

Oracle® Fusion Middleware

Securing Resources Using Roles and Policies for Oracle WebLogic Server



14c (14.1.2.0.0)

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Oracle Fusion Middleware Securing Resources Using Roles and Policies for Oracle WebLogic Server, 14c (14.1.2.0.0)

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Preface

This documentation describes how to use security roles and policies in Oracle WebLogic Server 14c to determine who can access resources in a domain.

Audience

This document contains information that is useful for security architects and security administrators who are designing a security strategy for resources within a WebLogic Server domain. It includes information about resource types, options for securing Web applications and EJBs, different types of security roles and policies, and the components of a role and policy.

It is assumed that the reader is familiar with Java EE security and the other features of the WebLogic Security Service.

The information in this document is relevant during the design and development phases of a software project. This document does not address production phase administration topics. For links to WebLogic Server documentation and resources related to these topics, see [Related Documentation](#).

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Related Documentation

Use the reference books as and when it is required for better understanding.

Other WebLogic Server documents that may be of interest to security administrators wanting to secure WebLogic resources are:

- *Understanding Security for Oracle WebLogic Server*—Summarizes the features of the WebLogic Security Service, including an overview of its architecture and capabilities. It is the starting point for understanding WebLogic security.
- *Administering Security for Oracle WebLogic Server*—Describes how to ensure that security is comprehensively configured for a WebLogic Server installation, including information about security providers, identity and trust and SSL.
- Security Policies and Roles in *Oracle WebLogic Remote Console Online Help* Provides instructions for using the WebLogic Remote Console to complete the tasks described in this document.

These documents provide additional information about specific resource types:

- Securing Web Applications, Securing Enterprise JavaBeans (EJBs) and Using Java Security to Protect WebLogic Resources in *Developing Applications with the WebLogic Security Service*
- Configuring Access Control in *Developing JCOM Applications for Oracle WebLogic Server* (COM resources)
- Security in *Developing Resource Adapters for Oracle WebLogic Server* (EIS resources)
- *Securing WebLogic Web Services for Oracle WebLogic Server*

Tutorials and Samples

Additional security documents are listed in Code Examples and Sample Applications in *Understanding Oracle WebLogic Server*.

New and Changed WebLogic Server Features

For a comprehensive listing of the new WebLogic Server features introduced in this release, see *What's New in Oracle WebLogic Server*.

Conventions

The following text conventions are used in this document:

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

1

Introduction

The WebLogic Security Service combines several layers of security features to prevent unauthorized access to your WebLogic Server domains.

This document describes using roles and policies to determine who can access resources in a domain. The roles and policies feature fulfills the same function as the familiar Access Control List (ACL), but offers an improvement over ACLs: an ACL is static while roles and policies specify conditions under which users can access resources, and these conditions are evaluated at run time.

2

Understanding WebLogic Resource Security

Learn the terms and concepts related to securing WebLogic Server resources and understand the main steps you can follow to create roles and policies to secure them.

This chapter includes the following sections:

- [Overview of Securing WebLogic Resources](#)
- [Designing Roles and Policies for WebLogic Resources: Main Steps](#)

Overview of Securing WebLogic Resources

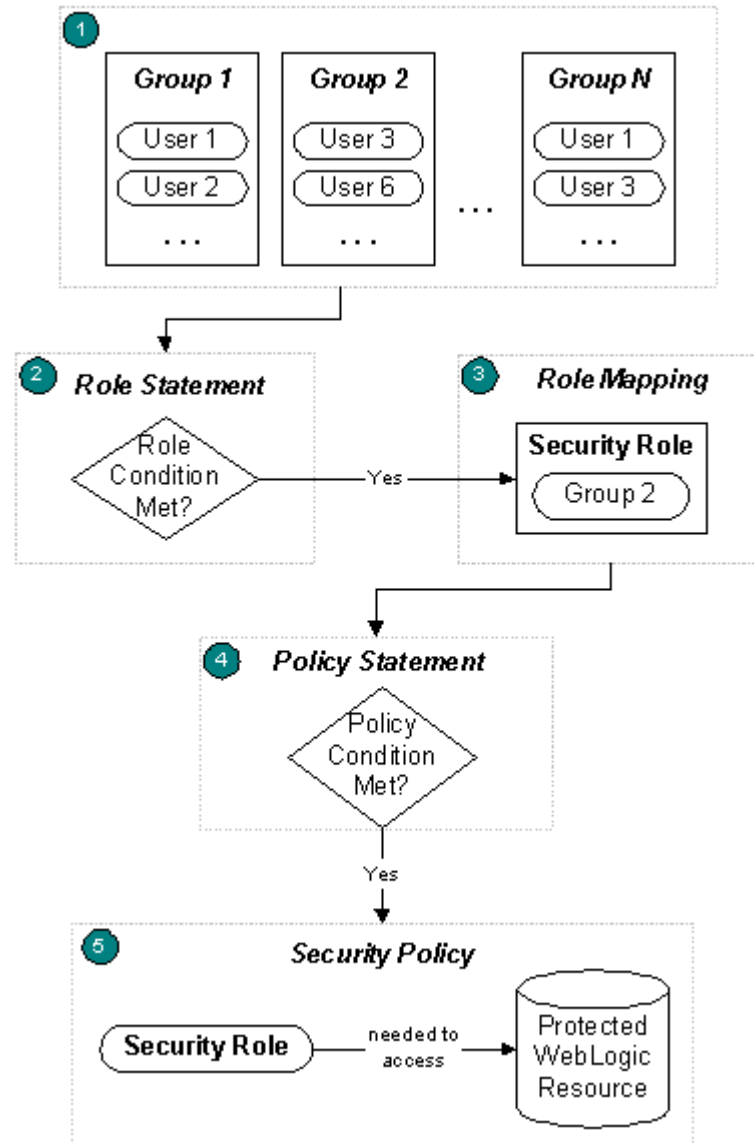
To secure a resource in a WebLogic Server domain, you create a policy and an optional role. A **resource** is an entity (such as a Web Service or a server instance) or an action (such as a method in a Web Service or the act of shutting down a server instance). A **policy** specifies which users, groups, or roles can access the resource under a set of conditions. A security **role**, like a security group, grants an identity to a user. Unlike a group, however, membership in a role can be based on a set of conditions that are evaluated at run time.

Note:

The Java EE Security API (JSR 375) requires that group principal names are mapped to roles of the same name by default. In WebLogic Server, if the `security-role-assignment` element in the `weblogic.xml` deployment descriptor does not declare a mapping between a security role and one or more principals in the WebLogic Server security realm, then the role name is used as the default principal.

[Figure 2-1](#) describes how you create roles and policies and how the Security Service uses them to determine whether a client can access a resource. A brief explanation follows the figure.

Figure 2-1 How a Policy Grants Access to a Resource



1. Before creating security policies and roles, Administrators statically assign users to groups, which can represent organizational boundaries. The same user can be a member of multiple groups. Figure 2-1 shows three groups with two users each. User 1 and User 3 are members of multiple groups.

Oracle recommends assigning users to groups because doing so increases efficiency for administrators who work with many users.

2. Administrators create a security role based on their organization's established business procedures. The security role consists of one or more conditions, which specify the circumstances under which a particular user, group, or other role should be granted the security role.
3. At run time, the Security Service compares the groups against the role condition(s) to determine whether users in the group should be dynamically granted a security role. This process of comparing groups to roles is called role mapping. In Figure 2-1, Group 2 is the only group that is granted a security role.

Individual users can also be granted a security role, but this is a less typical practice.

4. Administrators create a security policy based on their organization's established business procedures. The security policy consists of one or more policy conditions which specify the circumstances under which a particular security role should be granted access to a WebLogic resource.
5. At run time, the WebLogic Security Service uses the security policy to determine whether access to the protected WebLogic resource should be granted. Only users who are members of the group that is granted the security role can access the WebLogic resource. In [Figure 2-1](#), User 3 and User 6 can access the protected WebLogic resource because they are members of Group 2, and Group 2 is granted the necessary security role.

Using Policies to Protect Multiple Resources

WebLogic Server provides two techniques for using a single policy to protect a collection of resources, described in the following sections:

- [Protecting Policies by Type](#)
- [Protecting a Hierarchy of Resources](#)

Protecting Policies by Type

You can create a policy that protects all resources of a specific type. Such policies are called **root-level policies**. For example, you can create a root-level policy for the Web Service type. All Web Services that you deploy in the domain for which you have defined this root-level policy will be protected by the root-level policy.

If you define a policy for a specific Web Service, then the Web Service will be protected by its own policy and will ignore the root-level policy.

Protecting a Hierarchy of Resources

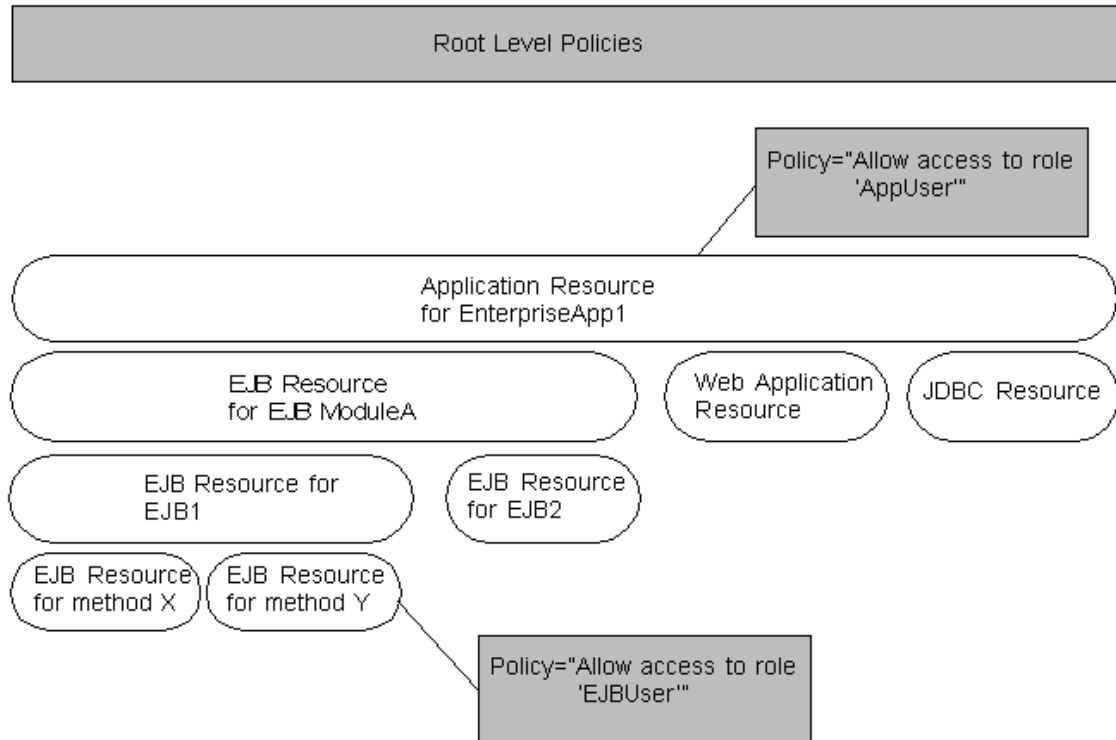
All of the resources within a Jakarta EE application or module that you deploy exist within a hierarchy, and policies on resources higher in the hierarchy act as default policies for resources lower in the same hierarchy. Policies lower in a hierarchy always override policies higher in the hierarchy.

For example, EnterpriseApp1 contains EJB ModuleA along with a Web application and a JDBC module (see [Figure 2-2](#)). You create a policy for EnterpriseApp1 and for method Y within EJB ModuleA. When an EJB client attempts to invoke method Y, the WebLogic Security Service enforces the specific policy and ignores the policy for the enterprise application.

When a client requests access to EJB method X (which is not protected by its own policy), the WebLogic Security Service asks:

- Is there a policy for this EJB method? No, therefore go to the next higher level in the hierarchy.
- Is there a policy for the EJB that contains this method? No, therefore go to the next higher level in the hierarchy.
- Is there a policy for the EJB module that contains the method's parent EJB? No, therefore go to the next higher level in the hierarchy.
- Is there a policy for the enterprise application that contains this URL pattern? Yes, use it. (If there were no such policy, the Security Service would have used the default root-level policy for EJBs.)

Figure 2-2 Hierarchy of Resources and Policies



Designing Roles and Policies for WebLogic Resources: Main Steps

To secure WebLogic resources, define roles and policies to a list of resources in the domain. For this purpose, determine the kind of policies you want to create and analyze the user groups and roles associated with the group.

To design a set of roles and policies that can secure the resources in your domain:

1. List all of the resources that will be in your domain and determine which ones should be accessed only by specific users or groups.

To see a list of all the types of resources that could be in any given domain, see [Resource Types You Can Secure with Policies](#).

For planning purposes, organize the resources into the following categories:

- Server resources, administrative resources, and JMX resources. Server resources determine who can start and stop server instances. Administrative resources determine who can complete such tasks as unlocking users who have been locked out of their accounts, uploading files (used during deployment), and viewing the domain and server logs. JMX resources determine who can change the configuration of servers, clusters, machines, and other components that are defined in the domain's configuration document (config.xml).

For these tasks, WebLogic Server already provides a detailed, layered security scheme that grants different types of access to eight security roles (Admin, Deployer, Operator, Monitor, Anonymous, AppTester, CrossDomainConnector, AdminChannelUser). For most environments, this security scheme is adequate and

only requires you to assign users to the eight default security roles appropriately (see step 3).

While it is possible to modify some parts of this layered security scheme, such modifications are usually not needed and require careful planning to maintain consistency between the different layers. See [Administrative Resources](#), [Server Resources](#), and [JMX Resources](#).

- Web application resources and EJB resources, which determine who can access the Web applications and EJBs that you deploy in your domain.

The Jakarta EE platform already provides a standard model for securing Web applications and EJBs. In this standard model, developers define role mappings and policies in the Web application or EJB deployment descriptors.

You can use the standard model or you can use the WebLogic Remote Console to define policies and roles, which offers unified and dynamic security management. See [Options for Securing Web Application and EJB Resources](#).

- All other resources, which determine who can access the business logic and business content in the enterprise applications and other modules that you deploy or otherwise configure for the domain.

By default, these resources are not protected by policies; you must define policies to determine who can access them.

2. For each type of resource that you want to secure, determine if you need to create root-level policies, scoped policies, or a combination of both.

A **root-level** policy applies to all instances of a resource type. For example, if you define a root-level policy for the Web Services resource type, then the policy will apply to all Web Services in your domain.

A **scoped** policy applies to a specific resource instance and **overrides** a root-level policy.

See [Security Policies](#).

3. Analyze your users and the resources that you want them to access. Organize users into security groups and roles as follows:

- Add any user that you want to start and stop servers or to engage in other administrative tasks to one of the eight default global roles. The WebLogic Server security scheme allows only the eight global roles to perform many of these tasks.
- For other users (that you do **not** want to access administrative or server resources but you do want to access other resources for which you have defined policies), create additional security groups and roles. Because role membership can be granted at run time, you can place users or groups in roles based on business rules or the context of the request.

You can create **global** roles, which can be used in any policy, or **scoped** roles, which can be used only in a policy for a specific resource instance.

See [Users, Groups, And Security Roles](#).

4. Use the WebLogic Remote Console to create users, groups, roles, and policies:
 - a. To create the users and groups, see *Users and Groups in Oracle WebLogic Remote Console Online Help*.
 - b. To create security roles and policies, see *Security Policies and Roles in Oracle WebLogic Remote Console Online Help*.

Best Practices: Conditionalize Policies or Conditionalize Roles

Because both roles and policies can evaluate a set of conditions at run time, you should consider which parts of your security data should be static and which should be dynamic. For example, you might want some policies to always allow one specific role to access a resource, and then you use conditions in the role's definition to move users in and out of the roles as needed. In other cases, you might want a static role definition and create a policy that allows access to different roles at different times of the day.

As a general guideline, if you base the authorization decision on the resource instead of the entities (roles) who can access the resource, you would add conditions to the security policy. If you base authorization on who can access the resource, then you would add conditions to the security role.

For an example of authorization based on who can access the resource, consider a manager who is going on vacation. You can temporarily place a user in a `Manager` security role. Dynamically granting this security role means that you do not need to change or redeploy your application to allow for such a temporary arrangement. You simply specify the hours between which the temporary manager should have special privileges. Further, you do not need to remember to revoke these special privileges when the actual manager returns as you would if you temporarily added the user to a management group.

Best Practices: Configure Entitlements Caching When Using WebLogic Providers

The WebLogic Authorization provider, known as the `DefaultAuthorizer`, and the WebLogic Role Mapping provider, referred to as the `DefaultRoleMapper`, improve performance by caching the roles, predicates, and resource data that they look up. If you modify your realm to use these WebLogic providers, you can configure the maximum number of items that they store in the caches.

In WebLogic Server 14.1.1.0.0, the WebLogic Authorization provider (`DefaultAuthorizer`) and the Role Mapping provider (`DefaultRoleMapper`) are deprecated and will be removed in a future release.

Note:

By default, security realms in newly created domains include the XACML Authorization and Role Mapping providers. The XACML providers use their own cache, but this cache is not configurable. The WebLogic Authorization provider (`DefaultAuthorizer`) and the Role Mapping provider (`DefaultRoleMapper`) are the only WebLogic-provided security providers with configurable caches of entitlement data.

By default, the Weblogic Authorization and Role Mapping providers store the following number of items in each cache:

- 2000 items in the roles cache
This cache contains the name of each role that has been looked up and the policy that protects it.
- 200 items in the predicates cache

This cache contains each predicate that the WebLogic entitlements engine has looked up.

- 5000 items in the resources cache

This cache contains the name of each resource that has been looked up and the policy that protects it.

If a cache exceeds its maximum size, the WebLogic entitlements engine removes the least recently used (LRU) item from the cache.

If the applications on a WebLogic Server instance use more than 2000 roles or 5000 resources, consider increasing the cache sizes. (The WebLogic providers include less than 50 predicates, so there is no need to increase the size of this cache.)

To change the maximum number of items that a cache contains, pass one of the following system properties in the `java` startup command for a WebLogic Server instance:

- `-Dweblogic.entitlement.engine.cache.max_role_count=max-roles`
where `max-roles` is the maximum number of roles that you want to cache.
- `-Dweblogic.entitlement.engine.cache.max_predicate_count=max-predicates`
where `max-predicates` is the maximum number of predicates that you want to cache.
- `-Dweblogic.entitlement.engine.cache.max_resource_count=max-resources`
where `max_resource_count` is the maximum number of resources that you want to cache.

By default, the WebLogic providers add items to the cache as they use them. With this configuration, the initial lookup of entitlement data takes longer than subsequent lookups. You can, however, decrease the amount of time needed for an initial lookup by configuring a WebLogic Server instance to load the caches during its startup cycle. To do so, pass the following system property to the server's `java` startup command:

```
-Dweblogic.entitlement.engine.cache.preload=true
```

For example:

```
java -Dweblogic.entitlement.engine.cache.max_role_count=6001 -  
Dweblogic.entitlement.engine.cache.max_resource_count=3001 -  
Dweblogic.entitlement.engine.cache.preload=true weblogic.Server
```


3

Resource Types You Can Secure with Policies

Learn about the types of resources that you can secure using policies in WebLogic Server. This chapter includes the following sections:

- [Administrative Resources](#)
- [Application Resources](#)
- [COM Resources](#)
- [EJB Resources](#)
- [Enterprise Information Systems \(EIS\) Resources](#)
- [Java DataBase Connectivity \(JDBC\) Resources](#)
- [Java Messaging Service \(JMS\) Resources](#)
- [Java Naming and Directory Interface \(JNDI\) Resources](#)
- [JMX Resources](#)
- [Server Resources](#)
- [URL Resources](#)
- [Web Service Resources](#)
- [Work Context Resources](#)
- [Coherence Resources](#)

Administrative Resources

Policies for administrative resources are different from the policies defined for regular users. Administrative resources have special privileges such as uploading files during deployment, viewing the domain and server logs, and unlocking users, and so on.

Policies for administrative resources determine who can complete such tasks as uploading files (used during deployment), viewing the domain and server logs, and unlocking users who have been locked out of their accounts.

For the most security-sensitive of these tasks, users must first be authorized by additional policies on a JMX resource (see [Figure 3-1](#)). For information about JMX resources and how to design roles and policies for activities that are protected by multiple resources, see [JMX Resources](#).

