Oracle® Application Server Containers for J2EE

Security Guide

10*g* Release 2 (10.1.2)

Part No. B14013-01

December 2004

This book gives information on writing and deploying secure applications using OC4J.

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Oracle Application Server Containers for J2EE Security Guide 10*g* Release 2 (10.1.2)

Part No. B14013-01

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Preface

This manual discusses how to make effective use of the Oracle Application Server Containers for J2EE (OC4J) security features.

This preface contains these topics:

Documentation Accessibility

Our goal is to make Oracle products, services, and supporting documentation accessible, with good usability, to the disabled community. To that end, our documentation includes features that make information available to users of assistive technology. This documentation is available in HTML format, and contains markup to facilitate access by the disabled community. Standards will continue to evolve over time, and Oracle is actively engaged with other market-leading technology vendors to address technical obstacles so that our documentation can be accessible to all of our customers. For additional information, visit the Oracle Accessibility Program Web site at:

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Intended Audience

This manual is intended for experienced Java developers, deployers, and application managers who want to understand the security features of OC4J. It discusses the Oracle Application Server Java Authentication and Authorization Service (JAAS) Provider in detail, as well as discussing security implications of individual J2EE features, including EJBs, the J2EE Connector Architecture, SSL, and CSIv2.

Organization

This document contains:

- Chapter 1, "Concepts"—Concepts fundamental to application security.
- Chapter 2, "Overview of JAAS in Oracle Application Server"—The Java Authentication and Authorization Service (JAAS) and the OracleAS JAAS Provider.
- Chapter 3, "Understanding OC4J Security"—Security issues affecting J2EE applications in Oracle Application Server Containers for J2EE (OC4J).
- Chapter 4, "Overall Security Configuration"—Security configuration decisions that affect your entire installation.
- Chapter 5, "Configuring the OC4J Instance"—Security configuration decisions that are instance-specific.
- Chapter 6, "Security Considerations During Application Deployment"—Security configuration decisions that occur during the deployment process.
- Chapter 7, "Configuring the LDAP-Based Provider"—Security configuration decisions that are applicable only to the LDAP-based provider.
- Chapter 8, "Configuring the XML-Based Provider"—Security configuration decisions that are applicable only to the XML-based provider.
- Chapter 9, "Configuring External LDAP Providers"—Using third-party LDAP implementations with the OracleAS JAAS Provider.
- Chapter 10, "Custom LoginModules"—User-developed JAAS LoginModules.
- Chapter 11, "Configuring OC4J and SSL"—Configuring OC4J to use SSL in communicating with other application components.
- Chapter 12, "Configuring EJB Security"—Security implications of EJB development.
- Chapter 13, "Oracle HTTPS for Client Connections"—HTTPS and HTTPClient.
- Chapter 14, "Password Management"—Protecting file-stored passwords with obfuscation.
- Chapter 15, "Configuring CSIv2"— Common Secure Interoperability Version 2 protocol (CSIv2) settins for OC4J-based applications.
- Chapter 16, "J2EE Connector Architecture Security"—Security implications of the J2EE Connector Architecture.
- Chapter 17, "Security Support for EIS Connections"—J2EE Connector Architecture security and EIS connections.
- Chapter 18, "Troubleshooting Security Issues"—Common security problems and how to fix them.
- Chapter 19, "Security Tips"—Security best practices.
- Appendix A, "OracleAS JAAS Provider Standards and Samples"—A sample `jazn.xml` file and sample applications.
- Appendix B, "Using the JAZN Admintool"—Reference guide for JAZN Admintool.

Related Documents

For more information, see these Oracle resources:

- *Oracle Application Server Security Guide*
- *Oracle Application Server Administrator's Guide*
- *Oracle Identity Management Concepts and Deployment Planning Guide*
- *Oracle Application Server Certificate Authority Administrator's Guide*
- *Oracle Application Server Single Sign-On Administrator's Guide*
- *Oracle Internet Directory Administrator's Guide*
- *Oracle Internet Directory Application Developer's Guide*
- *Oracle Application Server Containers for J2EE Services Guide*
- *Oracle Application Server Containers for J2EE Enterprise JavaBeans Developer's Guide*
- *Oracle Application Server Web Services Developer's Guide*
- The OC4J Javadoc

Printed documentation is available for sale in the Oracle Store at:

`http://oraclestore.oracle.com/`

To download free release notes, installation documentation, white papers, or other collateral, please visit the Oracle Technology Network (OTN). You must register online before using OTN; registration is free and can be done at:

`http://www.oracle.com/technology/membership/index.html`

If you already have a username and password for OTN, then you can go directly to the documentation section of the OTN Web site at:

`http://www.oracle.com/technology/index.html`

For additional information, see:

- The Sun Java and J2EE Web pages, especially the Java Authentication and Authorization Service (JAAS) Web site at :

  `http://java.sun.com/products/jaas/overview.html`

Conventions

The following conventions are also used in this manual:

Convention	Meaning
. . .	Vertical ellipsis points in an example mean that information not directly related to the example has been omitted.
. . .	Horizontal ellipsis points in statements or commands mean that parts of the statement or command not directly related to the example have been omitted
boldface text	Boldface type in text indicates a term defined in the text, the glossary, or in both locations.
italic text	Italicized text indicates placeholders or variables for which you must supply particular values.
[ ]	Brackets enclose optional clauses from which you can choose one or none.

1

Concepts

This chapter describes the following topics:

- The Java 2 Security Model
- Principals
- Subjects
- Authentication and Authorization
- Secure Communications
- Developing Secure J2EE Applications

For a broader description of Oracle Application Server security in middle-tier environments that connect to the Internet, see the *Oracle Application Server Security Guide*. For information on Web services, see the *Oracle Application Server Web Services Developer's Guide*.

The Java 2 Security Model

The Java 2 Security Model is fundamental to the OracleAS JAAS Provider.The Java 2 Security Model enables configuration of security at all levels of restriction. This provides developers and administrators with increased control over many aspects of enterprise applet, component, servlet, and application security. The Java 2 Security Model is capability-based and enables you to establish protection domains, and set security policies for these domains.

> **See Also:** For a tutorial on Java 2 Security, see `http://java.sun.com/docs/books/tutorial/security1.2/index.html`. For full information on Java 2 Security, see `http://java.sun.com/security`.

Permissions

Permissions are the basis of the Java 2 Security Model. All Java classes (whether run locally or downloaded remotely) are subject to a configured security policy that defines the set of permissions available for those classes. Each permission represents a specific access to a particular resource. Table 1–1 identifies the elements that comprise a Java permission instance.

Table 1–1 Java Permission Instance Elements

Element	Description	Example
Class name	The permission class	`java.io.FilePermission`
Target	The target name (resource) to which this permission applies	Directory `/home/*`
Actions	The actions associated with this target	Read, write, and execute permissions on directory `/home/*`

Protection Domains

Each Java class, when loaded, is associated with a protection domain. Protection domains can be configured for all levels of restriction (from complete restriction on resources to full access to all resources). Each protection domain is assigned a group of permissions based on a configured security policy at Java virtual machine (JVM) startup.

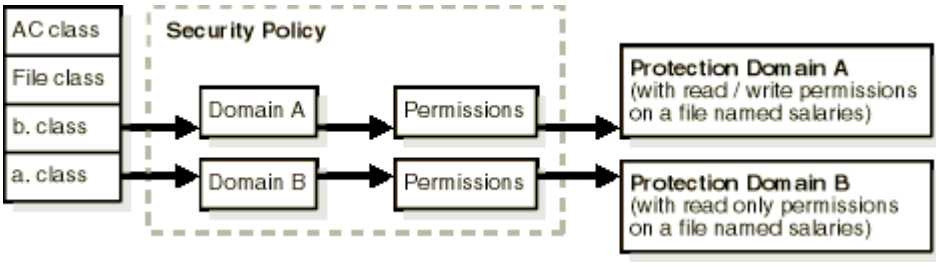
At runtime, the authorization check is done by stack introspection. This consists of reviewing the runtime stack and checking permissions based on the protection domains associated with the classes on the stack. This is typically triggered by a call to either:

- `SecurityManager.checkPermission()`
- `AccessController.checkPermission()`

The permission set in effect is defined as the intersection of all permission sets assigned to protection domains at the moment of the security check.

Figure 1–1 shows the basic model for authorization checking at runtime.

Figure 1–1 Java 2 Security Model



See Also:

- Chapter 4, "JAAS Provider Administration Tasks"
- Sun Java documentation at `http://java.sun.com/security/`

OracleAS JAAS Provider Permission Classes

Table 1–2 lists the permission classes furnished by the OracleAS JAAS Provider. These classes allow applications to control access to resources. For information about the classes discussed, see the OracleAS JAAS Provider Javadoc.

Table 1–2 OracleAS JAAS Provider Permission Classes

Permission	Part of Package	Description
`AdminPermission`	`oracle.security.jazn.policy`	Represents the right to administer a permission (that is, grant or revoke another user's permission assignment).
`RoleAdminPermission`	`oracle.security.jazn.policy`	The grantee of this permission is granted the right to further grant / revoke the target role.
`JAZNPermission`	`oracle.security.jazn`	For authorization permissions. `JAZNPermission` contains a name (also called a target name), but no actions list; you either have or do not have the named permission.
`RealmPermission`	`oracle.security.jazn.realm`	Represents permission actions for a realm (such as `createRealm`, `dropRealm`, and so on). `RealmPermission` extends from `java.security.Permission`, and is used like any regular Java permission.

Principals

A *principal* is a specific identity, such as a user named `frank` or a role named `hr`. A principal is associated with a subject upon successful authentication to a computing service. Principals are instances of classes that implement the `java.security.Principal` interface. A principal class must define a namespace that contains a unique name for each instance of the class.

Subjects

A *subject* represents a grouping of related information for a single user of a computing service, such as a person, computer, or process. This related information includes the subject's identities and security-related attributes (such as passwords and cryptographic keys).

Subjects can have multiple identities; principals represent identities in a subject. A subject becomes associated with a principal (user `frank`) upon successful authentication to a computing service—that is, the subject provides evidence (such as a password) to prove its identity.

Principals bind names to a subject. For example, a person subject, user `frank`, may have two principals:

- One binds the principal `frank doe` (name on his driver license) to the subject
- Another binds the identification principal `999-99-9999` (number on his student identification card) to the subject

Both principals refer to the same subject.

Subjects can also own security-related attributes (known as *credentials*). Sensitive credentials requiring special protection, such as private cryptographic keys, are stored in a private credential set. Credentials intended to be shared, such as public key

certificates or Kerberos server tickets, are stored in a public credential set. Different permissions are required to access and modify different credential sets.

Subjects are represented by the `javax.security.auth.Subject` class.

To perform work as a particular subject, an application invokes the method `Subject.doAs(Subject, PrivilegedAction)` (or one of its variations). This method associates the subject with the current thread's `AccessControlContext` and then executes the specified request.

Authentication and Authorization

Software security depends on two fundamental concepts: authentication and authorization.

- *Authentication* deals with the question “Who is trying to access my services?” In any system and application it is paramount to ensure that the identity of the entity or caller trying to access your application is identified in a secure manner. In a multitier application, the entity or caller can be a human user, a business application, a host, or one entity acting on behalf of (or impersonating) another entity.

  Authentication information is stored in a *user repository*. When a subject attempts to access a J2EE application, a *user manager* looks up the subject in the user repository and verifies the subject’s identity. A user repository can be a file or a directory server, depending on your environment. The Oracle Internet Directory is an example of a user repository.

  Although each J2EE application determines which user can use the application, it is the user manager that authenticates the user’s identity using the user repository.

  OC4J supports several different authentication options; for details, see "Authentication Environments" on page 3-3.

- *Authorization* deals with the question “Who can access what services offered by which components?” For large-scale enterprises, where the access to various business-critical services and resources by millions of users need to be managed, it is important that a scalable authorization infrastructure be in place to deal with user and application provisioning. Unfortunately, in part due to the complex nature of authorization, this is also an area where confusion reigns and incompatible technologies and standards are prevalent.

  Developers specify authorization for subjects in the application’s J2EE and OC4J-specific deployment descriptors. These deployment descriptors indicate what roles are needed to access the different parts of the application. *Roles* are the identities that each application uses to indicate access rights to its different objects. The OC4J-specific deployment descriptors provide a mapping between the logical roles and the users and groups known by OC4J.

Secure Communications

To communicate securely, applications must satisfy the following goals:

- Secure communications—the data transmitted over the network cannot be intercepted, read, or altered by a third party. OC4J supports secure communications using the HTTP protocol over the Secure Sockets Layer.
- Network authentication—clients and servers must be able to authenticate themselves to one another over the network. This is achieved using digital certificates, single sign-on, or username/password combinations.
- Identity propagation—allowing one client to act as the agent of another client, using the original client's identity.

Secure Sockets Layer

The Secure Sockets Layer (SSL) is the industry-standard point-to- point protocol which provides confidentiality through encryption, authentication and data integrity. Although SSL is used by many protocols, it is most important for OC4J when used with the HTTP browser protocol and in the AJP link between the OHS and OC4J processes.

Certificates

Applications need to transmit authentication and authorization information over the network. A *digital certificate*, as specified by the X.509 v3 standard, contains data establishing a principal's authentication and authorization information. A certificate contains:

- A public key, which is used in Public Key Infrastructure (PKI) operations
- Identity information (for example, name, company, country, and so on)
- Optional digital rights which grant privileges to the owner of the certificate.

Each certificate is digitally signed by a *trustpoint*. The trustpoint signing the certificate can be a certificate authority such as VeriSign, a corporation, or an individual.

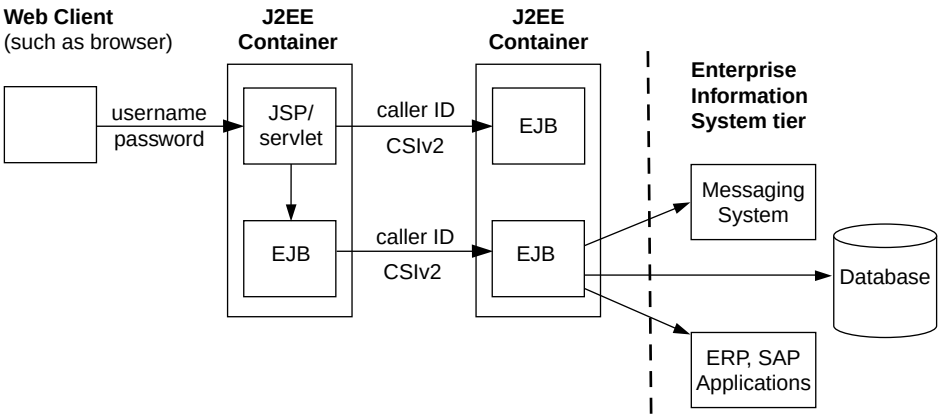
HTTPS

For convenience, this book uses "HTTPS" as shorthand when discussing HTTP running over SSL. Although there is an `https:` URL prefix, there is no HTTPS protocol as such.

Identity Propagation

OC4J supports propagating the identity of principals from context to context. A Web client can establish its identity to a servlet; the servlet can then use that identity to communicate with other EJBs and servlets, as illustrated in Figure 1–2.

Figure 1–2 Identity Propagation Using CSIv2



Developing Secure J2EE Applications

J2EE software development is based on a develop-deploy-manage cycle. The OracleAS JAAS Provider plays an important role in the deploy-manage part of the cycle. The OracleAS JAAS Provider is integrated with J2EE security. This means that developers can use a declarative security model instead of having to integrate security programmatically, unburdening the developer.

The following list summarizes the J2EE development cycle, with an emphasis on the tasks specific to developing secure applications.

1. The software developer creates Web components, enterprise beans, applets, servlets, and application clients.

   The OracleAS JAAS Provider offers programmatic interfaces, but the developer can create components without making use of those interfaces.

2. The application assembler takes these components and combines them into an Enterprise Archive (EAR) file.

   As part of this process, the application assembler specifies OracleAS JAAS Provider options appropriate to the environment.

3. The deployer installs the EAR into an instance of OC4J.

   As part of the deployment process, the deployer may map roles to users.

4. The system administrator maintains and manages the deployed application.

   This task includes creating and managing JAAS roles and users as required by the application customers.

2

Overview of JAAS in Oracle Application Server

This chapter introduces the Oracle Application Server Java Authentication and Authorization Service (JAAS) Provider in Oracle Application Server Containers for J2EE (OC4J). The OracleAS JAAS Provider enables application developers to integrate authentication, authorization, and delegation services with their applications.

This chapter contains these topics:

The OracleAS JAAS Provider

The Oracle Application Server supports JAAS with the OracleAS JAAS Provider. The OracleAS JAAS Provider implements user authentication, authorization, and delegation services that developers can integrate into their application environments. Instead of devoting resources to developing these services, application developers can focus on the presentation and business logic of their applications.

Note: Some class and component names contain the word "JAZN," which is a shortened name for the OracleAS JAAS Provider.

The JAAS framework and the Java 2 Security model form the foundation of JAAS. The OracleAS JAAS Provider implements support for JAAS policies. Policies contain the rules (permissions) that authorize a user to use resources, such as reading a file. Using JAAS, services can authenticate and enforce access control upon resource users. The OracleAS JAAS Provider is easily integrated with J2SE and J2EE applications that use the Java 2 Security model.

Provider Types

The OC4J JAAS implementation supports two different provider types. Each provider type implements a repository for secure, centralized storage, retrieval, and administration of provider data. This data consists of realm (users and roles) and JAAS policy (permissions) information.

- XML-Based Provider

  The XML-based provider is used for lightweight storage of information in XML files. The XML-based provider stores user, realm, and policy information in an XML file, normally `jazn-data.xml`.

  Note: XML files are used as property and configuration files by both LDAP-based and XML-based provider types. However, only the XML-based provider stores users, realms, and policies in an XML file, `jazn-data.xml`.

- LDAP-Based Provider

  The LDAP-based provider is based on the Lightweight Directory Access Protocol (LDAP) for centralized storage of information in a directory. The LDAP-based provider stores user, realm, and policy information in the LDAP-based Oracle Internet Directory.

  Note: We recommend that you use the LDAP-based provider in a production environment; the XML-based provider is suitable for prototyping only.

What Is JAAS?

JAAS is a Java package that enables applications to authenticate and enforce access controls upon users. The OracleAS JAAS Provider is an implementation of the JAAS interface.

JAAS is designed to complement the existing code-based Java 2 security. JAAS implements a Java version of the standard Pluggable Authentication Module (PAM) framework. This enables an application to remain independent from the authentication service.

JAAS extends the access control architecture of the Java 2 Security Model to support principal-based authorization.

This section describes JAAS support for the following authentication, authorization, and user community (realm) features. The OracleAS JAAS Provider enhances some of these features.

- Login Module Authentication
- Roles
- Realms
- Policies and Permissions

See Also:

- "JAAS Framework Features" on page 2-5 for information on how the OracleAS JAAS Provider enhances the JAAS framework to explicitly define key authorization, authentication, and user community (realm) features
- JAAS documentation at the following Web site for more specific discussions of key JAAS features:

  `http://java.sun.com/products/jaas/`

Login Module Authentication

To associate a principal (such as `frank`) with a subject, a client attempts to log in to an application. In login module authentication, the `LoginContext` class provides the basic methods used to authenticate subjects such as users, roles, or computing services. The `LoginContext` class consults configuration settings to determine whether the authentication modules (known as login modules) are configured for use with the particular application that the subject is attempting to access. Different login modules can be configured with different applications; furthermore, a single application can use multiple login modules.

Because the `LoginContext` separates the application code from the authentication services, you can plug a different login module into an application without affecting the application code.

Actual authentication is performed by the method `LoginContext.login()`. If authentication succeeds, then the authenticated subject can be retrieved by invoking `LoginContext.getSubject()`. The real authentication process can involve multiple login modules. The JAAS framework defines a two-phase authentication process to coordinate the login modules configured for an application.

After retrieving the subject from the `LoginContext`, the application then performs work as the subject by invoking `Subject.doAs()` or `Subject.doAsPrivileged()`.

Roles

The JAAS framework does not explicitly define roles or groups. Instead, roles or groups are implemented as concrete classes that use the interface `java.security.Principal`.

The JAAS framework does not define how to support the role-based access control (RBAC) role hierarchy, in which you can grant a role to a role.

Realms

The JAAS framework does not explicitly define user communities. However, the J2EE reference implementation (RI) defines a similar concept of user communities called *realms*. A realm provides access to users and roles (groups) and optionally provides administrative functionality. A user community instance is essentially a realm that is maintained internally by the authorization system. The J2EE RI Realm API supports user-defined realms through subclassing.

See Also:

"JAAS Provider Realm Framework" on page 4-3 for OracleAS JAAS Provider enhancements to realms.

Applications

The JAAS framework does not explicitly define an application or subsystem for partitioning authorization rules.

Policies and Permissions

A *policy* is a repository of JAAS authorization rules. The policy includes grants of *permissions* to principals, thus answering the question: given a grantee, what are the granted permissions of the grantee?

Policy information is supplied by the OracleAS JAAS Provider. The JAAS framework does not define an administrative API for policy administration. The administrative API provided by the OracleAS JAAS Provider is an Oracle extension.

Table 2–1 describes the Sun Microsystems implementation of policy file parameters.

Table 2–1 Policy File Parameters

Where	Is Defined As	Example
subject	one or more principal(s)	`duke`
codesource	*`codebase`*`,` *`signer`*	`http://www.example.com,` *`mysigner`*

XML-Based Example

The JAAS XML-based provider can store policy data in the file `jazn-data.xml`. In the following example, a segment of the `jazn-data.xml` file grants the `admin` principal permission to log in.

```
<jazn-policy>
  <grant>
   <grantee>
     <principals>
      <principal>
        <class>oracle.security.jazn.samples.SampleUser</class>
        <name>admin</name>
      </principal>
    </principals>
   </grantee>
   <permissions>
     <permission>
       <class>com.evermind.server.rmi.RMIPermission</class>
       <name>login</name>
     </permission>
   </permissions>
  </grant>
</jazn-policy>
```

See Also:

- "Sample jazn-data.xml Code" on page A-1 to view a complete `jazn-data.xml` file.

JAAS Framework Features

Table 2–2 contains the JAAS framework features implemented by the OracleAS JAAS Provider.

Table 2–2 OracleAS JAAS Provider Features

Feature	Description	See Also
Authentication	■ Integrates with Oracle Application Server Single Sign-On for login authentication in J2EE application environments. ■ Supplies an out-of-the-box `RealmLoginModule` class for non-OracleAS Single Sign-On environments, such as OracleAS Core or Java Edition ■ Supports any JAAS-compliant custom `LoginModule`	Chapter 3, "Understanding OC4J Security"
Declarative Model	■ Integrates J2EE deployment descriptors, such as. `web.xml`, with JAAS security ■ Supports programmatic model as well	Chapter 4, "Overall Security Configuration"
Authorization	■ Provides centralized role-based access control, including support for hierarchical roles	"Role-Based Access Control (RBAC)" on page 2-8
Realms	■ Organizes users and roles (groups) around user communities. An Oracle API package (`oracle.security.jazn.realm`) is provided to support user and role management. This API includes a `RealmPrincipal` interface that extends from `java.security.Principal` and associates a realm with users and roles.	"Realms" on page 2-3 "JAAS Provider Realm Framework" on page 4-3
Management	■ Manages settings and data using command-line tool (Admintool) or Oracle Enterprise Manager 10*g* ■ Supports a centrally managed provider type with Oracle Internet Directory	Chapter 4, "JAAS Provider Administration Tasks"
`JAZNUserManager`	■ Provides an implementation of the OC4J `UserManager` that integrates with both the XML-based and the LDAP-based providers.	"JAZNUserManager" on page 3-3

User Managers

OC4J security employs a user manager to authenticate and authorize users and groups that attempt to access a J2EE application. You base your choice of user manager on performance and security needs.

All `UserManager` classes implement the `com.evermind.security.UserManager` interface (see the Javadoc for further information.). `UserManager` classes manage users, groups, and passwords through methods such as `createUser()`, `getUser()`, and `getGroup()`.

OC4J provides two predefined user managers, `JAZNUserManager` and `XMLUserManager`. `JAZNUserManager` supports both XML-based and LDAP-based providers. We recommend using `JAZNUserManager` because it is based on the JAAS specification and is integrated with Oracle Application Server Single Sign-On and Oracle Internet Directory. `JAZNUserManager` is the default security provider, because it offers powerful and flexible security control. Customers can also supply their own classes that implement the `UserManager` interface, although this will be deprecated at a future release.

Note: For a discussion of creating a custom `UserManager`, see `http://otn.oracle.com/sample_code/tech/xml/xmlnews/News_Security.html`.

Table 2–3 lists the user managers provided by OC4J.

Table 2–3 OC4J User Managers And Repositories

User Manager Class	User Repository
`oracle.security.jazn.oc4j.JAZNUserManager`	Several types: ■ using the XML-based provider —`jazn-data.xml` ■ using the LDAP-based provider—Oracle Internet Directory ■ Using a third-party LDAP provider
`com.evermind.server.XMLUserManager`	`The principals.xml` file
Custom user manager	Customized user repository

See "Specifying a UserManager In orion-application.xml" on page 4-6 for directions on how to define the default `UserManager` for all applications or a single `UserManager` for a specific application.

The following sections describe the JAZN and XML user managers:

- Using JAZNUserManager
- Using XMLUserManager

Using JAZNUserManager

The `JAZNUserManager` class is the default user manager. The primary purpose of the `JAZNUserManager` class is to leverage the OracleAS JAAS Provider as the security infrastructure for OC4J.

There are two JAAS Providers supplied with OC4J security: XML-based and LDAP-based.

- The XML-based provider is a fast, lightweight implementation of the JAAS Provider API. This provider type uses XML to store user names and encrypted passwords. The user repository is stored in the `jazn-data.xml` file, in a location specified in the jazn.xml file. For details, see Chapter 8, "Configuring the XML-Based Provider".

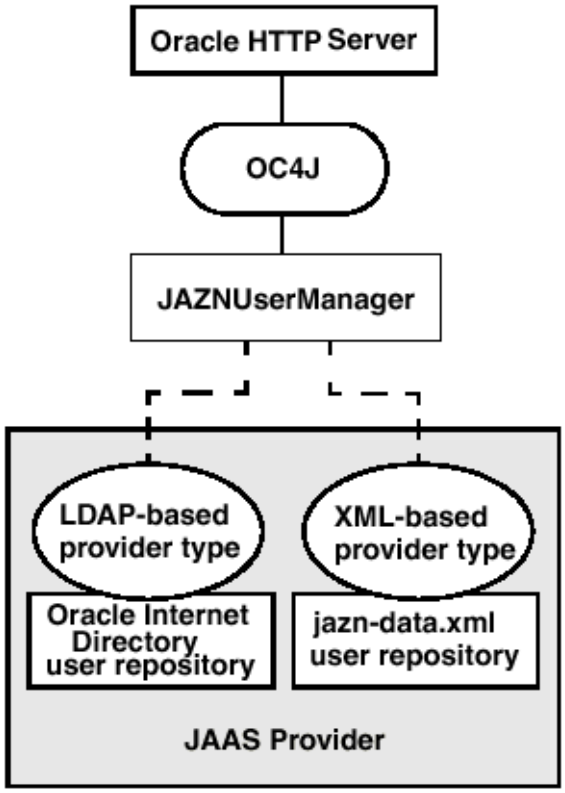
  Select JAZN-XML as the user manager in the Enterprise Manager. Configure its users, roles, and groups using the JAZN Admintool. For further information, see Chapter 8, "Configuring the XML-Based Provider".

- The LDAP-based provider is scalable, secure, enterprise-ready, and integrated with OracleAS Single Sign-On. The LDAP-based provider is the only OracleAS JAAS Provider that supports OracleAS Single Sign-On.

  Select JAZN-LDAP as the user manager in the Enterprise Manager. Configure its users and groups using the Oracle Delegated Administration Services from Oracle Internet Directory. The user repository is an Oracle Internet Directory instance, which requires that the application server instance be associated with an infrastructure. If it the server is not associated with an Oracle Internet Directory instance, then the LDAP-based provider is not a security option.For information on configuring the LDAP-based provider, see Chapter 7, "Configuring the LDAP-Based Provider".

Figure 2–1 shows the two different JAAS Providers supplied with OC4J.

Figure 2–1 OC4J Security Architecture Under the JAZNUserManager Class



Using XMLUserManager

The `XMLUserManager` class is a simple user manager that manages users, groups, and roles in an XML-based system. It stores user passwords in the clear, and therefore is not as secure as the `JAZNUserManager`. All `XMLUserManager` configuration information is stored in the `principals.xml` file, which is the user repository for the `XMLUserManager` class.

Note: The `XMLUserManager` class is supported for backward compatibility only, and will be desupported in a forthcoming release. Oracle strongly recommends that you use one of the OracleAS JAAS Provider types.

Capability Model of Access Control

The *capability model* is a method for organizing authorization information. The OracleAS JAAS Provider is based on the Java 2 Security Model, which uses the capability model to control access to permissions. With the capability model, authorization is associated with the principal (a user named `frank` in the following example). Table 2–4 shows the permissions that user `frank` is authorized to use:

Table 2–4 User Permissions

User	Has These File Permissions
`frank`	Read and write permissions on a file named `salaries.txt` in the `/home/user` directory

When user `frank` logs in and is successfully authenticated, the permissions described in Table 2–4 are retrieved from the OracleAS JAAS Provider (whether the LDAP- based Oracle Internet Directory or XML-based provider) and granted to user `frank`. User `frank` is then free to execute the actions permitted by these permissions.

Role-Based Access Control (RBAC)

RBAC enables you to assign permissions to roles. You grant users permissions by making them members of appropriate roles. Support for RBAC is a key JAAS feature. This section describes the following RBAC features:

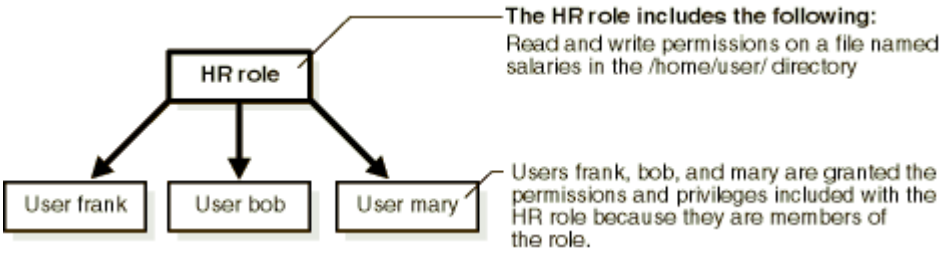
- Role Hierarchy
- Role Activation

Role Hierarchy

RBAC simplifies the management problems created by direct assignment of permissions to users. Assigning permissions directly to multiple users is potentially a major management task. If multiple users no longer require access to a specific permission, you must individually remove that permission from each user.

Instead of directly assigning permissions to users, permissions are assigned to a role, and users are granted their permissions by being made members of that role. Multiple roles can be granted to a user. A role can also be granted to another role, thus forming a *role hierarchy* that provides administrators with a tool to model enterprise security policies. Figure 2–2 provides an example of role-based access control.

Figure 2–2 Role-Based Access Control



When a user's responsibilities change (for example, through a promotion), the user's authorization information is easily updated by assigning a different role to the user instead of a massive update of access control lists containing entries for that individual user.

For example, if multiple users no longer require write permissions on a file named `salaries` in the `/home/user` directory, those privileges are removed from the `HR` role. All members of the `HR` role then have their permissions and privileges automatically updated.

Role Activation

A user is typically granted multiple roles. However, not all roles are enabled by default. An application can selectively enable the required roles to accomplish a specific task in a user session with the `run-as` security identity and `Subject.doAS()`. Selectively enabling roles upholds the principle of least privilege: the application is not enabling permissions or privileges unnecessary for the task. This limits the damage that can potentially result from an accident or error.

Changes Since Release 9.0.4

- The correct setting for the environment variable controlling loading of dynamic libraries (for example, `LD_LIBRARY_PATH` in Solaris) is now *`ORACLE_HOME`*`/lib32` instead of *`ORACLE_HOME`*`]/lib`). Table 2–5shows the complete settings.

Table 2–5 Dynamic Library Path Settings

Operating System	Variable	Value
Solaris	LD_LIBRARY_PATH_64	*`ORACLE_HOME`*`/lib32`
		`ORACLE_HOME``/lib`
HP/UX	SHLIB_PATH	*`ORACLE_HOME`*`/lib32`
	LD_LIBRARY_PATH	*`ORACLE_HOME`*`/lib`
AIX	LIBPATH	*`ORACLE_HOME`*`/lib32` for 32-bit applications, *`ORACLE_HOME`*`/lib` for 64-bit applications
	LD_LIBRARY_PATH	Null
Windows	Not applicable	Not applicable

- The Java Development Kit 1.3 default installation does not include JAAS support. To use JAAS with JDK1.3, you must download JAAS 1.0_01 from the Sun Web site `http://java.sun.com/products/jaas/index-10.html` and follow the installation Land deployment instructions.

  Note: When you develop applications using JDK 1.3, you should be aware of a JDK class loader issue. The class loader can locate custom login modules only if you deploy the JAR containing them as a standard extension in *`ORACLE_HOME`*`/jre/lib/ext`. This problem will be fixed at the next release.

- At this release, Oracle supports third-party LDAP providers. See Chapter 9, "Configuring External LDAP Providers", for details.

- At this release, Oracle supplies a default file (`jazn.security.props`) in the directory *`ORACLE_HOME`*`/j2ee/home/startup` that specifies the OracleAS JAAS provider to be used for JAAS login configuration and policy. Note that these properties are set by default during OC4J startup, so in most circumstances you do not need to worry about setting these properties. For details, see "Specifying An Alternate Policy Provider (Optional)" on page 4-5.
- Custom `UserManager` classes are still supported at this release, but will be deprecated at a future release.
- The file principals.xml will no longer be supported at a future release. We strongly encourage you to migrate your existing applications from using `principals.xml` to using `JAZNUserManager`. For instructions, see "Migrating Principals from the principals.xml File" on page 8-5.
- The interface for retrieving the SSL client certificate has changed. You now use `servletRequest.getAttribute("javax.servlet.request.X509Certificate")` instead of `servletRequest.getAttribute("javax.security.cert.X509certificate")`.

3

Understanding OC4J Security

This chapter describes security issues affecting J2EE applications in Oracle Application Server Containers for J2EE (OC4J).

This chapter contains these topics:

Introduction

The following are components of the OC4J security architecture:

- The OracleAS JAAS Provider, which provides support for storage, retrieval, and administration of realm information (users and roles) and policy information (permissions). The OracleAS JAAS Provider supports two possible repositories or *provider types*:
  - XML-based Provider Type
  - LDAP-based Oracle Internet Directory (available only with Oracle Application Server Infrastructure installation)
- JAAS login modules, such as the `RealmLoginModule`, third-party `LoginModules`, and custom `LoginModules`

See Also:

- "Provider Types" on page 2-2 for further information about provider types
- *Oracle Application Server Installation Guide* for information on installing Oracle Internet Directory.

Security Considerations During Development and Deployment

The OracleAS JAAS Provider is designed to work with the J2EE declarative security model. This declarative model requires little or no programming to use JAAS security in your application. Instead, most security decisions are made as part of the deployment process, making it easy to make changes without requiring re-coding. If the declarative model is not sufficient, the OracleAS JAAS Provider also supports programmatic security in the same manner that JAAS is used in any J2SE environment.

Development

If your application relies on the declarative security model (where J2EE security roles are defined in deployment descriptors, such as `web.xml`), the developer must determine if the application uses application-specific roles. If so, the developer must define these roles so that they can be mapped to the J2EE logical roles during the deployment phase.

Deployment

Using the declarative security model, the deployer must make the following security-related decisions:

- Determine the J2EE logical roles that are assumed in the application, then define these roles in the deployment descriptors. For example, an HR application may assume that the J2EE logical role `hr_manager` is running the application; the deployer must define that role.
- Determine the authorization constraints that apply to these roles and define them in the deployment descriptors. For web modules, these constraints typically apply to URL patterns as defined in the J2EE specification. EJB modules typically have constraints at the EJB-method level.
- Decide whether to use an XML flat file or Oracle Internet Directory (LDAP) as the repository for the OracleAS JAAS Provider. This also determines which provider, XML-based or LDAP-based, and user manager the application uses.
- Map the security roles (including the application-specific roles, if they exist) to users and groups defined by the OC4J user manager (for instance, `JAZNUserManager`). For example, the J2EE logical role called `hr_manager` may be mapped to a given set of users defined by the OC4J user manager.

For information on making and implementing these decisions, see Chapter 6, "Security Considerations During Application Deployment"; for a full discussion of deployment, see the *Oracle Application Server Containers for J2EE User's Guide.*

OC4J and the OracleAS JAAS Provider

Oracle Application Server Containers for J2EE is a J2EE container that accepts HTTP and RMI client connections. These connections permit access to servlets, Java Server Pages (JSPs), and Enterprise JavaBeans (EJBs).

J2EE containers separate business logic from resource and lifecycle management. This enables developers to focus on writing business logic, rather than writing enterprise infrastructure. For example, Java servlets simplify Web development by providing an infrastructure for component, communication, and session management in a Web container integrated with a Web server.

OC4J Integration

The OracleAS JAAS Provider is integrated with Oracle Application Server Containers for J2EE and with OracleAS Single Sign-On to enhance application security. This integration provides the following benefits:

- `run-as` identity support, delegation support (from servlet to Enterprise JavaBeans)
- Full support for OracleAS Single Sign-On
- Support for custom `LoginModule`s

JAZNUserManager

The OracleAS JAAS Provider is supported through `JAZNUserManager`, `JAZNUserManager`, an implementation of the OC4J `UserManager` interface, supports the following features:

- Secure storage of obfuscated passwords
- Full role-based access control (RBAC), including hierarchical roles
- Full support for the Java 2 permission model and JAAS
- Secure implementation based on the Java 2 permission model, allowing non-trusted (or partially trusted) code to run in the same JVM as the OracleAS JAAS Provider
- OracleAS Single Sign-On integration with Oracle Application Server Containers for J2EE
- `RealmLoginModule` integration in non-OracleAS Single Sign-On environments
- Support for custom JAAS login modules
- Identity propagation

Authentication Environments

The OracleAS JAAS Provider integrates with several different login authentication environments in a J2EE application.

- **OracleAS Single Sign-On**

  Uses OracleAS Single Sign-On to authenticate logins

- **SSL**
  - Uses Secure Socket Layers for client certificate-based authentication
  - Uses a login module (for example, `RealmLoginModule`) to authenticate logins
- **Basic Authentication**
  - Prompts user directly for username and password, without going through OracleAS Single Sign-On
  - Uses a login module (for example, `RealmLoginModule`) to authenticate logins

- **Form-based Authentication**

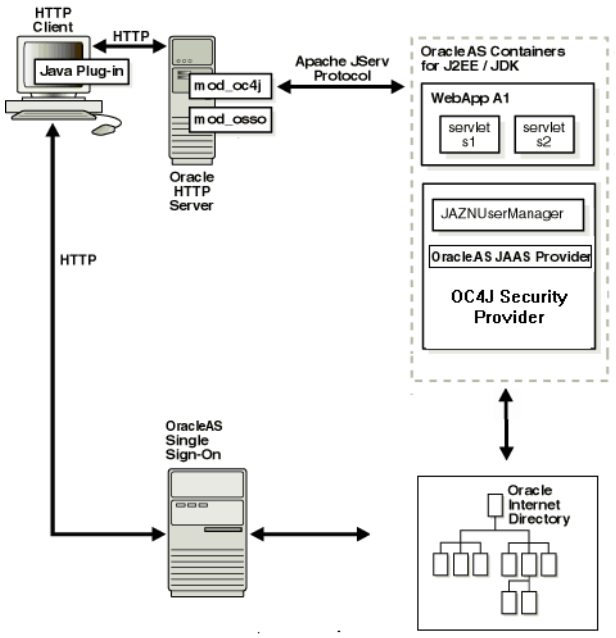
  When the user attempts to access a protected resource, OC4J checks whether the user has already been authenticated. If not, OC4J displays an application-specific login screen, prompting for username and password.

