans, because you are connecting directly to the server (instead of routing requests through the Administration Server).

The MBeanHome interface includes the getRuntimeMBean() method, which returns only Runtime MBeans that reside on the current WebLogic Server. If you invoke MBeanHome.getRuntimeMBean()on the Administration Server, it returns only the Runtime MBeans that are on the Administration Server.

In the following example, weblogic is the username and password for a user who has permission to view and modify MBean attributes and Server1 is the name of the WebLogic Server instance for which you want to view and change status. For information about permissions to modify MBeans, refer to "Protecting System Administration Operations" in the *WebLogic Server Administration Guide*.

**Listing 5-2 Using a Local MBeanHome and getRuntimeMBean()**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.ServerRuntimeMBean;
import weblogic.management.WebLogicObjectName;

public class serverRuntimeInfo1 {

  public static void main(String[] args) {

    MBeanHome home = null;

//domain variables
   String url = "t3://localhost:7003";
   String serverName = "Server1";

   String username = "weblogic";
   String password = "weblogic";

   ServerRuntimeMBean serverRuntime = null;
   ServerRuntimeMBean serverRuntimeM = null;

//setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

//getting the local MBeanHome
    home = (MBeanHome) ctx.lookup("weblogic.management.home." + serverName);
    System.out.println("Got the MBeanHome: " + home + " for server: " +
      serverName);
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

    /* Here we use the getRuntimeMBean method to access the ServerRuntimeMbean
     * of the server instance.
     */

    try {
     serverRuntime =
       (ServerRuntimeMBean)home.getRuntimeMBean(serverName,"ServerRuntime");
     System.out.println("Got serverRuntimeMBean: " + serverRuntime);
    } catch (javax.management.InstanceNotFoundException e) {
       System.out.println("Caught exception: " + e);
      }

    System.out.println("Current state: " + serverRuntime.getState() );
    System.out.println("Suspending the server ...");
    serverRuntime.suspend();
    System.out.println("Current state: " + serverRuntime.getState() );
    System.out.println("Stopping the server ...");

//changing the state to SHUTDOWN
    serverRuntime.shutdown();
    System.out.println("Current state: " + serverRuntime.getState() );
  }
}
```

## Using the Administration MBeanHome and getMBeansByType()

Like the example in Listing 5-1, "Determining the Active Domain and Servers," on page 5-2, the example class in this section uses the Administration MBeanHome interface to retrieve a ServerRuntime MBean. The Administration MBeanHome provides a single access point for all MBeans in the domain, but it requires you to either construct the WebLogicObjectName of the MBean you want to retrieve or to filter MBeans to find those that apply to a specific current server.

This example class uses MBeanHome.getMBeansByType method to retrieve the set of all ServerRuntime MBeans in the domain. It then iterates through the set and compares the names of the ServerRuntimeMBean instances with the name of a WebLogic Server instance. When it finds a specific server instance, the class changes the state of the server to SHUTDOWN.

In the following example, weblogic is the username and password for a user who has permission to view and modify MBean attributes, Server1 is the name of the WebLogic Server instance for which you want to view and change status, and mihirDomain is the name of the WebLogic Server administration domain.

For information about permissions to modify MBeans, refer to "Protecting System Administration Operations" in the *WebLogic Server Administration Guide*.

**Listing 5-3 Using the Administration MBeanHome and getMBeansByType()**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.ServerRuntimeMBean;
import weblogic.management.WebLogicObjectName;
```

```
public class serverRuntimeInfo3 {

  public static void main(String[] args) {

       MBeanHome home = null;

//domain variables
   String url = "t3://localhost:7001";
   String serverName = "Server1";
   String username = "weblogic";
   String password = "weblogic";

   ServerRuntimeMBean serverRuntime = null;
   Set mbeanSet = null;
   Iterator mbeanIterator = null;

//Setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

// Getting the Administration MBeanHome.
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the Admin MBeanHome: " + home );
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

   /* Here we use the getMBeansByType method to get the set of ServerRuntime mbeans
    * Then we iterate through the set. We retrieve the ServerRuntimeMbean we are
    * interested in by comparing the name to the value of serverName.
    */

  try {
     mbeanSet = home.getMBeansByType("ServerRuntime");
     mbeanIterator = mbeanSet.iterator();
     while(mbeanIterator.hasNext()) {
    serverRuntime = (ServerRuntimeMBean)mbeanIterator.next();
    if(serverRuntime.getName().equals(serverName)) {
     System.out.println("we have got the serverRuntimembean: " + serverRuntime +
      " for: " + serverName);
             System.out.println("Current state: " + serverRuntime.getState() );
             System.out.println("Suspending the server ...");
             System.out.println("Stopping the server ...");
//changing the state to SHUTDOWN
             serverRuntime.shutdown();
             System.out.println("Current state: " + serverRuntime.getState() );
    } catch (javax.management.InstanceNotFoundException e) {
       System.out.println("Caught exception: " + e);
     }
}
```

