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Best Practices Guide

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Oracle Application Server Best Practices Guide, 10*g* Release 2 (10.1.2)

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Preface

Oracle Application Server Best Practices Guide provides a collection of common practices regarding usage, deployment, or development of Oracle Application Server.

Audience

Oracle Application Server Best Practices Guide is intended for anyone deploying Oracle Application Server.

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. Accessibility 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 more information, visit the Oracle Accessibility Program Web site at

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For more information, see the Oracle Application Server Documentation Library.

Conventions

The following text conventions are used in this document:

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

1

Introduction to Best Practices

This book provides a collection of best practices, covering configuration, deployment, and development of Oracle Application Server. A best practice provides a recommendation or a common practice on how to perform certain tasks and actions. This recommendation may involve a combination of tools and manual processes to achieve a desired result. This collection covers the following technology areas:

- Administration and management tools for Oracle Application Server
- Oracle HTTP Server
- Oracle Application Server Containers for J2EE (OC4J) Applications and associated tools
- Oracle Application Server Portal
- Oracle Application Server Wireless
- Oracle Application Server Web Cache
- Oracle Business Intelligence, including components Oracle Reports and Oracle Business Intelligence Discoverer
- Security and Oracle Identity Management
- High availability

2

Management and Monitoring

This chapter describes management and monitoring best practices for Oracle Application Server. It includes the following topics:

- Section 2.1, "Oracle Enterprise Manager 10g Best Practices"
- Section 2.2, "Oracle Process Manager and Notification Server Best Practices"
- Section 2.3, "Distributed Configuration Management Best Practices"
- Section 2.4, "Dynamic Monitoring Services Best Practices"

2.1 Oracle Enterprise Manager 10*g* Best Practices

This section describes best practices for Oracle Enterprise Manager 10*g*. It features the following topics:

- Section 2.1.1, "Select the Framework Options That Best Suit Your Needs"
- Section 2.1.2, "Application Server Control Console"
- Section 2.1.3, "Grid Control Console"

2.1.1 Select the Framework Options That Best Suit Your Needs

There are ways to deploy Enterprise Manager in order to give you the flexibility to select the configuration that best suits your needs. If you are working in a simple development or test environment, or if you have a single Oracle Application Server 10*g* instance to manage, you can use Oracle Enterprise Manager 10*g* Application Server Control Console (Application Server Control Console), which is available with any Oracle Application Server middle-tier installation. Application Server Control Console enables you to directly access all the pages for managing and monitoring the instance.

In a production environment, you typically manage a wider variety of software and hardware components. For example, you need to manage the databases and host computers that support your Web applications. For your production environment, you should use Oracle Enterprise Manager 10*g* Grid Control Console. The Grid Control Console provides you with a central location from which you can manage your Oracle Application Server instances, your databases, and your entire Oracle environment. Grid Control Console also supports sharing of information between administrators.

Implementation Details

See Also: *Oracle Enterprise Manager Concepts* for further information about the Application Server Control Console and Grid Control Console

2.1.2 Application Server Control Console

This section contains the following topics:

- Section 2.1.2.1, "Use the Deployment Wizard to Deploy Applications"
- Section 2.1.2.2, "Use Clusters for Application Deployment and Configuration Management to Simplify Management of Application Servers"
- Section 2.1.2.3, "Monitor Application Performance During Application Development or Test Cycles to Identify Resource Usage and Identify Bottlenecks"
- Section 2.1.2.4, "Use the Host Home Page to Help Diagnose Performance Issues"
- Section 2.1.2.5, "Perform Configuration Changes in Application Server Control to Ensure the Repository is Properly Updated"
- Section 2.1.2.6, "Monitor Rate and Aggregated Performance Metrics to Identify Slow Requests"

2.1.2.1 Use the Deployment Wizard to Deploy Applications

A simple way to deploy an application is to use the Oracle Enterprise Manager 10*g* deployment wizard, which you can access from the Application Server Control Console. The wizard walks you systematically through all the essential deployment options to ensure that your application is deployed correctly.

Implementation Details

See Also: "Deploying a New OC4J Application" in the Application Server Control Console Online Help

2.1.2.2 Use Clusters for Application Deployment and Configuration Management to Simplify Management of Application Servers

Using OracleAS Clusters simplifies management and maintenance of your application servers. Clustering enforces consistent configurations across all members of the cluster. If you want to make a configuration change in every instance, you only need to make the change once. The clustering mechanism ensures that the new configuration is propagated to all members.

Similarly, clustering also enforces consistency of deployed applications across all application server instances. If you wish to deploy a new application or update an existing deployment on every application server instance in the cluster, you only need to deploy or update the application once. The clustering mechanism ensures that the application is properly deployed to all members.

Implementation Details

See Also: "About Managing Oracle Application Server Clusters" in the Application Server Control Console Online Help

2.1.2.3 Monitor Application Performance During Application Development or Test Cycles to Identify Resource Usage and Identify Bottlenecks

During application development and testing, you can use the Application Server Control Console to monitor the application's resource usage and identify bottlenecks. For example, during a performance or load test you can view memory and CPU use for the Oracle Application Server instance overall and for the application. You can also drill down to find sessions, modules, EJBs, and methods that may be bottlenecks in the application.

Implementation Details

> **See Also:** "Maintaining OC4J Applications" in the Application Server Control Online Help

2.1.2.4 Use the Host Home Page to Help Diagnose Performance Issues

The Application Server Control Console home page not only displays critical performance data and resource usage for the application server instance, it also includes a link to information for the host. For example, if your application server is performing poorly you can first drill down to the related Host home page to determine if the underlying problem is due to resource problems with the host and other processes, or to services running on the computer.

Implementation Details

> **See Also:** "Obtaining Information about the Host Computer " in the Application Server Control

2.1.2.5 Perform Configuration Changes in Application Server Control to Ensure the Repository is Properly Updated

When you edit the configuration of Oracle Application Server components including Oracle HTTP Server, OC4J, or OPMN, you should do so using Application Server Control Console. Enterprise Manager ensures that your configuration changes are updated in the repository. If you edit these configuration files manually, you must use the command `dcmctl updateConfig` to notify the DCM repository of the changes.

Implementation

> **See Also:** Appendix A, "dcmctl Commands," in the *Distributed Configuration Management Administrator's Guide* for further information about the dcmctl updateConfig command

2.1.2.6 Monitor Rate and Aggregated Performance Metrics to Identify Slow Requests

Enterprise Manager home pages and drill downs include rate and aggregated performance data that are not available through command line or other tools. For example, you can use Enterprise Manager to view average processing time for a HTTP request, allowing you to zero in on specific requests that may be slow.

Enterprise Manager also displays performance information, such as average processing time for a servlet for the most recent five minutes, in addition to averages since startup. This information enables you to more easily diagnose problems in real time.

2.1.3 Grid Control Console

This section contains the following topics:

- Section 2.1.3.1, "Use Alerts and Notifications to Proactively Monitor System Availability"
- Section 2.1.3.2, "Set Up Grid Control Console to Monitor for Availability and Performance Issues"
- Section 2.1.3.3, "Add OracleAS Farms and OracleAS Clusters to Centrally Manage Application Server"
- Section 2.1.3.4, "Use End-User Performance Monitoring to Monitor Response Times of Web Pages"
- Section 2.1.3.5, "Proactively Monitor Web Application Transactions to Test Performance Monitoring"
- Section 2.1.3.6, "Use Diagnostics to Pinpoint OC4J Performance Problems"
- Section 2.1.3.7, "Use Job System to Schedule a Deployment"
- Section 2.1.3.8, "Regularly Perform Backups to Prepare for Loss of Data"
- Section 2.1.3.9, "Use Grid Control to Manage Both Oracle Application Server and the Oracle Database"
- Section 2.1.3.10, "Manage Multiple Oracle Application Server Instances on a Single Host to Reduce Resource Usages"

2.1.3.1 Use Alerts and Notifications to Proactively Monitor System Availability

Grid Control Console enables you to monitor your systems for specific conditions, such as loss of service or poor performance. When such a condition exists, Enterprise Manager generates an alert, which displays automatically on the appropriate Enterprise Manager home pages. In addition, you can also be notified through email or pager. Minimally, you should set up the Grid Control Console to alert you when your critical or production application servers are unavailable.

You can also configure the Grid Control Console to notify specific administrators when an event condition occurs. This feature simplifies cooperation between administrators who share responsibility for the same systems.

Implementation Details

> **See Also:** Chapter 12, "Configuring Notifications," in *Oracle Enterprise Manager Advanced Configuration*

2.1.3.2 Set Up Grid Control Console to Monitor for Availability and Performance Issues

Once you have set up Grid Control Console to monitor for availability and performance issues, you will be alerted when a problem is detected. If Enterprise Manager detects that an application server component is unavailable, you can use Application Server Control Console to check the status of the component and restart it if desired. If a performance issue was detected, with a component or application, you can drill down to the component home page and view detailed performance and diagnostic information. You can also drill down from the Oracle Application Server Containers for J2EE (OC4J) home page to find applications, modules, and methods. Using these drill downs, you can diagnose and resolve performance issues.

Implementation Details

> **See Also:** "Viewing An Application Server at a Glance" and "Viewing the Performance of Your Application Server" in the Grid Control Console Online Help

2.1.3.3 Add OracleAS Farms and OracleAS Clusters to Centrally Manage Application Server

If you use Oracle Application Server Farms and OracleAS Clusters in your environment and you use Grid Control Console, you should add the Oracle Application Server Farms and Clusters to Grid Control for central management. When adding the farm, Oracle recommends using the same farm name as what the Application Server Control Console shows so that the two consoles remain consistent as you are navigating from one to another to perform various tasks. After the farm and cluster is added, you can monitor the members of the farm and clusters, and perform common administrative tasks such as starting/stopping/restarting members; scheduling jobs to automate commonly-executed tasks against the farm or cluster, or creating blackouts to perform scheduled maintenance on the farm or cluster.

Implementation Details

> **See Also:** "Adding Oracle Application Server Farms "in the Grid Control Console Online Help

2.1.3.4 Use End-User Performance Monitoring to Monitor Response Times of Web Pages

To monitor the actual performance of your Web application as experienced by your end-users, use the End-User Performance Monitoring feature for Web applications. The End-User Performance Monitoring feature of Enterprise Manager enables you to view and analyze the actual request response times for all Web pages accessed by all your end-users. You can assess the impact of a performance problem on your end-user base, or view page performance data by visitor, domain, region, or Web server, or by a combination of these axes. Also, you can highlight the monitoring of the most critical pages of your Web application by setting up a Watch List.

The End-User Performance Monitoring option requires configuration of OracleAS Web Cache, Apache HTTP Server 2.0, or standalone Oracle HTTP Server 2.0 to instrument end-user performance data.

Implementation Details

> **See Also:** Section 6.8, "Configuring End-User Performance Monitoring," in *Oracle Enterprise Manager Advanced Configuration*

2.1.3.5 Proactively Monitor Web Application Transactions to Test Performance Monitoring

Enterprise Manager provides a proactive approach to monitoring Web applications through test performance monitoring. Synthetic business transactions, or service tests, are created using the transaction recorder, and are then replayed and monitored at specified intervals from key representative user communities called beacons. Measure the response times of key business transactions from various geographical user communities using this feature. Use test performance monitoring to:

- Isolate server-side problems from network delays

- Profile how much time is spent connecting to the server
- Document its first byte time
- Time spent serving HTML and non-HTML content

Alerts will notify you when transaction response time thresholds have been exceeded.

Implementation Details

> **See Also:** Section 6.4.4, "Service Tests and Beacons," in *Oracle Enterprise Manager Advanced Configuration* to configure and enable this option

2.1.3.6 Use Diagnostics to Pinpoint OC4J Performance Problems

Enterprise Manager provides comprehensive diagnostics that enable you to quickly pinpoint Oracle Application Server Containers for J2EE (OC4J) performance problems within the middle tier. To determine performance bottlenecks within your application, use the Web Application Request Performance page to identify the slowest requests by OC4J processing time. Each request is broken down by JSP, servlet, EJB and JDBC processing times. By traversing through the invocation paths of the processing call stack down to the SQL statement level, you can quickly identify the source of the bottlenecks causing application slowdowns. Use the application correlation feature to determine whether other system level problems have attributed to performance bottlenecks.

In addition, you can trace all invocation paths of a Web application starting at the transaction level on an on-demand basis, and diagnose performance problems across all tiers: from the network, through the middle tier (including JSP servlet, EJB, and JDBC times) down to the SQL statement level.

If the performance bottleneck is found to be SQL, then in context you should launch the SQL Tuning Advisor to schedule analysis and tuning of the SQL statement in question. After analyzing the SQL statements, the advisor provides advice on optimizing the execution plan, the rationale for the proposed optimization, the estimated performance benefit, and the command to implement the advice.

> **See Also:** Section 6.9.1, "Selecting OC4J Targets for Request Performance Diagnostics," in *Oracle Enterprise Manager Advanced Configuration*

2.1.3.7 Use Job System to Schedule a Deployment

In some cases, you may want to deploy an application during off-hours or at a certain scheduled time. You can use the Enterprise Manager job system to schedule a deployment to occur at a selected time. Simply create a script containing the DCM command-line `dcmctl deployApplication` command and schedule the script with the Enterprise Manager job system.

Implementation Details

See Also:

- Appendix A, "dcmctl Commands," in the *Distributed Configuration Management Administrator's Guide* for information about the `deployApplication` command
- Chapter 8, "Job System," in *Oracle Enterprise Manager Concepts* for more information on how to the use the Enterprise Manager job system

2.1.3.8 Regularly Perform Backups to Prepare for Loss of Data

You should perform regular backups of your application server, and when you backup you should consider your entire application server environment. For example, you should not back up your middle-tier installation on Monday and your Infrastructure on Tuesday. If you did, you would not be able to restore your environment to a consistent state. Instead, you should back up your entire Oracle Application Server environment at once. Then, if a loss occurs, you can restore your entire environment to a consistent state. Ideally, you should perform application server backups after every administrative change, or, if this is not possible, on a regular basis, perform an instance backup of your Oracle Application Server environment. This backup enables you to restore your environment to a consistent state as of the time of your most recent configuration and metadata backup. To avoid an inconsistent backup, do not make any configuration changes until backup completes for all Oracle Application Server instances.

You can use Grid Control to perform immediate Application Server backups or backups on a scheduled basis. For instance, you can schedule a weekly full, cold backup for Sunday nights and then an incremental, online backup for other nights. You should also take backups after installation as well any major configuration change.

Implementation Details

See Also: "Scheduling a Backup of Oracle Application Servers" and "About Backing Up and Recovering Oracle Application Servers" in the Grid Control Console Online Help

2.1.3.9 Use Grid Control to Manage Both Oracle Application Server and the Oracle Database

If you plan to manage both your Oracle Application Server instances and your Oracle database from the same management console, install the latest version of Grid Control. This install will ensure that you have the most up-to-date functionality for managing both types of targets.

2.1.3.10 Manage Multiple Oracle Application Server Instances on a Single Host to Reduce Resource Usages

By default, each Oracle Application Server instance on a host has its own Application Server Control Console, which manages the components of that particular Oracle Application Server instance.

If you have installed multiple Oracle Application Server instances on a single host, you can optionally reduce the memory and CPU consumption by performing a postinstallation configuration procedure to configure a single Application Server

Control Console to manage two Oracle Application Server instances installed on the same host.

Implementation Details

> **See Also:** Section A.8, "Managing Multiple Oracle Application Server Instances on a Single Host," in *Oracle Application Server Administrator's Guide*

2.2 Oracle Process Manager and Notification Server Best Practices

This section describes Oracle Process Manager and Notification (OPMN) Server best practices. It includes the following topics:

- Section 2.2.1, "Start OPMN to Manage Components"
- Section 2.2.2, "Never Start or Stop OPMN Managed Components Manually"
- Section 2.2.3, "Review stdout and stderr to Determine Cause of Components Not Starting"
- Section 2.2.4, "Increase Timeout For Components to Avoid Timed-Out Requests"
- Section 2.2.5, "Set Retry to High Values For Components Running on an Overloaded System to Avoid Restart of Computer"
- Section 2.2.6, "Leverage Additional Logging to Aid in Debugging"
- Section 2.2.7, "Configure Log Rotation to Avoid Log File Size Issues"
- Section 2.2.8, "Configure Additional Start Order Dependencies to Customize Startup"
- Section 2.2.9, "Use Event Scripts to Record Important Events"
- Section 2.2.10, "Use OPMN to Manage External Components"

2.2.1 Start OPMN to Manage Components

Start the OPMN server as soon as possible after turning on the host. OPMN must be running whenever OPMN-managed components are turned on or off. OPMN must be the last service turned off whenever you reboot or turn off your computer.

2.2.2 Never Start or Stop OPMN Managed Components Manually

Oracle Application Server components managed by OPMN should never be started or stopped manually. Do not use command line scripts or utilities from previous versions of Oracle Application Server for starting and stopping Oracle Application Server components.

Implementation Details

To implement this best practice, use the Application Server Control or the `opmnctl` command line utility to start or stop Oracle Application Server components.

2.2.3 Review stdout and stderr to Determine Cause of Components Not Starting

The process-specific console logs are the first and best resource for investigating problems related to starting and stopping components. OPMN creates a log file for each component and assigns a unique concatenation of the Oracle Application Server

component with a number. For example, the standard output log for OracleAS Web Cache may be `WebCache~WebCacheAdmin~1`.

Implementation Details

To implement this best practice, review the standard output (`stdout`) and standard error (`stderr`) of OPMN managed processes are reported in the log file in available in the `ORACLE_HOME/opmn/logs` directory.

The `stdout and stderr` log files are reused and appended to when a component is restarted so these files can contain output from multiple invocations of a component.

2.2.4 Increase Timeout For Components to Avoid Timed-Out Requests

The time it takes to execute an `opmnctl` command is dependent on the type of Oracle Application Server process and available computer hardware. Because of this the time it takes to execute an `opmnctl` command may not be readily apparent. For example, the default start time out for OC4J is approximately five minutes. If an OC4J process does not start-up after an `opmnctl` command, OPMN will wait approximately an hour before timing out and aborting the request.

Increase the `start` element timeout attribute for the component that takes a long time to start. Similarly, increase the `stop` element timeout attribute in `opmn.xml` for the component that takes a long time to stop.

Implementation Details

Set the timeout in the `opmn.xml` file at a level that will allow OPMN to wait for process to come up.

2.2.5 Set Retry to High Values For Components Running on an Overloaded System to Avoid Restart of Computer

Pings occur periodically between OPMN and the components that it manages to ensure that each component is not unresponsive and is capable of servicing requests. Ping failures result in a certain number of retry attempts and multiple failures in a row result in a restart of the component. On overloaded systems, it may be necessary to increase the number of retry attempts made before restarting the component.

Implementation Details

To implement this best practice:

1. In the `opmn.xml` file, locate `<start>` and `<restart>` elements.
2. Set the `retry` attribute in the appropriate element to a value greater than what is needed for the component to be pinged successfully.

   This attribute specifies the number of times to retry a ping attempt before a component is considered hung.

2.2.6 Leverage Additional Logging to Aid in Debugging

OPMN provides different levels of logging. In a typical production mode, set the log level to the minimum level. When you are having a problem related to OPMN, prior to contacting Oracle Support, try leveraging additional logging to aid in debugging the problem.

OPMN provides different levels of logging. In a typical production mode, set the log level to a minimum.

Implementation Details

When you are having an OPMN-related problem, perform these steps prior to contacting technical support:

1. In the `opmn.xml` file, set the `level` attribute of `<log-file>` element for both `<notification-server>` and `<process-manager>` elements to `8` or `9`.
2. Execute the `$ORACLE_HOME/opmn/bin/opmnctl debug` command and save the output to a file.
3. Save a copy of all logs in the `$ORACLE_HOME/opmn/logs` directory.

   The file at this log level contains valuable information to assist in debugging.

2.2.7 Configure Log Rotation to Avoid Log File Size Issues

OPMN can rotate notification server log file (`ons.log`) and process manager log file (`ipm.log`) based on size, time or both. When the log file reaches the configured size or at the given hour of the day, the OPMN logging mechanism will close the file, rename it with a time stamp suffix, and then create a new log file. By default, log files are configured to be rotated based on size (1500000 KB), but when necessary, explicitly set rotation attributes for your environment.

OPMN can rotate managed process console log files too, for example, `$ORACLE_HOME/opmn/logs/HTTP_Server~1` file for Oracle HTTP Server. At process startup, before handing off an existing console log file to a managed process, OPMN checks the size against a configured limit (`rotation-size` attribute of `<log-file>` element of `<process-manager>` element), and if the file size exceeds the limit, it will rename the existing file to include a time stamp, and then creates a new file for the managed process. If the `rotation-size` attribute is not configured, OPMN will not be able rotate the process console log file.

Having a proper rotation plan ensures OPMN and OPMN managed process starting and running without log file size issues, for limitation of 2 GB file size on some operating systems.

Implementation Details

To enable log rotation, configure the `rotation-size` and `rotation-hour` attributes of the `<log-file>` element for both `<notification-server>` and `<process-manager>` elements.

2.2.8 Configure Additional Start Order Dependencies to Customize Startup

OPMN is configured at installation with default start order dependencies, which enables you to start all of the components in an instance in a specific order with a single command. But if a specific component requires that other components and services are up and running before it starts, you can configure additional dependencies according to the environment.

2.2.9 Use Event Scripts to Record Important Events

You can configure OPMN to execute your own custom event scripts whenever a particular component starts, stops, or fails. It is useful to use one or more of the following event types:

- **pre-start:** OPMN runs the pre-start script after any configured dependency checks have been performed and passed, and before the Oracle Application Server

component starts. For example, you can use the pre-start script for site-specific initialization of external components.

- **pre-stop**: OPMN runs the pre-stop script before stopping a designated Oracle Application Server component. For example, you can use the pre-stop script for collecting Java Virtual Machine stack traces prior to stopping OC4J processes.
- **post-crash**: OPMN runs the post-crash script after the Oracle Application Server component has terminated unexpectedly. For example, a user could learn of component crashes by supplying a script or program to be executed at post-crash events, which sends a notification to the administrator's pager."

Implementation Details

> **See Also:** Appendix A, "OPMN Troubleshooting," in the *Oracle Process Manager and Notification Server Administrator's Guide* for a sample pre-start script

2.2.10 Use OPMN to Manage External Components

OPMN has the ability to manage arbitrary daemon processes that are not part of your Oracle Application Server installation. You can even create more sophisticated process management services by supplying the `opmn.xml` file the optional paths to scripts for stopping, restarting, and pinging the daemon process.

Implementation Details

Here is a simple example of an `opmn.xml` configuration for a custom component. The following lines load and identify the custom process module:.

```
<module path="%ORACLE_HOME%/opmn/lib/libopmncustom.so">
   <module-id id="CUSTOM" />
</module>
```

The following lines represent the minimum configuration for a custom process:

```
<ias-component id="Custom">
   <process-type id="Custom" module-id="CUSTOM">
      <process-set id="Custom" numprocs="1">
         <module-data>
            <category id="start-parameters">
               <data id="start-executable" value="Your start executable here" />
            </category>
         </module-data>
      </process-set>
   </process-type>
</ias-component>
```

> **See Also:** Chapter 15, "Configuring Custom Process," in the *Oracle Process Manager and Notification Server Administrator's Guide* for a sample pre-start script

2.3 Distributed Configuration Management Best Practices

This section describes best practices for Distributed Configuration Management (DCM). It contains the following topics:

- Section 2.3.1, "Use DCM Archiving to Take Snapshots of Configuration"

- Section 2.3.2, "Specify a Single Instance in a Cluster as the Management Point to Provide A Correct Order of Operations"
- Section 2.3.3, "Avoid Concurrent Administration Operations to Prevent Configuration Conflicts"
- Section 2.3.4, "Avoid Running updateConfig Concurrently with Any Other Configuration Operation to Prevent Configuration Conflicts"
- Section 2.3.5, "Restart Application Server Control Console after Joining or Leaving a Farm or Cluster to Refresh the Console"
- Section 2.3.6, "Use High Availability Features for Infrastructure Repository to Synchronize within a Farm"
- Section 2.3.7, "Follow dcmctl Tips to Improve Usage"

2.3.1 Use DCM Archiving to Take Snapshots of Configuration

You should frequently be creating archives prior to performing any configuration operations.