Figure 3-1 Some Policies Overlap

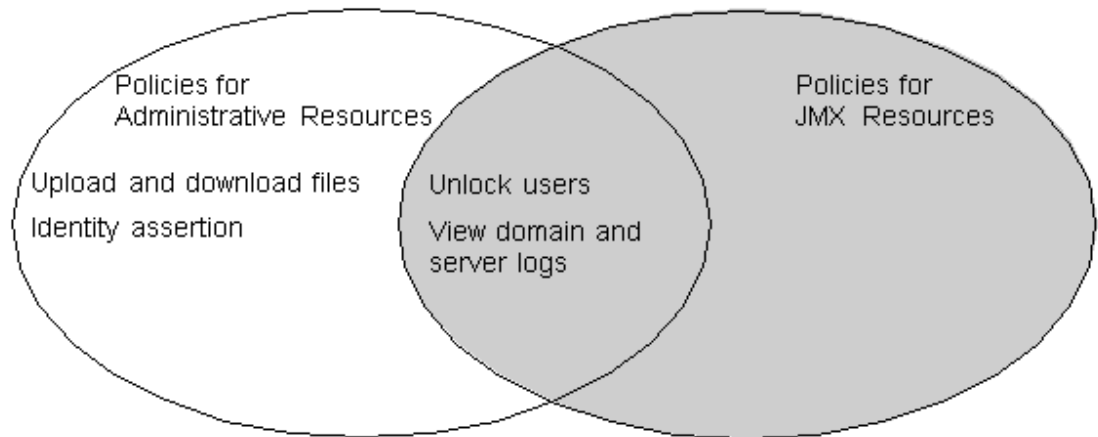


Table 3-1 describes the administrative activities that administrative resources protect and which of these activities are also protected by additional JMX resources. For activities that are protected by multiple resources, the default policy in the JMX resource duplicates the protections in the Administrative resource.

Table 3-1 Activities And Default Policies For Administrative Resources

Administrative Activities	Default Policy Allows These Roles	Also Protected By a JMX Resource?
Upload files for deployment.	Admin, Deployer	No
Control access to these methods in the file download servlet:	Admin, Operator	No
<ul style="list-style-type: none"> • ALL methods • wl_component_request • wl_ear_resource_request • ear_request • wl_xml_entity_request • wl_jsp_refresh_request • file • wl_init_replica_request • wl_file_realm_request • wl_managed_server_independence_request 		

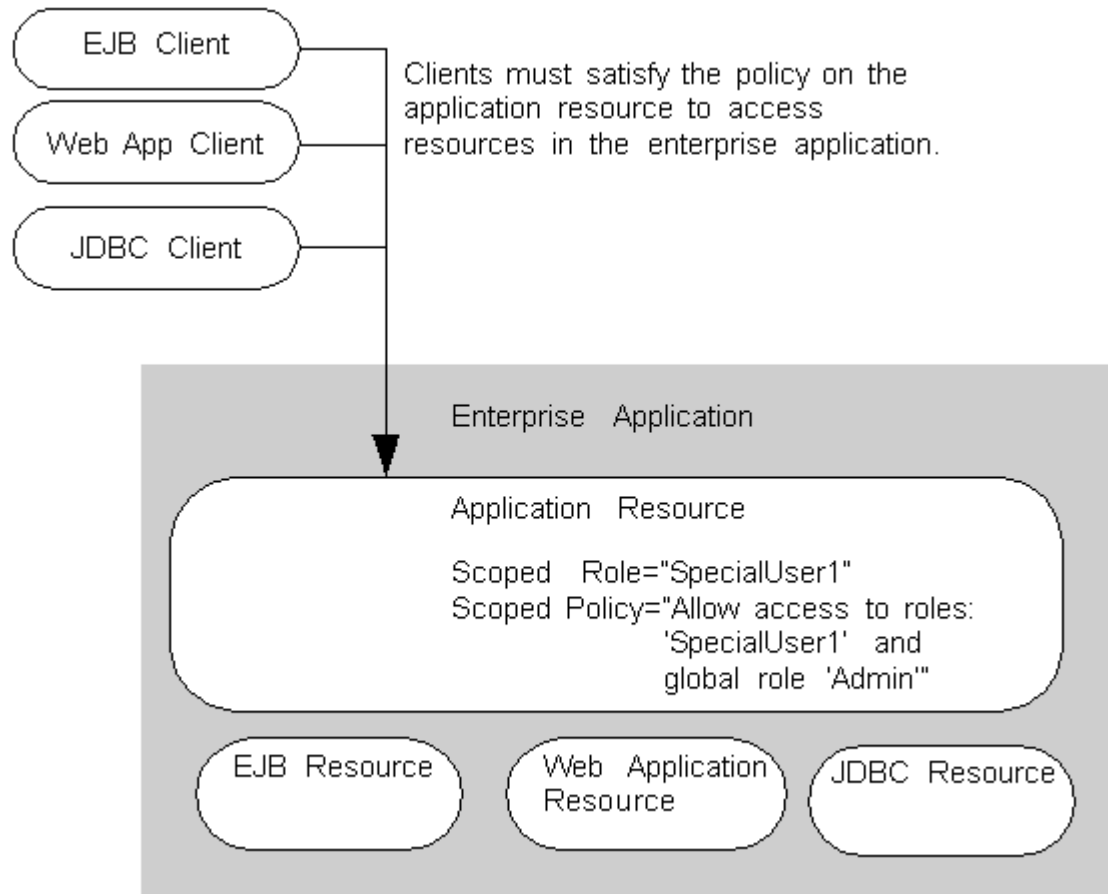
Note: The file download servlet is used internally by WebLogic Server. Oracle recommends that you do not modify the default policies for any of its methods. They are listed here only for completeness.

Table 3-1 (Cont.) Activities And Default Policies For Administrative Resources

Administrative Activities	Default Policy Allows These Roles	Also Protected By a JMX Resource?
Enable applications to use identity assertion. The default policy for this activity specifies that an application must supply credentials for a user who is in the <code>Admin</code> role before it can successfully invoke the <code>Authentication.assertIdentity()</code> API. See weblogic.security.services.Authentication in the <i>Java API Reference for Oracle WebLogic Server</i> .	Admin	No
View domain and server logs through the WebLogic Remote Console.	Admin, Deployer, Operator, Monitor	Yes
Unlock users who have been locked out of their accounts.	Admin	Yes

Application Resources

An application resource is an enterprise application, Web application, or other Java EE module that you deploy as a stand-alone application (for example, you can deploy Web Services and JDBC modules as stand-alone applications). You secure an application resource when you want to protect all resources that constitute the application. For example, securing an enterprise application protects access to all WebLogic resources within that application (see [Figure 3-2](#)).

Figure 3-2 Application Resource Protects All Resources

See [Protecting a Hierarchy of Resources](#).

COM Resources

A COM resource represents a package that contains one or more jCOM classes. jCOM is a software bridge that allows bidirectional access between Java/Java EE objects deployed in WebLogic Server and Microsoft ActiveX components available within the Microsoft Office family of products, Visual Basic and C++ objects, and other Component Object Model/ Distributed Component Object Model (COM/DCOM) environments.

A policy on a COM resource protects access to all jCOM objects in a package.

For related information, see *Configuring Access Control in Developing JCOM Applications for Oracle WebLogic Server*.

EJB Resources

An EJB (Enterprise JavaBean) resource is an EJB deployment module (JAR), individual EJB, or individual method in an EJB. EJB resources exist within a hierarchy of resources, and at the top of the hierarchy is an application resource. See [Protecting a Hierarchy of Resources](#).

Because the Java EE platform standardizes EJB security in deployment descriptors, WebLogic Server integrates this standard mechanism with its Security Service to give you a choice of

techniques for securing EJB resources. See [Options for Securing Web Application and EJB Resources](#).

Enterprise Information Systems (EIS) Resources

An EIS resource is a system-level software driver used by an application server, such as WebLogic Server, to connect to an Enterprise Information System. Oracle supports resource adapters developed by EIS vendors and third-party application developers. Resource adapters can be deployed in any application server supporting the applicable Java EE Platform Specification. Resource Adapters contain the Java code, and if necessary, the native components required to interact with the EIS.

To secure access to an EIS, create security policies and security roles for all resource adapters as a group, or for individual adapters. These resources exist within a hierarchy of resources, and at the top of the hierarchy is an application resource. See [Protecting a Hierarchy of Resources](#).

For related information, see *Security in Developing Resource Adapters for Oracle WebLogic Server*.

Java DataBase Connectivity (JDBC) Resources

A Java DataBase Connectivity (JDBC) resource is a JDBC system resource, JDBC module that is part of an application, JDBC data source, or a specific method within a data source. If you deploy a JDBC module as a stand-alone application, the application is represented by an application resource (see [Application Resources](#)).

JDBC resources exist within a hierarchy of resources, and at the top of the hierarchy is an application resource. See [Protecting a Hierarchy of Resources](#).

JDBC Operations

When you secure an individual data source, you can choose whether to protect [JDBC operations](#) using one or more of the following administrator methods:

- `admin`—The following methods on the `JDBCDataSourceRuntimeMBean` are invoked as `admin operations`: `clearStatementCache`, `suspend`, `forceSuspend`, `resume`, `shutdown`, `forceShutdown`, `start`, `getProperties`, and `poolExists`.
- `reserve`—Applications reserve a connection in the data source by looking up the data source and then calling `getConnection`.

Note:

Giving a user the `reserve` permission enables them to execute vendor-specific operations. Depending on the database vendor, some of these operations may have database security implications.

- `shrink`—Shrinks the number of connections in the data source to the maximum of the currently reserved connections or to the initial size.
- `reset`—Resets the data source connections by shutting down and re-establishing all physical database connections. This also clears the statement cache for each connection. You can only reset data source connections that are running normally.

- All—An individual data source is protected by the union of the `Admin`, `reserve`, `shrink`, and `reset` administrator methods.

 **Note:**

If a security policy controls access to connections in a multi data source, access checks are performed at both levels of the JDBC resource hierarchy (once at the multi data source level, and again at the individual data source level). As with all types of WebLogic resources, this double-checking ensures that the most specific security policy controls access.

Table 3-2 lists the JDBC administrator methods and the roles that the default policy allows for each operation.

Table 3-2 Default Policies for JDBC Resources

JDBC Administrator Methods	Default Policy Allows These Roles
<code>admin</code>	Admin, Deployer
<code>reset</code>	Admin, Deployer
<code>reserve</code>	Everyone
<code>shrink</code>	Admin, Deployer

Java Messaging Service (JMS) Resources

A Java Messaging Service (JMS) resource is a JMS system module, a JMS module that is part of an application (deprecated), a specific WebLogic JMS destination or destination template defined within a module, or a specific operation within a WebLogic JMS destination. You can create security policies and roles for WebLogic JMS destinations (JMS queues and JMS topics) as a group by securing the JMS module where they are defined, or for specific WebLogic JMS destinations (JMS queues or JMS topics) defined within a JMS module. The WebLogic destinations defined in a JMS module run on WebLogic JMS Servers.

These resources exist within a hierarchy of resources, and at the top of the hierarchy is an application resource. See [Protecting a Hierarchy of Resources](#).

JMS Operations

When you secure a specific destination on a JMS server, you can protect operations on the destination. By default, destinations are not protected. This means that any valid user for a WebLogic server instance can send, receive, and browse messages on a destination. Only users defined by the policy condition can access control of the destination. Valid protection operations are:

- `send`—Required to send a message to a queue or a topic. This includes calls to the `MessageProducer.send()`, `QueueSender.send()`, and `TopicPublisher.publish()` methods, as well as the Messaging Bridge.
- `receive`—Required to create a consumer on a queue or a topic. This includes calls to the `Session.createConsumer()`, `Session.createDurableSubscriber()`, `QueueSession.createReceiver()`, `TopicSession.createSubscriber()`, `TopicSession.createDurableSubscriber()`, `Connection.createConnectionConsumer()`, and `Connection.createDurableConnectionConsumer()`.

`QueueConnection.createConnectionConsumer()`,
`TopicConnection.createConnectionConsumer()`, and
`TopicConnection.createDurableConnectionConsumer()` methods, as well as the
Messaging Bridge and message-driven beans.

- `browse`—Required to view the messages on a queue using the `QueueBrowser` interface.
- `ALL`—Required to `send`, `receive`, and `browse` methods on a destination.

Java Naming and Directory Interface (JNDI) Resources

A Java Naming and Directory Interface (JNDI) resource is a node in a server's JNDI tree. A policy on a JNDI resource determines who can access WebLogic Server entities and actions through JNDI. You can create a policy on the root node of the JNDI tree or on individual nodes.

If your domain is configured to run in secured production mode, then the authorization policies for JNDI and MBean access are more restrictive to enforce a highly secure environment for your production domain. In this mode, remote anonymous JNDI access is not allowed for modify and list operations. This is enforced by the `RemoteAnonymousJNDIEnabled` attribute in the `SecurityConfigurationMBean`. This attribute disables anonymous JNDI access and the default value, in secured production mode, is `true`. See [SecurityConfigurationMBean](#) in *MBean Reference for Oracle WebLogic Server* for more information about this MBean attribute. When in secured production mode, only the standard roles (`Admin`, `Deployer`, `Operator`, and `Monitor`) can look up MBeans using the JNDI `lookup` methods.

JNDI Operations

For each JNDI node, you can create a policy for all operations or for one of the following operations:

- `modify`—Whenever an application modifies the JNDI tree in any way (that is, adding, removing, changing) the current user must have permission to make the modification. This includes the `bind()`, `rebind()`, `createSubContext()`, `destroySubContext()`, and `unbind()` methods.
- `lookup`—Whenever an application looks up an object in the JNDI tree, the current user must have permission to perform the lookup. This includes the `lookup()` and `lookupLink()` methods.

If your domain is configured to run in secured production mode, then *only* the standard roles (`Admin`, `Deployer`, `Operator`, and `Monitor`) can look up MBeans using the JNDI `lookup` methods. For more information about secured production mode, see *Install WebLogic Server in a Secure Manner* in *Securing a Production Environment for Oracle WebLogic Server*.

- `list`—Whenever an application lists the contents of a context in JNDI, the current user must have permission to perform the listing operation. This includes the `list()` and `listBindings()` methods.

JMX Resources

A JMX resource is an MBean attribute or MBean operation. A policy on a JMX resource controls who can read or write MBean attributes or invoke operations.

WebLogic Server uses managed beans (MBeans) in the implementation of its management system. Almost all administrative activities require you to invoke an MBean operation or modify

an MBean attribute using a Java Management Extensions (JMX) client. For example, the WebLogic Scripting Tool is a JMX client. See *Understanding WebLogic Server MBeans in Developing Custom Management Utilities Using JMX for Oracle WebLogic Server*.

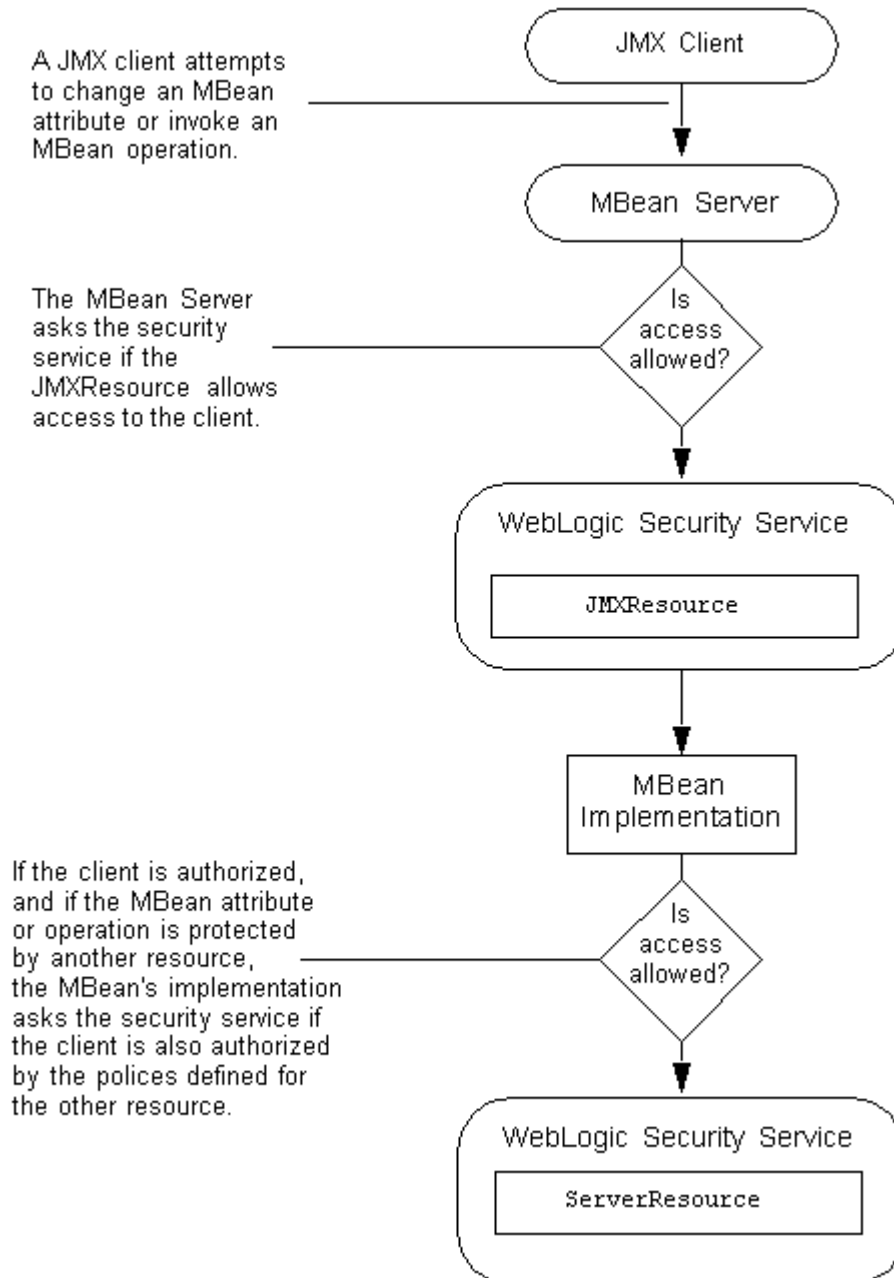
Oracle provides a default set of JMX resources to protect WebLogic Server MBeans. See [Default Security Policies for MBeans](#) in the *MBean Reference for Oracle WebLogic Server*. For MBean attributes and operations that represent particularly sensitive data or actions, WebLogic Server uses additional types of resources to secure access. For example, the `ServerLifecycleRuntimeMBean`'s `shutdown()` operation is protected by a JMX resource and a Server resource.

If your domain is configured to run in secured production mode, then more restrictive policies are enabled by default for JMX authorization. If you enable restrictive JMX policies, then the default policies allow MBean access *only* to the standard WebLogic Server roles (`Admin`, `Deployer`, `Operator`, or `Monitor`). You can enable or disable restrictive JMX policies using as follows:

- Use Fusion Middleware Control. From the WebLogic Domain menu, select **Security > Administration**. Expand **Advanced**, then expand **Secure Mode Settings**. Under Secure Mode Settings, select the **Restrictive JMX Policies** check box. See *Configure domain security in Administering Oracle WebLogic Server with Fusion Middleware Control*.

When a JMX client attempts to invoke an operation or change an attribute that is secured by a JMX resource and some other resource type, the client must satisfy the policies defined in both resources (see [Figure 3-3](#)).

Figure 3-3 MBean Server Checks with Both Resources



Maintaining a Consistent Security Scheme

The default configuration of groups, global roles, and security policies on all resources that are used to protect an entity or action create a consistent security scheme. You can, however, make modifications to that limit access in ways that you do not intend. Make sure that any modifications you make to the default security settings do not prevent a user from being authorized by both the JMX resource and other resource type. When you create or modify a security policy, consider taking the following action:

- Always include the `Admin` and `Operator` global roles in policies for `Server` resources.

Failure to use the `Operator` global role or a security role nested within this default global role may result in inconsistent behavior by the WebLogic Security Service.

- For a security policy on a deployable resource (such as a Web application or EJB module, Connector module, or startup/shutdown class), use the `Deployer` global role.

Server Resources

Policies for a server resource determine who can control the state of a WebLogic Server server instance.