The following sections discuss how the OracleAS JAAS Provider integrates with each of these authentication types.

Enabling OracleAS Single Sign-On in J2EE Applications

OracleAS Single Sign-On lets a user access multiple applications with a single set of login credentials. Figure 3–1 shows JAAS integration in an application running in an OracleAS Single Sign-On-enabled J2EE environment.

Figure 3–1 OracleAS Single Sign-On and J2EE Environments



OracleAS Single Sign-On-Enabled J2EE Environments: A Typical Scenario

This section describes the responsibilities of Oracle components when an HTTP client request is initiated in an OracleAS Single Sign-On-enabled J2EE environment.

1. An HTTP client attempts to access a Web application, WebApp A1, hosted by Oracle Application Server Containers for J2EE (the Web container for executing servlets). Oracle HTTP Server (using an Apache listener) handles the request.
2. mod_osso / Oracle HTTP Server receives the request and:
   - Determines that WebApp A1 application requires Web-based OracleAS Single Sign-On for authenticating HTTP clients
   - Redirects the HTTP client request to the Web-based OracleAS Single Sign-On (because it has not yet been authenticated).
3. The HTTP client is authenticated by OracleAS Single Sign-On through a user name and password or through a user certificate. OracleAS Single Sign-On then:

- Validates the user's stored login credentials
- Sets the OracleAS Single Sign-On cookie (including the user's distinguished name and realm)
- Redirects back to the WebApp A1 application (in Oracle Application Server Containers for J2EE)

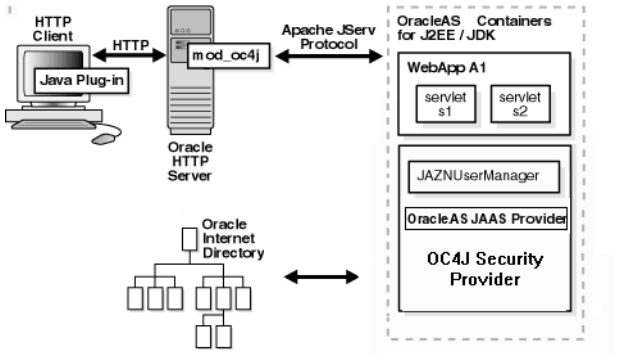
4. The OracleAS JAAS Provider retrieves the OracleAS Single Sign-On user.

> **Note:** For full details on OracleAS Single Sign-On, see the *Oracle Application Server Single Sign-On Administrator's Guide*.

Integrating the OracleAS JAAS Provider with SSL-Enabled Applications

SSL is an industry standard protocol for managing the security of message transmission on the Internet. Figure 3–2 shows JAAS integration in an application running in an SSL-enabled J2EE environment.

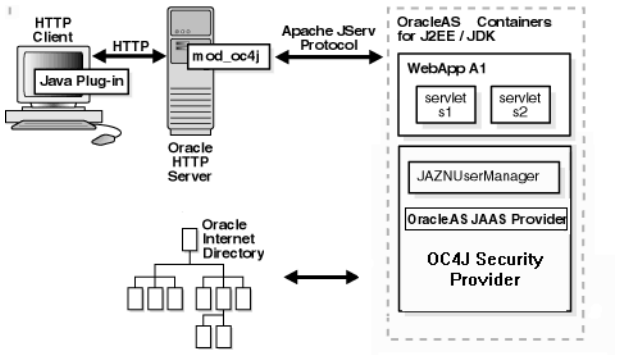
Figure 3–2 Oracle Component Integration In SSL-Enabled J2EE Environments



Integrating the OracleAS JAAS Provider with Basic Authentication

Basic authentication bypasses OracleAS Single Sign-On. Figure 3–3 shows specific JAAS integration in an application configured for Basic authentication in a J2EE environment.

Figure 3–3 Oracle Component Integration in j2ee Environment



Basic Authentication J2EE Environments: Typical Scenario

This section describes the responsibilities of Oracle components when an HTTP client request is initiated in a J2EE environment configured for Basic authentication. In this environment, OracleAS Single Sign-On is not used. A login module (for example, `RealmLoginModule`) is used.

1. An HTTP client attempts to access a Web application (named WebApp A1) hosted by Oracle Application Server Containers for J2EE (the Web container for executing servlets).
2. OC4J invokes the `RealmLoginModule` whenever user credentials are required. For example, when a request hits a protected page, OC4J will ask the OracleAS JAAS Provider to authenticate the user, then the `RealmLoginModule` will be invoked to authenticate the user, using the credentials sent by the user via the browser over HTTP.
3. The OracleAS JAAS Provider retrieves the user.

> **See Also:** Your Sun Java documentation for more information on J2EE by visiting the following URL:
>
> `http://java.sun.com/j2ee/`

Authentication in the J2EE Environment

Authentication is the process of verifying the identity of a user in a computing system, often as a prerequisite to granting access to resources in a system. User authentication in the J2EE environment is performed by the following:

- OracleAS Single Sign-On (for OracleAS Single Sign-On environments) or the OracleAS JAAS Provider `RealmLoginModule` or other login module (for non-OracleAS Single Sign-On environments)

  Before HTTP requests can be dispatched to the target servlet, the `JAZNUserManager`gets the authenticated user information (set by `mod_osso`) from the HTTP request object and sets the JAAS subject in Oracle Application Server Containers for J2EE.

- One of the following:
  - `JAZNUserManager`
  - `XMLUserManager`
  - A developer-supplied `UserManager`

> **Note:** Developer-supplied `UserManager`s are deprecated and will be desupported in a future release.

Running with an Authenticated Identity

You can choose to configure the `JAZNUserManager` so that a filter enables the target servlet to run with the permissions and roles associated with an authenticated identity or run-as identity. To do this, configure the `jazn-web-app` element.

> **See Also:** "JAZNUserManager" on page 3-3 for further information on options and configuration of the `JAZNUserManager` filter, including the `jazn-web-app` element.

Retrieving Authentication Information

The following `javax.servlet.HttpServletRequest` APIs retrieve authentication information within the servlet:

- `getRemoteUser` for the authenticated username
- `getAuthType` for the authentication scheme
- `getUserPrincipal` for the authenticated principal object

> **Note:** The returned principal is an instance of the interface `com.evermind.security.User`, which extends `java.security.Principal`.

- `getAttribute("javax.servlet.request.X509certificate")` for the SSL client certificate

Authorization in the J2EE Environment

Authorization is the process of granting permissions and privileges to an authenticated user. This section discusses authorization within servlets.

If the servlet is configured to permit `doAs()`, the `JAZNUserManager` invokes an authenticated target servlet within a `Subject.doAs()` block to enable JAAS-based authorization in the target servlets.

Authorization is achieved through the following:

- `JAZNUserManager`
- Methods based on JAAS authorization:
  - `Servlet.service()` in the servlet
  - `Subject.doAs()` and `Subject.doAsPrivileged()` in the client
  - `SecurityManager.checkPermission()`in the server

See Also: Configuring J2EE Authorization on page 4-10.

Security Role Mapping

Two distinct role types are available to application developers creating secure applications in J2EE environments: J2EE roles and JAAS roles. When these role types are mapped together using Oracle Application Server Containers for J2EE group mappings, users can access an application with a defined set of role permissions for as long as the user is mapped to this role.

This section describes these role types and how they are mapped together.

- J2EE Security Roles
- Deployment Roles and Users
- OC4J Group Mapping to J2EE Security Roles

J2EE Security Roles

The J2EE development environment includes a portable security roles feature defined in the `web.xml` file for servlets and Java Server Pages (JSPs). Security roles define a set of resource access permissions for an application. Associating a principal (in this case, a JAAS user) with a security role assigns the defined access permissions to that principal for as long as they are mapped to the role. For example, an application defines a security role called `sr_developer`:

```
<security-role>
     <role-name>sr_developer</role-name>
</security-role>
```

You also define the access permissions for the `sr_developer` role.

```
 <security-constraint>
    <web-resource-collection>
      <web-resource-name>access to the entire application</web-resource-name>
      <url-pattern>/*</url-pattern>
    </web-resource-collection>
        <!-- authorization -->
    <auth-constraint>
      <role-name>sr_developer</role-name>
    </auth-constraint>
  </security-constraint>
```

Deployment Roles and Users

JAAS roles and users are defined depending on the provider type, LDAP-based or XML-based.

For example, with the XML-based provider type, developer is listed as a role element in the `jazn-data.xml` file:

```
<role>
  <name>developer</name>
  <members>
    <member>
      <type>user<type>
      <name>john<name>
    </member>
  </members>
</role>
```

OC4J Group Mapping to J2EE Security Roles

Oracle Application Server Containers for J2EE (OC4J) enables you to map portable J2EE security roles defined in the J2EE `web.xml` file to groups in an `orion-application.xml` file.

The roles and users defined in your provider environment are mapped to the Oracle Application Server Containers for J2EE `developer` group role in the `orion-application.xml` file.

For example, the `sr_developer` security role is mapped to the group named `developer.`

```
<security-role-mapping name="sr_developer">
       <group name="developer" />
  </security-role-mapping>
```

Notice that a `<group>` in a `<security-role-mapping>` element corresponds to a role in the OracleAS JAAS Provider. Therefore, this association permits the `developer` group to access the resources allowed for the `sr_developer` security role.

In this paradigm, the user `john` is listed as a member of the `developer` role. Because the `developer` group is mapped to the J2EE security role `sr_developer` in the `orion-application.xml` file, `john` has access to the application resources defined by the `sr_developer` role.

4

Overall Security Configuration

This chapter discusses tasks related to configuring the complete security system. It contains the following parts:

Choosing the XML-Based or LDAP-Based Provider

As part of installing OC4J, you determine whether to use the LDAP-based or XML-based provider. This section gives guidelines on how to make that choice.

- **XML-based Provider**—Use the XML-based provider in development environments and in deployed applications with a small user population.
- **LDAP-Based Provider**—Use the LDAP-based provider in production environments.

  Compared to the XML-based provider, the LDAP-based provider offers better security and performance. The centralized Oracle Internet Directory server scales gracefully as the number of applications and users grows. We recommend you take advantage of a centralized Oracle Internet Directory server in your production deployments, both for better performance and to take advantage of

such features as centralized account creation and management, single passwords, and credential management.

The LDAP-based provider enables you to configure cache parameters to improve overall performance of authentication and authorization. If secure communications are needed between the Oracle Internet Directory server and OC4J, configure the system to use the level of security required.

When you install infrastructure, then associate the OC4J instance with a mid-tier Oracle Internet Directory or Oracle Application Server Single Sign-On instance, the installer automatically selects the LDAP-based provider. For details, see the *Oracle Application Server Installation Guide* . If you need to configure OC4J to use the LDAP-based Provider, see the instructions in the *Oracle Application Server Administrator's Guide.*

Locating jazn.xml, jazn-data.xml, and the <jazn> element

To configure the Oracle Application Server Java Authentication and Authorization Service (JAAS) Provider, you must sometimes edit various configuration files using text editors. This section discusses how to locate the configuration files and the `<jazn>` element.

Locating jazn.xml

The OracleAS JAAS Provider must locate a valid `jazn.xml` file before it can begin running. The `jazn.xml` file is used to configure the OracleAS JAAS Provider.

The bootstrap `jazn.xml` is in *`ORACLE_HOME`*`/j2ee/home/config].` The OracleAS JAAS Provider reads the information in this file before OC4J is started up. This means that certain settings can only be made in the bootstrap file; if these changes are read after OC4J starts up, they have no effect on the OracleAS JAAS Provider. Optionally, users can specify a different location for `jazn.xml`; see "Locating jazn.xml" on page 18-1 for details.

Locating jazn-data.xml

The file `jazn-data.xml` is the datastore for the XML-based JAAS provider. By default, OC4J expects the file `jazn-data.xml` to be in *`ORACLE_HOME`*`/j2ee/]`*`instancename`*`/config`. You can specify an alternate path name for `jazn-data.xml` in the `<jazn provider="xml" location="`*`pathname`*`">` element in `jazn.xml`.

Locating the <jazn> element

The `<jazn>` element is used to configure the OracleAS JAAS Provider. Most often, the `<jazn>` element appears in one of two places:

1. The global application.xml, for global configuration
2. The application-specific `orion-application.xml`

The `<jazn>` tag may also appear in the bootstrap `<jazn.xml>` when it is used to configure virtual machine properties. For details, see "The Bootstrap jazn.xml File" on page 5-1.

Admintool Overview

This section discusses basic information needed to understand and use the JAZN Admintool.

Admintool Prerequisites

When you use the JAZN Admintool, by default it edits the file `jazn-data.xml` under the `config` directory of the OC4J home instance. For details on locating `jazn-data.xml`, see "Locating jazn-data.xml". The password for the `admin` user is set during installation time to the same value as the Oracle Application Server administrator (`ias_admin`) password.

Before using the Admintool with the LDAP-based provider, be sure to set the correct environment settings as described in "Preparing To Use LDAP" on page 7-1.

Authenticating Yourself

If you are using the XML-based provider, you must authenticate yourself to the JAZN Admintool before making administrative changes. You authenticate yourself in one of two ways:

- Supplying the `-user` and `-password` switches, as in:

  ```
  java -jar jazn.jar -user myusername -password mypassword -listrealms
  ```

  Note: If you specify the `-user`, `-password`, or `-clustersupport` options, you must specify them before all other options on the command line.

- Supplying a username and password when prompted by the Admintool, as in:

```
java -jar jazn.jar -listrealms
>RealmLoginModule username: martha
>RealmLoginModule password: mypass
```

Caution: The Admintool does not require authentication when used with the LDAP-based provider; anyone who runs the tool can perform Admintool operations against the Oracle Internet Directory server. This means that it is vital to secure access to the production machine(s) on which OC4J uses the LDAP-based provider. If you specify the `-user` and `-password` options when using the LDAP-based provider, they are ignored.

Adding Clustering Support

-clustersupport *oracle_home*

Specifying this option instructs the Admintool to propagate all JAAS configuration changes throughout a cluster. The *oracle_home* argument specifies the absolute path name of *ORACLE_HOME*, the Oracle home directory. You can combine `-clustersupport` with the `-shell` option.

Notes: If you are using the `-clustersupport` option, you must specify it before all other options on the command line.

The `-clustersupport` option is meaningful only when using the XML-based provider.

For example:

```
java -jar jazn.jar -clustersupport /oracle_home -shell
```

Specifying an Admintool LoginModule in jazn-data.xml

To specify which `LoginModule` the JAZN Admintool uses to authenticate its users, you must add a `<login-modules>` element to the `application` element in `jazn-data.xml`. For example:

```
<application>
  <name>oracle.security.jazn.tools.Admintool</name>
  <login-modules>
    <login-module>
     <class>oracle.security.jazn.realm.RealmLoginModule</class>
      <control-flag>required</control-flag>
      <options>
  <option>
    <name>debug</name>
    <value>false</value>
  </option>
  <option>
     <name>addAllRoles</name>
     <value>true</value>
  </option>
      </options>
    </login-module>
  </login-modules>
</application>
```

If you try to run the JAZN Admintool without specifying a `LoginModule`, the `RealmLoginModule` with the default options is used. The default options are shown in Table 4–2, " RealmLoginModule Options".

Specifying An Alternate Policy Provider (Optional)

If you use the Java Virtual Machine shipped with Oracle Application Server, the OracleAS JAAS Provider is automatically specified as the JAAS policy provider. If you use another JVM, you must explicitly specify `oracle.security.jazn.spi.PolicyProvider` as the policy provider, because by default, the JVM uses the Sun JAAS provider.

> **Note:** When you use OC4J, the JAAS configuration properties are set by default during OC4J startup, so in most circumstances you do not need to worry about setting these properties. You set them only when you are running a J2SE application outside OC4J.

You can specifying Oracle-specific JAAS properties in a separate file and passing them to the JVM on the command line. Oracle supplies a default file (`ORACLE_HOME/j2ee/home/config/jazn.security.props`) that specifies the OracleAS JAAS provider.

- To replace all security properties with the Oracle properties:

  ```
  java -Djava.security.properties==propfile
  ```

- To append the Oracle-specific properties to the other properties:

  ```
  java -Djava.security.properties=propfile
  ```

Specifying Bootstrap OracleAS JAAS Provider Settings

The bootstrap `jazn.xml` file is in*ORACLE_HOME*`/j2ee/home/config].` The OracleAS JAAS Provider reads the information in this file before OC4J is started up. This means that certain settings can only be made in the bootstrap file; if they are read after OC4J starts up, they have no effect on the OracleAS JAAS Provider. These properties are discussed in detail in Chapter 5, "Configuring the OC4J Instance".

Turning On Debug Logging

To turn on OracleAS JAAS Provider debug logging, set the system property `jazn.debug.log.enable` to `true` during Java Virtual Machine (JVM) startup.

You do this by modifying the JVM startup settings for your OC4J instance. In Oracle Application Server, you normally manage JVM settings with Oracle Enterprise Manager, using the **Java Options** textbox on the **Server Properties** screen.

In standalone mode, you set this property using JVM command-line options. For instance, you might start OC4J standalone with a command line such as:

```
java -Djazn.debug.log.enable=true -jar oc4j.jar
```

Or you can start the Admintool shell in debug mode with the command:

```
java -Djazn.debug.log.enable=true -jar jazn.jar -shell
```

In Oracle Application Server, the debug output is captured by OPMN and written to log files associated with each OC4J instance in the directory *ORACLE_HOME*`/opmn/logs`.

Specifying UserManagers

The user manager, employing the user name and password, verifies the user's identity using information in the user repository. The user manager contains your definitions for users, groups, or roles. The default user manager is the `JAZNUserManager`.

You can define a user manager for all applications or for specific applications.

- Global user manager—The global (default) user manager is inherited by all applications within an instance that has not defined a specific user manager. The instance `UserManager` is defined in `application.xml`.
- Specific user manager—This user manager is defined in `orion_application.xml` solely for a single application. It is not used by any other application.

> **Note:** Within a single OC4J instance you can specify different values for the application-specific `UserManager` instance and the global `UserManager` instance. When you do this, we recommend that you not mix custom `UserManager`s and Oracle-supplied `UserManager`s. You can use different custom `UserManager`s for the application and the global instance, and you can use different Oracle-supplied `UserManager`s for the application and the global instance, but you should avoid using a custom `UserManager` for the one instance and an Oracle-supplied `UserManager` for the other.

- In some cases, if an application inherits from another application instead of inheriting from the global application, then the application's parent user manager will be the global `UserManager` instance instead of the `UserManager` instance specified in the parent application.

Specifying A UserManager

To specify a UserManager for an entire OC4J instance or for a specific application within that instance, use Enterprise Manager. For details, see the Enterprise Manager help screen "Modifying the User Manager for All Applications".

Specifying a UserManager In orion-application.xml

Every application, including the top-level default application, has an associated `UserManager`. The `UserManager`'s primary function is to authenticate users who attempt to access web pages and EJBs.

> **Note:** We strongly encourage you to use `JAZNUserManager`. User-defined `UserManager`s will stop being supported in a future release.

The `UserManager` is used to authenticate users when connections are made to the application. These are specified using sub-elements within an `<orion-application>` element that define the configuration. There are three tags that can be used to specify a `UserManager`. They are:

Table 4–1 UserManager Tags

Tag	Meaning
<user-manager>	A user manager implemented by a user-defined class.
<jazn>	JAZNUserManager.
<principals>	A user manager defined in a principals.xml file. See "Using the <principals> element and principals.xml" on page 4-13

Advanced Configuration

There may be more than one of the user-manager configuration within a single <orion-application> element. Which element determines the UserManager is determined by the order the elements appear in the table: <user-manager> takes precedence over <jazn>, which takes precedence over <principals>. For example, if both a <jazn> and a <principals> element are present, the UserManager is based on the <jazn> element. If multiple elements with the highest-priority tag are present, then the UserManagers are chained together as parents. That is, the UserManager specified in the first tag becomes the parent of the UserManager specified in the second, and so on. The last UserManager specified then becomes the UserManager of the application. The parent of the first UserManager is the UserManager associated with the parent application (if any) of the application. The default application does not have a parent application and the parent of its UserManager is null.

If no user manager is specified, then the UserManager is determined according to the following rules.

- For the default application, a JAAS UserManager is created based on jazn-data.xml in the directory containing application.xml. If no jazn-data.xml is present in that directory, one is created. The default realm of the created jazn-data.xml is jazn.com.
- At deployment time, if the UserManager of the parent application is the JAAS UserManager, then a JAAS UserManager is created based on jazn-data.xml. If necessary, a jazn-data.xml file is created in the same way as the previous bullet. A <jazn> element is written into the orion-application.xml associated with the application.
- At application deployment time, if the UserManager of the parent application is based on principals.xml, then the UserManager of the application will be a principals UserManager. If a principals.xml file is not present, then an empty file is created. A <jazn> element is written into the orion-application.xml associated with the application.
- If the UserManager of the parent application is user-written, then the parent's UserManager will become the UserManager of the application.

Customizing RealmLoginModule

The RealmLoginModule class is the default LoginModule that is configured through the jazn-data.xml file. The RealmLoginModule class authenticates user login credentials before the user can access J2EE applications. Authentication is performed using OC4J container-based authentication (HTTP BASIC, FORM, and so on). You do not need to enable the RealmLoginModule class if your application uses OracleAS Single Sign-On authentication.

See Also: *Oracle Application Server Installation Guide* for OracleAS Single Sign-On configuration tasks.

You can configure `RealmLoginModule` either using the JAZN Admintool or by editing `jazn-data.xml`. For details on using the Admintool, see "Adding and Removing Login Modules" on page 10-4.

The `<login-module>` tag supports the following `<option>` values:

Table 4–2 RealmLoginModule Options

Name	Meaning	Default
`debug`	If set to `true`, prints debugging messages.	`false`
`addRoles`	If set to `true`, the `RealmLoginModule` adds all directly granted roles of the user to the Subject after successful authentication.	`true`
`addAllRoles`	If set to `true`, the `RealmLoginModule` adds all directly or indirectly granted roles of the user to the Subject after successful authentication.	`true`
`storePrivateCredentials`	If set to `true`, the `RealmLoginModule` adds all private credentials (for instance, password credentials) to the Subject after successful authentication.	`false`
`supportCSIv2`	If set to `true`, the `RealmLoginModule` supports CSIv2. See Chapter 15, "Configuring CSIv2" for details.	`false`
`supportNullPassword`	(LDAP-based provider **only**) If set to `true`, the `RealmLoginModule` does not check to see if the supplied password is null or empty. If set to `false`, authentication fails if the supplied password is null or empty.	`false`

Enabling RealmLoginModule Using A Text Editor

Use a text editor to modify the login configuration file `jazn-data.xml` where needed.

The default configuration for the `RealmLoginModule` class setting in the `jazn-data.xml` file is as follows:

```
<!DOCTYPE jazn-data (View Source for full doctype...)>
<jazn-data>
    .
    .
    .
<!--  Login Module Data -->
 <jazn-loginconfig>
   <application>
     <name>oracle.security.jazn.oc4j.JAZNUserManager</name>
     <login-modules>
       <login-module>
          <class>oracle.security.jazn.realm.RealmLoginModule</class>
          <control-flag>required</control-flag>
          <options>
             <option>
               <name>addRoles</name>
               <value>true</value>
             </option>
```

```
        </options>
      </login-module>
    </login-modules>
  </application>
 </jazn-loginconfig>
</jazn-data>
```

See Also: The OracleAS JAAS Provider Javadoc.

"Adding and Removing Login Modules" on page 10-4

Specifying Authentication (auth-method)

You specify the authentication method (`auth-method`) in one of several configuration files, using either the `<jazn-web-app>` or `<login-config>` elements. You must edit these files by hand.

Specifying auth-method in web.xml

To specify authentication method at the application level, you edit the `<login-config>` element of `web.xml`. For example:

```
<login-config>
   <auth-method>BASIC</auth-method>
</login-config>
```

In `web.xml`, `auth-method` can have the values shown in Table 4–3:

Table 4–3 Values for auth-method in web.xml

Setting	Meaning
`BASIC` (default)	The application uses basic authentication, the standard authentication.
`FORM`	The application uses form-based authentication.
`CLIENT-CERT`	The application requires the client to supply its own certificate for use with SSL.

These values can be overridden at the application level by using the `<jazn-web-app>` element in `orion-application.xml`.

Specifying auth-method in orion-application.xml

The `auth-method` supplied in the top-level `<jazn-web-app>` element overrides the `auth-method` in `web.xml`.

There is only one possible value for `auth-method` in `orion-application.xml`: `SSO`, meaning that the application uses OracleAS Single Sign-On. If your installation includes LDAP, Oracle Enterprise Manager automatically sets `auth-method` to `SSO`. If you stop using OracleAS Single Sign-On, you must edit the file to remove this method.

A sample entry for `orion-application.xml` would look like:

```
<jazn provider="LDAP"
    <jazn-web-app auth-method="SSO"/>
</jazn>
```

Configuring J2EE Authorization

J2EE defines a declarative authorization model that decouples applications from the underlying security infrastructure. This model allows an application's authorization policy to be expressed in a portable manner in the application's deployment descriptors. This model has proven to be hugely successful and suffice for most application's needs.

In some advanced scenarios, however, the J2EE authorization model may seem too static and coarse-grained - in these cases the JAAS authorization model can be used instead of (or in addition to) the J2EE security model. When compared to the J2EE authorization model, the JAAS authorization model is more powerful (fine-grained and dynamic) and more flexible (custom permission types supported). Such power and flexibility come at a cost, however, the JAAS authorization model is more complex to understand, deploy and administer than the J2EE authorization model.

Both models are fully supported in OC4J.

Servlets, runas-mode, and doasprivileged-mode

In most cases, URL authorization is sufficient for an application. However, if your application requires granular authorization, this extended authorization can be used to enforce JAAS Policy-based authorization at the method level.

If you want a servlet to be invoked using `subject.doAs()` or `subject.doAsPrivileged()`, you must set the `runas-mode` and `doasprivileged-mode` attributes of the `<jazn-web-app>` element contained in a `<jazn>` element in either the `orion-web.xml` or `orion-application.xml` files. To do this, you open the appropriate file in a text editor.

- `subject.doAs()` invokes the servlet using the privileges of a particular *subject*. A subject is defined by an instance of the `javax.security.auth.Subject` class and includes a set of facts regarding a single entity, such as a person. Such facts include identities and security-related attributes, such as passwords and cryptographic keys. The OracleAS JAAS Provider passes in the `Subject` instance in the method call.

  When the `doAs()` method is used, an `AccessControlContext` instance is retrieved from the current thread (from the server).

- `subject.doAsPrivileged()` uses the privileges of a particular subject without being limited by the access-control restrictions of the server.

  When the `doAsPrivileged()` method is used, the OracleAS JAAS Provider invokes the method with a null `java.security.AccessControlContext` instance, in order to start the action fresh and execute the servlet without the restrictions of the current server `AccessControlContext` instance.

`runas-mode` and `doasprivileged-mode` control whether the servlet is invoked with `subject.doAsPrivileged()` or `subject.doAs()`. By default, `runas-mode` is set to `false`, which means that neither `subject.doAsPrivileged()` or `subject.doAs()` is invoked.

Note: `runas-mode` is unrelated to the `servlet.runAs` method.

Table 4–4 runas-mode and doasprivileged-mode Settings

If runas-mode is Set To	And doasprivileged-mode Is Set To	Then the servlet is invoked with:
`false` (default)	`true` or `false`	No special privileges
`true`	`true` (default)	`subject.doAsPrivileged()`
`true`	`false`	`subject.doAs()`

Thus, to have your servlet invoked using `subject.doAsPrivileged()` you should have a `<jazn-web-app>` element that looks like this:

```
<jazn-web-app
    auth-method="SSO"
    runas-mode="true"
    doasprivileged-mode="true"
/>
```

Mapping Logical Roles to Security Roles

You sometimes deploy a servlet into a container that uses different role names than expected by the servlet. You do this by mapping the logical role (the role name used by the servlet) to the security role (the role name used by the container) in the file `web.xml`.

For example, the following entity maps the security role `corpmanagers` to the logical role to the logical role `mgmt`:

```
<security-role-ref>
  <role-name>mgmt</role-name>
  <role-link>corpmanagers</role-link>
</security-role-ref>
```

In this example, if a servlet running as a user belonging to `corpmanagers` invokes `isUserInRole("mgmt")`, the method will return `true`. Whenever the container finds no `security-role-ref` matching a security role, the container checks the `<role-name>` against the entire list of security roles for the Web application.

Removing Realm Names From Authentication Principals

It is often desirable to avoid parsing the principal returned by various method calls. You can configure OracleAS JAAS Provider so that the returned principal contains no realm name. To do this, you add a `jaas.username.simple` property to the `<jazn>` element in the file `jazn.xml`, or, at application level, to the `<jazn>` element in the file `orion-application.xml`. If this property is set to `true`, returned principals contain no realm name; if it is set to `false`, the default, returned principals contain the complete realm name.

This property affects the return values of the following methods:

- `javax.servlet.http.HTTPServletRequest`, `getRemoteUser` and `getUserPrincipal` methods
- `javax.ejb.EJBContext`, `getCallerIdentity` and `getCallerPrincipal` methods

By default, the principal returned by these methods is in the format *realm_name/simple_name*, such as jazn.com/john. When you set jaas.username.simple to true, the returned principal is in the format *simple_name*, such as john.

You set jaas.username.simple as follows:

1. Locate the file containing the <jazn> element (see "Locating jazn.xml, jazn-data.xml, and the <jazn> element"), open the file in a text editor, and go to the <jazn> element within the file.
2. Search for a <property name="jaas.username.simple"> sub-element within the <jazn> element.
3. If the sub-element exists, change the value to true or false; if the sub-element does not exist, create one. In either case, you should have a sub-element that looks like:

```
<jazn provider="XML" location="./jazn-data.xml">
   <property name="jaas.username.simple" value="true" />
</jazn>
```

Note: Do not edit any <jazn> properties except as specified in this chapter.

Configuring Third-Party LDAP Providers

See Chapter 9, "Configuring External LDAP Providers".

Permitting EJB RMI Client Access

To enable fat client access to EJBs using RMI, you must grant the correct permissions using the JAZN Admintool. (For general information on using the Admintool, see "Admintool Overview" on page 4-3.) You must grant RMIPermission login to your user, role, or group.

```
java -jar jazn.jar -grantperm myrealm -role administrators \
  com.evermind.server.rmi.RMIPermission login
```

Creating a Java 2 Policy File

The Java 2 policy file grants permissions to trusted code or applications that you run. This enables code or applications to access Oracle support for JAAS or JDK APIs requiring specific access privileges.

A preconfigured Java 2 policy (`java2.policy`) is provided in *`ORACLE_HOME`*`/j2ee/home/config`.

You need to modify the Java 2 policy file to grant permissions to trusted code or applications.

For example, the following section of a `java2.policy` file grants `java.security.AllPermission` to the trusted `jazn.jar`.

```
/* grant the JAZN library AllPermission */
grant codebase "file:${oracle.home}/j2ee/home/jazn.jar" {
    permission java.security.AllPermission;
};
```

The following example grants specific permissions to all applications running in the *`ORACLE_HOME`*`/appdemo` directory.

```
/* Assuming you are running your application demo in $ORACLE_HOME/appdemo/, */
/* Grant JAZN permissions to the demo to run JAZN APIs*/
grant codebase "file:/${oracle.ons.oraclehome}/appdemo/-" {
   permission oracle.security.jazn.JAZNPermission "getPolicy";
   permission oracle.security.jazn.JAZNPermission "getRealmManager";
   permission oracle.security.jazn.policy.AdminPermission
"oracle.security.jazn.realm.RealmPermission$*$createRealm,dropRealm,
  createRole, dropRole,modifyRealmMetaData";
```

Using the <principals> element and principals.xml

The `<principals>` element tells OC4J to use the `UserManager` described in a principals file, normally `principals.xml`. A `<principals>` element has one attribute, `<path>`, which specifies a path for the principals file, normally `principals.xml`.

For example,

```
<principals path="myprincipals.xml" />
```

A `principals.xml` file also contains a `<principals>` element; this contains two sub-elements, `<groups>` and `<users>`. The `<groups>` element contains one or more `<group>` elements, and the `<users>` element contains one or more `<user>` elements.

Note: The `XMLUserManager` class is deprecated, and is supported for backward compatibility only. Oracle will cease to support `XMLUserManager` and `principals.xml` in a future release.

Table 4–5 Elements in principals.xml

Element	Can Contain	Attributes	Description
`<principals>`	`<groups>`, `<users>`	`NA`	Containing element in file
`<groups>`	`<group>`		A list of groups known to this user manager
`<group>`	`<description>`, `<permission>`	`name`	Identifies a single user group; name attribute specifies group name
`<description>`			Not used by OracleAS JAAS Provider, but is displayed in various circumstances.
`<permission>`		`name`	A `java.security.Permission` that is granted to principals. There are two special values: ▪ `administrator`—equivalent to `com.evermind.security.AdministrationPermission()` ▪ `rmi:login`— equivalent to `com.evermind.server.rm.RMIPermission("login")`
`<users>`	`<user>`		List of users known to the `UserManager`
`<user>`	`<description>`, `<group-membership>`		Single user belonging to this group
		`username`	String used to identify the user
		`password`	Cleartext password used to authenticate the user. There is no mechanism for obfuscating this password.
		`deactivated`	Either `true` or `false`. If `true`, then this user will not be found in lookups and will not be able to be authenticated
`<description>`			Arbitrary content that may be displayed in various circumstances
`<group-membership>`		`group`	Name attribute of a <group> which contains this user

Groups in `principals.xml` correspond to roles in the OracleAS JAAS Provider. The `principals.xml` file does not support any equivalent of the OracleAS JAAS Provider's concept of realms. Permissions granted to groups may be checked explicitly, and OC4J does check for the special permissions listed above. However, group permissions are not integrated with the usual `Permission` checking performed by a `SecurityManager`.

The following is an example `principals.xml` file.

```
<?xml version="1.0" standalone='yes'?>
<!DOCTYPE principals PUBLIC "//Evermind - Orion Principals//"
"http://xmlns.oracle.com/ias/dtds/principals.dtd">

<principals>
  <groups>
<group name="guests">
    <description>users</description>
  </group>
  <group name="administrators">
    <description>administrators</description>
    <permission name="administration" />
  </group>
  </groups>
  <users>
  <user username="SCOTT" password="TIGER">
  <group-membership group="guests" />
  </user>
  <user username="anonymous" password="">
    <description>The default guest/anonymous user</description>
    <group-membership group="guests" />
  </user>
  <user username="admin" password=""  deactivated="true">
    <description>The default administrator</description>
    <group-membership group="users" />
    <group-membership group="administrators" />
  </user>
  </users>
</principals>
```

5

Configuring the OC4J Instance

This chapter discusses instance-specific OC4J configuration. All tasks in this chapter affect an entire OC4J instance and all applications running under that instance. This chapter contains the following sections:

The Bootstrap jazn.xml File

All of the tasks in this chapter rely on editing the *bootstrap jazn.xml file*, which is the instance-specific configuration file read at instance startup. The bootstrap `jazn.xml` file is *`ORACLE_HOME`*`/j2ee/`*`instancename`*`/config/jazn.xml`. All changes to this file affect the entire OC4J instance. The properties listed in this section can be changed only in the instance-specific `jazn.xml` file.

Note: You cannot change the bootstrap `jazn.xml` file with Application Server Control Console; you must edit it using a text editor.

Specifying LDAP Connection Properties

There are two properties that change LDAP connection properties. They are listed in Table 5–1.

Table 5–1 LDAP Connection Properties

Property Name	Meaning	Default Value
`ldap.connect.max.retry`	Number of times the OracleAS JAAS Provider attempts to create an LDAP connection before giving up.	5
`ldap.connect.sleep`	Number of milliseconds the OracleAS JAAS Provider waits before retrying a failed LDAP connection attempt.	5000

To configure LDAP connection properties, use the following steps:

1. Open the bootstrap <jazn.xml> file, *ORACLE_HOME*/j2ee/*instance*/config/jazn.xml, in a text editor and go to the <jazn> element within the file.
2. Locate the <property> sub-element within the <jazn> element. The syntax of the <property> sub-element is:

   ```
   <property name="propname" value="propvalue"/>
   ```

   If there is no <property> sub-element corresponding to the property you want to change, create one.
3. Restart OC4J.

Specifying LDAP JNDI Connection Pool Size

There are two properties that change LDAP connection pool properties. They are listed in Table 5–2.

Table 5–2 LDAP JNDI Connection Pool Properties

Property Name	Meaning	Default Value
jndi.ctx_pool.init_size	Initial size for JNDI/LDAP connection pool.	**5**
jndi.ctx_pool.inc_size	Pool increment size for JNDI/LDAP connection pool — number of connections added to pool whenever the supply of connections in the pool is exhausted.	**10**

To specify the size of the connection pool used by JNDI:

1. Open the bootstrap <jazn.xml> file, *ORACLE_HOME*/j2ee/*instance*/config/jazn.xml, in a text editor and go to the <jazn> element within the file.
2. Locate the <property> sub-element within the <jazn> element. The syntax of the <property> sub-element is:

   ```
   <property name="propname" value="propvalue"/>
   ```

If there is no <property> sub-element corresponding to the property you wish to change, create one. For example, a <property> sub-element setting the initial size to 20 would look like:

```
<property name="jndi.ctx_pool.init_size" value="20">
```

Note: Do not edit any <jazn> properties except as specified in this documentation.

3. Restart OC4J.

Configuring LDAP Caching

The LDAP-based OracleAS JAAS Provider supports caching, providing improved performance and scalability. There are three separate caches:

- Policy cache, which stores grantees and permissions
- Realm cache, which stores realms, users and roles, and a role graph.
- Session cache, which stores users and role graphs in an HTTP session object. (This cache is available only to web-based clients with cookies enabled.)

The caching service maintains a global HashMap, which is used to store and retrieve cached objects. A daemon thread runs periodically in the background to invalidate and clean up expired objects in the HashMap. Objects in the cache expire based on a time-to-live algorithm; expiration time can be set with the cache properties, described in Table 5–3.

Note: Only the LDAP-based Provider provides these caches. The XML-based Provider defaults to caching the entire XML document.

Changing Session Cache Details

HttpSession objects persist for the duration of the server-side session. An application can terminate a session explicitly, by invoking HttpSession.invalidate(); a container can terminate a session based on the <session-timeout> value.

Note: Objects stored in an HttpSession instance must implement the java.io.Serializable interface in order to be deployed with the <distributable /> flag in web.xml.

See Also: The *Oracle HTTP Server Administrator's Guide* for more information about session support in OC4J.

Disabling LDAP Caching

Caching is enabled by default. You should disable the caches when performing management and administrative tasks programmatically. In particular:

- Disable the policy cache when managing policy. If the policy cache is enabled, calling `Policy.grant()` or `Policy.revoke()` causes an `UnsupportedOperationException.`
- Disable the realm cache when managing realms. This includes adding realms, dropping realms, granting roles, and revoking roles.
- Disable the session cache when you disable HTTP session cookies.

> **Note:** The JAZN Admintool automatically disables caching while it is in operation, then reenables caching when it finishes.