The DCM archive feature provides a convenient and easy means of managing snapshots of the DCM-managed portions of Oracle Application Server system configuration. Archives are useful for staging changes, recovering from errors, and to provision DCM managed configuration information associated with one Oracle Application Server instance to another.

DCM managed system configuration includes configuration for a farm, clusters, Oracle HTTP Server, OPMN, OC4J, and JAZN. For OC4J, in addition to configuration information related to the container itself, DCM manages all deployed J2EE applications.

If you use DCM-Managed Oracle Application Server Clusters, DCM assures that any change to the configuration is automatically distributed to all members of the cluster. As an alternative to using clusters, you can manually apply an archive of a staged configuration to non-clustered instances in a farm.

A hybrid staging solution is to first stage and test changes to a non-clustered instance, archive the changes, and finally apply the archive to DCM-Managed Oracle Application Server Cluster. These changes are then automatically propagated to all members of the cluster.

Implementation Details

For example, to create an archive prior to deploying a new J2EE application named `foo` use the command:

```
dcmctl createArchive -arch PriorToDeployingFoo -comment "prior to foo deploy V1"
```

When using `createArchive`, it is a good practice to use an archive name and a corresponding comment that identifies the version of configuration that the archive is associated with.

> **See Also:** Chapter 3, "Archiving A Managed Configuration," in the *Distributed Configuration Management Administrator's Guide* for a sample pre-start script

2.3.2 Specify a Single Instance in a Cluster as the Management Point to Provide A Correct Order of Operations

You can manage Oracle Application Server instances, grouped in a DCM-Managed Oracle Application Server Cluster, as a single point of administration, using Application Server Control Console or `dcmctl` on any instance in the cluster. Use one instance as the administrative point for the entire cluster at any point in time.

Specifying a single instance in a cluster as the management point ensures that operations are executed in the correct order and are properly serialized.

2.3.3 Avoid Concurrent Administration Operations to Prevent Configuration Conflicts

When changing instance specific configuration, for example port numbers, host names or virtual hosts, on a particular instance in the DCM-Managed OracleAS Cluster, you must ensure that there are no other administrative changes are being made concurrently in the cluster to avoid conflicting changes to configuration resulting in an unusable configuration.

Concurrent administration within a DCM-Managed OracleAS Cluster is strongly discouraged. If multiple administrative operations are issued at the same time in a cluster, this can lead to errors and associated confusing error messages. For example, a concurrent attempt to change the configuration of an instance being deleted really does not make sense.

2.3.4 Avoid Running updateConfig Concurrently with Any Other Configuration Operation to Prevent Configuration Conflicts

Do not run the `dcmctl updateConfig` command concurrently with any other `dcmctl` commands or Application Server Control Console configuration operations from multiple Oracle Application Server instances in a Farm or DCM-Managed OracleAS Cluster. If `updateConfig` is being executed concurrently with other configuration operation, there is a risk of conflicting changes being placed in the metadata repository. These conflicts could leave the configuration stored in the metadata repository in a non-functional state and could require a restore from the archive.

2.3.5 Restart Application Server Control Console after Joining or Leaving a Farm or Cluster to Refresh the Console

When using a file-based repository, you should stop and then start Application Server Control Console after issuing the following `dcmctl` commands:

- `joinCluster`
- `joinFarm`
- `leaveCluster`
- `leaveFarm`

Implementation Details

Use following commands to restart Application Server Control Console:

- `emctl stop iasconsole`
- `emctl start iasconsole`

2.3.6 Use High Availability Features for Infrastructure Repository to Synchronize within a Farm

The infrastructure repository houses all the configuration information for the Oracle Application Server instances in a farm. This information is critical during startup, since DCM ensures that the local configuration of any node is synchronized with the configuration in this central repository. Therefore, it is a good idea to employ the high availability features for the infrastructure instance.

However, it is also important to understand that the database-based repository (in the case of a J2EE and OracleAS Web Cache installation) is used for management operations and OracleAS Single Sign-On. Thus, if a site is not using single sign-on capabilities, then the repository is primarily required to be up when performing configuration management operations, such as deploying new applications and joining or moving from a DCM-Managed OracleAS Cluster.

2.3.7 Follow dcmctl Tips to Improve Usage

The following are best practices when using `dcmctl`:

- Always use `-d` and `-v` options with `dcmctl` commands.

  By default, the `dcmctl` script is configured for programmatic usage. Instead of displaying lengthy messages that can differ across releases and languages, error codes are displayed, such as `ADMN-906005`. Scripting tools can use these error codes to perform different activities based upon the result of commands.

  Unfortunately a message like `ADMN-906005` does not mean much by itself. In order to see an explanation of the error code, use the `-d` and `-v` switches whenever possible.

- Use the `dcmctl getError` command to display the last error message

  Use the `dcmctl getError` command to display the error message from the most recent DCM error that occurred

- Always use `dcmctl getreturnstatus` to determine whether a command failed after timeout

  Long-running operations will often timeout but continue to execute asynchronously. This issue is indicated by `dcmctl` with an `ADMN-906005` error code:

  Using the `dcmctl deployApplication` command with the `-v` option as an example, the following message will be displayed.

  ```
  "The specified command "deployApplication", is being executed
  asynchronously. The maximum wait time of n seconds has been
  reached. This operation will continue to execute to
  completion. Use the "getReturnStatus" command to determine
  if/when the operation completes successfully."
  ```

  Once this timeout message is received, you can invoke the `dcmctl getReturnStatus` command periodically until the operation has completed.

- Use `dcmctl` shell mode for multiple commands.

  When you need to perform a number of `dcmctl` commands, use the `dcmctl` shell or the `dcmctl` command file options. Each initialization of `dcmctl` requires creation of a Java Virtual Machine and the parsing of a number of XML documents. This initialization only has to occur once if using a dcmctl shell versus multiple times if executing a set of `dcmctl` commands individually.

Implementation Details

Following is a sample shell session in which the shell is started, commands are executed, and the shell is stopped.

```
% dcmctl shell
dcmctl> createcluster -cl testcluster
dcmctl> joincluster -cl testcluster
dcmctl> createcomponent -ct oc4j -co component1
dcmctl> deployapplication -f /stage/apps/app1.ear -a app1 -co component1
dcmctl> getstate
dcmctl> exit
```

> **See Also:** Appendix A, "dcmctl Commands," in the *Distributed Configuration Management Administrator's Guide* for a sample pre-start script

2.4 Dynamic Monitoring Services Best Practices

This section describes Dynamic Monitoring Services (DMS) best practices. It includes the following topics:

- Section 2.4.1, "Monitor Your System Regularly to Identify Performance Problems"
- Section 2.4.2, "Take Regular Dumps of Metrics to Capture and Save a Record of Performance Data"
- Section 2.4.3, "Add Performance Instrumentation to Application to Aid Developers"
- Section 2.4.4, "Isolate Expensive Intervals Using PhaseEvent Metrics to Validate Code"
- Section 2.4.5, "Organize Performance Data to Avoid Metrics Not Displaying"
- Section 2.4.6, "DMS Naming Conventions to Improve Metric Reports"
- Section 2.4.7, "Follow DMS Coding Recommendations to Improve Code"
- Section 2.4.8, "Validate New Metrics to Verify Accuracy"

2.4.1 Monitor Your System Regularly to Identify Performance Problems

It is a good practice to monitor Oracle Application Server regularly. Monitoring Oracle Application Server and obtaining performance data can assist you in tuning the system and debugging applications with performance problems.

Implementation Details

> **See Also:** *Oracle Application Server Performance Guide* for available monitoring tools

2.4.2 Take Regular Dumps of Metrics to Capture and Save a Record of Performance Data

Run the `dmstool` command with the `-dump` option periodically, such as every 15 to 20 minutes, to capture and save a record of performance data for your Oracle Application Server installation. If you save performance data over time, it can assist you if you need to analyze system behavior to improve performance or if problems occur. Using `dmstool -dump` reports all the available metrics on the standard output.

The `-dump` option also supports the `format=xml` query. Using this query at the end of the command line supplies the metric output in XML format.

2.4.3 Add Performance Instrumentation to Application to Aid Developers

Consider instrumenting applications with DMS metrics. Adding performance instrumentation to Java applications will help developers, system administrators and support analysts understand system performance and monitor system status. DMS instrumentation refers to the process of inserting DMS calls into application code. Using the DMS API is a simple and efficient way to enable your application to measure, collect, and save performance information.

To create DMS metrics, developers add calls that notify DMS when events occur, when important intervals begin and end, or when pre-computed values change their state. At runtime, DMS stores performance information, called DMS metrics, in memory and enables you to save or view the metrics.

Implementation Details

See Also: *Oracle Application Server Performance Guide* for available monitoring tools

2.4.4 Isolate Expensive Intervals Using PhaseEvent Metrics to Validate Code

Carefully consider the requirements for new metrics when you add DMS instrumentation. It is important to add a sufficient number of metrics to validate that your code is behaving as desired but not so much that the useful statistics become buried in too much detail. As a guide, try to observe the following rules when you add DMS metrics:

- Add metrics only to provide an overview of the time the system spends in your block of code or module. You do not need to collect performance data for every method call, or for every distinct phase of your code or module.
- When your code calls external code that you do not control, and that you expect could take a significant amount of time, add a `PhaseEvent Sensor` to track the start and the completion of the external code.

2.4.5 Organize Performance Data to Avoid Metrics Not Displaying

The DMS metrics are organized in a tree, with leaf nodes being `Sensor` metrics and branching nodes being `Nouns`. Define DMS `Nouns` to organize `Sensors` and their associated metrics. It is good practice to only use `Noun` types for `Nouns` that directly contain `Sensors`. When a `Noun` contains only `Nouns`, and does not directly contain `Sensors`, `AggreSpy` displays the `Noun` type as a metric table, with no metrics.

Maintain a static hierarchy for `Noun` types. A static hierarchy for `Noun` types means that some `Noun` types will always be ancestors of other `Noun` types. If it can be avoided, ensure a `Noun` does not have the same `Noun` type as any of its ancestors.

2.4.6 DMS Naming Conventions to Improve Metric Reports

Follow the guidelines for defining DMS names, which aids users viewing DMS metric reports to easily understand metrics across applications and across Oracle Application Server components. In applying the naming convention rules, try to be as clear as possible, if there is a conflict, you might need to make an exception.

In general, try to use only alphanumeric and underscore characters for naming and avoid using the forward slash (/) character.

Implementation Details

> **See Also:** *Oracle Application Server Performance Guide* for different naming conventions

2.4.7 Follow DMS Coding Recommendations to Improve Code

Use the following coding recommendations for working with DMS:

- When you create a new `Noun` or `Sensor` (`PhaseEvent`, `Event`, or `State`), its full name must not conflict with names in use by Oracle built-in metrics, or by other applications.
- Be sure all `PhaseEvents` are stopped. Put the `PhaseEvents start()` in a `try` block with the `stop()` in the `finally` block.
- Avoid creating any DMS Sensor or Noun more than once. You should define Sensors and Nouns during static initialization, or in the case of a Servlet, in the `init()` method. Caching makes this less important as a best practice unless you are concerned about maximum performance.
- Assign a `Noun` type for each `Noun`. `Nouns` with no `Noun` type specified are not shown in the `Spy` or `AggreSpy` display.
- `PhaseEvents` should only be used to measure a section of code that is expensive under some set of conditions.
- The DMS API calls are thread safe; they provide sufficient synchronization to prevent races and access bugs.
- Avoid frequently creating and destroying Nouns and Sensors.

2.4.8 Validate New Metrics to Verify Accuracy

You should test and verify the accuracy of the metrics that you add to Java applications. Use the `dmstool` and the other available DMS monitoring tools to verify and test new metrics. Try the following to validate new metrics:

- Do expected metrics appear in the display?
- Do unexpected metrics appear in the display?

  Verify that you have only added the metrics that you planned to add.
- Are the metric values you see within reasonable ranges?

  For example, a `size of pool` metric should never report a negative value.
- Are metric values accurate?

  This validation can be difficult to test. If an alternate means of measuring a particular metric is available, then use it to verify metric values. For example, you can verify an Event Sensor count metric by examining records that you write to a log file or to the console.
- When integrating DMS instrumentation with an existing package or when implementing a new feature, consider insulating a previously working system.

  For example, you could include an option to enable and disable new DMS metrics.

3

Oracle HTTP Server

This chapter describes best practices for Oracle HTTP Server. It includes the following topics:

- Section 3.1, "Configure Topology Appropriately For Modem Connections to Prevent Blocking Oracle HTTP Server"
- Section 3.2, "Tune TCP/IP Parameters to Improve Oracle HTTP Server Performance"
- Section 3.3, "Tune KeepAlive Directives to Improve Connection Performance"
- Section 3.4, "Tune MaxClients Directive to Improve Request Performance"
- Section 3.5, "Avoid Any DNS Lookup to Prevent Performance Degradation"
- Section 3.6, "Tune Off Access Logging to Reduce Overhead"
- Section 3.7, "Use FollowSymLinks and Not SymLinkIfOwnerMatch to Configure Symbolic Links"
- Section 3.8, "Set AllowOverride to None to Prevent Unnecessary Directive Checking"
- Section 3.9, "Use mod_rewrite to Hide URL Changes For End-Users"
- Section 3.10, "Use mod_oc4j Sticky Routing Instead of Configuring the External Router"

> **See Also:** *Oracle HTTP Server Administrator's Guide* for information about directives mentioned in this chapter

3.1 Configure Topology Appropriately For Modem Connections to Prevent Blocking Oracle HTTP Server

Some Web sites have visitors connecting from slow modems. Sometimes, it takes longer for data to transfer over these slow connections than for data to be computed by the application server. Thus, an Oracle HTTP Server process can be blocked doing the transfer, and CPU processing power is not available for another request to perform computation.

If this is perceived to be a problem in your environment, you should front-end Oracle HTTP Server with either:

- OracleAS Web Cache, which uses a threaded architecture
- Oracle HTTP Server in reverse proxy mode, which can spawn more lightweight processes to handle the transfer

In both cases, the backend Oracle HTTP Server is reserved to do the computation work. This separation of data computation and data transfer responsibilities buffers a site from latency due to slow modem connections.

3.2 Tune TCP/IP Parameters to Improve Oracle HTTP Server Performance

Setting TCP/IP parameters can improve Oracle HTTP Server performance.

See Also: *Oracle Application Server Performance Guide*

3.3 Tune KeepAlive Directives to Improve Connection Performance

The `KeepAlive`, `KeepAliveTimeout`, and `MaxKeepAliveRequests` directives are used to control persistent connections. Persistent connections are supported in HTTP 1.1 to allow a client to send multiple sequential requests through the same connection.

Setting `KeepAlive` to `On` allows Apache to keep the connection open for that client when the client requests it. This setting can improve performance, because the connection has to be set up only once. The trade-off is that the `httpd` server process cannot be used to service other requests until either the client disconnects, the connection times out (controlled by the `KeepAliveTimeout` directive), or the `MaxKeepAliveRequests` value has been reached.

You can change these `KeepAlive` parameters to meet your specific application needs, but you should not set the `MaxKeepAliveRequests` to 0. A value of 0 in this directive means there is no limit. The connection will be closed only when the client disconnects or times out.

You may also consider setting `KeepAlive` to `Off` if your application has a large population of clients who make infrequent requests.

3.4 Tune MaxClients Directive to Improve Request Performance

The `MaxClients` directive controls the maximum number of clients who can connect to the server simultaneously. This value is set to 1024 by default. If your requests have a short response time, you may be able to improve performance by setting `MaxClients` to a lower value. When this value is reached, no additional processes will be created, causing other requests to fail. In general, increasing the value of `MaxClients` does not improve performance when the system is saturated.

If you are using persistent connections, you may require more concurrent `httpd` server processes, and you may need to set the `MaxClients` directive to a higher value. Tune this directive according to the `KeepAlive` parameters.

3.5 Avoid Any DNS Lookup to Prevent Performance Degradation

Any DNS lookup can affect Oracle HTTP Server performance. The `HostNameLookups` directive in Apache informs Apache whether it should log information based on the IP address (if the directive is set to `Off`), or look up the host name associated with the IP address of each request in the DNS system on the Internet (if the directive is set to `On`).

Performance degraded by a minimum of about three percent in Oracle tests with `HostNameLookups` set to `On`. Depending on the server load and the network connectivity to your DNS server, the performance cost of the DNS lookup could be much higher. Unless you really need to have host names in your logs in real time, it is best to log IP addresses and resolve IP addresses to host names off-line.

3.6 Tune Off Access Logging to Reduce Overhead

It is generally useful to have access logs for your Web server, both for load tracking and for the detection of security violations. If you find that you do not need this data, turn it off and reduce the overhead of writing the data to this log file.

3.7 Use FollowSymLinks and Not SymLinkIfOwnerMatch to Configure Symbolic Links

The `FollowSymLinks` and `SymLinksIfOwnerMatch` options are used by Apache to determine if it should follow symbolic links. If the `SymLinksIfOwnerMatch` option is used, Apache will check the symbolic link and make sure the ownership is the same as that of the server.

3.8 Set AllowOverride to None to Prevent Unnecessary Directive Checking

If the `AllowOverride` directive is not set to `None`, Apache will check for directives in the `htaccess` files at each directory level until the requested resource is found for each URL request.

3.9 Use mod_rewrite to Hide URL Changes For End-Users

The `mod_rewrite` module can transparently map the URLs visible to the end users to a different URL. You can accomplish this result without a round-trip through the Web browser or any code change.

This feature makes it very easy to re-organize directories on the server side or perform other changes; you can do this even after an application has been developed and deployed. There is a slight performance impact, however, as this configuration change for `mod_rewrite` is preferred.

3.10 Use mod_oc4j Sticky Routing Instead of Configuring the External Router

The `mod_oc4j` module is able to do sticky routing independent of any external router or OracleAS Web Cache. Thus, for J2EE requests, do not set the external router to perform sticky routing. If there are other non-J2EE requests that require sticky routing, then perform the necessary sticky routing setup on the external load balancer.

4

Oracle Application Server Containers for J2EE (OC4J) Applications and Developer Tools

This chapter describes the best practices for J2EE applications. It includes the following topics:

- Section 4.1, "Java Server Pages Best Practices"
- Section 4.2, "Sessions Best Practices"
- Section 4.3, "Enterprise Java Bean Best Practices"
- Section 4.4, "Data Access Best Practices"
- Section 4.5, "J2EE Class Loading Best Practices"
- Section 4.6, "Java Message Service Best Practices"
- Section 4.7, "Oracle Application Server XML Developer's Kit Best Practices"
- Section 4.8, "Oracle Application Server TopLink Best Practices"
- Section 4.9, "Oracle Application Server Forms Services Best Practices"

4.1 Java Server Pages Best Practices

This section describes Java Server Pages (JSP) best practices. It includes the following topics:

- Section 4.1.1, "Pre-Translate JSPs Before Deployment to Prevent Translation Overhead"
- Section 4.1.2, "Separate Presentation Markup from Java to Improve Application Performance"
- Section 4.1.3, "Use JSP Template Mechanism to Reserve Resources"
- Section 4.1.4, "Set sessions to false If Not Using Sessions to Prevent Overhead of Creating Sessions"
- Section 4.1.5, "Always Invalidate Sessions When No Longer Used to Prevent Overhead of Applications"
- Section 4.1.6, "Set main_mode Parameter to justrun to Prevent Recompilation of JSPs"
- Section 4.1.7, "Use Available JSP Tags In Tag Library to Create Clean and Reusable Code"

- Section 4.1.8, "Minimize Context Switching Between Servlets and EJBs to Avoid Performance Issues"
- Section 4.1.9, "Package JSP Files In EAR File Rather Than Standalone to Standardize Deployment Process"
- Section 4.1.10, "Use Compile-Time Object Introspection to Improve Application Performance"
- Section 4.1.11, "Choose Static Versus Dynamic Includes Appropriately"
- Section 4.1.12, "Disable JSP Page Buffer If Not Used to Improve Performance"
- Section 4.1.13, "Use Forwards Instead of Redirects to Improve Browser Experience"
- Section 4.1.14, "Use JSP Cache Tags to Save Development Time"
- Section 4.1.15, "Use well_known_taglib_loc to Share Tag Libraries"
- Section 4.1.16, "Use jsp-timeout Attribute to Provide Efficient Memory Utilization"
- Section 4.1.17, "Use reduce_tag_code Parameter to Reduce the Size of Generated Java Method"
- Section 4.1.18, "Use Workarounds to Avoid Reaching JVM Code Size Limit"
- Section 4.1.19, "Hide JSP Pages to Prevent Access"

4.1.1 Pre-Translate JSPs Before Deployment to Prevent Translation Overhead

You can use the Oracle `ojspc` tool to pre-translate the JSPs and avoid the translation overhead that has to be incurred when the JSPs are executed the first time. You can pre-translate the JSPs on the production system or before you deploy them. Also, pre-translating the JSPs allows you the option to deploy only the translated and compiled class files, if you choose not to expose and compromise the JSP source files.

4.1.2 Separate Presentation Markup from Java to Improve Application Performance

Separating presentation markup such as HTML from Java code is a good practice to get better performance from your application. The following are a few tips:

- Use JavaBeans for the business logic and JSPs only for the view. Thus, JSPs should primarily contain logic for HTML (or other presentation markup) generation only.
- Use stylesheets when appropriate to provide even more separation of the aspects of HTML that a user can control better.
- JSPs containing a large amount of static content, including large amounts of HTML code that does not change at runtime, which may result in slow translation and execution. Use dynamic includes, or better, enable the external resource configuration parameter to put the static HTML into a Java resource file.

4.1.3 Use JSP Template Mechanism to Reserve Resources

Using the JSP code `out.print("<html>")` requires more resources than including static template text. For performance reasons, it is best to reserve the use of `out.print()` for dynamic text.

4.1.4 Set sessions to false If Not Using Sessions to Prevent Overhead of Creating Sessions

The default for JSPs is `session="true"`. If your JSPs do not use any sessions, you should set `session="false"` to eliminate the overhead of creating and releasing these internal sessions created by the JSP runtime.

Implementation Details

To disable sessions, set the directive as follows:

```
<%@page session="false" %>
```

4.1.5 Always Invalidate Sessions When No Longer Used to Prevent Overhead of Applications

Sessions add performance overhead to your Web applications. Each session is an instance of the `javax.servlet.http.HttpSession` class. The amount of memory used for each session depends on the size of the session objects created.

If you use sessions, ensure that you explicitly cancel each session using the `invalidate()` method to release the memory occupied by each session when you no longer need it.

The default session timeout for OC4J is 30 minutes.

Implementation Details

To change this timeout for a specific application, set the `<session-timeout>` parameter in the `<session-config>` element of the `web.xml` file.

4.1.6 Set main_mode Parameter to justrun to Prevent Recompilation of JSPs

The Oracle JSP configuration parameter `main_mode` determines whether classes are automatically reloaded or JSPs are automatically recompiled. In a deployment environment set `main_mode` to a value of `justrun`. The runtime dispatcher does not perform any timestamp checking, so there is no recompilation of JSPs or reloading of Java classes. This mode is the most efficient mode for a deployment environment where code is not expected to change.

Implementation Details

If comparing timestamps is unnecessary, as is the case in a production deployment environment where source code does not change, you can avoid all timestamp comparisons and any possible re-translations and reloads by setting the `main_mode` parameter to the value justrun. Using this value can improve the performance of JSP applications.