## Using the Administration MBeanHome and getMBean()

Instead of retrieving a list of all MBeans and then filtering the list to find the `ServerRuntimeMBean` for a specific server, this example uses the MBean naming conventions to construct the `WebLogicObjectName` for the `ServerRuntimeMBean` on a server instance named `Server1`. For information about constructing a `WebLogicObjectName`, refer to "WebLogicObjectNames for WebLogic Server MBeans" on page 2-16.

To make sure that you supply the correct object name, you can use the `weblogic.Admin GET` command. For example, the following command returns the object name and list of attributes of the `ServerRuntimeMBean` for a server instance named `Server1`:

```
java weblogic.Admin -url http://Server1:7001 -username weblogic
 -password weblogic GET -pretty -type ServerRuntime
```

For more information about using the `weblogic.Admin` utility to find information about MBeans, refer to "MBean Management Command Reference" in the *WebLogic Server Command Line Reference*.

In Listing 5-4, `weblogic` is the username and password for a user who has permission to view and modify MBean attributes, `Server1` is the name of the WebLogic Server instance for which you want to view and change status, and `mihirDomain` is the name of the WebLogic Server administration domain.

**Listing 5-4 Using the Administration MBeanHome and getMBean()**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.runtime.ServerRuntimeMBean;
import weblogic.management.WebLogicObjectName;

public class serverRuntimeInfo2 {

  public static void main(String[] args) {

    MBeanHome home = null;

//domain variables

   String url = "t3://localhost:7001";
   String serverName = "Server1";
   String username = "weblogic";
   String password = "weblogic";

   ServerRuntimeMBean serverRuntime = null;

//setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

/* Getting the Administration MBeanHome.
* Note: Looking up MBeanHome.ADMIN_JNDI_NAME returns the Administration
*       MBeanHome interface. It provides access to all MBeans in the domain.
*       Looking up "weblogic.management.home.<AdminServerName>" returns the
*       local MBeanHome for the Administration Server. It provides
*       to the Configuration and Runtime MBeans on the Administration Server.
*/
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the Admin MBeanHome: " + home + " from the
      Admin server");
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

  try {

     /* Creating the mbean object name.
     *  The serverName refers to the name of the Managed Server that hosts
     *  the ServerRuntimeMBean.
     */
     String name = "mihirDomain:Location=" + serverName + ",Name=" +
      serverName + ",Type=ServerRuntime" ;
     WebLogicObjectName objName = new WebLogicObjectName(name);
     System.out.println("Created WebLogicObjectName: " + name);

    serverRuntime = (ServerRuntimeMBean)home.getMBean(objName);
    System.out.println("Got the serverRuntime using the adminHome: " +
      serverRuntime );
  } catch(Exception e) {
     System.out.println("Exception: " + e);
    }

    System.out.println("Current state: " + serverRuntime.getState() );
    System.out.println("Suspending the server ...");
    serverRuntime.suspend();
    System.out.println("Current state: " + serverRuntime.getState() );
    System.out.println("Stopping the server ...");