To disable the LDAP cache, use the following steps:

1. Open the bootstrap `<jazn.xml>` file, *`ORACLE_HOME`*`/j2ee/`*`instance`*`/config/jazn.xml`, in a text editor and go to the `<jazn>` element within the file.
2. Edit the `<jazn>` element to appear as follows:

```
<jazn provider="LDAP">
   <property
      name="ldap.user" value=
"orclApplicationCommonName=jaznadmin1,cn=JAZNContext,cn=products,cn=OracleContext"/>
   <property name="ldap.password"
             value="{903}3o4PTHbgMzVlzbVfKITIO5Bgio6KK9kD"/>
   <property name="ldap.cache.session.enable"
             value="false" />
   <property name="ldap.cache.realm.enable"
             value="false" />
   <property name="ldap.cache.policy.enable"
             value="false" />
</jazn>
```

3. Restart OC4J.

LDAP Cache Configuration

The properties that affect the LDAP cache are controlled by `<property>` sub-elements within the `<jazn>` element. To change these properties, you must edit the bootstrap `<jazn.xml>` file, *`ORACLE_HOME`*`/j2ee/`*`instance`*`/config/jazn.xml`, and change the `<jazn>` element.

To configure LDAP cache properties, use the following steps:

1. Open the bootstrap `<jazn.xml>` file, *`ORACLE_HOME`*`/j2ee/`*`instance`*`/config/jazn.xml`, in a text editor and go to the `<jazn>` element within the file.
2. Locate the `<property>` sub-element within the `<jazn>` element. The syntax of the `<property>` sub-element is:

   `<property name="`*`propname`*`" value="`*`propvalue`*`"/>`

   If there is no `<property>` sub-element corresponding to the property you wish to change, create one.

3. Restart OC4J.

Table 5–3 describes the LDAP cache properties and their default values. You can set these properties only at the instance level, in the <jazn> tag in the bootstrap <jazn.xml>.

Table 5–3 LDAP Cache Properties

Property	Description	Default
ldap.cache.policy.enable (see **Note**)	If set to true, enables cache; if set to false, disables cache.	true
ldap.cache.realm.enable	If set to true, enables cache; if set to false, disables cache.	true
ldap.cache.session.enable	If set to true, enables cache; if set to false, disables cache.	true
ldap.cache.initial.capacity	Initial capacity for the HashMap.	20
ldap.cache.load.factor	Load factor for the HashMap.	.7
ldap.cache.purge.initial.delay	String containing an integer that represents the number of milliseconds the daemon thread waits before starts checking for expired objects.	3600000
ldap.cache.purge.timeout	The string representation of an integer that represents the number of milliseconds an object remains in cache before being invalidated and removed. It is also the sleep time for the daemon thread between each run looking for expired objects.	3600000

Notes:

- Do not edit any <jazn> properties except as specified in this documentation.
- ldap.cache.policy.enable replaces the deprecated property ldap.cache.enable

A jazn element with all caches enabled, a cache size of 100, and a 10000-millisecond timeout would look like:

```
< jazn provider="LDAP" location="ldap://example.com:389" >
   < property name="ldap.cache.initial capacity" value="100" />
   < property name="ldap.cache.purget.timeout" value="10000" />
</jazn>
```

Configuring LDAP SSL Properties

The properties that affect SSL are controlled by <property> sub-elements within the <jazn> element. To change these properties, you must edit the file containing the <jazn> element.

To configure LDAP SSL properties, use the following steps:

1. Open the bootstrap <jazn.xml> file, *ORACLE_HOME*/j2ee/*instance*/config/jazn.xml, in a text editor and go to the <jazn> element within the file.
2. Locate the <property> sub-element within the <jazn> element. The syntax of the <property> sub-element is:

   ```
   <property name="propname" value="propvalue"/>
   ```

   If there is no <property> sub-element corresponding to the property you wish to change, create one.
3. Restart OC4J.

Table 5–4 lists the SSL properties.

Table 5–4 Values For <property> Element of <jazn> Tag

Property Name	Value
ldap.password	Obfuscated password for the LDAP user name. For example: {903}oZZYqmGc/iyCaDrD4qs2FHbXf3LAWtMN See "Password Obfuscation In jazn-data.xml and jazn.xml" on page 14-1 for details on obfuscation.
ldap.protocol	The protocol to be used when communicating with LDAP using SSL.
ldap.user	LDAP username or DN. This element is populated automatically; you should not change the contents. For example: orclApplicationCommonName=jaznadmin1,cn=JAZNContext, cn=products,cn=OracleContext

Note: Do not edit any <jazn> properties except as specified in this document.

Choosing SSL Authentication

This section discusses configuring the OracleAS JAAS Provider to use SSL with Oracle Internet Directory. For information on how to configure Oracle Internet Directory to use SSL, see the *Oracle Internet Directory Administrator's Guide* and *Oracle Application Server Containers for J2EE Servlet Developer's Guide* .

At 10*g* Release 2 (10.1.2), you must use NULL authentication when communicating with Oracle Internet Directory, NULL authentication means that data are encrypted with the Anonymous Diffie-Hellman cipher suite, but no certificates are used for authentication.

If you choose SSL at install time, SSL is enabled with NULL authentication in place. You must manually enable SSL only if you did not choose SSL as part of your installation. In that case, for NULL authentication, add a <property> tag to the <jazn> tag in the bootstrap jazn.xml to specify a protocol (note that you do not

specify a wallet location or password, because NULL authentication does not use certificates):

```
<?xml version = '1.0' encoding = 'UTF-8'?>
<jazn provider="LDAP" location="ldap://example.com:5000" default-realm="us">

   <property name="ldap.protocol" value="ssl"/>

</jazn>
```

Configuring LDAP Default Realm

The default realm is the realm used whenever an authentication or authorization request does not specify a realm explicitly. This attribute is automatically populated with the default Oracle Identity Management realm; you need to edit the attribute only if the default is incorrect for your application. To configure the LDAP default realm, use the following steps:

1. Open the bootstrap `<jazn.xml>` file, *ORACLE_HOME*`/j2ee/`*instance*`/config/jazn.xml`, in a text editor and go to the `<jazn>` element within the file.
2. Edit the `default-realm` attribute of the `<jazn>` element. The syntax is:

   ```
   <jazn provider="LDAP" default-realm="myrealm"
   ```

3. Restart OC4J.

> **Note:** Do not edit any `<jazn>` properties except as specified in this documentation.

For example, a jazn element that set the default-realm to "Sales" would look like:

```
<jazn provider="LDAP" default-realm="Sales" ... more attributes
   <contents of jazn element/>
</jazn>
```

6

Security Considerations During Application Deployment

This chapter discusses issues to be considered when deploying applications. It is divided into the following sections:

Selecting a UserManager

By default, if you associated your OC4J instance with infrastructure, the JAZN LDAP `UserManager` is used for your newly-deployed application; otherwise, the JAZN XML `UserManager` is used for your application. If for some reason you need to change your application's user manager, you can do so from the Application Server Control Console. For details, see the Application Server Control Console help screen "Modifying the User Manager for All Applications".

Mapping Security Roles

You map security roles for your application using the **Security** page of the Application Server Control Console. You use the following steps:

1. Select your application from the Application Server Control Console, then click the **Security** link.
2. Select a role from the list titled **Security Roles**.
3. Click the button **Map Roles To Principals**. A new screen appears headed **Role: *yourrole***.
4. Click the checkbox next to the desired group or user. (There are two separate areas labeled **Map Role To Groups** and **Map Role To Users**.) Click **Apply**.
5. A confirmation screen appears. Click **OK**.

Granting Permissions

There are two different ways to grant permissions.

- To grant RMI permission or `administration` permission, use Oracle Enterprise Manager 10*g* Application Server Control Console; for details, see "Granting RMI Permission Or Administration Permission" .
- To grant any permissions other than RMI permission or `administration` permission, you use the JAZN Admintool. For details, see "Granting and Revoking All Other Permissions".

Granting RMI Permission Or Administration Permission

You can grant RMI or `administration` permission to a group using Oracle Enterprise Manager 10*g* Application Server Control Console. To do this:

1. Select an application and navigate to the **Security** page.
2. Select the group's name from the list of groups. The **Add/Edit Group Page** appears.
3. Check whichever permissions you wish to add and click **Apply**.

Granting and Revoking All Other Permissions

You use the JAZN Admintool to grant and revoke user permissions. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

```
-grantperm realm {-user user|-role role } | principal_class principal_parameters}
permission_class [permission_parameters]
-revokeperm realm {-user user|-role role} | principal_class principal_parameters}
permission_class [permission_parameters]
-listperms realm {-user user|-role role} | principal_class principal_parameters}
permission_class [permission_parameters]
```

where *`principal_class`* is the fully qualified name of a class that implements the principal interface (such as `com.sun.security.auth.NTDomainPrincipal`) and *`principal_paramters`* is a ***single*** String parameter.

The `-grantperm` option grants the specified permission to a user (when called with `-user`) or a role (when called with `-role`) or a principal. The `-revokeperm` option revokes the specified permission from a user or role or principal

A *`permission_descriptor`* consists of a permission's explicit class name (for example, `oracle.security.jazn.realm.RealmPermission`), its action, and its action and target parameters (for `RealmPermission`, `realmname action`). Note that there may be multiple action and target parameters.

Note: If the Admintool gives the error message `Permission class not found`, it means that the permission you wish to grant is not in the classpath. You must place the JAR containing the permission class in the `jdk/jre/lib/ext` directory so that the Admintool can locate it..

For example, to grant `FilePermission` with target `a.txt` and actions "`read, write`" to user `martha` in realm `foo`, type:

```
java -jar jazn.jar -grantperm foo -user martha java.io.FilePermission
 a.txt read,write
```

Admintool shell:

```
JAZN:> grantperm foo -user martha java.io.FilePermission a.txt read,write
```

Creating Users And Groups

See Chapter 7, "Configuring the LDAP-Based Provider" or Chapter 8, "Configuring the XML-Based Provider" for details on creating users and groups in each provider.

7

Configuring the LDAP-Based Provider

This chapter discusses configuring the LDAP-based provider. It contains the following sections:

- Preparing To Use LDAP
- Creating LDAP Users and Groups

Some LDAP properties affect the entire OC4J instance; these properties are discussed in "Specifying Bootstrap OracleAS JAAS Provider Settings" on page 4-5.

Preparing To Use LDAP

You normally associate OC4J with infrastructure at the time of installation.However, you can also associate OC4J with infrastructure using Oracle Enterprise Manager 10*g* Application Server Control Console. See the Oracle Enterprise Manager 10*g* help screen "**Application Server- Infrastructure Page**"

When you associate an OC4J instance with an Oracle Application Server Infrastructure (including the Oracle Internet Directory), your application can leverage the LDAP-based provider for central management of users.

Creating Administrative Users and Groups

If you specify the LDAP-based provider globally in the `application.xml` configuration file, then you must set up certain users, groups, and permissions in Oracle Delegated Administration Services:, and then grant these users and groups the appropriate permissions.

You can set up the appropriate groups and users by using the tool `oracle.security.jazn.util.LoadOidData`, which is part of the `jazncore` library supplied in*J2EE_HOME*.. You run the tool with the command line:

```
java -cp ./jazncore.jar oracle.security.jazn.util.LoadOidData
```

The syntax for this tool is:

```
LoadOidData [-h ldaphost] [-p ldapport] [-D binddn] [-w passwd] [-f filename
[-oc4jAdminPwd passwd] [-ignoreError [true|false]
```

The supported options are:

- `-h` *`ldaphost`* —The LDAP hostname
- `-p` *`ldapport`*—The port of the LDAP server
- `-D` *`binddn`*—The distinguished name for the Oracle Internet Directory administrator
- `-w` *`password`*—The password for the Oracle Internet Directory administrator
- `-f` *`filename`*—The file containing the entries to be loaded; this should always be *`J2EE_HOME`*`/jazn/install/oidConfigForOc4j.sbs`
- `-oc4jAdminPwd` *`password`*—The password that will be assigned to OC4J administrator
- `-ignoreError`*`boolean`*—If set to `false`, the default, the tool stops as soon as it encounters an error; if set to `true`, the tool continues after reporting the error.

For example, assume the password for the Oracle database administrator is `welcome1` and the password for the OC4J admin user is `welcome2`. The command line would be:

```
java -cp $J2EE_HOME/jazncore.jar oracle.security.jazn.util.LoadOidData
  -h oidhost -p oidport -D cn=orcladmin -w welcome1
  -f $J2EE_HOME/jazn/install/oidConfigForOc4j.sbs -oc4jAdminPwd welcome2
```

After you run this tool, your default Oracle Identity Management realm will contain the following:

- An `administrators` group
- An `admin` user that is a member of the `administrators` group

The `administrators` group will have the following permissions:

- `com.evermind.server.AdministrationPermission ("administration")`
- `com.evermind.server.rmi.RMIPermission("login")`

Finally, you must set the `ldap.user` property to `admin` and the `ldap.password` property to the admin password; see "Configuring LDAP SSL Properties" on page 5-6 for instructions.

LDAP-Based Provider Environment Variables

Before beginning development, you must ensure that the operating-system-specific environment variable controlling loading of dynamic libraries (for example, `LD_LIBRARY_PATH` in Solaris) is set appropriately. See Table 2–5 for details.

When you manage OC4J with Oracle Enterprise Manager, it sets this variable automatically.

Creating LDAP Users and Groups

To create users and groups when using the LDAP-based provider, you use the Oracle Delegated Administration Services tools. For details, see *Oracle Identity Management Guide to Delegated Administration*.

8

Configuring the XML-Based Provider

This chapter discusses performing basic user, group, and role management tasks using Oracle Enterprise Manager 10*g* Application Server Control Console and JAZN Admintool. It is divided into the following sections:

- Creating Users
- Creating Roles (Groups)
- Deleting Users
- Deleting Roles (Groups)
- Creating Realms
- Deleting Realms
- Granting Permissions
- Revoking Permissions
- Granting Roles (Groups)
- Revoking Roles (Groups)
- Setting Persistence Mode
- Configuring XML Default Realm
- Migrating Principals from the principals.xml File

Note: This chapter uses the term "role" because that term is used by the JAZN Admintool. A "role" is the same thing as a "group", which is the more commonly-used term.

Creating Users

To create users in the XML-based Provider, use Enterprise Manager as follows:

1. Go to the Application Server Control Console.
2. Navigate to the **Security** screen for the appropriate OC4J instance.
3. Click the **Add User** button and follow the instructions on the screens.

Creating Roles (Groups)

To create roles (also known as groups) in the XML-based Provider, use Enterprise Manager as follows:

1. Go to the Application Server Control Console.
2. Navigate to the **Security** screen for the appropriate OC4J instance.
3. Click the **Add Group** button and follow the instructions on the screens.

Deleting Users

To delete users in the XML-based Provider, use Enterprise Manager as follows:

1. Go to the Application Server Control Console.
2. Navigate to the **Security** screen for the appropriate OC4J instance.
3. Select a user with the radio button.
4. Click the **Remove** button and follow the instructions on the screens.

Note: The bootstrap `jazn-data.xml` must contain accounts for "`admin`" and "`anonymous`". Do not remove these accounts; if you do, the OracleAS JAAS Provider will stop working.

Deleting Roles (Groups)

To delete roles (also known as groups) in the XML-based Provider, use Enterprise Manager as follows:

1. Go to the Application Server Control Console.
2. Navigate to the **Security** screen for the appropriate OC4J instance.
3. Select a group with the radio button.
4. Click the **Remove** button and follow the instructions on the screens.

Creating Realms

To add a realm, use the JAZN Admintool. See "Admintool Overview" on page 4-3 for details on using the Admintool.

The Admintool `-addrealm` option adds a realm. It takes as arguments the realm name, the administrator name, and the administrator password. The syntax is:

```
-addrealm realm admin adminpwd adminrole
```

For example, using the XML-based Provider, the administrator `martha` with password `mypass` using role `hr` would add the realm `employees` as follows:

```
java -jar jazn.jar -addrealm employees martha mypass hr
```

Deleting Realms

To delete realms, use the JAZN Admintool. See "Admintool Overview" on page 4-3 for details on using the Admintool.

The Admintool `-remrrealm` option deletes a role from the realm. It takes one arguments, `realm`, the realm name. The syntax is:

```
-remrealm realm
```

To delete a realm foo, type:

```
java -jar jazn.jar -remrealm foo
```

Granting Permissions

See "Granting Permissions" on page 6-2.

Revoking Permissions

To revoke permissions, use the JAZN Admintool. See"Admintool Overview" on page 4-3 for details on using the Admintool.

The `-revokeperm` option revokes the specified permission from a user or role or principal. To supply multiple words in the *`permission`* argument, enclose it in quotation marks ("*`three word permission`*"). The syntax is:

```
-revokeperm realm {-user user|-role role} | principal_class principal_parameters}
permission_class [permission_parameters]
```

where *`principal_class`* is the fully qualified name of a class that implements the principal interface (such as `com.sun.security.auth.NTDomainPrincipal`) and *`principal_paramters`* is a *single* `String` parameter.

To revoke the `perm1` permission, type:

```
java -jar jazn.jar -revokeperm foo -user martha java.io.FilePermission a.txt
read,write
```

Granting Roles (Groups)

To grant roles in the XML-based Provider, use Enterprise Manager as follows:

1. Go to the Application Server Control Console.
2. Navigate to the **Security** screen of the chosen OC4J instance.
3. Select a user with the radio button.
4. Select the checkboxes that correspond to the roles you wish to grant.
5. Click the **Apply** button.

Revoking Roles (Groups)

To grant roles in the XML-based Provider, use Enterprise Manager as follows:

1. Go to the Application Server Control Console.
2. Navigate to the **Security** screen of the chosen OC4J instance.
3. Select a user with the radio button.
4. Select the checkboxes that correspond to the roles you wish to revoke..
5. Click the **Apply** button.

Setting Persistence Mode

Persistence mode governs when changes to data are written to `jazn-data.xml`. There are three possible values for persistence:

- `NONE`

  Do not write changes to `jazn-data.xml`.

- `ALL`

  Write changes after every modification.

- `VM_EXIT` (the default)

  Write changes when the Java Virtual Machine exits.

To configure the persistence mode in the XML-based provider, you must edit the `<jazn>` element in the `jazn.xml` file by hand. (For details on locating `jazn.xml`, see "Locating jazn.xml, jazn-data.xml, and the <jazn> element" on page 4-2)

1. Open `jazn.xml` in your text editor and go to the `<jazn>` element.
2. Edit the `persistence` attribute of the `<jazn>` element. For example, to write changes after every modification, you should edit the `jazn` element to look like:

   ```
   <jazn persistence="ALL" ... other attributes />
   ```

Note: Do not change the other attributes of the `jazn` tag.

Configuring XML Default Realm

The default realm is the realm used whenever an authentication or authorization request does not specify a realm explicitly. This attribute is not needed if you have configured only one realm in the repository. To configure the XML default realm, use the following steps:

1. Locate the file containing the `<jazn>` element (see "Locating jazn.xml, jazn-data.xml, and the <jazn> element" on page 4-2), open the file in a text editor, and go to the `<jazn>` element within the file.
2. Edit the `default-realm` attribute of the `<jazn>` element. The syntax is:

   ```
   <jazn provider="XML" default-realm="myrealm"
   ```

3. For example, a jazn element that set the default-realm to Sales would look like:

   ```
   <jazn provider="XML" default-realm="Sales" ... more attributes
      <contents of jazn element/>
   </jazn>
   ```

Note: Do not edit any `<jazn>` properties except as specified in this chapter.

Migrating Principals from the principals.xml File

You use the JAZN Admintool to migrate your data out of the `principals.xml` file. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

`-convert` *`filename realm`*

The `-convert` option migrates the `principals.xml` file into the specified realm of the current OracleAS JAAS Provider. The *`filename`* argument specifies the path name of the input file (typically *`ORACLE_HOME`*`/j2ee/home/config/principals.xml`).

The migration converts `principals.xml` users to JAAS `users` and `principals.xml` groups to JAAS roles. All permissions that were previously granted to a `principals.xml` group are mapped to the JAAS role. Users that were deactivated at the time of migration are not migrated. This ensures that no users can inadvertently gain access through the migration.

An error (either `Javax.naming.AuthenticationException:Invalid username/password` or `javax.naming.NamingException:Lookup Error`) is returned if the input file contains errors.

Before you convert `principals.xml`, you must make sure that you have an administrator user that is authorized to manage realms. To do this:

1. Activate the administrative user in `principals.xml`, which is deactivated by default. Be sure to create a password for the administrator.
2. Create the realm `principals.com` with a dummy user and a dummy role. For example, in the Admintool shell you would type:

   ```
   JAZN> addrealm principals.com u1 welcome r1
   ```

   Make sure that the administrator name you used to create the realm is different from the name of the administrator in `principals.xml`. This is necessary because the convert command does not migrate duplicate users, and migrates duplicate roles by overwriting the old one.
3. Migrate `principals.xml` to the `principals.com` realm, as in

   ```
   java -jar jazn.jar -convert config/principals.xml principals.com
   ```
4. Change the `<default-realm>` to `principals.com`; see "Setting Persistence Mode" on page 8-4.
5. Stop OC4J and restart it.

9

Configuring External LDAP Providers

This chapter discusses how to configure OC4J to use non-Oracle LDAP servers. It is divided into the following sections:

- Prerequisites
- Creating a <login-module> Element in jazn-data.xml
- An Example LDIF Description
- Configuring Sun Java System Application Server as LDAP Provider
- Configuring Microsoft Active Directory as LDAP Provider

> **Note:** Although OC4J supports non-Oracle LDAP servers, Oracle Identity Management does not. You cannot configure Oracle Identity Management to use a third-party LDAP server. Furthermore, you should not configure the JAAS Provider to use Oracle Identity Management as a third-party LDAP server; by doing so, you lose access to the optimizations and integrations available when using Oracle Identity Management as the native LDAP provider.

Prerequisites

Before you configure OC4J, you must complete the following prerequisites:

1. Install and configure Sun Java System Application Server (formerly iPlanet) or Active Directory.
2. Install and configure OC4J.
3. Locate the `jazn-data.xml` file associated with your OC4J instance. This is normally in the directory *`ORACLE_HOME`*`/j2ee/`*`instance_name`*`/config`. You will be editing this file using a text editor.

   > **Note:** Although many `jazn-data.xml` files can be associated with an OC4J instance, the `jazn-data.xml` specified in the bootstrap `jazn.xml` serves as the default repository for JAAS login modules.

4. Locate the `orion-application.xml` file that controls your application. This file will normally be located in the directory *`ORACLE_HOME`*`/j2ee/`*`instance_name`*`/application-deployment/`*`application_name`*. You will be editing this file using a text editor.

Note: Sample login module entries for Sun Java System Application Provider and Microsoft Active Directory are provided in the directory *J2EE_HOME*/jazn/config. A non-provider-specific login module entry is provided in *J2EE_HOME*/jazn/config/ldap_login_module.template.

Creating a <login-module> Element in jazn-data.xml

Each option in a <login-module> corresponds to a configuration setting in the LDAP provider. The supported options are listed in Table 9–2,Table 9–2 , and Table 9–3. Unless marked (optional), all options must be explicitly specified.

Table 9–1 LoginModule Provider Options

Option name	Meaning
oracle.security.jaas.ldap.provider.url	The URL of the LDAP provider in the format *hostname*:*portname*.
oracle.security.jaas.ldap.provider.principal	The Distinguished Name (DN) of the LDAP user that is used to connect to the LDAP server. This user must be an admiinstrator with privileges to search users and groups, and to invoke ldapcompare on a user password if the target directory supports this.
oracle.security.jaas.ldap.provider.credential	The credential (generally a password) used to authenticate the LDAP user defined in oracle.security.jaas.ldap.provider.principal.
oracle.security.jaas.ldap.provider.type	(Optional) The product name of the LDAP provider. Supported values are iplanet, active directory, and other. If you supply iplanet or active directory, the login module is able to infer some LDAP properties (for example, the group objectclass for active directory is "group") and do some optimizations.
oracle.security.jaas.ldap.provider.connect.pool	(Optional) Boolean: whether connection pooling is enabled. True enables connection pooling, false disables it.
oracle.security.jaas.ldap.lm.cache_enabled	(Optional) Boolean: whether login module caching is enabled. True (default) enables caching, false disables it.

Table 9–2 LoginModule User Options

Option name	Meaning
oracle.security.jaas.ldap.user.name.attribute	The name of the LDAP attribute that uniquely identifies the name of the user. In Sun Java System Application Server, uid; on Active Directory, sAMAccountName.
oracle.security.jaas.ldap.user.objectclass	A list of space-separated LDAP schema object class(es) used to represent a use. On SSun Java System Application Server, inetOrgPerson.
oracle.security.jaas.ldap.user.searchbase	A list of space-separated based distinguished name (DN) in the LDAP directory that contains users. For example, cn=users,dc=us,dc=abc,dc=com
oracle.security.jaas.ldap.user.searchscope	Specifies how deep in the LDAP directory tree to search for users. Supported values: subtree, onelevel

Table 9–3 LoginModule Role Options

Option name	Meaning
oracle.security.jaas.ldap. role.name.attribute	The name of the LDAP attribute that uniquely identifies the name of the role. In iplanet, this would be `uniqueMember`; in Active Directory, it would be `member`.
oracle.security.jaas.ldap. role.object.class	A list of space-separated LDAP schema object classes that is used to represent a group. On Sun Java System Application Server, `groupOfUniqueNames`. On Active Directory, `group`.
oracle.security.jaas.ldap. role.searchbase	A list of space-separated distinguished names (DN) in the LDAP directory that contains group. For example, `cn=groups,dc=us,dc=abc,dc=com`
oracle.security.jaas.ldap. role.searchscope	Specifies how deep in the LDAP directory tree to search for roles. Supported values: `subtree`, `onelevel`.
oracle.security.jaas.ldap.. role.membership. searchscope	Specifies how deep in the LDAP directory tree to search for role membership. Supported values: `direct`, `nested`.
oracle.security.jaas.ldap. role.member.attribute	The attribute of a static LDAP group object specifying the distinguished names (DNs) of the members of the group. On Sun Java System Application Server, `uniqueMember`; on Active Directory, `member`.

An Example LDIF Description

Table 9–1, "Sample LDIF Defining A User and Role" contains sample declarations for a user object and role object; each of the next two sections discusses how to map those objects to an LDAP provider.

Example 9–1 Sample LDIF Defining A User and Role

```
# An example user object entry
uid= jdoe,dc=us,dc=example,dc=com
uid= jdoe
givenName=John
sn=Doe
cn=John Doe
userPassword={SSHA}zD/44JbZY33osry4mzfLn0du7nBhIIAHKDG5Fg==
uidNumber=1
gidNumber=1
homeDirectory=c:\
objectClass=top
objectClass=person
objectClass=organizationalPerson
objectClass= inetOrgPerson
objectClass=posixAccount

# An example role object entry
cn=managers,ou=groups,dc=us,dc=example,dc=com
objectClass=top
objectClass= groupOfUniqueNames
cn=managers
uniqueMember=uid=jdoe,dc=us,dc=example,dc=com
```

Configuring Sun Java System Application Server as LDAP Provider

At this release, you must configure Sun Java System Application Server as your LDAP provider by editing the `jazn-data.xml` file to add a `<login-module>` corresponding to the Sun product. This section discusses the necessary changes.

Note: A template file containing a sample login module entry for Sun Java System Application Server is provided in the file *J2EE_HOME*`/jazn/config/sample_login_module.sun`.

---

1. Open your `jazn-data.xml` file (see "Prerequisites") using a text editor.
2. Locate the `<application>` element representing your application. If there is no `<application>` element, create one.
3. Locate the `<login-modules>` section within the `<application>` element. If there is no `<login-modules>` element, create one.
4. Edit the `<option>` elements to specify appropriate values for Sun Java System Application Server. One set of suggested values can be found in Example 9–2. Save the edited file.
5. Open your `orion-application.xml` file (see "Prerequisites") using a text editor.
6. Locate the `<jazn>` element within `orion-application.xml`. Set the `provider` property to `"XML"` and add a `<property>` element setting `custom.ldap.provider` to `true`. The edited `<jazn>` element should look like this:

```
<jazn provider="XML">
    <property name="custom.ldap.provider" value="true"/>
 </jazn>
```

7. Restart the OC4J instance using Enterprise Manager.

SunOne Example

Suppose that your Sun Java System Application Server installation is described by the set of LDIF entries shown in Example 9–1.

The corresponding `<jazn-loginconfig>` entity is shown in Example 9–2.

Example 9–2 JAAS LoginModule Configuration Corresponding To Example 9–1

```
<jazn-loginconfig>
<application>
<name>callerInfo</name>
<login-modules>
<login-module
<class>oracle.security.jazn.login.module.LDAPLoginModule</class>
<control-flag>required</control-flag>
<options>
... irrelevant options omitted ...
<option>
<name>oracle.security.jaas.ldap.user.name.attribute</name>
<value>uid</value>
</option>
<option>
<name>oracle.security.jaas.ldap.user.object.class</name>
<value>inetOrgPerson</value>
</option>
```

```
<option>
<name>oracle.security.jaas.ldap.user.searchbase</name>
<value>dc=us,dc=example,dc=com</value>
</option>
<option>
<name>oracle.security.jaas.ldap.role.name.attribute</name>
<value>cn</value>
</option>
<option>
<name>oracle.security.jaas.ldap.role.object.class</name>
<value>groupOfUniqueNames</value>
</option>
<option>
<name>oracle.security.jaas.ldap.role.searchbase</name>
<value>ou=groups,dc=us,dc=example,dc=com</value>
</option>
<option>
<name>oracle.security.jaas.ldap.member.attribute</name>
<value> uniqueMember </value>
</option>
</options>
</login-module>
</login-modules>
</application>
</jazn-loginconfig>
```

Configuring Microsoft Active Directory as LDAP Provider

At this release, you must configure Microsoft Active Directory as your LDAP provider by editing the `jazn-data.xml` file to add a `<login-module>` corresponding to the Microsoft product. This section discusses the necessary changes.

> **Note:** A template file containing a sample login module entry for Active Directory is provided in the file *J2EE_HOME*`/jazn/config/sample_login_module.ad`

1. Locate the `<application>` element representing your application. If there is no `<application>` element, create one.
2. Locate the `<login-modules>` section within the `<application>` element. If there is no `<login-modules>` element, create one.
3. Edit the `<option>` elements to specify appropriate values for Microsoft Active Directory. Save the edited file.
4. Open your `orion-application.xml` file (see "Prerequisites") using a text editor.
5. Locate the `<jazn>` element within `orion-application.xml`. Set the `provider` property to `"XML"` and add a `<property>` element setting `custom.ldap.provider` to `true`. The edited `<jazn>` element should look like this:

   ```
   <jazn provider="XML">
       <property name="custom.ldap.provider" value="true"/>
    </jazn>
   ```

6. Restart the OC4J instance using Enterprise Manager.

10

Custom LoginModules

This chapter discusses how to write and install a `LoginModule` to be used with the OracleAS JAAS Provider. This chapter contains the following sections:

> **Note:** Because the JAAS specification does not cover user management, when you configure your application to use a custom `LoginModule`, the use of the `UserManager` API within your application is effectively disabled. The J2EE API, however, will continue to function within your application.

Overview of JAAS Login Modules

OC4J supplies a JAAS pluggable authentication framework that conforms to the JAAS standard. With this framework, an application server and any underlying authentication services remain independent from each other, and alternative authentication services can be plugged in through JAAS login modules without requiring modifications to the application server or application code.

Possible types of JAAS login modules include the following:

- Principal mapping JAAS module
- Credential mapping JAAS module
- Kerberos JAAS module

A JAAS login module can be developed by the customer or supplied by the provider of the EIS and resource adapter. A login module must implement the standard JAAS `LoginModule` interface, which includes methods to initialize the login module,

authenticate a given subject (referred to as phase 1), commit or abort an authentication (referred to as phase 2), and sign off a subject.

OC4J passes an initiating-principal subject to a JAAS login module. Specifically, this is a `Subject` instance containing a `Principal` instance that represents the OC4J user (initiating principal), along with any public certificates. OC4J can pass a null `Subject` instance if there is no authenticated user (that is, if the OC4J user is anonymous). The initiating-principal subject is passed to the `initialize()` method of the JAAS login module.

The `login()` method of the JAAS login module (for phase 1 authentication) must, based on the initiating principal, find the corresponding resource principal and create a new credential (such as a `PasswordCredential` instance) for the resource principal. The resource principal and the credential are then added to the initiating-principal `Subject` instance through the JAAS login module `commit()` method. The resource credential is passed to the `createManagedConnection()` method of the `ManagedConnectionFactory` implementation that is provided by the resource adapter.

If a null `Subject` is passed, the JAAS login module is responsible for creating a new `Subject` instance containing the resource principal and the appropriate credential.

Prerequisites

Before working with custom `LoginModule`s, you must verify that you are using the XML-based provider; the LDAP-based provider does not support custom LoginModules. After you have verified the provider, turn on dynamic role mapping; see Configuring Dynamic Role Mapping for details.

Configuring Dynamic Role Mapping

When you turn on dynamic role mapping, the OracleAS JAAS Provider performs authorization checks based on the current `Subject` instead of using static configurations. By default, dynamic role mapping is turned off, which means that the OracleAS JAAS Provider uses static configurations as the basis for authorization checks.

To turn on dynamic role mapping:

1. Openthe bootstrap `jazn.xml` file, *`ORACLE_HOME`*`/j2ee/`*`instance`*`/config/jazn.xml`, in a text editor and go to the `<jazn>` element within the file.
2. Search for a `<property name="role.mapping.dynamic">` sub-element within the `<jazn>` element.
3. If the sub-element exists, change the value to `true` or `false`; if the sub-element does not exist, create one. In either case, you should have a sub-element that looks like:

   ```
   <jazn provider="XML" location="./jazn-data.xml">
      <property name="role.mapping.dynamic" value="true" />
   </jazn>
   ```

   Note: Do not edit any `<jazn>` properties except as specified in this documentation.

4. Restart OC4J.

Integrating Custom JAAS LoginModules

A custom JAAS `LoginModule` may be desirable when Oracle Identity Management is not available and users and roles are defined in an external repository. You can configure a `LoginModule` using the XML-based provider type. When you create a custom `LoginModule`, the following preliminary questions need to be considered.

1. **Development**. Do you want to take advantage of J2EE security constraints?
2. **Development, packaging, and deployment**. Are you using the login modules that come with J2SE 1.4? Or are you deploying custom or third-party login modules?

Note: Custom login modules are supported only with the XML-based Provider.

Developing a LoginModule

You can use an any JAAS-compliant `LoginModule` within the OC4J framework. For general information on developing LoginModules, see the Sun JAAS documentation at `http://java.sun.com/j2se/1.4.2/docs/guide/security/jaas/JAASLMDevGuide.html`

When developing a `LoginModule`, you must consider several important issues:

- Subject-based Authorization
- J2EE Security Authorization
- Callback Support
- Debugging Tips

Each of these is discussed in detail in its own section.

Subject-based Authorization

When you associate a custom `LoginModule` with an application, the Subject and the principals it contains are used as the sole basis for all authorization tasks, including evaluating J2EE security constraints. To ensure that all relevant principals are considered during authorization, the `LoginModule` must add the relevant principals, including all roles and groups that the authenticated user participates in, to the Subject durring the commit phase of the JAAS authentication process.

J2EE Security Authorization

The OracleAS JAAS Provider custom `LoginModule` framework supports the J2EE declarative security model. This means that Subject-based authorization enforces the J2EE security constraints declared in an application's deployment descriptors (`web.xml` and `ejb-jar.xml`, for example). We encourage you to take advantage of the J2EE security model whenever possible.

Callback Support

The OracleAS JAAS Provider supports the standard `javax.security.auth.callback` name (NameCallback) and password (PasswordCallback) callbacks.

Debugging Tips

When debugging your secure application, bear the following issues in mind:

- Debug Logging
- Debugging LoginModules

Debug Logging

If you set the JVM system property `jazn.debug.log.enable` to `true`, the OracleAS JAAS Provider logs debugging output to the console. Under Oracle Application Server, debugging output is captured in the directory *`ORACLE_HOME`*`/opmn/logs`.

Debugging LoginModules

We encourage you to include debugging options in your custom `LoginModule`. For an example, see the default login module, `RealmLoginModule`, which provides diagnostic output if `debug` is set to `true`.

Adding and Removing Login Modules

You use the JAZN Admintool to add and remove login modules. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

```
java -jar jazn.jar -addloginmodule application_name login_module_name
  control_flag [optionname=value ...]
 java -jar jazn.jar -remloginmodule application_name login_module_name
```

The `-addloginmodule` option configures a new `LoginModule` for the named application.

The *`control_flag`* must be one of `required`, `requisite`, `sufficient` or `optional`, as specified in `javax.security.auth.login.Configuration`. See Table 10–1.

Table 10–1 LoginModule Control Flags

Flag	Meaning
`Required`	The `LoginModule` must succeed. Whether or not it succeeds, authentication proceeds down the `LoginModule` list.
`Requisite`	The `LoginModule` must succeed. If it succeeds, authentication continues down the `LoginModule` list. If it fails, control immediately returns to the application (authentication does not continue down the `LoginModule` list).
`Sufficient`	The `LoginModule` is not required to succeed. If it succeeds, control immediately returns to the application and authentication does not proceed down the `LoginModule` list. If it fails, authentication continues down the `LoginModule` list.
`Optional`	The `LoginModule` is not required to succeed. Whether or not it succeeds, authentication proceeds down the `LoginModule` list.

If the `LoginModule` accepts its own options, you specify each option and its value as an *`optionname=value`* pair. Each `LoginModule` has its own individual set of options.

For instance, to add `MyLoginModule` to the application `myapp` as a required module with `debug` set to `true`, type:

```
java -jar jazn.jar -addloginmodule myapp MyLoginModule required debug=true
```

To delete `MyLoginModule` from `myapp`, type:

```
java -jar jazn.jar -remloginmodule myapp MyLoginModule
```

Admintool shell:

```
JAZN:> addloginmodule myapp MyLoginModule required debug=true
JAZN: remloginmodule myapp MyLoginModule
```

Listing Login Modules

You use the JAZN Admintool to list login modules. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

```
java -jar jazn.jar -listloginmodules [application_name [login_module_class]]
```

The `-listloginmodules` option displays all `LoginModule`s either in the specified *`application_name`* , or, if no *`application_name`* is specified, in all applications. Specifying *`login_module_class`*, after *`application_name`* displays information on only the specified class within the application.

For example, to display all `LoginModule`s for the application `myapp`, type:

```
java -jar jazn.jar -listloginmodules myapp
```

Admintool shell:

```
JAZN:> listloginmodules myapp
```

Packaging and Deploying

If you are using one or more of the default login modules provided with J2SE 1.3 and 1.4 (such as the J2SE1.4 `com.sun.security.auth.module.Krb5LoginModule`), then no additional configuration is needed. The OracleAS JAAS Provider can locate the default login modules.

If you are deploying your application with a custom login module, then you must deploy the login module and configure the OracleAS JAAS Provider properly so that the module can be found at runtime.

The following options are available when packaging and deploying your custom login modules:

- Deploying as Standard Extensions or Optional Packages
- Deploying Within the J2EE Application
- Using the OC4J Classloading Mechanism

The remainder of this section discusses these options in greater detail.

Deploying as Standard Extensions or Optional Packages

If you deploy your login modules as standard extensions, the OracleAS JAAS Provider will be able to find them. No additional configuration is necessary. Deploying login modules as standard extensions allows multiple applications to share the deployed login modules.

For example, one way to deploy your login modules as standard extensions is to deploy them to the *$J2EE_HOME*`/lib/ext` directory.

> **See Also:**
> `http://java.sun.com/j2se/1.4/docs/guide/extensions`

Deploying Within the J2EE Application

If your login module is used only by a single J2EE application rather than shared among multiple applications, then you can simply package your login module as part of your application, and the OracleAS JAAS Provider will be able to find it. No additional configuration is necessary.

If a later application needs the same `LoginModule`, you must repackage the login module and any relevant classes with the new application.

If you want to enable multiple applications to share the same `LoginModule` but you cannot deploy the `LoginModule` as an extension, then you can consider using the OC4J classloading mechanism.

Using the OC4J Classloading Mechanism

The OracleAS JAAS Provider is integrated with OC4J's classloading architecture. If you configure your application so that the deployed custom login modules are part of your application `classpath`, then the OracleAS JAAS Provider can locate them.