Note that before you set `main_mode` to `justrun`, make sure that the JSP is compiled at least once. You can compile the JSP by invoking it through a Web browser or by running your application (using the recompile value for `main_mode`). This compilation assures that the JSP is compiled before you set the `justrun` flag.

> **See Also:** Chapter 3, "Getting Started," in the *Oracle Application Server Containers for J2EE Support for JavaServer Pages Developer's Guide* for further information about the `main_mode` configuration parameter

4.1.7 Use Available JSP Tags In Tag Library to Create Clean and Reusable Code

JSP tags make the JSP code cleaner, and more importantly, provide easy reuse. In some cases, there is also a performance benefit. Oracle Application Server ships with a very comprehensive JSP tag library that will meet most needs. In cases where custom logic is required or if the provided library is insufficient, you can build a custom tag library, if appropriate.

4.1.8 Minimize Context Switching Between Servlets and EJBs to Avoid Performance Issues

Minimize context switching between different Enterprise JavaBeans (EJB) and servlet components, especially when the EJB and Web container processes are different. If context switching is required, co-locate EJBs whenever possible.

4.1.9 Package JSP Files In EAR File Rather Than Standalone to Standardize Deployment Process

Oracle Application Server supports deploying of JSP files by copying them to the appropriate location. This functionality is very useful when developing and testing the pages. This functionality is not recommended for releasing your JSP-based application for production. You should always package JSP files into an Enterprise Archive (EAR) file. With an EAR file, you deploy JSPs in a standard manner, even across multiple application servers.

4.1.10 Use Compile-Time Object Introspection to Improve Application Performance

Developers should try to rely on compile-time object introspection on the beans and objects generated by the tag library instead of request-time introspection.

4.1.11 Choose Static Versus Dynamic Includes Appropriately

JSP pages have two different include mechanisms:

- Static includes, which have a page directive, such as:

```
<%@ include file="filename.jsp" %>
```

- Dynamic includes, which have a page directive, such as:

```
<jsp:include page="filename.jsp" flush="true" />
```

Static includes create a copy of the include file in the JSP. Therefore, it increases the page size of the JSP, but it avoids additional trips to the request dispatcher. Dynamic includes are analogous to function calls. Therefore, they do not increase the page size of the calling JSP, but they do increase the processing overhead because each call must go through the request dispatcher.

Dynamic includes are useful if you cannot determine which page to include until after the main page has been requested. A page that is dynamically included must be an independent entity, which can be translated and executed on its own.

4.1.12 Disable JSP Page Buffer If Not Used to Improve Performance

In order to allow part of the response body to be produced before the response headers are set, JSPs can store the body in a buffer.

When the buffer is full or at the end of the page, the JSP runtime will send all headers that have been set, followed by any buffered body content. This buffer is also required if the page uses dynamic content type settings, forwards, or error pages. The default size of a JSP page buffer is 8 KB.

Implementation Details

If you need to increase the buffer size, for example to 20 KB, you can use the following JSP attribute and directive:

```
<%@page buffer="20kb" %>
```

If you are not using any JSP features that require buffering, you can disable it to improve performance; memory will not be used in creating the buffer, and output can go directly to the Web browser. You can use the following directive to disable buffering:

```
<%@ page buffer="none" %>
```

4.1.13 Use Forwards Instead of Redirects to Improve Browser Experience

For JSPs, you can pass control from one page to another by using forward or redirect, but forward is always faster. When you use forward, the forwarded target page is invoked internally by the JSP runtime, which continues to process the request. The Web browser is totally unaware that such an action has taken place.

When you use redirect, the Web browser actually has to make a new request to the redirected page. The URL shown in the Web browser is changed to the URL of the redirected page, but it stays the same in a forward operation.

Therefore, redirect is always slower than the forward operation. In addition, all request-scope objects are unavailable to the redirected page because redirect involves a new request. Use redirect only if you want the URL to reflect the actual page that is being executed in case the user wants to reload the page.

4.1.14 Use JSP Cache Tags to Save Development Time

Using the Java Object Cache in JSP pages, as opposed to servlets, is particularly convenient because JSP code generation can save much of the development effort. Oracle JSP provides the following tags for using the Java Object Cache:

- `ojsp:cache`
- `ojsp:cacheXMLObj`
- `ojsp:useCacheObj`
- `ojsp:invalidateCache`

Implementation Details

Set the `ojsp:cacheXMLObj` or `ojsp:cache` tag to enable caching and specify cache settings. Use `ojsp:useCacheObj` to cache any Java serializable object. Use the `ojsp:invalidateCache` tag to invalidate a cache block. Alternatively, you can arrange invalidation through the `invalidateCache` attribute of the `ojsp:cacheXMLObj` or `ojsp:cache` tag.

> **See Also:** Chapter 7, "Web Object Cache Tags and API," in the *Oracle Application Server Containers for J2EE JSP Tag Libraries and Utilities Reference* for further information about these tags

4.1.15 Use well_known_taglib_loc to Share Tag Libraries

As an extension of standard JSP "well-known URI" functionality described in the JSP 1.2 specification, the OC4J JSP container supports the use of a shared tag library directory where you can place tag library JAR files to be shared across multiple Web applications. The benefits are:

- Avoidance of duplication of tag libraries between applications
- Easy maintenance, as the TLDs can be in a single JAR file
- Minimized application size

Implementation Details

The Oracle JSP configuration parameter `well_known_taglib_loc` configuration parameter specifies the location of the shared tag library directory. The default location is the *`ORACLE_HOME`*`/j2ee/home/jsp/lib/taglib/` directory..

You must add the shared directory to the server-wide `CLASSPATH` by specifying it as a library path element. The default location is set in the `application.xml` file.

See Also:

- Chapter 3, "Getting Started," in the *Oracle Application Server Containers for J2EE Support for JavaServer Pages Developer's Guide* for further information about the `well_known_taglib_loc` configuration parameter
- Appendix B, "Additional Information," in the *Oracle Application Server Containers for J2EE User's Guide* for further information about the `application.xml` file

4.1.16 Use jsp-timeout Attribute to Provide Efficient Memory Utilization

Resource utilization is a key factor for any efficient application. Oracle Application Server provides the `<orion-web-app>` attribute `jsp-timeout`. The `jsp-timeout` attribute specifies an integer value, in seconds, after which any JSP page will be removed from memory if it has not been requested. This attribute frees up resources in situations where some pages are called infrequently. The default value is 0 for no timeout.

Implementation Details

See Also: Chapter 3, "Getting Started," in the *Oracle Application Server Containers for J2EE Support for JavaServer Pages Developer's Guide* for further information about the `jsp_timeout` attribute

4.1.17 Use reduce_tag_code Parameter to Reduce the Size of Generated Java Method

The JVM limits the amount of code to 65536 bytes for each Java method. Sometimes, as the JSPs grow larger, there is a possibility of hitting this limit. To reduce the size of generated code for custom tag usage:

- Use the `reduce_tag_code` configuration parameter.
- Design smaller JSPs for your Web application.

Implementation Details

Set the `reduce_tag_code` configuration parameter in the:

- `<orion-web-app>` element in the OC4J `global-web-application.xml` file to apply to all applications in an OC4J instance
- `<orion-web-app>` element in the deployment-specific `orion-web.xml` file to apply to a specific application

> **See Also:** Chapter 3, "Getting Started," in the *Oracle Application Server Containers for J2EE Support for JavaServer Pages Developer's Guide* for further information about the `reduce_tag` configuration parameter

4.1.18 Use Workarounds to Avoid Reaching JVM Code Size Limit

The JVM limits the amount of code to 65536 bytes for each Java method. Sometimes, as JSPs grow larger, there is a possibility of reaching this limit. The following are some suggestions to workaround this limitation:

- Design smaller JSPs for your Web application.
- If your JSP primarily uses tag libraries, and if you are reaching the 64 KB limit, use the `reduce_tag_code` configuration parameter to reduce the size of generated code for custom tag usage. Note that this configuration setting may impact performance.
- The version of the JDK you are using can impact the size of the code generated. Generally, JDK 1.4.2_04-b05 generates far less code compared to JDK 1.4.1_03-b02.

4.1.19 Hide JSP Pages to Prevent Access

There are situations when you do not want to allow access to specific JSPs from a Web browser. For example, when a JSP is not presented in the Web browser but is part of application logic, which gets accessed by other JSPs or servlets.

Implementation Details

Put the JSPs you want to hide into a `/WEB-INF` directory. Provide access within your application code with the following:

```
<jsp: forward page = "WEB-INF/forwarded.jsp"/>
```

4.2 Sessions Best Practices

This section describes best practices for sessions. It includes the following topics:

- Section 4.2.1, "Persist Session State If Appropriate to Preserve State with Browser"
- Section 4.2.2, "Replicate Sessions If Persisting Is Not an Option to Improve Performance"
- Section 4.2.3, "Avoid Storing Objects in Sessions to Reuse Shared Resources"
- Section 4.2.4, "Set Session Timeout Appropriately to Optimize Performance"
- Section 4.2.5, "Monitor Session Memory Usage to Determine Data to Store in Session Objects"
- Section 4.2.6, "Use Small Islands to Improve Fault Tolerance"
- Section 4.2.7, "Use a Mix of Cookie and Sessions to Improve Performance"
- Section 4.2.8, "Use Coarse Objects Inside HTTP Sessions to Reduce Update Events"

- Section 4.2.9, "Use Transient Data in Sessions Whenever Appropriate to Reduce Replication Overhead"
- Section 4.2.10, "Invalidate Sessions to Prevent Memory Usage Growth"
- Section 4.2.11, "Miscellaneous Guidelines"

4.2.1 Persist Session State If Appropriate to Preserve State with Browser

HTTP sessions are used to preserve the conversation state with a Web browser. As such, they hold information, which if lost, could result in a client having to start the conversation over.

Therefore, it is always safe to save the session state in database. This functionality imposes a performance penalty. If this overhead is acceptable, then persisting sessions is the best approach.

There are trade-offs when implementing state safety that affect performance, scalability, and availability. If you do not implement state-safe applications, then:

- A single JVM process failure will result in many user session failures. For example, work done shopping online, filling in a multiple page form, or editing a shared document will be lost, and the user will have to start over.
- Not having to load and store session data from a database will reduce CPU overhead, thus increasing performance.
- Having session data clogging the JVM heap when the user is inactive reduces the number of concurrent sessions a JVM can support, and thus decreases scalability.

In contrast, you can write a state-safe application so that the session state exists in the JVM heap for active requests only, which is typically 100 times fewer than the number of active sessions.

Implementation Details

To improve performance of state safe applications:

- Minimize session state. For example, a security role might map to detailed permissions on thousands of objects. Rather than store all security permissions as session state, just store the role ID. Maintain a cache, shared across many sessions, mapping role ID to individual permissions.
- Identify key session variables that change often, and store these attributes in a cookie to avoid database updates on most requests.
- Identify key session variables that are read often, and use `HttpSession` as a cache for that session data in order to avoid having to read it from the database on every request. You must manually synchronize the cache, which requires care to handle planned and unplanned transaction rollback.

4.2.2 Replicate Sessions If Persisting Is Not an Option to Improve Performance

For the category of applications where the HTTP session state information cannot be persisted and retrieved on each HTTP request (due to the performance overhead), OC4J provides an intermediate option, replication.

It can replicate the session state information across an island of servers that are in the same cluster. This functionality provides a performance improvement, because the sessions remain in memory and provide fault tolerance. Fault tolerance occurs because Oracle HTTP Server automatically routes the HTTP requests to a different server in the island, if the original OC4J and the session it contains is down.

Set up at least two servers in an island, so that they can back session state for each other.

4.2.3 Avoid Storing Objects in Sessions to Reuse Shared Resources

Objects that are stored in the session objects will not be released until the session times out (or is invalidated). If you hold any shared resources that have to be explicitly released to the pool before they can be reused, such as a JDBC connection, then these resources may never be returned to the pool properly and can never be reused.

4.2.4 Set Session Timeout Appropriately to Optimize Performance

Set session timeout appropriately (`setMaxInactiveInterval()`) so that sessions do not frequently time out or live forever and consume memory.

Implementation Details

See Also: Appendix A, "Servlet and JSP Technical Background," in the *Oracle Application Server Containers for J2EE Support for JavaServer Pages Developer's Guide* for further information about setting the session timeout

4.2.5 Monitor Session Memory Usage to Determine Data to Store in Session Objects

Monitor the memory usage for the data you want to store in session objects. Make sure there is sufficient memory for the number of sessions created before the sessions time out.

4.2.6 Use Small Islands to Improve Fault Tolerance

Setting up an island of OC4J JVMs causes the sessions to be replicated across all JVMs. This functionality provides better fault tolerance, since a server failure does not necessarily result in a lost session. Oracle Application Server automatically re-routes request to another server in the island. As a result, an end-user never finds out about a failure. This replication overhead increases as more servers are added to the island. For example, if your session object requires 100 KB for each user, and there are 100 users for each server, there is a 10 MB memory requirement for session replication for each server. If you have five servers in an island, the memory requirement increases five-fold. Since islands provide session replication, it is, in general, not prudent to exceed an island size beyond three.

Setting up multiple islands, with few servers in an island is a better choice compared to having a fewer number of larger-sized islands.

4.2.7 Use a Mix of Cookie and Sessions to Improve Performance

Typically, a cookie is set on the Web browser (automatically by the container), to track a user session. In some cases, this cookie may last a much longer duration than a single user session. For example, one time settings, such as to determine the end-user geographic location.

Thus, a cookie that persists on the client disk could be used to save information valid for the long-term, while a server side session will typically include information valid for the short-term.

In this situation, parse the long-term cookie on only the first request to the server, when a new session established. The session object created on the server should

contain all the relevant information, so as not to require re-parsing the cookie on each request.

A new clientside cookie should then be set that contains only an ID to identify the serverside session object. This functionality automatically occurs for any JSP page that uses sessions.

Because the session object contents do not have to be re-created from the long-term cookie, there is a performance benefit. The other option is to save the user settings in a database on the server, and have the user login. The unique user ID can then be used to retrieve the contents from the database and store the information in a session.

4.2.8 Use Coarse Objects Inside HTTP Sessions to Reduce Update Events

Oracle Application Server automatically replicates sessions when a session object is updated. If a session object contains granular objects, such as a person's name, it results in too many update events to all the servers in the island. Therefore, use coarse objects, such as the person object, as opposed to the name attribute, inside the session.

4.2.9 Use Transient Data in Sessions Whenever Appropriate to Reduce Replication Overhead

Oracle Application Server does not replicate transient data in a session across servers in the island. This behavior reduces the replication overhead, as well as the memory requirements. Therefore, use the transient-type liberally.

4.2.10 Invalidate Sessions to Prevent Memory Usage Growth

The number of active users is generally quite small compared to the number of users on the system. For example, of the 100 users on a Web site, only 10 may actually be doing something.

A session is typically established for each user on the system, which uses memory.

Simple things, like a logout button, provide an opportunity for quick session invalidation and removal. Session invalidation and removal avoids memory usage growth, because the sessions on the system will be closer to the number of active users, as opposed to all those that have not timed out yet.

4.2.11 Miscellaneous Guidelines

- Use sessions as light-weight mechanism by verifying session creation state.
- Use cookies for long-standing sessions.
- Put recoverable data into sessions, so that they can be recovered if the session is lost. Store non-recoverable data persistently in the file system or in database using JDBC. Storing data persistently is an expensive operation. Instead, you can save data in sessions and use `HttpSessionBindingListener` or other events to flush data into persistent storage during session close.
- Sticky versus Distributable Sessions
  - Distributable session data must be serializable and useful for failover. This data is expensive, as the data has to be serializable and replicated among peer processes.
  - Sticky sessions affect load-balancing across multiple JVMs, but are less expensive as there is no state replication.

4.3 Enterprise Java Bean Best Practices

This section describes Enterprise Java Beans (EJB) best practices. It includes the following topics:

- Section 4.3.1, "Use Local, Remote, and Message-Driven EJBs Appropriately to Improve Performance"
- Section 4.3.2, "Use EJB Judiciously"
- Section 4.3.3, "Use Service Locator Pattern"
- Section 4.3.4, "Cluster Your EJBs"
- Section 4.3.5, "Index Secondary Finder Methods"
- Section 4.3.6, "Understand EJB Lifecycle"
- Section 4.3.7, "Use Deferred Database Constraints"
- Section 4.3.8, "Create a Cache with Read Only EJBs"
- Section 4.3.9, "Pick an Appropriate Locking Strategy"
- Section 4.3.10, "Understand and Leverage Patterns"
- Section 4.3.11, "When Using Entity Beans, Use Container Managed Aged Persistence Whenever Possible"
- Section 4.3.12, "Entity Beans using Local interfaces Only"
- Section 4.3.12, "Entity Beans using Local interfaces Only"
- Section 4.3.13, "Use a Session Bean Facade for Entity Beans"
- Section 4.3.14, "Enforce Primary Key Constraints at the Database Level"
- Section 4.3.15, "Use Foreign Key for 1-1 and 1-M Relationships"
- Section 4.3.16, "Avoid findAll Method on Entities Based on Large Tables"
- Section 4.3.17, "Set prefetch-size Attribute to Reduce Round Trips to Database"
- Section 4.3.18, "Use Lazy Loading with Caution"
- Section 4.3.19, "Avoid Performing O-R Mapping Manually"

4.3.1 Use Local, Remote, and Message-Driven EJBs Appropriately to Improve Performance

EJBs can be local or remote. If you envision calls to an EJB to originate from the same container as the one running the EJB, local EJBs are better since they do not entail the marshalling, unmarshalling, and network communication overhead. The local beans also allow you to pass an object-by-reference, thus, improving performance further.

Remote EJBs allow clients to be on different computers and have different application server instances to talk to them. In this case, it is important to use the value object pattern to improve performance by reducing network traffic.

If you choose to write an EJB, write a local EJB over a remote EJB object. Since the only difference is in the exception on the EJB object, almost all of the implementation bean code remains unchanged.

Additionally, if you do not have a need for making synchronous calls, message-driven beans are more appropriate.

4.3.2 Use EJB Judiciously

An EJB is a reusable component backed by component architecture with several useful services, such as persistence, transactions security, and naming. These additions make it "heavy."

If you just require abstraction of some functionality and are not leveraging the EJB container services, you should consider using a simple Java Bean, or implement the required functionality using JSPs or servlets.

4.3.3 Use Service Locator Pattern

Most J2EE services or resources require acquiring a handle to them through an initial Java Naming and Directory Interface (JNDI) call. These resources could be an EJB home object or a JMS topic. These calls are expensive to the server computer to resolve the JNDI reference, even though the same client may have gone to the JNDI service for a different thread of execution to fetch the same data.

To avoid this issues, use a **service locator**, which in some sense is a local proxy for the JNDI service, so that the client programs communicates with the local service locator, which in turn communicates to the real JNDI service, if required.

The Java Object Cache bundled with the product may be used to implement this pattern.

This practice improves availability since the service locator can hide failures of the backend server or JNDI tree by having cached the lookup. Although this is only temporary since the results still have to be fetched.

Performance is also improved since trips to the back-end application server are reduced.

4.3.4 Cluster Your EJBs

Cluster your EJBs only when you require:

- Load Balancing: The EJB clients are load balanced across the servers in the EJB cluster.
- Fault Tolerance: The state (in case of stateful session beans) is replicated across the OC4J processes in the EJB cluster. If the proxy classes on the client cannot connect to an EJB server, they will attempt to connect to the next server in the cluster. The client does not see the failure.
- Scalability: Since multiple EJB servers behaving as one can service many more requests than a single EJB server, a clustered EJB system is more scalable. The alternative is to have standalone EJB systems, with manual partitioning of clients across servers. This configuration can be difficult and does not provide fault-tolerance advantages.

In order to fully leverage EJB clustering you will need to use remote EJBs. Remote EJBs have some performance implications over local EJBs (Section 4.3.1, "Use Local, Remote, and Message-Driven EJBs Appropriately to Improve Performance"). If you use local EJBs and save a reference to them in a servlet (or JSP) session, when the session is replicated the saved reference becomes invalid. Therefore, use EJB clustering only when you need the listed features.

4.3.5 Index Secondary Finder Methods

When finder methods, other than `findByPrimaryKey` and `findAll`, are created they may be extremely inefficient if appropriate indexes are not created that help to optimize execution of the SQL generated by the container.

4.3.6 Understand EJB Lifecycle

As a developer, it is imperative that you understand the EJB lifecycle. You can avoid many problems by following the lifecycle and the expected actions during callbacks more closely.

This is especially true with entity beans and stateful session beans. For example, in a small test environment, a bean may never be made passive. Therefore, a faulty implementation or non-implementation of `ejbPassivate()` and `ejbActivate()` may not show up until later. Moreover, since these are not used for stateless beans, they may confuse new developers.

4.3.7 Use Deferred Database Constraints

For those constraints that may be invalid for a short time during a transaction but will be valid at transaction boundaries, use deferred database constraints. For example, if a column is not populated during an `ejbCreate()`, but will be set prior to the completion of the transaction, then you may want to set the not null constraint for that column to be deferred. This recommendation also applies to foreign-key constraints that are mirrored by EJB relationships with EJB 2.0.

4.3.8 Create a Cache with Read Only EJBs

For those cases where data changes very slowly or not at all, and the changes are not made by your EJB application, read-only beans may make a very good cache. A good example of this is a country EJB. It is unlikely that it will change very often and it is likely that some degree of stale data is acceptable.

Implementation Details

To do this:

1. Create read-only entity beans.
2. Set `exclusive-write-access="true"`.
3. Set the validity timeout to the maximum acceptable staleness of the data.

4.3.9 Pick an Appropriate Locking Strategy

It is critical that an appropriate locking strategy be combined with an appropriate database isolation mode for properly performing and highly reliable EJB applications.

Use optimistic locking where the likelihood of conflict in updates is low. If a lost update is acceptable or cannot occur because of application design, use an isolation mode of read-committed. If the lost updates are problematic, use an isolation mode of serializable.

Use pessimistic locking where there is a higher probability of update conflicts. Use an isolation mode of read-committed for maximum performance in this case. Use read-only locking when the data will not be modified by the EJB application.

4.3.10 Understand and Leverage Patterns

With the wider industry adoption, there are several common (and generally) acceptable ways of solving problems with EJBs. These have been widely published in either books or discussion forums, and so on. In some sense, these patterns are best practices for a particular problem. Research and follow these patterns.

Here are some examples:

- Session facade: Combines multiple entity bean calls into a single call on a session bean, thus reducing the network traffic.
- Message facade: Use MDBs if you do not need a return status from your method invocation.
- Value object pattern: A value object pattern reduces the network traffic by combining multiple data values that are usually required to be together, into a single value object.

A full discussion on the large number of patterns available is outside the scope of this document, but the references section contains some useful books or Web sites on this subject.

4.3.11 When Using Entity Beans, Use Container Managed Aged Persistence Whenever Possible

Although there are some limitations to container-managed persistence (CMP), CMP has a number of benefits. One benefit is portability. With CMP, decisions like persistence mapping and locking model selection become a deployment activity rather than a coding activity. CMP allows deployment of the same application in multiple containers with no change in code. This is commonly not true for bean-managed persistence (BMP), since you must write SQL statements and concurrency control into the entity bean and are therefore specific to the container or the data store.

Another benefit is that, in general, J2EE container vendors provide quality of service (QoS) features such as locking model variations, lazy loading, and performance and scalability enhancements, which may be controlled through deployment configuration rather than by writing code. Oracle Application Server includes features such as read-only entity beans, minimal writing of changes, and lazy loading of relations, which would have to be built into code for BMP.

A third benefit of CMP is container-managed relationships. Through declarations, not unlike CMP field mapping, a CMP entity bean can have relationships between two entity beans managed by the container with no implementation code required from application developers.

Finally, tools are available to aid in the creation of CMP entity beans, so that minimal work is required from developers for persistence. These tools enable developers to focus on business logic. Oracle JDeveloper is a perfect example where, through modeling tools and wizards, very little work is required to create CMP entity beans including creation of both the generic EJB descriptors and the Oracle Application Server specific descriptors.