//changing the state to SHUTDOWN
    serverRuntime.shutdown();
    System.out.println("Current state: " + serverRuntime.getState() );

  }
}
```

## Using the MBeanServer Interface

The example in this section uses a standard JMX approach for interacting with MBeans. It uses the Administration `MBeanHome` interface to retrieve the `javax.management.MBeanServer` interface and then uses `MBeanServer` to retrieve the value of the `ListenPort` attribute of the `ServerRuntimeMBean` for a server instance named `Server1`.

In the following example, `weblogic` is the username and password for a user who has permission to view and modify MBean attributes and `mihirDomain` is the name of the WebLogic Server administration domain.

**Listing 5-5 Using the Administration MBeanHome and getMBean()**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import javax.management.ObjectName;
import javax.management.MBeanServer;

import weblogic.jndi.Environment;
import weblogic.management.MBeanHome;
import weblogic.management.WebLogicMBean;
import weblogic.management.runtime.ServerRuntimeMBean;
import weblogic.management.WebLogicObjectName;

public class serverRuntimeInfo3 {

  public static void main(String[] args) {

    MBeanHome home = null;

//domain variables

   String url = "t3://adminserver:7001";
   String serverName = "Server1";
   String username = "weblogic";
   String password = "weblogic";
   String ListenPort = "7001";

   ServerRuntimeMBean serverRuntime = null;

//setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

// Getting the Administration MBeanHome.
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
    System.out.println("Got the Admin MBeanHome: " + home + " from the
      Admin server");
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

  try {

     /* Creating the mbean object name.
     *  The serverName refers to the name of the Managed Server that hosts
     *  the ServerRuntimeMBean.
     */
     String name = "mihirDomain:Location=" + serverName + ",Name=" +
      serverName + ",Type=ServerRuntime" ;
     WebLogicObjectName objName = new WebLogicObjectName(name);
     System.out.println("Created WebLogicObjectName: " + name);

    //Retrieving the MBeanServer interface
    homeServer = home.getMBeanServer();

    //Retrieving the ListenPort attribute of ServerRuntimeMBean
    attributeValue = homeServer.getAttribute(objName, ListenPort);
    System.out.println("ListenPort for " + serverName + " is:" + attributeValue);

    } catch(Exception e) {
     System.out.println("Exception: " + e);
    }

}
```

## Example: Viewing Runtime Information About Clusters

The example in this section retrieves the number and names of WebLogic Server instances currently running in a cluster. It uses `weblogic.management.runtime.ClusterRuntimeMBean`, which provides information about a single Managed Server's view of the members of a WebLogic cluster.

Only Managed Servers host instances of `ClusterRuntimeMBean`, and you must retrieve the `ClusterRuntimeMBean` instance from a Managed Server that is actively participating in a cluster.

To make sure that it retrieves a `ClusterRuntimeMBean` from an active Managed Server that is in a cluster, this example does the following:

1. Retrieves the Administration `MBeanHome`, which runs on the Administration Server and can provide access to all `ClusterRuntimeMBeans` in the domain.
2. Retrieves all `ClusterRuntimeMBeans` and determines whether they belong to a specific domain.
3. Finds one `ClusterRuntimeMBean` for a Managed Server in the domain of interest.
4. Uses the `ClusterRuntimeMBean` APIs on the Managed Server to determine the number and name of active servers in the cluster.

In the example, `weblogic` is the username and password for a user who has permission to view and modify MBean attributes. For information about permissions to modify MBeans, refer to "Protecting System Administration Operations" in the *WebLogic Server Administration Guide*.