When users start server instances by directly invoking the `weblogic.Server` class in a Java command, the policy on the Server resource is the only security check that occurs. All other tasks that change the state of a WebLogic Server instance require the use of the WebLogic Remote Console, WebLogic Scripting Tool, Node Manager, or some other JMX client, and therefore require users to be authorized first by an additional JMX resource. See [JMX Resources](#).

You can create security policies that apply to all WebLogic Server instances in a domain or to individual servers. If you define a policy for an individual server, you can protect all of its life cycle operations or define individual policies for each of the following operations:

- `boot`—A user who tries to start a WebLogic Server instance, either an Administration Server or Managed Server, must have permission to do so. This action is typically initiated through a call to the `java weblogic.Server` command on the command line, by a configured start script (which in turn calls the `java weblogic.Server` command), or through the Node Manager capabilities that allow for remote start of WebLogic Server
- `shutdown`—A user who tries to shut down a running WebLogic Server instance, either an Administration Server or Managed Server, must have permission to do so. This action is typically initiated through the WebLogic Remote Console or the `WLST SHUTDOWN` or `FORCESHUTDOWN` commands.
- `suspend`—A user who tries to prohibit additional logins (logins other than for privileged administrative actions) to a running WebLogic Server instance, either an Administration Server or Managed Server, must have permission to do so. This action is typically initiated through the WebLogic Remote Console.
- `resume`—A user who tries to re-enable non-privileged logins to a running WebLogic Server instance, either an Administration Server or Managed Server, must have permission to do so. This action is typically initiated through the WebLogic Remote Console.

All server resources inherit a default security policy that gives permission to the `Admin` and `Operator` global security roles.

Note:

If you enable the domain-wide administration port, then only the `Admin` role (and not `Operator`) can control the state of a WebLogic Server server instance. See *Configure the Domain-Wide Administration Port* in *Oracle WebLogic Remote Console Online Help*.

 **Note:**

Do not remove roles from the default security policies. Eliminating some of the existing security roles might negatively affect the functioning of WebLogic Server. However, if you like, you can make the default security policies more inclusive (for example, by adding new security roles). See [Maintaining a Consistent Security Scheme](#).

Permissions for the `weblogic.Server` Command and the Node Manager

WebLogic Server provides two ways to start and shut down WebLogic Server instances (servers): the `weblogic.Server` command and the Node Manager. Because the underlying components for the `weblogic.Server` command and the Node Manager are different, the two commands use different authorization methods.

Permissions for Using the `weblogic.Server` Command

The `weblogic.Server` command, which you can use to start both Administration and Managed Servers, calls methods that are protected by a security policy on the Server resource. To use this command, you must satisfy the requirements of the security policy on the Server resource.

Some `weblogic.Server` arguments set attributes for MBeans. However, because these arguments modify an MBean before the server is in the `RUNNING` state, the security policy on the Server resource, not the protection on the MBean, is the authorizer. For example, a user in the `Operator` global role can use the `-Dweblogic.ListenPort` argument to change a server's default listen port, but once the WebLogic Server instance is running, this user cannot change the listen port value.

See `weblogic.Server` Command-Line Reference in the *Command Reference for Oracle WebLogic Server*.

Permissions for Using the Node Manager

The Node Manager uses both MBeans and the security policy on the Server resource to start a remote server.

If you configure a Node Manager on the host machine of a remote WebLogic Server instance, by default a user in the `Admin` or `Operator` global role can use the Node Manager to start the remote server.

See *Node Manager Overview* in *Administering Node Manager for Oracle WebLogic Server*.

Shutting down a WebLogic Server instance involves both MBeans and the security policy on the Server resource. When a user issues a shutdown command, the server first determines whether that user is granted the `Admin` or `Operator` global role (per the MBean security layer). Then, after the MBean operations run, the server determines whether the security policy on the Server resource authorizes the user to shut down the server.

See *Starting and Stopping Servers: Quick Reference* in *Administering Server Startup and Shutdown for Oracle WebLogic Server*.

URL Resources

A URL resource is a specific URL or URL pattern in a Web application. You can create a policy for a URL resource that protects all HTTP methods for a specified URL or URL pattern, or that protects only specific HTTP methods. These resources exist within a hierarchy of resources, and at the top of the hierarchy is an application resource. See [Protecting a Hierarchy of Resources](#).

Because the Java EE platform standardizes Web application security in deployment descriptors, WebLogic Server integrates this standard mechanism with its Security Service to give you a choice of techniques for securing Web application resources. See [Options for Securing Web Application and EJB Resources](#).

Web Service Resources

A Web Service resource is a Web Service module (WAR or JAR) or an operation within a Web Service module. Web Services are protected by the following hierarchy of resources:

- The application resource for the parent application.
- The Web Service resource for the Web Service module (WAR or JAR).
- Individual Web Service resources for each Web Service operation.

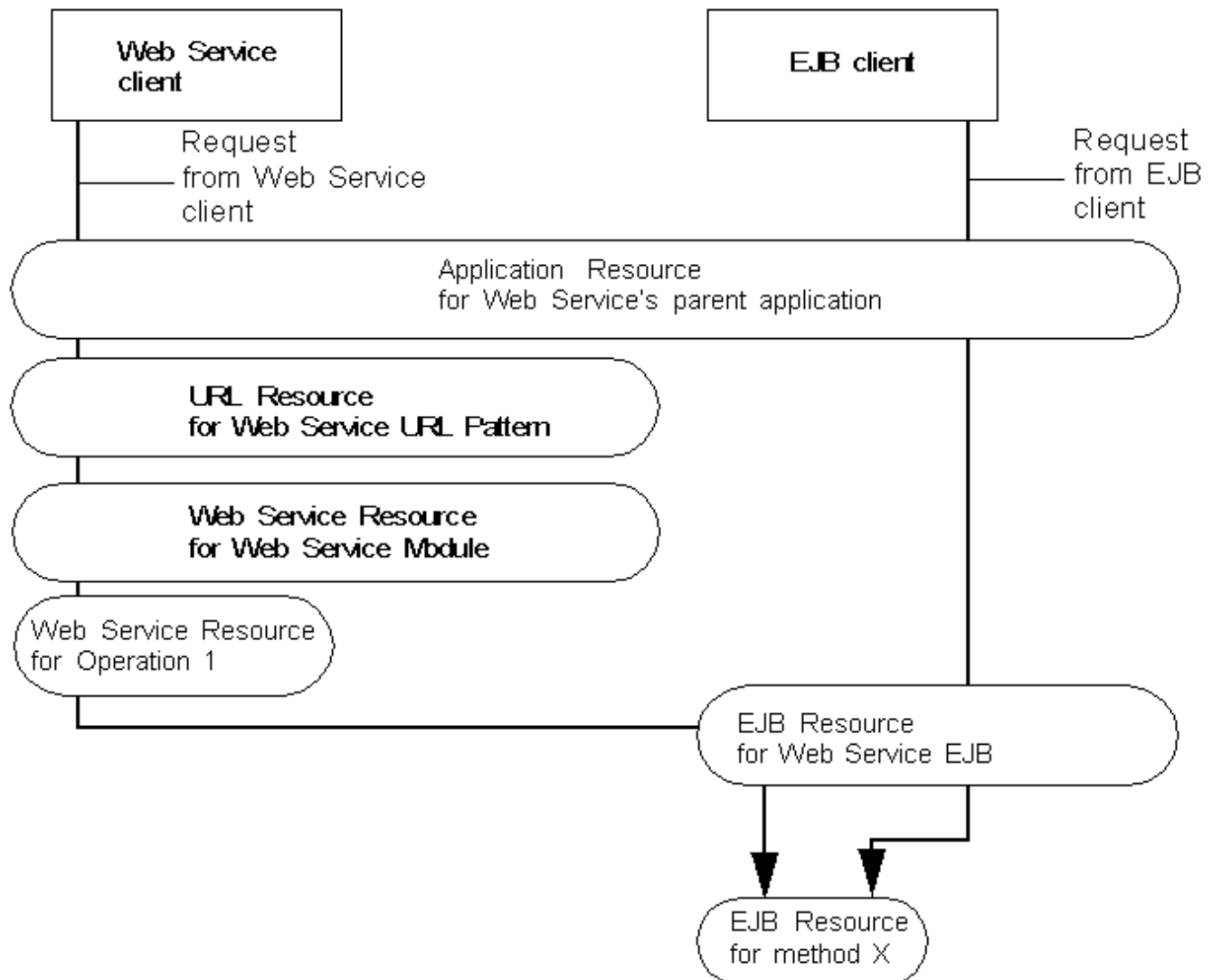
If you implement the Web Service with standard Java objects, any of the above resources protect the Java objects.

If you implement the Web Service with an EJB any of the above **or** any of the following resources protect the EJB implementation:

- The EJB resource for the EJB.
- Individual EJB resources for each EJB method.

If you use an EJB to implement your Web Service, Oracle recommends that you create a policy at the application level. Policies on the Web Service module and individual Web Service operations apply only to Web Service clients. EJB clients can use RMI or JNDI to bypass the Web Service module and directly invoke EJB operations (see [Figure 3-4](#)).

Figure 3-4 Hierarchy of Resources for Web Service with EJB Implementation



For information on using Java annotations to secure Web Services, see *Configuring Message-Level Security in Securing WebLogic Web Services for Oracle WebLogic Server*.

Work Context Resources

Work Contexts enable Java EE developers to define and pass properties without including them in a remote call. A Work Context resource represents the operations that create, delete, read, or modify a property. You can use one Work Context resource for all operations of a given property, or you can create individual resources for each operation.

See *Best Practices for Application Design in Developing RMI Applications for Oracle WebLogic Server*.

Coherence Resources

Coherence resources provide distributed, in-memory caching and data grid processing for applications. Roles and policies can be applied to two types of Coherence resources:

- Caches – A cluster contains any number of caches that are shared by all cluster members. The caches are used by applications to store and retrieve data.
- Services – A cluster contains any number of services that are shared by all cluster members. The services include connectivity services, cache services, and processing services. Each cluster member can provide and consume such services.

The default authorization policy allows everybody access to all Coherence resources. To define policies and roles on caches and services, the names of the caches and services must be known. In some cases, the cache configuration file in a Coherence Grid ARchive (GAR) module can be inspected to discover cache and service names. However, there are some configurations that allow applications to use different names to refer to the same cache. Always consult an application's developers or architects to be certain of the cache and service names used by an application.

4

Options for Securing Web Application and EJB Resources

WebLogic Server offers several options for securing your Web application and EJB resources, including the Java EE standard model.

In the Java EE standard model, you can secure Web applications and EJBs in either of the following ways:

- Declaratively, using deployment descriptors or metadata annotations.

For EJB 3.x, EJB security metadata annotations can be specified directly in the EJB bean class to specify the roles that are allowed to invoke all, or a subset, of the EJB's methods.

- Programmatically, as described in the following topics in *Developing Applications with the WebLogic Security Service*:

- Using Programmatic Security With Web Applications

To implement programmatic security in web applications, WebLogic Server supports the use of the Java EE Security API (JSR 375) `getCallerPrincipal`, `getPrincipalsByType`, `isCallerInRole`, `hasAccessToWebResource`, and `authenticate` methods of the `SecurityContext` interface, and the `getUserPrincipal` and `isUserInRole` methods of the `HttpServletRequest` interface.

- Using Programmatic Security With EJBs

To implement programmatic security in EJBs, WebLogic Server supports the use of the Java EE Security API (JSR 375) `getCallerPrincipal`, `getPrincipalsByType`, and `isCallerInRole` methods of the `SecurityContext` interface, and the `isCallerInRole` and `getCallerPrincipal` methods of the `EJBContext` interface. WebLogic Server also supports the use of the `security-role-ref` element in deployment descriptors.

Because this Java EE standard may be too inflexible for some environments, WebLogic Server also offers a choice of other, more flexible models in addition to supporting the Java EE standard.

Note:

If you are implementing security using JACC (Java Authorization Contract for Containers as defined in [JSR 115](#)), you must use the Java EE standard model. Other WebLogic Server models are not available and the security functions for Web applications and EJBs in the WebLogic Remote Console are disabled. See *Using the Java Authorization Contract for Containers* in *Developing Applications with the WebLogic Security Service*.

This chapter includes the following sections:

- [Deployment Descriptors Not Required](#)
- [Comparison of Security Models for Web Applications and EJBs](#)

- [Understanding the Advanced Security Model](#)
- [Securing Web Applications and EJBs](#)

 **Note:**

The instructions for EJB resources provided in this section also apply to Message-Driven Beans (MDBs).

Deployment Descriptors Not Required

As described in *What Was New and Changed in EJB 3.0* in *Developing Enterprise JavaBeans for Oracle WebLogic Server*, you are no longer required to create the deployment descriptor files (such as `ejb-jar.xml`). You can now use metadata annotations in the bean file itself to configure metadata. Annotations simplify the EJB development process by allowing a developer to specify within the Java class itself how the bean behaves in the container, requests for dependency injection, and so on. Annotations are an alternative to deployment descriptors that were required by older versions (2.x and earlier) of EJB.

You can still use XML deployment descriptors in addition to, or instead of, the metadata annotations if you so choose.

 **Note:**

Deployment descriptor elements always override their annotation counterparts. In the case of conflicts, the deployment descriptor value overrides the annotation value.

Comparison of Security Models for Web Applications and EJBs

For EJBs, the application developer can make the deployer's task easier by using the security-related metadata annotations to specify the security roles that are allowed to invoke the EJB methods. If you use annotations or deployment descriptors, you choose a security model when you deploy each Web application or EJB and your choice is immutable for the lifetime of the deployment. If you want to use a different model, you must delete and redeploy the Web application or EJB.

Each deployment descriptor-based security model defines two types of behaviors for securing Web applications and EJBs: where roles and policies are defined and which URL patterns and EJB methods trigger the Security Service to perform security checks.

[Table 4-1](#) compares the security model behaviors.

Table 4-1 Security Model Behaviors

This Model . . .	Uses Roles and Policies From . . .	And Performs Security Checks . . .
Metadata Annotations Categorized as Deployment Descriptor Only (Java EE standard) in WebLogic Remote Console	Metadata annotations in the EJB bean file itself specify the roles that are allowed to invoke all, or a subset, of the EJB's methods.	Only when clients request EJB methods that are protected by a role specified in an annotation. You can use metadata annotations in conjunctions with deployment descriptor- and WebLogic Remote Console-based mechanisms. In case of conflict, deployment descriptor elements always override their annotation counterparts.
Deployment Descriptor Only (Java EE standard)	The <code>web.xml</code> , <code>weblogic.xml</code> and <code>ejb-jar.xml</code> , <code>weblogic-ejb-jar.xml</code> deployment descriptors. If roles have been defined for the application that contains the Web application or EJB, all roles are combined using a logical OR operation.	Only when clients request URLs or EJB methods that are protected by a policy in the deployment descriptor. Deployment descriptor elements always override their annotation counterparts, if any.
Custom Roles	This model uses role mappings from a role mapping provider that you configure for the security realm. You can use WebLogic Remote Console to configure the provider. Any role mappings in the deployment descriptors or annotations are ignored. The model uses the policies that are defined in the <code>web.xml</code> and <code>ejb-jar.xml</code> deployment descriptors.	Only when clients request URLs or EJB methods that are protected by a policy in the deployment descriptor.
Custom Roles and Policies	A role mapping provider and an authorization provider that you configure for the security realm. You can use WebLogic Remote Console to configure the providers. Any role mappings or policies in the deployment descriptors or annotations are ignored.	For all URLs and EJB methods.
Advanced	Configurable. You can configure this model to use only security data from annotations or deployment descriptors, use only the data from security providers, or import security data from deployment descriptors into the security provider databases to provide a baseline for further modifications.	Configurable.

Discussion of Each Model

The following sections describe each model and suggest scenarios under which each is appropriate.

Metadata Annotations

As described in Overview of Metadata Annotations and EJB Bean Files in *Developing Enterprise JavaBeans for Oracle WebLogic Server*, the EJB programming model uses the

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

The following security-related annotations are available:

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

At deployment time, the deployer must then create these security roles if they do not already exist and map users to these roles using the WebLogic Remote Console to update your security realm. For details, see Security Policies and Roles in *Oracle WebLogic Remote Console Online Help*.

This model gives the application developer more control without having to implement programmatic authorization in EJBs.

Table 4-2 Metadata Annotations: Typical Scenario

Company A, Developer	Company A, Admin/Deployer
<p>In Company A, a user in the role of developer performs the following tasks:</p> <ul style="list-style-type: none"> • Adds one or more security-related metadata annotations. • Uses the WebLogic compile tool <code>weblogic.appc</code> (or its Ant equivalent <code>wlappc</code>) to compile the bean file. • Turns application over to the Admin/Deployer. Provides instructions as to which roles are required. 	<p>In Company A, a user in the role of administrator or deployer performs the following tasks:</p> <ul style="list-style-type: none"> • Uses the WebLogic Remote Console to ensure that the roles exist and are properly mapped to groups and users. • To have only the annotations considered, deploys the application as Deployment Descriptor Only (Java EE standard) in the WebLogic Remote Console.

You can use metadata annotations in conjunction with deployment descriptor- and WebLogic Remote Console mechanisms. If you do so, note the following:

- In case of conflict, deployment descriptor elements always override their annotation counterparts. For example, if the annotation specifies Deny All for a method and the deployment descriptor specifies that the Developer role has access to that method, the Developer role does have access to the method.
- If you specify Custom Roles in the WebLogic Remote Console, any role mappings in the deployment descriptors or annotations are ignored.

See Securing Access to the EJB in *Developing Enterprise JavaBeans for Oracle WebLogic Server* for an example of a simple stateless session EJB that uses all of the security-related annotations.

Deployment Descriptor Only Model

This is part of the standard Java EE model and is therefore a widely known technique for adding declarative security to Web applications and EJBs. It uses only roles and policies defined by a developer in the Java EE deployment descriptor (DD) and the WebLogic Server DD. It requires the security administrator to verify that the security principals (groups or users) in the deployment descriptors exist and are mapped properly in the security realm.



Note:

This model also affects application-scoped roles that apply to an EAR: with this model, the Security Service uses only the application-scoped roles defined in the WebLogic Server DD.

If a developer changes roles or policies in a deployment descriptor, WebLogic Server recognizes the change as soon as you redeploy the Web application, EJB, or EAR.

With this model, EJBs and URL patterns are not protected by roles and policies of a broader scope (such as a policy scoped to an entire Web application). If an EJB or URL pattern is not protected by a role or policy in the DD, then it is unprotected: anyone can access it. For example, if you create an application-scoped policy for an EAR and the EAR contains an EJB, the EJB will not be protected by the EAR's application-scoped policy.

This model is appropriate if developers and security administrators can closely coordinate their work, both upon initial deployment of the Web application or EJB and upon subsequent redeployments. [Table 4-3](#) shows a typical scenario:

Table 4-3 Deployment Descriptors Only: Typical Scenario

Company A, Developer	Company A, Admin/Deployer
<p>In Company A, a user in the role of developer performs the following tasks:</p> <ul style="list-style-type: none"> • Maps EJBs and/or Web URLs to roles in the Java EE DD. • Maps roles to principals in the WebLogic Server DD. • Turns application over to the Admin/Deployer. 	<p>In Company A, a user in the role of administrator or deployer performs the following tasks:</p> <ul style="list-style-type: none"> • Uses the WebLogic Remote Console to ensure that groups exist and are properly mapped to users.

Custom Roles Model

This security model uses policies defined in the Java EE DD and ignores any principal mappings in the WebLogic Server DD. The security administrator completes the role mappings using the WebLogic Remote Console.

The model enables team members to focus on their areas of expertise. Web application and EJB developers need only to declare which URL patterns or EJB methods should be secured. Then the security administrator creates role mappings that fit within the existing hierarchy of roles and principals for a given realm.

If a developer changes policies in a deployment descriptor, WebLogic Server recognizes the change as soon as you redeploy the Web application or EJB. If an administrator changes role mappings, the changes take effect immediately without requiring a redeployment.

This model is appropriate if developers and administrators cannot closely coordinate their work or if role mappings change frequently. [Table 4-4](#) shows a typical scenario:

Table 4-4 Customize Roles Only: Typical Scenario

Company A, ISV Developer; or Company B, Developer	Company B, Admin/Deployer
<p>An ISV developer from Company A, or a developer from Company B, does the following tasks:</p> <ul style="list-style-type: none"> • Maps EJBs/URLs to roles in Java EE deployment descriptor. • Turns application over to Admin/Deployer 	<p>An administrator or a deployer from Company B does the following task:</p> <ul style="list-style-type: none"> • Uses the WebLogic Remote Console to define security roles.