One way to accomplish this is using the `<library>` element in either of the following files:

- `application.xml` (instance-specific)
- `orion-application.xml` (application-specific)

> **See Also:** The *Oracle Application Server Containers for J2EE Services Guide* for more information about the `<library>` element.

Configuring Your Application

You modify the following files to configure your application to take advantage of custom login modules:

- jazn-data.xml
- web.xml or ejb-jar.xml
- orion-application.xml
- oc4j-ra.xml (J2EE Connector Architecture only)

This section gives details on the configuration files.

> **Note:** You must choose the XML-based provider when using custom login modules. See "Integrating Custom JAAS LoginModules" on page 10-3.

jazn-data.xml

All login module configuration information is stored in the bootstrap `jazn-data.xml` file. This file is usually located in the directory *`ORACLE_HOME`*`/j2ee/`*`instance_name`*`/config`.

> **Note:** The bootstrap `jazn-data.xml` must contain accounts for "`admin`" and "`anonymous`". Do not remove these accounts; if you do, the administrative functions of the OracleAS JAAS Provider will not work.

Because the bootstrap `jazn-data.xml` file is instance-specific, you must modify it whenever you deploy your application into a new OC4J instance. You edit this file using the JAZN Admintool.

The following sections discuss these XML elements:

- <jazn-loginconfig>
- <jazn-policy>

<jazn-loginconfig>

This tag contains information that associates applications with login modules.

Example 10–1 Example jazn-loginconfig element

```
<jazn-loginconfig>
  <application>
    <name>sampleLM</name>
    <login-modules>
       <login-module>
          <class>oracle.security.jazn.samples.SampleLoginModule</class>
          <control-flag>required</control-flag>
       </login-module>
    </login-modules>
  </application>
</jazn-loginconfig>
```

This fragment associates the application `sampleLM` with the login module `sample.SampleLoginModule`.

> **Note:** Do not remove login configuration information on RealmLoginModule.

<jazn-policy>

This tag contains information that associates grantees with permissions. If you want to make your fat client accessible to an EJB, you must explicitly make the permissions available. When you deploy a custom `LoginModule` in OC4J, you normally use custom principal classes or types. To grant or revoke permissions to these types, use the JAZN Admintool.

Example 10–2 Example jazn-policy element

```
<jazn-policy>
  <grant>
   <grantee>
     <principals>
      <principal>
        <class>oracle.security.jazn.samples.SampleUser</class>
        <name>admin</name>
      </principal>
    </principals>
   </grantee>
   <permissions>
     <permission>
       <class>com.evermind.server.rmi.RMIPermission</class>
       <name>login</name>
     </permission>
   </permissions>
  </grant>
</jazn-policy>
```

This fragment grants the permission `com.evermind.server.rmi.RMIPermission` with target name `login` to the principal with class `oracle.security.jazn.samples.SampleUser` and name `admin`.

> **Note:** Oracle recommends that you manage the contents of `jazn-data.xml` using the JAZN Admintool.

For more information about the JAZN Admintool, see Chapter 8, "Configuring the XML-Based Provider".

web.xml or ejb-jar.xml

To take advantage of J2EE declarative security in your application, you must configure the appropriate security constraints, either using your IDE or by hand-editing either `web.xml` or `ejb-jar.xml`. For details on these files, see the J2EE standard documentation at `http://java.sun.com/j2ee`.

orion-application.xml

This file is a container-specific deployment descriptor that is generated for each application deployed in OC4J. The following elements are relevant to writing custom `LoginModules`:

- <jazn>
- <security-role-mapping>

> **Note:** This section discusses only elements relevant to security. For a full discussion of this file, see the *Oracle Application Server Containers for J2EE User's Guide.*

<jazn>

> **Note:** For a discussion of how to locate the <jazn> element, see "Locating the <jazn> element" on page 4-2.

The following `<jazn>` property is specific to `LoginModule` configuration:

- `role.mapping.dynamic`

  This property, when set to `true`, instructs the OracleAS JAAS Provider to base authorization checks on the authenticated `Subject` instead of basing checks on the users and roles defined in the application specific `jazn-data.xml`.

  The `LoginModule` instance(s) must ensure that the appropriate principals (users, roles, or groups) are associated with the `Subject` instance during the commit phase of the authentication process, in order for the principals to be taken into consideration during the authorization process. This association of principals to the `Subject` is typically implemented using the standard JAAS API.

```
<jazn provider="XML" location="./jazn-data.xml">
   <property name="role.mapping.dynamic" value="true" />
</jazn>
```

> **Note:** For full details on dynamic role mapping, see "Configuring Dynamic Role Mapping" on page 10-2.

<security-role-mapping>

When you set J2EE security constraints in `web.xml` or `ejb-jar.xml`, you must configure security role mapping.

The optional `<security-role-mapping>` element describes static security-role mapping information. If you set J2EE security constraints in your application's deployment descriptors (`web.xml` or `ejb-jar.xml`), you must configure security role mapping.

For details, see "Authenticating and Authorizing EJB Applications" on page 12-2.

<library>

This tag sets the `classpath` associated with your application. (nested in libraries) Example:

```
<library path="../../shared/lib/sample.jar"/>
<library path="../../shared/lib/samplemodule.jar"/>
```

oc4j-ra.xml (J2EE Connector Architecture only)

Each <connector-factory> element in oc4j-ra.xml can specify a different JAAS login module, as in the following example. This also shows <config-property> setup to connect to a database through Oracle JDBC.

```
<connector-factory connector-name="myBlackbox" location="eis/myEIS1">
   <config-property name="connectionURL"
                    value="jdbc:oracle:thin:@localhost:5521/myservice" />
   <security-config use="jaas-module">
      <jaas-module>
         <jaas-application-name>JAASModuleDemo</jaas-application-name>
      </jaas-module>
   </security-config>
</connector-factory>
```

Simple Login Module J2EE Integration

Developing a simple LoginModule follows the standard development, packaging, and deployment cycle. The following sections discuss each step in the cycle.

Development

Develop a JAAS-compliant LoginModule according to the JAAS SPI (see the Javadoc for javax.security.auth.spi.LoginModule for more information).

Packaging

Package your LoginModule classes as part of your application's EAR file. For Web applications, include the classes under the WEB-INF/classes.

Deployment

To deploy your LoginModule in the bootstrap jazn-data.xml file:

1. Register your application's login module within the <application> tag.

   The following entry registers the login module oracle.security.jazn.samples.SampleLoginModule to be used for authenticating users accessing the sampleLM application.

```
<application>
        <name>sampleLM</name>
        <login-modules>
           <login-module>
              <class>oracle.security.jazn.samples.SampleLoginModule</class>
              <control-flag>required</control-flag>
              <options>
                 <option>
                    <name>debug</name>
                    <value>true</value>
                 </option>
              </options>
           </login-module>
        </login-modules>
     </application>
```

2. **Optional**. Grant relevant permissions to your users and roles.

   For example, if the principal `admin` needs EJB access, then you must grant the permission `com.evermind.rmi.RMIPermission` to `admin`.

```
<grant>
  <grantee>
    <principals>
      <principal>
        <class>oracle.security.jazn.samples.SampleUser</class>
        <name>admin</name>
      </principal>
    </principals>
  </grantee>
  <permissions>
    <permission>
      <class>com.evermind.server.rmi.RMIPermission</class>
      <name>login</name>
    </permission>
  </permissions>
</grant>
```

To deploy your `LoginModule` in the application-specific `orion-application.xml` file:

1. Set the `<jazn>` property `role.mapping.dynamic` to `true`:

```
<jazn provider="XML" location="./jazn-data.xml" >
  <property name="role.mapping.dynamic" value="true" />
</jazn>
```

2. Create appropriate `<security-role-mapping>` entries.

```
<security-role-mapping name="sr_developer">
  <user name="developer" />
</security-role-mapping>
<security-role-mapping name="sr_manager">
  <group name="managers" />
</security-role-mapping>
```

Custom LoginModule Example

This section gives source code for a simple custom `LoginModule` to be used by the `CallerInfo` example; you can find the complete source code for the revised example by searching the Oracle Technology Network at `http://www.oracle.com/technology/index.html`.

Example 10–3 SampleLoginModule.java

```
package oracle.security.jazn.samples;

import java.util.Set;
import java.util.Iterator;
import java.util.Map;
import java.security.Principal;
import javax.security.auth.Subject;
import javax.security.auth.callback.CallbackHandler;
import javax.security.auth.callback.Callback;
import javax.security.auth.callback.NameCallback;
import javax.security.auth.callback.PasswordCallback;
import javax.security.auth.login.LoginException;
import javax.security.auth.spi.LoginModule;
```

```
public class SampleLoginModule implements LoginModule {

    // initial state
    protected Subject _subject;
    protected CallbackHandler _callbackHandler;
    protected Map _sharedState;
    protected Map _options;

    // configuration options
    protected boolean _debug;

    // the authentication status
    protected boolean _succeeded;
    protected boolean _commitSucceeded;

    // username and password
    protected String _name;
    protected char[] _password;

    protected Principal[] _authPrincipals;


    /**
     * Initialize this <code>LoginModule</code>.
     * <p/>
     * <p/>
     *
     * @param subject         the <code>Subject</code> to be authenticated. <p>
     * @param callbackHandler a <code>CallbackHandler</code> for communicating
     *                        with the end user (prompting for usernames and
     *                        passwords, for example). <p>
     * @param sharedState     shared <code>LoginModule</code> state. <p>
     * @param options         options specified in the login
     *                        <code>Configuration</code> for this particular
     *                        <code>LoginModule</code>.
     */
    public void initialize(Subject subject,
                           CallbackHandler callbackHandler,
                           Map sharedState,
                           Map options) {
        this._subject = subject;
        this._callbackHandler = callbackHandler;
        this._sharedState = sharedState;
        this._options = options;

        // initialize any configured options
        _debug = "true".equalsIgnoreCase((String) _options.get("debug"));

        if (debug()) {
            printConfiguration(this);
        }
    }


    final public boolean debug() {
        return _debug;
    }


    protected Principal[] getAuthPrincipals() {
```

```
        return _authPrincipals;
    }


    /**
     * Authenticate the user by prompting for a username and password.
     * <p/>
     * <p/>
     *
     * @return true if the authentication succeeded, or false if this
     *         <code>LoginModule</code> should be ignored.
     * @throws FailedLoginException if the authentication fails. <p>
     * @throws LoginException       if this <code>LoginModule</code>
     *                              is unable to perform the authentication.
     */
    public boolean login() throws LoginException {
        if (debug())
            System.out.println("\t\t[SampleLoginModule] login");

        if (_callbackHandler == null)
            throw new LoginException("Error: no CallbackHandler available " +
                    "to garner authentication information from the user");

        // Setup default callback handlers.
        Callback[] callbacks = new Callback[] {
            new NameCallback("Username: "),
            new PasswordCallback("Password: ", false)
        };

        try {
            _callbackHandler.handle(callbacks);
        } catch (Exception e) {
            _succeeded = false;
            throw new LoginException(e.getMessage());
        }


        String username = ((NameCallback)callbacks[0]).getName();
        String password = new
String(((PasswordCallback)callbacks[1]).getPassword());
        if (debug())
        {
            System.out.println("\t\t[SampleLoginModule] username : " + username);
        }

        // Authenticate the user. On successfull authentication add principals
        // to the Subject. The name of the principal is used for authorization by
        // OC4J by mapping it to the value of the name attribute of the group
        // tag in the security-role-mapping for the application.
        if(username.equals("developer") && password.equals("welcome"))
        {
            _succeeded = true;
            _name = "developer";
            _password = password.toCharArray();
            _authPrincipals = new SamplePrincipal[2];
            //Adding username as principal to the subject
            _authPrincipals[0] = new SamplePrincipal("developer");
            //Adding role developers to the subject
            _authPrincipals[1] = new SamplePrincipal("developers");
        }
```

```
            if(username.equals("manager") && password.equals("welcome"))
            {
                _succeeded = true;
                _name = "manager";
                _password = password.toCharArray();
                _authPrincipals = new SamplePrincipal[3];
                //Adding username as principal to the subject
                _authPrincipals[0] = new SamplePrincipal("manager");
                //Adding roles developers and managers to the subject
                _authPrincipals[1] = new SamplePrincipal("developers");
                _authPrincipals[2] = new SamplePrincipal("managers");
            }


            ((PasswordCallback)callbacks[1]).clearPassword();
            callbacks[0] = null;
            callbacks[1] = null;

            if (debug())
            {
                System.out.println("\t\t[SampleLoginModule] success : " + _succeeded);
            }

            if (!_succeeded)
                throw new LoginException("Authentication failed: Password does not
match");

            return true;
        }


        /**
         * <p> This method is called if the LoginContext's
         * overall authentication succeeded
         * (the relevant REQUIRED, REQUISITE, SUFFICIENT and OPTIONAL LoginModules
         * succeeded).
         * <p/>
         * <p> If this LoginModule's own authentication attempt
         * succeeded (checked by retrieving the private state saved by the
         * <code>login</code> method), then this method associates a
         * <code>Principal</code>
         * with the <code>Subject</code> located in the
         * <code>LoginModule</code>.  If this LoginModule's own
         * authentication attempted failed, then this method removes
         * any state that was originally saved.
         * <p/>
         * <p/>
         *
         * @return true if this LoginModule's own login and commit
         *         attempts succeeded, or false otherwise.
         * @throws LoginException if the commit fails.
         */
        public boolean commit()
                throws LoginException {
            try {

                if (_succeeded == false) {
                    return false;
                }
```

```
            if (_subject.isReadOnly()) {
                throw new LoginException("Subject is ReadOnly");
            }

            // add authenticated principals to the Subject
            if (getAuthPrincipals() != null) {
                for (int i = 0; i < getAuthPrincipals().length; i++) {
                    if(!_subject.getPrincipals().contains(getAuthPrincipals()[i]))
{
                        _subject.getPrincipals().add(getAuthPrincipals()[i]);
                    }
                }
            }

            // in any case, clean out state
            cleanup();
            if (debug()) {
                printSubject(_subject);
            }

            _commitSucceeded = true;
            return true;

        } catch (Throwable t) {
            if (debug()) {
                System.out.println(t.getMessage());
                t.printStackTrace();
            }
            throw new LoginException(t.toString());
        }
    }


    /**
     * <p> This method is called if the LoginContext's
     * overall authentication failed.
     * (the relevant REQUIRED, REQUISITE, SUFFICIENT and OPTIONAL LoginModules
     * did not succeed).
     * <p/>
     * <p> If this LoginModule's own authentication attempt
     * succeeded (checked by retrieving the private state saved by the
     * <code>login</code> and <code>commit</code> methods),
     * then this method cleans up any state that was originally saved.
     * <p/>
     * <p/>
     *
     * @return false if this LoginModule's own login and/or commit attempts
     *         failed, and true otherwise.
     * @throws LoginException if the abort fails.
     */
    public boolean abort() throws LoginException {
        if (debug()) {
            System.out.println("\t\t[SampleLoginModule] aborted authentication
attempt.");
        }

        if (_succeeded == false) {
            cleanup();
            return false;
```

```
    } else if (_succeeded == true && _commitSucceeded == false) {
        // login succeeded but overall authentication failed
        _succeeded = false;
        cleanup();
    } else {
        // overall authentication succeeded and commit succeeded,
        // but someone else's commit failed
        logout();
    }
    return true;
}


protected void cleanup() {
    _name = null;
    if (_password != null) {
        for (int i = 0; i < _password.length; i++) {
            _password[i] = ' ';
        }
        _password = null;
    }
}


protected void cleanupAll() {
    cleanup();

    if (getAuthPrincipals() != null) {
        for (int i = 0; i < getAuthPrincipals().length; i++) {
            _subject.getPrincipals().remove(getAuthPrincipals()[i]);
        }
    }
}


/**
 * Logout the user.
 * <p/>
 * <p> This method removes the <code>Principal</code>
 * that was added by the <code>commit</code> method.
 * <p/>
 * <p/>
 *
 * @return true in all cases since this <code>LoginModule</code>
 *         should not be ignored.
 * @throws LoginException if the logout fails.
 */
public boolean logout() throws LoginException {
    _succeeded = false;
    _commitSucceeded = false;
    cleanupAll();
    return true;
}

// helper methods //

protected static void printConfiguration(SampleLoginModule slm) {
    if (slm == null) {
        return;
    }
```

```
            System.out.println("\t\t[SampleLoginModule] configuration options:");
            if (slm.debug()) {
                System.out.println("\t\t\tdebug = " + slm.debug());
            }
        }


        protected static void printSet(Set s) {
            try {
                Iterator principalIterator = s.iterator();
                while (principalIterator.hasNext()) {
                    Principal p = (Principal) principalIterator.next();
                    System.out.println("\t\t\t" + p.toString());
                }
            } catch (Throwable t) {
            }
        }


        protected static void printSubject(Subject subject) {
            try {
                if (subject == null) {
                    return;
                }
                Set s = subject.getPrincipals();
                if ((s != null) && (s.size() != 0)) {
                    System.out.println("\t\t[SampleLoginModule] added the following
Principals:");
                    printSet(s);
                }

                s = subject.getPublicCredentials();
                if ((s != null) && (s.size() != 0)) {
                    System.out.println("\t\t[SampleLoginModule] added the following
Public Credentials:");
                    printSet(s);
                }
            } catch (Throwable t) {
            }
        }
    }
```

The `Principal` that this `LoginModule` uses is in Example 10–4.

Example 10–4 SamplePrincipal example

```
package oracle.security.jazn.samples;

import java.security.Principal;

class SamplePrincipal implements Principal {

    private String _name = null;


    SamplePrincipal(String name) {
        _name = name;
    }


    public boolean equals(Object another) {
        return ((SamplePrincipal)another).getName().equals(_name);
    }


    public String getName() {
        return _name;
    }


    public int hashCode() {
        return _name.hashCode();
    }


    public String toString() {
        return "[SamplePrincipal] : " + _name;
    }

}
```

11

Configuring OC4J and SSL

OC4J supports Secure Socket Layer (SSL) communication between Oracle HTTP Server and OC4J in an Oracle Application Server environment, using secure AJP. This is the secure version of Apache JServ Protocol, the protocol that Oracle HTTP Server uses to communicate with OC4J. Note, however, that the secure AJP protocol used between Oracle HTTP Server and OC4J is not visible to the end user.

This chapter discusses only configuring OC4J to take advantage of SSL; for full information about configuring other Oracle Application Server components, see the *Oracle Application Server Administrator's Guide* .

The following sections provide details:

- Overview of SSL Keys and Certificates
- Using Keys and Certificates with OC4J and Oracle HTTP Server
- Enabling SSL in OC4J
- Requesting Client Authentication
- Resolving Common SSL Problems

> **Note:** Secure communication between a client and Oracle HTTP Server is independent of secure communication between Oracle HTTP Server and OC4J. This chapter covers only secure communication between Oracle HTTP Server and OC4J.

This chapter assumes some prior knowledge of security and SSL concepts. See the following documents for additional information about Oracle Application Server security and Oracle HTTP Server.

- *Oracle Application Server Security Guide*
- *Oracle HTTP Server Administrator's Guide*

Overview of SSL Keys and Certificates

In SSL communication between two entities, such as companies or individuals, the server has a *public key* and an associated *private key*. Each key is a number, with the private key of an entity being kept secret by that entity, and the public key of an entity being publicized to any other parties with which secure communication might be necessary. The security of the data exchanged is guaranteed by keeping the private key secret, and by the complex encryption algorithm. This system is known as *asymmetric encryption*, because the key used to encrypt data is not the same as the key used to decrypt data.

Asymmetric encryption has a performance cost due to its complexity. A much faster system is *symmetric encryption*, where the same key is used to encrypt and decrypt data. But the weakness of symmetric encryption is that the same key has to be known by both parties, and if anyone intercepts the exchange of the key, then the communication becomes insecure.

SSL uses both asymmetric and symmetric encryption to communicate. An asymmetric key (*PKI public key*) is used to encode a symmetric encryption key (the *bulk encryption key*); the bulk encryption key is then used to encrypt subsequent communication. After both sides agree on the bulk encryption key, faster communication is possible without losing security and reliability.

When an SSL session is negotiated, the following steps take place:

1. The server sends the client its public key.
2. The client creates a bulk encryption key, often a 128 bit RC4 key, using a specified encryption suite.
3. The client encrypts the bulk key with the server's public key, and sends the encrypted bulk key to the server.
4. The server decrypts the bulk encryption key using the server's private key.

This set of operations is called *key exchange*. After key exchange has taken place, the client and the server use the bulk encryption key to encrypt all exchanged data.

Note: It is possible, but rare, for the client to have its own private and public keys as well.

In SSL the public key of the server is sent to the client in a data structure known as an X.509 certificate. This certificate, created by a *certificate authority* (CA), contains a public key, information concerning the owner of the certificate, and optionally some digital rights of the owner. Certificates are digitally signed by the CA which created them using that CA's digital certificate public key.

In SSL, the CA's signature is checked by the receiving process to ensure that it is on the *approved list* of CA signatures. This check is sometimes performed by analysis of certificate chains. This occurs if the receiving process does not have the signing CA's public key on the approved list. In that case the receiving process checks to see if the signer of the CA's certificate is on the approved list or the signer of the signer, and so on. This chain of certificate, signer of certificate, signer of signer of certificate, and so on is a *certificate chain*. The highest certificate in the chain (the original signer) is called the *root certificate* of the certificate chain.

The root certificate is often on the approved list of the receiving process. Certificates in the approve list are called *trust points* or trusted certificates. A root certificate can be signed by a CA or can be *self-signed*, meaning that the digital signature that verifies the root certificate is encrypted through the private key that corresponds with the public key that the certificate contains, rather than through the private key of a higher CA. (Note that certificates of the CAs themselves are always self-signed.)

Functionally, a certificate acts as a container for public keys and associated signatures. A single certificate file can contain one or multiple chained certificates, up to an entire chain. Private keys are normally kept separately to prevent them from being inadvertently revealed, although they can be included in a separate section of the certificate file for convenient portability between applications.

A *keystore* is used to store certificates, including the certificates of all trusted parties, for use by a program. Through its keystore, an entity such as OC4J (for example) can authenticate other parties as well as authenticate itself to other parties. The keystore password is obfuscated. Oracle HTTP Server has what is called a *wallet* for the same purpose. Sun's SSL implementation introduces the notion of a *truststore*, which is a keystore file that includes the trusted certificate authorities that a client will implicitly accept during an SSL handshake.

In Java, a keystore is a `java.security.KeyStore` instance that you can create and manipulate using the `keytool` utility that is provided with the Sun Microsystems JDK. The underlying physical manifestation of this object is a file. Go to `http://java.sun.com/j2se/1.3/docs/tooldocs/win32/keytool.html` for information about `keytool`.

Using Keys and Certificates with OC4J and Oracle HTTP Server

The follwoing steps describe using keys and certificates for SSL communication in OC4J. These are server-level steps, typically executed prior to deployment of an application that will require secure communication, perhaps when you first set up an Oracle Application Server instance.

Note that a *keystore* stores certificates, including the certificates of all trusted parties, for use by a program. Through its keystore, an entity such as OC4J (for example) can authenticate other parties, as well as authenticate itself to other parties. Oracle HTTP Server uses what is called a *wallet* for the same purpose.

In Java, a keystore is a `java.security.KeyStore` instance that you can create and manipulate using the `keytool` utility that is provided with the Sun Microsystems JDK. The underlying physical manifestation of this object is a file. Go to the following Web site for information about `keytool`:

`http://java.sun.com/j2se/1.3/docs/tooldocs/win32/keytool.html`

The Oracle Wallet Manager has functionality for Oracle wallets that is equivalent to the functionality of `keytool` for keystores. For information on Oracle Wallet Manager, see the *Oracle Application Server Administrator's Guide*

Here are the steps in using certificates between OC4J and Oracle HTTP Server:

1. Use `keytool` to generate a private key, public key, and unsigned certificate.You can place this information into either a new keystore or an existing keystore.
2. Obtain a signature for the certificate, using either of the following two approaches.

   Generate your own signature:

   a. Use `keytool` to "self-sign" the certificate. This is appropriate if your clients trust you as, in effect, your own certificate authority.

   Alternatively, obtain a signature from a recognized certificate authority:

   a. Using the certificate from Step 1, use `keytool` to generate a *certificate request*, which is a request to have the certificate signed by a certificate authority.

   b. Submit the certificate request to a certificate authority.

   c. Receive the signature from the certificate authority, and import it into the keystore, again using `keytool`. In the keystore, the signature is matched with the associated certificate.

> **Note:** Oracle Application Server includes Oracle Application Server Certificate Authority (OCA). OCA enables customers to create and issue certificates for themselves and their users, although these certificates would probably be unrecognized outside a customer's organization without prior arrangements. See the *Oracle Application Server Certificate Authority Administrator's Guide* for information about OCA.

The process for requesting and receiving signatures is up to the particular certificate authority you use. Because that is outside the scope and control of Oracle Application Server, the documentation does not cover it. You can go to the Web site of any certificate authority for information. (Any browser should have a list of trusted certificate authorities.) Here are the Web addresses for VeriSign, Inc. and Thawte, Inc., for example:

`http://www.verisign.com/`

`http://www.thawte.com/`

For SSL communication between OC4J and Oracle HTTP Server, execute the preceding steps for Oracle HTTP Server, but use a wallet and Oracle Wallet Manager instead of a keystore and the `keytool` utility. See the *Oracle Application Server Administrator's Guide* for information about wallets and the Oracle Wallet Manager.

In addition to steps 1 and 2 above, execute the following steps as necessary:

1. **If the OC4J certificate is signed by an entity that Oracle HTTP Server does not yet trust**, obtain the certificate of the entity and import it into Oracle HTTP Server. The specifics depend on whether the OC4J certificate in question is self-signed, as follows.

   If OC4J has a self-signed certificate (essentially, Oracle HTTP Server does not yet trust OC4J):

   a. From OC4J, use `keytool` to export the OC4J certificate. This step places the certificate into a file that is accessible to Oracle HTTP Server.

   b. From Oracle HTTP Server, use Oracle Wallet Manager to import the OC4J certificate.

   Alternatively, if OC4J has a certificate that is signed by another entity (that Oracle HTTP Server does not yet trust):

   a. Obtain the certificate of the entity in any appropriate way, such as by exporting it from the entity. The exact steps vary widely, depending on the entity.

   b. From Oracle HTTP Server, use Oracle Wallet Manager to import the certificate of the entity.

2. **If the Oracle HTTP Server certificate is signed by an entity that OC4J does not yet trust, and OC4J is in a mode of operation that requires client authentication: (as** "Requesting Client Authentication" on page 11-8 **discusses):**

   a. Obtain the certificate of the entity in any appropriate way, such as by exporting it from the entity. The exact steps vary widely, depending on the entity.

   b. From OC4J, use `keytool` to import the certificate of the entity.

Note: During communications over SSL between Oracle HTTP Server and OC4J, all data on the communications channel between the two is encrypted. The following steps are executed:

1. The OC4J certificate chain is authenticated to Oracle HTTP Server during establishment of the encrypted channel.
2. Optionally, if OC4J is in client-authentication mode, Oracle HTTP Server is authenticated to OC4J. This process also occurs during establishment of the encrypted channel.
3. Any further communication after this initial exchange will be encrypted.

Example: Creating an SSL Certificate and Generating Your Own Signature This example corresponds to the step of obtaining a signature for the certificate, in the mode where you generate your own signature by using `keytool` to self-sign the certificate.

First, create a keystore with an RSA private / public keypair, using the `keytool` command. The following example (in which % is the system prompt) uses the RSA keypair algorithm to generate a keystore to reside in a file named `mykeystore`, which has a password of `123456` and is valid for 21 days:

```
% keytool -genkey -keyalg "RSA" -keystore mykeystore -storepass 123456 -validity 21
```

Note the following:

- The `keystore` option specifies the name of the file in which the keys are stored.
- The `storepass` option sets the password for protecting the keystore.
- The `validity` option sets the number of days for which the certificate is valid.

The `keytool` prompts you for more information, as follows:

```
What is your first and last name?
  [Unknown]:  Test User
What is the name of your organizational unit?
  [Unknown]:  Support
What is the name of your organization?
  [Unknown]:  Oracle
What is the name of your City or Locality?
  [Unknown]:  Redwood Shores
What is the name of your State or Province?
  [Unknown]:  CA
What is the two-letter country code for this unit?
  [Unknown]:  US
Is <CN=Test User, OU=Support, O=Oracle, L=Reading, ST=Berkshire, C=GB> correct?
  [no]:  yes

Enter key password for <mykey>
        (RETURN if same as keystore password):
```

Note: To determine your two-letter country code, use the ISO country code list at the following URL:

http://www.bcpl.net/~jspath/isocodes.html

The `mykeystore` file is created in the current directory. The default alias of the key is `mykey`.

Enabling SSL in OC4J

For secure communication between Oracle HTTP Server and OC4J, configuration steps are required at each end, as discussed in the following section.

Configuring Oracle HTTP Server for SSL

In Oracle HTTP Server, verify proper SSL settings in the `mod_oc4j.conf` file for secure communication. SSL must be enabled, with a wallet file and password specified, as follows:

```
Oc4jEnableSSL on
Oc4jSSLWalletFile wallet_path
Oc4jSSLWalletPassword pwd
```

The *wallet_path* value is a directory path to the wallet file, without a file name. (The wallet file name is already known.) The *pwd* value is the wallet password.

For more information about the `mod_oc4j.conf` file, see the *Oracle HTTP Server Administrator's Guide.*

Example 11–1 Creating an SSL Certificate and Configuring HTTPS

The following example uses `keytool` to create a test certificate and shows all of the XML configuration necessary for HTTPS to work. To create a valid certificate for use in production environments, see the `keytool` documentation.

1. Install the correct JDK

   Ensure that JDK 1.3.x is installed. This is required for SSL with OC4J. Set the *JAVA_HOME* to the JDK 1.3 directory. Ensure that the JDK 1.3.x *JAVA_HOME/bin* is at the beginning of your path. This may be achieved by doing the following:

   UNIX

   ```
   $ PATH=/usr/opt/java130/bin:$PATH
   $ export $PATH
   $ java -version
   java version "1.3.0"
   ```

   Windows

   ```
   set PATH=d:\jdk131\bin;%PATH%
   ```

   Ensure that this JDK version is set as the current version in your Windows registry. In the Windows Registry Editor under `HKEY_LOCAL_MACHINE/SOFTWARE/JavaSoft/Java Development Kit`, set '`CurrentVersion`' to 1.3 (or later).

2. Request a certificate

   a. Change directory to *ORACLE_HOME*`/j2ee`

   b. Create a keystore with an RSA private / public keypair using the `keytool` command. In our example, we generate a keystore to reside in a file named '`mykeystore`', which has a password of '`123456`' and is valid for 21 days, using the 'RSA' key pair generation algorithm with the following syntax:

   ```
   keytool -genkey -keyalg "RSA" -keystore mykeystore -storepass 123456 -validity
   21
   ```

In this tool,

- the `keystore` option sets the filename where the keys are stored
- the `storepass` option sets the password for protecting the keystore
- the `validity` option sets number of days the certificate is valid

The `keytool` prompts you for more information, as follows:

```
keytool -genkey -keyalg "RSA" -keystore mykeystore -storepass 123456 -validity
21

What is your first and last name?
  [Unknown]:  Test User
What is the name of your organizational unit?
  [Unknown]:  Support
What is the name of your organization?
  [Unknown]:  Oracle
What is the name of your City or Locality?
  [Unknown]:  Redwood Shores
What is the name of your State or Province?
  [Unknown]:  CA
What is the two-letter country code for this unit?
  [Unknown]:  US
Is <CN=Test User, OU=Support, O=Oracle, L=Reading, ST=Berkshire, C=GB> correct?
  [no]:  yes

Enter key password for <mykey>
        (RETURN if same as keystore password):
```

Note: To determine your 'two-letter country code', use the ISO country code list at `http://www.bcpl.net/~jspath/isocodes.html`.

The `mykeystore` file is created in the current directory. The default alias of the key is `mykey`.

3. If you do not have a `secure-web-site.xml` file, then copy the `default-web-site.xml` to *`ORACLE_HOME`*`/j2ee/home/config/secure-web-site.xml`.
4. Edit `secure-web-site.xml` with the following elements:
   a. Add `secure="true"` to the `<web-site>` element, as follows:

```
<web-site port="8888" display-name="Default OracleAS Containers for J2EE
Web Site" secure="true">
```

b. Add the following new line inside the <web-site> element to define the keystore and the password.

```
<ssl-config keystore="<Your-Keystore>" keystore-password="<Your-Password>"
/>
```

Where <Your-Keystore> is the full path to the keystore and <Your-Password> is the keystore password. In our example, this is as follows:

```
<!-- Enable SSL -->
<ssl-config keystore="../../keystore" keystore-password="123456"/>
```

Note: The keystore path is relative to where the XML file resides.

---

c. Change the web-site port number, to use an available port. For example, the default for SSL ports is 443, so change the Web site port attribute to port="4443". To use the default of 443, you have to be a super user.

d. Now save the changes to secure-web-site.xml.

5. If you did not have the secure-web-site.xml file, then edit server.xml to point to the secure-web-site.xml file.

a. Uncomment or add the following line in the file server.xml so that the secure-web-site.xml file is read.

```
<web-site path="./secure-web-site.xml" />
```

Note: Even on Windows, you use a forward slash, not a backslash, in the XML files.

---

b. Save the changes to server.xml.

6. Stop and restart OC4J to initialize the secure-web-site.xml file additions. Test the SSL port by accessing the site in a browser on the SSL port. If successful, you will be asked to accept the certificate, because it is not signed by an accepted authority.

When completed, OC4J listens for SSL requests on one port and non-SSL requests on another. You can disable either SSL requests or non-SSL requests, by commenting out the appropriate *web-site.xml in the server.xml configuration file.

```
<web-site path="./secure-web-site.xml" /> - comment out this to remove SSL
<default-site path="./default-web-site.xml" /> - comment out this to
      remove non-SSL
```

Requesting Client Authentication

OC4J supports a *client authentication* mode in which the server explicitly requests authentication from the client before the server communicates with the client. In an Oracle Application Server environment, Oracle HTTP Server acts as the client to OC4J.

For client authentication, Oracle HTTP Server must have its own certificate and must authenticate itself by sending a certificate and a certificate chain that ends with a root certificate. You can configure OC4J to accept only root certificates from a specified list in establishing a chain of trust back to a client.

A certificate that OC4J trusts is called a *trust point*. In the certificate chain from Oracle HTTP Server, the trust point is the first certificate OC4J encounters that matches one in its own keystore. There are three ways to establish trust:

- The client certificate is in the keystore.
- One of the intermediate CA certificates in the certificate chain from Oracle HTTP Server is in the keystore.
- The root CA certificate in the certificate chain from Oracle HTTP Server is in the keystore.

OC4J verifies that the entire certificate chain, up to and including the trust point, is valid to prevent any forged certificates.

If you request client authentication with the `needs-client-auth` attribute, perform the following steps.

1. Decide which of the certificates in the chain from Oracle HTTP Server is to be your trust point. Ensure that you either have control over the issuance of certificates using this trust point or that you trust the certificate authority as an issuer.
2. Import the intermediate or root certificate in the server keystore as a trust point for authentication of the client certificate.

   Note: If you do not want OC4J to accept certain trust points, make sure these trust points are not in the keystore.

3. Execute the steps to create the client certificate (documented in "Using Keys and Certificates with OC4J and Oracle HTTP Server" on page 11-3). The client certificate includes the intermediate or root certificate that is installed in the server. If you wish to trust another certificate authority, obtain a certificate from that authority.
4. Save the certificate in a file on Oracle HTTP Server.

   Note: If you are running OC4J Standalone, save the certificate on the client.

5. Provide the certificate.
   a. If you are running Oracle HTTP Server, then provide the certificate for the Oracle HTTP Server initiation of the secure AJP connection.
   b. If you are running OC4J in a standalone environment,
      – If the client is a browser, set the certificate in the client browser security area.
      – If the client is a Java client, you must programmatically present the client certificate and the certificate chain when initiating the HTTPS connection.

Resolving Common SSL Problems

This section discusses some common SSL errors and their causes and remedies, followed by a brief discussion of general SSL debugging.

Common SSL Errors and Solutions

The following errors may occur when using SSL certificates:

Keytool Error: java.security.cert.CertificateException: Unsupported encoding

Cause: There is trailing white space, which the `keytool` utility does not allow.

Action: Delete all trailing white space. If the error still occurs, add a newline in your certificate reply file.

Keytool Error: KeyPairGenerator not available

Cause: You are probably using the `keytool` utility from an older JDK.

Action: Use the `keytool` utility from the latest JDK on your system. To ensure that you are using the latest JDK, specify the full path for this JDK.

Keytool Error: Failed to establish chain from reply

Cause: The `keytool` utility cannot locate the root CA certificates in your keystore, and therefore cannot build the certificate chain from your server key to the trusted root certificate authority.

Action: Execute the following command:

```
keytool -keystore keystore -import -alias cacert -file cacert.cer
(keytool -keystore keystore -import -alias intercert -file inter.cer)
```

If you use an intermediate CA `keytool` utility, then execute this command:

```
keystore keystore -genkey -keyalg RSA -alias serverkey
keytool -keystore keystore -certreq -file my.host.com.csr
```

Get the certificate from the Certificate Signing Request (CSR), then execute the following command:

```
keytool -keystore keystore -import -file my.host.com.cer -alias serverkey
```

No available certificate corresponds to the SSL cipher suites that are enabled

Cause: Something is wrong with your certificate.

Action: Determine and rectify the problem.

General SSL Debugging

While you are developing in OC4J standalone, you can display verbose debug information from the Java Secure Socket Extension (JSSE) implementation. To get a list of options, start OC4J as follows (where `%` is the system prompt):

```
% java -Djavax.net.debug=help -jar oc4j.jar
```

Start it as follows to enable full verbosity:

```
% java -Djavax.net.debug=all -jar oc4j.jar
```

This will display the browser request header, server HTTP header, server HTTP body, content length (before and after encryption), and SSL version.

12

Configuring EJB Security

This chapter discusses security issues affecting EJBs. It discusses the following topics:

- EJB JNDI Security Properties
- Configuring Security

For full information about EJBs, see the *Oracle Application Server Containers for J2EE Enterprise JavaBeans Developer's Guide.*

EJB JNDI Security Properties

There are two JNDI properties that are specific to security. You can either set these within the jndi.properties file or within your EJB implementation.

JNDI Properties in jndi.properties

If setting the JNDI properties within the `jndi.properties` file, set the properties as follows. Make sure that this `jndi.properties` file is accessible from the `CLASSPATH`.

When you access EJBs in a *remote* container, you must pass valid credentials to this container. Stand-alone clients define their credentials in the `jndi.properties` file deployed with the client's code.

```
java.naming.security.principal=<username>
java.naming.security.credentials=<password>
```

JNDI Properties Within Implementation

Set the properties with the same values, only with different syntax. For example, JavaBeans running within the container pass their credentials within the `InitialContext`, which is created to look up the remote EJBs.

For instance, to pass JNDI security properties within the `Hashtable` environment, set these as shown in the following example:

```
Hashtable env = new Hashtable();
env.put("java.naming.provider.url", "ormi://myhost/ejbsamples");
env.put("java.naming.factory.initial",
      "com.evermind.server.ApplicationClientInitialContextFactory");
env.put(Context.SECURITY_PRINCIPAL, "guest");
env.put(Context.SECURITY_CREDENTIALS, "welcome");
Context ic = new InitialContext (env);
Object homeObject = ic.lookup("java:comp/env/employeeBean");

// Narrow the reference to a TemplateHome.
EmployeeHome empHome =
   (EmployeeHome) PortableRemoteObject.narrow(homeObject,
   EmployeeHome.class);
```

Note: `ApplicationClientInitialContextFactory` is in the file `oc4jclient.jar`.