**Listing 5-6 Retrieving a List of Servers Running in a Cluster**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.runtime.ClusterRuntimeMBean;
import weblogic.management.WebLogicObjectName;
import weblogic.management.MBeanHome;

public class getRunningServersInCluster {

  public static void main(String[] args) {

    MBeanHome home = null;

//domain variables
   String url = "t3://localhost:7001"; //url of the Administration Server

/* If you have more than one cluster in your domain, define a list of all the
*  servers in the cluster. You compare the servers in the domain with this list
*  to determine which servers are in a specific cluster.
*/

   String server1 = "cs1"; // name of server in the cluster
   String server2 = "cs2"; // name of server in the cluster

   String username = "weblogic";
   String password = "weblogic";

   ClusterRuntimeMBean clusterRuntime = null;

   Set mbeanSet = null;
   Iterator mbeanIterator = null;
   String name = "";

   String[] aliveServerArray = null;
```

```
//Setting the initial context
   try {
    Environment env = new Environment();
    env.setProviderUrl(url);
    env.setSecurityPrincipal(username);
    env.setSecurityCredentials(password);
    Context ctx = env.getInitialContext();

// Getting the Administration MBeanHome.
    home = (MBeanHome) ctx.lookup(MBeanHome.ADMIN_JNDI_NAME);
   } catch (Exception e) {
      System.out.println("Exception caught: " + e);
     }

// Retrieving a list of ClusterRuntime MBeans in the domain.
     try {
      mbeanSet = home.getMBeansByType("ClusterRuntime");
      mbeanIterator = mbeanSet.iterator();
      while(mbeanIterator.hasNext()) {

// Retrieving one ClusterRuntime MBean from the list.
    clusterRuntime = (ClusterRuntimeMBean)mbeanIterator.next();

    // Getting the name of the ClusterRuntime MBean.
    name = clusterRuntime.getName();

    // Determining if the current ClusterRuntimeMBean belongs to a
    // server in the cluster of interest.
    if(name.equals(server1) || name.equals(server2) ) {

     // Using the current ClusterRuntimeMBean to retrieve the number of
     // servers in the cluster.
     System.out.println("\nNumber of active servers in the cluster: " +
       clusterRuntime.getAliveServerCount());

     // Retrieving the names of servers in the cluster.
            aliveServerArray = clusterRuntime.getServerNames();
     break;
    }
     }
    } catch (Exception e) {
       System.out.println("Caught exception: " + e);
      }

     if(aliveServerArray == null) {
      System.out.println("\nThere are no running servers in the cluster");
      System.exit(1);
     }
     System.out.println("\nThe running servers in the cluster are: ");
     for (int i=0; i < aliveServerArray.length; i++) {
     System.out.println("server " + i + " : " + aliveServerArray[i]);
     }
  }
}
```

CHAPTER

# 6 Monitoring WebLogic Server MBeans

WebLogic Server includes a set of **monitor MBeans** that emit JMX notifications only when specific MBean attributes change beyond a specific threshold. A monitor MBean observes the attribute of another MBean (the observed MBean) at specific intervals. The monitor derives a value from this observation, called the **derived gauge**. This derived gauge is either the exact value of the observed attribute, or optionally, the difference between two consecutive observed values of a numeric attribute.

When the value of the derived gauge satisfies a set of conditions, the monitor MBean emits a specific notification type. Monitors can also send notifications when certain error cases are encountered while monitoring an attribute value.

The process for monitoring an attribute of an MBean is as follows:

1. Create a listener class that can listen for notifications from monitor MBeans.
2. Choose a monitor MBean type that matches the type of data you want to observe.
3. Configure and instantiate a monitor MBean.
4. Instantiate the listener class.

This topic contains the following sections:

## Creating a Notification Listener

As any other MBean, monitor MBeans emit notifications by implementing `javax.management.NotificationBroadcaster`. To create a listener for notifications from a monitor MBean, create a class that does the following:

1. Implements `NotificationBroadcaster` or `weblogic.management.RemoteNotificationListener`.
2. Includes the `NotificationListener.handleNotification()` or the `RemoteNotificationListener.handleNotification()` method.

You can register the same notification listener with instances of `LogBroadcasterMBean`, monitor MBeans, or any other MBean.

The example below creates a listener object for an application that runs in a JVM outside the WebLogic Server JVM. It includes logic that outputs additional messages when it receives notifications from monitor MBeans.

**Listing 6-1 Listener for Monitor Notifications**