Custom Roles and Policies Model

This security model offers unified and dynamic security management. It uses roles and policies that a security administrator has created using the WebLogic Remote Console and ignores any roles and policies defined in deployment descriptors.

Instead of requiring developers to modify multiple deployment descriptors when organizational security requirements change, administrators can modify all security configurations from a centralized, graphical user interface. Users, groups, security roles, and security policies can all be defined using the WebLogic Remote Console. As a result, the process of making changes based on updated security requirements becomes more efficient.

This model is appropriate if you require only that entire Web applications or EJBs be secured, but is less appropriate if you require fine-grained control of a large number of specific URL patterns or EJB methods. Such fine-grained control requires a developer to provide to administrators detailed information about the URL patterns or EJB methods that must be secured. If you require such fine-grained control, consider using the Custom Roles model (see [Custom Roles Model](#)).

The model also introduces a slight performance degradation because it checks permissions regardless of which URL a client requests or EJB method a client attempts to invoke.

[Table 4-5](#) shows a typical scenario:

Table 4-5 Customize roles and Policies: Typical Scenario

Company A, Developer	Company A, Admin/Deployer
<ul style="list-style-type: none"> • Provides no mappings in the Java EE or WebLogic Server DD. • Turns application over to Admin/Deployer 	<ul style="list-style-type: none"> • Uses the WebLogic Remote Console to define roles and policies for EJBs and Web applications.

Advanced Model

WebLogic Server provides this model primarily for backwards compatibility with releases prior to 9.0.

You can configure the following behaviors for this model (see [Understanding the Combined Role Mapping Enabled Setting](#)):

- Perform security checks for all URLs and EJB methods or only those that are protected in the deployment descriptors.

- (Not applicable if you configure this model to perform security checks only for URLs and EJB methods that are secured in deployment descriptors.) Use only roles and policies defined in the deployment descriptors, or use only roles and policies defined in the realm's security providers, or import security data from deployment descriptors into the realm's authorization provider or role mapping provider databases.
- (Not applicable if you configure this model to use only roles and policies defined in the realm's security providers.) Combine roles in parent applications with roles in the Web application or EJB, or override roles in parent applications.

If you change the configuration of this model, the change applies to all Web applications and EJBs that use this model. For example, you configure the Advanced model to perform security checks for all URLs and methods, and then you deploy several EJBs and configure them to use the Advanced model. The EJB container will request a security check any time a client tries to invoke any method in any of the several EJBs. If you then modify the Advance model to perform security checks only for the EJB methods that are protected in deployment descriptors, then the EJB container immediately begins to request security checks only for protected methods for the several EJBs.

Understanding the Advanced Security Model

Note:

This section applies only for those Web applications and EJBs that use the Advanced security model.

Oracle recommends using an alternative security model instead of the advanced security model. See [Comparison of Security Models for Web Applications and EJBs](#).

Three settings configure the Advanced model: **Check Roles and Policies, When Deploying Web Applications or EJBs**, and **Combined Role Mapping Enabled**. Failure to understand these settings could result in incorrect or lost security data.

If you change the configuration of this model, the change applies to all Web applications and EJBs that use this model.

The following sections describe the settings for the Advanced security model:

- [Understanding the Check Roles and Policies Setting](#)
- [Understanding the When Deploying Web Applications or EJBs Setting](#)
- [How the Check Roles and Policies and When Deploying Web Applications or EJBs Settings Interact](#)
- [Understanding the Combined Role Mapping Enabled Setting](#)

Understanding the Check Roles and Policies Setting

The **Check Roles and Policies** setting determines whether the Security Service performs security checks for all URLs and EJB methods or only those that are protected in the deployment descriptors and annotations.

Using WLST, set the value of **Check Roles and Policies** as follows:

- To perform security checks only on Web application and EJB resources that have security specified in their associated deployment descriptors (DDs) and annotations, set `RealmMBean.FullyDelegateAuthorization` to `false`.

 **Note:**

This selection is analogous to the Deployment Descriptor Only security model: the Security Service uses only roles and policies defined in a Web application or EJB's deployment descriptors and annotations.

- To perform security checks on all Web application and EJB resources, regardless of whether there are any security settings in the deployment descriptors and annotations for these WebLogic resources, set `RealmMBean.FullyDelegateAuthorization` to `true`.

 **Note:**

With this selection, you can also configure the **When Deploying Web Applications or EJBs** setting.

Understanding the When Deploying Web Applications or EJBs Setting

The **When Deploying Web Applications or EJBs** setting determines whether the Security Service ignores role and policy data in deployment descriptors and annotations or imports the data into role mapping and authorization provider databases **each time** you deploy a Web application or EJB.

 **Note:**

This setting is valid only if you have set **Check Roles and Policies to All Web applications and EJBs** (`RealmMBean.FullyDelegateAuthorization=true`).

Using WLST, set the value of **When Deploying Web Applications or EJBs** as follows:

- To secure Web application and EJB resources using *only* WebLogic Remote Console, set both `RealmMBean.DeployPolicyIgnored` and `RealmMBean.DeployRoleIgnored` to `true`.

At this point, you can begin to use WebLogic Remote Console to secure the resources. See *Create a Scoped Role and Create a Policy for Resource Instances* in *Oracle WebLogic Remote Console Online Help*.

- To import security data from the deployment descriptors and annotations, set both `RealmMBean.DeployPolicyIgnored` and `RealmMBean.DeployRoleIgnored` to `false`.

 **Note:**

Importing security data introduces risks to the integrity of your security data. Each time you import security data, the Security Service attempts to remove all associated security data from the provider databases and re-imports data from the deployment descriptors and annotations. If you modified the imported security data, then your modifications could become invalid or could be removed.

How the Check Roles and Policies and When Deploying Web Applications or EJBs Settings Interact

Table 4-6 shows how to achieve the behavior you want from the WebLogic Security Service using different combinations of the Check Roles and Policies and When Deploying Web Applications and EJBs settings.

Table 4-6 Interaction Between the Check Roles and Policies Setting and the When Deploying Web Applications or EJBs Setting

If you want to control security for . . .	and set security for Web application and EJB resources . . .	then set Check Roles and Policies to . . .	and set When Deploying Web Applications or EJBs to . . .
All Web application and EJB resources	using <i>only</i> WebLogic Remote Console	All Web applications and EJBs	Ignore Roles and Policies from DD
All Web application and EJB resources	by <i>copying</i> or <i>reinitializing</i> security data from the deployment descriptors and annotations into the configured Authorization and Role Mapping providers' databases when the Web application or EJB resource is deployed, then use one of the other techniques to modify security roles and security policies Note: Security data is copied/reinitialized <i>each time</i> the Web application or EJB resource is deployed.	All Web applications and EJBs	Initialize Roles and Policies from DD
<i>Only</i> on Web applications and EJB methods that are specified in the deployment descriptors and annotations (default configuration)	using <i>only</i> the deployment descriptors and annotations	Web applications and EJBs Protected in DD	--

Understanding the Combined Role Mapping Enabled Setting

The Combined Role Mapping Enabled setting determines how the role mappings in the Enterprise Application, Web application, and EJB containers interact.

WebLogic Server provides this setting for backwards compatibility with 8.x versions. For all applications initially deployed in version 9.x, the default value for this setting is true (enabled). For all applications previously deployed in version 8.1 and upgraded to version 9.x, the default value is false (disabled). If either of the following is true, consider changing the default value for Combined Role Mapping Enabled:

- You selected the Advanced security model for an 8.x application upgrade and want to use the combine role mapping behavior available in version 9.x.
- You selected the Advanced security model for a 9.x application and want to use the role mapping behavior in version 8.x.

Table 4-7 compares how this setting affects security for Web applications and EJBs:

Table 4-7 How Combined Role Mapping Affects Security for Web Applications and EJBs

When Combined Role Mapping is Disabled...	When Combined Role Mapping is Enabled...
<p>Role mappings for each container are exclusive to other containers unless defined by the <code><externally-defined></code> descriptor element.</p>	<p>Application role mappings are combined with EJB and Web application mappings so that all principal mappings are included. The Security Service combines the role mappings with a logical OR operator.</p>
<p>If one or more policies in the web.xml file specifies a role for which no role mapping exists in the weblogic.xml file, the Web application container assumes that the undefined role is the name of a principal. It therefore maps the assumed principal to the role name. For example, if the web.xml file contains the following stanza in one of its policies:</p> <pre><auth-constraint> <role-name>PrivilegedUser</role-name> </auth-constraint></pre> <p>but the weblogic.xml file has no role mapping for PrivilegedUser, then the Web application container creates an in-memory mapping that is equivalent to the following stanza:</p> <pre><security-role-assignment> <role-name>PrivilegedUser</role-name> <principal-name>PrivilegedUser </principal-name> </security-role-assignment></pre>	<p>If one or more policies in the web.xml file specifies a role for which no mapping exists in the weblogic.xml file, the Web application container creates an empty map for the undefined role (that is, the role is explicitly defined as containing no principal). Therefore, no one can access URL patterns that are secured by such policies.</p>
<p>Role mappings for EJB methods must be defined in the weblogic-ejb-jar.xml file. Role mappings defined in the other containers are not used unless defined by the <code><externally-defined></code> descriptor element.</p>	<p>If one or more policies in the ejb-jar.xml file specifies a role for which no mapping exists in the weblogic-ejb-jar.xml file, the EJB container creates an empty map for the undefined role (that is, the role is explicitly defined as containing no principal). Therefore, no one can access methods that are secured by such policies.</p>

Usage Examples

The following examples show the differences in role mapping behaviors depending on whether Combined Role Mapping is enabled or disabled.

Example for EAR, WAR and EJB

MyAppEar contains MyAppWAR which contains MyEJB. Role to Principal mappings (p1 and p2) are as follows:

- EAR descriptor, myRole = p1
- WAR descriptor, myRole = p2
- EJB-JAR descriptor, myRole = empty

When Combined Role Mapping is enabled, the role mappings would be:

- For the Ear container, myRole maps to p1.
- For the WAR container, myRole maps to p1 or p2.
- For the EJB container, myRole maps to p1.

When Combined Role Mapping is disabled, the role mappings would be

- For the Ear container, myRole maps to p1.
- For the WAR container, myRole maps to p2.
- For the EJB container: Must be externally-defined or the deployment fails.

Example for EAR and WAR

MyAppEar contains MyAppWAR. Role to Principal mappings are as follows:

- In MyAppEAR descriptor, myRole = p1
- In MyAppWAR descriptor, myRole = (none defined)

When Combined Role Mapping is enabled, the role mappings would be:

- For the Ear container, myRole maps to p1.
- For the WAR container, myRole maps to p1.

The mapping is the same because of the combined role behavior.

When Combined Role Mapping is disabled, the role mappings would be:

- For the Ear container, myRole maps to p1.
- For the WAR container, myRole maps to MyRole.

The mapping is the same because if there is no mapping defined for the Web application, WebLogic Server copies the EAR mapping to the WAR mapping.

Securing Web Applications and EJBs

For metadata annotations, when you code an EJB you add the security-related annotations to specify the roles that are allowed to invoke all, or a subset, of the methods. At deployment time, the deployer must then create these security roles if they do not already exist and map users to these roles using WebLogic Remote Console to update your security realm. For details, see *Security Policies and Roles in Oracle WebLogic Remote Console Online Help*.

For deployment descriptor- and WebLogic Remote Console-based security, you choose a security model when you deploy each Web application or EJB, and your choice is immutable for the lifetime of the deployment. If you want to use a different model, you must delete and redeploy the Web application or EJB.

For information on using WebLogic Remote Console to deploy applications, choose a security model, modify roles and polices, and complete other related tasks, see *Deploying Applications* in *Oracle WebLogic Remote Console Online Help*.

If you plan to use deployment descriptors to secure Web applications or EJBs, see *Using Declarative Security With Web Applications* and *Using Declarative Security With EJBs* in *Developing Applications with the WebLogic Security Service*.

5

Security Policies

Understand the features and functions of security policies, which specify who can access a WebLogic Server resource. You can create simple policies, such as "allow access if user is in Admin role", or more complex policies, such as "between the hours of 8 and 5, allow access if user is in Admin role".

This chapter includes the following sections:

- [Security Policy Storage and Prerequisites for Use](#)
- [Default Root Level Security Policies](#)
- [Security Policy Conditions](#)
- [Protected Public Interfaces](#)
- [Using the WebLogic Remote Console to Manage Security Policies](#)

For information on using security policies to protect multiple resources, see [Using Policies to Protect Multiple Resources](#).

Security Policy Storage and Prerequisites for Use

Security policies for all resources other than Web Application resources and EJB resources are always stored in the security provider database of the Authorization provider that is configured in the security realm. The security realm that WebLogic Server provides stores policies in the embedded LDAP server.

For Web Application resources and EJB resources, the location of policies depends on the following:

- If you implement security using JACC (Java Authorization Contract for Containers as defined in [JSR 115](#)), the policies are stored in the Web application or EJB deployment descriptors.
- If you use the DDOnly model to secure a Web application or EJB, the policies are stored in the deployment descriptors.
- If you use a security model that ignores the policies in the descriptors, then the Authorization provider determines where the policies are stored. The security realm that WebLogic Server provides stores policies in the embedded LDAP server.
- If you use the Advanced security model, the location of policies depends on how you configure the model.

See [Options for Securing Web Application and EJB Resources](#).

Each user or group that you add to a security policy must be defined in the security provider database of the Authentication provider that is configured in the active security realm. Each role that you add must be defined in the security provider database of the Role Mapping provider that is configured in the active security realm. The security realm that WebLogic Server provides is configured to use the WebLogic Authentication and WebLogic XACML Role Mapping providers, which store users, groups, and roles in the embedded LDAP server.

See WebLogic Security Providers in *Understanding Security for Oracle WebLogic Server*.

Default Root Level Security Policies

A **root level policy** is inherited by all instances of a specific resource type. [Table 5-1](#) describes the default root level policies that are defined in the security realm that WebLogic Server installs. For information about the roles and groups that are named in these policies, see [Users, Groups, And Security Roles](#).

 **Note:**

You can access root level policies in the WebLogic Remote Console. See Security Policies in *Oracle WebLogic Remote Console Online Help*.

Table 5-1 Default Security Policies for WebLogic Resources

WebLogic Resource	Security Policy
Administrative resources	Default global role: Admin
Application resources	None
EIS (Resource Adapter) resources	Default group: Everyone
EJB resources	Default group: Everyone
COM resources	None
JDBC resources	Default group: Everyone
JNDI resources	Default group: Everyone
JMS resources	Default group: Everyone
Server resources	Default global roles: <ul style="list-style-type: none">• Admin• Operator
Work Context	Default group: Everyone
URL resources	Default group: Everyone
Web Services resources	Default group: Everyone
Coherence resources	Default group: Everyone

 **Note:**

Do not modify the default root level policies for Administrative and Server resources to make them more restrictive. Eliminating some of the existing security roles might negatively impact the functioning of WebLogic Server. However, if you like, you can make the default security policies more inclusive (for example, by adding new security roles). See [Maintaining a Consistent Security Scheme](#).

Security Policy Conditions

To determine who can access a resource, a policy contains one or more conditions. The most basic policy simply contains the name of a security role or a principal. For example, a basic policy might simply name the Admin global role. At run time, the WebLogic Security Service interprets this policy as allow access if user is in Admin role. You can create more complex conditions and combine them using the logical operators AND and OR (which is an inclusive OR). You can also negate any condition, which would prohibit access under the specified condition.

The WebLogic Server Authorization providers display three kinds of built-in policy conditions in the WebLogic Remote Console:

 **Note:**

These sections describe the conditions that are available in realms that use the WebLogic Authorization provider or the WebLogic XACML Authorization provider. If your security realm uses a third-party Authorization provider, refer to the third-party documentation for information on its capabilities.

- [Basic Policy Conditions](#)
- [Date and Time Policy Conditions](#)
- [Context Element Policy Conditions](#)

Basic Policy Conditions

The basic policy conditions that are available in this release of WebLogic Server are:

- **User**—Allows a specific user to access the resource. For example, you might create a condition indicating that only the user `John` can access the `Deposit` EJB.

 **Note:**

Instead of the User condition, Oracle recommends adding the user to a Group and using the Group condition in the security policy. If you do use the User condition, ensure that you update any existing policies when the user is deleted from the authentication store.

- **Group**—Allows all users or groups in the specified group to access the resource unless a User or Role condition contradicts the Group condition.
- **Role**—Allows all users or groups in the specified role to access the resource unless a User or Group condition contradicts the Role condition. For example, if you create a Role condition that specifies 'Admin' and a User condition that negates 'Joe', then user 'Joe' will be denied access even if he is in the Admin role.
- **Server is in Development Mode**—Allows access if the server that hosts the resource is running in development mode. See *Creating a WebLogic Domain in Creating WebLogic Domains Using the Configuration Wizard*.
- **Allow access to everyone**—Allows access for all users, groups, and roles.

- Deny access to everyone—Prohibits access for all users, groups, and roles.
- Element requires signature by—(Used only when securing Web Services resources)
Creates a condition for a security policy based on who has digitally signed an element in the SOAP request message that invokes a Web Service operation. For example, you might create a condition that says the `getBalance` operation can only be invoked if the `AccountNumber` element in the incoming SOAP request has been digitally signed by a user who is named `joe`.

To create an `Element requires signature by` condition, provide the following information:

- Specify whether a group or a user is required to sign the SOAP element.
For example, enter `user` to specify that a user must sign the element.
- The name of the user or group that must sign the element.
- The name of the SOAP message element that must be digitally signed. Use the following format:

```
{Namespace}LocalPart
```

where `LocalPart` refers to the name of the element in the SOAP message that must be digitally signed and `Namespace` refers to its namespace. Use the WSDL of the Web Service to get these values.

For example:

```
{http://schemas.xmlsoap.org/soap/envelope/}AccountNumber
```

Note:

You can specify only those elements that have already been configured to be digitally signed in the WS-Policy of the Web Service. For details, see *Configuring Message-Level Security in Securing WebLogic Web Services for Oracle WebLogic Server*.

Date and Time Policy Conditions

When you use any of the date and time conditions, the security policy grants access to *all* users for the date or time you specify, unless you further restrict the users by adding one of the other conditions. The date and time policy conditions available in this release of WebLogic Server are:

- Access occurs between specified hours—Allows access during a specified time period. For example, you might create a condition granting access to users only during business hours.
- Access occurs after—Allows access after a specified time. For example, you might create a condition that grants access to users after the business opens or after a certain date and time.
- Access occurs before—Allows access before a specified time. For example, you might create a condition that grants access to users before the business closes or before a certain date and time.
- Access occurs on specified days of the week—Allows access on specified days. For example, you might create a condition that grants access to users on week days.

- Access occurs on the specified day of the month—Allows access on an ordinal day of the month. For example, you might create a condition that grants access to users only the first day of each month.
- Access occurs after the specified day of the month—Allows access after an ordinal day in the month. For example, you might create a condition indicating that grants access to users after the 15th day of the month.
- Access occurs before the specified day of the month—Allows access before an ordinal day in the month. For example, you might create a condition that grants access to users before the 15th day of the month.

 **Note:**

The format for specifying the time in a time policy condition, such as `Access occurs between specified hours`, is locale-dependent. In English versions of WebLogic Server, the format is 12-hour based and is expressed as `hh:mm:ss AM|PM`, using the time zone local to the WebLogic Server instance. For example, to specify 8:30 p.m., use the format `08:30:00 PM`.

Context Element Policy Conditions

You can use the context element conditions to create security policies based on the value of HTTP Servlet Request attributes, HTTP Session attributes, and EJB method parameters. WebLogic Server retrieves this information from the `ContextHandler` object and allows you to defined policy conditions based on the values. When using any of these conditions, it is your responsibility to ensure that the attribute or parameter/value pairs apply to the context in which you are using them. See *ContextHandlers and WebLogic Resources* in *Developing Security Providers for Oracle WebLogic Server*.