Configuring Security

EJB security involves two realms: granting permissions if you download into a browser and configuring your application for authentication and authorization. This section covers the following:

- Granting Permissions in Browser
- Authenticating and Authorizing EJB Applications
- Specifying Credentials in EJB Clients

Granting Permissions in Browser

If you download the EJB application as a client where the security manager is active, you must grant the following permissions before you can execute:

```
permission java.net.SocketPermission "*:*", "connect,resolve";
permission java.lang.RuntimePermission "createClassLoader";
permission java.lang.RuntimePermission "getClassLoader";
permission java.util.PropertyPermission "*", "read";
permission java.util.PropertyPermission "LoadBalanceOnLookup",
  "read,write";
```

Authenticating and Authorizing EJB Applications

For EJB authentication and authorization, you define the principals under which each method executes by configuring of the EJB deployment descriptor. The container enforces that the user who is trying to execute the method is the same as defined within the deployment descriptor.

The EJB deployment descriptor enables you to define security roles under which each method is allowed to execute. These methods are mapped to users or groups in the OC4J-specific deployment descriptor. The users and groups are defined within your designated security user managers, which uses either the JAZN or XML user manager. For a full description of security user managers, see the *Oracle Application Server Containers for J2EE User's Guide* and *Oracle Application Server Containers for J2EE Services Guide.*

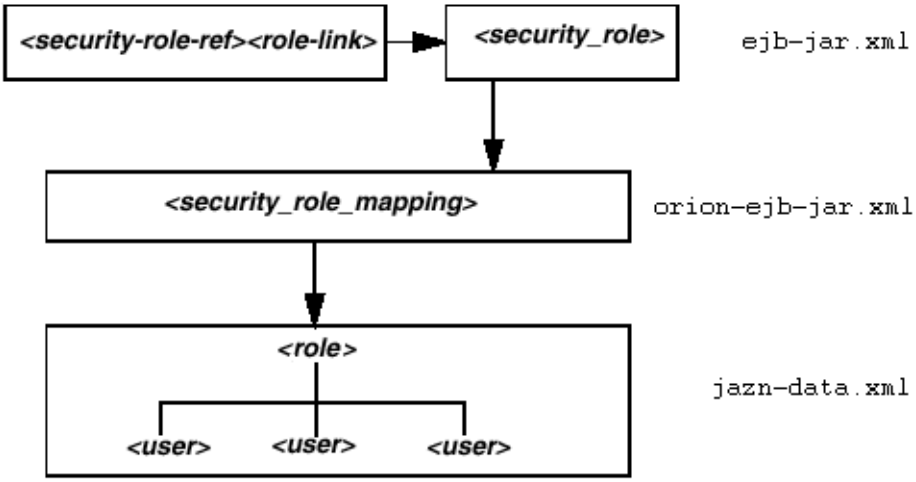
For authentication and authorization, this section focuses on XML configuration within the EJB deployment descriptors. EJB authorization is specified within the EJB and OC4J-specific deployment descriptors. You can manage the authorization piece of your security within the deployment descriptors, as follows:

- The EJB deployment descriptor describes access rules using logical roles.
- The OC4J-specific deployment descriptor maps the logical roles to concrete users and groups, which are defined either the JAZN or XML user managers.

Users and groups are identities known by the container. Roles are the *logical* identities each application uses to indicate access rights to its different objects. The username/passwords can be digital certificates and, in the case of SSL, private key pairs.

Thus, the definition and mapping of roles is demonstrated in Figure 12–1.

Figure 12–1 Role Mapping



Defining users, groups, and roles are discussed in the following sections:

- Specifying Users and Groups
- Specifying Logical Roles in the EJB Deployment Descriptor
- Specifying Unchecked Security for EJB Methods
- Specifying the runAs Security Identity
- Mapping Logical Roles to Users and Groups
- Specifying a Default Role Mapping for Undefined Methods
- Specifying Users and Groups by the Client

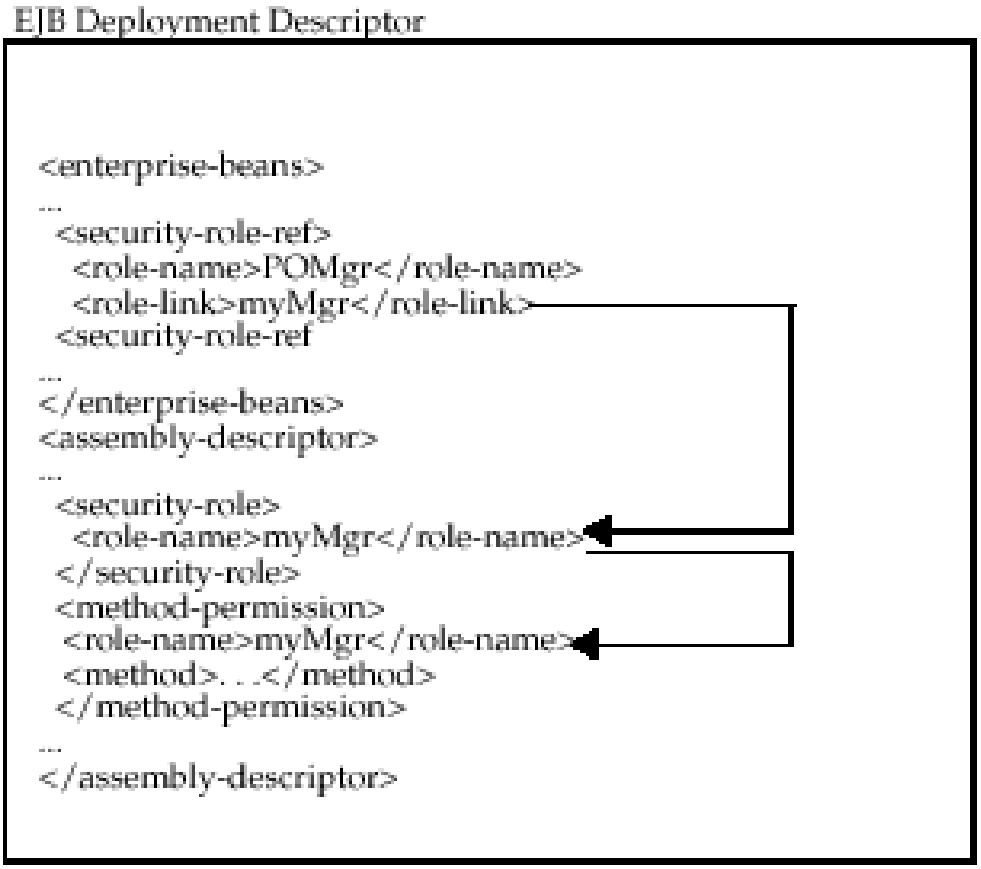
Specifying Users and Groups

OC4J supports the definition of users and groups—either shared by all deployed applications or specific to given applications. You define shared or application-specific users and groups within either the JAZN or XML user managers. See the *Oracle Application Server Containers for J2EE User's Guide* and *Oracle Application Server Containers for J2EE Services Guide*. for directions.

Specifying Logical Roles in the EJB Deployment Descriptor

As shown in Figure 12–2, you can use a logical name for a role within your bean implementation, and map this logical name to the correct security role or user. The mapping of the logical name to a database role is specified in the OC4J-specific deployment descriptor. See "Mapping Logical Roles to Users and Groups" on page 12-8 for more information.

Figure 12–2 Security Mapping



If you use a logical name for a database role within your bean implementation for methods such as `isCallerInRole`, you can map the logical name to an actual database role by doing the following:

1. Declare the logical name within the `<enterprise-beans>` section `<security-role-ref>` element. For example, to define a role used within the purchase order example, you may have checked, within the bean's implementation, to see if the caller had authorization to sign a purchase order. Thus, the caller would have to be signed in under a correct role. In order for the bean to not need to be aware of database roles, you can check `isCallerInRole` on a logical name, such as `POMgr`, because only purchase order managers can sign off on the order. Thus, you would define the logical security role, `POMgr` within the `<security-role-ref><role-name>` element within the `<enterprise-beans>` section, as follows:

```
<enterprise-beans>
...
  <security-role-ref>
   <role-name>POMgr</role-name>
   <role-link>myMgr</role-link>
  </security-role-ref>
</enterprise-beans>
```

The <role-link> element within the <security-role-ref> element can be the actual database role, which is defined further within the <assembly-descriptor> section. Alternatively, it can be another logical name, which is still defined more in the <assembly-descriptor> section and is mapped to an actual database role within the Oracle-specific deployment descriptor.

Note: The <security-role-ref> element is not required. You only specify it when using security context methods within your bean.

---

2. Define the role and the methods that it applies to. In the purchase order example, any method executed within the PurchaseOrder bean must have authorized itself as myMgr. Note that PurchaseOrder is the name declared in the <entity | session><ejb-name> element.

   Thus, the following defines the role as myMgr, the EJB as PurchaseOrder, and all methods by denoting the'*' symbol.

Note: The myMgr role in the <security-role> element is the same as the <role-link> element within the <enterprise-beans> section. This ties the logical name of POMgr to the myMgr definition.

```
<assembly-descriptor>
 <security-role>
  <description>Role needed purchase order authorization</description>
  <role-name>myMgr</role-name>
 </security-role>
 <method-permission>
  <role-name>myMgr</role-name>
  <method>
   <ejb-name>PurchaseOrder</ejb-name>
   <method-name>*</method-name>
  </method>
 </method-permission>
...
</assembly-descriptor>
```

After performing both steps, you can refer to POMgr within the bean's implementation and the container translates POMgr to myMgr.

Note: If you define different roles within the <method-permission> element for methods in the same EJB, the resulting permission is a union of all the method permissions defined for the methods of this bean.

The <method-permission><method> element is used to specify the security role for one or more methods within an interface or implementation. According to the EJB specification, this definition can be of one of the following forms:

1. Defining all methods within a bean by specifying the bean name and using the'*' character to denote all methods within the bean, as follows:

```
<method-permission>
  <role-name>myMgr</role-name>
  <method>
  <ejb-name>EJBNAME</ejb-name>
  <method-name>*</method-name>
  </method>
</method-permission>
```

2. Defining a specific method that is uniquely identified within the bean. Use the appropriate interface name and method name, as follows:

```
<method-permission>
  <role-name>myMgr</role-name>
  <method>
  <ejb-name>myBean</ejb-name>
  <method-name>myMethodInMyBean</method-name>
  </method>
</method-permission>
```

> **Note:** If there are multiple methods with the same overloaded name, the element of this style refers to all the methods with the overloaded name.

3. Defining a method with a specific signature among many overloaded versions, as follows:

```
<method-permission>
  <role-name>myMgr</role-name>
  <method>
      <ejb-name>myBean</ejb-name>
   <method-name>myMethod</method-name>
   <method-params>
      <method-param>javax.lang.String</method-param>
      <method-param>javax.lang.String</method-param>
       </method-params>
  </method>
</method-permission>
```

The parameters are the fully-qualified Java types of the method's input parameters. If the method has no input arguments, the <method-params> element contains no elements. Arrays are specified by the array element's type, followed by one or more pair of square brackets, such as int[ ][ ].

Specifying Unchecked Security for EJB Methods

If you want certain methods to not be checked for security roles, you define these methods as unchecked, as follows:

```
<method-permission>
  <unchecked/>
  <method>
     <ejb-name>EJBNAME</ejb-name>
     <method-name>*</method-name>
  </method>
</method-permission>
```

Instead of a `<role-name>` element defined, you define an `<unchecked/>` element. When executing any methods in the `EJBNAME` bean, the container does not check for security. Unchecked methods always override any other role definitions.

Specifying the runAs Security Identity

You can specify that all methods of an EJB execute under a specific identity. That is, the container does not check different roles for permission to run specific methods; instead, the container executes all of the EJB methods under the specified security identity. You can specify a particular role or the caller's identity as the security identity.

Specify the runAs security identity in the `<security-identity>` element, which is contained in the `<enterprise-beans>` section. The following XML demonstrates that the `POMgr` is the role under which all the entity bean methods execute.

```
<enterprise-beans>
 <entity>
 ...
  <security-identity>
     <run-as>
        <role-name>POMgr</role-name>
     </run-as>
  </security-identity>
...
 </entity>
</enterprise-beans>
```

Alternatively, the following XML example demonstrates how to specify that all methods of the bean execute under the identity of the caller:

```
<enterprise-beans>
 <entity>
 ...
  <security-identity>
     <use-caller-identity/>
  </security-identity>
...
 </entity>
</enterprise-beans>
```

Mapping Logical Roles to Users and Groups

You can use logical roles or actual users and groups in the EJB deployment descriptor. However, if you use logical roles, you must map them to the actual users and groups defined either in the JAZN or XML User Managers.

Map the logical roles defined in the application deployment descriptors to JAZN or XML User Manager users or groups through the `<security-role-mapping>` element in the OC4J-specific deployment descriptor.

- The `name` attribute of this element defines the logical role that is to be mapped.
- The `group` or `user` element maps the logical role to a group or user name. This group or user must be defined in the JAZN or XML User Manager configuration. See *Oracle Application Server Containers for J2EE User's Guide* and *Oracle Application Server Containers for J2EE Services Guide* for a description of the JAZN and XML User Managers.

Example 12–1 Mapping Logical Role to Actual Role

This example maps the logical role `POMGR` to the `managers` group in the `orion-ejb-jar.xml` file. Any user that can log in as part of this group is considered to have the `POMGR` role; thus, it can execute the methods of `PurchaseOrderBean`.

```
<security-role-mapping name="POMGR">
 <group name="managers" />
</security-role-mapping>
```

Note: You can map a logical role to a single group or to several groups.

To map this role to a specific user, do the following:

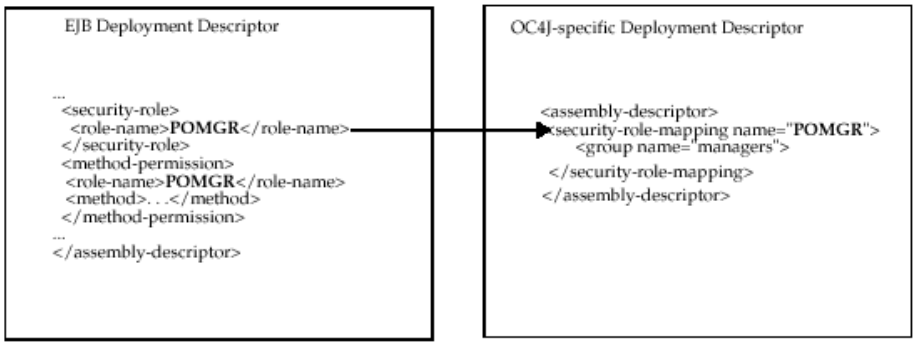
```
<security-role-mapping name="POMGR">
 <user name="guest" />
</security-role-mapping>
```

Lastly, you can map a role to a specific user within a specific group, as follows:

```
<security-role-mapping name="POMGR">
 <group name="managers" />
 <user name="guest" />
</security-role-mapping>
```

As shown in Figure 12–3, the logical role name for `POMGR` defined in the EJB deployment descriptor is mapped to `managers` within the OC4J-specific deployment descriptor in the `<security-role-mapping>` element.

Figure 12–3 Security Mapping



Notice that the `<role-name>` in the EJB deployment descriptor is the same as the name attribute in the `<security-role-mapping>` element in the OC4J-specific deployment descriptor. This is what identifies the mapping.

Specifying a Default Role Mapping for Undefined Methods

If any methods have not been associated with a role mapping, they are mapped to the default security role through the `<default-method-access>` element in the `orion-ejb-jar.xml` file. The following is the automatic mapping for any insecure methods:

```
<default-method-access>
   <security-role-mapping name="&lt;default-ejb-caller-role&gt;"
                          impliesAll="true" />
   </security-role-mapping>
</default-method-access>
```

The default role is `<default-ejb-caller-role>` and is defined in the `name` attribute. You can replace this string with any name for the default role. The `impliesAll` attribute indicates whether any security role checking occurs for these methods. This attribute defaults to true, which states that no security role checking occurs for these methods. If you set this attribute to false, the container will check for this default role on these methods.

If the `impliesAll` attribute is false, you must map the default role defined in the `name` attribute to a JAZN or XML user or group through the `<user>` and `<group>` elements. The following example shows how all methods not associated with a method permission are mapped to the "`others`" group.

```
<default-method-access>
   <security-role-mapping name="default-role" impliesAll="false" />
      <group name="others" />
   </security-role-mapping>
</default-method-access>
```

Specifying Users and Groups by the Client

In order for the client to access methods that are protected by users and groups, the client must provide the correct user or group name with a password that the JAZN or XML User Manager recognizes. And the user or group must be the same one as designated in the security role for the intended method. See "Specifying Credentials in EJB Clients" on page 12-10 for more information.

Specifying Credentials in EJB Clients

When you access EJBs in a *remote* container, you must pass valid credentials to this container.

- Stand-alone clients define their credentials in the `jndi.properties` file deployed with the EAR file.
- Servlets or JavaBeans running within the container pass their credentials within the `InitialContext`, which is created to look up the remote EJBs.

Credentials in JNDI Properties

Indicate the username (principal) and password (credentials) to use when looking up remote EJBs in the `jndi.properties` file.

For example, if you want to access remote EJBs as `POMGR/welcome`, define the following properties. The `factory.initial` property indicates that you will use the Oracle JNDI implementation:

```
java.naming.security.principal=POMGR
java.naming.security.credentials=welcome
java.naming.factory.initial=
   com.evermind.server.ApplicationClientInitialContextFactory
java.naming.provider.url=ormi://myhost/ejbsamples
```

In your application program, authenticate and access the remote EJBs, as shown in the following example:

```
InitialContext ic = new InitialContext();
CustomerHome =
(CustomerHome)ic.lookup("java:comp/env/purchaseOrderBean");
```

Credentials in the InitialContext

To access remote EJBs from a servlet or JavaBean, pass the credentials in the `InitialContext` object, as follows:

```
Hashtable env = new Hashtable();
env.put("java.naming.provider.url", "ormi://myhost/ejbsamples");
env.put("java.naming.factory.initial",
   "com.evermind.server.ApplicationClientInitialContextFactory");
env.put(Context.SECURITY_PRINCIPAL, "POMGR");
env.put(Context.SECURITY_CREDENTIALS, "welcome");
Context ic = new InitialContext (env);
CustomerHome =
   (CustomerHome)ic.lookup("java:comp/env/purchaseOrderBean")
```

13

Oracle HTTPS for Client Connections

This chapter describes the Oracle Application Server Containers for J2EE (Oracle Application Server Containers for J2EE) implementation of HTTPS that provides SSL functionality to client HTTP connections. The following topics are included:

> **Note:** For a general overview of configuring OC4J to use the Secure Sockets Layer, see Chapter 11, "Configuring OC4J and SSL". This chapter assumes that you have already obtained keys and certificates.

Introduction

This chapter discusses how to use the Secure Sockets Layer protocol to communicate securely between networked applications. It discusses using Oracle HTTPS and JSSE.

> **Note:** Secure communication between a client and Oracle HTTP Server is independent of secure communication between Oracle HTTP Server and OC4J. (Also note that the secure AJP protocol used between Oracle HTTP Server and OC4J is not visible to the end user.) This section covers only secure communication between OC4J and the client.

Requesting Client Authentication

OC4J supports a *client authentication* mode in which the server explicitly requests authentication from the client before the server will communicate with the client. In an Oracle Application Server environment, Oracle HTTP Server acts as the client to OC4J.

For client authentication, Oracle HTTP Server must have its own certificate and authenticate itself by sending a certificate and a certificate chain that ends with a root certificate. OC4J can be configured to accept only root certificates from a specified list in establishing a chain of trust back to a client.

A certificate that OC4J trusts is called a *trust point*. In the certificate chain from Oracle HTTP Server, the trust point is the first certificate that OC4J encounters that matches one in its own keystore. There are three ways to establish trust:

- The client certificate is in the keystore.
- One of the intermediate CA certificates in the certificate chain from Oracle HTTP Server is in the keystore.
- The root CA certificate in the certificate chain from Oracle HTTP Server is in the keystore.

OC4J verifies that the entire certificate chain up to and including the trust point is valid to prevent any forged certificates.

If you request client authentication with the `needs-client-auth` attribute, perform the following steps. See "Requesting Client Authentication" on page 11-8 for how to configure this attribute.

1. Decide which of the certificates in the chain from Oracle HTTP Server is to be your trust point. Ensure that you either have control over the issuance of certificates using this trust point or that you trust the certificate authority as an issuer.
2. Import the intermediate or root certificate in the server keystore as a trust point for authentication of the client certificate.

> **Note:** If you do not want OC4J to accept certain trust points, make sure these trust points are not in the keystore.

3. Execute the steps to create the client certificate (documented in Chapter 11, "Configuring OC4J and SSL"). The client certificate includes the intermediate or root certificate that is installed in the server. If you wish to trust another certificate authority, obtain a certificate from that authority.
4. Save the certificate in a file on Oracle HTTP Server.
5. Provide the certificate for the Oracle HTTP Server initiation of the secure AJP connection.

During secure communication between the client and OC4J, the following functionality is executed:

- The link (all communications) between the two is encrypted.
- OC4J is authenticated to the client. A "secret key" is securely exchanged and used for the encryption of the link.
- Optionally, if OC4J is in client-authentication mode, the client is authenticated to OC4J.

See Also:

- *Oracle Application Server Administrator's Guide* for information about Oracle Wallet Manager, PKI, and security fundamentals.
- Documentation for JSSE and the `java.net` packages at `http://www.java.sun.com`

Oracle HTTPS And Clients

HTTPS is vital to securing client-server interactions. For many server applications, HTTPS is handled by the Web server. However, any application that acts as a client, such as servlets that initiate connections to other Web servers, needs its own HTTPS implementation to make requests and to receive information securely from the server. Java application developers who are familiar with either the HTTP package, `HTTPClient`, or who are familiar with the Sun Microsystems, Inc., `java.net` package can easily use Oracle HTTPS to secure client interactions with a server.

Oracle HTTPS extends the `HTTPConnection` class of the `HTTPClient` package, which provides a complete HTTP client library. To support client HTTPS connections, several methods have been added to the `HTTPConnection` class that use the OracleSSL class, `OracleSSLCredential`.

Note: Oracle `HTTPClient` supports two different SSL implementations: the Java Secure Socket Extension (JSSE) and OracleSSL. This documentation discusses the two implementations separately.

HTTPConnection Class

The `HTTPConnection` class is used to create new connections that use HTTP, with or without SSL. To provide support for PKI (Public Key Infrastructure) digital certificates and wallets, the methods described in "Oracle HTTPS Example" on page 13-8 have been added to this class.

See Also: The `HTTPClient` Javadoc.

OracleSSLCredential Class (OracleSSL Only)

Security credentials are used to authenticate the server and the client to each other. Oracle HTTPS uses the Oracle Java SSL package, `OracleSSLCredential`, to load user certificates and trustpoints from base64 or DER-encoded certificates. (DER, part of the X.690 ASN.1 standard, stands for Distinguished Encoding Rules.)

The API for Oracle Java SSL requires that security credentials be passed to the HTTP connection before the connection is established. The `OracleSSLCredential` class is used to store these security credentials. Typically, a wallet generated by Oracle Wallet Manager is used to populate the `OracleSSLCredential` object. Alternatively, individual certificates can be added by using an `OracleSSLCredential` class API. After the credentials are complete, they are passed to the connection with the `setCredentials` method.

Overview of Oracle HTTPS Features

Oracle HTTPS supports HTTP 1.0 and HTTP 1.1 connections between a client and a server. To provide SSL functionality, new methods have been added to the `HTTPConnection` class of this package. These methods are used in conjunction with Oracle Java SSL to support cipher suite selection, security credential management with Oracle Wallet Manager, security-aware applications, and other features that are described in the following sections. Oracle HTTPS uses the Oracle Java SSL class, `OracleSSLCredential`, and it extends the `HTTPConnection` class of the `HTTPClient` package. `HTTPClient` supports two SSL implementations, OracleSSL and JSSE.

In addition to the functionality included in the `HTTPClient` package, Oracle HTTPS supports the following:

- Multiple cryptographic algorithms
- Certificate and key management with Oracle Wallet Manager
- Limited support for the `java.net.URL` framework
- Both the OracleSSL and JSSE SSL implementations

In addition, Oracle HTTPS uses the `HTTPClient` package to support

- HTTP tunneling through proxies
- HTTP proxy authentication

The following sections describe Oracle HTTPS features in detail:

SSL Cipher Suites

Before data can flow through an SSL connection, both sides of the connection must negotiate common algorithms to be used for data transmission. A set of such algorithms combined to provide a mix of security features is called a *cipher suite*. Selecting a particular cipher suite lets the participants in an SSL connection establish the appropriate level for their communications.

`HTTPClient` supports two different SSL implementations, each of which supports different cipher suites. These are discussed in this section.

Choosing a Cipher Suite

In general, you should prefer:

- RSA to Diffie-Hellman, because RSA defeats many security attacks.
- 3DES or RC4 128 to other encryption methods, because 3DES and RC4 128 have strong keys
- SHA1 digest to MD5, because SHA1 produces a stronger digest.

SSL Cipher Suites Supported by OracleSSL

OracleSSL supports the cipher suites listed in Table 13–1. Note that with NULL encryption, SSL is only used for authentication and data integrity purposes.

Table 13–1 Cipher Suites Supported By OracleSSL

Cipher Suite	Authentication	Encryption	Hash Function (Digest)
SSL_RSA_WITH_3DES_EDE_CBC_SHA	RSA	3DES EDE CBC	SHA1
SSL_RSA_WITH_RC4_128_SHA	RSA	RC4 128	SHA1
SSL_RSA_WITH_RC4_128_MD5	RSA	RC4 128	MD5
SSL_RSA_WITH_DES_CBC_SHA	RSA	DES CBC	SHA1
SSL_RSA_EXPORT_WITH_RC4_40_MD5	RSA	RC4 40	MD5
SSL_RSA_EXPORT_WITH_DES40_CBC_SHA	RSA	DES40 CBC	SHA1
SSL_DH_anon_WITH_3DES_EDE_CBC_SHA	DH anon	3DES EDE CBC	SHA1
SSL_DH_anon_WITH_RC4_128_MD5	DH anon	RC4 128	MD5
SSL_DH_anon_WITH_DES_CBC_SHA	DH anon	DES CBC	SHA1
SSL_DH_anon_EXPORT_WITH_RC4_40_MD5	DH anon	RC4 40	MD5
SSL_DH_anon_EXPORT_WITH_DES40_CBC_SHA	DH anon	DES40 CBC	SHA1
SSL_RSA_WITH_NULL_SHA	RSA	NULL	SHA1
SSL_RSA_WITH_NULL_MD5	RSA	NULL	MD5

SSL Cipher Suites Supported by JSSE

JSSE supports the cipher suites listed in Table 13–2. Note that with NULL encryption, SSL is only used for authentication and data integrity purposes.

Table 13–2 Cipher Suites Supported By JSSE

Cipher Suite	Authentication	Encryption	Hash Function (Digest)
SSL_RSA_WITH_3DES_EDE_CBC_SHA	RSA	3DES EDE CBC	SHA1
SSL_RSA_WITH_RC4_128_SHA	RSA	RC4 128	SHA1
SSL_RSA_WITH_RC4_128_MD5	RSA	RC4 128	MD5
SSL_RSA_WITH_DES_CBC_SHA	RSA	DES CBC	SHA1
SSL_RSA_EXPORT_WITH_RC4_40_MD5	RSA	RC4 40	MD5
SSL_DH_anon_WITH_3DES_EDE_CBC_SHA	DH anon	3DES EDE CBC	SHA1
SSL_DH_anon_WITH_RC4_128_MD5	DH anon	RC4 128	MD5
SSL_DH_anon_WITH_DES_CBC_SHA	DH anon	DES CBC	SHA1
SSL_DH_anon_EXPORT_WITH_RC4_40_MD5	DH anon	RC4 40	MD5
SSL_DH_anon_EXPORT_WITH_DES40_CBC_SHA	DH anon	DES40 CBC	SHA1
SSL_RSA_WITH_NULL_SHA	RSA	NULL	SHA1
SSL_RSA_WITH_NULL_MD5	RSA	NULL	MD5
SSL_DHE_DSS_WITH_DES_CBC_SHA	DH	DES CBC	SHA1
SSL_DHE_DSS_WITH_3DES_EDE_CBC_SHA	DH	3DES EDE CBC	SHA1
SSL_DHE_DSS_EXPORT_WITH_DES40_CBC_SHA	DH	DES40 CBC	SHA1

Access Information About Established SSL Connections

Users can access information about established SSL connections using the `getSSLSession` method of Oracle HTTPS. After a connection is established, users can retrieve the cipher suite used for the connection, the peer certificate chain, and other information about the current connection.

Security-Aware Applications Support

Oracle HTTPS uses Oracle Java SSL to provide security-aware applications support. When security-aware applications do not set trust points, Oracle Java SSL allows them to perform their own validation letting the handshake complete successfully only if a complete certificate chain is sent by the peer. When applications authenticate to the trustpoint level, they are responsible for authenticating individual certificates below the trustpoint.

After the handshake is complete, the application must obtain the SSL session information and perform any additional validation for the connection.

Security-unaware applications that need the trust point check must ensure that trust points are set in the HTTPS infrastructure.

> **See Also:** *Oracle Advanced Security Administrator's Guide* for information about Oracle Java SSL.

java.net.URL Framework Support

The `HTTPClient` package provides basic support for the `java.net.URL` framework with the `HTTPClient.HttpUrlConnection` class. However, many of the Oracle HTTPS features are supported through system properties only.

Features that are only supported through system properties are

- cipher suites selection option
- confidentiality only option
- server authentication option
- mutual authentication option
- security credential management with Oracle Wallet Manager

> **Note:** If the `java.net.URL` framework is used, then set the `java.protocol.handler.pkgs` system property to select the `HTTPClient` package as a replacement for the JDK client as follows:
>
> ```
> java.protocol.handler.pkgs=HTTPClient
> ```
>
> **See Also:**
>
> - "Specifying Default System Properties" on page 13-7 for information about configuring your client to use JSSE.
> - Documentation for the `java.net.URL` framework at
>
>   `http://java.sun.com`
> - *Oracle Application Server Administrator's Guide* for information about wallets and Oracle Wallet Manager.

Specifying Default System Properties

For many users of HTTPS it is desirable to specify some default properties in a non-programmatic way. The best way to accomplish this is through Java system properties which are accessible through the `java.lang.System` class. These properties are the only way for users of the `java.net.URL` framework to set security credential information. Oracle HTTPS recognizes the following properties:

- javax.net.ssl.KeyStore
- javax.net.ssl.KeyStorePassword
- Oracle.ssl.defaultCipherSuites (OracleSSL only)

The following sections describe how to set these properties.

javax.net.ssl.KeyStore

This property can be set to point to the text wallet file exported from Oracle Wallet Manager that contains the credentials that are to be used for a specific connection. For example:

```
javax.net.ssl.KeyStore=/etc/ORACLE/WALLETS/Default/default.txt
```

where *`default.txt`* is the name of the text wallet file that contains the credentials.

If no other credentials have been set for the HTTPS connection, then the file indicated by this property is opened when a handshake first occurs. If any errors occur while reading this file, then the connection fails and an `IOException` is thrown.

If you do not set this property, the application is responsible for verifying that the certificate chain contains a certificate that can be trusted. However, `HTTPClient` using Oracle SSL does verify that all of the certificates in the certificate chain, from the user certificate to the root CA, have been sent by the server and that all of these certificates contain valid signatures.

javax.net.ssl.KeyStorePassword

This property can be set to the password that is necessary to open the wallet file. For example:

```
javax.net.ssl.KeyStorePassword=welcome1
```

where *welcome1* is the password that is necessary to open the wallet file.

Potential Security Risk with Storing Passwords in System Properties

Storing the wallet file password as a Java system property can result in a security risk in some environments. To avoid this risk, use one of the following alternatives:

- If mutual authentication is not required for the application, use a text wallet that contains no private key. No password is needed to open these wallets.
- If a password is necessary, then do not store it in a clear text file. Instead, load the property dynamically before the `HTTPConnection` is started by using `System.setProperty()`. Unset the property after the handshake is completed.

Oracle.ssl.defaultCipherSuites (OracleSSL only)

This property can be set to a comma-delimited list of cipher suites. For example:

```
Oracle.ssl.defaultCipherSuites=
            SSL_RSA_WITH_DES_CBC_SHA,\
            SSL_RSA_EXPORT_WITH_RC4_40_MD5,\
            SSL_RSA_WITH_RC4_128_MD5
```

The cipher suites that you set this property to are used as the default cipher suites for new HTTPS connections.

> **See Also:** Table 13–1 on page 13-5 for a complete list of the cipher suites that are supported by OracleSSL.

Oracle HTTPS Example

The following is a simple program that uses Oracle HTTPS, `HTTPClient`, and OracleSSL to connect to a Web server, send a `GET` request, and fetch a Web page. The complete code for this program is presented here followed by sections that explain how Oracle HTTPS is used to set up secure connections.

```
import HTTPClient.HTTPConnection;
import HTTPClient.HTTPResponse;
import oracle.security.ssl.OracleSSLCredential;
import java.io.IOException;

public class HTTPSConnectionExample
{
```

```
public static void main(String[] args)
{
    if(args.length < 4)
    {
        System.out.println(
        "Usage: java HTTPSConnectionTest [host] [port] " +
        "[wallet] [password]");
        System.exit(-1);
    }

    String hostname = args[0].toLowerCase();
    int port = Integer.decode(args[1]).intValue();
    String walletPath = args[2];
    String password = args[3];

    HTTPConnection httpsConnection = null;
    OracleSSLCredential credential = null;

    try
    {
        httpsConnection = new HTTPConnection("https", hostname, port);
    }
    catch(IOException e)
    {
        System.out.println("HTTPS Protocol not supported");
        System.exit(-1);
    }

    try
    {
        credential = new OracleSSLCredential();
        credential.setWallet(walletPath, password);
    }
    catch(IOException e)
    {
        System.out.println("Could not open wallet");
        System.exit(-1);
    }
    httpsConnection.setSSLCredential(credential);

    try
    {
        httpsConnection.connect();
    }
    catch (IOException e)
    {
        System.out.println("Could not establish connection");
        e.printStackTrace();
        System.exit(-1);
    }

    javax.servlet.request.X509Certificate[] peerCerts = null;
    try
    {
        peerCerts =
          (httpsConnection.getSSLSession()).getPeerCertificateChain();
    }
```

```
            catch(javax.net.ssl.SSLPeerUnverifiedException e)
            {
                System.err.println("Unable to obtain peer credentials");
                System.exit(-1);
            }

            String peerCertDN =
              peerCerts[peerCerts.length -1].getSubjectDN().getName();
            peerCertDN = peerCertDN.toLowerCase();
            if(peerCertDN.lastIndexOf("cn="+hostname) == -1)
            {
                System.out.println("Certificate for " + hostname + " is issued to "
                  + peerCertDN);
                System.out.println("Aborting connection");
                System.exit(-1);
            }

            try
            {
                HTTPResponse rsp = httpsConnection.Get("/");
                System.out.println("Server Response: ");
                System.out.println(rsp);
            }
            catch(Exception e)
            {
                System.out.println("Exception occured during Get");
                e.printStackTrace();
                System.exit(-1);
            }
        }
    }
```

Initializing SSL Credentials In OracleSSL

This program example uses a wallet created by Oracle Wallet Manager to set up credential information. First the credentials are created and the wallet is loaded using

```
credential = new OracleSSLCredential();
credential.setWallet(walletPath, password);
```

After the credentials are created, they are passed to `HTTPSConnection` using

```
httpsConnection.setSSLCredential(credential);
```

The private key, user certificate, and trust points located in the wallet can now be used for the connection.

Verifying Connection Information

Although SSL verifies that the certificate chain presented by the server is valid and contains at least one certificate trusted by the client, that does not prevent impersonation by malicious third parties. An HTTPS standard that addresses this problem requires that HTTPS servers have certificates issued to their host name. Then it is the responsibility of the client to perform this validation after the SSL connection is established.

To perform this validation in this sample program, `HTTPSConnectionExample` establishes a connection to the server without transferring any data using the following:

```
httpsConnection.connect();
```

After the connection is established, the connection information, in this case the server certificate chain, is obtained with the following:

```
peerCerts = (httpsConnection.getSSLSession()).getPeerCertificateChain();
```

Finally the server certificate's common name is obtained with the following:

```
String peerCertDN = peerCerts[peerCerts.length -1].getSubjectDN().getName();
peerCertDN = peerCertDN.toLowerCase();
```

If the certificate name is not the same as the host name used to connect to the server, then the connection is aborted with the following:

```
if(peerCertDN.lastIndexOf("cn="+hostname) == -1)
{
    System.out.println("Certificate for " + hostname + " is issued to " +
        peerCertDN);
    System.out.println("Aborting connection");
        System.exit(-1);
}
```

Transferring Data Using HTTPS

It is important to verify the connection information before data is transferred from the client or from the server. The data transfer is performed in the same way for HTTPS as it is for HTTP. In this sample program a `GET` request is made to the server using the following:

```
HTTPResponse rsp = httpsConnection.Get("/");
```

Using HTTPClient with JSSE

Oracle Application Server supports HTTPS client connections using the Java Secure Socket Extension (JSSE). A client can configure `HTTPClient` to use JSSE as the underlying SSL provider.

Notes:

- The JSSE SSL implementation is not thread-safe; if you need to use SSL in a threaded application, use OracleSSL.
- For full information on JSSE, see the Sun documentation at `http://java.sun.com/products/jsse/`

`HTTPClient` still uses OracleSSL as the default provider, but the developer can easily change this by setting the `SSLSocketFactory` on the `HTTPConnection` class. Example 13–1 demonstrates how a client could configure HTTPClient to use JSSE for SSL communication.

Example 13–1 Using JSSE with HTTPClient

```
public void obtainHTTPSConnectionUsingJSSE() throws Exception
{
// set the trust store to the location of the client's trust store file
      // this value specifies the certificate authorities the client accepts
   System.setProperty("javax.net.ssl.trustStore", KEYSTORE_FILE);
   // creates the HTTPS URL
   URL testURL = new URL("https://" + HOSTNAME + ":" + HTTPS_PORTNUM);
   // call SSLSocketFactory.getDefault() to obtain the default JSSE implementation
  // of an SSLSocketFactory
   SSLSocketFactory socketFactory =
(SSLSocketFactory)SSLSocketFactory.getDefault();
   HTTPConnection connection = new HTTPConnection(testURL);

   // configure HTTPClient to use JSSE as the underlying
   // SSL provider
   connection.setSSLSocketFactory(socketFactory);
   // call connect to setup SSL handshake
   try
   {
       connection.connect();
   }
   catch (IOException e)
   {
       e.printStackTrace();    }

   HTTPResponse response = connection.Get("/index.html");

       }
```

Configuring HTTPClient To Use JSSE

The steps required to use JSSE with `HTTPClient` are as follows:

1. Create a truststore using the keytool.

   Notes:
   - For details of using the keytool, see `http://java.sun.com/j2se/1.3/docs/tooldocs/win32/keytool.html`
   - JSSE's implementation of SSL has some subtle differences from Oracle's implementation. Unlike in OracleSSL, if no truststore is set, the JDK default truststore will be used. This default will accept known certificate authorities, such as Verisign and Thawte. Many self-signed certificates will be rejected by this default.

2. Set the truststore property. A client wishing to use JSSE must specify the client truststore location in `javax.net.ssl.trustStore`. Unlike OracleSSL, the client does not need to set the `javax.net.ssl.keyStore` property.
3. Obtain the JSSE `SSLSocketFactory` by calling `SSLSocketFactory.getDefault()`.
4. Create an `HTTPClient` connection.