Overall, there are cases where CMP does not meet the requirements of an application, but the development effort saved, and the optimizations that J2EE containers like OC4J provide make CMP much more attractive than BMP.

4.3.12 Entity Beans using Local interfaces Only

It is a good practice to expose your entity beans using only local interfaces because container managed relationship can only be used with local interfaces. Also local interfaces avoid expensive serialization and remote network calls.

4.3.13 Use a Session Bean Facade for Entity Beans

Avoid using entity beans directly from Web modules and client applications and use a session bean façade layer instead. Use of entity beans from client applications hard codes the domain model in the client. It also introduces difficulty when managing both remote and local interfaces for entity beans.

Implementation Details

Create a session bean facade layer by grouping together all natural use cases. This layer exposes operations to one or more entity beans. It provides finer-grained access to the entity beans and reduces database interactions by acting as a transaction boundary. This also enables the entity beans to be accessed by Web services by exposing the stateless session bean as a Web service endpoint.

4.3.14 Enforce Primary Key Constraints at the Database Level

Enforce primary key constraint for the underlying table for your CMP entity beans instead of having the container execute an extra SQL statement to check for a duplicate primary key.

Implementation Details

You can switch this check by setting the `do-select-before-insert="false"` for your entity bean in the `orion-ejb-jar.xml` file.

4.3.15 Use Foreign Key for 1-1 and 1-M Relationships

Use a foreign key when completing the O-R mapping for 1-1 and 1-Many relationships between entity beans instead of using an association table. This enables you to avoid maintaining an extra table and an extra SQL statement generated by container to maintain the relationships.

4.3.16 Avoid findAll Method on Entities Based on Large Tables

When you use the `findAll` method, the container tries to retrieve all rows of the table. You should try to avoid this type of operation on entities based on tables that have a large number of records. It will slowdown the operations of your database.

4.3.17 Set prefetch-size Attribute to Reduce Round Trips to Database

Oracle JDBC drivers have extensions that allows setting the number of rows to prefetch into the client while a result set is being populated during a query. This reduces the number of round trips to the server. This can drastically improve performance of finder methods that return a large number of rows.

Implementation Details

Specify the `prefetch-size` attribute for your finder method in the `orion-ejb-jar.xml` file.

4.3.18 Use Lazy Loading with Caution

If you turn on lazy loading, which is off by default, then only the primary keys of the objects retrieved within the finder are returned. Thus, when you access the object within your implementation, the OC4J container uploads the actual object based on the primary key.

You may want to turn on the lazy loading feature if the number of objects that you are retrieving is so large that loading them all into your local cache would decrease performance. If you retrieve multiple objects, but you only use a few of them, then you should turn on lazy loading. In addition, if you only use objects through the `getPrimaryKey` method, then you should also turn on lazy loading.

4.3.19 Avoid Performing O-R Mapping Manually

O-R mapping for CMP entity beans in the `orion-ejb-jar.xml` file is very complex and error prone. Any error in the mapping can cause deployment errors and generation of wrong SQL for EJB-QL statements. The following two approaches are recommended:

- Use JDeveloper 9.0.5.1 to perform the O-R mapping and to generate the mapping information in the `orion-ejb-jar.xml` file.
- Deploy the application in OC4J to generate the mappings and then modify the `orion-ejb-jar.xml` file to include the correct table-name and persistence-names.

4.4 Data Access Best Practices

This section describes data access best practices. It includes the following topics:

- Section 4.4.1, "Use Datasources Connections Caching and Handling to Prevent Running Out of Connections"
- Section 4.4.2, "Use Data Source Initialization"
- Section 4.4.3, "Disable Escape Processing to Improve Performance"
- Section 4.4.4, "Define Column Types to Save Round-trips to Database Server"
- Section 4.4.5, "Prefetch Rows to Improve Performance"
- Section 4.4.6, "Update Batching to Improve Performance"
- Section 4.4.7, "Use More Than One Database Connection Simultaneously in the Same Request to Avoid a Deadlock in the Database"
- Section 4.4.8, "Tune the Database and SQL Statements to Optimize the Handling of Database Resources"
- Section 4.4.9, "Configure Data Source Configurations Options"

4.4.1 Use Datasources Connections Caching and Handling to Prevent Running Out of Connections

Connections must not be closed within `finalize()` methods. This can cause the connection cache to run out of connections to use, since the connection is not closed until the object that obtained it is garbage collected.

The current connection cache does not provide any mechanism to detect "abandoned" connections, reclaim them, and return them to the cache. The application can explicitly close all connections.

If a connection is declared as static, then it is possible that the same connection object is used on different threads at the same time. Do not declare connections as static objects.

Use the `FIXED_WAIT_SCHEME` when using the connection cache, especially when writing Web applications. This guarantees enforcement of the `MaxLimit` on the connection cache as well as retrieval of a connection from the cache when a connection is returned to the cache.

Always use connection cache timeouts such as `CacheInactivityTimeout` to close unused physical connections in the cache and cause "shrinking" of the cache, thus releasing valuable resources.

4.4.1.1 DataSource Connection Caching Strategies

In order to minimize the lock up of resources for long periods of time but allow for recycling of connections from the connection cache, you should use the most appropriate strategy for obtaining and releasing connections as follows:

- Many clients, few connections: Open and close a connection in the same method that needs to use the connection. In order to ensure that connections are returned to the pool, all calls to this method should happen within `try-catch`, try-finally, or `try-catch-finally` blocks. This strategy is useful when you have a large number of clients sharing a few connections at the cost of the overhead associated with getting and closing each connection.
- Private client pool: Take advantage of the BMP life cycle. Get a connection within `setEntityContext()` and release the connection in `unsetEntityContext()`. Make connections available to all methods by declaring it a member instance.
- Combined strategy: You may take further advantage of BMP life cycle and implement a strategy, which combines the preceding two strategies.

4.4.2 Use Data Source Initialization

It is a good practice to put the JNDI lookup of a `DataSource` as part of the application initialization code, since `DataSources` are simply connection factories.

For example, when using servlets, it is a good idea to put the `DataSource` lookup code into the `init()` method of the servlet.

4.4.3 Disable Escape Processing to Improve Performance

Escape processing for SQL92 syntax is enabled by default, which results in the JDBC driver performing escape substitution before sending the SQL code to the database.

Implementation Details

If you want the driver to use regular Oracle SQL syntax, which is more efficient than SQL92 syntax and escape processing, then disable escape processing using the following statement:

```
stmt.setEscapeProcessing(false);
```

4.4.4 Define Column Types to Save Round-trips to Database Server

The Oracle-specific defining column types feature provides the following benefits:

- Saves a round-trip to the database server.
- Defines the datatype for every column of the expected result set.
- For `VARCHAR`, `VARCHAR2`, `CHAR`, and `CHAR2`, specifies their maximum length.

The following example illustrates the use of this feature. It assumes you have imported the `oracle.jdbc.*` and `java.sql.*` interfaces and classes.

```
//ds is a DataSource object
Connection conn = ds.getConnection();
PreparedStatement pstmt = conn.prepareStatement("select empno, ename, hiredate
from emp");

//Avoid a round-trip to the database and describe the columns
((OraclePreparedStatement)pstmt).defineColumnType(1,Types.INTEGER);

//Column #2 is a VARCHAR, we need to specify its max length
((OraclePreparedStatement)pstmt).defineColumnType(2,Types.VARCHAR,12);
((OraclePreparedStatement)pstmt).defineColumnType(3,Types.DATE);
ResultSet rset = pstmt.executeQuery();
while (rset.next())
System.out.println(rset.getInt(1)+","+rset.getString(2)+","+rset.getDate(3));
pstmt.close();
…
```

4.4.5 Prefetch Rows to Improve Performance

Row prefetching improves performance by reducing the number of round trips to a database server. For most database-centric applications, Oracle recommends the use of row prefetching as much as possible. The default prefetch size is 10.

The following example illustrates the use of row prefetching. It assumes you have imported the `oracle.jdbc.*` and `java.sql.*` interfaces and classes

```
//ds is a DataSource object Connection conn = ds.getConnection();

//Set the default row-prefetch setting for this connection
((OracleConnection)conn).setDefaultRowPrefetch(7);

//The following statement gets the default row-prefetch value for
//the connection, that is, 7 Statement stmt = conn.createStatement();
//Subsequent statements look the same, regardless of the row

//prefetch value. Only execution time changes.
ResultSet rset = stmt.executeQuery("SELECT ename FROM emp");
System.out.println( rset.next () );
while( rset.next () )
System.out.println( rset.getString (1) );

//Override the default row-prefetch setting for this

//statement
( (OracleStatement)stmt ).setRowPrefetch (2);
ResultSet rset = stmt.executeQuery("SELECT ename FROM emp");
System.out.println( rset.next () );
while( rset.next() )
System.out.println( rset.getString (1) );
stmt.close();
…
.
.
```

Implementation Details

> **See Also:** *Oracle Database JDBC Developer's Guide and Reference* from the Oracle Database documentation library

4.4.6 Update Batching to Improve Performance

Update batching sends a batch of operations to the database in one trip. When using it, always disable auto-commit mode with update batching. Use a batch size of around 10. Do not mix the standard and Oracle models of update batching.

> **See Also:** *Oracle Database JDBC Developer's Guide and Reference* from the Oracle Database documentation library

4.4.6.1 Oracle Update Batching

The following example illustrates how you use the Oracle update batching feature. It assumes you have imported the `oracle.jdbc.driver.*` interfaces.

```
//ds is a DataSource object
Connection conn = ds.getConnection();
//Always disable auto-commit when using update batching
conn.setAutoCommit(false);
PreparedStatement ps =
conn.prepareStatement("insert into dept values (?, ?, ?)");
//Change batch size for this statement to 3
((OraclePreparedStatement)ps).setExecuteBatch (3);
//--------#1------------
ps.setInt(1, 23);
ps.setString(2, "Sales");
ps.setString(3, "USA");
ps.executeUpdate(); //JDBC queues this for later execution
//--------#2------------
ps.setInt(1, 24);
ps.setString(2, "Blue Sky");
ps.setString(3, "Montana");
ps.executeUpdate(); //JDBC queues this for later execution
//--------#3------------
ps.setInt(1, 25);
ps.setString(2, "Applications");
ps.setString(3, "India");
ps.executeUpdate(); //The queue size equals the batch value of
3

//JDBC sends the requests to the database
//--------#1------------
ps.setInt(1, 26);
ps.setString(2, "HR");
ps.setString(3, "Mongolia");
ps.executeUpdate(); //JDBC queues this for later execution
((OraclePreparedStatement)ps).sendBatch(); // JDBC sends the
//queued request
conn.commit();
ps.close();
...
```

4.4.6.2 Standard Update Batching

This example uses the standard update batching feature. It assumes you have imported the `oracle.jdbc.driver.*` interfaces.

```
//ds is a DataSource object
Connection conn = ds.getConnection();
//Always disable auto-commit when using update batching
conn.setAutoCommit(false);
Statement s = conn.createStatement();
s.addBatch("insert into dept values ('23','Sales','USA')");
s.addBatch("insert into dept values ('24','Blue
Sky','Montana')");
s.addBatch("insert into dept values
('25','Applications','India')");
//Manually execute the batch
s.executeBatch();
s.addBatch("insert into dept values ('26','HR','Mongolia')");
s.executeBatch();
conn.commit();
ps.close();
...
```

4.4.7 Use More Than One Database Connection Simultaneously in the Same Request to Avoid a Deadlock in the Database

Using more than one database connection simultaneously in a request can cause a deadlock in the database. This result is most common in JSPs. First, a JSP will get a database connection to do some data accessing. Before the JSP commits the transaction and releases the connection, it invokes a bean, which gets its own connection for its database operations. If these operations are in conflict, they can result in a deadlock.

Furthermore, you cannot easily roll back any related operations if they are done by two separate database connections in case of failure.

Unless your transaction spans multiple requests or requires some complex distributed transaction support, you should try to use just one connection at a time to process the request.

4.4.8 Tune the Database and SQL Statements to Optimize the Handling of Database Resources

Current Web applications are still very database-centric. From 60 percent to 90 percent of the execution time on a Web application can be spent in accessing the database. No amount of tuning on the mid-tier can give significant performance improvement if the database computer is saturated or the SQL statements are inefficient.

Monitor frequently executed SQL statements. Consider alternative SQL syntax, use PL/SQL or bind variables, pre-fetch rows, and cache rowsets from the database to improve your SQL statements and database operations.

Web applications often access a database at the backend. One must carefully optimize handling of database resources, since a large number of concurrent users and high volumes of data may be involved. Database performance tuning falls into two categories:

- Tuning of SQL tables and statements.
- Tuning of JDBC calls to access the SQL database.

This section contains the following topics:

- Section 4.4.8.1, "Tune JDBC"
- Section 4.4.8.2, "Cache JDBC Connections"

- Section 4.4.8.3, "Cache JDBC Statements"
- Section 4.4.8.4, "Cache JDBC Rowsets"

4.4.8.1 Tune JDBC

JDBC objects such `Connections`, `Statements`, and `Result Sets` are quite often used for database access in Web applications. Frequent creation and destruction of these objects is quite detrimental to the performance and scalability of the application, as these objects are quite heavyweight. Therefore, always cache these JDBC resources

4.4.8.2 Cache JDBC Connections

Creating a new database connection is an expensive operation that you should avoid. Instead, use a cache of database connections to avoid frequent session creations and tear-downs. EJBs, servlets and JSPs can use or share the connection cache within a JVM. Create as a single object during startup, so that they can be shared across multiple requests.

Implementation Details

> **See Also:** *Oracle Database JDBC Developer's Guide and Reference* from the Oracle Database documentation library

4.4.8.3 Cache JDBC Statements

JDBC statement caching avoids cursor creation and tear-down, as well as cursor parsing. It provide two types of statement caching:

- Implicit: Saves Metadata of cursor but clears the State and Data content of the cursor across calls
- Explicit: Saves Metadata, Data, and State of the cursor across calls

You can use statement caching with pooled connection and connection cache, for example:

```
conn.setStmtCacheSize(<cache-size>)
```

Implementation Details

> **See Also:** *Oracle Database JDBC Developer's Guide and Reference* from the Oracle Database documentation library

4.4.8.4 Cache JDBC Rowsets

JDBC cached rowsets provide the following benefits:

- Disconnected, serializable, and scrollable container for retrieved data
- Free up connections and cursors faster
- Local scrolling on cached data

This feature is useful for small sets of data that do not change often.

Implementation Details

> **See Also:** *Oracle Database JDBC Developer's Guide and Reference* from the Oracle Database documentation library

4.4.9 Configure Data Source Configurations Options

See Also: Section "Setting Up Data Sources - Performance Issues," in the *Oracle Application Server Performance Guide* for more information about setting up data source configuration options for global data sources

4.5 J2EE Class Loading Best Practices

This section describes best practices for J2EE class loading. It includes the following topics:

- Section 4.5.1, "Avoid Duplicating Libraries to Prevent Loading Problems"
- Section 4.5.2, "Load Resources Appropriately to Avoid Errors"
- Section 4.5.3, "Enable Class Loading Search Order within Web Modules to ?...."
- Section 4.5.4, "Declare and Group Dependencies to Prevent Hidden or Unknown Dependencies"
- Section 4.5.5, "Minimize Visibility to Satisfy Dependencies"
- Section 4.5.6, "Create Portable Configurations"
- Section 4.5.7, "Do Not Use the lib Directory for Container-Wide Shared Libraries to Prevent Loading Issues"

4.5.1 Avoid Duplicating Libraries to Prevent Loading Problems

Avoid duplicating copies of the same library at different location in your Oracle Application Server installation. Duplication of class libraries can lead to several class loading problems and may consume additional memory and disk space. If your class library is used by multiple applications, then you can put it at the application server level by using the `<library>` tag in the `application.xml` file. Or, use the `<parent>` attribute in the `server.xml` file to share libraries in two applications.

For a class library that is to be shared by all applications running on your OC4J instance, you can use the default global shared library directory. To do this, place the class library in the `$ORACLE_HOME/j2ee/home/applib` directory. This directory is configured as a default in the `$ORACLE_HOME/j2ee/home/config/application.xml` configuration file.

If you have a library that is shared between multiple modules in the same application, that is, two Web modules in the same EAR file, then use the `WAR` file manifest `Class-Path` element to share the class libraries between the modules instead of duplicating the libraries in the `WEB-INF/lib` for every module. In order to enable the use of a `Class-Path` entry in a WAR file manifest, the following has to be defined in the `orion-web.xml` for your Web application:

```
<web-app-class-loader include-war-manifest-class-path="true" />
```

If you have a library that is shared between multiple modules in the same EAR file, for example, two EJB modules in the same EAR file, then you can place the shared class library and an `orion-application.xml` file within your EAR file and define the relative path to the shared library using a `<library>` tag within the `orion-application.xml` file.

4.5.2 Load Resources Appropriately to Avoid Errors

If you are using dynamic class loading or are loading a resource, such as the properties file in your application, use the correct loader.

If you call `Class.forName()`, always explicitly pass the loader returned by:

```
Thread.currentThread().getContextClassLoader();
```

If you are loading a properties file, use:

```
Thread.currentThread().getContextClassLoader().getResourceAsStream();
```

4.5.3 Enable Class Loading Search Order within Web Modules

The servlet 2.3 specification requires that the search order within a Web module is `WEB-INF/classes` first, then `WEB-INF/lib`. The specification recommends another class loading related implementation detail:

```
"the application classloader [could] be implemented  so that classes and resources
packaged within the WAR are loaded in preference to classes and resources residing
in container wide library JARs".
```

To enable this local classes class loading behavior for a Web application, you configure it on a for each Web-application basis by having the following tag in the `orion-web.xml` file:

```
<web-app-class-loader search-local-classes-first="true"/>
```

This tag is commented out by default and is not the default behavior.

4.5.4 Declare and Group Dependencies to Prevent Hidden or Unknown Dependencies

Make dependencies between your class libraries explicit. Hidden or unknown dependencies will be left behind when you move your application to another environment. Use available mechanisms such as `Class-Path` entries in manifest files to declare dependencies among class libraries and applications.

Group dependencies between your class libraries and ensure that all dependencies are visible at the same level or preceding. If you must move a library, make sure all the dependencies are still visible.

4.5.5 Minimize Visibility to Satisfy Dependencies

Place the dependency libraries at the lowest-visibility level that satisfies all dependencies. For example, if a library is only used by a single Web application, it should only be included in the `WEB-INF/lib` directory of the WAR file.

4.5.6 Create Portable Configurations

Create configurations that are as portable as possible. Specify configuration options in the following order:

- Standard J2EE options
- Options that can be expressed within the EAR file
- Server-level options
- J2SE extension options

4.5.7 Do Not Use the lib Directory for Container-Wide Shared Libraries to Prevent Loading Issues

Do not place container-wide shared application libraries in the `$ORACLE_HOME/j2ee/home/lib` directory. With Oracle Application Server 10*g*, this directory is no longer used for loading custom container-wide shared libraries. The container will not load additional libraries placed in this directory.

If you wish to use a container-wide shared library, place your class library in the `$ORACLE_HOME/j2ee/home/applib` directory or define it using a `<library>` tag.

4.6 Java Message Service Best Practices

This section describes JMS best practices. It includes the following topics:

- Section 4.6.1, "Set the Correct time_to_live Value to Avoid Messages Never Expiring"
- Section 4.6.2, "Do Not Grant Execute Privilege of the AQ PL/SQL Package to a User or Role"
- Section 4.6.3, "Close JMS Resources No Longer Needed to Keep JMS Objects Available"
- Section 4.6.4, "Reuse JMS Resources Whenever Possible to Perform Concurrent JMS Operations"
- Section 4.6.5, "Use Debug Tracing to Track Down Problems"
- Section 4.6.6, "Understand Handle/Interpret JMS Thrown Exceptions to Handle Runtime Exceptions"
- Section 4.6.7, "Connect to the Server and Database From the Client Computer to Debug JMS Connection Creation Problems"
- Section 4.6.8, "Tune Your Database Based on Load to Improve Performance"
- Section 4.6.9, "Ensure OracleAS JMS Connection Parameters are Correct to Avoid Runtime Exceptions"
- Section 4.6.10, "Provide Correct OracleAS JMS Configuration to Avoid Java JMS Exceptions"

4.6.1 Set the Correct time_to_live Value to Avoid Messages Never Expiring

OracleAS JMS message expiration is set in the `JMSExpiration` header field. If this value is set to zero (the default), then the message will never expire. If the amount of used table space (memory for OC4J) is a concern, then optimally setting the `time_to_live` parameter will keep messages from accumulating. This is especially true in the publish-subscribe domain where messages may sit forever waiting for the final durable subscriber to return to retrieve the message.

> **See Also:** Chapter 7, "Developing and Deploying JMS Web Services," in the *Oracle Application Server Web Services Developer's Guide* for further information about the `JMSExpiration` header field

4.6.2 Do Not Grant Execute Privilege of the AQ PL/SQL Package to a User or Role

While there are outstanding OracleAS JMS session blocking on a dequeue operation this might cause the granting operation to be blocked and even time out. Execute granting calls before other OracleAS JMS operations.

Another way to avoid the blocking or time out is to grant roles instead of granting specific privileges to the user directly. Oracle Advanced Queuing has an `AQ_ADMINISTRATOR_ROLE` that you can use, or users may create their own tailored role. You can then grant the execute privilege of a PL/SQL package to this role. Provided the role was created before hand, the granting of the role to the user does not require a lock on the package. This will allow the granting of the role to be executed concurrently with any other OracleAS JMS operation.

Implementation Details

See Also: *Oracle Application Server Integration InterConnect Adapter for AQ Installation and User's Guide*

4.6.3 Close JMS Resources No Longer Needed to Keep JMS Objects Available

When JMS objects like JMS connections, JMS sessions, and JMS consumers are created, they acquire and hold on to server-side database and client-side resources.

If JMS programs do not close JMS objects when they are done using them either during the normal course of operation or at shutdown, then database and client-side resources held by JMS objects are not available for other programs to use.

The JVM implementation does not guarantee that finalizers will kick in and clean up JMS object held resources in a timely fashion when the JMS program terminates.

4.6.4 Reuse JMS Resources Whenever Possible to Perform Concurrent JMS Operations

JMS objects like JMS connections are heavyweight and acquire database resources not unlike JDBC connection pools. Instead of creating separate JMS connections based on coding convenience, Oracle recommends that a given JMS client program create only one JMS connection against a given database instance for a given connect string and reuse this JMS connection by creating multiple JMS sessions against it to perform concurrent JMS operations.

JMS administrable objects like queues, queue tables, durable subscribers are costly to create and lookup. This is because of the database round trips and in some cases, JDBC connection creation and tear-down overhead. Oracle recommends that JMS clients cache JMS administrable objects once they are created or looked up and reuse them rather than create or look them up each time the JMS client wants to enqueue or dequeue a message. The Oracle Application Server Java Object Cache could be used to facilitate this caching.

4.6.5 Use Debug Tracing to Track Down Problems

OracleAS JMS enables users to turn debug tracing by setting `oracle.jms.traceLevel` to values between one and five. (One captures fatal errors only and five captures all possible trace information including stack traces and method entries and exits). Debug tracing allows one to track down silent or less understood error conditions.

4.6.6 Understand Handle/Interpret JMS Thrown Exceptions to Handle Runtime Exceptions

OracleAS JMS is required by the JMS specification to throw particular JMS defined exceptions when certain error or exception conditions occur. In some cases the JMS

specification allows or expects OracleAS JMS to throw runtime exceptions when certain conditions occur. Code the JMS client program to handle these conditions gracefully.

The catch all JMS exception, `JMSException`, that OracleAS JMS is allowed to throw in certain error/exception cases provides information as to why the error/exception occurred as a linked exception in the `JMSException`. Code the JMS programs to obtain and interpret the linked exception in some cases.