The context element role conditions available in this release of WebLogic Server are:

- `Context element defined`—Allows access based on the existence of a specified attribute or parameter.
- `Context element's value equals a numeric constant`—Allows access based on a specified attribute or parameter's number value (or string representing a double number) being equal to a specified `double` number.
- `Context element's value is greater than a numeric constant`—Allows access based on a specified attribute or parameter's number value (or string representing a double number) being greater than a specified `double` number.
- `Context element's value is less than a numeric constant`—Allows access based on a specified attribute or parameter's number value (or string representing a double number) being less than a specified `double` number.
- `Context element's value equals a string constant`—Allows access based on a specified attribute or parameter's string value being equal to a specified string.

Protected Public Interfaces

The WebLogic Remote Console, the WebLogic Scripting Tool (WLST), and MBean APIs are secured using the default security policies, which are based on the default global roles and default groups described in [Table 6-2](#). Therefore, to use the WebLogic Remote Console, a user

must belong to one of these default groups or be granted one of these global roles. Additionally, administrative operations that require interaction with MBeans are secured using the MBean protections described in [Maintaining a Consistent Security Scheme](#). Therefore, interaction with the following protected public interfaces typically must satisfy both security schemes.

- *WebLogic Remote Console*—The WebLogic Security Service verifies whether a particular user can access the WebLogic Remote Console when the user attempts to log in. Operations for which the user does not have access are hidden from the user.
- *The WebLogic Scripting Tool*—The WebLogic Scripting Tool (WLST) is a command-line scripting interface that system administrators and operators can use to monitor and manage WebLogic Server instances and domains. The WebLogic Security Service verifies whether a particular user has permission to execute a WLST command when the user attempts to invoke the command. If a user attempts to invoke an operation for which the user does not have access, WebLogic Server throws a `weblogic.management.NoAccessRuntimeException`, which developers can catch explicitly in their programs. The server sends this exception to its log file, but you can also configure the server to send exceptions to standard out.

For information about using this public interface, see [Using the WebLogic Scripting Tool in Understanding the WebLogic Scripting Tool](#).

 **Note:**

WLST is a convenience utility that abstracts the interaction with the MBean APIs (described next). Therefore, for any administrative task you can perform using WLST, you can also perform using the MBean APIs.

- *MBean APIs*—The WebLogic Security Service verifies whether a particular user has permission to access the API when the user attempts to perform an operation on the MBean. If a user attempts to invoke an operation for which the user does not have access, WebLogic Server throws a `weblogic.management.NoAccessRuntimeException`, which developers can catch explicitly in their programs. The server sends this exception to its log file, but you can also configure the server to send exceptions to standard out.

For information about using these APIs, see [Understanding WebLogic Server MBeans in Developing Custom Management Utilities Using JMX for Oracle WebLogic Server](#).

Using the WebLogic Remote Console to Manage Security Policies

 **Note:**

This section describes the features and functions that are available in security realms that are using the WebLogic Authorization provider or the WebLogic XACML Authorization provider. If your security realm uses a third-party Authorization provider, refer to the third-party documentation for information on how to add policies to the provider database.

You can use the WebLogic Remote Console to access WebLogic resources for creating and modifying security policies. See Security Policies and Roles in *Oracle WebLogic Remote Console Online Help*.

6

Users, Groups, And Security Roles

Understand the features and functions of users, groups, and security roles within security realms in WebLogic Server.

This chapter includes the following sections:

- [Overview of Users and Groups](#)
- [Default Users](#)
- [Default Groups](#)
- [Overview of Security Roles](#)
- [Types of Security Roles: Global Roles and Scoped Roles](#)
- [Default Global Roles](#)
- [Security Role Conditions](#)
- [Using the WebLogic Remote Console to Manage Users, Groups, and Roles](#)

Overview of Users and Groups

A user is an entity that can be authenticated. A user can be a person or a software entity, such as a Java client. Each user is given a unique identity within a security realm. For efficient security management, Oracle recommends adding users to groups. A group is a collection of users who usually have something in common, such as working in the same department in a company.

Default Users

When you create a WebLogic Server domain, three user accounts are created in the security realm by default: the Administration user account that you define during domain creation, `OracleSystemUser` and `LCMUser`.

- The default WebLogic Administrator user account for the domain is used to boot and connect to the domain's Administration Server. You specify the user name and password for this account when you create the domain. You should make note of these credentials because you will need them to start and access the Administration Server, and to log into the WebLogic Remote Console.

Note:

- For additional security, avoid choosing an obvious name such as `system`, `admin`, `administrator`, or `weblogic` for your system administrator user accounts. If you enable secured production mode, then WebLogic Server logs warnings if users in the administrator group have these obvious user names.
- You should create at least one additional user and assign them the Admin security role. Be sure to use unique names that cannot be easily guessed. Having at least two system administrator user accounts helps to ensure that one user maintains account access in case another user becomes locked out by a dictionary/brute force attack.

- `OracleSystemUser` facilitates the installation of Fusion Middleware components that run on WebLogic Server, such as Oracle SOA Suite, and is the default user for Fusion Middleware components such as Oracle Web Services Manager.

Note:

- `OracleSystemUser` is assigned the same password that you specify for the default Administration user when you create the domain. If necessary, you can change this password in the WebLogic Remote Console.
- `OracleSystemUser` is assigned to the `OracleSystemGroup` and is granted the `OracleSystemRole` by default. This user is not a member of any of the default WebLogic Server groups or global roles. Therefore, it does not have access to WebLogic Server resources and would not represent any security concerns.
- Although you can remove `OracleSystemUser` with no issues if you have a standalone WebLogic Server installation, if you do so you will encounter problems if you attempt to install Fusion Middleware components on top of WebLogic Server at a later date, or use Oracle Web Services Manager.
- `LCMUser` is an internal WebLogic account that is required for software features such as Lifecycle Manager, RESTful Management Services, and Fusion Middleware Control.

Note:

- The password for `LCMUser` is randomly generated, therefore you cannot log into the WebLogic Remote Console as this user. Oracle recommends that you do not change this password.
- Do not remove the `LCMUser` account. If you remove `LCMUser` from the WebLogic security realm, then you are disabling the maintenance capability of the Lifecycle Manager tool and you may encounter errors if you later attempt to upgrade your installation.
- If you replace the embedded LDAP with an external provider and you plan to use the WebLogic Server Lifecycle Manager functionality, then you need to recreate this user in the new provider. See *Configuring Authentication Providers in Administering Security for Oracle WebLogic Server*.

Default Groups

[Table 6-1](#) lists the groups that WebLogic Server defines in the security realm that it installs. By default, if you add a user to one of these groups, you also place the user in one of the default global security roles (see [Default Global Roles](#)).

Table 6-1 Default Groups

Group Name	Membership
Administrators	By default, this group contains the user information entered as part of the installation process (that is, the Configuration Wizard). Any user assigned to the <code>Administrators</code> group is granted the <code>Admin</code> security role by default. See Best Practices: Add a User To the Administrators Group .
Deployers	By default, this group is empty. Any user assigned to the <code>Deployers</code> group is granted the <code>Deployer</code> security role by default.
Operators	By default, this group is empty. Any user assigned to the <code>Operators</code> group is granted the <code>Operator</code> security role by default.

Table 6-1 (Cont.) Default Groups

Group Name	Membership
Monitors	By default, this group is empty. Any user assigned to the <code>Monitors</code> group is granted the <code>Monitor</code> security role by default.
AppTesters	By default, this group is empty. Any user assigned to the <code>AppTesters</code> group is granted the <code>AppTester</code> security role by default.
CrossDomainConnectors	By default, this group is empty. Any user assigned to the <code>CrossDomainConnectors</code> group is granted the <code>CrossDomainConnector</code> security role by default.
AdminChannelUsers	By default, this group is empty. Any user assigned to the <code>AdminChannelUsers</code> group is granted the <code>AdminChannelUser</code> security role by default.
OracleSystemGroup	By default, this group contains the user <code>OracleSystemUser</code> and is granted the <code>OracleSystemRole</code> role by default.

Run Time Groups

At run time, WebLogic Server places all users in the following groups:

- `users`. This group contains all users who have been authenticated.
- `everyone`. This group contains all anonymous users and, because it contains the `users` group, all users who have been authenticated.

Unlike the groups in [Table 6-1](#) (or other groups that you create), you cannot add or remove users directly to these groups; WebLogic Server assigns users to them dynamically. These groups do not appear under Groups in the WebLogic Remote Console, and they are not exported with the authentication database.

Best Practices: Add a User To the Administrators Group

Oracle recommends that you add at least one user to the `Administrators` group *in addition to* the user you defined at installation (using the Configuration wizard). Having at least two administrators at all times helps protect against a single admin user being locked out from a potential security breach. Also, avoid using predictable user names like `system`, `admin`, or `Administrator`.

Overview of Security Roles

A security role is an identity granted to users or groups based on specific conditions. Multiple users or groups can be granted the same security role and a user or group can be in more than one security role. Security roles are used by policies to determine who can access a WebLogic resource. (See [Security Policies](#).)

Like a security group, a role grants an identity to a user. Security roles differ from groups as follows:

- Security roles can be scoped to specific WebLogic resources within a single application in a WebLogic Server domain. Groups, on the other hand, are always scoped to an entire WebLogic Server domain. See [Types of Security Roles: Global Roles and Scoped Roles](#).
- Security roles are computed and granted to users or groups dynamically, based on conditions such as user name, group membership, or the time of day. Groups are static.

The process of computing and granting roles is referred to as role mapping and occurs just before the WebLogic Security Service renders an access decision for a protected WebLogic resource. An access decision is the component of an Authorization provider that determines whether a subject has permission to perform a given operation on a WebLogic resource. (See Access Decisions in *Developing Security Providers for Oracle WebLogic Server*.)

Types of Security Roles: Global Roles and Scoped Roles

There are two types of security roles in WebLogic Server:

- A **global** security role can be used in any security policy. Oracle provides several default global roles that you can use out of the box to secure your WebLogic resources; these are described in [Default Global Roles](#).

Note:

If you are implementing security using JACC (Java Authorization Contract for Containers as defined in [JSR 115](#)) global security roles cannot be used.

- A **scoped** role can be used only in policies that are defined for a specific instance of a WebLogic resource (such as a method on an EJB or a branch of a JNDI tree). You might never need to use scoped roles. They are provided for their flexibility and are an extra feature for advanced customers.

Default Global Roles

[Table 6-2](#) lists the global roles that WebLogic Server defines in the security realm that it installs. The table also summarizes the access that the default security policies grant to each role and indicates which groups are in each role by default. [Table 6-3](#) summarizes the permissions in the WebLogic Remote Console for the Admin, Deployer, Operator, and Monitor global roles.

Note:

Do not delete these roles. They are used in the default security policies that protect most types of WebLogic resources. In addition, they are used by the MBean security layer. If you delete the Admin role, no one will be able to modify the configuration of a running domain. See [Maintaining a Consistent Security Scheme](#).

Table 6-2 Default Global Roles, Privileges, and Default Group Assignments

Global Role	Default Policies Grant Access To . . .	Default Conditions Include This Group . . .
Admin	<ul style="list-style-type: none"> • View the server configuration, including the encrypted value of some encrypted attributes. • Modify the entire server configuration. • Deploy Enterprise Applications and Web application, EJB, Java EE Connector, and Web Service modules. • Start, resume, and stop servers. 	Administrators

Table 6-2 (Cont.) Default Global Roles, Privileges, and Default Group Assignments

Global Role	Default Policies Grant Access To . . .	Default Conditions Include This Group . . .
AdminChannelUser	Access the administrative channel, AdminChannel.	AdminChannelUsers, Administrators, Deployers, Operators, Monitors, and AppTesters
Anonymous	All users (the group <code>everyone</code>) are granted this global role. Note: This global role is provided as a convenience, and can be specified in the <code>weblogic.xml</code> and <code>weblogic-ejb-jar.xml</code> deployment descriptors. See <code>weblogic.xml</code> Deployment Descriptor Elements in <i>Developing Web Applications, Servlets, and JSPs for Oracle WebLogic Server</i> and <code>weblogic-ejb-jar.xml</code> Deployment Descriptor Reference in <i>Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server</i> .	<code>everyone</code>
Deployer	<ul style="list-style-type: none"> View the server configuration, including some encrypted attributes related to deployment activities. Change startup and shutdown classes, Web applications, JDBC data pool connections, EJB, Java EE Connector, Web Service, and WebLogic Tuxedo Connector components. If applicable, edit deployment descriptors. Access deployment operations in the Java EE Deployment Implementation (JSR-88). See <i>Understanding WebLogic Server Deployment in Deploying Applications to Oracle WebLogic Server</i>. 	Deployers
Operator	<ul style="list-style-type: none"> View the server configuration, <i>except</i> for encrypted attributes. Start, resume, and stop servers. Start and stop applications using MBean APIs and WLST. You cannot start and stop applications in the WebLogic Remote Console. See Table 6-3. 	Operators
Monitor	View the server configuration, <i>except</i> for encrypted attributes. This security role effectively provides read-only access to the WebLogic Remote Console, WLST, and MBean APIs.	Monitors
AppTester	Access applications for testing purposes that are running in Administration mode. See Administration Mode for Isolating Production Applications in <i>Deploying Applications to Oracle WebLogic Server</i> .	AppTesters
CrossDomainConnector	Make inter-domain calls from foreign domains. See Enabling Trust Between WebLogic Server Domains in <i>Administering Security for Oracle WebLogic Server</i> .	CrossDomainConnectors
OracleSystemRole	Assert identity on behalf of users whose WS-Security tokens have been authenticated. Note: This global role is provided for use by Oracle Web Services Manager.	OracleSystemGroup

[Table 6-3](#) summarizes the privileges provided in the WebLogic Remote Console for the Admin, Deployer, Operator, and Monitor global roles. Note that the information provided in the table is based on the default out-of-the-box security policy for WebLogic Resources and MBeans. You can manage the default security policies in the WebLogic Remote Console, as described in Security Policies and Roles in *Oracle WebLogic Remote Console Online Help*.

Table 6-3 WebLogic Server WebLogic Remote Console Privileges for Default Global Roles

Privileges	Administrator	Deployer	Operator	Monitor
Edit session operations: start or release session, activate or undo changes	Yes	Yes	No	No
Server, Cluster, Template, or Machine				
Lifecycle operations: create, delete	Yes	No	No	No
Modify configuration	Yes	No	No	No
Control operations: start, stop, resume	Yes	No	Yes	No
View configuration	Yes	Yes	Yes	Yes
Application Deployments				
Lifecycle operations: deploy, undeploy, redeploy	Yes	Yes	No	No
Modify configuration	Yes	Yes	No	No
Control operations: start, stop	Yes	Yes	No	No
JDBC and JMS resources				
Lifecycle operations: create, delete	Yes	Yes	No	No
Modify configuration	Yes	Yes	No	No
Control operations: start, stop	Yes	No	No	No
View configuration	Yes	Yes	Yes	Yes
Startup and Shutdown Classes, Coherence Clusters				
Lifecycle operations: create, delete	Yes	No	No	No
Modify configuration	Yes	Yes	No	No
View configuration	Yes	Yes	Yes	Yes

Security Role Conditions

To determine who is in a security role at run time, a role contains one or more conditions. For example, a basic role might simply be the Administrator group. At run time, the WebLogic Security Service interprets this policy as place the Administrator group in this role. You can create more complex conditions and combine them using the logical operators AND and OR (which is an inclusive OR). You can also negate any condition, which would make sure that a user is not in the role. The entire collection of conditions must be true for a user or group to be granted the security role. More restrictive expressions should come later in a role statement.

In the WebLogic Remote Console, the WebLogic Server Role Mapping providers display the three built-in policy conditions described in the following sections:

- [Basic Role Conditions](#)
- [Date and Time Role Conditions](#)

- [Context Element Role Conditions](#)

 **Note:**

The following sections describe the conditions that are available in realms that use the WebLogic Role Mapping provider or the WebLogic XACML Role Mapping provider. If your security realm uses a third-party Role Mapping provider, refer to the third-party documentation for information about its capabilities.

Basic Role Conditions

The basic role conditions available in this release of WebLogic Server are:

- **User**—Adds the specified user to the role. For example, you might create a condition indicating that only the user `John` can be granted the `BankTeller` security role.

 **Note:**

Instead of the `User` condition, Oracle recommends adding the user to a `Group` and using the `Group` condition in the security role. If you do use the `User` condition, ensure that you update any existing roles when the user is deleted from the authentication store.

- **Group**—Adds the specified group to the role. For example, you might create a condition indicating that only users in the group `FullTimeBankEmployees` can be granted the `BankTeller` security role.

As a minimum requirement, Oracle recommends this role condition for more efficient security management.

- `Server is in development mode`—Adds principals to the role only when the server is running in development mode. See *Creating a WebLogic Domain in Creating WebLogic Domains Using the Configuration Wizard*.
- `Allow access to everyone`—Adds all users and groups to the role.
- `Deny access to everyone`—Prevents any user or group from being in the role.

Date and Time Role Conditions

When you use any of the date and time role conditions, the security role is granted to *all users* for the date or time you specify, unless you further restrict the users by adding one of the other role conditions. The date and time role conditions available in this release of WebLogic Server are:

- `Access occurs between specified hours`—Adds principals to the role only during the specified time period. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users when the bank is open.
- `Access occurs after`—Adds principals to the role only if the current time is after a specified time. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users after the bank opens or after a certain date and time.

- `Access occurs before`—Adds principals to the role only if the current time is before a specified time. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users before the bank closes or before a certain date and time.
- `Access occurs on specified days of the week`—Adds principals to the role only on specified days. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users on week days.
- `Access occurs on the specified day of the month`—Adds principals to the role only on an ordinal day of the month. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users on the first day of each month.
- `Access occurs after the specified day of the month`—Creates a condition for a security role based on a time after an ordinal day in the month. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users after the 15th day of the month.
- `Access occurs before the specified day of the month`—Adds principals to the role only if the current day is before an ordinal day in the month. For example, you might create a condition indicating that the `BankTeller` security role can only be granted to users before the 15th day of the month.

Context Element Role Conditions

You can use the context element conditions to create security roles based on the value of HTTP Servlet Request attributes, HTTP Session attributes, and EJB method parameters. WebLogic Server retrieves this information from the `ContextHandler` object and allows you to defined role conditions based on the values. When using any of these conditions, it is your responsibility to ensure that the attribute or parameter/value pairs apply to the context in which you are using them. See `ContextHandlers` and `WebLogic Resources` in *Developing Security Providers for Oracle WebLogic Server*.

The context element role conditions available in this release of WebLogic Server are:

- `Context element defined`—Adds principals to the role based on the existence of a specified attribute or parameter.
- `Context element's value equals a numeric constant`—Adds principals to the role based on a specified attribute or parameter's number value (or string representing a double number) being equal to a specified `double` number.
- `Context element's value is greater than a numeric constant`—Adds principals to the role based on a specified attribute or parameter's number value (or string representing a double number) being greater than a specified `double` number.
- `Context element's value is less than a numeric constant`—Adds principals to the role based on a specified attribute or parameter's number value (or string representing a double number) being less than a specified `double` number.
- `Context element's value equals a string constant`—Adds principals to the role based on a specified attribute or parameter's string value being equal to a specified string.

Using the WebLogic Remote Console to Manage Users, Groups, and Roles

 **Note:**

This section describes the features that are available in realms that use the WebLogic Authentication provider and the WebLogic Role Mapping provider or the WebLogic XACML Role Mapping provider. If your security realm uses a third-party Authentication or Role Mapping provider, refer to the third-party documentation for information on its capabilities.

For information on adding users and groups to a security realm, see Users and Groups in *Oracle WebLogic Remote Console Online Help*.

For information on creating security roles, see Security Policies and Roles in *Oracle WebLogic Remote Console Online Help*.

7

Using XACML Documents to Secure WebLogic Resources

Learn how to use the eXtensible Access Control Markup Language (XACML), an XML language for expressing authorization policies and role assignments, to secure WebLogic resources. You can create roles and policies in an XACML document and then use the WebLogic Scripting Tool (WLST) to add them to your security realm. This is useful if you need to create security roles or policies that are more complex than can be created with the WebLogic Remote Console, or if you are required to use a standard language. You can also export your realm's roles and policies to a XACML document and then import the document in other WebLogic Server realms.

This chapter includes the following sections:

- [Prerequisites](#)
- [Adding a XACML Role or Policy to a Realm: Main Steps](#)
- [Creating Roles and Policies for Custom MBeans](#)
- [Exporting Roles and Policies to XACML Documents](#)



Note:

Always create a backup of a domain before you load XACML documents into a security realm. If you make a typographical or other type of error in an attribute description, you can cause the XACML provider to evaluate your realm's roles and policies as indeterminate, which locks all users (including the administrative user) out of the domain. See [Caution: Indeterminate Results Can Lock Out All Users](#).