```
import java.rmi.Remote;
import javax.management.Notification;
import javax.management.monitor.MonitorNotification;
import weblogic.management.RemoteNotificationListener;

public class CounterListener
             implements RemoteNotificationListener {

 public void handleNotification(Notification notification ,Object obj) {

  System.out.println("\n\n Notification Received ...");
  System.out.println("Type=" + notification.getType() );
  System.out.println("SequenceNumber=" + notification.getSequenceNumber());
  System.out.println("Source=" + notification.getSource());
  System.out.println("Timestamp=" + notification.getTimeStamp() + "\n" );

  if(notification instanceof MonitorNotification) {

   MonitorNotification monitorNotification = (MonitorNotification) notification;
   System.out.println("This notification is a MonitorNotification");
   System.out.println("Observed Attribute: " +
                      monitorNotification.getObservedAttribute() );
   System.out.println("Observed Object: " +
                     monitorNotification.getObservedObject() );
   System.out.println("Trigger value: " + monitorNotification.getTrigger() );
  }
 }
}
```

## Choosing a WebLogic Server Monitor Type

Monitor MBeans are specialized to observe changes in specific data types. You must instantiate the type of monitor MBean that matches the type of the object that an MBean returns for an attribute value. For example, a monitor MBean based on the `StringMonitor` type can observe an attribute that is declared as an `Object` as long as actual values of the attributes are `String` instances, as determined by the `instanceof` operator.

To choose a monitor type, do the following:

1. Determine the type of object that is returned by the MBean attribute that you want to observe by doing any of the following:
   - Refer to the WebLogic Server Javadoc.
   - Use the `weblogic.Admin GET` command, which provides information about the MBean that you specify. For more information, refer to "MBean Management Command Reference" in the *WebLogic Server Administration Guide*.
   - Use the `javap` command on the MBean you are monitoring. The `javap` command is a standard Java utility that disassembles a class file.
2. Choose a monitor type from the following table.

| **A Monitor MBean of This Type** | **Observes This Object Type** |
|---|---|
| `CounterMonitor` | `Integer` |

| A Monitor MBean of This Type | Observes This Object Type |
|---|---|
| `GaugeMonitor` | Integer or floating-point (`Byte`, `Integer`, `Short`, `Long`, `Float`, `Double`) |
| `StringMonitor` | `String` |

For more information about monitor types, refer to the JMX 1.0 specification, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

# Instantiating the Monitor and Listener

After you determine which type of monitor to instantiate, you create a class that instantiates and configures the monitor, and instantiates and registers the listener.

This section contains the following subsections:

- "Main Steps for Instantiating a Monitor and Listener" on page 6-5
- "Example: Instantiating a CounterMonitor for a Remote Application" on page 6-7
- "Configuring CounterMonitor Objects" on page 6-9
- "Configuring GaugeMonitor Objects" on page 6-11
- "Configuring StringMonitor Objects" on page 6-12

## Main Steps for Instantiating a Monitor and Listener

To instantiate a monitor MBean and listener object, create a class that does the following:

1. Creates a monitor object. The example in Listing 6-2 creates a `CounterMonitor` object using the default constructor of `javax.management.monitor.CounterMonitor`.
2. Configures the monitor object by doing the following:
   a. Constructs a JMX object name for the **monitor object**. Listing 6-2 uses `WebLogicObjectName()`, but you can use `javax.management.ObjectName` for the monitor object. The object name must be unique throughout the entire WebLogic Server domain, and it must follow the JMX conventions:

      `*domain name*:Name=*name*,Type=*type*[,*attr*=*value*]...`

   b. Constructs a JMX object name for the **observed MBean** using `WebLogicObjectName()`.

      If the observed MBean is a WebLogic Server MBean, you must use `WebLogicObjectName()` instead of `javax.management.ObjectName`. You can also use `MBeanHome.getMBeansByType()` or other WebLogic Server APIs to get the name of the observed MBean object. For examples of different methods of retrieving MBeans, refer to "Accessing WebLogic Server MBeans" on page 2-1.

   c. Sets values for the monitor's threshold parameters. The set of available parameters varies, depending on whether you are instantiating a `CounterMonitor`, `GaugeMonitor`, or `StringMonitor`.

      For more information about the parameters that you pass to configure a monitor argument, refer to "Configuring CounterMonitor Objects" on page 6-9, "Configuring GaugeMonitor Objects" on page 6-11, and "Configuring StringMonitor Objects" on page 6-12.

   d. Configures the monitor object using the monitor's APIs.

3. Instantiates the listener object that you created in "Creating a Notification Listener" on page 6-2.

4. Registers the listener object using the monitor's `addNotificationListener()` method.

5. (This step is needed only if your monitor class runs in a JVM that is outside the WebLogic Server JVM.) Initializes a reference to the monitor object within the MBean Server by doing the following:

   a. Retrieving the `MBeanServer` interface using the Administration `MBeanHome` interface.

   b. Using the monitor's `preRegister()` method

6. Starts the monitor using the monitor's `start()` method.

## Example: Instantiating a CounterMonitor for a Remote Application

The following example creates a monitor for the `ServicedRequestTotalCount` attribute of the `ExecuteQueRuntimeMBean`, which returns the number (`int`) of requests that have been processed by the corresponding execution queue.

**Listing 6-2 Instantiating the Monitor and Listener**