5. Configure the `HTTPClient` connection to use the JSSE implementation of SSL. `HTTPClient` can be configured to use JSSE in one of two ways:

    1. (**For each connection**) The client calls `HTTPConnection.setSSLSocketFactory(SSLSocketFactory factory)`

    2. (**Entire VM**) The client calls the static method: `HttpConnection.setDefaultSSLSocketFactory(SSLSocketFactory factory)`. This static method must be called before instantiating any `HTTPConnection` instances.

6. Call `HTTPConnection.connect()` before sending any HTTPS data. This allows the connection to verify the SSL handshaking that must occur between client and server before any data can be encrypted and sent.

7. Use the `HTTPConnection` instance normally. At this point, the client is set up to use `HTTPClient` with JSSE. There is no additional configuration necessary and basic usage is the same.

14

Password Management

This chapter discusses managing passwords within XML files. It contains the following sections:

Introduction

Many OC4J components require passwords for authentication. Embedding these passwords into deployment and configuration files poses a security risk, especially if the permissions on the files allow them to be read by any user. To avoid this problem, OC4J provides two solutions:

- *password obfuscation*, which replaces passwords stored in cleartext files with an encrypted version of the password. This is discussed in "Password Obfuscation In jazn-data.xml and jazn.xml".
- *password indirection*, which replaces cleartext passwords with information necessary to look up the password in another location. This is discussed in "Creating An Indirect Password".

Password Obfuscation In jazn-data.xml and jazn.xml

The JAAS configuration files, `jazn.xml` and `jazn-data.xml`, contain user names and passwords for JAAS authorization. To protect these files, OC4J uses password obfuscation.

Whenever you update `jazn.xml` or `jazn-data.xml`, OC4J reads the file, then rewrites it with obfuscated (encrypted) versions of all passwords. In all other OC4J configuration files, you can avoid exposing password cleartext by using password indirection, as explained in "Creating An Indirect Password" on page 14-2.

The OracleAS JAAS Provider does not obfuscate passwords in `orion-application.xml`. This means that you should not embed passwords within a `<jazn>` element that is stored in `orion-application.xml`.

Note: For security reasons, credentials stored in Oracle Internet Directory cannot usually be retrieved in decrypted (cleartext) format, which means that the LDAP-based JAAS Provider cannot be used as a password manager for your application. To resolve this, you can specify the XML-based JAAS Provider as your application's password manager even when your application uses the LDAP-based JAAS provider as the `UserManager`.

To do this, add the following entry to `application.xml`:

```
<password-manager>
 <jazn provider="XML"
  location=ORACLE_HOME/j2ee/instance/config/jazn-data.xml>
 </jazn>
</password-manager>
```

Otherwise, passwords are not obfuscated.

Hand-editing jazn-data.xml

If you prefer, you can directly edit `jazn-data.xml` with a text editor. The next time OC4J reads `jazn-data.xml`, it will rewrite the file with all passwords obfuscated and unreadable.

Setting the `clear` attribute of the `<credentials>` element to `true` enables you to use clear (human-readable) passwords in the `jazn-data.xml` file.

```
<credentials clear="true">welcome</credentials>
<credentials>!welcome</credentials>
```

Creating An Indirect Password

The following OC4J XML configuration and deployment files support password indirection in one or more entities:

- `data-sources.xml`—`password` attribute of `<data-source>` element
- `ra.xml` — `<res-password>` element
- `rmi.xml`— `password` attribute of `<cluster>` element
- `application.xml`— `password` attributes of `<resource-provider>` and `<commit-coordinator>` elements
- `jms.xml`— `<password>` element
- `internal-settings.xml`— `<sep-property>` element, attributes `name="keystore-password"` and `name="truststore-password"`

To make any of these passwords indirect, replace the literal password string with a string containing "`->`" followed by either the username or by the realm and username separated by a slash ("`/`").

Note: To begin a literal (non-indirect) password with the string "`->`", precede the password by "`->!`". For instance, you would represent the direct password "`->silly`" as "`->!->silly`".

Indirect Password Examples

- <data-source password="->Scott">— Use JaznUserManager to look up Scott in the JaznUserManager, and use the password stored there.
- <res-password="->customers/Scott">— Use JaznUserManager to look up Scott in the customers realm, and use the password stored there.
- <cluster password="martha">—The literal string "martha" is the password; the password is not indirect.

Specifying a UserManager In application.xml

The <password-manager> element in application.xml specifies the UserManager that the global application uses to look up indirect passwords. (See "Creating An Indirect Password" on page 14-2.) If this element is omitted, the UserManager of the global application is used for authentication and authorization of indirect passwords. The <jazn> element within a <password-manager> element can be different from the <jazn> element at the top level.

The <password-manager> element should always contain the path name of the instance-level <jazn-data.xml>.

For example, you can use an LDAP-based UserManager for the regular UserManager, but use an XML-based UserManager to authenticate indirect passwords. This is the only way to use indirect passwords in LDAP.

For full details, see"Specifying UserManagers" on page 4-6.

Note: It is possible to use pluggable UserManagers as password managers. However, if you use XMLUserManager as your password manager, principals.xml will not have passwords obfuscated.

15

Configuring CSIv2

Oracle Application Server Containers for J2EE supports the Common Secure Interoperability Version 2 protocol (CSIv2). CSIv2 specifies different conformance levels; Oracle Application Server Containers for J2EE complies with the EJB specification, which requires conformance level 0.

This chapter covers the following topics:

> **Note:** If your application uses JAAS, you must configure the OracleAS JAAS Provider to use CSIv2; see Table 4–2, " RealmLoginModule Options" for details.

Introduction to CSIv2 Security Properties

Common Secure Interoperability version 2 (CSIv2) is an Object Management Group (OMG) standard for a secure interoperable wire protocol that supports authorization and identity delegation. You configure CSIv2 properties in three different locations:

- `internal_settings.xml`
- `orion-ejb-jar.xml`
- `ejb_sec.properties`

These configuration files are discussed in "CSIv2 Security Properties in internal-settings.xml" on page 15-3, "CSIv2 Security Properties in orion-ejb-jar.xml" on page 15-5, "CSIv2 Security Properties in orion-ejb-jar.xml" on page 15-5, and "EJB Client Security Properties in ejb_sec.properties" on page 15-7.

EJB Server Security Properties in internal-settings.xml

You specify server security properties in `internal-settings.xml`.

> **Note:** You cannot edit `internal-settings.xml` with the Enterprise Manager.

This file specifies certain properties as values within `<sep-property>` entities. Table 15–1, " EJB Server Security Properties" contains a list of properties.

The table refers to *keystore* and *truststore* files, which use the Java Key Store (JKS), a JDK-specified format, to store keys and certificates. A keystore stores a map of private keys and certificates. A truststore stores trusted certificates for the certificate authorities (CAs; such as VeriSign and Thawte).

Table 15–1 EJB Server Security Properties

Property	Meaning
`port`	IIOP port number (defaults to `5555`)
`ssl`	`true` if IIOP / SSL is supported, `false` otherwise
`ssl-port`	IIOP / SSL port number (defaults to `5556`) This port is used for server-side authentication only. If your application uses client and server authentication, you also need to set `ssl-client-server-auth-port`.
`ssl-client-server-auth-port`	Port used for client and server authentication (defaults to `5557`). This is the port on which OC4J listens for SSL connections that require both client and server authentication. If not set, OC4J will listen on `ssl-port` + 1 for client-side authentication.
`keystore`	Name of keystore (used only if `ssl` is `true`)
`keystore-password`	the keystore password (used only if `ssl` is `true`)
`trusted-clients`	Comma-separated list of hosts whose identity assertions can be trusted. Each entry in the list can be an IP address, a host name, a host name pattern (for instance, `*.example.com`), or `*`; `*` alone means that all clients are trusted. The default is to trust no clients.
`truststore`	Name of truststore. If you do not specify a truststore for a server, OC4J uses the keystore as the truststore (used only if `ssl` is `true`).
`truststore-password`	Truststore password (can only be set if `ssl` is `true`)

> **Note:** In Table 15–1, the properties `keystore-password` and`truststore-password` support password indirection.

If Oracle Application Server Containers for J2EE is started by the Oracle Process Management Notification service (OPMN) in an Oracle Application Server (as opposed to standalone) environment, then ports specified in `internal-settings.xml` are ignored. If OPMN is configured to disable IIOP for a

particular Oracle Application Server Containers for J2EE instance, then, even though IIOP may be enable through `internal-settings.xml` (as pointed to by `server.xml`), IIOP is not enabled.

The following example shows a typical `internal-settings.xml` file:

```
<server-extension-provider name="IIOP"
        class="com.oracle.iiop.server.IIOPServerExtensionProvider">
    <sep-property name="port" value="5555" />
    <sep-property name="host" value="localhost" />
    <sep-property name="ssl" value="false" />
    <sep-property name="ssl-port" value="5556" />
    <sep-property name="ssl-client-server-auth-port" value="5557" />
    <sep-property name="keystore" value="keystore.jks" />
    <sep-property name="keystore-password" value="123456" />
    <sep-property name="truststore" value="truststore.jks" />
    <sep-property name="truststore-password" value="123456" />
    <sep-property name="trusted-clients" value="*" />
</server-extension-provider>
```

> **Note:** Although the default value of `port` is one less than the default value for `ssl-port`, this relationship is not required.

Here is the DTD for `internal-settings.xml`:

```
<!-- A server extension provider that is to be plugged in to the server.
-->
<!ELEMENT server-extension-provider (sep-property*) (#PCDATA)>
<!ATTLIST server-extension-provider name class CDATA #IMPLIED>
<!ELEMENT sep-property (#PCDATA)>
<!ATTLIST sep-property name value CDATA #IMPLIED>
<!-- This file contains internal server configuration settings. -->
<!ELEMENT internal-settings (server-extension-provider*)>
```

CSIv2 Security Properties in internal-settings.xml

This section discusses the semantics of the values you set within the `<sep-property>` element in `internal_settings.xml`. For details of syntax, see "EJB Server Security Properties in internal-settings.xml" on page 15-2.

To use the CSIv2 protocol with Oracle Application Server Containers for J2EE, you must both set `ssl` to `true` and specify an IIOP/SSL port (`ssl-port`).

- If you do not set `ssl` to `true`, then CSIv2 is not enabled. Setting `ssl` to `true` permits clients and servers to use CSIv2, but does not require them to communicate using SSL.
- If you do not specify an `ssl-port`, then no CSIv2 component tag is inserted by the server into the IOR, even if you configure an `<ior-security-config>` entity in `orion-ejb-jar.xml`.

When IIOP/SSL is enabled on the server, Oracle Application Server Containers for J2EE listens on two different sockets—one for server authentication alone and one for server and client authentication. You specify the server authentication port within the `<sep-property>` element; the server and client authentication listener uses the port number immediately following.

For SSL clients using server authentication alone, you can specify:

- Truststore only
- Both keystore and truststore.
- Neither

If you specify neither keystore nor truststore, the handshake may fail if there are no default truststores established by the security provider.

SSL clients using client-side authentication must specify both a keystore and a truststore. The certificate from the keystore is used for client authentication.

CSIv2 Security Properties in ejb_sec.properties

If the client does not use client-side SSL authentication, you must set `client.sendpassword` in the `ejb_sec.properties` file in order for the client runtime to insert a security context and send the user name and password. You must also set `server.trustedhosts` to include your server.

Note: Server-side authentication takes precedence over a user name and password.

If the client does use client-side SSL authentication, the server extracts the `DistinguishedName` from the client's certificate and then looks it up in the corresponding user manager; it does not perform password authentication.

Trust Relationships

Two types of trust relationships exist:

- Clients trusting servers to transmit user names and passwords using non-SSL connections
- Servers trusting clients to send *identity assertions*, which delegate an originating client's identity

Clients list trusted servers in the EJB property `oc4j.iiop.trustedServers`. See Table 15–2, " EJB Client Security Properties" on page 15-7 for details. Servers list trusted clients in the `trusted-client` property of the `<sep-property>` element in `internal-settings.xml`. See "EJB Server Security Properties in internal-settings.xml" on page 15-2 for details.

Conformance level 0 of the EJB standard defines two ways of handling trust relationships:

- *presumed trust*, in which the server presumes that the logical client is trustworthy, even if the logical client has not authenticated itself to the server, and even if the connection is not secure
- *authenticated trust*, in which the target trusts the intermediate server based on authentication either at the transport level or in the `trusted-client` list or both

---

Note: You can also configure the server to both require SSL client-side authentication and also specify a list of trusted client (or intermediate) hosts that are allowed to insert identity assertions.

Oracle Application Server Containers for J2EE provides both kinds of trust; you configure trust using the bean's <ior-security-config> element in orion-ejb-jar.xml. See "CSIv2 Security Properties in orion-ejb-jar.xml" on page 15-5 for details.

CSIv2 Security Properties in orion-ejb-jar.xml

This section discusses the CSIv2 security properties for an EJB. You configure each individual bean's CSIv2 security policies in its orion-ejb-jar.xml. The CSIv2 security properties are specified within <ior-security-config> elements. Each element contains a <transport-config> element, an <as-context> element, and a <sas-context> element.

The <transport-config> element

This element specifies the transport security level. Each element within <transport-config> must be set to supported, required, or none. None means that the bean neither supports nor uses that feature; supports means that the bean permits the client to use the feature; required means that the bean insists that the client use the feature. The elements are:

- <integrity>—Is there a guarantee that all transmissions are received exactly as they were transmitted?
- <confidentiality>—Is there a guarantee that no third party was able to read transmissions?
- <establish-trust-in-target>—Does the server authenticate itself to the client?
- <establish-trust-in-client>—Does the client authenticate itself to the server?

Notes: If you set <establish-trust-in-client> to required, this overrides specifying username_password in <as-context>. If you do this, you must also set the <required> node value in the <as-context> section to false; otherwise access permission issues will arise.

Setting any of the <transport-config> properties to required means that the bean will use RMI/IIOP/SSL to communicate.

The <as-context> element

This element specifies the message-level authentication properties.

- <auth-method>—Must be set to either username_password or none. If set to username_password, beans use user names and passwords to authenticate the caller.
- <realm>—Must be set to default at this release.
- <required>—If set to true, the bean requires the caller to specify a user name and password.

The <sas-context> element

This element specifies the identity delegation properties. It has one element, `<caller-propagation>`, which can be set to `supported`, `required`, or `none`. If the `<caller-propagation>` element is set to `supported`, then this bean accepts delegated identities from intermediate servers. If it is set to `required`, then this bean requires all other beans to transmit delegated identities. If set to `none`, this bean does not support identity delegation.

An example:

```
<ior-security-config>
  <transport-config>
    <integrity>supported</integrity>
    <confidentiality>supported</confidentiality>
    <establish-trust-in-target>supported</establish-trust-in-target>
    <establish-trust-in-client>supported</establish-trust-in-client>
  </transport-config>
  <as-context>
    <auth-method>username_password</auth-method>
    <realm>default</realm>
    <required>true</required>
  </as-context>
  <sas-context>
    <caller-propagation>supported</caller-propagation>
  </sas-context>
</ior-security-config>
```

DTD

The DTD for the `<ior-security-config>` element is:

```
<!ELEMENT ior-security-config (transport-config?, as-context?
sas-context?) >
<!ELEMENT transport-config (integrity, confidentiality,
establish-trust-in-target, establish-trust-in-client) >
<!ELEMENT as-context (auth-method, realm, required) >
<!ELEMENT sas-context (caller-propagation) >
<!ELEMENT integrity (#PCDATA) >
<!ELEMENT confidentiality (#PCDATA)>
<!ELEMENT establish-trust-in-target (#PCDATA) >
<!ELEMENT establish-trust-in-client (#PCDATA) >
<!ELEMENT auth-method (#PCDATA) >
<!ELEMENT realm (#PCDATA) >
<!ELEMENT required (#PCDATA)> <!-- Must be true or false -->
<!ELEMENT caller-propagation (#PCDATA) >
```

EJB Client Security Properties in ejb_sec.properties

Any client, whether running inside a server or not, has EJB security properties. Table 15–2 lists the EJB client security properties controlled by the `ejb_sec.properties` file. By default, Oracle Application Server Containers for J2EE searches for this file in the current directory when running as a client or in *`J2EE_HOME`*`/config` when running in the server. You can specify this file's location explicitly with `-Dejb_sec_properties_location=`*`pathname`*.

Table 15–2 EJB Client Security Properties

Property	Meaning
`# oc4j.iiop.keyStoreLoc`	The path name for the keystore.
`# oc4j.iiop.keyStorePass`	The password for the keystore.
`# oc4j.iiop.trustStoreLoc`	The path name for the truststore.
`# oc4j.iiop.trustStorePass`	The password for the truststore.
`# oc4j.iiop.enable.clientauth`	Whether the client supports client-side authentication. If this property is set to `true`, you must specify a keystore location and password.

`oc4j.iiop.ciphersuites`	Which cipher suites are to be enabled. The valid cipher suites are:
	`TLS_RSA_WITH_RC4_128_MD5`
	`SSL_RSA_WITH_RC4_128_MD5`
	`TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA`
	`SSL_DHE_DSS_WITH_3DES_EDE_CBC_SHA`
	`TLS_RSA_EXPORT_WITH_RC4_40_MD5`
	`SSL_RSA_EXPORT_WITH_RC4_40_MD5`
	`TLS_DHE_DSS_EXPORT_WITH_DES40_CBC_SHA`
	`SSL_DHE_DSS_EXPORT_WITH_DES40_CBC_SHA`

`nameservice.useSSL`	Whether to use SSL when making the initial connection to the server.
`client.sendpassword`	Whether to send user name and password in clear form (unencrypted) in the service context when not using SSL. If this property is set to `true`, the user name and password are sent only to servers listed in the `trustedServer` list.
`oc4j.iiop.trustedServers`	A list of servers that can be trusted to receive passwords sent in clear form. Has no effect if `client.sendpassword` is set to `false`. The list is comma-separated. Each entry in the list can be an IP address, a host name, a host name pattern (for instance, `*.example.com`), or `*`; `*` alone means that all servers are trusted.

Note: The properties marked with a # can be set either in `ejb_sec.properties` or as system properties. The settings in `ejb_sec.properties` always override settings specified as system properties.

16

J2EE Connector Architecture Security

This chapter describes the security issues affecting the J2EE Connector Architecture in an Oracle Application Server Containers for J2EE (OC4J) application. For full information on the J2EE Connector Architecture, see the *Oracle Application Server Containers for J2EE Services Guide*. This chapter covers the following topics:

- Deploying Resource Adapters
- Specifying Container-Managed or Component-Managed Sign-On
- Authentication in Container-Managed Sign-On

Deploying Resource Adapters

This section discusses deployment descriptors, deploying standalone resource adapters, and deploying embedded resource adapters.

Oracle Application Server Containers for J2EE supports three deployment descriptors: `ra.xml`, `oc4j-ra.xml`, and `oc4j-connectors.xml`. The `ra.xml` descriptor is normally supplied with the resource adapter. Whenever you deploy a resource adapter within an EAR file, Oracle Application Server Containers for J2EE generates `oc4j-connectors.xml` and `oc4j-ra.xml`. You should manually edit the second file.

The oc4j-ra.xml Descriptor

The `oc4j-ra.xml` descriptor provides Oracle Application Server Containers for J2EE-specific deployment information (Java Naming and Directory Interface (JNDI) path name and connector properties) for resource adapters. For each resource adapter, `oc4j-ra.xml` contains one or more `<connector-factory>` elements specifying a JNDI name corresponding to a set of configuration parameter values. Oracle Application Server Containers for J2EE binds each connection into the proper JNDI namespace location as a `ConnectionFactory` instance.

A `<connector-factory>` element can contain an optional `<security-config>` element that describes how to supply user names and passwords to the EIS.

The <security-config> Element

The <security-config> element specifies the user name and password for container-managed sign-ons.

There are two ways of supplying this information in the <security-config> element of the oc4j-ra.xml file:

- Specifying mapping sub-elements explicitly (in the <principal-mapping-entries> sub-element)
- Specifying the name of a user-created mapping class that either implements oracle.j2ee.connector.PrincipalMapping or inherits from oracle.j2ee.AbstractPrincipalMapping (in the <principal-mapping-interface> sub-element)

Authentication issues are discussed in detail in "Authentication in Container-Managed Sign-On" on page 16-5. This section discusses only the syntax for the <security-config> element.

A <security-config> element contains either a <principal-mapping-entries> element, specifying user names and passwords explicitly; a <principal-mapping-interface> element, specifying the name of the mapping class; or a <jaas-module> element, specifying the JAAS module to be used for authentication.

```
<security-config>
  <principal-mapping-entries>                        // 1
     <default-mapping>                               // 2
        <res-user>username</res-user>                // 3
        <res-password>password</res-password>        // 4
     </default-mapping>
     <principal-mapping-entry>                       // 5
        <initiating-user>iuname</initiating-user> // 6
        <res-user>username</res-user>
        <res-password>password</res-password>
     </principal-mapping-entry>
  </principal-mapping-entries>

  <principal-mapping-interface>                      // 7
    <impl-class>classname</impl-class>             // 8
    <property name="propname"
              value="propvalue" />                 // 9
  </principal-mapping-interface>

  <jaas-module>                                      // 10
      <jaas-application-name>                        // 11
         appname
      </jaas-application-name>
  </jaas-module>
</security-config>
```

1. <principal-mapping-entries>:

   Provides a declarative specification for resource mapping. This element begins with an optional <default-mapping> element; it continues with one or more <principal-mapping-entry> elements.

2. <default-mapping>: specifies the user name and password for the default resource principal.

3. <res-user>: specifies user name.

4. `<res-password>`: specifies password.

   Note: This element supports password indirection. For more information, refer to "Creating An Indirect Password" on page 14-2.

5. `<principal-mapping-entry>`: specifies a mapping from a single initiating principal to a resource principal and password.
6. `<initiating-user>`: specifies the initiating principal.
7. `<principal-mapping-interface>`: specifies information necessary to employ user-created classes to provide mappings.
8. `<impl-class>`: specifies the name of the user-provided `PrincipalMapping` implementation.
9. `<property name="`*`propname`*`" value="`*`propvalue`*`">`: specifies information specific to your `PrincipalMapping` implementation: for instance, the path of the principal mapping file, or LDAP server connection information. (This element is optional and it can be repeated.)
10. `<jaas-module>`: specifies the JAAS module that is used for authentication. It has only one element, `<jaas-application-name>`.
11. `<jaas-application-name>`: specifies the name of the JAAS module that is used for authentication.

The oc4j-connectors.xml Descriptor

The `oc4j-connectors.xml` descriptor configures the resource adapters that are deployed by `oc4j-ra.xml`. The `oc4j-connectors.xml` descriptor lists the standalone resource adapters that are deployed in this Oracle Application Server Containers for J2EE instance, as well as the resource adapters that are embedded within an application. This descriptor contains, for each individual connector, a `connector>` element that specifies the name and path name for the connector. Each `<connector>` element contains a `<security-permission>` element that defines the permissions granted to each resource adapter. The syntax is:

`<security-permission enabled="`*`booleanvalue`*`">`
This element specifies the permissions to be granted to each resource adapter. Each `<security-permission>` contains a `<security-permission-spec>` that conforms to the Java 2 Security policy file syntax.

Oracle Application Server Containers for J2EE automatically generates a `<security-permission>` element in `oc4j-connectors.xml` for each `<security-permission>` element in `ra.xml`. Each generated element has the `enabled` attribute set to `false`. Setting the `enabled` attribute to `true` grants the named permission.

```
<oc4j-connectors>
  <connector name="myEIS" path="eis.rar">
  . . .
    <security-permission>
      <security-permission-spec enabled="false">
        grant {permission java.lang.RuntimePermission "LoadLibrary", *'};
      </security-permission-spec>
    </security-permission>
  </connector>
</oc4j-connectors>
```

Specifying Container-Managed or Component-Managed Sign-On

Applications can use either application components or the Oracle Application Server Containers for J2EE application server to manage resource-adapter sign-on to the EIS system. Specify the manager using the `<res-auth>` deployment descriptor element for EJB or Web components. If `<res-auth>` is set to `Application`, then the application component signs on to the EIS programmatically. The application component is responsible for providing explicit security information for the sign-on. If `<res-auth>` is set to `Container`, then Oracle Application Server Containers for J2EE provides the resource principal and credentials that are required for signing on to the EIS.

Example:

```
Context initctx = new InitialContext();
// perform JNDI lookup to obtain a connection factory
javax.resource.cci.ConnectionFactory cxf =

(javax.resource.cci.ConnectionFactory)initctx.lookup("java:com/env/eis/MyEIS");
  // For container-managed sign-on, no security information is passed in the
getConnection call
  javax.resource.cci.Connection cx = cxf.getConnection();
  // If component-managed sign-on is specified, the code should instead provide
explicit security
  // information in the getConnection call
  // We need to get a new ConnectionSpec implementation instance for setting login
  // attributes
  com.myeis.ConnectionSpecImpl connSpec = ...
  connSpec.setUserName("EISuser");
  connSpec.setPassword("EISpassword");
  javax.resource.cci.Connection cx = cxf.getConnection(connSpec);
```

In either case, the `createManagedConnection` method in the resource adapter's implementation of `javax.resource.spi.ManagedConnectionFactory` interface is called to create a physical connection to the EIS.

If you specify component-managed sign-on, then Oracle Application Server Containers for J2EE invokes the `createManagedConnection` method with a null `Subject` and the `ConnectionRequestInfo` object that is passed in from the application component code. If you specify container-managed sign-on, then Oracle Application Server Containers for J2EE provides a `javax.security.auth.Subject` object to the `createManagedConnection` method. The content of the `Subject` object depends on the value in the `<authentication-mechanism-type>` and `<credential-interface>` elements in the resource adapter deployment descriptor.

If `<authentication-mechanism-type>` is `BasicPassword` and `<credential-interface>` is `javax.resource.spi.security.PasswordCredential`, then the `Subject` object must contain `javax.resource.spi.security.PasswordCredential` objects in the private credential set.

On the other hand, if `<authentication-mechanism-type>` is Kerberos version 5 (Kerbv5) or any other non-password-based authentication mechanism, and `<credential-interface>` is `javax.resource.spi.security.GenericCredential`, then the `Subject` object must contain credentials represented by instances of implementers of the `javax.resource.spi.security.GenericCredential` interface. The

`GenericCredential` interface is used for resource adapters that support non-password-based authentication mechanisms, such as Kerberos.

Authentication in Container-Managed Sign-On

When using container-managed sign-on, Oracle Application Server Containers for J2EE must provide a resource principal and its credentials to the EIS. The principal and credentials can be obtained in one of the following ways:

- Configured Identity: the resource principal is independent of the initiating or caller principal and can be configured at deployment time in a deployment descriptor.
- Principal Mapping: the resource principal is determined by a mapping from the identity and security attributes of the initiating or caller principal.
- Caller Impersonation: the resource principal acts on behalf of an initiating or caller principal by delegating the caller's identity and credentials to the EIS.
- Credentials Mapping: the resource principal is identical to the initiating or caller principal, but with its credential mapped from the authentication type that Oracle Application Server Containers for J2EE uses to the authentication type that the EIS uses. An example would be to map a public key certificate-based credential associated with a principal to a Kerberos credential.

Oracle Application Server Containers for J2EE supports all these methods with three authentication mechanisms:

- JAAS Pluggable Authentication
- User-Created Authentication Classes
- Modifying oc4j-ra.xml

The following sections discuss these mechanisms in detail.

JAAS Pluggable Authentication

Oracle Application Server Containers for J2EE furnishes a JAAS pluggable authentication framework that conforms to Appendix C in the Connector Architecture 1.0 specification. With this framework, an application server and its underlying authentication services remain independent from each other, and new authentication services can be plugged in without requiring modifications to the application server.

Authentication services can obtain resource principals and credentials using any of the following modules:

- Principal Mapping JAAS module
- Credential Mapping JAAS module
- Kerberos JAAS module (for Caller Impersonation)

The JAAS login modules can be furnished by the customer, the EIS vendors, or the resource adapter vendors. Login modules must implement the `javax.security.auth.spi.LoginModule` interface, as documented in the Sun JAAS specification.

Oracle Application Server Containers for J2EE provides initiating user subjects to login modules by passing an instance of `javax.security.auth.Subject` containing any public certificates and an instance of `oracle.j2ee.connector.InitiatingPrincipal` representing the Oracle

Application Server Containers for J2EE user. Oracle Application Server Containers for J2EE can pass a null `Subject` if there is no authenticated user (that is, an anonymous user). The JAAS login module's login method must, based on the initiating user, find the corresponding resource principal and create new `PasswordCredential` or `GenericCredential` instances for the resource principal. The resource principal and credential objects are then added to the initiating `Subject` in the `commit` method. The resource credential is passed to the `createManagedConnection` method in the `javax.resource.spi.ManagedConnectionFactory` implementation that is provided by the resource adapter. If a null `Subject` is passed, the JAAS login module is responsible for creating a new `javax.security.auth.Subject` containing the resource principal and the appropriate credential.

The InitiatingPrincipal and InitiatingGroup Classes

The classes `oracle.j2ee.connector.InitiatingPrincipal` and `oracle.j2ee.connector.InitiatingGroup` represent Oracle Application Server Containers for J2EE users to the JAAS login modules. Oracle Application Server Containers for J2EE creates instances of `oracle.j2ee.connector.InitiatingPrincipal` and incorporates them into the Subject that is passed to the `initialize` method of the login modules. The `oracle.j2ee.connector.InitiatingPrincipal` class implements the `java.security.Principal` interface and adds the method `getGroups()`.

```
/**
 * Returns a Set of groups (or roles in JAZN terminology) that this
 * principal is a member of.
 *
 * @return A set of InitiatingGroup objects representing the groups
 *      that this pricipal belongs to.
 */
public Set getGroups()
```

The `getGroups` method returns a `java.util.Set` of `oracle.j2ee.connector.InitiatingGroup` objects, representing the Oracle Application Server Containers for J2EE groups or JAZN roles for this Oracle Application Server Containers for J2EE user. The group membership is defined in Oracle Application Server Containers for J2EE-specific descriptor files such as `principals.xml` or `jazn-data.xml`, depending on the user manager. The `oracle.j2ee.connector.InitiatingGroup` class implements but does not extend the `java.security.Principal` interface.

Login modules can use `getGroups()` to provide mappings between Oracle Application Server Containers for J2EE groups and EIS users. The `java.security.Principal` interface methods support mappings between Oracle Application Server Containers for J2EE users and EIS users. Login modules do not need to refer to the `oracle.j2ee.connector.InitiatingPrincipal` and `oracle.j2ee.connector.InitiatingGroup` classes if they do not provide mappings between Oracle Application Server Containers for J2EE groups and EIS users.

JAAS and the <connector-factory> Element

Each `<connector-factory>` element in `oc4j-ra.xml` can specify a different JAAS login module. Specify a name for the connector factory configuration in the `<jaas-module>` element. Here is an example of a `<connector-factory>` element in `oc4j-ra.xml` that uses JAAS login modules for container-managed sign-on:

```
  <connector-factory connector-name="myBlackbox" location="eis/myEIS1">
    <description>Connection to my EIS</description>
    <config-property name="connectionURL"
value="jdbc:oracle:thin:@localhost:5521:orcl" />
    <security-config>
      <jaas-module>
        <jaas-application-name>JAASModuleDemo</jaas-application-name>
      </jaas-module>
    </security-config>
  </connector-factory>
```

In JAAS, you must specify which `LoginModule` to use for a particular application, and in what order to invoke the `LoginModule`s. JAAS uses the value that are specified in the `<jaas-application-name>` element to look up `LoginModule`s.

User-Created Authentication Classes

Oracle Application Server Containers for J2EE provides the `oracle.j2ee.connector.PrincipalMapping` interface for principal mapping.

```
package oracle.j2ee.connector;

public interface PrincipalMapping
{
/**
* Initializes the various settings for the PrincipalMapping implementation class.
* Implementation class may use the properties for setting default user name and
* password, LDAP connect info, or default mapping.
*
* OC4J will pass the properties specified in the <principal-mapping-interface>
* element in oc4j-ra.xml to this method.
*
* @param prop A Properties object containing the set up information required
*             by the implementation class.
*/
  public void init(Properties prop);

/**
* The ManagedConnectionFactory instance that can be used in creating a
   * PasswordCredential.
   *
 * @param mcf The ManagedConnectionFactory instance that is needed when
  *creating a PasswordCredential instance
  */
  public void setManagedConnectionFactory(ManagedConnectionFactory mcf);

  /**
* Passes the authentication mechanism(s) supported by the resource
* adapter to the PrincipalMapping implementation class.
   * The key of the map passed is a String containing the supported mechanism
* type, such as "BasicPassword", or "Kerbv5". The value is a String
  * containig the corresponding credentials interface as declared in ra.xml,
* such as "javax.resource.spi.security.PasswordCredential".
  *
 * The map may contain multiple elements if the resource adatper supports
  * multiple authentication mechanisms.
   *
 * @param authMechanisms The authentication mechanisms and their corresponding
   *  credentials intereface supported by the resource adapter
  */
```

```
  public void setAuthenticationMechanisms(Map authMechanisms);

    /**
* This is the method that performs the principal mapping. An application user
   * subject is passed, and the implemetation of this method should return
   * a subject for use by the resource adapter to log in to the EIS resource
* according to the Connector specifications.
   *
 * OC4J will only called this method for container-managed sign on.
*
 * @param initiatingSubject A Subject containing the application server logged
   *     in principals and public credentials.
     *
    * @return A Subject for use by resource adapter to log in to the remote EIS.
    *      It may return null if the proper resource principal cannot be
determined.
  */
  public Subject mapping(Subject initiatingSubject);
}
```

The `mapping` method must return a `Subject` containing the resource principal and credential. The `Subject` that is returned must adhere to either option A or option B in section 8.2.6 of the Connector Architecture 1.0 specification. Oracle Application Server Containers for J2EE invokes the `mapping` method with the initiating user as the `initiatingPrincipal`.

Oracle Application Server Containers for J2EE also provides the abstract class `oracle.j2ee.connector.AbstractPrincipalMapping`. This class furnishes a default implementation of the `setManagedConnectionFactory()` and `setAuthenticationMechanism()` methods, as well as utility methods to determine whether the resource adapter supports the `BasicPassword` or Kerberos version 5 (Kerbv5) authentication methods, and a method for extracting the `Principal` from the application server user `Subject`. By extending the `oracle.j2ee.connector.AbstractPrincipalMapping` class, developers need only implement the `init` and `mapping` methods.

Here are the utility methods provided by the `oracle.j2ee.connector.AbstractPrincipalMapping` class:

```
/**
   *  Utility method provided by this abstract class to return
  *  the ManagedConnectionFactory instance for use to create a
    *  PasswordCredentials object
   *
    *  @return The ManagedConnectionFactory instance that is needed when
    *    creating a PasswordCredential instance
    */
  public ManagedConnectionFactory getManagedConnectionFactory()

   /**
   * Utility method provided by this abstract class to return the Map
   * of all authentication mechanisms supported by this resource adapter.
  * The key of the map passed is a String containing the supported mechanism
   * type, such as "BasicPassword", or "Kerbv5". The value is a String
  * containig the corresponding credentials interface as declared in ra.xml,
   * such as "javax.resource.spi.security.PasswordCredential".
  *
    * @return The authentication mechanisms and their corresponding
      *      credentials intereface supported by the resource adpater
```

```
 */
  public Map getAuthenticationMechanisms()

   /**
 * Utility method provided by this abstract class to return whether
 * BasicPassword authention mechanism is supported by this resource
 * adapter.
 *
  * @return true if BasicPassword authentication mechanism is supported
 *      by the resource adapter, false otherwise.
*/
  public boolean isBasicPasswordSupported()

  /**
 * Utility method provided by this abstract class to return whether
 * Kerbv5 authention mechanism is supported by this resource
* adapter.
 *
  * @return true if Kerbv5 authentication mechanism is supported
*      by the resource adapter, false otherwise.
*/
  public boolean isKerbv5Supported()

 /**
 * Utility method provided by this abstract class to extract the
    * Principal object from the given application server user subject
 * passed from OC4J.
*
  * @param subject The application server user subject passed from
   *       OC4J.
*
  * @return The principal extracted from the given subject
   */
  public Principal getPrincipal(Subject subject)
```

After you create your implementation class, copy a JAR file containing the class into the directory containing the decompressed RAR file. This directory is typically *OC4J_HOME*/applications/application_name/*rar-name*. After copying the file, edit oc4j-ra.xml to contain a <principal-mapping-interface> element for the new class; see "The <security-config> Element" on page 16-2 for details.

Extending AbstractPrincipalMapping

This simple example demonstrates how to extend the oracle.j2ee.connector.AbstractPrincipalMapping abstract class to provide a principal mapping that always maps the user to the default user and password. Specify the default user and password by using properties under the <principal-mapping-interface> element in oc4j-ra.xml.

The PrincipalMapping class is called MyMapping. It is defined as follows:

```
package com.acme.app;

import java.util.*;
import javax.resource.spi.*;
import javax.resource.spi.security.*;
import oracle.j2ee.connector.AbstractPrincipalMapping;
import javax.security.auth.*;
import java.security.*;
```

```
public class MyMapping extends AbstractPrincipalMapping
{
  String m_defaultUser;

   String m_defaultPassword;

    public void init(Properties prop)
    {
      if (prop != null)
      {
           // Retrieves the default user and password from the properties
         m_defaultUser = prop.getProperty("user");
           m_defaultPassword = prop.getProperty("password");
      }
    }

    public Subject mapping(Subject initiatingSubject)
    {
      // This implementation only supporst BasicPassword authentication
      // mechanism. Return if the resource adapter does not support it.
      if (!isBasicPasswordSupported())
            return null;

      // Use the utility method to retrieve the Principal from the
      // OC4J user. This code is included here only as an example.
      // The principal obtained is not being used in this method.
       Principal principal = getPrincipal(initiatingSubject);

    char[] resPasswordArray = null;
      if (m_defaultPassword != null)
         resPasswordArray = m_defaultPassword.toCharArray();

       // Create a PasswordCredential using the default user name and
      // password, and add it to the Subject, as in option A in section
    // 8.2.6 in the Connector 1.0 spec.
     PasswordCredential cred = new PasswordCredential(m_defaultUser,
resPasswordArray);
        cred.setManagedConnectionFactory(getManagedConnectionFactory());
       initiatingSubject.getPrivateCredentials().add(cred);
      return initiatingSubject;
    }
}
```

You add a `<principal-mapping-interface>` entry to `oc4j-ra.xml` that specifies `com.acme.app.MyMapping` for the principal mapping mechanism:

```
  <connector-factory name="..." location="...">
    ...
    <security-config>
   <principal-mapping-interface>
     <impl-class>com.acme.app.MyMapping</impl-class>
     <property name="user" value="scott" />
     <property name="password" value="tiger" />
   </principal-mapping-interface>
    </security-config>
    ...
  </connector-factory>
```

Modifying oc4j-ra.xml

If you prefer, you can create default principal mappings in the `oc4j-ra.xml` file. To employ the default principal mappings mechanism, use the `<principal-mapping-entries>` sub-element under the `<security-config>` element. For syntax details, see "The <security-config> Element" on page 16-2.

Use the `<default-mapping>` element to specify the user name and password for the default resource principal. This principal is used to log on to the EIS if there is no `<principal-mapping-entry>` element whose initiating user corresponds to the current initiating principal. If no default mapping is specified, Oracle Application Server Containers for J2EE uses the values of the configuration properties `UserName` and `Password` from the deployment descriptor (either in `ra.xml` or `oc4j-ra.xml`), assuming that these defaults are acceptable to the resource adapter. If neither configuration properties nor a default mapping is specified, Oracle Application Server Containers for J2EE may not be able to log in to the EIS.

Each `<principal-mapping-entry>` element contains a mapping from initiating principal to resource principal and password.