The WebLogic Server XACML Authorization Provider and the WebLogic Server XACML Role Mapping Provider implement the *XACML 2.0 Core Specification*, available at http://docs.oasis-open.org/xacml/2.0/access_control-xacml-2.0-core-spec-os.pdf.

Prerequisites

Note the following prerequisites for using XACML documents to secure WebLogic resources:

- To add XACML authorization policies to a security realm, the realm must use either the WebLogic Server XACML Authorization Provider or a third party authorization provider that implements the `weblogic.management.security.authorization.PolicyStoreMBean` interface.
- To add XACML role assignments to a security realm, the realm must use either the WebLogic Server XACML Role Mapping Provider or a third party authorization provider that implements the `weblogic.management.security.authorization.PolicyStoreMBean` interface.

- To secure a resource with a XACML authorization or role policy, you need the resource identifier (ID). Because WebLogic Server creates an immutable, unique ID when you deploy or create a resource, you must deploy the resource before creating a policy for it.
- To secure an EJB or Web application, you must deploy using the Custom Roles or Custom Roles and Policies security model. You cannot use a XACML document to create roles and policies for an EJB or Web application that you have deployed using the Deployment Descriptor Only security model. See [Comparison of Security Models for Web Applications and EJBs](#).

Adding a XACML Role or Policy to a Realm: Main Steps

You can create a XACML document that describes roles and policies and then use the WebLogic Scripting Tool to add the policy or role to your security realm.

The main steps for this process are as follows:

1. [Determine Which Resource to Secure](#)
2. [Get the ID of the Resource to Secure](#)
3. [Create XACML Documents](#)
4. [Use WebLogic Scripting Tool to Add the Role or Policy to the Realm](#)
5. [Verify That Your Roles and Policies Are in the Realm](#)

Caution: Indeterminate Results Can Lock Out All Users

The XACML specification requires that if the decision engine is unable to process a decision point, the engine returns a result of indeterminate. Depending on the combining algorithms that you use for a decision point and its associated decision points, an indeterminate result can propagate to the top of the decision and cause the provider to deny access to all requests.

For example, the following attribute specifies `MustBePresent='true'` and contains a spelling mistake (`ancester` instead of `ancestor`). It will evaluate as indeterminate and will cause the security provider to deny access:

```
<ResourceAttributeDesignator
  AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-ancester"
  DataType="http://www.w3.org/2001/XMLSchema#string"
  MustBePresent="true"/>
```

Determine Which Resource to Secure

WebLogic Server organizes its resources into a hierarchy. If you use the WebLogic Remote Console or a Java EE deployment descriptor (instead of a XACML document) to secure WebLogic resources, policies that you create on resources that are higher in the hierarchy act as default policies for resources lower in the same hierarchy. Policies lower in a hierarchy always override policies higher in the hierarchy.

Your XACML document can encode this hierarchical protection scheme, though XACML's hierarchical model differs slightly from WebLogic Server. See [Comparison of WebLogic Server and XACML Security Models](#).

Get the ID of the Resource to Secure

WebLogic Server creates an immutable, unique identifier (ID) when you deploy or create a resource, and your XACML document must include a resource identifier that specifies the WebLogic Server ID.

To find the ID that WebLogic Server has assigned to a resource:

1. Enable security auditing for your realm by configuring an Auditing provider.

See *Configure an Auditing Provider* in *Oracle WebLogic Remote Console Online Help*.

Take note of the location in which the Auditing provider saves its log files (by default, in the server's `logs` directory).

2. Deploy or create the resource.
3. Send a request from an external client to the resource.

For example, use a Web Service client to invoke a Web Service method that you want to secure. This will trigger an event that causes the Auditing provider to generate a message for the resource.

Note:

The Web Service client needs to authenticate itself before it can be granted access to the Weblogic resource that is secured by the roles and policies specified in the XACML document.

4. Open the log file for the Auditing provider and find the entry for the event that you triggered.

For example, if you configure the WebLogic Server Default Auditor to generate messages for severity level `INFORMATION` and higher, when you invoke the `sayHello` method from a Web Service named `SimpleSoapPort`, the audit log contains the following entries, one from the Role Mapping provider and the other from the Authorization provider:

```
#### Audit Record Begin <Mar 30, 2006 9:24:12 AM>
<Severity =INFORMATION>
<<<Event Type = RoleManager Audit Event >><Subject: 0>
<<webservices>><type=<webservices>,
application=webservicesJwsSimpleEar, contextPath=/jws_basic_simple,
webService=SimpleSoapPort, method=sayHello,
signature={java.lang.String}>>>> Audit Record End ####
#### Audit Record Begin <Mar 30, 2006 9:24:12 AM>
<Severity =SUCCESS>
<<<Event Type = Authorization Audit Event V2 >><Subject: 0>
<ONCE><<webservices>><type=<webservices>,
application=webservicesJwsSimpleEar, contextPath=/jws_basic_simple,
webService=SimpleSoapPort, method=sayHello,
signature={java.lang.String}>>>> Audit Record End ####
```

The resource ID for the `sayHello` method is:

```
type=<webservices>,
application=webservicesJwsSimpleEar, contextPath=/jws_basic_simple,
webService=SimpleSoapPort, method=sayHello,
signature={java.lang.String}
```

5. Edit the resource ID from the auditing record to specify the resource that you want to protect.

The IDs in the audit log are for resources that are at the bottom of the WebLogic Server resource hierarchy. Typically, instead of creating policies for a specific operation (such as a Web Service or EJB method or an HTTP method on a specific URL), you design policies for resources higher in the hierarchy, such as for a URL pattern or an entire Web Service.

You can derive the following resource IDs from the resource ID from the previous step:

- The ID for the Web Service that contains the sayHello method is:

```
type=<webservices>,
application=webservicesJwsSimpleEar, contextPath=/jws_basic_simple,
webService=SimpleSoapPort
```

- The ID for the application that contains the Web Service is:

```
type=<application>,
application=webservicesJwsSimpleEar
```

Note that resource ID for an application specifies `type=<application>`.

- The ID for the Web Service type, which you would use to create a root-level policy for all Web Services is:

```
type=<webservices>
```

For information about root-level policies and the hierarchy of resources, see [Using Policies to Protect Multiple Resources](#).

Create XACML Documents

If you want to create role assignments and authorization policies, create two XACML documents: one that describes your roles and another that describes your policies. You load one of the documents into the Role Mapping provider's store and the other into the Authorization provider's store.

For information about using XACML to describe WebLogic Server resources, see [Reference for XACML on WebLogic Server](#).

Example: Defining Role Assignments

The syntax for describing role assignments in a XACML document is specified in the OASIS RBAC Profile specification, available at http://docs.oasis-open.org/xacml/2.0/access_control-xacml-2.0-rbac-profile1-spec-os.pdf. (WebLogic Server supports only a subset of this specification.)

The syntax requires the following elements:

- A `Policy` parent element.
- Under `Policy`, a `Target` element.
 - Under `Target`, at least one `Resource` element that contains the following `ResourceMatch` elements:

(Optional) One `ResourceMatch` element to identify the name of the role. If you do not include this `ResourceMatch` element, then the role policy applies to all roles in the realm. The `MatchId` attribute may specify function identifiers and, thus, wildcard role names. The `DataType` attribute must specify the `string` type.

(Optional) Another `ResourceMatch` element to identify the WebLogic resource to which the role applies. If you do not include this `ResourceMatch` element, the role applies to all WebLogic resources.

- Under `Target`, an `Action` element that indicates that the policy applies to a role instead of some other type of resource.
- Under `Policy`, one or more `Rule` elements that define which users, groups, or roles are in the role.

The XACML document in [Example 7-1](#) specifies that a role named `MyRole` role can be used with the `SimpleSoapPort` Web Service. It also specifies that the `webServiceGroup` group is in the role.



Note:

When specifying values in the `<AttributeValue>` element, you must not include extraneous space characters. In particular:

- Do not precede the first value with more than a single space character.
- When specifying multiple values, do not separate each value by more than a single space character.
- Make sure there are no space characters that follow the last value.

For example:

```
<AttributeValue datatype>value1, value2, value3</AttributeValue>
```

Example 7-1 XACML Policy for a Role

```
<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" PolicyId="urn:bea:xacml:2.0:myRolePolicy"
RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:first-applicable">
  <Description>Grp (group1)</Description>
  <Target>
    <Resources>
      <Resource>
        <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">type=&lt;webservices&gt;,
application=webservicesJwsSimpleEar, contextPath=/jws_basic_simple, webService=SimpleSoapPort</
AttributeValue>
          <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-
ancestor-or-self" DataType="http://www.w3.org/2001/XMLSchema#string" MustBePresent="true"/>
        </ResourceMatch>
        <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">MyRole</AttributeValue>
          <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:subject:role"
DataType="http://www.w3.org/2001/XMLSchema#string" MustBePresent="true"/>
        </ResourceMatch>
      </Resource>
    </Resources>
  </Target>
  <Actions>
    <Action>
      <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:anyURI-equal">
        <AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#anyURI">urn:oasis:names:tc:xacml:2.0:actions:enableRole</AttributeValue>
        <ActionAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id"
DataType="http://www.w3.org/2001/XMLSchema#anyURI" MustBePresent="true"/>
      </ActionMatch>
    </Action>
  </Actions>
</Policy>
```

```

    </ActionMatch>
  </Action>
</Actions>
</Target>
<Rule RuleId="primary-rule" Effect="Permit">
  <Condition>
    <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:string-is-in">
      <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">webServiceGroup</
AttributeValue
      <SubjectAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:subject:group"
DataType="http://www.w3.org/2001/XMLSchema#string"/>
    </Apply>
  </Condition>
</Rule>
<Rule RuleId="deny-rule" Effect="Deny"/>
</Policy>

```

Example: Defining Authorization Policies

The XACML document in [Example 7-2](#) specifies that only the `MyRole` role can access the `SimpleSoapPort` Web Service.

Example 7-2 XACML Policy for a Web Service

```

<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" PolicyId="urn:bea:xacml:2.0:myPolicy"
RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:first-applicable">
  <Description>Rol (MyRole)</Description>
  <Target>
    <Resources>
      <Resource>
        <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">type=&lt;webservices&gt;,
application=webservicesJwsSimpleEar, contextPath=/jws_basic_simple, webService=SimpleSoapPort</
AttributeValue
          <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-
ancestor-or-self" DataType="http://www.w3.org/2001/XMLSchema#string" MustBePresent="true"/>
        </ResourceMatch>
      </Resource>
    </Resources>
  </Target>
  <Rule RuleId="primary-rule" Effect="Permit">
    <Condition>
      <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:string-is-in">
        <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">MyRole</AttributeValue>
        <SubjectAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:subject:role"
DataType="http://www.w3.org/2001/XMLSchema#string"/>
      </Apply>
    </Condition>
  </Rule>
  <Rule RuleId="deny-rule" Effect="Deny"/>
</Policy>

```

Use WebLogic Scripting Tool to Add the Role or Policy to the Realm

The WebLogic Scripting Tool (WLST) is a command-line scripting interface that you can use to load your XACML document into a WebLogic security realm.

You can use WLST in interactive mode or script mode. You cannot use WLST in offline mode; the Authentication provider and Role Mapping provider can update their policy stores only when the Administration Server is running.

For information about using script mode, see *Using the WebLogic Scripting Tool in Understanding the WebLogic Scripting Tool*.

The following steps describe using the WLST interactive mode:

1. Start the WebLogic Server instance that contains the realm you want to configure.
2. Open a command prompt and set up the environment for running WLST.

One way to set up the environment is as follows:

- a. Change to the root directory of the domain.
- b. Invoke the `setWLSenv` script (the Domain Configuration Wizard creates this script for you when you create the domain).
3. Change to the directory that contains your XACML document.
4. To start WLST and connect to a WebLogic Server instance that is listening at `localhost:7001`, enter the following commands:

- a. `java weblogic.WLST`

This command returns a WLST offline prompt.

- b. `connect(' ',' ','localhost:7001')`

Please enter your username :

Please enter your password :

Here, username and password are credentials for an administrative user.

5. To load a XACML document into a Java `String` object, enter the following commands:

- a. `xacmlFile = open('myfile','r')`

where *myfile* is the name of your XACML document.

- b. `xacmlDoc = xacmlFile.read()`

- c. (Optional) To verify that you have loaded your document into a `String`, enter:

```
print(xacmlDoc)
```

The command prints the value of the `xacmlDoc` variable to standard out.

6. To load role assignments into the WebLogic XACML Role Mapper, enter the following commands:

- a. `cd ('SecurityConfiguration/mydomain/Realms/myrealm/RoleMappers/XACMLRoleMapper')`

where

mydomain is the name of your WebLogic Server domain

myrealm is the name of your security realm

- b. `cmo.addPolicy(xacmlDoc)` or `cmo.addPolicySet(xacmlDoc)`, depending on whether your XACML document contains a `Policy` or `PolicySet`.

- c. `cmo.setPolicyExpression('type=<jmx>', '{Rol(Admin) | Rol(myrole)}')`

where *myrole* is any additional role to which you want the policy to apply.

7. To load authorization policies into the WebLogic XACML Authorizer, repeat step 5 to load your XACML policies document, Then enter the following commands:

- a. `cd ('SecurityConfiguration/mydomain/Realms/myrealm/Authorizers/XACMLAuthorizer')`

where

mydomain is the name of your WebLogic Server domain

myrealm is the name of your security realm
- b. `cmo.addPolicy(xacmlDoc)` or `cmo.addPolicySet(xacmlDoc)`, depending on whether your XACML document contains a `Policy` or `PolicySet`.
- c. `cmo.setPolicyExpression('type=<jmx>', '{Rol(Admin) | Rol(myrole)}')`

where *myrole* is any additional role to which you want the policy to apply.

To see a full list of operations that you can use to add, modify, or delete policies, see [XACMLAuthorizerMBean](#) in *MBean Reference for Oracle WebLogic Server*.

Verify That Your Roles and Policies Are in the Realm

The WebLogic Remote Console does not display roles and policies that you add from a XACML document.

Instead, to verify that your roles and policies were added to the realm, see [Exporting Roles and Policies to XACML Documents](#).

Creating Roles and Policies for Custom MBeans

A Managed Bean (MBean) is a standard for exposing management data and operations for a resource. Your application developers can greatly reduce the cost of operating and maintaining your applications by creating MBeans (custom MBeans) to monitor and manage your applications. See *Developing Manageable Applications Using JMX for Oracle WebLogic Server*.

If you register custom MBeans in a WebLogic Server MBean server, you can create a XACML document that defines who can access your MBeans. In addition to the prerequisites described in [Prerequisites](#), note that your MBean's object name must include a `Type=valuekey` property.

The main steps for creating roles and policies for custom MBeans are:

1. [Determine the Resource IDs for a Custom MBean](#)
2. [Create XACML Documents](#)
3. [Use WebLogic Scripting Tool to Add the Role or Policy to the Realm](#)
4. [Verify That Your Roles and Policies Are in the Realm](#)

Determine the Resource IDs for a Custom MBean

When you register a custom MBean with a WebLogic MBean server, the WebLogic security service creates two resource IDs for each attribute in the MBean: one for the attribute's getter method and another for the setter. It creates one resource ID for each MBean operation.

The IDs use the following pattern:

```
type=<jmx>, operation=type-of-access, application=, mbeanType=type-name,  
target=attribute-or-operation
```

In the preceding pattern:

- *type-of-access* specifies the type of access that the policy secures. Use one of the following values:
 - `get`
Indicates that the policy controls who can read one or more MBean attributes.
 - `set`
Indicates that the policy controls who can write one or more MBean attributes.
 - `invoke`
Indicates that the policy controls who can invoke one or more MBean operations.
 - `create`
Indicates that the policy controls who can use the MBean-server's `create` method to create an instance of an MBean.
 - `unregister`
Indicates that the policy controls who can use the MBean-server's `unregister` method to unregister an instance of an MBean.
- *type-name* is the value of the MBean object name's `Type` key property.
- *attribute-or-operation* is the name of an MBean attribute or operation.

For example, if you create an MBean that contains a single attribute named `NewUserCount` and an operation named `clearNewUserCount`, and if you register the MBean under the object name `medrec:Name=AdminReportMBean,Type=CustomMBeanType`, then the security service creates the following resource IDs:

```
type=<jmx>, operation=get, application=, mbeanType=CustomMBeanType,
target=NewUserCount
```

```
type=<jmx>, operation=set, application=, mbeanType=CustomMBeanType,
target=NewUserCount
```

```
type=<jmx>, operation=clearNewUserCount, application=,
mbeanType=CustomMBeanType,target=
```

Exporting Roles and Policies to XACML Documents

To see a XACML representation of all roles and policies that are in your security realm, you can export the data from the Authorization and Role Mapping providers.

Note:

Do not attempt round-trip editing of roles and policies. That is, do not export roles and policies, modify the XACML documents, and then import the modified documents. Editing exported files might result in an unusable WebLogic Server configuration and is not supported.

A

Reference for XACML on WebLogic Server

Understand the extensions that you can use when writing XACML 2.0 documents to protect resources on WebLogic Server and the restrictions that WebLogic Server places on XACML. The eXtensible Access Control Markup Language (XACML) is an XML language for expressing authorization policies and role assignments. XACML offers extension points so that vendors such as Oracle can express vendor-specific resources, data types, and functions in XACML.

The WebLogic Server XACML Authorization Provider and XACML Role Mapping Provider:

- Implement and extend the OASIS XACML 2.0 Core Specification, available at http://docs.oasis-open.org/xacml/2.0/access_control-xacml-2.0-core-spec-os.pdf
- Partially implement the Core and Hierarchical Role Based Access Control (RBAC) Profile of XACML 2.0, described in the OASIS RBAC specification at http://docs.oasis-open.org/xacml/2.0/access_control-xacml-2.0-rbac-profile1-spec-os.pdf

This appendix includes the following sections:

- [Comparison of WebLogic Server and XACML Security Models](#)
- [Action Identifiers](#)
- [Environment Identifiers](#)
- [Policy and PolicySet Identifiers](#)
- [Resource Identifiers](#)
- [Subject Identifiers](#)
- [WebLogic Server Functions for XACML](#)
- [Rule and Policy-Combining Algorithm](#)

This document describes only the WebLogic Server extensions and restrictions for XACML. For a complete reference of the XACML 2.0 language, see the OASIS XACML 2.0 Core Specification and the OASIS RBAC specification.

Comparison of WebLogic Server and XACML Security Models

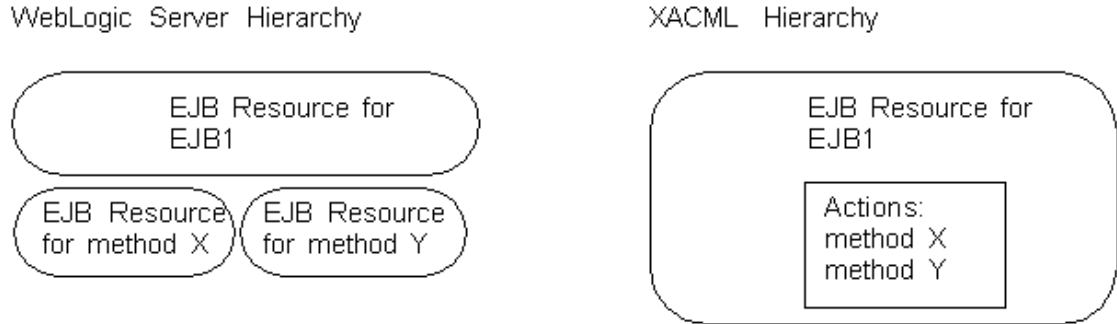
The WebLogic Server model for representing resources and policies follows the model of Java EE deployment descriptors. This Java EE model creates a hierarchy of resources in which roles and authorization policies at the top of the hierarchy protect resources that are lower in the hierarchy. (See [Protecting a Hierarchy of Resources](#).) Policies lower in a hierarchy always override policies higher in the hierarchy. The higher levels of the resource hierarchy contain enterprise applications, Web applications, and EJBs. The lowest levels of the resource hierarchy contain EJB methods, HTTP methods on specific URL patterns, and MBean getters and setters.