```
import java.util.Set;
import java.util.Iterator;
import java.rmi.RemoteException;
import javax.naming.*;
import weblogic.jndi.Environment;

import weblogic.management.MBeanHome;
import javax.management.ObjectName;
import weblogic.management.WebLogicMBean;
import weblogic.management.configuration.ServerMBean;
import weblogic.management.*;
import weblogic.management.monitor.*;
import javax.management.*;
import javax.management.monitor.CounterMonitor;

public class clientMonitor {

    public static void main (String Args[]) {

    try {

      //Instantiate a CounterMonitor
      CounterMonitor monitor = new CounterMonitor();

       // construct the objectName for your CounterMonitor object
            WebLogicObjectName monitorObjectName = new
              WebLogicObjectName("mydomain:Type=CounterMonitor,Name=MyCounter");

       // Construct the objectName for the observed MBean
            WebLogicObjectName qObjectName = new
                WebLogicObjectName("mihirDomain:Location=MyServer,Name=default,
                           ServerRuntime=MyServer,Type=ExecuteQueueRuntime");
       // Define variables to be used when configuring your CounterMonitor
       // object.
            Integer threshold = new Integer(1000);
            Integer offset = new Integer(2000);
       //Configure your monitor object using the CounterMonitor APIs
            monitor.setThreshold(threshold);
            monitor.setNotify(true);
            monitor.setOffset(offset);
            monitor.setObservedObject(qObjectName);
            monitor.setObservedAttribute("ServicedRequestTotalCount");

       //Instantiate and register your listener with the monitor
         CounterListener listener = new CounterListener();
         monitor.addNotificationListener(listener, null, null);

   //Use the Administration MBeanHome API to get the MBeanServer interface.
   // this is needed when you are registering a monitor from the
   // client side.

     String url = "t3://localhost:7001"; //URL of the Administration server
     String username = "weblogic";
     String password = "weblogic";

     MBeanHome home = null;

     Environment env = new Environment();
     env.setProviderUrl(url);
     env.setSecurityPrincipal(username);
     env.setSecurityCredentials(password);
     Context ctx = env.getInitialContext();
     home = (MBeanHome) ctx.lookup(weblogic.management.adminhome);
     RemoteMBeanServer rmbs = home.getMBeanServer();

     monitor.preRegister(rmbs, monitorObjectName);

  //start the monitor
   monitor.start();

}
      catch (Exception e) {   e.printStackTrace();     }   }
}
```

## Configuring CounterMonitor Objects

`CounterMonitor` objects observe changes in MBean attributes that are expressed as integers. The following list describes groups of `CounterMonitor` operations that you use to achieve typical configurations of a `CounterMonitor` instance:

- Sends a notification when the observed attribute exceeds the threshold.