For example, if the Oracle Application Server Containers for J2EE principal `scott` should be logged in to a certain EIS, `myEIS1`, as user name `scott` and password `tiger`, while all other Oracle Application Server Containers for J2EE users should be logged in to the EIS using user name `guest` with password `guestpw`, the `<connector-factory>` element in `oc4j-ra.xml` should look like this:

```
<connector-factory name="..." location="...">
    ...
  <security-config>
    <principal-mapping-entries>
      <default-mapping>
        <res-user>guest</res-user>
        <res-password>guestpw</res-password>
      </default-mapping>
      <principal-mapping-entry>
        <initiating-user>scott</initiating-user>
        <res-user>scott</res-user>
        <res-password>tiger</res-password>
      </principal-mapping-entry>
    </principal-mapping-entries>
  </security-config>
    ...
</connector-factory>
```

17

Security Support for EIS Connections

This chapter discusses security considerations and how to configure security and authentication for EIS sign-on. The following topics are covered:

Overview of Security and Authentication Setup for EIS Connections

To ensure secure interactions between a J2EE application and an EIS, the J2EE Connector Architecture allows application components to associate a security context with connections established to the EIS. To accomplish this, the J2EE Connector Architecture security contract can work in conjunction with the standard Java Authentication and Authorization Service (JAAS). The following sections provide an overview:

Summary of J2EE Connector Architecture Security Contract

The J2EE Connector Architecture security contract, between an application server and a resource adapter, extends the connection management contract with functionality relating to secure connections. The security contract supports standard JAAS interfaces, allowing it to be independent of any particular security framework or mechanism. In particular, the security contract includes features for the following:

- Propagating a security context, or subject, directly from a J2EE component to a resource adapter (for component-managed sign-on)
- Propagating a security context, or subject, from an application server to a resource adapter (for container-managed sign-on)

The security contract supports two particular authentication mechanisms:

- The commonly used "basic password" mechanism relies on a user name / password pair, contained together in a password credential object. The application server passes this object to the resource adapter for authentication.

- The Kerberos version 5 mechanism ("Kerbv5" for short) is an authentication protocol distributed by the Massachusetts Institute of Technology. This mechanism uses a "generic credential" object that encapsulates credential information such as a Kerberos ticket. The application server passes this object to the resource adapter for verification.

Security contract functionality includes use of the following key interfaces:

- `javax.security.auth.Subject`: This JAAS interface, which represents a subject, is for use in providing a custom plugin module.
- `javax.security.Principal`: This JAAS interface, which represents a resource principal, is for use in providing a custom plugin module.
- `javax.security.auth.spi.LoginModule`: This JAAS interface represents a JAAS login module.
- `javax.resource.spi.security.PasswordCredential`: This J2EE Connector Architecture class represents a user name / password pair for basic password authentication.
- `org.ietf.jgss.GSSCredential` (in J2SE version 1.4): This interface represents a generic credential object for Kerberos version 5 authentication. (This replaces the J2EE Connector Architecture `javax.resource.spi.security.GenericCredential` interface, which is deprecated.)

Note: Reauthentication" may be supported in the `ra.xml` file of a resource adapter, through a value of `true` in the `<reauthentication-support>` element. In this case, it is possible for a managed connection to be reused even for aconnection request with a security context that differs from the security context with which the managed connection was initially created.

Summary of Component-Managed Versus Container-Managed Sign-On

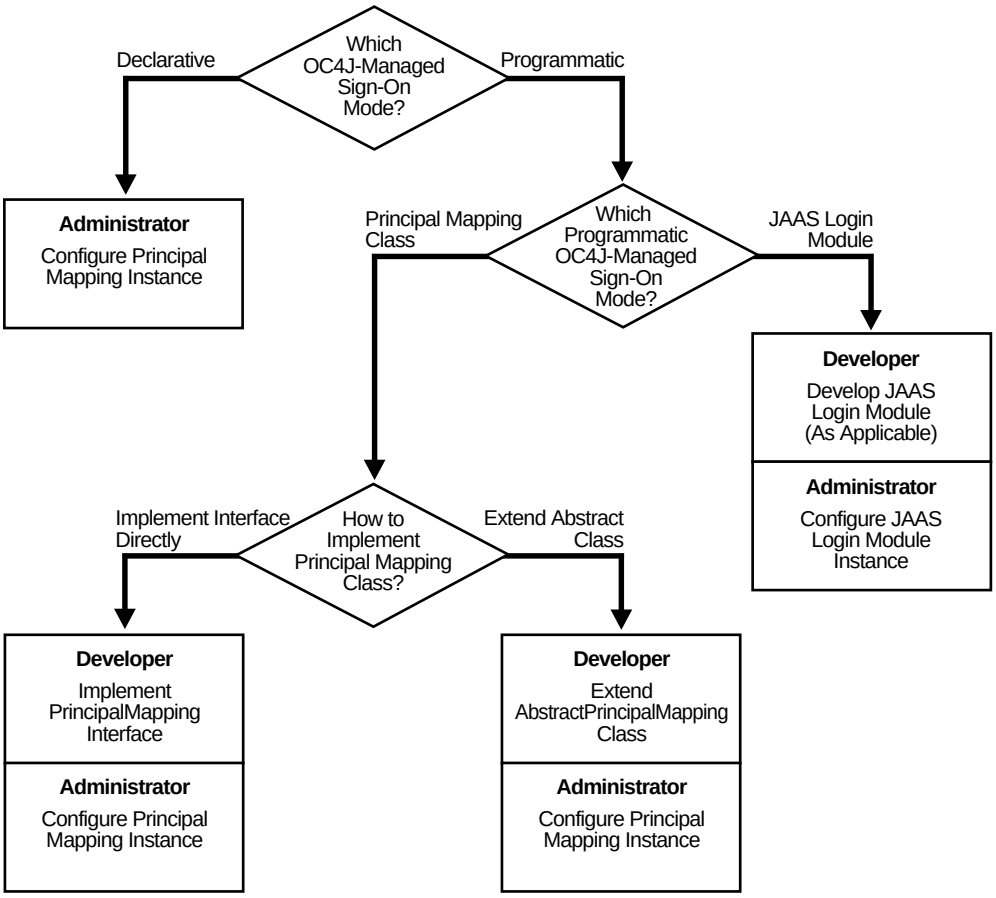
Sign-on from a J2EE application to an EIS can be managed either by the application component or by the J2EE container (OC4J). Component-managed sign-on must be set up programmatically and does not involve OC4J-specific configuration. Container-managed sign-on can be set up either declaratively, through OC4J-specific configuration without any programming requirements, or programmatically, involving a combination of OC4J-specific configuration and programming requirements. Programmatic container-managed sign-on can use either a principal mapping class or a JAAS login module (both discussed later in this chapter).

The following list summarizes the options and the type of setup required for each. Bullets at each level represent choices.

- Component-managed sign-on: requires `web.xml` or `ejb-jar.xml` `<res-auth>` setting of `Application`; programmatic setup for sign-on; no OC4J-specific configuration
- Container-managed sign-on: requires `web.xml` or `ejb-jar.xml` `<res-auth>` setting of `Container`; setup for sign-on may be declarative or programmatic; OC4J-specific configuration, as follows, for each of the container-managed sign-on modes:
  - None: implies either component-managed sign-on or no security; specify through Application Server Control; reflected as `use="none"` in `<security-config>` element of `oc4j-ra.xml`
  - Declarative: OC4J configuration through principal mapping entries; configure through Application Server Control; reflected as `use="principal-mapping-entries"` with appropriate sub-elements in `<security-config>` element of `oc4j-ra.xml`
  - Programmatic: using either a principal mapping class or a JAAS login module:
    - Principal mapping class: implement `PrincipalMapping` interface directly or extend `AbstractPrincipalMapping` class (both in package `oracle.j2ee.connector`); configure directly through `oc4j-ra.xml` (no Application Server Control support) with `use="principal-mapping-interface"` and appropriate sub-elements in `<security-config>` element
    - JAAS login module: use a JAAS login module; configure directly through `oc4j-ra.xml` (no Application Server Control support) with `use="jaas-module"` and appropriate sub-elements in `<security-config>` element

Choices for container-managed sign-on in OC4J are also illustrated in Figure 17–1.

Figure 17–1 Flow Chart of Choices for OC4J Container-Managed Sign-On



Understanding Component-Managed Sign-On

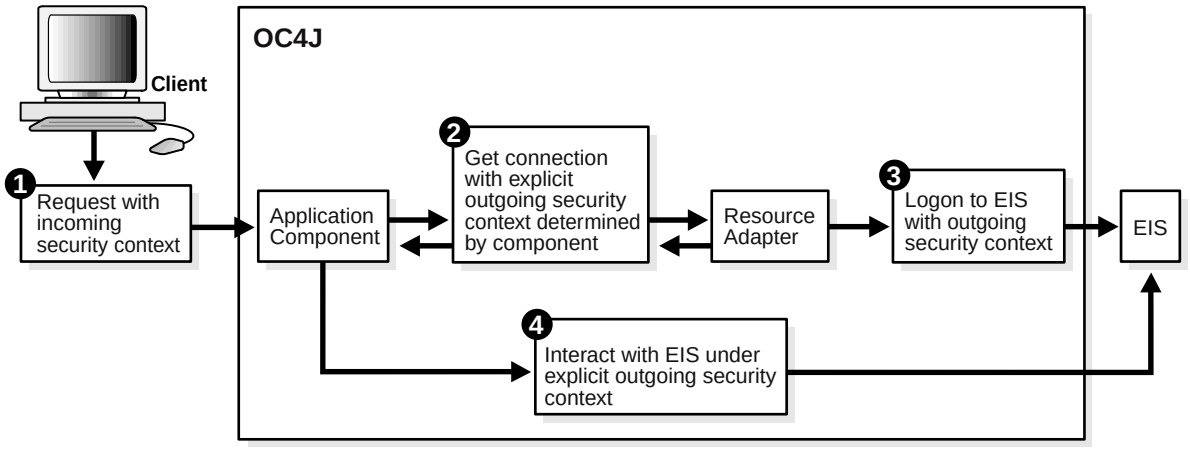
When deploying an application that is to manage its EIS sign-on, use a `<res-auth>Application</res-auth>` setting in the appropriate descriptor file (`web.xml` for a Web component or `ejb-jar.xml` for an EJB component). The application component is then responsible for providing explicit security information for the sign-on. Here is an example:

```
<resource-ref>
   <res-ref-name>...</res-ref-name>
   <res-type>...</res-type>
   <res-auth>Application</res-auth>
   <res-sharing-scope>...</res-sharing-scope>
</resource-ref>
```

No OC4J-specific configuration is required for component-managed sign-on.

Figure 17–2 shows the steps in component-managed sign-on, with the text that follows providing further detail.

Figure 17–2 Component-Managed Sign-On



1. The client makes a request, which is associated with an incoming security context for the initiating principal.
2. As part of servicing the request, the application component maps the incoming security context to an outgoing security context for the resource principal, or hard-codes an outgoing security context, then uses the outgoing security context to request a connection to the EIS.
3. As part of the connection acquisition, the resource adapter signs on to the EIS using the outgoing security context provided by the application component.
4. Once the connection is acquired, the application component can interact with the EIS under the established outgoing security context.

The following example is an excerpt from an application that performs component-managed sign-on:

```
Context initctx = new InitialContext();
// Perform JNDI lookup to obtain a connection factory.
javax.resource.cci.ConnectionFactory cxf =
                  (javax.resource.cci.ConnectionFactory)initctx.lookup
                                                        ("java:com/env/eis/MyEIS");
// Assume a custom class ConnectionSpecImpl, used to store sign-on credentials.
com.myeis.ConnectionSpecImpl connSpec = ...
connSpec.setUserName("EISuser");
connSpec.setPassword("EISpassword");
// Pass sign-on credentials through getConnection() method call.
javax.resource.cci.Connection cx = cxf.getConnection(connSpec);
```

Understanding Container-Managed Sign-On

When deploying an application that is to depend on OC4J to manage EIS sign-on, use a `<res-auth>Container</res-auth>` element in the appropriate descriptor file (`web.xml` for a Web component or `ejb-jar.xml` for an EJB component). OC4J is then responsible for providing security information for the sign-on. Example 17–2, "Extending AbstractPrincipalMapping" demonstrates the use of this element.

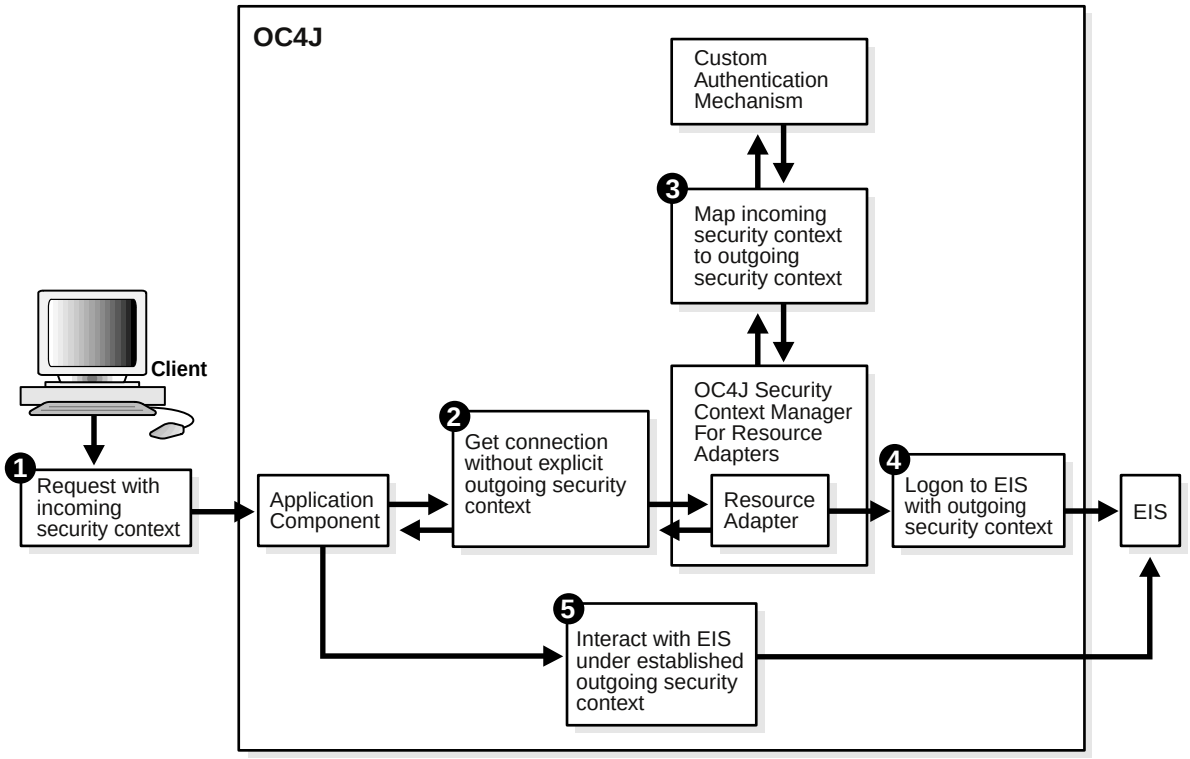
Example 17–1 The <res-auth> Element

```
<resource-ref>
   <res-ref-name>...</res-ref-name>
   <res-type>...</res-type>
   <res-auth>Container</res-auth>
   <res-sharing-scope>...</res-sharing-scope>
</resource-ref>
```

For declarative container-managed sign-on, OC4J uses configuration information that you specify through Application Server Control. For programmatic container-managed sign-on—through either a principal mapping class or a JAAS login module—OC4J uses configuration information that you specify directly through the `oc4j-ra.xml` file. When an application tries to obtain a connection, OC4J uses the applicable mechanism to determine the outgoing security context and to perform authentication.

Figure 17–3 illustrates the steps in container-managed sign-on. These steps are detailed following the diagram.

Figure 17–3 Container-Managed Sign-On



1. The client makes a request, which is associated with an incoming security context for the initiating principal.
2. As part of servicing the request, the application component requests a connection to the EIS.
3. As part of the connection acquisition, the container (the OC4J security context manager shown in Figure 17–3) maps the incoming security context to the outgoing security context for the resource principal. This is based on principal mapping entry elements, a principal mapping class, or a JAAS login module.

4. The resource adapter logs on to the EIS using the outgoing security context provided by OC4J.
5. Once the connection is acquired, the application component can interact with the EIS under the established outgoing security context.

The following example is an excerpt from an application that depends on container-managed sign-on:

```
Context initctx = new InitialContext();

// perform JNDI lookup to obtain a connection factory
javax.resource.cci.ConnectionFactory cxf =
 (javax.resource.cci.ConnectionFactory)initctx.lookup("java:com/env/eis/MyEIS");
// For container-managed sign-on, no security information is passed in the
// getConnection call
javax.resource.cci.Connection cx = cxf.getConnection();
```

Using Declarative Container-Managed Sign-On

This section describes how to set up authentication through OC4J-specific configuration of principal mapping entries. We refer to this as "declarative container-managed sign-on" (as opposed to "programmatic container-managed sign-on"). You can configure this through Application Server Control.

Specify a default resource user and a set of principal mapping entries. Each principal mapping entry specifies an initiating principal and a corresponding resource principal. If the actual initiating principal (OC4J user) during program execution matches one of the initiating principals you specified, then the corresponding resource principal is used for sign-on to the EIS. If the actual initiating principal does not match any you specified, then the default resource user is used for sign-on to the EIS, assuming one is provided or defined. If no default resource user is specified, then a `null` subject will be passed to the EIS. In this case, the EIS has the option of signing on with its own default.

Use the following steps in the Application Server Control Console:

1. From the Connection Factories tab of the appropriate Resource Adapter page, choose to create or edit a connection factory, as desired.
2. Go to the Security tab for the connection factory you are creating or editing.
3. Choose to enable security for container-managed sign-on.
4. Specify declarative principal mappings. This is to specify the default resource user.
   a. Specify the default resource user name.
   b. Specify a password for the default resource user, either indirectly or by typing the desired password. For an indirect password, specify a key (which might just be the user name, for example). OC4J uses the key to do a lookup in the User Manager (such as through the `jazn-data.xml` file).
5. Specify initiating user mappings. Specify a mapping for each initiating principal that you want to map to a resource principal. You can edit an existing row ro change an existing mapping, or add another row to specify a new mapping. For each mapping:
   a. Specify the initiating user—the user name of an initiating principal.
   b. Specify the resource user—the user name for a corresponding resource principal.

c. Specify the resource password—a password for the mapped resource principal. As with the default principal mapping, you can do this either directly or indirectly.

Table 17–1 summarizes how these settings correspond to XML entities in the `oc4j-ra.xml` file. An example follows the table.

Table 17–1 Properties for Declarative Container-Managed Sign-On

Application Server Control Property	Corresponding XML Entity	Description
Enable security for container-managed sign-on	<security-config> element `use` attribute	Being enabled corresponds to `use="principal-mapping-entries"` (assuming declarative container-managed sign-on). Being disabled corresponds to `use="none"`.
Default Resource User	<res-user> sub-element of <default-mapping>	User name for the default resource principal.
Indirect Password or Password (for Declarative Principal Mappings)	<res-password> sub-element of <default-mapping>	Password for the default resource principal, specified either indirectly or directly.
Initiating User	<initiating-user> sub-element of <principal-mapping-entry>	User name for an initiating principal that you want to map to a resource principal.
Resource User	<res-user> sub-element of <principal-mapping-entry>	User name for a resource principal that you want to map to an initiating principal. (Each initating-user / resource-user pair uses a separate <principal-mapping-entry> element.)
Resource Password	<res-password> sub-element of <principal-mapping-entry>	Password for the resource principal, specified either indirectly or directly.

```
<oc4j-connector-factories ... >
   <connector-factory ... >
      ...
      <security-config use="principal-mapping-entries">
         <principal-mapping-entries>
            <default-mapping>
               <res-user>scott</res-user>
               <res-password>->tiger</res-password>
            </default-mapping>
            <principal-mapping-entry>
               <initiating-user>servletuser1</initiating-user>
               <res-user>jmsuser1</res-user>
               <res-password>->jmsuser1</res-password>
            </principal-mapping-entry>
            <principal-mapping-entry>
               <initiating-user>servletuser2</initiating-user>
               <res-user>jmsuser2</res-user>
               <res-password>->jmsuser2</res-password>
            </principal-mapping-entry>
         </principal-mapping-entries>
      </security-config>
   </connector-factory>
   ...
</oc4j-connector-factories>
```

Using Programmatic Container-Managed Sign-On

OC4J can manage programmatic authentication, either through an OC4J-specific mechanism that uses a principal mapping class, or through a pluggable JAAS mechanism that uses a JAAS login module. The following sections discuss these mechanisms plus additional features:

- Using a Principal Mapping Class
- Using a JAAS Login Module
- OC4J Support for Groups in Programmatic Container-Managed Sign-On

Using a Principal Mapping Class

One option in OC4J for programmatic container-managed sign-on is to use an Oracle feature that implements principal mapping. The application must include a principal mapping class, which is a class that implements the `oracle.j2ee.connector.PrincipalMapping` interface. A developer can accomplish this by implementing the interface directly, or by extending the `oracle.j2ee.connector.AbstractPrincipalMapping` class, supplied by Oracle for convenience. You must configure a principal mapping class through the `oc4j-ra.xml` file. The following sections describe aspects of using a principal mapping class:

- Understanding the PrincipalMapping Interface APIs
- Extending the AbstractPrincipalMapping Class
- Configuring a Principal Mapping Class

Understanding the PrincipalMapping Interface APIs

Table 17–2 describes how OC4J uses methods of the `PrincipalMapping` interface.

Table 17–2 Method Descriptions for PrincipalMapping Interface

Method Signature	Use by OC4J
void init (java.util.Properties prop)	OC4J calls `init()` to initialize the settings for the `PrincipalMapping` instance, passing in property values specified under the `<principal-mapping-interface>` element in `oc4j-ra.xml`. (See "Configuring a Principal Mapping Class" on page 17-13.) The implementation class can use the properties to set either a default user name and password, information for LDAP connection, or a default mapping.
void setManagedConnectionFactory (ManagedConnectionFactory mcf)	OC4J calls `setManagedConnectionFactory()` to provide the `PrincipalMapping` instance with a `ManagedConnectionFactory` instance (for connections to the EIS), which is used in creating a `PasswordCredential` instance.
void setAuthenticationMechanisms (java.util.Map authMechanisms)	OC4J calls `setAuthenticationMechanisms()` to pass the authentication mechanisms supported by the resource adapter to the `PrincipalMapping` instance. The key in the map that is passed is a string containing the supported mechanism type, such as `"BasicPassword"` or `"Kerbv5"`. The value corresponding to the key is a string containing the fully qualified name of the corresponding credentials interface, as declared in a `<credential-interface>` element in `ra.xml`, such as for the `PasswordCredential` interface. The map can contain multiple entries if the resource adapter supports multiple authentication mechanisms.
Subject mapping (Subject initiatingSubject)	OC4J calls `mapping()` to instruct the `PrincipalMapping` instance to perform the principal mapping. A `Subject` instance for the OC4J user (initiating principal) is passed in, and this method returns a `Subject` instance for the resource principal, for use by the resource adapter for sign-on to the EIS. (The implementation may return `null` if the proper resource principal cannot be determined.)

Extending the AbstractPrincipalMapping Class

As a convenience, OC4J provides the abstract class `AbstractPrincipalMapping`, which implements the `PrincipalMapping` interface. This class provides default implementations of the the the `setManagedConnectionFactory()` and `setAuthenticationMechanism()` methods, as well as utility methods to accomplish the following:

- Retrieve the managed connection factory used for connections to the EIS.
- Retrieve the authentication mechanisms supported by the resource adapter.
- Determine whether the resource adapter supports the basic password authentication mechanism.
- Determine whether the resource adapter supports the Kerberos version 5 authentication mechanism.
- Extract a `Principal` instance from a `Subject` instance.

When extending the `AbstractPrincipalMapping` class, developers need only implement the `init()` and `mapping()` methods.

The methods exposed by the `AbstractPrincipalMapping` class are summarized in Table 17–3.

Table 17–3 Method Descriptions for AbstractPrincipalMapping Class

Method Signature	Description
abstract void init (java.util.Properties prop)	The subclass must implement the `init()` method. See Table 17–2 for a description.
void setManagedConnectionFactory (ManagedConnectionFactory mcf)	The subclass need not implement the `setManagedConnectionFactory()` method. See Table 17–2 for a description.
void setAuthenticationMechanisms (java.util.Map authMechanisms)	The subclass need not implement the `setAuthenticationMechanisms()` method. See Table 17–2 for a description. Note that the subclass can use the `isBasicPasswordSupported()` and `isKerbv5Supported()` methods (described later in this table) to determine which authentication mechanism is supported by the resource adapter. The subclass can also use the `getAuthenticationMechanisms()` method to retrieve the authentication mechanisms.
abstract Subject mapping (Subject initiatingSubject)	The subclass must implement the `mapping()` method. See Table 17–2 for a description.
ManagedConnectionFactory getManagedConnectionFactory ()	The `getManagedConnectionFactory()` utility method returns the `ManagedConnectionFactory` instance (for connections to the EIS), which might be required to create a `PasswordCredential` instance.
java.util.Map getAuthenticationMechanisms ()	The `getAuthenticationMechanisms()` utility method returns a map of all authentication mechanisms supported by the resource adapter. See `setManagedConnectionFactory()` in Table 17–2 for a description of the map.
boolean isBasicPasswordSupported ()	The `isBasicPasswordSupported()` utility method determines whether the basic password authentication mechanism is supported by the resource adapter.
boolean isKerbv5Supported ()	The `isKerbv5Supported()` utility method determines whether the Kerbv5 authentication mechanism is supported by the resource adapter.
Principal getPrincipal (Subject)	The `getPrincipal()` utility method extracts the `Principal` instance from the OC4J user `Subject` instance passed from OC4J. **Note:** In cases where there are multiple principals in a subject (which is not typical), this method would retrieve the first principal. (There is also a `getPrincipals()` method, and the "first" principal is the first element of the collection of principals that this method would return.)

Example 17–2, "Extending AbstractPrincipalMapping", extends the `AbstractPrincipalMapping` class to provide a principal mapping from the OC4J user to the EIS default user and password. This assumes a default user and password is specified under the `<principal-mapping-interface>` element in `oc4j-ra.xml`, as shown in "Configuring a Principal Mapping Class" on page 17-13.

Example 17–2 Extending AbstractPrincipalMapping

```
package com.example.app;

import java.util.*;
import javax.resource.spi.*;
import javax.resource.spi.security.*;
import oracle.j2ee.connector.AbstractPrincipalMapping;
import javax.security.auth.*;
import java.security.*;

public class MyMapping extends AbstractPrincipalMapping
{
  String m_defaultUser;
  String m_defaultPassword;

  public void init(Properties prop)
  {
    if (prop != null)
    {
      // Retrieves the default user and password from the properties
      m_defaultUser = prop.getProperty("user");
      m_defaultPassword = prop.getProperty("password");
    }
  }
  public Subject mapping(Subject initiatingSubject)
  {
    // This implementation is for BasicPassword authentication
    // mechanism. Return if the resource adapter does not support it.
    if (!isBasicPasswordSupported())
      return null;
    // Use the utility method to retrieve the Principal from the incoming Subject
    // (security context), corresponding to the OC4J user.
    // This code is included here only as an example.
    // The principal obtained is not actually used in this example.
    Principal principal = getPrincipal(initiatingSubject);
    char[] resPasswordArray = null;
    if (m_defaultPassword != null)
      resPasswordArray = m_defaultPassword.toCharArray();
    // Create a PasswordCredential using the default user name and
    // password, and add it to the Subject, as in "Option A" in the
    // J2EE Connector Architecture specification.
    PasswordCredential cred =
      new PasswordCredential(m_defaultUser, resPasswordArray);
    cred.setManagedConnectionFactory(getManagedConnectionFactory());
    initiatingSubject.getPrivateCredentials().add(cred);
    return initiatingSubject;
  }
}
```

Configuring a Principal Mapping Class

To use a principal mapping class, you must update `oc4j-ra.xml` to include a `<principal-mapping-interface>` element for the class. This is a sub-element of the `<security-config>` element and must include the following:

- An `<impl-class>` sub-element to specify the fully qualified name of the principal mapping class
- Property settings appropriate to the principal mapping class implementation—for the class shown in the preceding section, a `<property>` sub-element with `name="user"` and a `value` setting to specify the default user name for EIS sign-on, and a `<property>` sub-element with `name="password"` and a `value` setting to specify the password for the default user, as shown in the following example.

```
<oc4j-connector-factories>
   <connector-factory name="..." location="...">
      ...
      <security-config use="principal-mapping-interface">
         <principal-mapping-interface>
            <impl-class>com.example.app.MyMapping</impl-class>
            <property name="user" value="scott" />
            <property name="password" value="tiger" />
         </principal-mapping-interface>
      </security-config>
     ...
   </connector-factory>
</oc4j-connector-factories>
```

Note: You can use password indirection to hide the password. For a full discussion of password indirection, see Chapter 14, "Password Management".

Using a JAAS Login Module

Alternatively, you can manage sign-on to an EIS programmatically through JAAS. For details, see Chapter 10, "Custom LoginModules".

OC4J Support for Groups in Programmatic Container-Managed Sign-On

Principal mapping classes and JAAS login modules, in addition to mapping from individual OC4J users to EIS users, can map from OC4J groups to EIS users.

The `oracle.j2ee.connector` package contains the `InitiatingPrincipal` class, which implements the `Principal` interface and represents OC4J users, and the `InitiatingGroup` class, which also implements the `Principal` interface but represents OC4J groups. OC4J creates an `InitiatingPrincipal` intance and incorporates it into the `Subject` instance that it passes either to the `initialize()` method of a login module, or to the `mapping()` method of a principal mapping class.

The `InitiatingPrincipal` class also has a `getGroups()` method. This returns a `java.util.Set` instance with a collection of `InitiatingGroup` instances that represent the OC4J groups or JAZN roles that the OC4J user belongs to. The group membership is defined in OC4J-specific descriptor files such as `jazn-data.xml` (depending on the user manager).

18

Troubleshooting Security Issues

This chapter discusses techniques for locating security problems in your OC4J application. It is divided into the following sections:

Locating jazn.xml

When the OracleAS JAAS Provider starts, it searches for a `jazn.xml` file. The `jazn.xml` file can be in a variety of locations, but is normally in *`ORACLE_HOME`*`/j2ee/home/config` . However, if you specify the location of this file in a system property, the file in the system property takes precedence.

When the OracleAS JAAS Provider starts, it searches for `jazn.xml` in order through the directories specified by:

1. `oracle.security.jazn.config` (system property)
2. `java.security.auth.policy` (system property)
3. *`J2EE_HOME`*`/config` (*`J2EE_HOME`* is specified by the system property `oracle.j2ee.home`)
4. *`ORACLE_HOME`*`/j2ee/home/config` (*`ORACLE_HOME`* is specified by the system property `oracle.home`)
5. `./config`

The OracleAS JAAS Provider stops searching after locating a `jazn.xml` file. If no file is found, you receive the error message "`JAZN has not been properly configured`."

JAZN Admintool

Before using the Admintool, you must set the environment variable controlling loading of dynamic libraries (for example, `LD_LIBRARY_PATH` in Solaris). See Table 2–5 for details.

> **Caution:** The Admintool does not require authentication when used with the LDAP-based provider; anyone who runs the tool is granted all rights. This means that it is vital to secure the Admintool in production environments; you normally do this by using file-system properties. If you specify the `-user` and `-password` options when using LDAP, they are ignored.

If you are attempting to grant a permission and the Admintool gives the error message `Permission class not found`, it means that the permission you wish to grant is not in the classpath. You must place the JAR containing the permission class in the `jdk/jre/lib/ext` directory so that the Admintool can locate it..

Custom LoginModules

When writing a custom `LoginModule`, you should be aware of the following issues:

- Subject-Based Authorization
- J2EE Security Integration

Subject-Based Authorization

When an application uses a custom login module, the Subject (and the principals it contains) are used as the sole basis for authorization, including the evaluation of J2EE security constraints. To ensure that all relevant principals are taken into consideration during authorization, the login module should add the relevant principals (including any roles / groups that the authenticated user belongs to) to the Subject during the `commit` phase of the JAAS authentication process.

J2EE Security Integration

The custom `LoginModule` framework supports the J2EE security declarative security model. That is, the J2EE security constraints declared in an application's deployment descriptors, such as `web.xml` and `ejb-jar.xml`, are enforced using Subject-based authorization.

We encourage J2EE developers to take advantage of the J2EE security model whenever possible, rather than writing their own security implementation; this ensures forward compatibility with future releases.

LDAP-Based Provider Issues

Two important issues when troubleshooting the LDAP-based provider are:

- Checking JAZN-LDAP Configuration
- Enabling and Disabling Caching

Checking JAZN-LDAP Configuration

When you associate an Oracle Application Server instance with Oracle Application Server Infrastructure, either during installation or using Enterprise Manager, the instance is automatically configured to use the LDAP-based provider. The Oracle Internet Directory location and port are determined by the file *ORACLE_HOME*/config/ias.properties.

To verify that the LDAP-based provider has been configured property, do the following:

1. Use Enterprise Manager to verify that the user manager is set to "LDAP".
2. Issue the JAZN Admintool `-listrealms` command to verify that the LDAP-based provider can retrieve data from Oracle Internet Directory.

   ```
   java -jar jazn.jar -listrealms
   ```

3. If the Admintool responds with the message "`Communication Error`", then it is likely that Oracle Internet Directory is down.
4. If the Admintool responds with the message "`Invalid Credentials`", then the LDAP users and credentials are incorrectly configured.

Enabling and Disabling Caching

LDAP caching is enabled by default; caching is per-JVM, not per-application. Before using JAAS Admintool management commands, such as granting permissions or roles, you must disable caching. After you use the Admintool, you should re-enable caching.

For details on enabling and disabling caching, see "Configuring LDAP Caching" on page 5-3.

Servlets, runas-mode, and doasprivileged-mode

If you want a servlet to be invoked using `subject.doAs()` or `subject.doAsPrivileged()`, you must set the `runas-mode` and `doasprivileged-mode` attributes of the `<jazn-web-app>` element in the `orion-web.xml` or `orion-application.xml` files.

For details, see "Configuring J2EE Authorization" on page 4-10.

Creating Realms

It is important to use the appropriate tool to create realms. In general, if you're using the LDAP-based provider or Oracle Application Server Single Sign-On, use Oracle Delegated Administration Services to create realms; if you're using the XML-based provider, create realms with the JAAS Admintool. The realms you create with the JAAS Admintool are external or application realms; they are located in a different place in the realm tree than identity management realms.

Removing Realm Names From Principals

In some applications, you prefer to avoid parsing the principal returned by various method calls. You can configure the OracleAS JAAS Provider so that the returned principal contains no realm name. To do this, you add a property to the `<jazn>` element in the file `jazn.xml`. The new property is:

```
<property name="jaas.username.simple" value="true" />
```

This property affects the return values of the following methods:

- `javax.servlet.http.HTTPServletRequest`, `getRemoteUser` and `getUserPrincipal` methods
- `javax.ejb.EJBContext`, `getCallerIdentity` and `getCallerPrincipal` methods

Specifying the JAAS Provider

If you receive an exception and stack trace similar to:

```
Exception in thread "main" java.lang.SecurityException: Unable to locate a login
configuration
at com.sun.security.auth.login.ConfigFile.<init>(ConfigFile.java:97)
at sun.reflect.NativeConstructorAccessorImpl.newInstance0(Native Method)
at sun.reflect.NativeConstructorAccessorImpl.newInstance
```

you have probably failed to specify the OracleAS JAAS Provider as the JAAS policy provider. See "Specifying An Alternate Policy Provider (Optional)" on page 4-5for details.

19

Security Tips

These hints come from the Security Best Practices document, available from Oracle Technology Network (`http://www.oracle.com/technology/index.html`). Check the OTN Web site for updates. This chapter is divided into the following parts:

HTTPS

Oracle HTTP Server (OHS) has several features that provide security to an application without requiring you to modify the application. You should evaluate and leverage these features before coding similar features yourself. HTTP security features include:

- Authentication — OHS can authenticate users and pass the authenticated user-id to an application in a standard manner (`REMOTE_USER`). It also supports single sign-on, thus reusing existing login mechanisms.
- Authorization — OHS has directives that can allow access to your application only if the end user is authenticated and authorized. Again, no code change is required.
- Encryption — OHS can provide transparent SSL communication to end customers without any code change on the application.

Other suggestions for securing HTTPS:

- *Configure Oracle Application Server to fail attempts to use weak encryption*. You can configure Oracle Application Server to use only specified encryption ciphers for HTTPS connections. For instance, your application could reject connections from non-128-bit client-side SSL libraries. This ability is especially useful for banks and other financial institutions because it provides server-side control of the encryption strength for each connection.
- *Use HTTPS to HTTP appliances for accelerating HTTP over SSL*. Use HTTPS everywhere you need to. However, the huge performance overhead of HTTPS forces a trade-off in some situations.

  For a relatively low cost, HTTPS-to-HTTP appliances can change throughput on a 500MHz UNIX machine from 20-30 transactions per second to 6000 transactions per second, making this trade-off decision easier.

  Moreover, these appliances provide much better solutions than adding mathematics or cryptography cards to UNIX, Windows, or Linux boxes.

- *Ensure that sequential HTTPS transfers are requested through the same Web server.* Expect 40 to 50 milliseconds of CPU time to initiate SSL sessions on a 500 MHz machine. Most of this CPU time is spent in the key exchange logic, where the bulk encryption key is exchanged. Caching the bulk encryption will significantly reduces CPU overhead on subsequent accesses, provided that the accesses are routed to the same Web server.
- *Keep secure pages and pages not requiring security on separate servers.* Although it may be easier to place all pages for an application on one HTTPS server, this strategy has enormous performance costs. Reserve your HTTPS server for pages needing SSL, and put the pages not needing SSL on an HTTP server.

  If secure pages are composed of many GIF, JPEG, or other files to be displayed on the same screen, it is probably not worth the effort to segregate secure from nonsecure static content. The SSL key exchange (a major consumer of CPU cycles) is likely to be called exactly once in any case, and the overhead of bulk encryption is not that high.

Overall Security

- *When assigning privileges to modules, use the lowest levels that are adequate to perform the modules' function(s).* Using low-level privileges provides "fault containment": if security is compromised, it is contained within a small area of the network and cannot invade the entire intranet.
- *Tune the SSLSessionCacheTimeout directive if you are using SSL.* The Apache server in Oracle Application Server caches a client's SSL session information by default. With session caching, only the first connection to the server incurs high latency.

  In a simple test to connect and disconnect to an SSL-enabled server, the elapsed time for 5 connections was 11.4 seconds without SSL session caching; with session caching enabled, the elapsed time was 1.9 seconds.

  The default `SSLSessionCacheTimeout` is 300 seconds. Note that the duration of an SSL session is unrelated to the use of HTTP persistent connections. You can change the `SSLSessionCacheTimeout` directive in the `httpd.conf` file to meet your application needs.

JAAS

- *Migrate your user management from principals.xml to the OracleAS JAAS Provider.* In earlier releases of Oracle Application Server, the J2EE application server component stored all user information in a file called `principals.xml` (including storing passwords in cleartext). The OracleAS JAAS Provider provides a similar simple security model as a default, without storing passwords in cleartext. The OracleAS JAAS Provider also offers tight integration with Oracle Application Server Infrastructure Infrastructure (including OracleAS Single Sign-On and Oracle Internet Directory) out of the box.
- *Avoid writing custom user managers; instead, extend the OracleAS JAAS Provider, OracleAS Single Sign-On, and Oracle Internet Directory*. The Oracle Application Server Containers for J2EE (OC4J) container continues to supply several methods and levels of extending security providers. Although you can extend the `UserManager` class to build a custom user manager, leveraging the rich functionality provided by the OracleAS JAAS Provider, OracleAS Single Sign-On, and Oracle Internet Directory gives you more time to focus on actual business logic instead of infrastructure code. Both OracleAS Single Sign-On and Oracle

Internet Directory provide APIs to integrate with external authentication servers and directories respectively.