The XACML model also recognizes a hierarchy of resources. Unlike the native WebLogic Server model, your XACML policies must specify how to interpret cases in which a resource is protected by its own policy and by a policy on the resource's parent or ancestor.

In addition, a XACML document typically distinguishes between a resource and the actions of a resource. For example, a XACML document defines a resource such as an EJB, and then

defines an action within the EJB resource to represent a method in the EJB. The native WebLogic Server model considers an EJB and each EJB method to be resources. See [Figure A-1](#).

Figure A-1 WebLogic Resource Hierarchy Includes Methods



While it is possible to describe an action such as an EJB method as a XACML resource, a more natural expression in XACML would define an EJB as a resource and an EJB method as an action within the resource.

Comparison of Terminology

The WebLogic Server terminology for describing resources and policies follows the model of Java EE deployment descriptors. This Java EE model uses the following terms to describe key concepts:

- **Role**, which contains one or more conditions that describe which users or groups are in the role at any given time. A role **expression** is a collection of conditions and the name of a user or group whom the conditions add to the role. The collection of expressions is the role **statement**.
- **Policy**, which contains one or more conditions that describe who can access a resource at any given time. A policy expression is a collection of conditions and the name of a user, group, or role whom the conditions allow access. The collection of expressions is the policy statement.

In XACML, a set of **rules** comprise a policy, and policies can be used to determine who is in a role or who can access a resource. In general, a XACML policy is equivalent to a role statement or policy statement in WebLogic Server.

Description of Data Types

Oracle implements support for all of the data types that are required by the XACML core specification. It supports additional, standard XML data types and provides a group of custom data types. This document uses the `bea:` prefix to indicate that a data type is a custom Oracle type.

For a description of all data types that the WebLogic XACML providers recognize, see [com.bea.common.security.xacml.Type](#) in *Java API Reference for Oracle WebLogic Server*.

Action Identifiers

XACML uses an `Action` element to identify an operation in a resource or a hierarchy of resources.

WebLogic Server supports all of the XACML `Action` identifiers, as described in the XACML 2.0 Core Specification, and adds support for an additional one that can appear anywhere that a standard XACML environment identifier can appear.

To identify operations in WebLogic Server resources (for example, to identify a specific EJB method), use action identifiers as described in [Table A-1](#).

 **Note:**

While it is possible to use a resource identifier to describe an operation such as an EJB method, a more natural expression in XACML would use an action identifier. See [Comparison of WebLogic Server and XACML Security Models](#).

Table A-1 Action Identifiers

To Identify...	Use This Identifier...
An operation	<ul style="list-style-type: none"> Attribute ID: <code>urn:oasis:names:tc:xacml:1.0:action:action-id</code> Data Type: <code>string</code> Value: Depends on the type of resource that contains the operation. See Table A-2.
When the provider performs a security check	<ul style="list-style-type: none"> Attribute ID: <code>urn:bea:xacml:2.0:action:direction</code> Data Type: <code>string</code> Values: <code>ONCE</code>, <code>PRIOR</code>, or <code>POST</code> <p>The WebLogic Security SPI contains an optional feature that enables containers to specify when a provider performs a security check on a request:</p> <ul style="list-style-type: none"> <code>ONCE</code> requests an authorization check once with no preference of whether it is done before or after an operation. <code>PRIOR</code> requests an authorization check prior to processing the request. <code>POST</code> requests an authorization check after the request has been processed but before the results have been returned. <p>You can use this <code>direction</code> identifier to match requests that have been checked <code>ONCE</code>, <code>PRIOR</code>, or <code>POST</code>.</p> <p>See weblogic.security.spi.Direction in the <i>Java API Reference for Oracle WebLogic Server</i>, which is the object type that is used to pass <code>ONCE</code>, <code>PRIOR</code>, or <code>POST</code> to the security provider.</p> <p>Note: Using a <code>Direction</code> object in a decision is optional for Authorization providers. The WebLogic Server XACML Authorization provider supports only the <code>ONCE</code> value.</p>

[Table A-2](#) describes the value that you specify for the `action-id` identifier.

Table A-2 Value for the action-id Identifier

If the operation is in this resource type...	Specify...
Admin	The name of an administrative activity that is protected by an Admin resource. For example, <code>UserLockout</code> . For a list of valid values, see the action parameter for the weblogic.security.service.AdminResource constructor in the <i>Java API Reference for Oracle WebLogic Server</i> .
Application	The name of the application as displayed in the WebLogic Remote Console.
Control	The name of a method in a Java control. Java controls are reusable components that you can create and use anywhere within a WebLogic Platform application.
EJB	The name of an EJB method. For example, <code>mymethod</code> . If the method is overloaded, all methods with the specified method name will be matched.
JDBC	The name of an administrative activity that is protected by a JDBC resource. For a list of valid values, see the <code>action</code> parameter for the weblogic.security.service.JDBCResource constructor in the <i>Java API Reference for Oracle WebLogic Server</i> .
JMS	The name of an administrative activity that is protected by a JMS resource. For a list of valid values, see the <code>action</code> parameter for the weblogic.security.service.JMSResource constructor in the <i>Java API Reference for Oracle WebLogic Server</i> .
JMX	The name of an operation in a WebLogic Server MBean. For example, <code>shutdown</code> .
JNDI	The name of an administrative activity that is protected by a JNDI resource. For a list of valid values, see the <code>action</code> parameter for the weblogic.security.service.JNDIResource constructor in the <i>Java API Reference for Oracle WebLogic Server</i> .
Server	The name of a server life cycle activity that is protected by a Server resource. For example, <code>boot</code> . For a list of valid values, see Server Resources .
URL	The name of an HTTP method. For example, <code>POST</code> .
Web Service	The name of a Web Service method. For example, <code>mymethod</code> .
Work Context	The name of an administrative activity that is protected by a Work Context resource. For a list of valid values, see the <code>action</code> parameter for the weblogic.security.service.WorkContextResource constructor in the <i>Java API Reference for Oracle WebLogic Server</i> .
All others	The following string: <code>access</code>

Examples

The following example uses an `Action` element to specify that the target is `mymethod` within the SimpleSoap Web Service.

 **Note:**

When specifying values in the `<AttributeValue>` element, you must not include extraneous space characters. In particular:

- Do not precede the first value with more than a single space character.
- When specifying multiple values, do not separate each value by more than a single space character.
- Make sure there are no space characters that follow the last value.

For example:

```
<AttributeValue datatype>value1, value2, value3</AttributeValue>
```

```
<Target>
  <Resources>
    <Resource>
      <ResourceMatch
        MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#string">type=&lt;webservicess>;
application=webservicessJwsSimpleEar,contextPath=/jws_basic_simple,
webService=SimpleSoapPort</AttributeValue>
          <ResourceAttributeDesignator
            AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-ancestor"
            DataType="http://www.w3.org/2001/XMLSchema#string"
            MustBePresent="true"/>
          </ResourceMatch>
        </Resource>
      </Resources>
      <ActionMatch
        MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">mymethod</
AttributeValue>
          <ActionAttributeDesignator
            AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id"
            DataType="http://www.w3.org/2001/XMLSchema#string"
            MustBePresent="true"/>
          </ActionMatch>
        </ActionMatch>
      </Target>
```

Environment Identifiers

XACML uses an optional `Environment` element to describe conditions in the operating environment that must be met before providing access to a target. For example, an `Environment` element can specify a time and date range within which access is allowed.

WebLogic Server supports all of the XACML `Environment` identifiers (see the OASIS XACML 2.0 Core Specification at http://docs.oasis-open.org/xacml/2.0/access_control-xacml-2.0-core-spec-os.pdf) and adds support for an additional one that can appear anywhere that a standard XACML environment identifier can appear. Table A-3 lists and provides the values that can be specified for identifiers that can be used to hold values that the container passes to the provider.

Table A-3 WebLogic Server Environment Identifiers

Identifier	Value and Description
Attribute ID	urn:bea:xacml:2.0:environment:context:key In this identifier, <i>key</i> specifies a <code>ContextHandler</code> element name as defined in <i>ContextHandlers and WebLogic Resources in Developing Security Providers for Oracle WebLogic Server</i> . A <code>ContextHandler</code> is a WebLogic class that obtains additional context and container-specific information from the resource container and represents the information as a list of name/value pairs.
Data Type	bea:Object, string, or double
Value	The value of the <code>ContextHandler</code> element that you want to match.

Examples

The following example uses an `Environment` element to match value of a WebLogic Server listen port. Such an element could create a policy that requires a request to come through listen port 9001:

```
<Environment>
  <EnvironmentMatch
    MatchId="urn:oasis:names:tc:xacml:1.0:function:double-equal">
      <EnvironmentAttributeDesignator
        AttributeId="urn:bea:xacml:2.0:environment:context:com.bea.cont
extelement.channel.Port"
        DataType="http://www.w3.org/2001/XMLSchema#double"/>
      <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#double">9001</
AttributeValue>
    </EnvironmentMatch>
  </Environment>
```

Policy and PolicySet Identifiers

XACML uses a `Policy` element to contain one or more rules and a `PolicySet` element to contain one or more policies. Each element must include the `PolicySetId` attribute to provide a unique identification. The XACML specification requires `PolicySetId` identifiers to be legal URI values.

XACML documents use the `PolicySetId` to include a specific `Policy` or `PolicySet` element within another `PolicySet` element. WebLogic Server uses the `PolicySetId` as the key in the Authorization provider or Role Mapping provider's policy store.

WebLogic Server reserves URI values beginning with `urn:bea:` for its internal use. While you cannot create your own policies with URIs that begin with `urn:bea:`, you can use these values to include Oracle's policies in your policy sets.

Examples

The following example is a valid identifier for a `Policy` element:

```
<Policy
  PolicyId="urn:mycompany:myapplication:policyid:1"
  ...>
```

The following example is a valid reference to the `Policy` element above:

```
<PolicyIdReference>
  urn:mycompany:myapplication:policyid:1
</PolicyIdReference>
```

Resource Identifiers

XACML uses a `Resource` element to represent data, a service, or a system component.

WebLogic Server supports all of the XACML `Resource` identifiers, as described in the XACML 2.0 Core Specification.

To identify a WebLogic Server resource, use resource identifiers as described in [Table A-4](#). For information about WebLogic Server resources, see [Resource Types You Can Secure with Policies](#).

Table A-4 WebLogic Server Resource Identifiers

To identify a...	Use the following identifier...
Resource	<ul style="list-style-type: none"> Attribute ID: <code>urn:oasis:names:tc:xacml:1.0:resource:resource-id</code> Data Type: <code>string</code> Value: A collection of name and value pairs that specify the WebLogic Server resource type and the location of the resource in the WebLogic Server resource hierarchy. WebLogic Server generates these identifiers. <p>Note that a policy that uses this identifier will not protect resources that are below the specified resource. For example, if you use this identifier for a policy on a Web Service module, the policy will not protect methods within the Web Service.</p> <p>See Get the ID of the Resource to Secure .</p>
Resource and its ancestors	<ul style="list-style-type: none"> Attribute ID: <code>urn:oasis:names:tc:xacml:2.0:resource:resource-ancestor-or-self</code> Data Type: <code>string</code> Values: A collection of name and value pairs that specify a WebLogic Server resource type. WebLogic Server generates these identifiers. <p>See Get the ID of the Resource to Secure .</p>
Parent of a resource	<ul style="list-style-type: none"> Attribute ID: <code>urn:oasis:names:tc:xacml:1.0:resource:resource-parent</code> Data Type: <code>string</code> Values: A collection of name and value pairs that specify a WebLogic Server resource type. WebLogic Server generates these identifiers. <p>See Get the ID of the Resource to Secure .</p>
Ancestor of a resource	<ul style="list-style-type: none"> Attribute ID: <code>urn:oasis:names:tc:xacml:2.0:resource:resource-ancestor</code> Data Type: <code>string</code> Values: A collection of name and value pairs that specify a WebLogic Server resource type. WebLogic Server generates these identifiers. <p>See Get the ID of the Resource to Secure .</p>

Examples

The following example `Resource` element matches a Web Service named `SimpleSoapPort` and all methods within that Web Service:

```
<Resource>
  <ResourceMatch
```

```

    MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
    <AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#string">type=&lt;webservicess>; application=webservicessJwsSimpleEar,
contextPath=/jws_basic_simple, webservice=SimpleSoapPort</AttributeValue>
    <ResourceAttributeDesignator
    AttributeId="urn:oasis:names:tc:xacml:2.0:resource:resource-ancestor"
    DataType="http://www.w3.org/2001/XMLSchema#string"
    MustBePresent="true"/>
    </ResourceMatch>
</Resource>

```

Subject Identifiers

XACML uses a `Subject` element to represent an actor whose attributes may be referenced by a predicate.

WebLogic Server supports all of the XACML Subject identifiers, as described in the XACML 2.0 Core Specification.

To identify a WebLogic Server user, group, or role as defined in a WebLogic Server realm, use subject identifiers as described [Table A-5](#).

Table A-5 WebLogic Subject Identifiers

To identify a...	Use the following identifier...
User principal	<ul style="list-style-type: none"> Attribute ID: urn:oasis:names:tc:xacml:1.0:subject:subject-id Data Type: string Value: Name of a WebLogic Server user principal.
Group principal	<ul style="list-style-type: none"> Attribute ID: urn:oasis:names:tc:xacml:2.0:subject:group Data Type: string Values: Name of a WebLogic Server group principal.
Role	<ul style="list-style-type: none"> Attribute ID: urn:oasis:names:tc:xacml:2.0:subject:role Data Type: string Values: Names of one or more roles as resolved by a XACML Role Mapping provider. <p>Note: WebLogic Server supports only a subset of the RBAC Profile specification, which is the specification that defines this attribute.</p>
Subject who has signed a SOAP document	<ul style="list-style-type: none"> Attribute ID: urn:bea:xacml:2.0:subject:context:com.bea.contextelement.webservice.Integrity{{namespace}element} where <i>namespace</i> and <i>element</i> are the namespace and element that was signed. For example: urn:bea:xacml:2.0:subject:context:com.bea.contextelement.webservice.Integrity{{ http://schemas.xmlsoap.org/soap/envelope/}Body} Data Type: string Values: The Java subject who has signed the element (either user ID or group ID).

Examples

For an example of a XACML document that uses identifiers from [Table A-7](#) to define a security role that can be used to protect access to a Web Service, see [Example 7-2](#).

WebLogic Server Functions for XACML

The following sections describe the functions that the WebLogic Server XACML providers support in addition to the functions described in the XACML Core Specification:

- [Custom Data Type Variants](#)
- [Miscellaneous Functions](#)
- [Time/Date Conversions](#)
- [Arithmetic Conversions and Functions](#)
- [Object Type Conversions](#)
- [Object Comparisons](#)
- [String Comparisons and Manipulations](#)

Custom Data Type Variants

The following function identifiers specify functions that are direct ports of standard XACML functions and operate on XML and WebLogic Server data types `long`, `float`, `decimal` and `bea:Character`. For a description of these data types, see [com.bea.common.security.xacml.Type](#) in *Java API Reference for Oracle WebLogic Server*.

In this list, *type* refers to the names of the data types (`long`, `float`, `decimal` or `character`):

```
urn:bea:xacml:2.0:function:type-equal
urn:bea:xacml:2.0:function:type-greater-than
urn:bea:xacml:2.0:function:type-greater-than-or-equal
urn:bea:xacml:2.0:function:type-less-than
urn:bea:xacml:2.0:function:type-less-than-or-equal
urn:bea:xacml:2.0:function:type-one-and-only
urn:bea:xacml:2.0:function:type-bag-size urn:bea:xacml:2.0:function:type-is-in
urn:bea:xacml:2.0:function:type-bag urn:bea:xacml:2.0:function:type-intersection
urn:bea:xacml:2.0:function:type-union
urn:bea:xacml:2.0:function:type-at-least-one-member-of
urn:bea:xacml:2.0:function:type-subset
urn:bea:xacml:2.0:function:type-set-equals
```

For information on functions that compare `bea:Objects`, see [Object Comparisons](#).

Examples

The following example is a `Condition` that uses `urn:bea:xacml:2.0:function:character-equal` to compare two `bea:characters`:

```
<Condition>
  <Apply FunctionId="urn:bea:xacml:2.0:function:character-equal">
    <AttributeValue DataType="urn:bea:xacml:2.0:data-type:character">Q</AttributeValue>
    <AttributeValue DataType="urn:bea:xacml:2.0:data-type:character">Q</AttributeValue>
  </Apply>
</Condition>
```

Miscellaneous Functions

[Table A-6](#) lists the miscellaneous functions that WebLogic Server provides in addition to the standard XACML functions.

Table A-6 Miscellaneous WebLogic Server XACML Functions

Function	Description
in-development-mode	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:in-development-mode • Input Type: null • Return Type: boolean • Description: This function takes no arguments and returns true if the WebLogic Server instance that hosts the realm is in development mode <p>See Creating a WebLogic Domain in <i>Creating WebLogic Domains Using the Configuration Wizard</i>.</p>
instance-method	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:instance-method • Input Type: bea:Object, string, Bag of bea:Class, [bea:Object ...] • Return Type: bea:Object • Description: This function invokes a method on a bea:Object that the container makes available in the current context. <p>The function takes the following arguments:</p> <ul style="list-style-type: none"> • bea:Object. A Java object whose method will be invoked. Use the urn:bea:xacml:2.0:environment:context:key environment identifier to specify the bea:Object. See Environment Identifiers. • string. The method name. • Bag of bea:Class. The Java classes that are declared in the method's signature. Use Oracle's string-to-class function to create the required classes. See Object Type Conversions. • Zero or more bea:Objects. Each object contains a parameter value to pass to the method. Use Oracle's object conversion functions to create the required objects. See Object Type Conversions. <p>The function returns the return value of the invoked method as a bea:Object. Methods that return void may not be invoked.</p>
instance-method-match	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:instance-method-match • Input Type: bea:Object, string, [bea:Object ...] • Return Type: bea:Object • Description: This function invokes a method on a bea:Object that the container makes available in the current context. <p>The function takes the following arguments:</p> <ul style="list-style-type: none"> • bea:Object. A Java object whose method will be invoked. Use the urn:bea:xacml:2.0:environment:context:key environment identifier to specify the bea:Object. See Environment Identifiers. • string. The method name. • Zero or more bea:Objects. Each object contains a parameter value to pass to the method. Use Oracle's object conversion functions to create the required objects. See Object Type Conversions. <p>This function uses the method name and the class types of the parameter bea:Objects to find the appropriate method in the target bea:Object. If the target bea:Object does not exactly one method that matches the parameters, then the function result is indeterminate.</p> <p>The function returns the return value of the invoked method as a bea:Object. Methods that return void may not be invoked.</p>

Table A-6 (Cont.) Miscellaneous WebLogic Server XACML Functions

Function	Description
instance-method-v2	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:instance-method-v2 • Input Type: bea:Class, bea:Object, string, Bag of bea:Class, [bea:Object ...] • Return Type: bea:Object • Description: This function invokes a method on a bea:Object that the container makes available in the current context. <p>The function takes the following arguments:</p> <ul style="list-style-type: none"> • bea:Class. The class type of the bea:Object. Use Oracle's string-to-class function to create the class. See Object Type Conversions. • bea:Object. A Java object whose method will be invoked. Use the urn:bea:xacml:2.0:environment:context:key environment identifier to specify the bea:Object. See Environment Identifiers. • string. The method name. • Bag of bea:Class. The Java classes that are declared in the method's signature. Use Oracle's string-to-class function to create the required classes. See Object Type Conversions. • Zero or more bea:Objects. Each object contains a parameter value to pass to the method. Use Oracle's object conversion functions to create the required objects. See Object Type Conversions. <p>The function returns the return value of the invoked method as a bea:Object. Methods that return void may not be invoked.</p>
instance-method-match-v2	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:instance-method-match-v2 • Input Type: bea:Class, bea:Object, string, [bea:Object ...] • Return Type: bea:Object • Description: This function uses the class type of the bea:Object, method name, and the class types of the parameter bea:Objects to find the appropriate method in the target bea:Object. If the target bea:Object does not contain exactly one method that matches the parameters, then the function result is indeterminate. <p>The function takes the following arguments:</p> <ul style="list-style-type: none"> • bea:Class. The class type of the bea:Object. Use Oracle's string-to-class function to create the class. See Object Type Conversions. • bea:Object. A Java object whose method will be invoked. Use the urn:bea:xacml:2.0:environment:context:key environment identifier to specify the bea:Object. See Environment Identifiers. • string. The method name. • Zero or more bea:Objects. Each object contains a parameter value to pass to the method. Use Oracle's object conversion functions to create the required objects. See Object Type Conversions. <p>The function returns the return value of the invoked method as a bea:Object. Methods that return void may not be invoked.</p>

Table A-6 (Cont.) Miscellaneous WebLogic Server XACML Functions

Function	Description
instance-method-match-v3	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:instance-method-match-v3 • Input Type: string, bea:Object, string, Bag of string, [bea:Object...] • Return Type: bea:Object • Description: This function uses the class name of the bea:Object, method name, and the class types of the parameter bea:Objects to find the appropriate method in the target bea:Object. If the target bea:Object does not contain exactly one method that matches the parameters, then the function result is indeterminate. <p>This function invokes uses the Java reflection API to invoke a method on a specified bea:Object. The function takes the following arguments:</p> <ul style="list-style-type: none"> • String. The name of the bea:Object's class type. • bea:Object. A Java object whose method will be invoked. Use the urn:bea:xacml:2.0:environment:context:key environment identifier to specify the bea:Object. See Environment Identifiers. • String. The method name. • Bag of string. The class names of the parameters in the method signature. • Zero or more bea:Objects. Each object contains a parameter value to pass to the method. Use Oracle's object conversion functions to create the required objects. See Object Type Conversions. • The function returns the return value of the invoked method as a bea:Object. Methods that return void may not be invoked.