  ```
  setThreshold(int threshold);
  setNotify(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the observed attribute exceeds the threshold. Then it increases the threshold by the offset value. Each time the observed attribute exceeds the new threshold, the threshold is increased by the offset value. For example, if you set `Threshold` to `1000` and `Offset` to `2000`, when the observed attribute exceeds `1000`, the `CounterMonitor` object sends a notification and increases the threshold to `3000`. When the observed attribute exceeds `3000`, the `CounterMonitor` object sends a notification and increases the threshold again to `5000`.

  ```
  setThreshold(int threshold);
  setNotify(true);
  setOffset(int offset);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the observed attribute exceeds the threshold, and increases the threshold by the offset value. When the threshold reaches the value specified by the modulus, the threshold is returned to the value that was specified through the latest call to the monitor's `setThreshold` method, before any offsets were applied. For example, if the original `Threshold` is set to `1000` and the `Modulus` is set to `5000`, when the `Threshold` exceeds `5000`, the monitor sends a notification and resets the `Threshold` to `1000`.

  ```
  setThreshold(int threshold);
  setNotify(true);
  setOffset(int offset);
  setModulus(int modulus);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the difference between two consecutive observations exceeds the threshold. For example, the `Threshold` is `20` and the monitor observes an attribute value of `2`. If the next observation is greater than `22`, then the monitor sends a notification. However, if the value is `10` at the next observation, and `25` at the following observation, then the monitor does not send a notification because the value has not changed by more than `20` for any two consecutive observations.

  ```
  setThreshold(int threshold);
  setNotify(true);
  setDifferenceMode(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the difference between two consecutive observations exceeds the threshold, and increases the threshold by the offset value. When the threshold reaches the value specified by the modulus, the threshold is returned to the value that was specified through the latest call to the monitor's `setThreshold` method, before any offsets were applied.

  ```
  setThreshold(int threshold);
  setNotify(true);
  setOffset(int offset);
  setModulus(int modulus);
  setDifferenceMode(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

To see all possible configurations of a `CounterMonitor` instance, refer to the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

## Configuring GaugeMonitor Objects

`GaugeMonitor` objects observe changes in MBean attributes that are expressed as integers or floating-point. The following list describes groups of `GaugeMonitor` operations that you use to achieve typical configurations of a `GaugeMonitor` instance:

- Sends a notification when the observed attribute is beyond the high threshold.

  ```
  setHighThreshold(int Highthreshold);
  setNotifyHigh(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the observed attribute is outside the range of the high or low threshold.

  ```
  setThresholds(int Highthreshold, Lowthreshold);
  setNotifyHigh(true);
  setNotifyLow(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the difference between two consecutive observations is outside the range of the high or low threshold.

  ```
  setThresholds(int Highthreshold, Lowthreshold);
  setNotifyHigh(true);
  setNotifyLow(true);
  setDifferenceMode(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

`GaugeMonitor` does not support an offset or modulus.

To see all possible configurations of a `GaugeMonitor` instance, refer to the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

## Configuring StringMonitor Objects

`StringMonitor` objects observe changes in MBean attributes that are expressed as strings. The following list describes groups of `StringMonitor` operations that you use to achieve typical configurations of a `StringMonitor` instance:

- Sends a notification when the observed attribute **matches** the string specified in `StringToCompare`.

  ```
  setStringToCompare(String);
  setNotifyMatch(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

- Sends a notification when the observed attribute **differs from** the string specified in `StringToCompare`.

  ```
  setStringToCompare(String);
  setNotifyDiffer(true);
  setObservedObject(ObjectName);
  setObservedAttribute("AttributeName");
  ```

To see all possible configurations of a `StringMonitor` instance, refer to the JMX 1.0 API documentation, which you can download from http://jcp.org/aboutJava/communityprocess/final/jsr003/index.html. The archive that you download includes the API documentation.