- *Use OracleAS Single Sign-On as the authentication mechanism with the OracleAS JAAS Provider.* The OracleAS JAAS Provider allows different authentication options. However, we strongly recommend leveraging the OracleAS Single Sign-On server whenever possible because:
  - It is the default mechanism for most Oracle Application Server components, such as Portal, Forms, Reports, Wireless, and so on.
  - It is easy to set up in a declarative fashion and does not require any custom programming.
  - It provides seamless PKI integration.
- *Use the OracleAS JAAS Provider's declarative features to reduce programming.* Because most of the features in the OracleAS JAAS Provider are controlled declaratively, particularly in the area of authentication, developers can postpone setup until deployment time. This not only reduces the programming tasks for integrating a JAAS based application, it enables the deployer to use environment-specific security models for that application.
- *Use the fine-grained access control offered by the OracleAS JAAS Provider and the Java permission model.* Unlike the "coarse-grained" J2EE authorization model as it exists today, the OracleAS JAAS Provider integrated with OC4J allows any protected resource to be modeled using Java permissions. The Java permission model (and associated Permission class) is extensible and allows a flexible way to define fine-grained access control.
- *Use Oracle Internet Directory as the central repository for the OracleAS JAAS Provider in production environments.* Although the OracleAS JAAS Provider supports a flat-file XML-based repository useful for development and testing environments, it should be configured to use Oracle Internet Directory for production environments. Oracle Internet Directory provides LDAP standard features for modeling administrative metadata and is built on the Oracle database platform, inheriting all the database properties of scalability, reliability, manageability, and performance.
- *Take advantage of the authorization features of the OracleAS JAAS Provider.* In addition to the authorization functionality defined in the JAAS 1.0 specification, the OracleAS JAAS Provider supports:
  - Hierarchical, role-based access control (RBAC)
  - The ability to partition security policy by subscriber (that is, each user community)

  These extensions provide a more scalable and manageable framework for security policies covering a large user population.

A

OracleAS JAAS Provider Standards and Samples

This appendix provides supplemental samples and standards. It contains the following topics:

- Sample jazn-data.xml Code
- Modifying User Permissions
- Modifying User Permissions Code

Sample jazn-data.xml Code

This section presents a sample `jazn-data.xml` file which illustrates the specific standards that XML files must conform to. This `jazn-data.xml` file contains a realm, `jazn.com`, users, and roles.

See Also:

- "Realm Management in XML-Based Environments" on page 4-3.
- "Realm and Policy Management" on page 4-2 for further information on managing the OracleAS JAAS Provider in XML-based provider environment

Example A–1 Sample jazn-data.xml File

```
<?xml version="1.0" encoding="UTF-8" standalone='yes'?>
<!DOCTYPE jazn-data PUBLIC "JAZN-XML Data"
"http://xmlns.oracle.com/ias/dtds/jazn-data-9_04.dtd">
<jazn-data>

<!-- JAZN Realm Data -->
<jazn-realm>
  <realm>
    <name>jazn.com</name>
    <users>
      <user>
        <name>anonymous</name>
        <description>The default guest/anonymous user</description>
      </user>
      <user>
        <name>SCOTT</name>
        <display-name>SCOTT</display-name>
        <credentials>!TIGER</credentials>
```

```
    </user>
    <user>
      <name>admin</name>
      <display-name>OC4J Administrator</display-name>
      <description>OC4J Administrator</description>
      <credentials>!welcome</credentials>
    </user>
    <user>
      <name>user</name>
      <description>The default user</description>
      <credentials>!456</credentials>
    </user>

          <!-- users used for password hiding -->
    <user>
      <name>pwForScott</name>
      <description>Password for database user Scott</description>
      <credentials>!TIGER</credentials>
    </user>
    <user>
      <name>pwForSSL</name>
      <description>Password for ssl key and trust stores</description>
      <credentials>!123456</credentials>
    </user>
    <user>
      <name>pwForSystem</name>
      <description>Password for database system user </description>
      <credentials>!manager</credentials>
    </user>
  </users>
  <roles>
    <role>
      <name>administrators</name>
      <display-name>Realm Admin Role</display-name>
      <description>Administrative role for this realm.</description>
      <members>
        <member>
          <type>user</type>
          <name>admin</name>
        </member>
      </members>
    </role>
    <role>
      <name>users</name>
      <members>
        <member>
          <type>user</type>
          <name>user</name>
        </member>
        <member>
          <type>user</type>
          <name>SCOTT</name>
        </member>
        <member>
          <type>role</type>
          <name>administrators</name>
        </member>
      </members>
    </role>
    <role>
```

```
        <name>guests</name>
        <members>
          <member>
            <type>user</type>
            <name>anonymous</name>
          </member>
          <member>
            <type>role</type>
            <name>users</name>
          </member>
        </members>
      </role>
      <role>
        <name>jmxusers</name>
                              <display-name>JMX users</display-name>
        <description>Allows access to application level user defined
MBeans</description>
        <members>
        </members>
      </role>
    </roles>
  </realm>
</jazn-realm>

<!-- JAZN Policy Data -->
<jazn-policy>
  <grant>
    <grantee>
      <principals>
        <principal>
          <realm-name>jazn.com</realm-name>
          <type>role</type>
          <class>oracle.security.jazn.spi.xml.XMLRealmRole</class>
          <name>jazn.com/administrators</name>
        </principal>
      </principals>
    </grantee>
    <permissions>
      <permission>
        <class>oracle.security.jazn.policy.AdminPermission</class>

<name>oracle.security.jazn.realm.RealmPermission$jazn.com$createrealm</name>
      </permission>
      <permission>
        <class>oracle.security.jazn.realm.RealmPermission</class>
        <name>jazn.com</name>
        <actions>createrealm</actions>
      </permission>
      <permission>
        <class>oracle.security.jazn.policy.AdminPermission</class>
        <name>oracle.security.jazn.realm.RealmPermission$jazn.com$droprealm</name>
      </permission>
      <permission>
        <class>oracle.security.jazn.policy.AdminPermission</class>

<name>oracle.security.jazn.realm.RealmPermission$jazn.com$createrole</name>
      </permission>
      <permission>
        <class>oracle.security.jazn.policy.AdminPermission</class>
        <name>oracle.security.jazn.policy.RoleAdminPermission$jazn.com/*$</name>
```

```
      </permission>
      <permission>
        <class>com.evermind.server.AdministrationPermission</class>
        <name>administration</name>
        <actions>administration</actions>
      </permission>
      <permission>
        <class>oracle.security.jazn.realm.RealmPermission</class>
        <name>jazn.com</name>
        <actions>droprealm</actions>
      </permission>
      <permission>
        <class>oracle.security.jazn.realm.RealmPermission</class>
        <name>jazn.com</name>
        <actions>dropuser</actions>
      </permission>
      <permission>
        <class>oracle.security.jazn.policy.RoleAdminPermission</class>
        <name>jazn.com/*</name>
      </permission>
      <permission>
        <class>com.evermind.server.rmi.RMIPermission</class>
        <name>login</name>
      </permission>
      <permission>
        <class>oracle.security.jazn.policy.AdminPermission</class>

<name>oracle.security.jazn.realm.RealmPermission$jazn.com$modifyrealmmetadata</nam
e>
      </permission>
      <permission>
        <class>oracle.security.jazn.realm.RealmPermission</class>
        <name>jazn.com</name>
        <actions>modifyrealmmetadata</actions>
      </permission>
      <permission>
        <class>oracle.security.jazn.policy.AdminPermission</class>
        <name>oracle.security.jazn.realm.RealmPermission$jazn.com$droprole</name>
      </permission>
    </permissions>
  </grant>
  <grant>
    <grantee>
      <principals>
        <principal>
          <realm-name>jazn.com</realm-name>
          <type>role</type>
          <class>oracle.security.jazn.spi.xml.XMLRealmRole</class>
          <name>jazn.com/users</name>
        </principal>
      </principals>
    </grantee>
    <permissions>
      <permission>
        <class>com.evermind.server.rmi.RMIPermission</class>
        <name>login</name>
      </permission>
    </permissions>
  </grant>
      <grant>
```

```
    <grantee>
      <principals>
        <principal>
          <realm-name>jazn.com</realm-name>
          <type>role</type>
          <class>oracle.security.jazn.spi.xml.XMLRealmRole</class>
          <name>jazn.com/jmxusers</name>
        </principal>
      </principals>
    </grantee>
    <permissions>
      <permission>
        <class>com.evermind.server.rmi.RMIPermission</class>
        <name>login</name>
      </permission>
    </permissions>
  </grant>

</jazn-policy>

<!-- Permission Class Data -->
<jazn-permission-classes>
</jazn-permission-classes>

<!-- Principal Class Data -->
<jazn-principal-classes>
</jazn-principal-classes>

<!-- Login Module Data -->
<jazn-loginconfig>
  <application>
    <name>oracle.security.jazn.oc4j.JAZNUserManager</name>
    <login-modules>
      <login-module>
        <class>oracle.security.jazn.realm.RealmLoginModule</class>
        <control-flag>required</control-flag>
        <options>
          <option>
            <name>addAllRoles</name>
            <value>true</value>
          </option>
        </options>
      </login-module>
    </login-modules>
  </application>
  <application>
    <name>oracle.security.jazn.tools.Admintool</name>
    <login-modules>
      <login-module>
        <class>oracle.security.jazn.realm.RealmLoginModule</class>
        <control-flag>required</control-flag>
        <options>
          <option>
            <name>addAllRoles</name>
            <value>true</value>
          </option>
          <option>
            <name>debug</name>
            <value>false</value>
          </option>
```

```
        </options>
      </login-module>
    </login-modules>
  </application>
  <application>
    <name>oracle.security.jazn.oc4j.DigestAuthenticator</name>
    <login-modules>
      <login-module>
        <class>oracle.security.jazn.login.module.digest.DigestLoginModule</class>
        <control-flag>required</control-flag>
        <options>
          <option>
            <name>debug</name>
            <value>false</value>
          </option>
          <option>
            <name>addAllRoles</name>
            <value>true</value>
          </option>
        </options>
      </login-module>
    </login-modules>
  </application>
</jazn-loginconfig>

</jazn-data>
```

Modifying User Permissions

Example A–2 demonstrates granting `java.io.FilePermission` to a user named `Jane.Smith`. The objects to be modified are presented in bold.

Table A–1 lists the objects in Example A–2.

Table A–1 Objects In Sample Modifying User Permissions Code

Objects	Names	Comments
`RealmUser user`	`Jane.Smith`	
`codesource cs`	`file:/home/task.jar`	
File path	report.data	Path is the path name of the file.
sample organization	`abc.com`	`abc.com` does not appear in this code directly.
sample External Realm	`abcRealm`	

Modifying User Permissions Code

Example A–2 Modifying User Permissions

```
import oracle.security.jazn.*;
import oracle.security.jazn.policy.*;
import oracle.security.jazn.realm.*;
import java.lang.*;
import java.security.*;
import java.util.*;
import java.net.*;
import java.io.*;
```

```
public class Init {

    public static void main(String[] args) {

    try {
      RealmManager realmMgr = JAZNContext.getRealmManager();
            Realm realm = realmMgr.getRealm("abcRealm");
            UserManager userMgr = realm.getUserManager();
            RoleManager roleMgr = realm.getRoleManager();
            final JAZNPolicy policy = JAZNContext.getPolicy();

            final RealmUser user = userMgr.getUser("Jane.Smith");

            AccessController.doPrivileged (new PrivilegedAction() {
                    public Object run() {

                try {

                  CodeSource cs = new CodeSource(new URL("
                            file:/home/task.jar"), null);
                    HashSet prop = new HashSet();
                    prop.add((Principal) user);

                    // assign permission to principals
                    policy.grant(new Grantee(prop, cs), new
                             FilePermission("report.data", "read"));

                    return null;
                        } catch (JAZNException e1) {
                            e1.printStackTrace();
                        } catch (java.net.MalformedURLException e2) {
                            e2.printStackTrace();
                        }
                    return null;
                    }
                }
             );

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

Discussion Of Sample Code

The sample code shown in Example A–2 grants a user, `Jane.Smith`, permission to use the sample application, `AccessTest1`, as follows:

The name `cs` is assigned to the `file:/home/task.jar`, which includes the sample application `AccessTest1`:

```
CodeSource cs = new CodeSource(new URL("
                            file:/home/task.jar"), null);
```

`Jane.Smith` is the user added to the `HashSet prop`:

```
HashSet prop = new HashSet();
                    prop.add((Principal) user);
```

`Jane.Smith` is granted permission, on the `Codesource cs`, to read the file `report.data.`

```
policy.grant(new Grantee(prop, cs), new
                             FilePermission("report.data", "read"));
```

B

Using the JAZN Admintool

The JAZN Admintool can manage both XML-based and LDAP-based JAAS configurations and data from the command prompt. The JAZN Admintool is a flexible Java console application, with functions that can be called directly from the command line or through an interactive shell. The JAZN Admintool is located in *OC4J_HOME*/j2ee/home/jazn.jar.

> **Note:** The JAZN Admintool manages only XML-based roles and users. To manage LDAP-based users and roles, use the Delegated Administration Service (DAS); see the *Oracle Internet Directory Administrator's Guide* for details.

This chapter discusses how to perform common administration tasks using the JAZN Admintool. It is divided into the following sections:

Authentication and the JAZN Admintool (XML-based Provider Only)

If you are using the XML-based provider, you must authenticate yourself to the JAZN Admintool before making administrative changes. You authenticate yourself in one of two ways:

- Supplying the `-user` and `-password` switches, as in:

```
java -jar jazn.jar -user myusername -password mypassword -listrealms
```

> **Note:** If you specify the `-user`, `-password`, or `-clustersupport` options, you must specify them before all other options on the command line.

- Supplying a username and password when prompted by the Admintool, as in:

```
java -jar jazn.jar -listrealms
>RealmLoginModule username: martha
>RealmLoginModule password: mypass
```

> **Cautions:**
>
> - Because of Java limitations, the password you type to the Admintool may be visible in the command window. Be sure to close the command window after using the Admintool.
> - The Admintool does not require authentication when used with the LDAP-based provider; anyone who runs the toolcan perform Admintool operations against the Oracle Internet Directory server. This means that it is vital to secure access to the production machine(s) on which OC4J uses the LDAP-based provider. If you specify the `-user` and `-password` options when using the LDAP-based provider, they are ignored.

JAZN Admintool Command-Line Options

The JAZN Admintool provides the following command options, described in greater detail in the following sections. The tool prints error messages if the syntax or parameters are incorrect. You can list all the options and their syntax with the `-help` option, as in:

```
java -jar jazn.jar -help
```

Syntax

The overall syntax for the Admintool is

```
java -jar jazn.jar [-user username -password mypassword
  -clustersupport ORACLE_HOME] [otheroptions]
```

> **Note:** If you are using the `-user`, `-password`, or `-clustersupport` options, you must specify them before all other options on the command line.

This section lists all the Admintool command options.

Admintool Authentication (XML-based Provider Only)

`-user username -password mypassword`
See "Authentication and the JAZN Admintool (XML-based Provider Only)" on page B-2.

Clustering Operations

`-clustersupport oracle_home`

See "Adding Clustering Support" on page B-5.

Configuration Operations

`-getconfig`

See "Configuration Operations" on page B-9.

Interactive Shell

`-shell`

See "Using the JAZN Admintool Shell" on page B-15.

Login Modules

```
-addloginmodule application_name login_module_name
  control_flag [options]
-listloginmodules [application_name] [login_module_class]
-remloginmodule application_name login_module_name
```

See "Adding and Removing Login Modules (XML-based Provider Only)" on page B-6 and "Listing Login Modules" on page B-10.

Migration Operations

`-convert filename realm`

See "Migrating Principals from the principals.xml File" on page B-13.

Miscellaneous

`-help [command name]`

To display help for a specific command.

Password Management (XML-based Provider only)

```
-checkpasswd realm user [-pw password]
-setpasswd realm user old_pwd new_pwd
```

See "Checking Passwords (XML-based Provider Only)" on page B-9 and "Setting Passwords (XML-based Provider only)" on page B-14.

Policy Operations

```
-addperm permission permission_class action target [description]
-addprncpl principlename principle_class parameters [description]
-grantperm {realm {-user user|-role role} | principal_class
        principal_params} permission_class [permission_params]
-listperms [{realm {-user user |-role role} |
        principal_class principal_params | permission_name]
-listperm permission
-listprncpls [principal_name ]
-listprncpl principal_name
-remperm permission
-remprncpl principal_name
-revokeperm {realm {-user user|-role role} | principal_class
        principal_params} permission_class [permission_params]
```

See "Adding and Removing Policy Permissions (XML-based Provider Only)" on page B-5, "Adding and Removing Principals (XML-based Provider Only)" on page B-7, "Granting and Revoking Permissions" on page B-9, "Listing Permissions" on page B-11, "Listing Permission Information" on page B-11, "Listing Principal Classes" on page B-12, and"Listing Principal Class Information".

Realm Operations

```
-addrealm realm admin {adminpwd adminrole | adminrole
  userbase rolebase realmtype }
-addrole realm role
-adduser realm username password
-grantrole role realm {user|-role to_role}
-listrealms realm
-listroles [realm [user|-role role]]
-listusers [realm [-role role|-perm permission]]
-remrealm realm
-remrole realm role
-remuser realm user
-revokerole role realm {user|-role from_role}
```

See "Adding and Removing Realms" on page B-7, "Adding and Removing Roles (XML-based Provider Only)" on page B-8, "Adding and Removing Users (XML-based Provider Only)" on page B-8, "Granting and Revoking Roles" on page B-10, "Listing Realms" on page B-12, "Listing Roles" on page B-13, and "Listing Users" on page B-13.

Adding and Removing Policy Permissions (XML-based Provider Only)

-addperm *permission permission_class action target [description]*
-remperm *permission*

The `-addperm` option registers a permission with the JAAS Provider `PermissionClassManager`. The `-remperm` option removes registration for the specified permission class. To supply multiple words in the *`permission`* or *`description`* arguments, enclose them in quotation marks ("*`three word permission`*").

If you add a permission that already exists, the Admintool updates the permission's action and target lists.

For instance, to create permission to drop a realm, type:

```
java -jar jazn.jar -addperm perm1 oracle.security.jazn.realm.RealmPermission
droprealm "permission to drop a realm"
```

To delete the `droprealm` permission, type:

```
java -jar jazn.jar -remperm perm1
```

Admintool shell:

```
JAZN:> addperm perm1 oracle.security.jazn.realm.RealmPermission droprealm -null
"permission to drop a realm"
JAZN: remperm perm1
```

Adding Clustering Support

-clustersupport *oracle_home*

Specifying this option instructs the Admintool to propagate all JAAS configuration changes throughout a cluster. The *`oracle_home`* argument specifies the absolute path name of *`$ORACLE_HOME`*, the Oracle home directory. You can combine `-clustersupport` with the `-shell` option.

Notes: If you are using the `-clustersupport` option, you must specify it before all other options on the command line.

The `-clustersupport` option is meaningful only when using the XML-based provider.

For example:

```
java -jar jazn.jar -clustersupport /oracle_home -shell
```

Adding and Removing Login Modules (XML-based Provider Only)

You use the JAZN Admintool to add and remove login modules. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

```
java -jar jazn.jar -addloginmodule application_name login_module_name
  control_flag [optionname=value ...]
 java -jar jazn.jar -remloginmodule application_name login_module_name
```

The `-addloginmodule` option configures a new `LoginModule` for the named application.

The *`control_flag`* must be one of `required`, `requisite`, `sufficient` or `optional`, as specified in `javax.security.auth.login.Configuration`. See Table B–1.

Table B–1 LoginModule Control Flags

Flag	Meaning
`Required`	The `LoginModule` must succeed. Whether or not it succeeds, authentication proceeds down the `LoginModule` list.
`Requisite`	The `LoginModule` must succeed. If it succeeds, authentication continues down the `LoginModule` list. If it fails, control immediately returns to the application (authentication does not continue down the `LoginModule` list).
`Sufficient`	The `LoginModule` is not required to succeed. If it succeeds, control immediately returns to the application and authentication does not proceed down the `LoginModule` list. If it fails, authentication continues down the `LoginModule` list.
`Optional`	The `LoginModule` is not required to succeed. Whether or not it succeeds, authentication proceeds down the `LoginModule` list.

If the `LoginModule` accepts its own options, you specify each option and its value as an *`optionname=value`* pair. Each `LoginModule` has its own individual set of options.

For instance, to add `MyLoginModule` to the application `myapp` as a required module with `debug` set to `true`, type:

```
java -jar jazn.jar -addloginmodule myapp MyLoginModule required debug=true
```

To delete `MyLoginModule` from `myapp`, type:

```
java -jar jazn.jar -remloginmodule myapp MyLoginModule
```

Admintool shell:

```
JAZN:> addloginmodule myapp MyLoginModule required debug=true
JAZN: remloginmodule myapp MyLoginModule
```

Adding and Removing Principals (XML-based Provider Only)

-addprncpl *principlename principle_class parameters* [*description*]
-remprncpl *principal_name*

The `-addprncpl` option registers a principal with the JAAS Provider `PrincipalClassManager`. The `-remprncpl` option removes registration for the specified principal class. To supply multiple words in the *`principal_name`* and *`description`* arguments, enclose them in quotation marks ("*`three word description`*").

If you add a principal that already exists, the Admintool updates the principal's parameter list.

For example, to add the principal `staff`, type:

```
java -jar jazn.jar -addprincpl staff oracle.security.jazn.spi.xml.XMLRealmUser
  "a staff user"
```

Admintool shell:

```
JAZN:> addprincpl staff oracle.security.jazn.spi.xml.XMLRealmUser -null "a staff
user"
```

Adding and Removing Realms

-addrealm *realm admin {adminpwd adminrole | adminrole*
userbase rolebase realmtype}
-remrealm *realm*

The `-addrealm` option creates a realm of the specified type with the specified name, and `-remrealm` deletes a realm.

For example, using the XML-based Provider, the administrator `martha` with password `mypass` using role `hr` would add the realm `employees` as follows:

```
java -jar jazn.jar -addrealm employees martha mypass hr
```

Using the LDAP-based Provider, the administrator `martha` using role `hr` would add the realm `employees` to userbase `ub` and rolebase `rb` in an external realm as follows:

```
java -jar jazn.jar -addrealm employees martha hr ub rb external
```

Note: The *`realmtype`* argument is required only when using the LDAP-based Provider. The possible values for *`realmtype`* are:

- `external`
- `application`

In either environment, the administrator would delete `employees` as follows:

```
java -jar jazn.jar -remrealm employees
```

Adding and Removing Roles (XML-based Provider Only)

-addrole *realm role*
-remrole *realm role*

The `-addrole` option creates a role in the specified realm; the `-remrole` option deletes a role from the realm.

> **Note:** If you are using the LDAP-based provider, `-addrole` and `-remrole` are supported only for application realms; they are not supported for external or identity management realms.

For example, to add the role `roleFoo` to the realm `foo`, type:

```
java -jar jazn.jar -addrole foo fooRole
```

To delete the role from the realm, type:

```
java -jar jazn.jar -remrole foo fooRole
```

Admintool shell:

```
JAZN:> remrole foo fooRole
```

Adding and Removing Users (XML-based Provider Only)

-adduser *realm username password*
-remuser *realm user*

The `-adduser` option adds a user to a specified realm; the `-remuser` option deletes a user from the realm. For example, to add the user `martha` to the realm `foo` with the password `mypass`, type:

```
java -jar jazn.jar -adduser foo martha mypass
```

> **Notes:** ■
>
> - To insert a user with no password, end the command line with the `-null` option, as in:
>
>   ```
>   jazn -jar jazn.jar -adduser foo martha -null
>   ```
>
> - If you are using the LDAP-based provider, these commands will not work.

To delete `martha` from the realm, type:

```
java -jar jazn.jar -remuser foo martha
```

Admintool shell:

```
JAZN:> adduser foo martha mypass
```

Checking Passwords (XML-based Provider Only)

-**checkpasswd** *realm user* [-pw *password*]

The -checkpasswd option indicates whether the given user requires a password for authentication.

When you specify -checkpasswd alone, the Admintool responds "A password exists for this principal" if the user has a password, or "No password exists for this principal" if the user has no password.

When you specify -checkpasswd together with the -pw option, the Admintool responds "Successful verification of user/password pair" if the username and password pair are correct, or "Unsuccessful verification of user/password pair" if username and / or password is incorrect.

For example, to check whether the user martha in realm foo uses the password Hello, type:

```
java -jar jazn.jar -checkpasswd foo martha -pw Hello
```

Admintool shell:

```
JAZN:> checkpasswd foo martha -pw Hello
```

Configuration Operations

-**getconfig**

The -getconfig option displays the current configuration setting in jazn.xml.

For example, to check the configuration settings for the realm foo, type:

```
java -jar jazn.jar -getconfig
```

Admintool shell:

```
JAZN:> getconfig foo
```

Granting and Revoking Permissions

-**grantperm** *realm* {*-user user*|-role *role* } | *principal_params*} *permission_class* [*permission_params*]
-**revokeperm** *realm* {-user user|-role *role*} | *principal_class principal_parameters}* *permission_class* [*permission_parameters]*
-**listperms** *realm* {-user user|-role *role*} | *principal_class principal_parameters}* *permission_class* [*permission_parameters]*

where *principal_class* is the fully qualified name of a class that implements the principal interface (such as com.sun.security.auth.NTDomainPrincipal) and *principal_paramters* is a ***single*** String parameter.

The -grantperm option grants the specified permission to a user (when called with -user) or a role (when called with -role) or a principal. The -revokeperm option revokes the specified permission from a user or role or principal

A *permission_descriptor* consists of a permission's explicit class name (for example, oracle.security.jazn.realm.RealmPermission), its action, and its action and target parameters (for RealmPermission, realmname action). Note that there may be multiple action and target parameters.

For example, to grant `FilePermission` with target `a.txt` and actions "`read, write`" to user `martha` in realm `foo`, type:

```
java -jar jazn.jar -grantperm foo -user martha java.io.FilePermission
 a.txt read, write
```

Admintool shell:

```
JAZN:> grantperm foo -user martha java.io.FilePermission a.txt read, write
```

Granting and Revoking Roles

-**grantrole** *role realm* {user|-role *to_role*}
-**revokerole** *role realm* {user|-role *from_role*}

The `-grantrole` option grants the specified role to a user (when called with a user name) or a role (when called with `-role`). The `-revokerole` option revokes the specified role from a user or role.

Note: If you are using the LDAP-based provider, `-grantrole` and `-revokerole` are supported only for application realms; they are not supported for external or identity management realms.

For example, to grant the role `editor` to the user `martha` in realm `foo`, type:

```
java -jar jazn.jar -grantrole editor foo martha
```

Admintool shell:

```
JAZN:> grantrole editor foo martha
```

Listing Login Modules

-**listloginmodules** [*application_name*] [*login_module_class*]

You use the JAZN Admintool to list login modules. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

```
java -jar jazn.jar -listloginmodules [application_name [login_module_class]]
```

The `-listloginmodules` option displays all `LoginModule`s either in the specified *`application_name`* , or, if no *`application_name`* is specified, in all applications. Specifying *`login_module_class`*, after *`application_name`* displays information on only the specified class within the application.

For example, to display all `LoginModule`s for the application `myapp`, type:

```
java -jar jazn.jar -listloginmodules myapp
```

Admintool shell:

```
JAZN:> listloginmodules myapp
```

Listing Permissions

-listperms *realm* {-user *user*|-role *role*} | *principal_class principal_parameters*} *permission_class* [*permission_parameters*]

The -listperms option displays all permissions that match the list criteria. This option lists the following:

- All permissions registered with the JAAS Provider PermissionClassManager
- Permissions that are granted to a role when the -role option is used.
- Permissions that are grated to a prinicpal.

For example, to display all permissions for the user martha in realm foo, type:

```
java -jar jazn.jar -listperms foo -user martha
```

Admintool shell:

```
JAZN:> listperms foo -user martha
```

Listing Permission Information

-**listperm** *permission*

The-listperm option displays detailed information about the specified permission, including the permission's display name, class, description, actions, and targets.

For example, to list all information about the permission perm1, type:

```
java -jar jazn.jar -listperm perm1
```

Typical output might look like

```
Name:
perm1

Class:
oracle.security.jazn.realm.RealmPermission

Description:
permission to drop realm

Targets:

Actions:
droprealm  <no description available>
```

Admintool shell:

```
JAZN:> listperm perm1
```

Listing Principal Classes

-listprncpls *principal_name*

The -listprncpls option lists all principal classes registered with the PrincipalClassManager. If the *principal_name* argument is present, only the named principal class is listed.

For example:

```
java -jar jazn.jar -listprncpls
```

Admintool shell:

```
JAZN:> listprncpls
```

Listing Principal Class Information

-listprncpl *principal_name*

The -listprncpl option displays detailed information about the specified principal, including the display name, class, description, and actions.

For example, to list all information about the principal martha, type:

```
java -jar jazn.jar -listprncpl martha
```

In our example, the output would be:

```
Name:
martha
Class:
oracle.security.jazn.spi.xml.XMLRealmUser
Description:
a staff user
Parameters:
```

Admintool shell:

```
JAZN:> listprncpl martha
```

Listing Realms

-listrealms [*realm*]

The -listrealms option displays all realms in the current JAAS environment; if an argument is specified, it lists only the specified realm.

For example, to list all realms, type:

```
java -jar jazn.jar -listrealms
```

Admintool shell:

```
JAZN:> listrealms
```

Listing Roles

-listroles [*realm* [*user*|-role *role*]]

The -listroles option displays a list of roles that match the list criteria. This option lists:

- All roles in all realms, when called without any parameters
- All roles granted to a user, when called with a realm name and user name
- Roles that are granted the specified *role*, when called with a realm name and the option -role

For example, to list all roles in realm foo, type:

```
java -jar jazn.jar -listroles foo
```

Admintool shell:

```
JAZN:> listroles foo
```

Listing Users

-listusers [*realm* [-role *role*|-perm *permission*]]

The -listusers option displays a list of users that match the list criteria. This option lists:

- All users in all realms, when called without any parameters
- All users in a realm, when called with a realm name
- Users that are granted a certain role or permission, when called with a realm name and the option -role or -perm

For example, to list all users in realm foo, type:

```
java -jar jazn.jar -listusers foo
```

Admintool shell:

```
JAZN:> listusers foo
```

For example, to list all users in realm foo using permission bar, type:

```
java -jar jazn.jar -listusers foo -perm bar
```

The Admintool lists users one to a line, as in:

```
scott
admin
anonymous
```

Migrating Principals from the principals.xml File

You use the JAZN Admintool to migrate your data out of the principals.xml file. For basic information on running the JAZN Admintool, see "Admintool Overview" on page 4-3.

-convert *filename realm*

The -convert option migrates the principals.xml file into the specified realm of the current OracleAS JAAS Provider. The *filename* argument specifies the path

name of the input file (typically *$ORACLE_HOME*/j2ee/home/config/principals.xml).

The migration converts principals.xml users to JAAS users and principals.xml groups to JAAS roles. All permissions that were previously granted to a principals.xml group are mapped to the JAAS role. Users that were deactivated at the time of migration are not migrated. This ensures that no users can inadvertently gain access through the migration.

An error (either javax.naming.AuthenticationException:Invalid username/password or javax.naming.NamingException:Lookup Error) is returned if the input file contains errors.

Before you convert principals.xml, you must make sure that you have an administrator user that is authorized to manage realms. To do this:

1. Activate the administrative user in principals.xml, which is deactivated by default. Be sure to create a password for the administrator.

   Make sure that the administrator name you used to create the realm is different from the name of the administrator in principals.xml. This is necessary because the convert command does not migrate duplicate users, and migrates duplicate roles by overwriting the old one.

2. Create the realm principals.com with a dummy user and a dummy role. For example, in the Admintool shell you would type:

   ```
   JAZN> addrealm principals.com u1 welcome r1
   ```

3. Migrate principals.xml to the principals.com realm, as in

   ```
   java -jar jazn.jar -convert config/principals.xml principals.com
   ```

4. Change the <default-realm> to principals.com; see "Setting Persistence Mode" on page 8-4.

5. Stop OC4J and restart it.

Setting Passwords (XML-based Provider only)

-**setpasswd** *realm user old_pwd new_pwd*

The -setpasswd option enables administrators to reset the password of a user given the old password.

For example, to change the user martha in realm foo from password mypass to password a2d3vn, type:

```
java -jar jazn.jar -setpasswd foo martha mypass a2d3vn
```

Admintool shell:

```
JAZN:> setpasswd foo martha mypass a2d3vn
```

Using the JAZN Admintool Shell

-shell

The -shell option starts a JAZN Admintool shell. The JAZN Admintool shell provides interactive administration of JAAS principals and policies through a UNIX-derived interface.

```
java -jar jazn.jar -user martha -password mypass -shell
JAZN:>
```

The shell responds with the JAZN:> prompt. To leave the interface shell, type exit.

Note: Multi-word arguments must be enclosed in quotes. For example, `java -jar jazn.jar -user 'Oracle DBA' ...`

If you are using the XML-based provider you must supply a username and password to the Admintool; for details see "Authentication and the JAZN Admintool (XML-based Provider Only)" on page B-2. If you are using the LDAP-based Provider, you do not need to specify the -user and -password arguments.

Navigating the JAZN Admintool Shell

The Admintool shell supports UNIX-like commands for navigating within a JAZN structure. For a complete discussion of the Admintool directory structure, see "Admintool Shell Directory Structure" on page B-17. All the Admintool commands support relative and absolute paths.

The Admintool navigation commands are:

add: Creating Provider Data

add *directory_name* [*other_parameter*]
mkdir *directory_name* [*other_parameter*]
mk *directory_name* [*other_parameter*]

The add, mkdir, and mk commands are synonyms: they create a subdirectory or node in the current directory. For example, if the current directory is the root, then mk creates a realm. If the current directory is /realm/users, then mk creates a user. The effect of add depends upon the current directory. Some commands require additional parameters in addition to the name.

cd: Navigating Provider Data

cd *path*

The cd command enables users to navigate the directory tree. Relative and absolute path names are supported. To exit a directory, type:

```
cd ..
```

Typing cd / returns the user to the root node. An error message is displayed if the specified directory does not exist.

clear: Clearing the Screen

clear

The `clear` command clears the terminal screen by displaying 80 blank lines.

exit: Exiting the JAZN Shell

`exit`

The `exit` command exits the JAZN shell.

help: Listing JAZN Admintool Shell Commands

`help`

The `help` command displays a list of all valid commands.

ls: Listing Data

`ls [`*`path`*`]`

The `ls` command lists the contents of the current directory or node. For example, if the current directory is the root, then `ls` lists all realms. If the current directory is `/realm/users`, then `ls` lists all users in the realm. The results of the listing depends on the current directory. The `ls` command can operate with the * wildcard.

man: Viewing JAZN Admintool Man Pages

`man` *`command_option`*
`man` *`shell_command`*

The `man` command displays detailed usage information for the specified shell command or JAZN Admintool command option. Where information presented by the `man` page and this document conflict, this document contains the correct usage for the command.

pwd: Displaying The Working Directory

`pwd`

The `pwd` command displays the current location of the user in the directory tree. Undefined values are left blank in this listing.

rm: Removing Provider Data

`rm` *`directory_name`*

The `rm` command removes the directory or node in the current directory. For example, if the current directory is the root, then `rm` removes the specified realm. If the current directory is `/realm/users`, it removes the specified user. The effect of `rm` depends on the current directory. An error message is displayed if the specified directory does not exist.

The `rm` command accepts the * wildcard.

set: Updating Values

set *name=value*

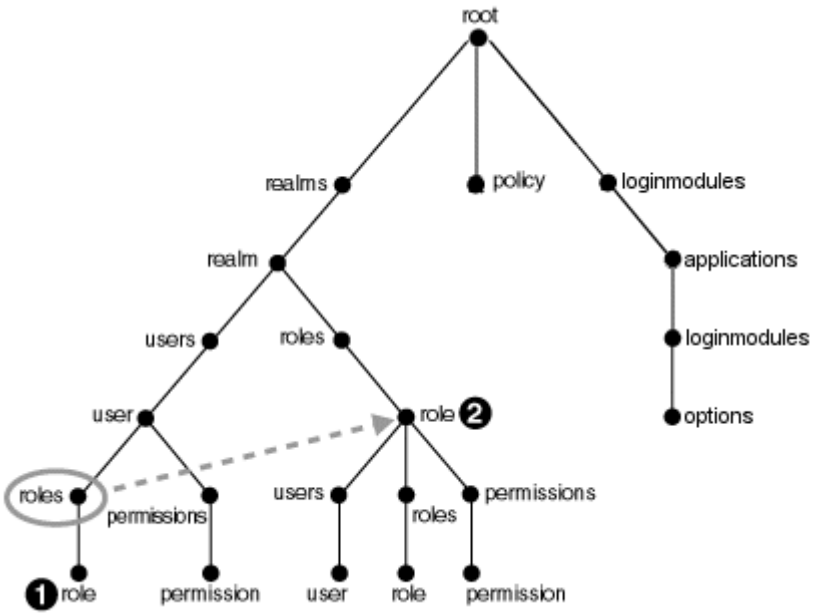
The `set` command updates the value of the specified name. For example, use this command to update the login module class, or a login module control flag, or a login module class option, depending on the working directory.

Admintool Shell Directory Structure

The JAZN Admintool includes a shell called the JAZN shell interface. The JAZN shell is an interactive interface to the JAAS Provider API.

The shell directory structure consists of nodes, where nodes contain subnodes that represent the parent node's properties. Figure B–1 illustrates the node structure.

Figure B–1 JAZN Shell Directory Structure

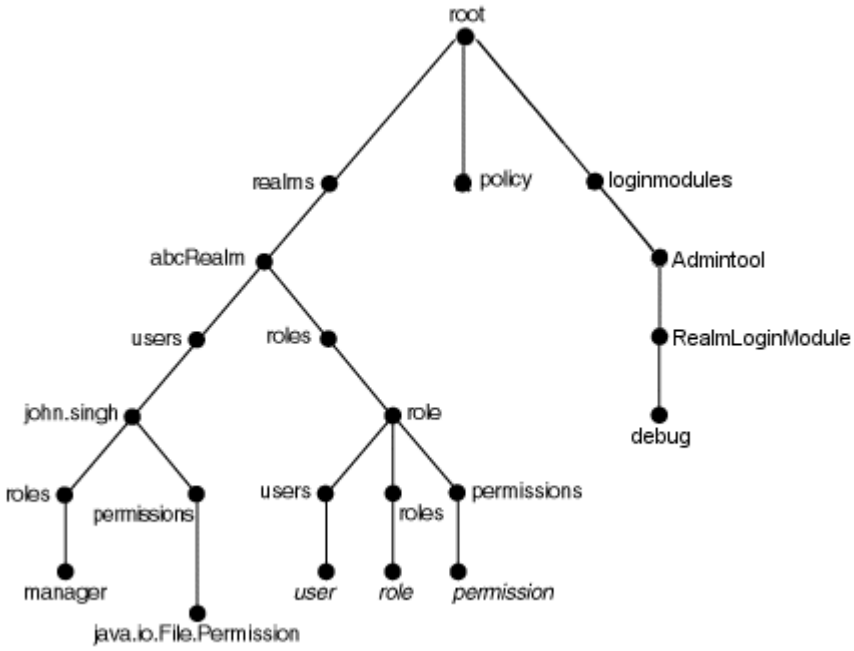


In this structure, the `user` and `role` nodes are linked together. This means that the `roles` link under `user` is the same link as the `roles` link under `realm`. In Unix terms, the `role` at numeral 1 in the diagram is a symbolic link to `role` at numeral 2 in the diagram.

Note: In this release, the policy directory is always empty.

Figure B–2 shows nodes of the `abcRealm` created by the `jazn-data.xml` file in "Sample jazn-data.xml Code" on page A-1.

Figure B–2 Illustrated Shell Directory Structure



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