For instance, when resources like processes, cursors, or tablespaces run out or when database timeouts/deadlocks occur, SQL exceptions are thrown by the backend database, which are presented to the JMS client program as linked SQL exceptions to the catch all `JMSException` that is thrown. It would be useful for JMS programs to log or interpret the `ORA` error numbers and strings so that the administrator of the database can take corrective action.

The following code segment illustrates a way to print both the `JMSException` and its linked exception:

```
try
{...}
catch (JMSException jms_ex)
{

jms_ex.printStackTrace();
if (jms_ex.getLinkedException() != null)
jms_ex.getLinkedException().printStackTrace();
}
```

4.6.7 Connect to the Server and Database From the Client Computer to Debug JMS Connection Creation Problems

When debugging JMS connection creation problems or problems with receiving asynchronous messages/notifications make sure that you can:

- Ping the database using `tnsping`
- Connect to the database with its connect string using `sqlplus`
- Resolve the name or the IP address of the server computer from the client (by using a simple program that accesses a socket) and vice versa.

4.6.8 Tune Your Database Based on Load to Improve Performance

OracleAS JMS performance is greatly improved by proper database tuning. OracleAS JMS performance is dependent on Oracle Advanced Queuing enqueue/dequeue performance. Oracle Advanced Queuing performance will not scale even if you run the database on a computer with better physical resources unless the database is tuned to make use of those physical resources.

4.6.9 Ensure OracleAS JMS Connection Parameters are Correct to Avoid Runtime Exceptions

Make sure that the parameters that control the datasources underlying OracleAS JMS connections are set appropriately (see datasources best practices). Runtime exceptions that are caused when transaction, inactivity, and cache-connection-availability timeouts occur or connection creation attempts fail can lead to message-driven beans (MDBs) and JMS objects becoming unusable until the underlying cause is resolved. In

some cases the change cannot be made dynamically and in others container redeployment maybe needed for the changes to take effect.

Make sure that the EJB-location is used to look up the emulated datasources underlying JMS Connections and MDB instances in case these MDBs and JMS Connections need to participate in Container Managed Transactions. If datasource location is used instead MDBs will not receive messages and JMS Connections will not participate in CMTs.

Since datasource support is not available in OC4J for the application client deployment mode in this release, OracleAS JMS requires that the JMS code use a URL definition to access MS resources within application clients. When the application is a standalone client, configure the `<resource-provider>` element with a URL property that has the URL of the database where OracleAS JMS is installed and, if necessary, provides the username and password for that database. The following demonstrates a URL configuration:

```
<resource-provider class="oracle.jms.OjmsContext" name="ojmsdemo">
   <description> OJMS/AQ </description>
      <property name="url" value="jdbc:oracle:thin:@hostname:port number:SID">
      </property>
      <property name="username" value="user">
      </property>
      <property name="password" value="passwd">
      </property>
</resource-provider>
```

Since OC4J does not support distributed transactions in the application client deployment mode in this release, OracleAS JMS only supports local transactions through it's transacted sessions. If the JMS application requires transaction co-ordination then make sure that it is deployed inside a container and not as an application client.

In this release OC4J optimizes transacted Oracle database operations, including OracleAS JMS operations, so that a 2-PC is not required for them in a distributed transaction that they are involved in when the operations take place against the same Oracle database instance and the same database schema. If possible, make sure that the Oracle Advanced Queuing queues against, which OracleAS JMS operations take place are located in the same schema if the applications using them will perform distributed operations against them. when the underlying database version is 10g or later, if the database operations (including OracleAS JMS operations) take place against different schemas then for the first time the transacted operations take place a complete 2-PC with prepare and commit phases is performed and in subsequent operations a 1-PC optimization kicks in. If it is required that the Oracle Advanced Queuing queues and database tables being used in a distributed transaction be on different schemas, make sure you upgrade to database 10g.

4.6.10 Provide Correct OracleAS JMS Configuration to Avoid Java JMS Exceptions

OracleAS JMS does not validate invalid configuration information, like host and port, at OC4J start up time and these misconfigurations manifest themselves at runtime as Java JMS exceptions. Make sure that the configuration information that you are providing is correct before deploying your JMS application.

OracleAS JMS throws a `java.lang.instantiation` exception during OC4J startup when the port specified for the JMS Server is already in use. Make sure that the port specified is not already in use when starting up the OC4J instance with a JMS Server enabled.

Make sure that run-time exceptions do not occur in the `onMessage` call of an MDB instance that uses OracleAS JMS by catching the exceptions is a `try-catch` block (if feasible). This is because in this release runtime exceptions in the `onMessage` call can cause the MDB to enter into a endless redelivery loop.

4.7 Oracle Application Server XML Developer's Kit Best Practices

This section describes Oracle XML Developer's Kit best practices. It includes the following topics:

- Section 4.7.1, "Choose Correct XML Parsers to Improve Efficiency"
- Section 4.7.2, "Improve XSLT Performance"
- Section 4.7.3, "Use the Stream-based XML Schema and DTD Validation to Improve Performance"
- Section 4.7.4, "Process DOM using the JAXB Interface to Access and Operate on XML Data"

4.7.1 Choose Correct XML Parsers to Improve Efficiency

Choosing the right XML parser is critical to XML applications because it determines how efficient an application can access the XML data. Oracle XDK provides three XML parsers:

- Document Object Model (DOM) Parser: Parses the XML data and represents the XML data as an in-memory tree object. The DOM parser provides a set of object-oriented interfaces defined by the W3C DOM recommendation to access the XML data.
- The Simple API for XML (SAX) Parser: Supports an event-based XML parsing standard, which parses XML data and represents XML data as a set of events. The SAX parser pushes out all the events to the callback functions in the registered content handlers.
- The Java API for XML Parsing) (JAXP) Parser: Supports the JSR-63 standard and provides the standard interfaces in Java for both SAX and DOM XML parsing, XSLT transformation and XML Schema validation.

An XML application may not need to use all of parsers. Normally, an XML parser is chosen based on the application requirements.

Implementation Details

The DOM parser represents XML documents as in-memory tree objects. Therefore, using DOM parsers will leads to high memory footprint, especially when processing large XML documents. Because of the maintaining of in-memory objects, the DOM parser allows applications to dynamically update the XML data and the document structure. The DOM parser is ideal for applications, which need to edit or transform XML documents because these applications require extensive and random document transversals. In order to reduce the memory footprint, you can use the `DOMParser.setNodeFactory()` to customize the building of the DOM object tree. In addition, you can use the `DOMParser.setAttribute(DOMParser.USE_DTD_ONLY_FOR_VALIDATION, true)` to avoid including the DTD object in DOM.

The SAX parser parses XML data with limited memory use. Therefore, SAX parsing performs well and is scalable. The SAX parser is good for XML applications that retrieve, filter, and search large XML documents. The SAX parser is not easy to use, because it does not maintain the hierarchical structure of the XML document. As a

result, the SAX parser usually is not used for XML transformations or XPath content navigations. Additionally, because the SAX parser does not allow the in-place XML document updates, it is also not good for implementing document-editing tools.

The JAXP parser is based on the JSR-063 standard. The benefit of using the JAXP parser is that the XML applications are more portable, which means that the applications can easily switch to other XML parsers later. JAXP applications are not portable in many cases, because of the incompatibility of DOM objects across different XML parser implementations. For example, a DOM created through JAXP interface using the Apache Xerces parser can't be used by the JAXP XSLT processor based on the Oracle XDK XSLT processor. This is because the Oracle XDK XSLT processor doesn't recognized the DOM object created by the Apache Xerces parser. The same applies the other way around. Additionally, the JAXP parser introduces extra overheads because the implement is wrapped around the existing DOM/SAX implementations.

4.7.2 Improve XSLT Performance

XSLT transformations are widely used by XML applications to convert data from one format to the other or add presentation formats to the XML data before publishing the XML documents. The performance for XSLT has great impact on these kinds of applications. The following section gives you some help on how to make the XSLT transformations perform well.

Implementation Details

- To boost the performance when transforming XML using XSLT, use SAX to build `XSLStylesheet` objects and reuse the XSLT objects for subsequent transformations. In the XSL stylesheets, you also need to avoid unconstrained axis like `//foo` because the Oracle XDK XSLT processor takes full DOM traversal for this kind of XPath evaluations, which is very time-consuming
- Since the size of DOM object significantly affects the memory use of XSLT transformations, you need to set `<xsl:strip-space elements="*"/>` to reduce the size of DOM object. Since in many case whitespaces do not affect the transformation result and this option dramatically reduce the size of DOM, it delivers better performance.

4.7.3 Use the Stream-based XML Schema and DTD Validation to Improve Performance

To ensure the XML documents conforms to the defined XML schemas or DTDs, the XML schema or DTD validation is needed. To get the best performance and be able to handle large XML documents, the steam-based XML Schema or DTD validation is needed.

Oracle XDK provides stream-based XML Schema validation if no `key/keyref` is defined in XML schemas. Here is an example of the SAX-based XML schema validation:

```
// Build the XML schema object
XSDBuilder builder = new XSDBuilder();
byte [] docbytes = xsd.getBytes();
ByteArrayInputStream in = new ByteArrayInputStream(docbytes);
XMLSchema schemadoc = (XMLSchema)builder.build(in,null);
//Parse the input XML document with the XML schema validation
SAXParser parser = new SAXParser();
parser.setXMLSchema(schemadoc);
parser.setValidationMode(XMLParser.SCHEMA_VALIDATION);
parser.parse(xml.getCharacterStream());
```

The following example shows the stream-based DTD XML document validation:

```
// Build the DTD object
DOMParser dp = new DOMParser();
dp.parseDTD(fileNameToURL(args[1]), args[2]);
DTD dtddoc = dp.getDoctype();
//Parse and validate the XML document against DTD using SAX
SAXParser parser = new SAXParser();
parser.setDoctype(dtddoc);
//When set Oracle XDK to perform DTD validation
parser.setFeature("http://xml.org/sax/features/validation", true);
parser.parse(fileNameToURL(args[0]));
```

Since no DOM object is built during the XML schema validation or DTD validation, the process is more scalable.

4.7.4 Process DOM using the JAXB Interface to Access and Operate on XML Data

JAXB (Java Architecture for XML Binding) allows XML applications to access and operate on XML data with easy-to-use Java `get` and `set` methods. Oracle XDK JAXB allows JAXB XML applications to directly update the existing DOM objects. Comparing with other JAXB implementations which generate a DOM copy for JAXB operations, the Oracle XDK JAXB DOM support delivers better performance.

Implementation Details

To use this feature:

1. Build a DOM object as follows:

   ```
   DocumentBuilderFactory dbf = DocumentBuilder
   Factory.newInstance();
   dbf.setNamespaceAware(true);
   DocumentBuilder db = dbf.newDocumentBuilder();
   Document currentDoc=b.newDocument();
   ```

2. Unmarshall the DOM object to the JAXB objects:

   ```
   JAXBContext jc = JAXBContext.newInstance("oracle.example.resource");
   oracle.example.resource.ExObject exObject= (oracle.example.resource.ExObject)
   unmarshaller.unmarshal(currentDoc);
   ```

3. Use the JAXB `set` and `get` APIs to update the DOM object.

   After the DOM updates, the `currentDoc` will contain all the changes. No extra step of the serialization/deserialization is needed for getting the DOM with the updates. This reduces the overall processing time.

4.8 Oracle Application Server TopLink Best Practices

This section describes best practices for Oracle Application Server TopLink (OracleAS TopLink). It includes the following topics:

- Section 4.8.1, "Use OracleAS TopLink Mapping Guidelines to Persist Application Data"
- Section 4.8.2, "Use Caching and Concurrency Protection to Improve Performance"
- Section 4.8.3, "Use Sequencing to Apply Project-Wide Properties to All Descriptions"
- Section 4.8.4, "Implement Performance Options to Improve Performance"

OracleAS TopLink is both an integrated and a stand alone component within Oracle Application Server; recommendations in this section are specific to the use of OracleAS TopLink and may not apply to the rest of Oracle Application Server. OracleAS TopLink is compatible with Oracle Application Server or other application servers. OracleAS TopLink fully supports persistence for any Java application with any JDBC 2.0 compliant database.

OracleAS TopLink provides flexibility to interact with any application design, not only at initial construction but also as the application evolves. It also interacts with the complexities of the underlying relational database. This flexibility enables the two domains to interact to form a high performance system, and also evolve separately, while minimizing complexity in the application or database domains. Ultimately, supplying a general best practices is difficult as each situation will be different. Therefore, the reader must understand that these guidelines will not apply in all situations..

See Also:

- `http://www.oracle.com/technology/products/ias/toplink/technical/support/index.html` for information on the support and certification matrices
- *Oracle Application Server TopLink Application Developer's Guide*

4.8.1 Use OracleAS TopLink Mapping Guidelines to Persist Application Data

These are some general guidelines for use in mapping object models or designing relational models to persist application data.

- If in doubt, always use indirection for any relationship. Indirection does more than just provide deferred reading. It also provides deferred cloning when an object is made transactional.
- For Inheritance, it is usually advantageous to flatten out the inheritance hierarchy in the relational model. Just because there are several levels of inheritance in the object model, this does not mean that you necessarily need that many levels of joined tables in the relational model.
- Use version numbers, instead of timestamps, for Optimistic Locking.
- For very simple aggregation, for example, involving only one database field, consider `TypeConversionMappings` with an extended `ConversionManager`.

4.8.2 Use Caching and Concurrency Protection to Improve Performance

OracleAS TopLink has its own specialized object caching mechanism, which is separate from other caching solutions in Oracle Application Server. It is tightly integrated with the rest of the OracleAS TopLink runtime and provides additional performance benefits.

This section describes caching best practices. It includes the following topics:

- Section 4.8.2.1, "OracleAS TopLink Cache Refreshing Policies"
- Section 4.8.2.2, "Avoid Stale Cache Content"
- Section 4.8.2.3, "Cache Coordination"

4.8.2.1 OracleAS TopLink Cache Refreshing Policies

OracleAS TopLink does not automatically perform cache invalidation. In OracleAS TopLink, objects are refreshed in one of the following ways:

- If the cache holds a weak reference, for example, using `WeakIdentityMaps`, then objects that are no longer referenced by the application are simply garbage collected on a regular basis
- If a query is set to `refreshIdentityMapResult()` then all objects returned from the query are refreshed with the most recent data from the database.

  The query also supports cascading, enabling the developer to control the effects of refreshing on related objects.
- Objects can be explicitly refreshed using the `refreshObject` API on the OracleAS TopLink session.
- Objects are sometimes implicitly refreshed as a result of OracleAS TopLink merging in a remote `ChangeSet`. This technique is used by the OracleAS TopLink's cache coordination whenever a OracleAS TopLink session is configured to use cache synchronization.

4.8.2.2 Avoid Stale Cache Content

J2EE applications often share data with legacy applications or are running in a clustered environment. When using caching technology in environments such as this, your applications need a well thought out caching strategy to minimize stale data and concurrency failures where the database could be corrupted.

This section summarizes some options a developer has when wanting to explicitly refresh or clear out possible stale caches and how to do this as efficiently as possible. There is also a short discussion on cache coordination. It is important to understand caching and locking and the various configuration options made available. The following article on .

The basic approach to developing a caching strategy involves understanding the volatility of your persistence types and the amount they are shared between users. Then, based on this information, developers must:

1. Configure an appropriate locking policy on an entity type where there is potential for concurrent modification. This will prevent the usage of cached data from corrupting the database.
2. Configure the single node caching for each entity type with its initial size.
3. Use query refreshing or descriptor default refreshing to ensure that persistent instances can be refreshed on critical use cases
4. Enable cache coordination for entity types that are read-mostly, have shared usage, and are only modified through the TopLink-enabled application.

You can make the refresh more efficient if you are using optimistic locking. As OracleAS TopLink is refreshing each result from a query, you can query it to check the optimistic lock version first to see if the refresh is actually necessary. This option is set at the descriptor level. Here is an example:

```
public static void amendCustDescriptor(Descriptor d)
{
        d.onlyRefreshCacheIfNewerVersion();
}
```

See Also:

- Article *Overview of TopLink Caching and Locking* available from the Oracle Technology Network at `http://www.oracle.com/technology/tech/java/newsletter/articles/toplink/toplink_caching_locking.html` for further information on TopLink caching and locking
- *Oracle Application Server TopLink Mapping Workbench User's Guide*

4.8.2.3 Cache Coordination

OracleAS TopLink allows developers to use cache coordination when running in a clustered environment. Cache coordination provides messaging between sessions' shared caches. This enables changes made in one node of the cluster to be reflected in other nodes to avoid stale data. It is important to note that cache coordination does not provide a replicated database type cache where all nodes are guaranteed to have the same values. The goal of cache coordination is simply to minimize stale data and the potential for locking failures.

Cache coordination works particularly well in read intensive applications. This feature requires experimentation to see if it is appropriate for your application's use cases and can be affected by a number of issues, such as the volume and frequency of updates, network, JVM, communication protocol, operating system, number of nodes in cluster, and many other factors. Where cache coordination is not feasible, employ the previously mentioned refresh strategies as they work well in a clustered environment.

4.8.3 Use Sequencing to Apply Project-Wide Properties to All Descriptions

At the project level, the **Sequencing** tab applies two project-wide properties that are applied to all descriptors that use sequencing:

- Whether OracleAS TopLink uses database native sequencing objects or a table to manage sequences. The preference is to use Oracle native sequencing.
- The sequence preallocation size determines how many sequences OracleAS TopLink grabs and caches in one call. If you use Oracle native sequencing then the increment property of the sequence object must match the OracleAS TopLink sequence preallocation size.

At the descriptor level, the **Use Sequencing** section enables you to specify:

- **Name:** For native sequencing this will be the name of the database sequence object to be used.
- **Table:** The table that contains the field that the sequence will be applied. You choose the table from a drop-down list of all the tables the descriptor is mapped.
- **Field:** The table field that the sequence will be applied. You choose the fields from a drop-down list for the chosen table that are mapped by the descriptor.

4.8.4 Implement Performance Options to Improve Performance

This section describes performance options best practices. It includes the following topics:

- Section 4.8.4.1, "Performance Diagnostics"
- Section 4.8.4.2, "Tuning"

4.8.4.1 Performance Diagnostics

When the OracleAS TopLink `UnitOfWork` commits, every object registering into this `UnitOfWork` is automatically inspected for changes. This process can be time-consuming. One of the easiest ways to improve performance is to minimize the number of objects that require inspection.

Developers should have an idea of the size of the cache. If this transaction involves the editing of five or 10 objects, then try to ensure that there are only five or 10 objects registered. A large cache size for a comparatively small transaction means that the `UnitOfWork` will be performing a lot of needless work during it's commit cycle.

Implementation Details

> **See Also:** White paper *Oracle Application Server TopLink Unit of Work Primer* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/ias/toplink/technical/unitOfWorkWP.pdf`

4.8.4.2 Tuning

This section describes tuning best practices. It includes the following topics:

- Section 4.8.4.2.1, "Reducing The Size of the Transactional Cache"
- Section 4.8.4.2.2, "Analyzing the Object-Building phase"
- Section 4.8.4.2.3, "Use of Named Queries"

Tuning affects three important aspects of OracleAS TopLink performance:

- Minimizing the number of objects in the UnitOfWork transactional cache
- Minimizing the number of objects read in from the Database
- Taking advantage of named queries

4.8.4.2.1 Reducing The Size of the Transactional Cache After determining that the `UnitOfWork` is checking too many objects, one must look for ways of reducing the size of this transactional cache. There are several techniques to use:

- Try not to register objects that are not going to be changed
- Use Indirection. The importance of this cannot be overstated. Indirection allows OracleAS TopLink to only register related objects into a transaction when they are accessed in the context of that transaction. Without indirection, OracleAS TopLink will have to check all related objects for updates.
- Avoid querying against a `UnitOfWork`. If only a few objects from a query will actually be changed then registered the whole result set into the `UnitOfWork` will be a lot of overhead (both at query time and at commit time). Querying against a `UnitOfWork` is very convenient but it can be very dangerous if not used properly.
- Make use of the `UnitOfWork` `unregisterObject` API. It is worthwhile un-registering objects from a UnitOfWork if you know that there have been no changes to the objects.

4.8.4.2.2 Analyzing the Object-Building phase

After executing an OracleAS TopLink `ObjectLevelQuery`, OracleAS TopLink has to build all objects that have not been cached in a previous query. This operation can be expensive if it is allowed to go unchecked. After building an object, OracleAS TopLink will throw a `postBuild` descriptor event. This event can be useful to diagnose

situations where slow performance is caused by building too many objects. The following is an example of a `postBuild` descriptor event:

```
public class CaminusSessionListener extends SessionEventAdapter{
   /**
   * catch the postBuild event for EVERY class in the current system
   */
   public void preLogin(SessionEvent arg0)
   {
         Session session = arg0.getSession();
               for (Iterator it = session.getDescriptors().values().iterator();
it.hasNext();) {
            Descriptor desc = (Descriptor)it.next();
desc.getEventManager().addListener(
                new DescriptorEventAdapter() {
                     public void postBuild(DescriptorEvent event)
                        // do we want to keep a running tally on the number of
objects that are built
                                 // during a single transaction in any case, we
have access to the object which
                                 // has just been built.  Here it is:
                               {
                                   object object = event.getObject();
                          };
                         };
        }
```

In this example, the `postBuild` event for every class in the current OracleAS TopLink project is noted. Look for situations where you are building more objects than you feel are actually required to handle the current request. After determining that too many objects are being built, developers should consider some of the following:

- Further qualify the selection criteria of the `DatabaseQuery` if possible.
- Use Indirection. Indirection allows OracleAS TopLink to avoid building related objects that are not accessed during request processing.
- Increase the sub-cache sizes if using "soft" identity maps, such as `SoftCacheWeakIdentityMap` and `HardCacheWeakIdentityMap`.
- Are there some "ToMany" mappings which have become overly large? For example, are you mapping collections of objects involving thousands of objects when typical Use Cases involve accessing only a small subset of these objects? In these situations, it is advisable to unmap the "ToMany" relationship and have the parent query for the subset of children directly.
- Use `ReportQueries` to build summary reports rather than actual objects.

4.8.4.2.3 Use of Named Queries The importance of named queries is typically underestimated. Defining queries in one place and then referencing them by name allows OracleAS TopLink to optimize several key steps in the execution of a query. In addition, centralizing query definitions can save weeks of development effort during the performance tuning phase of application development.

Without named queries, users end up with the following types of usage patterns scattered throughout the system:

```
ReadObjectQuery query = new ReadObjectQuery();
query.setReferenceClass(Person.class);
Expression exp = query.getExpressionBuilder().get("id").equal(argument));
query.setSelectionCriteria(exp);
getTopLinkSession().executeQuery(query);
```

There are several problems with this approach. You must build and parse the preceding expression every time this query is executed. In addition, the argument is statically bound into the expression, and into the generated select statement. This means that this statement will have to be prepared over and over again.

In an alternative implementation, the query is defined outside of the application code. This is best done within the mapping editors, such as Oracle JDeveloper or the standalone OracleAS TopLink Workbench. This allows the developer to graphically build and tune a named query where the definition is stored within the map (project) XML. This simplifies development, eliminating significant code that requires maintenance, but more importantly allows for changes to the models and mapping to reflect any queries that are no longer accurate. This ability to be notified of mapping changes that break queries greatly improves developer productivity at design time.

Alternative queries can be defined or customized in descriptor `after-load` methods. The following is an example of the descriptor `after-load` method.

```
public static void afterLoad(ClassDescriptor desc)
{
   ReadObjectQuery query = new ReadObjectQuery();
   ExpressionBuilder builder = query.getExpressionBuilder();
   query.addArgument("ARG");

   Expression exp = builder.get("id").equal(builder.getParameter("ARG"));
   query.setSelectionCriteria(exp);

   desc.getQueryManager().addQuery("findByArg",query);
}
```

Using this query definition, application code can execute this query over and over again without having to re-build, re-parse, and re-prepare the any of the underlying implementation details.

```
getTopLinkSession().executeQuery("findByArg".Person.class,argument);
```

Using named queries, along with enabling `bindAllParameters` in the OracleAS TopLink, the `DatabaseLogin` can significantly improve the performance of all `DatabaseQueries`.