Example

The following policy uses the `instance-method` function to invoke the `HttpServletRequest.getAuthType()` method on requests that match a specific URL pattern (see `javax.servlet.http.HttpServletRequest.getAuthType()` in the Java EE 8 Platform API Specification, available at <https://javaee.github.io/javaee-spec/javadocs/javax/servlet/http/HttpServletRequest.html>). The WebLogic Server `ContextHandler` makes this `HttpServletRequest` object available to the Authorization and Role Mapping providers for all requests that come through the servlet container. Any policy for a URL resource can invoke this or other `HttpServletRequest` methods.

Example A-1 Policy That Invokes `HttpServletRequest.getAuthType()`

```
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os"
  PolicyId="urn:sample:xacml:2.0:function:instance-method"
  RuleCombiningAlgId="urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:
    first-applicable">
  <Description>function:instance-method</Description>
  <Target>
    <Resources>
      <Resource>
        <ResourceMatch
          MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
            <AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#string">type=&lt;url&gt;; application=MedRecEAR, contextPath=,uri=/docs/*&lt;/
AttributeValue>
```

```

        <ResourceAttributeDesignator
            AttributeId="urn:oasis:names:tc:xacml:2.0:resource:
                resource-ancestor-or-self"
            DataType="http://www.w3.org/2001/XMLSchema#string"
            MustBePresent="true"/>
    </ResourceMatch>
</Resource>
</Resources>
</Target>
<!-- Declaring the instance-method function as a variable because this policy
    invokes it multiple times.
-->
<VariableDefinition VariableId="authType">
    <Apply FunctionId="urn:bea:xacml:2.0:function:instance-method">
        <!-- Passing the HttpServletRequest object to the function, which the
            BEA ContextHandler makes available to the security framework.
        -->
        <Apply FunctionId="urn:bea:xacml:2.0:function:object-one-and-only">
            <EnvironmentAttributeDesignator
                DataType="urn:bea:xacml:2.0:data-type:object"
                AttributeId="urn:bea:xacml:2.0:environment:context:com.bea.
                    contextelement.servlet.HttpServletRequest" />
        </Apply>
        <!-- Passing "getAuthType()" as the name of the HttpServletRequest
            method to invoke
        -->
        <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">getAuthType</
AttributeValue>
        <!-- Because the getAuthType() method signature contains no parameters,
            pass an empty bag of Class.
        -->
        <Apply FunctionId="urn:bea:xacml:2.0:function:class-bag" />
    </Apply>
</VariableDefinition>
<!-- Creating a rule that allows access to the resource only if
    the getAuthType() returns a non-null value and if the non-null
    value is "CLIENT_CERT"
-->
<Rule RuleId="primary-rule" Effect="Permit">
    <Condition>
        <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:and">
            <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:not">
                <Apply FunctionId="urn:bea:xacml:2.0:function:object-is-null">
                    <VariableReference VariableId="authType" />
                </Apply>
            </Apply>
            <Apply
                FunctionId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
                <!-- Because the instance-method function returns a bea:Object,
                    this policy wraps the function in an object-to-string function,
                    which enables comparison a of the function output with another
                    string.
                -->
                <Apply FunctionId="urn:bea:xacml:2.0:function:object-to-string">
                    <VariableReference VariableId="authType" />
                </Apply>
                <!-- Declaring a String object to compare to the
                    HttpServletRequest.getAuthType() return value.
                -->
                <AttributeValue DataType="http://www.w3.org/2001/
                    XMLSchema#string">CLIENT_CERT</AttributeValue>
            </Apply>
        </Apply>
    </Condition>

```



```

        </Apply>
    </Condition>
</Rule>
<Rule RuleId="deny-rule" Effect="Deny" />
</Policy>

```

Time/Date Conversions

Table A-7 lists the functions that Oracle provides to convert XACML times and dates to different data types.

Table A-7 WebLogic Server Time/Date Conversions

Function	Description
dateTime-dayOfMonth	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:dateTime-dayOfMonth Input Type: dateTime Return Type: integer Description: This function takes a single argument of type <code>dateTime</code> and returns an integer value that represents the day of month implied by the <code>dateTime</code> input. The first day of the month is represented with a value of 1.
dateTime-dayOfMonthMaximum	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:dateTime-dayOfMonthMaximum Input Type: dateTime Return Type: integer Description: This function takes a single argument of type <code>dateTime</code> and returns an integer value that represents the value of the last day of the month. For example, if the <code>dateTime</code> describes a time in the month of December, the function returns 31 (because December has a maximum of 31 days). This function adjusts the value returned for February on leap years.
dateTime-dayOfWeek	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:dateTime-dayOfWeek Input Type: dateTime Return Type: integer Description: This function takes a single argument of type <code>dateTime</code> and returns an integer value that indicates the day of the week implied by the <code>dateTime</code> input. Sunday is the first day of the week and has a value of 1.
dateTime-secondsOfDay	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:dateTime-secondsOfDay Input Type: dateTime Return Type: integer Description: This function takes a single argument of type <code>dateTime</code> and returns an integer value that indicates the number of whole seconds that have elapsed in the day that is indicated by the <code>dateTime</code> input.
dayTimeDuration-timeZoneOffset	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:dayTimeDuration-timeZoneOffset Input Type: null Return Type: dayTimeDuration Description: This function takes no arguments and returns a <code>dayTimeDuration</code> value that indicates the time-zone offset between the local time and GMT time.

Table A-7 (Cont.) WebLogic Server Time/Date Conversions

Function	Description
string-to-dateTime	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:string-to-dateTime Input Type: string Return Type: dateTime Description: This function takes a single argument of type string and returns the argument as a dateTime.
string-to-date	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:string-to-date Input Type: string Return Type: date Description: This function takes a single argument of type string and returns the argument as a date.
object-to-dateTime	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:object-to-dateTime Input Type: bea:Object Return Type: dateTime Description: This function takes a single argument of type bea:Object and returns the value as a dateTime object. If the bea:Object is an instance of java.util.Calendar, then its value is returned directly. If the bea:Object is an instance of java.security.Timestamp or java.util.Date, this function converts the bea:Object to java.util.Calendar and returns the Calendar value. Otherwise, this function converts the bea:Object to java.lang.String and parses the String into a dateTime value.
object-to-date	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:object-to-date Input Type: bea:Object Return Type: date Description: This function takes a single argument of type bea:Object and returns the value as a date object. If the bea:Object is an instance of java.util.Calendar, then its value is returned directly. If the bea:Object is an instance of java.util.Date, this function converts the bea:Object to java.util.Calendar and returns the Calendar value. Otherwise, this function converts the bea:Object to java.lang.String and parses the String into a date value.

Arithmetic Conversions and Functions

Table A-8 lists the functions that Oracle provides to convert arithmetic values to different Input Types and to extend the basic set of arithmetic functions specified by XACML.

Table A-8 WebLogic Server Arithmetic Conversions and Functions

Function	Description
float-to-double	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:float-to-double Input Type: float Return Type: double Description: This function takes a single argument of type float and returns the argument as a double.

Table A-8 (Cont.) WebLogic Server Arithmetic Conversions and Functions

Function	Description
long-to-double	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:long-to-double Input Type: long Return Type: double Description: This function takes a single argument of type long and returns the argument as a double.
long-to-float	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:long-to-float Input Type: long Return Type: float Description: This function takes a single argument of type long and returns the argument as a float.
integer-to-float	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:integer-to-float Input Type: integer Return Type: float Description: This function takes a single argument of type integer and returns the argument as a float.
integer-to-long	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:integer-to-long Input Type: integer Return Type: long Description: This function takes a single argument of type integer and returns the argument as a long.
string-to-double	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:string-to-double Input Type: string Return Type: double Description: This function takes a single argument of type string and returns the argument as a double.
string-to-long	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:string-to-long Input Type: string Return Type: long Description: This function takes a single argument of type string and returns the argument as a long.
string-to-integer	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:string-to-integer Input Type: string Return Type: integer Description: This function takes a single argument of type string and returns the argument as a integer.
string-to-float	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:integer-to-long Input Type: string Return Type: float Description: This function takes a single argument of type string and returns the argument as a float.
to-degrees	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:to-degrees Input Type: double Return Type: double Description: This function takes a single argument of type double, converts the value from radians to degrees, and returns the degrees value as a double.

Table A-8 (Cont.) WebLogic Server Arithmetic Conversions and Functions

Function	Description
to-radians	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:to-radians • Input Type: double • Return Type: double • Description: This function takes a single argument of type double, converts the value from degrees to radians, and returns the radians value as a double.
acos	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:acos • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns the arc cosine of the argument as a double.
asin	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:asin • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns the arc sine of the argument as a double.
atan	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:atan • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns the arc tangent of the argument as a double.
atan2	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:atan2 • Input Type: double • Return Type: double • Description: This function takes two arguments of type double that represent the x and y coordinates of a point. It returns a double value which is the theta component of the point in polar coordinates for the r value that corresponds to the x coordinate.
ceil	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:ceil • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns a double value that is the smallest mathematical integer that is greater than or equal to the argument value.
cos	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:cos • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns the cosine of the argument as a double.
exp	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:exp • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns a double value that is Euler's number, e, raised to the power of the argument value.

Table A-8 (Cont.) WebLogic Server Arithmetic Conversions and Functions

Function	Description
ieee-remainder	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:ieee-remainder • Input Type: double • Return Type: double • Description: This function takes two arguments of type double and returns a double value that is the remainder operation result of the two arguments as described in the IEEE 754 standard. See https://ieeexplore.ieee.org/document/5976968.
log	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:log • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and the natural logarithm as a double.
maximum	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:maximum • Input Type: double • Return Type: double • Description: This function takes two arguments of type double and returns the larger of the two values as a double.
minimum	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:minimum • Input Type: double • Return Type: double • Description: This function takes two arguments of type double and returns the smaller of the two values as a double.
pow	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:pow • Input Type: double • Return Type: double • Description: This function takes two arguments of type double and returns a double value that is the result of taking the first argument value to the power of the second argument value.
random-number	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:random-number • Input Type: double • Return Type: double • Description: This function takes two arguments of type double and returns a double value that is a random number greater than or equal to the first argument and less than the second argument.
rint	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:rint • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns a double value that is the mathematical integer that is closest to the argument value. If the higher and lower integer values are equally close, then the even value is returned.
sqrt	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:sqrt • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns the square root as a double.

Table A-8 (Cont.) WebLogic Server Arithmetic Conversions and Functions

Function	Description
tan	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:tan • Input Type: double • Return Type: double • Description: This function takes a single argument of type double and returns the tangent as a double.

Object Type Conversions

WebLogic Server provides a collection of functions for converting XACML data into Java objects. The URI for each function in this collection is as follows:

urn:bea:xacml:2.0:function:type-to-object

where *type* is the name of a XACML data type. [Table A-9](#) lists all data types and the Java object that the corresponding function returns.

For example, this function returns test as a `java.lang.String` object:

```
<Apply
  FunctionId="urn:bea:xacml:2.0:function:string-to-object">test</Apply>
```

Table A-9 Data to Java Object Conversion

When type equals...	The urn:bea:xacml:2.0:function:type-to-object function returns...
character	<code>java.lang.Character</code>
string	<code>java.lang.String</code>
boolean	<code>java.lang.Boolean</code>
integer	<code>java.lang.Integer</code>
double	<code>java.lang.Double</code>
float	<code>java.lang.Float</code>
long	<code>java.lang.Long</code>
decimal	<code>java.lang.Double</code>
base64Binary	<code>java.lang.Byte[]</code>
hexBinary	<code>java.lang.Byte[]</code>
date	<code>java.util.Calendar</code>
time	<code>java.util.Calendar</code>
dateTime	<code>java.util.Calendar</code>
dayTimeDuration	<code>java.lang.Long</code>
yearMonthDuration	<code>java.lang.Integer</code>
rfc822Name	<code>java.lang.String</code>
x500Name	<code>java.lang.String</code>
anyURI	<code>java.net.URI</code>

Table A-9 (Cont.) Data to Java Object Conversion

When type equals...	The urn:bea:xacml:2.0:function:type-to-object function returns...
ipAddress	java.lang.String
dnsAddress	java.lang.String

[Table A-10](#) lists the functions that Oracle provides to convert strings or Java objects to different data or object types. To pass objects that the container makes available to the current context, use the urn:bea:xacml:2.0:environment:context:key environment identifier to specify the bea:Object. See [Environment Identifiers](#).

Table A-10 WebLogic Server Object Conversions

Function	Description
string-to-class	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:string-to-class Input Type: string Return Type: bea:Class Description: This function takes a single argument of type string, invokes java.lang.Class.forName() on the argument value, and returns the result as a bea:Class.
object-to-string	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:object-to-string Input Type: bea:Object Return Type: string Description: This function takes a single argument of type bea:Object, invokes java.lang.Object.toString() on the argument value, and returns the result as a string.
object-to-double	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:object-to-double Input Type: bea:Object Return Type: double Description: This function takes a single argument of type bea:Object and returns the value as a double. If the bea:Object is an instance of double, then its value is used directly. If the bea:Object is an instance of java.lang.Number, then this function invokes Number.doubleValue() on the value. Otherwise, this function converts the bea:Object to a java.lang.String and parses the String into a double.
object-to-integer	<ul style="list-style-type: none"> URI: urn:bea:xacml:2.0:function:object-to-integer Input Type: bea:Object Return Type: integer Description: This function takes a single argument of type bea:Object and returns the value as integer. If the bea:Object is an instance of java.lang.Integer, then its value is used directly. If the bea:Object is an instance of java.lang.Number, then this function invokes Number.intValue() on the value. Otherwise, this function converts the bea:Object to java.lang.String and parses the String into an integer.

Object Comparisons

[Table A-11](#) lists the functions that Oracle provides to compare Java objects.

Table A-11 WebLogic Server Object Comparisons

Function	Description
object-is-null	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-is-null • Input Type: bea:Object • Return Type: boolean • Description: This function takes a single argument of type <code>bea:Object</code> and returns a boolean value indicating whether the object reference is equal to the Java keyword <code>null</code>. If there is no object that corresponds to the given object reference, this function returns <code>true</code>.
object-equal	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-equal • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type <code>bea:Object</code>, invokes <code>java.lang.Object.equals()</code>, and returns a boolean value indicating whether the two <code>Objects</code> are equal. For information about the <code>java.lang.Object.equals()</code> method, see Object in Jakarta SE and JDK API Specification.
object-greater-than	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-greater-than • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type <code>bea:Object</code> and returns a boolean value indicating whether the first <code>bea:Object</code> is greater than the second <code>bea:Object</code>. The two <code>bea:Objects</code> must implement <code>java.lang.Comparable</code>, else the evaluation is indeterminate.
object-greater-than-or-equal	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-greater-than-or-equal • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type <code>bea:Object</code> and returns a boolean value indicating whether the first <code>bea:Object</code> is greater than or equal to the second <code>bea:Object</code>. The two <code>bea:Objects</code> must implement <code>java.lang.Comparable</code>, else the evaluation is indeterminate.
object-less-than	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-less-than • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type <code>bea:Object</code> and returns a boolean value indicating whether the first <code>bea:Object</code> is less than the second <code>bea:Object</code>. The two <code>bea:Objects</code> must implement <code>java.lang.Comparable</code>, else the evaluation is indeterminate.
object-less-than-or-equal	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-less-than-or-equal • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type <code>bea:Object</code> and returns a boolean value indicating whether the first <code>bea:Object</code> is less than or equal to the second <code>bea:Object</code>. The two <code>bea:Objects</code> must implement <code>java.lang.Comparable</code>, else the evaluation is indeterminate.

Table A-11 (Cont.) WebLogic Server Object Comparisons

Function	Description
object-collection-contains	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-collection-contains • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type bea:Object and returns a boolean that indicates whether the first bea:Object contains the second bea:Object, as determined by Collection.contains(). The first bea:Object must implement java.util.Collection, else the evaluation is indeterminate. <p>For information about the Collection.contains() method, see Interface Collection <E> in Jakarta SE and JDK API Specification.</p>
object-collection-contains-all	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:object-collection-contains-all • Input Type: bea:Object, bea:Object • Return Type: boolean • Description: This function takes two arguments of type bea:Object and returns a boolean that indicates whether the first bea:Object contains all of the second bea:Object as determined by Collection.containsAll(). Both bea:Objects must implement java.util.Collection, else the evaluation is indeterminate. <p>For information about the Collection.containsAll() method, see Interface Collection <E> in Jakarta SE and JDK API Specification.</p>

String Comparisons and Manipulations

[Table A-12](#) lists the functions that Oracle provides to compare Java objects.

Table A-12 WebLogic Server String Comparisons and Manipulations

Function	Description
string-char-at	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-char-at • Input Type: string, integer • Return Type: bea:Character • Description: This function takes two arguments of type string and integer, searches in the string for the character that is in the position indicated by the Integer, and returns the character as a bea:Character.
string-compare-to-ignore-case	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-compare-to-ignore-case • Input Type: string, string • Return Type: integer <p>This function takes two arguments of type string and returns an integer that indicates how the two string arguments compare:</p> <ul style="list-style-type: none"> • 0 if the strings are identical • Less than 0 if the first string lexically precedes the second string • Greater than 0 if the first string lexically follows the second string <p>Comparisons are preformed without considering case.</p>

Table A-12 (Cont.) WebLogic Server String Comparisons and Manipulations

Function	Description
string-contains	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-contains • Input Type: string, string • Return Type: boolean • Description: This function takes two arguments of type string and returns a boolean value that indicates whether the first string contains the value of the second string as a substring.
string-starts-with	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-starts-with • Input Type: string, string • Return Type: boolean • Description: This function takes two arguments of type string and returns a boolean value that indicates whether the first string value starts with the value of the second string.
string-ends-with	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-ends-with • Input Type: string, string • Return Type: boolean • Description: This function takes two arguments of type string and returns a boolean that indicates whether the first string value ends with the value of the second string.
string-length	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-length • Input Type: string • Return Type: integer • Description: This function takes a single argument of type string and returns an integer that indicates the length of the string value.
string-replace	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-replace • Input Type: string, bea:Character, bea:Character • Return Type: string • Description: This function takes three arguments of type string, bea:Character, and bea:Character, replaces in the string all instances of the first bea:Character value with the value of the second bea:Character, and returns the result as a string.
string-substring	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-substring • Input Type: string, integer, integer • Return Type: string • Description: This function takes three arguments of type string, integer, and integer, and returns a string that is the substring of the string argument from and including the index of the first integer argument to but excluding the index of the second integer argument.
string-normalize-to-upper-case	<ul style="list-style-type: none"> • URI: urn:bea:xacml:2.0:function:string-normalize-to-upper-case • Input Type: string • Return Type: string • Description: This function takes a single argument of type string, normalizes it to upper case, and returns the result as a string.

Rule and Policy-Combining Algorithm

If multiple PolicySets apply to a decision, their results are combined using the following algorithm:

urn:oasis:names:tc:xacml:1.0:policy-combining-algorithm:deny-overrides