## Notification Types

Each type of monitor MBean emits specific types of notifications. The following table describes the type of notifications that monitor MBeans emit.

| A Monitor MBean of This Type | Emits This Notification Type |
|---|---|
| `CounterMonitor` | A counter monitor emits a `jmx.monitor.counter.threshold` when the value of the counter reaches or exceeds a threshold known as the comparison level. |
| `GaugeMonitor` | ■ If the observed attribute value is **increasing** and becomes equal to or greater than the high threshold value, the monitor emits a notification type of `jmx.monitor.gauge.high`. Subsequent crossings of the high threshold value do not cause further notifications unless the attribute value becomes equal to or less than the low threshold value.<br>■ If the observed attribute value is **decreasing** and becomes equal to or less than the low threshold value, the monitor emits a notification type of `jmx.monitor.gauge.low`. Subsequent crossings of the low threshold value do not cause further notifications unless the attribute value becomes equal to or greater than the high threshold value. |
| `StringMonitor` | ■ If the observed attribute value **matches** the string to compare value, the monitor emits a notification type of `jmx.monitor.string.matches`. Subsequent matches of the string to compare values do not cause further notifications unless the attribute value differs from the string to compare value.<br>■ If the attribute value **differs** from the string to compare value, the monitor emits a notification type of `jmx.monitor.string.differs`. Subsequent differences from the string to compare value do not cause further notifications unless the attribute value matches the string to compare value. |

## Error Notification Types

All monitors can emit the following notification types to indicate error cases:

- `jmx.monitor.error.mbean`, which indicates that the observed MBean is not registered in the MBean Server. The observed object name is provided in the notification.
- `jmx.monitor.error.attribute`, which indicates that the observed attribute does not exist in the observed object. The observed object name and observed attribute name are provided in the notification.
- `jmx.monitor.error.type`, which indicates that the object instance of the observed attribute value is `null` or not of the appropriate type for the given monitor. The observed object name and observed attribute name are provided in the notification.
- `jmx.monitor.error.runtime`, which contains exceptions that are thrown while trying to get the value of the observed attribute (for reasons other than the cases described above).

The counter and the gauge monitors can also emit the following `jmx.monitor.error.threshold` notification type under the following circumstances:

- For a counter monitor, when the threshold, the offset, or the modulus is not of the same type as the observed counter attribute.
- For a gauge monitor, when the low threshold or high threshold is not of the same type as the observed gauge attribute.

## Sample Monitoring Scenarios

This section outlines some typical MBean attributes that you might consider monitoring to observe performance and/or resource usage. For more details on individual MBean attributes or methods, see the appropriate MBean API documentation.

## JDBC Monitoring

The `JDBCConnectionPoolRuntime` MBean maintains several attributes that describe the connections to a deployed JDBC connection pool. Applications may monitor these attributes to observe the connection delays and connection failures, as well as connection leaks. The following table outlines those MBean attributes typically used for JDBC monitoring.

| JDBCConnectionPoolRuntime MBean Attribute | Typical Monitoring Application |
|---|---|
| `LeakedConnectionCount` | Notify a listener when the total number of leaked connections reaches a predefined threshold. Leaked connections are connections that have been checked out but never returned to the connection pool via a `close()` call; it is important to monitor the total number of leaked connections, as a leaked connection cannot be used to fulfill later connection requests. |
| `ActiveConnectionsCurrentCount` | Notify a listener when the current number of active connections to a specified JDBC connection pool reaches a predefined threshold. |
| `ConnectionDelayTime` | Notify a listener when the average time to connect to a connection pool exceeds a predefined threshold. |
| `FailuresToReconnect` | Notify a listener when the connection pool fails to reconnect to its datastore. Applications may notify a listener when this attribute increments, or when the attribute reaches a threshold, depending on the level of acceptable downtime. |

# Index