The use of named queries is conceptually very simple. Logistically, it is very difficult if the system has already been developed with `DatabaseQuery` definitions spread haphazardly through the application code. This aspect of application design needs to be addressed early in the development cycle.

4.9 Oracle Application Server Forms Services Best Practices

See Also: Whitepaper *Oracle 10gR2AS Forms Services - Best Practices for Application Development* available from the Oracle Technology Network at http://www.oracle.com/technology/products/forms/pdf/bestpractices10gr2.pdf

5

OracleAS Portal

This chapter describes best practices for OracleAS Portal. It includes the following topics:

- Section 5.1, "Installing, Configuration, Administration, Upgrade, and Troubleshooting"
- Section 5.2, "Performance Tuning and Features"
- Section 5.3, "Content Management and Publishing"
- Section 5.4, "Export/Import Utilities"
- Section 5.5, "Secure the Portal Environment"
- Section 5.6, "Portlet Development"

5.1 Installing, Configuration, Administration, Upgrade, and Troubleshooting

This section contains the following topics:

- Section 5.1.1, "Deploy, Patch, and Test Custom Portlet Providers to Provide Flexibility with Your Upgrade"
- Section 5.1.2, "Upgrade from 10g Release 2 (10.1.2.0.2) to 10g Release 2 (10.1.4)"

5.1.1 Deploy, Patch, and Test Custom Portlet Providers to Provide Flexibility with Your Upgrade

For greatest flexibility with your upgrade, you should deploy, patch and test any custom portlet providers (whether they are Oracle PDK-Java providers, WSRP producers, or JSR-168 providers) to their own OC4J instance. Ideally, put this OC4J instance in a separate Oracle home from your OracleAS Portal middle tier. Generally, you upgrade and patch Java applications at a much greater frequency than an Enterprise Oracle Portal middle tier. Therefore, using a separate Oracle home or OC4J instance will make this process easier.

Implementation Details

To implement a portlet provider OC4J instance in a development environment:

- Follow the instructions in Appendix A, "Installing OracleAS Developer Kits," in the *Oracle Application Server Installation Guide*.
- Follow Section 6.3.1.2, "Configuring without the Portal and Wireless Option," in the *Oracle Application Server Portal Developer's Guide*

To implement a portlet provider OC4J instance in a test or production environment:

- Follow the instructions to install a J2EE and Web Cache middle tier in Chapter 7, "Installing Middle Tiers," in the *Oracle Application Server Installation Guide*.
- Follow Section 6.3, "Configuring Your Application Server to Run JPS-Compliant Portlets," in the *Oracle Application Server Portal Developer's Guide*

5.1.2 Upgrade from 10*g* Release 2 (10.1.2.0.2) to 10*g* Release 2 (10.1.4)

The default installation of Oracle Application Server 10*g* Release 2 (10.1.2.0.2) Portal and Wireless instance includes an OracleAS Portal 10*g* Release 2 (10.1.2.0.2) instance. Oracle Application Server 10*g* Release 2 (10.1.2.0.2) also ships with the Oracle Application Server Portal Upgrade CD-ROM, which enables you to upgrade the OracleAS Portal Repository from release 10.1.2.0.2 to release 10.1.4.

OracleAS Portal 10*g* Release 2 (10.1.4) represents a major step forward in the evolution of OracleAS Portal and as such, will provide significant value to customers. Key themes for this upgrade release include:

- Comprehensive Fusion capabilities for better business agility
- Unleash the power of portal content management and publishing, as well as enable sophisticated, flexible and highly performant architectures, and out-of-the-box portal solutions

See Also: `http://portalcenter.oracle.com`

Implementation Details

To upgrade from 10*g* Release 2 (10.1.2.0.2) to 10*g* Release 2 (10.1.4):

- Install Oracle Application Server 10*g* Release 2 (10.1.2.0.2) Portal and Wireless.
- Upgrade the repository to OracleAS Portal 10*g* Release 2 (10.1.4) using the Oracle Application Server Portal Upgrade CD-ROM.

See Also: *Oracle Application Server Portal Installation and Upgrade Guide*

5.2 Performance Tuning and Features

This section contains the following topics:

- Section 5.2.1, "Use Appropriate Caching Strategy to Improve Performance"
- Section 5.2.2, "Use Providers Judiciously to Improve Portal Performance"
- Section 5.2.3, "Use Parallel Page Engine to Improve Availability and Scalability"
- Section 5.2.4, "Scale OracleAS Portal to Optimize Performance"
- Section 5.2.5, "Use Repository Services to Remove the Need for mod_plsql Tuning"
- Section 5.2.6, "Leverage Web Provider Session Caching to Improve the Portlet Cache-hit Rate"
- Section 5.2.7, "Increase Perceived Execution Speed to Improve Performance of Portlets"
- Section 5.2.8, "Reduce Page Complexity to Improve Cacheability"
- Section 5.2.9, "Measure Tuning Effectiveness to Improve Performance"

- Section 5.2.10, "Manage Portlet Execution For Each Page to Prevent Portal Slow-Down Issues"
- Section 5.2.11, "Prune Content to Improve Content Cleanup"
- Section 5.2.12, "Use Search Keys to Invalidate"

5.2.1 Use Appropriate Caching Strategy to Improve Performance

OracleAS Portal provides two different caching mechanisms to improve performance:

- Out-of-the-box integration with OracleAS Web Cache using an in-memory cache
- Persistent file-based cache

By default, OracleAS Portal issues dynamic caching instructions to OracleAS Web Cache, permitting the default content, such as pages, to be cached. The page designer can use the different cache options, such as whole page, page definition, or none, to ensure that the correct balance is maintained between enabling the speedy delivery of cached content and avoiding the delivery of stale content. It is important that the page or portlet designer understand that the degree of dynamism of a Web page is inversely proportional to its cacheability. Page designers should fully understand validation, expiration, and invalidation-based caching so that they can select the most appropriate cache method for their pages.

OracleAS Portal enables the page designer to cache page and portlets at the system level, thus storing a single copy of each object for all users. The following are the page caching options available in OracleAS Portal:

- Cache Page Definition Only
- Cache Page Definition And Content For [ ] Minutes
- Cache Page Definition Only at System Level
- Cache Page Definition And Content at System Level for [ ] Minutes
- Do Not Cache
- Page Portlets Cached Independently (New Feature)
- Portlet Caching
- Declarative Portlet Caching (New Feature)
- Partial Page Refresh (New Feature)

Cache Page Definition Only

With this option, the page designer can create a cached copy of the page definition in bothOracleAS Web Cache and the OracleAS Portal cache for each user. The page definition includes:

- Metadata describing the page structure
- Identification of the portlets that the page contains
- Style information for the page

Choose this option for the following types of pages:

- Pages with highly dynamic content
- Pages that contain portlets with short expiry periods
- Pages that contain portlets using validation-based caching or invalidation-based caching

Cache Page Definition And Content For [ ] Minutes

With this option, the page designer can create a cached copy of the page definition and page content, including the rendered content of all portlets, for a specified period. The OracleAS Portal cache and the Web browser cache the fully assembled page.

Choose this option for pages with more static content and long expiry periods. If you select this option, you may want to include a **Refresh** link on the page to regenerate the page content from the database.

Cache Page Definition Only at System Level

By using this option, the page designer can create a single cached copy of the page definition in the system cache for all users. Because the page definition is the same for all users, page customization options are disabled. This caching option greatly reduces storage requirements and improves performance.

Select this option for pages with highly dynamic content as long as they do not require customization.

Cache Page Definition And Content at System Level for [ ] Minutes

With this option, the page designer can create a single cached copy of the page definition and page content, including the rendered content of all portlets. The cached information remains the same for all users in the system cache for a specified period. Page customizations are not possible because the page definition and content is the same for all users.

Select this option for pages that are more static and unlikely to change within the specified period. Note that with this option, portlets display public content only. As a page designer, if you select this option, you may want to include a Refresh link on the page to regenerate the page content from the database.

Do Not Cache

Use this option to disable page caching. Selecting this option may adversely affect the performance of OracleAS Portal, as dynamic page generation places a heavy load on both the database and the middle tier.

By default, OracleAS Web Cache is installed, configured, and co-located with the OracleAS Portal middle tier. For optimal performance, deploy OracleAS Web Cache on a dedicated computer.

See Also: Chapter 7, "OracleAS Web Cache"

Page Portlets Cached Independently (New Feature)

In previous releases, page portlets were treated differently from other portlets-every page portlet was flattened directly into the page metadata of the containing page. Page portlets are now handled like all other portlets. You can cache a page portlet independently; however, changing the portlet content invalidates the cache..

Portlet Caching

OracleAS Portal enables you to cache portlets at the system level, which places a single copy of the portlet in the system cache for all users.

Before caching portlets at the system level, consider the following:

- Caching a portlet at the system level disables all customization options for the portlet.

- Caching a portlet at the system level does not enforce access privileges for the portlet.
- Caching a portlet at the system level means that only public data is displayed. Therefore, portlets such as the Recent Objects portlet or the External Applications portlet, which do not contain public data, do not display.
- Caching a page containing a portlet at the system level caches both the page and portlet at the system level.
- A Web provider that specifies system-level caching for a portlet sets the portlet to cache at the system level. You have the option to change the cache setting for the portlet manually.
- If you do not cache a portlet at the system level, but you place the portlet on a page that caches both the page definition and the content, then you cache the portlet at the user level. With user-level caching, you can customize portlet and enforce access privileges.

In summary, do not cache a portlet at the system level if that portlet includes sensitive data or other information that you do not want to display to all users. Examples of content that may be suitable for system-level caching include page banners and news portlets.

Declarative Portlet Caching (New Feature)

Page designers can now define or override the caching policy of any portlet instance using a new feature. Simply navigating to the instance options for the portlet on a page will allow a page designer to override or specify caching options for a portlet instance.

Using the **Force Portlet to be cached for *N* minutes** option allows the page designer to ensure that the portal will cache a portlet for a period of time using expiry based caching. Even if the portlet implements no caching this feature will allow a page designer or administrator to implement some form of caching.

Partial Page Refresh (New Feature)

You can set a portlet to refresh without refreshing the entire contents of the page. Partial page refreshing prevents unnecessary client-side requests and also improves the page viewing experience as pages no longer flash as they disappear and reappear.

5.2.2 Use Providers Judiciously to Improve Portal Performance

There are two different types of providers, Web providers and database providers. Using the right type of provider for your portlets can help improve your portal performance.

You can implement database providers in Java or PL/SQL, which execute as stored procedures within the Oracle database. The OracleAS Portal middle tier communicates with database providers in two ways:

- Through Repository Services, if the provider resides in the local OracleAS Portal database
- By SOAP over HTTP, if the provider resides in a remote database

Note that OracleAS Portal does not restrict a portlet that executes in the database in terms of functionality, as database facilities allow for external communication in many ways, including HTTP connections to external content. Database providers are particularly appropriate for portlets that require significant interaction with the

database, and in situations where the development team has extensive Oracle PL/SQL development experience.

You can implement Web providers in any Web deployment environment (for example: Java, ASP, or PERL) and execute as applications external to OracleAS Portal. OracleAS Portal communicates with these providers using SOAP over HTTP. Web providers are most appropriate for external information sources (for example: Internet news, business information) and in environments where developers have experience using Java and other Web development languages.

You can write Web providers using the PDK provided by Oracle or using WSRP and JSR 168 as open development standards for portlets.

> **See Also:** Chapter 2, "Portlet Technologies Matrix," in the *Oracle Application Server Portal Developer's Guide*

5.2.3 Use Parallel Page Engine to Improve Availability and Scalability

OracleAS Portal provides a parallel page engine (PPE) stateless servlet that fetches page metadata, assembles the page, and manages the cache. Because it is stateless, PPE is a key worker component that you can deploy across multiple OC4J instances.

By default, Oracle Application Server installs with a single `oc4j_portal` instance in which the PPE servlet is deployed. From a scalability perspective, Oracle recommends that you have at least one OC4J instance where you have deployed the PPE servlet. Alternatively, you can increase the number of OC4J processes dedicated to the single instance. Oracle HTTP Server load balance routing distributes requests across the multiple instances or processes, providing better scalability for the entire system.

5.2.4 Scale OracleAS Portal to Optimize Performance

OracleAS Infrastructure, including the database, provides important functionality to OracleAS Portal, as all metadata, database providers, and infrastructure entities reside there. Because of this heavy dependency on the database, conventional database tuning, such as putting OracleAS Portal indexes on a separate disk, becomes extremely important to optimize OracleAS Portal's performance. Oracle does not recommend that you analyze the schema for additional tuning opportunities, as the Cost-Based Optimizer (CBO) has already performed his analysis for you and used it where appropriate. Moreover, there are also standard ongoing jobs that re-tune the schema based on collected statistics on a regular basis.

Another aspect of tuning is the Oracle Net tuning between the Repository Services computer, such as Oracle HTTP Server, and the database itself. You should also consider Real Application Cluster (RAC) as an option for the availability and scalability of the OracleAS Portal database.

5.2.5 Use Repository Services to Remove the Need for mod_plsql Tuning

Prior to OracleAS Portal 10*g* Release 2 (10.1.4), Oracle recommends tuning the `mod_plsql` request process could be carried out to improve performance of repository bound activities. OracleAS Portal 10*g* Release 2 (10.1.4) no longer uses `mod_plsql` to make database calls. Instead, it uses something called Repository Services—a servlet component of the Portal Services servlet that maintains its own connection pool. There is no use of `mod_plsql` for OracleAS Portal requests to the database.

5.2.6 Leverage Web Provider Session Caching to Improve the Portlet Cache-hit Rate

When you register a Web provider, you can cache session-specific information, such as session ID and user login time for each request. Although this is a mandatory requirement for Web providers that rely on session information to ensure the validity of atomic transactions, providers that do not rely on this information should deactivate this option. Doing so improves the portlet cache-hit rate and reduces the time taken to initiate the portlet request as there is no attempt to instantiate a remote session with the provider, which can be a costly step.

5.2.7 Increase Perceived Execution Speed to Improve Performance of Portlets

End-user perception of the performance of a page is related to several factors. One of the most obvious factors is the performance of individual portlets. A single slow portlet can slow down the end user perception of the performance of a whole page. The slow refresh occurs because portlets execute in parallel and the page does not refresh for the user until the slowest portlet either returns content or times out.

Page execution speed, therefore, is equal to the speed of the slowest portlet, plus page assembly overhead. OracleAS Portal 10*g* Release 2 (10.1.4) includes a new feature that provides a solution to this problem from the perspective of a page designer, called Page Assembly Timeout. This feature enables page designers to define a maximum page creation time. The option limits the amount of time the server delays page display while it assembles portlets. If OracleAS Portal does not assemble a portlet within the specified time, the portlet appears after the page displays, using partial page refreshing.

This option is useful for pages known to have potentially slow portlets, perhaps one that is running remotely on a slow server far away.

If you are noting performance issues with a page try using the `_DEBUG` utility.

Implementation Details

See Also: *Oracle Application Server Portal Configuration Guide*

5.2.8 Reduce Page Complexity to Improve Cacheability

Page complexity, which is a combination of page security and the number of tabs, items, and portlets on a page, affects throughput by increasing the amount of metadata that needs to be generated, as well as the number of security and validity checks. Page complexity does not affect page assembly time in the middle tier, but may affect the time it takes to validate and refresh portlet content.

5.2.9 Measure Tuning Effectiveness to Improve Performance

One way to evaluate whether your attempts to improve performance are effective is to measure the performance, then use those measurements to further fine tune the system.

To obtain specific results from system internals, append `&_DEBUG=1` to the end of the portal page URL for which you wish to measure performance. The output is a report from the parallel page engine that provides details of performance of each component on the page, whether a cache miss or hit occurred, and how long page loading took.

Repeating this practice periodically will help keep your system fine-tuned for better performance.

Implementation Details

See Also: *Oracle Application Server Portal Configuration Guide* for further information about `_DEBUG`

5.2.10 Manage Portlet Execution For Each Page to Prevent Portal Slow-Down Issues

The PPE uses the concept of **fetcher threads**, which are threads within the PPE servlet that are used to service requests for portlet content. By default, there are 25 fetcher threads within the PPE waiting to service requests. If a page has 26 portlets and that page is requested, then 25 of the portlets will be requested in parallel and the 26th request will wait for the next available fetcher thread.

This serialization effect will ultimately slow down the portal performance as more requests are received. This degradation will affect the whole portal site, to combat this at a more granular page level OracleAS Portal introduces a feature called Managed Portlet Execution (MPE).

MPE provides a throttle effect similar to fetcher threads, but for each page. For example, if a page has 25 portlets, 20 will run and the other five will wait for free slots before running; in effect, these five are throttled.

MPE is set to 20 by default, but this is a configurable parameter enabling administrators to ensure that the performance of the whole site is not degraded by over-zealous page designers putting excessive quantities of portlets on one page.

OracleAS Portal 10*g* (10.1.4) includes a new, more specific engine management feature for page portlets accessible through the parameter `maxParallelPagePortlets`, which restricts the maximum number of page portlets the system as a whole will process. This feature enables you to stop deeply nested pages from using all the available request threads and also to prevent the processing of recursively nested pages before all threads are used.

5.2.11 Prune Content to Improve Content Cleanup

While Repository Services has replaced `mod_plsql` for backward compatibility, the persistent caching of content within the middle tier still uses the same file structures as when implemented within `mod_plsql`, therefore the following advice applies

The file cache under `$ORACLE_HOME/Apache/modplsql/cache` in the Oracle Application Server middle tier installation has a subdirectory for explicit storage of the page metadata (PMD). The separate storage of the PMD allows the cleanup processes to be more explicit in their selection of content to be pruned.

Cleanup is now controlled by new explicit parameters:

- `PlsqlCacheMaxAge 30`
- `PlsqlCacheCleanupTime Saturday 23:00`

PMD content will be given preferential retention treatment ensuring the greatest cache-hit ratios occur for PMD objects. These objects are the most expensive to generate and the least likely to change in a running production site.

5.2.12 Use Search Keys to Invalidate

When you set a document to be cached in Oracle Web Cache, it is cached using an invalidation basis. This means the content is stored in Oracle Web Cache until it is explicitly invalidated by a SOAP message issued by the OracleAS Portal Repository. Prior to OracleAS Portal 10*g* Release 2 (10.1.4), the OracleAS Portal Repository needed

to issue a single invalidation message for each piece of content that had changed for each possible cached element.

For example, suppose you base a page on a template, secure that page and cache it on for each user for 10 users, and then change that template. The portal must then issue 10 invalidation messages.

OracleAS Portal introduces a concept of search- key invalidation where the content is cached with a common identifier (search key) that allows the OracleAS Portal Repository to issue one invalidation message for the content with the common identifier thus invalidating all the content that matches that key with a single message.

5.3 Content Management and Publishing

This section contains the following topics:

- Section 5.3.1, "Use Page Groups to Delegate Administration"
- Section 5.3.2, "Research Your Taxonomy Before Building Up a Page Hierarchy to Save Rework Time"
- Section 5.3.3, "Use Portal Templates to Improve Consistency"
- Section 5.3.4, "Use Navigation Pages to Manage Portal Template Content"
- Section 5.3.5, "Use Categories, Perspectives and Custom Attributes to Enhance Content Metadata"
- Section 5.3.6, "Use Translations to Create Multilingual Web Sites"
- Section 5.3.7, "Use the View Mode Best Suited to the Task"
- Section 5.3.8, "Use Content Management APIs to Migrate Existing Content"
- Section 5.3.9, "Use Content Management APIs to Organize Content"
- Section 5.3.10, "Use the Content Management Event Framework to React on Any Activity in the Content Management System"
- Section 5.3.11, "Use the Public Search API to Implement Custom Searches"
- Section 5.3.12, "Use WebDAV Capabilities to Support Desktop Applications Centric Users"
- Section 5.3.13, "Use HTML Templates to Create Pixel-Perfect Pages"

5.3.1 Use Page Groups to Delegate Administration

OracleAS Portal enables you to organize portal pages within page groups. The easiest way to get started is with a single page group. Within a page group, you can easily copy or move content elements across pages.

In a larger environment, you may want different people to administer different areas of the site. Delegating administration is much easier if you separate your site into multiple page groups.

Implementation Details

To enhance the sharing and reuse of objects between page groups, consider creating templates, styles, and item types in the supplied Shared Objects page group.

In addition, any page can be published as a portlet, which allows the content on that page to be viewed on any other page in any page group.

See Also: Chapter 3, "Planning Your Portal," in the *Oracle Application Server Portal User's Guide*

5.3.2 Research Your Taxonomy Before Building Up a Page Hierarchy to Save Rework Time

There are several different ways to organize the content that your portal needs to provide to its end users. This organization is referred to as a taxonomy. You can create a physical taxonomy consisting of pages and sub-pages. You can also create virtual taxonomies consisting of categories and perspectives. Users can browse a taxonomy, which appears as a hierarchy of pages. OracleAS Portal dynamically builds each category and perspective page by searching for content belonging to the selected category or perspective when rendering the page. Planning your taxonomy in advance saves rework at a later date.

Implementation Details

It is easy to reorganize the taxonomy by moving pages around within a page group and by moving items between pages. Keep in mind, however, that you can move items between pages in different page groups when the item type is shared between page groups, but you can move pages only within the same page group.

OracleAS Portal does not currently support reorganizing category and perspective values. Although you can reassign content to a different category or perspective, you must manually do so for each piece of content, or programmatically by using the content management APIs. Therefore, carefully plan your category and perspective hierarchies before you start to add content to your pages.

See Also: Chapter 3, "Planning Your Portal," in the *Oracle Application Server Portal User's Guide*

5.3.3 Use Portal Templates to Improve Consistency

You can use portal templates to provide consistency for both pages and item content. Since both portal pages and portal items are both accessible by URL, as you navigate around your portal, using a similar template for both pages and items enables you to maintain a consistent look and feel.

It is also a good practice to manage your portal templates that could be used in multiple page groups in the Shared Objects page group, as the Shared Objects page group is the only page group. These contents can be shared with all customer-created page groups.

Implementation Details for Page Consistency

Creating pages with OracleAS Portal is easy, and it may be tempting to start adding pages quickly at the onset of your portal development project without first defining one or more portal templates. To ensure a consistent look and feel to your site and to minimize maintenance effort, Oracle recommends that you always base your pages on portal templates. You can keep this association for the lifecycle of the page in order to enforce a specific look and feel, control the page creation process and minimize maintenance efforts.

To implement this best practice:

- Create a portal template in the Shared Objects page group. Doing so allows the template to be used by all page groups within your portal installation.

- Define your page structure and add common content. You can manage common content with navigation pages. (See Section 5.3.4, "Use Navigation Pages to Manage Portal Template Content" for more information.)
- Assign templates to pages during page creation in step two of the Create Page wizard, or for pre-existing pages you can specify the usage in the **Template** tab within the Page Properties.

Implementation Details for Page Starting Point

Alternatively, you can use a portal template as a convenient starting point for creating a custom page layout. For example, you could create the page using a template (thus inheriting the page layout and region property settings), disassociate the page from the template, and make page unique changes to region properties and layout. Keep in mind that you can always re-apply the template to the page or apply a new template if required.

To implement this best practice:

- In the Page Properties for the page that should use a template as a starting point, set the page to use the template that will be used as a starting point..
- Click the **Detach From Template** link.

Implementation Details for Item Consistency

You can also use portal templates to surround item content with consistent decoration just like portal pages can use templates for consistent decoration. This way, you can display item content that is called directly with a consistent look and feel.

To implement this best practice:

- Create a Portal Template in the Shared Objects page group. Doing so allows the template to be used by all page groups within your portal installation.
- Define your page structure and add common content.
- Within the Portal Template region that you want items to show, add an item of type **Item Placeholder**. Choosing default content for the Item Placeholder is optional. This content displays if the template URL is called directly from a browser.
- To specify for items to use this template, go to the page where the items reside. In the page properties, click on the Items tab. Within the the Portal Template Assignment section you can choose a template for all items on the the page to use. If desired, you can enable items to choose their own template by checking the **Allow items on this page to use a different Portal Template** checkbox.
- Test the template by entering the Item's URL directly into the browser address bar.

> **See Also:** Section 13.2, "Working with Portal Templates for Pages and Items," in the *Oracle Application Server Portal User's Guide*

5.3.4 Use Navigation Pages to Manage Portal Template Content

A portal template defines the layout (the placement of item and portlet regions) for pages. A template can also contain content, in the form of portlets and items that you want to appear on all its pages. Making changes to a template immediately displays on its dependent pages. Making changes to the content on a template can take minutes or even hours, depending on the extent of the changes. During this time, the pages themselves will be in a state of flux as the template is modified. This can have a

negative impact on your portal users and may require that the affected pages be unavailable while performing template maintenance.

Implementation Details

You can avoid this impact by managing template content on navigation pages. For example, use a navigation page to contain the banner for your template, which may include such elements as the **Page Name Smart Text**, company logo, and various **Smart Links**, such as the **Customize** icon and the **Home Page** link.

To implement this best practice:

- When you want to modify the banner, copy the navigation page and make changes to the copy.
- When you are satisfied with the changes, replace the original banner navigation page portlet on the template with the modified copy. You can do this very quickly with minimal impact on portal users. The same recommendation applies to navigation bars, page footers, and other content that you want to include on the template.

> **See Also:** Section 14.1.1, "Navigation Pages," in the *Oracle Application Server Portal User's Guide*

5.3.5 Use Categories, Perspectives and Custom Attributes to Enhance Content Metadata

One of the big advantages of OracleAS Portal is the ability to define and associate metadata with any content. OracleAS Portal provides three types of metadata:

- **Categories**: Used for mutually exclusive properties like "What is it?"
- **Perspectives**: Used for content that may require multiple properties values like "Who is the audience?"
- **Custom Attributes**: Used for other mutually exclusive properties

It is important to understand the characteristics of these metadata elements in terms of their impact on content organization, maintenance, presentation, and search. For example, while they all aid in searching for content, each has a different style for search submission and for presentation in search results. There are also important differences in terms of how content contributors assign metadata values to content and in how these elements are presented on pages.

Implementation Details

Table 5–1 summarizes the characteristics of the metadata elements.

Table 5–1 Metadata Element Characteristics

Characteristics	Custom Attributes	Categories	Perspective
Can be mandatory on Add/Edit item	Yes	Yes	Yes
Can be selected for Group By in Region display	No	Yes	No
Can be arranged in a navigable hierarchy	No	Yes	Yes
Allows multiple values for a single item	No	No	Yes
Select values from Static List of Values	Yes	Yes	Yes

Table 5–1 (Cont.) Metadata Element Characteristics

Characteristics	Custom Attributes	Categories	Perspective
Select values from Dynamic List of Values (based on SQL Query)	Yes	No	No
Can be associated with an icon	No	Yes	Yes
Searchable	Yes	Yes	Yes
Can be shown in Item display	Yes	Yes	Yes
Can be shown in Search Results	Yes	Yes	Yes
Can be used to order a custom query (using SQL against the `WWSBR_ALL_ITEMS` repository view)	No	Yes	No
Translatable	Yes	Yes	Yes
Data types	Boolean, Date, File, Number, PL/SQL, Text (Single or Multi-Line), URL	Text Only	Text Only

See Also: Section 6.3, "Setting Up Content Classification," in the *Oracle Application Server Portal User's Guide*

5.3.6 Use Translations to Create Multilingual Web Sites

OracleAS Portal enables you to store, manage, and publish translations of your portal content. You can associate many of the objects that are managed in your portal with one or more languages in addition to the default language defined for a page group. OracleAS Portal automatically publishes translated content to viewers of your portal in their selected language.

Implementation Details

Although the translation feature is very useful and powerful, it is important to understand how translations are created, managed, published, and queried. In particular, you should make clear to your content contributors and portal users the impact of creating or editing an object in a nondefault languages. The following are several characteristics of the translation feature that are important to understand:

- Editing an object in a language other than the default language may cause the edits to appear to be lost when the object is viewed in the original language. Content contributors may not realize that multiple language records can exist for a single object.
- Editing a non-translatable attribute automatically copies the value of the attribute to all language records. The content contributor may wonder why the attribute value has suddenly changed after switching to a different language.
- Editing a translatable attribute does not copy the change to all language records. In this case, the content contributor may be concerned that all changes were lost when viewing the object in a different language.

- Translations may exist for one version of an item, but not for another version. If the current version changes, it may seem as if the translation has been lost.

  See Also: Chapter 20, "Translating Portal Content," in the *Oracle Application Server Portal User's Guide*

5.3.7 Use the View Mode Best Suited to the Task

When different users perform the tasks of authoring, publishing and managing content, you may want to choose a view mode that optimizes the user interface to the features that are required for the role being performed. A content author may want to see what the content looks like on the page so a graphical viewing mode is most appropriate, and a content manager that needs to approve multiple documents can do so in a single operation when using a list view.

Implementation Details

When editing a page, you can switch between **View** modes by using the **Graphical**, **Layout**, and **List** links in the **Edit** toolbar.

You can set the default edit mode for all pages in a page group to any of the edit modes by configuring the page group properties.

5.3.8 Use Content Management APIs to Migrate Existing Content

When setting up your portal, you may find that you want to load and attribute directory and file structures that exist on a file system into the OracleAS Portal Repository. While it is very time consuming to upload and set the attribution for every file using the Web browser interface, as an alternative, you can use APIs.

Implementation Details

Functions of the content management APIs that help you migrate existing content include:

- `add_folder`: Creates a new page within a given page group
- `add_item`: Uploads a file from the file system and adds a new item to an item region
- `set_attribute, modify_item`: Enables you to set the attribution for an existing item and helps you perform content management task programmatically without any Web browser-based interaction
- `modify_folder`: Enables you to modify the page properties

All of the files you plan to upload using the APIs must be accessible from the same file system as the installed OracleAS Metadata Repository, and you need access to the files themselves.

See Also: Part III, "Content Management APIs," in the *Oracle Application Server Portal Developer's Guide*

5.3.9 Use Content Management APIs to Organize Content

When managing your portal, there is often the requirement to have a staging page group and a production page group. That is, content contributors must author and manage content in a staging page group, which you then need to move to the production page group. While it is very time consuming to move every item using the Web browser interface, you can instead use the content management APIs.

Implementation Details

Functions of the content management APIs that help you organize content include:

- `move_item, copy_item`: Enables you to transfer items from one page group to another page group
- `delete item`: Enables you to delete an item that is no longer necessary

The metadata attribution of an item is automatically transferred when using the content management APIs.

> **See Also:** Part III, "Content Management APIs," in the *Oracle Application Server Portal Developer's Guide*

5.3.10 Use the Content Management Event Framework to React on Any Activity in the Content Management System

When users add content to OracleAS Portal's content management system you may want the system to perform certain actions, such as:

- Sanity check and verify the content
- Perform a virus scan on files
- Send an email notification
- Kick off an external Workflow
- Invoke an external Program

The Content Management Event Framework (CMEF) enables you to react on any event that occurs in OracleAS Portal content management system and programmatically perform any action. In combination with the content management APIs and views, it enables full flexibility.

Item Verification Example

A user adds a text item and you want to ensure that the title is no longer than 30 characters. An OracleAS Portal workflow kicks off and programmatically verifies that the item title is not longer than allowed. If it is longer than 30 characters, the system automatically rejects the item with a message to the author that the title exceeded the maximum length. If the item passes the verification it gets automatically approved and published

External Workflow Example

A user adds a new item to a page. The CMEF hides the item and submits it to the BPEL Workflow Engine. Once the BPEL Workflow finishes, a step in the workflow either rejects or approves the item. If approved, the CMEF unhides the item and publishes it; if rejected, the CMEF deletes the item from the page.

Implementation Details

First, you enable the CMEF at the page group level. The CMEF writes to Oracle Advanced Queuing in the database and creates an entry for each of the 155 pre-defined events that can occur in OracleAS Portal's content management system. You must create a program called subscriber and register it with the CMEF. The subscriber program must implement the logic on how to react on which events in the queue. The subscriber program is responsible to de-queue events from Oracle Advanced Queuing. Ideally, you set up the subscriber program as a database job that executes periodically.

See Also: Chapter 16, "Using the Content Management Event Framework," in the *Oracle Application Server Portal Developer's Guide*

5.3.11 Use the Public Search API to Implement Custom Searches

Frequently, you must create custom searches for your portal that perform beyond the functionality of the three out-of-the-box search portlets that OracleAS Portal provides. To create custom searches, you can use the public search API, which enables you to expose portal search submission and results in any third-party application. You can also use this API to publish the portal search results to a special document format, such as XML, which you can then use for further processing.

Implementation Details

The public search API includes the following search submission functions:

- Item Search
- Page Search
- Category Search
- Perspective Search

The public search API includes the following search-result functions:

- Get item results as XML Document
- Get page results as XML Document

See Also: Chapter 13, "Searching Portal Content," in the *Oracle Application Server Portal Developer's Guide*

5.3.12 Use WebDAV Capabilities to Support Desktop Applications Centric Users

OracleAS Portal supports the use of WebDAV clients, such as Microsoft Web Folders, to access the OracleAS Metadata Repository. WebDAV allows users to directly edit a document, such as a Microsoft Word document, on a portal page and save it back to the OracleAS Portal Repository without ever having to download or upload the file. It also allows users to publish files located on the local file system to a portal page directly from the Windows Explorer, as well as to delete, copy, or move those files. The same security settings found in the Web browser-based interface are also enforced in the WebDAV environment, using OracleAS Single Sign-On to authenticate to OracleAS Portal.

From OracleAS Portal 10*g* (9.0.4.1) onwards, a new, powerful WebDAV Client with tight OracleAS Portal integration is available from Oracle: Oracle Drive. This WebDAV Client supports all operations available with the WebDAV protocol plus additional OracleAS Portal-specific functions, such as:

Portal Item Menu Options:

- Set Properties
- Change Access Control
- Preview Content
- View Versions
- Approve/Reject
- Submit for Approval

Portal Page Menu Options:

- Set Properties
- Change Access Control
- View Page

In addition to the preceding functionality, Oracle Drive offers a number of useful Windows desktop integrations:

- Mount OracleAS Portal Repositories as Microsoft Windows Drives
- Edit and view content with any Windows application
- Work with offline content and synchronize when online
- Extra capabilities available in the right-click menus
- Access the repositories with a command line (DOS) utility
- Search from Windows Explorer

> **See Also:** Chapter 19, "Using WebDAV Clients with OracleAS Portal" in the *Oracle Application Server Portal User's Guide*

5.3.13 Use HTML Templates to Create Pixel-Perfect Pages

You can use OracleAS Portal's page editing capabilities to create complex page structures and a compelling user interface for a wide range of portal configurations. If your portal page calls for a sophisticated graphic design, you can use HTML Templates to control the HTML rendered as page decoration and item content layout. Using these templates allows for easy, standard based ways of using Web technologies, such as CSS and JavaScript. By placing special OracleAS Portal substitution tags in your HTML, you can place portal elements, such as **Page Title**, **Sub-Page** links, **Edit Page** link, **Navigator** link, **Item** attribute values, and other elements common to a portal page or item content directly in your HTML code.

There are two types of HTML templates: Page Skins and Content Layout. You apply Page Skins directly to a portal page or, if you apply them to a portal template, the HTML surrounds the portal page in its entirety. Content Layouts are snippets of HTML that you assign to a page region. The HTML repeats for every item contained within the region.

HTML templates also enable you to execute PL/SQL, allowing for programmatic control over the HTML.

By using this HTML Templates, you can apply virtually any corporate look to your portal pages, even if this design may not be achievable using the regular portal page design capabilities.

HTML Templates are created and maintained under Page Groups. If you want to use the same HTML Templates across multiple page groups, create them in the Shared Objects page group.

Implementation Details for HTML Page Skins

To apply a HTML Page Skin to a page, go to the Page Properties, Template tab. You will be able to select Page Skins created in the current page group and Page Skins created in the Shared Objects page group. A portal page may have only template applied to it. If you desire a page to use a Portal Template to define common content and structure, and also use a HTML Page Skin to surround the page with hand crafted

HTML, you must apply the HTML Page Skin to the Portal Template and then apply the Portal Template to the page.

The most critical OracleAS Portal replacement tag for a HTML Page Skin is the `#BODY#` tag. Wherever this tag is placed within the HTML, the entire Portal Page will be rendered.

Implementation Details for HTML Content Layouts

You apply Content Layouts to region settings on the Attributes tab. To determine how you want the content to display within a region, use the attributes or choose an HTML Content Layout. The HTML snippet you write in a Content Layout repeats for every item contained within the region. There are portal replacement tags for all item attributes, including custom attributes.

Since the HTML is repeated for every item, it is not a good practice to declare JavaScript methods, or include CSS styles at this level. In cases where you need to use JavaScript or CSS, use HTML Page Skins and HTML Content Layouts in coordination with each other. Declare the JavaScript method or CSS in the HTML Page skin where it will not be repeated, then simply reference the style or JavaScript method from within the HTML Content Layout.

The ability to place `<ORACLE> ... </ORACLE>` tags within HTML Templates allows Content Layouts to use IF statements to programmatically choose to output different HTML conditionally. While inside of the `<ORACLE>` tag, you will need to use a PL/SQL procedure such `HTP.P('<B>Hello World</B>');` to output any HTML that you want to display on your page.

> **See Also:** Section 13.3, "Working with HTML Templates" in the *Oracle Application Server Portal User's Guide*

5.4 Export/Import Utilities

This section contains the following topics:

- Section 5.4.1, "Review Supported Use Cases to Optimize Export and Import Operations"
- Section 5.4.2, "Follow the Guidelines for Export and Import of Portal Objects to Prevent Errors"

5.4.1 Review Supported Use Cases to Optimize Export and Import Operations

OracleAS Portal provides a set of export and import utilities to enable you to copy content between OracleAS Portal installations. For example, you might use these utilities to copy or update portal page groups and application components between a development instance and a production instance of OracleAS Portal.

It is critical to understand that the provided OracleAS Portal export and import utilities support a specific set of use cases and usage scenarios. Oracle recommends reviewing the *Oracle Application Server Portal Configuration Guide* for your version of OracleAS Portal before beginning the page and content design process for your portal, if regular export and import of content between portal instances is a requirement. The *Oracle Application Server Portal Configuration Guide* provides an overview of the export and import process and key concepts. It also describes the two most common export and import use cases:

- Importing and exporting between development to production instances
- Deploying identical content across multiple portal instances

5.4.2 Follow the Guidelines for Export and Import of Portal Objects to Prevent Errors

For best practices and recommendations for export and import of the objects defined within OracleAS Portal, see the *Oracle Application Server Portal Configuration Guide*. It describes best practices for:

- Migrating Your Users and Groups
- Migrating Your Page Groups and Components
- Migrating Your Web Providers
- Migrating Your Portal DB Providers and Components
- Migrating Your Search Components
- Migrating Your External Applications
- Migrating Your Portal Across Databases

See Also:

- Chapter 10 ,"Exporting and Importing Content" in the *Oracle Application Server Portal Configuration Guide*
- Oracle *MetaLink*, `http://metalink.oracle.com` for additional support updates and support information

5.5 Secure the Portal Environment

This section contains the following topics:

- Section 5.5.1, "Implement Post Installation Steps to "Harden" Your Portal Environment From Malicious Attack"
- Section 5.5.2, "Implement a Role-Based Security Model to Simplify Access Control Definition"
- Section 5.5.3, "Base Development of Pages on a Network Aware Custom Page Type to Enable Implementation of Network Access Security"
- Section 5.5.4, "Group secured content to Optimize ACL Determination and "Network Access" Security."
- Section 5.5.5, "Define Anonymous "Public" Pages and Authenticated "Public" Pages to Simplify Security"
- Section 5.5.6, "Implement Hash Message Authentication (HMAC) Encryption in Communication to Web Providers to Allow for Secured Identity Propagation and J2EE-Based Security"
- Section 5.5.7, "Implement Global Inactivity Timeout to Prevent Attacks through Unauthorized Sessions"
- Section 5.5.8, "Utilize Separate Page Groups and a Segmented Security Realm Within Oracle Internet Directory to Support a Hosted Portal that is to Be Shared Across Independent User Communities"

5.5.1 Implement Post Installation Steps to "Harden" Your Portal Environment From Malicious Attack

While the installation process of OracleAS Portal allows for a fully functional portal out-of-the-box, the fact that it uses a number of standard administration settings and passwords prevents the default installation from being used in a environment where it

may be compromised, for example, on an Internet site. Oracle recommends that you perform a number of simple post installation steps to change the configuration to site specific values, thereby preventing malicious attack by use of the default installation values.

Implementation Details

While much of the hardening of a portal site involves the changing of the default configuration values, a significant portion is dependent on the implementation of a secured network topology. Specifically, you want to minimize the direct access that a malicious user may have to the server itself, both from the external and internal network.

To harden your portal installation, consider doing the following:

- Change the passwords for all default OracleAS Portal lightweight users
- Change the default password used to bind the portal to the Oracle Internet Directory. This setting is found in the `orclApplicationCommonName` attribute under the Oracle Context.
- Remove unnecessary pages, such as demonstration pages, to limit the ability to enter the portal site through **back-doors**.
- Remove unnecessary seeded groups and privileges.

> **Note:** In OracleAS Portal 10g Release 2 (10.1.2.0.2) the seeded administrator accounts no longer have high-level privileges in the directory.

- Revoke public access to the components within the portal, which may expose information from the OracleAS Metadata Repository or transactional database.
- Control Access to the Builder Pages. This is particularly important because a link to the builder is exposed on the Customize user interface and allows users to see the structure of the site even if they cannot access any of the pages shown.
- Remove Web access to standard DBMS functionally PL/SQL Packages, which may allow access to the portal schema in the OracleAS Metadata Repository or other repositories, such as `UTL_HTTP` and `DBMS_JOB`.
- Consider placing the Oracle Application Server Portal middle tier behind a reverse proxy component to obfuscate the real name of the server. In particular, implement Network Address Translation (NAT) to hide the actual IP addresses of the portal's middle tier servers.
- Secure the individual network hops SSL as required. At a minimum, ensure the connection between the user's Web browser and the OracleAS Single Sign-On server is SSL-enabled.
- Implement a true **Intranet/Extranet** topology to separate both the physical executables and any generated content into two distinct user communities.
- Implement Secured Network Access (discussed subsequently) to prevent sensitive pages from being accessible from outside of the corporate network.

See Also:

- Section 6.3.2.3, "Post-Installation Security Checklist," in the *Oracle Application Server Portal Configuration Guide*
- Section 9.1, "Configuring a Dedicated Intranet and Internet for OracleAS Portal," in the *Oracle Application Server Enterprise Deployment Guide*
- Section 9.2, "Configuring a Reverse Proxy for OracleAS Portal and OracleAS Single Sign-On," in the *Oracle Application Server Enterprise Deployment Guide*
- Whitepaper *Expose your Intranet Portal to the Outside World in a Secured Manner* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/ias/portal/pdf/secured_inside_outside.pdf`

5.5.2 Implement a Role-Based Security Model to Simplify Access Control Definition

While the ability to define access privileges at the individual user level allows for the creation of very granular security policies, as the size of the user community increases such granular polices become successively more difficult to manage and maintain. Therefore, to simplify the implementation of security, Oracle recommends that you use a role-based metaphor, where a user's privileges are effectively defined by their functional position, rather than their direct identity.

Role-based access control (RBAC) is based on the concept that privileges are never assigned directly to a user. Rather, users are assigned to roles, permissions assigned to roles, and users ultimately acquire those permissions by being members of those roles. You can assign a user to multiple roles and a single role can contain multiple users. Similarly, you can assign the permissions themselves to multiple roles and multiple permissions to a given role.

By default, the OracleAS Portal enables you to assign privileges to both individual users and groups, the latter of which may be seen as either simple aggregations of users or as a role. With the group model, you assign a user to a group, while traditionally you might assign a role to a user. In the OracleAS Portal environment, the definition of a `role` is a group to which you assign privileges as opposed to a simple aggregation of users.

Therefore, to enforce a role-based access control style model within OracleAS Portal, ensure that you do not grant object ACLs or directory privileges directly to a user. Rather, only grant ACLs to groups/roles, while granting directory access by the assignment of the appropriate group/role .

Implementation Details

To implement a role-based security model:

1. Determine the appropriate User Functions and create an associated role.
2. Create a group using the Oracle Internet Directory Self-Service Console.
3. Assign Directory Privileges (on the **Assign Privileges** tab) as required by the role.

   If the Role is to have an administrator function over users, then it will also require Manage privilege for **All User Profiles** (set from the Portal Group Profile portlet).
4. Convert the group into a role within the console.

Select the **Enable Role assignment in the user management interface** option on the Enable Roles page of the **Identity Management Realm Configuration tab**.

5. Prevent the direct assignment of directory privileges to users by removing the appropriate section within the Oracle Delegated Administration Services Interface when it is called from the OracleAS Portal interface (through the **Create/Edit User Portlet**).
6. To do so, either clear the setting on the Global Settings page or execute the `wwsec_oid.set_preference_value` package within SQL*Plus.
7. To prevent the direct assignment of a portal object ACL to a individual user, similarly remove the option in the Access Definition screen by running the `secrlacl.sql` script within SQL*Plus.

See Also:

- Section 6.3.1.2 "Enforcing Role-Based Access Control," in the *Oracle Application Server Portal Configuration Guide*
- Section 6.1.6.9 "Oracle Delegated Administration Services Public Roles," in the *Oracle Application Server Portal Configuration Guide*

5.5.3 Base Development of Pages on a Network Aware Custom Page Type to Enable Implementation of Network Access Security

While the use of access control policies prevents users from directly viewing information to which they do not have clearance, it does not prevent that information from being compromised by those with the appropriate access, allowing it to be viewed in an inappropriate location, such as an Internet cafe. To decrease this risk, OracleAS Portal 10*g* (10.1.4) supports the concept of **network access** security, that is, the ability to define an appropriate network access path, by which it is valid to show the information, regardless of the ACL. This security is particularly useful in the intranet and extranet portal environment, where a user may view a secured page on the corporate network, but not externally, such as from home through the Internet.

To determine the network access requirements of a page, OracleAS Portal 10*g* Release 2 (10.1.4) does not include looks for specific attributes in that page (`isViewRestricted` and `isEditRestricted`). If these exist within the page, then OracleAS Portal secures the page accordingly when a user access it from an insecure location.

OracleAS Portal 10*g* Release 2 (10.1.4) does not include this metadata in the Standard Page Type, and may not secure the pages which were built previously using this type in this manner (though it is possible to globally turn off the ability to edit the page). Therefore, to allow OracleAS Portal to secure new pages, Oracle recommends you replace the default page type with one containing these attributes.

Implementation Details

To enable network access security:

1. Create two shared custom attributes specifically named `isViewRestricted` and `isEditRestricted`. Be careful with the case structure as the attribute names are case-sensitive.
2. Create a shared Custom Page Type to use as the default type when creating new portal pages. Base this page type on Standard Base Page type.
3. Add the custom attributes to the page type and define whether the page designer should have the ability to define whether to secure the page within the network.

If all pages will ultimately be limited to the Intranet then set the attribute values as follows

Default Value: `ON`

Required: `Unchecked`

To enable the page designer to define whether the page will be available through an unsecured network, select the required option to expose the attribute in the Page Builder user interface.

4. Configure the page group to expose the new page type within the Page Builder user interface.
5. Remove the Standard Page Type from the user interface and set the default page type to be the one created in the previous step.
6. Page designers should now choose the new network secured page type when building pages, as the default it is chosen automatically.
7. Once pages are built using the new page type, the pages will automatically be secured within the network when the server is configured for Extended Network Security.

See Also:

- Whitepaper *Expose your Intranet Portal to the Outside World in a Secured Manner* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/ias/portal/pdf/secured_inside_outside.pdf`
- Section 6.2.3, "Working with Page Types," in the *Oracle Application Server Portal User's Guide*

5.5.4 Group secured content to Optimize ACL Determination and "Network Access" Security.

While the implementation of item-level security allows for a very granular permissions model, it does dramatically increase the processing required to determine the users access rights on the page. By default, items inherit the security permissions of the containing page or tab. Enabling item-level security overrides this default setting, and those without specific privileges on the item itself will not see it.

To address this issue, Oracle recommends that you, where possible, group items with the same access rights onto the same page. For example, rather than placing items of interest for the HR department on several pages and using item level security to hide them, group them on a single page and use the appropriate page level security to hide or show the entire page.

In OracleAS Portal Release 10*g* Release 2 (10.1.2.0.2) the implementation of Network Access security works at the page level, and as such, it is not currently possible to secure an individual item on a page. By grouping items that should not be visible externally onto a single page, the Network Access security can hide them all in a single action.

Implementation Details

Design pages to group items into logical or functional security groups.

See Also:

- Section 18.9.1.1, "Understanding Item Level Security" in the *Oracle Application Server Portal User's Guide*
- Whitepaper *Expose your Intranet Portal to the Outside World in a Secured Manner* available from the Oracle Technology Network at http://www.oracle.com/technology/products/ias/portal/pdf/secured_inside_outside.pdf

5.5.5 Define Anonymous "Public" Pages and Authenticated "Public" Pages to Simplify Security

Frequently, you must allow portal pages to be seen by all users regardless of their specific access privileges. For example, all visitors to an Internet site should be able to see its Welcome page, while only authenticated visitors should be able to view the Welcome page of a company's internal site.

In both cases, the Welcome page may be considered public, because the users' specific permissions do not define their ability to view the page. Rather, the difference was whether the user was anonymous or a known identity.

In the anonymous case, access to the page is assumed for everyone, and therefore the standard ACL processing is bypassed. In the authenticated user case, all users must require at least View privilege, as the ACL determination is still performed. This is simplified by the fact that all users are dynamically made members of the `AUTHENTICATED_USERS` group when they log in. Therefore, any privilege you grant to this group also applies to any user that is authenticated to the portal.

Implementation Details

1. To enable non-authenticated users to view Public pages, set the **Display Page To Public Users** option on the **Access** tab.
2. To enable all authenticated users to view Public page, simply grant the View permission to the `AUTHENTICATED_USERS` group.
3. Implement Hash Message Authentication Code (HMAC) Encryption in Communication to Web Providers to allow for Secured Identity Propagation and J2EE based security.

5.5.6 Implement Hash Message Authentication (HMAC) Encryption in Communication to Web Providers to Allow for Secured Identity Propagation and J2EE-Based Security

Frequently, portlet developers base the security context of Web portlets on the identity of the user currently running within the portal (as opposed to a single generic account). While the portlet developer can use the PDK-Java APIs to allow the portlet to query the framework for the identity of the current user, there is an implicit trust of the information received by the portlet. That is, the portlet has to assume that the information passed within the packet headers is correct, and has not been altered during transmission (data substitution) or spoofed from a server other than the OracleAS Portal middle tier.

Traditionally the technique to ensure the integrity of the OracleAS Portal server, requesting the portlet, was to implement a Secure Socket Layer (SSL)-based connection, with an appropriate client certificate used to identify the portal server (the portlet provider itself would also need a certificate for the reverse trust relationship).

If the use of certificate based SSL is not viable, OracleAS Portal allows for message authentication through the use of a shared key, known only to the portlet provider and the OracleAS Portal middle tier. By the generation of a digital signature (passed with the SOAP message and based on the shared key, user information, timestamp and a Hash Message Authentication Code (HMAC) algorithm), the provider may authenticate the message by checking the signature against its own copy defined by the shared key. If the signatures match, the provider is assured that the message came from the correct source.

The provider may then enforce J2EE security by implementing the `RunAS` directive within the portlet.

Implementation Details

1. Register the shared key to the Web provider by defining a JNI variable within the `web.xml` file used by the Provider application. Alternatively, you can define the shared key within the deployment properties file:

   `<app_root>/WEB-INF/deployment/provider_name.properties`

2. The disadvantage of performing the latter is that it prevents the use of the Application Server Control Console to interpret or set the value.
3. Add the provider property `enhancedAuthentication=true` to the deployment properties file.
4. Register the provider within the OracleAS Portal. On the **General Properties** tab, enter the shared **secret** key in the appropriate field.
5. Set the **Login Frequency** to **Once per session**.

See Also:

- Section 6.1.7.9, "Message Authentication," in the *Oracle Application Server Portal Configuration Guide*
- Section 6.3.1.3, "Configuring Provider Message Authentication," in the *Oracle Application Server Portal Configuration Guide*

5.5.7 Implement Global Inactivity Timeout to Prevent Attacks through Unauthorized Sessions

While the use of well-defined security policies will prevent users from seeing content to which they are not entitled, one of the most common situations where security is compromised is when an authenticated user has left their portal session unattended. Given that the user has authenticated to a Single Sign-On environment, an opportunistic or malicious user who was able access the rightful user's browser (in their absence) would have access to all applications exposed by the portal. Furthermore, any transactions performed would be as the rightful user and could not be traced back to the miscreant.

A simple solution to such a situation is to invalidate the Single Sign-On session after a reasonable period of inactivity using the OracleAS Single Sign-On server's Global Inactivity Timeout functionality. Once activated, any request to a portal page (or any other partner application) after the specified period of inactivity, would result in a credential challenge. If the credential was the same as the currently defined portal session (as would be the case if the rightful user returned), then the user would be able to pick up where they left off within the portal. If not, then the current portal session is killed and a new session created to match the security policies of the new user.

Implementation Details

Configure the Global Inactivity Timeout within the OracleAS Single Sign-On Server. The implementation is due to its definition as a partner application.

> **See Also:** Section 2.11, "Configuring the Global User Inactivity Timeout," in the *Oracle Application Server Single Sign-On Administrator's Guide*

5.5.8 Utilize Separate Page Groups and a Segmented Security Realm Within Oracle Internet Directory to Support a Hosted Portal that is to Be Shared Across Independent User Communities

Frequently, a number of disparate user communities share a given portal implementation, each of which is to be independently administrated by one or more members of that community. While Oracle Internet Directory supports the separation of user communities into distinct security realms (with associated delegated administration) the use of separate realms prevents the implementation of a single Shared Portal . That is, objects in a given security realm may not be seen by those in another. Therefore, to enable components of a portal to be utilized by multiple communities, you must place them in the same realm.

Once you have defined the user communities, you can restrict the various pages of the portal to a given user community by standard ACL definitions at the page group level. All communities may view shared objects, and therefore templates, styles and common pages may be used by all communities, while content pages are limited to the community owning the data.

Implementation Details

The major configuration requirement lies within the Directory Information Tree (DIT) itself.

1. Create a named `community` container (for example `cn=CompanyA`) under the `cn=users` container in the default realm. Define the users of this community under the new container. Do *not* grant any Global Privileges to these users (either directly or through an associated role).
2. Create a named sub-tree for the community under the portal's group container to store community-specific groups. Create a private group under this tree to define membership in the associated community. As a private group, only members of the community will be able to see it, or its membership.
3. Create a named sub-tree for the community under the group container under the Oracle Context node. This tree will be used to define community level administrators who will have delegated administration privileges for their community.
4. Define ACIs within the directory tree to revoke access from all communities to the default (master) user and group containers and all containers following these, that is, the communities.
5. Define ACIs at the Community level in the `User` and `Groups` sub-tree to grant browse, read, write, and update access to the containers for members in the community only. For shared portal pages, add the appropriate policy for subsequent community groups.
6. Create shared objects within the Builder to be used by all communities.

7. Create a page group to support the community portal. Define an ACL on this page group to allow access to the community group defined. Doing so will allow only members of the community to view these pages.

See Also:

- Whitepaper *Expose your Intranet Portal to the Outside World in a Secured Manner* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/ias/portal/pdf/secured_inside_outside.pdf`
- Chapter 7, "Attribute Uniqueness in the Directory," in the *Oracle Internet Directory Administrator's Guide*
- Chapter 14, "Directory Access Control," in the *Oracle Internet Directory Administrator's Guide*
- Section 6.1.2.2, "OracleAS Portal Default, Seeded Groups," in the *Oracle Application Server Portal Configuration Guide*
- Section 6.1.3, "Resources Protected," in the *Oracle Application Server Portal Configuration Guide*
- Section 6.1.6.2.1, "Directory Entries in Oracle Internet Directory for OracleAS Portal," in the *Oracle Application Server Portal Configuration Guide*
- Whitepaper *The Implementation of a Departmental Level User Provisioning Model in OracleAS Portal 10g* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/ias/portal/pdf/admin_security_deptmental_level_delegated_admin.pdf`
- Chapter 4, "Working with Page Groups," in the *Oracle Application Server Portal User's Guide*
- Section 18.4, "Securing Page Groups," in the *Oracle Application Server Portal User's Guide*

5.6 Portlet Development

This section contains the following topics:

- Section 5.6.1, "Install the Portal Extension for Oracle JDeveloper to Improve Portlet Development"
- Section 5.6.2, "Apply WSRP Standard to Enable Interoperability Between a Standards-enabled Container and any WSRP Portal"
- Section 5.6.3, "Portlet Show Modes"
- Section 5.6.4, "Ensure Links in Portlet Are Correct to Avoid Sending the User Away from the Portal"
- Section 5.6.5, "Use Hybrid Portlets to Provide the Best Possible Rendition in the Desktop Environment"
- Section 5.6.6, "Create a Struts Portlet to Create and Publish Applications within Your Enterprise Portal"
- Section 5.6.7, "When Is It Best to Use the Web Clipping Portlet?"
- Section 5.6.8, "When Is It Best to use OmniPortlet?"

- Section 5.6.9, "When to Use Portlet Parameters?"
- Section 5.6.10, "When to Use Event Support?"
- Section 5.6.11, "Use the Oracle Application Server Portal Developer's Guide to Learn How to Build Portlets"

5.6.1 Install the Portal Extension for Oracle JDeveloper to Improve Portlet Development

The OracleAS Portal Developer Kit (PDK) provides you with the necessary libraries to install an extension for Oracle JDeveloper that dramatically increases your flexibility and productivity when developing portlets. This extension includes two wizards, one for building PDK-Java portlets and one for building JPS (Java Portlet Specification - JSR 168)-compliant portlets. Both wizards guide you through the steps of creating the portlet skeleton and all you need do then is implement your own business logic.

Implementation Details

To obtain the extension:

1. Visit `http://portalcenter.oracle.com`.
2. On the right, under **Software Downloads**, click **Portal Developer Kit**.
3. Under **Portal Extension for JDeveloper**, click **Portal Extension for Oracle JDeveloper** to download the extension.
4. Click **Portal Extension for Oracle JDeveloper Installation Guide** for installation instructions.

5.6.2 Apply WSRP Standard to Enable Interoperability Between a Standards-enabled Container and any WSRP Portal

The Web Services for Remote Portlets (WSRP) specification is a Web services standard that allows the plug-and-play of visual, user-facing Web services with portals or other intermediary Web applications. Being a standard, WSRP enables interoperability between a standards-enabled container based on a particular language (such as JSR 168, .NET, PERL) and any WSRP portal. Therefore, you can render a portlet (regardless of language) deployed to a WSRP-enabled container on any portal that supports this standard.

Java Portlet Specification (JPS) is based on JSR 168 and defines a set of APIs for building standards-based portlets using Java. You can deploy portlets built to this specification to a WSRP container for rendering portlets remotely.

See Also:

- `http://www.oasis-open.org/committees/download.php/2877/wsrp-specification-1.0-cs-1.0-rev2.pdf` for more information about WSRP
- `http://jcp.org/aboutJava/communityprocess/first/jsr168/index.html` for more information about JSR 168
- Section 6.3, "Configuring Your Application Server to Run JPS-Compliant Portlets," in the *Oracle Application Server Portal Developer's Guide*

5.6.3 Portlet Show Modes

Show mode exhibits the runtime portlet functionality seen by users. JPS offers some modes not offered by OracleAS Portal and vice versa. If you are coding portlets to JPS, you can declare custom portlet modes that map to the extra modes offered by OracleAS Portal.

An OracleAS Portal portlet may have the following Show modes, each with its own visualization and behavior. JPS portlets can define custom portlet modes in `portlet.xml`. Defining custom modes is especially useful if the portlet must interoperate with portal implementations from other vendors.

The list of modes is the following:

- Shared Screen Model (View Mode for JPS)
- Edit Mode (JPS and OracleAS Portal)
- Edit Defaults Mode (JPS and OracleAS Portal)
- Preview Mode (JPS and OracleAS Portal)
- Full Screen Mode (OracleAS Portal)
- Help Mode (JPS and OracleAS Portal)
- Link Mode (OracleAS Portal)

5.6.4 Ensure Links in Portlet Are Correct to Avoid Sending the User Away from the Portal

In some ways, navigation between different sections or pages of a single portlet is identical to navigation between standard Web pages. Users can submit forms and click links. In the case of typical, simple Web pages, both of these actions involve sending a message directly to the server responsible for rendering the new content, which is then returned to the client. In the case of portlets, which comprise only part of a page, the form submission or link rendered within the portlet does not directly target the portlet. It passes information to the portlet through the portal. If a link or form within a portlet does not refer back to the portal, then following that link takes the user away from the portal, which may not be the desired behavior.

The portlet developer does not need to know the detailed mechanics of how the parameters of a form or link get passed around between the user, portal, and portlet. Ensure the portlet developer does not write links in a portlet the same way as for typical, simple Web pages.

For PDK portlets, use the methods from the `UrlUtils` class (`oracle.portal.provider.v2.url.UrlUtils`) as it will render the HTML links appropriately.

5.6.5 Use Hybrid Portlets to Provide the Best Possible Rendition in the Desktop Environment

OracleAS Portal is capable of rendering its pages for both HTML and non-HTML (mobile) devices. When rendering for a mobile device, OracleAS Portal requires portlets to generate content in a universal markup language called OracleAS Wireless XML.

Many portlets, known as desktop portlets, generate only HTML responses and, as such, can only render themselves in standard Web browsers. Some portlets, known as mobile portlets, generate only OracleAS Wireless XML responses. These portlets can

render themselves on any device, including standard HTML browsers. Many portlets, though, take a hybrid approach that renders either HTML or OracleAS Wireless XML depending on the environment. These hybrid portlets can render themselves on any device, but they render best on standard HTML browsers. Although OracleAS Wireless XML is sufficient for HTML responses, it is not as expressive as HTML. Since portlets running in both a desktop and mobile environment are typically accessed through the desktop, developers commonly choose to create hybrid portlets that can provide the best possible rendition in the desktop environment.

5.6.6 Create a Struts Portlet to Create and Publish Applications within Your Enterprise Portal

The Oracle Application Server Portal Developer Kit (PDK-Java) contains numerous examples and documents regarding the usage of the OracleAS Portal APIs, such as personalization and caching. The integration of the application flow and business logic is not part of the portlet APIs. By using the Struts framework, however, you can leverage the Model-View-Controller (MVC) architecture to create and publish applications within your enterprise portal.

To create a Struts portlet, you must use the OracleAS Portal JSP tags, which are extensions of the default Struts JSP tags. This development process is similar to that of creating a standalone Struts application. Also, since the portlet and struts application must also be in the same Servlet Context, you must create a single Web application that contains both elements.

Implementation Details

> **See Also:** Section 7.3, "Building Struts Portlets with Oracle JDeveloper," in the *Oracle Application Server Portal Developer's Guide*to learn how to build a Struts portlet

5.6.7 When Is It Best to Use the Web Clipping Portlet?

In the event that you have to create a portlet that displays the content from a remote Web site as it is presented at the source location, the best tool to use is Web Clipping. Web Clipping can tolerate the changes of the source HTML page to some extent. If a clipped table moves from one place to another in the source page, the Web Clipping engine can find the table again using the internal "fuzzy match" algorithm. Portlets built with Web Clipping can also maintain sessions to the remote Web sites. Web Clipping also supports the end user personalization of HTML form values.

Web Clipping has URL rewriting support to achieve this functionality: it can process the links, originating from the source Web site, and modify (rewrite) them to achieve the desired functionality.

You can choose from the following three options:

- You can select not to rewrite the URLs within the portlet, in which case clicking the links takes the users out of Portal to the Web site providing the clipping. If the Web Clipping provider is registered with an External application, this may require that the user enter login information before navigating the Web site.
- If the Web Clipping provider is registered with an External Application and the clipping requires authentication, you can instruct Web Clipping to rewrite all URLs within the portlet to point to the Login Server. In this case, navigation will cause the user to leave OracleAS Portal, while also using the Login Server to log the browser into the External Application.

- You can select to rewrite all URLS within the portlet (inline rendering) to point back to the portal page so that all browsing within the Web Clipping portlet remains within OracleAS Portal. If the Web Clipping provider is registered with an External Application, this will cause the Web Clipping provider to log itself into the External Application. In this case, the navigation within Portal through the Web Clipping provider is authenticated in the External Application.

5.6.8 When Is It Best to use OmniPortlet?

Meant for page designers and portlet developers, the OracleAS Portal OmniPortlet is a declarative portlet-building tool that enables you to build portlets against a variety of data sources, including XML files, comma-delimited value files, such as spreadsheets, Web Services, databases, Web pages, and SAP data sources. OmniPortlet users can also choose a pre-built layout for the data. Pre-built layouts include tabular, news, bullet, form, or chart.

Like Web Clipping, OmniPortlet supports proxy authentication, including support for global proxy authentication and per-user authentication. You can specify whether all users will automatically log in using a user name and password you provide, each user will log in using an individual user name and password, or all users will log in using a specified user name and password.

5.6.9 When to Use Portlet Parameters?

There are three types of parameters in OracleAS Portal: page parameters, public portlet parameters, and private portlet parameters.

- Page parameters

  You can use a page parameter to pass a value to a page. Using page parameters, the information that displays on a page can vary depending on where the page is called from and who is viewing the page. Using page parameters, page designers can synchronize the portlets on a page by passing them the same values. This provides the ability to reuse and tailor portlets on pages by merely integrating them with page parameters. Without this functionality, you would have to code portlets individually to use different parameter values.

- Public portlet parameters

  You can use a public portlet parameter to pass a value to a portlet. Using portlet parameters, the information that displays in a portlet can be specific to a particular page or a user. Portlet parameters are created by the portlet developer and are exposed to the page designer through the user interface. After adding a portlet to a page, page designers can assign values to the public portlet parameters to make the information that displays in the portlet specific to the page.

  Page designers can assign values to public portlet parameters by providing a specific value (constant), a system variable, such as the portal user name, or a page parameter. At run time, the portlet receives the values from the sources specified. In this way, page designers have complete control over the source of the parameter, whereas you have complete control over how the data is used after it is transmitted to the portlet.

- Private portlet parameters

  You can use private portlet parameters to implement internal navigation in your portlet. You can pass parameters to your portlets every time the page is requested. The portlet instance can exclusively pass private portlet parameters to the same portlet instance.

Portlets supporting public portlet parameters enable page designers to tailor the portlets' data input for each portlet instance. In this case, the portlet developer can focus on the portlet logic, while page designers can easily reuse portlets and address the interaction between the page and the portlets.

OmniPortlet, Web Clipping, Java portlets, Portlet Builder, and PL/SQL portlets support public portlet parameters. OmniPortlet, Web Clipping, and Portlet Builder provide complete support through their wizard interface. You can add public portlet parameter support to your Java portlets programmatically or with the Java Portlet Wizard. PL/SQL portlets support public parameters only programmatically.

5.6.10 When to Use Event Support?

An event is a user action that you define to display a portal page. User actions include clicking a link or a button in a portlet. Page designers specify what to do when an event occurs in a portlet on a page. When an event occurs, page designers can either redisplay the current page or navigate the user to another portal page, optionally passing values to that page's parameters. Web Clipping, OmniPortlet, and Java portlets built with the PDK-Java support events Portlet Builder and PL/SQL portlets do not support events.

5.6.11 Use the *Oracle Application Server Portal Developer's Guide* to Learn How to Build Portlets

The *Oracle Application Server Portal Configuration Guide* describes how to build portlets for OracleAS Portal using a variety of tools and technologies. This manual includes information that helps understand the various technology choices, helps choose the technology that best meets requirements, and advise on how to use the appropriate tools to build and deploy portlets.

This manual is intended primarily for portal developers, but page designers may also find it useful. This manual guides through the process of first understanding and choosing a portlet technology, and then building portlets with that technology.

6

OracleAS Wireless

This chapter describes best practices for OracleAS Wireless. It includes the following topics:

- Section 6.1, "Deploy Multiple Tiers for High-Volume Environments to Avoid Capacity Issues"
- Section 6.2, "Establish Firewall Settings to Permit Protocols"
- Section 6.3, "Deploy Content Sources to a JVM Other Than OC4J_Portal or OC4J_Wireless to Avoid Stability Issues"
- Section 6.4, "Select a Voice Gateway Suited for Your Environment"
- Section 6.5, "Deploy Messaging Applications to Use a Gateway"
- Section 6.6, "Oracle Sensor Edge Server"

6.1 Deploy Multiple Tiers for High-Volume Environments to Avoid Capacity Issues

It is often necessary to deploy Wireless and Voice applications in a high-volume environment where the number of transactions may exceed the capacity of a single Oracle Application Server 10*g* middle-tier that is associated with an Oracle Application Server Infrastructure.

See Also:

- Chapter 14, "Load Balancing ," in the *Oracle Application Server Wireless Administrator's Guide* to determine if you need additional middle-tiers for your enterprise
- *Oracle Application Server Administrator's Guide* for more information about deploying multiple tiers

6.2 Establish Firewall Settings to Permit Protocols

A typical OracleAS Wireless request starts from a device to a WAP gateway. The gateway issues an HTTP request for the content to Oracle HTTP Server, which in turn issues an AJP request to the OC4J container. The Wireless application in the container then issues a corresponding HTTP request to a content source. Since these entities may be deployed on separate computers, it is necessary to ensure that the firewall settings in a DMZ permit these protocols to pass through.

6.3 Deploy Content Sources to a JVM Other Than OC4J_Portal or OC4J_Wireless to Avoid Stability Issues

Deploy content sources, that is, applications or pages that output XHTML or mobile XML, in a JVM other than `OC4J_Portal` or `OC4J_Wireless`. You may also consider dedicating a separate instance of the application server if your content source is implemented using Oracle Application Server.

6.4 Select a Voice Gateway Suited for Your Environment

Applications written in Oracle Application Server presentation independent XML can be delivered:

- To any telephone, either local or wireless
- By audio playback of information
- By a voice-enabled user interface

In the same way that SMS or WAP applications running on OracleAS Wireless can utilize gateways from multiple vendors, Oracle Application Server voice applications can also run on any Oracle-accepted VoiceXML gateway.

The voice gateways include:

- A VoiceXML interpreter
- Speech recognition (ASR) or text-to-speech (TTS or synthetic speech) software
- Telephony interface cards such as Dialogic, NMS, or AudioCodes

> **See Also:** **Integrated Partner Solutions** section of Oracle Technology Network at `http://www.oracle.com/technology/tech/wireless/integration/index.html` for a list of Oracle-accepted Voice Gateways

6.5 Deploy Messaging Applications to Use a Gateway

Messaging applications require a gateway. This gateway is most often a SMPP or UCP gateway for sending or receiving Short Message Service (SMS) messages. It is possible to configure the same short code to multiple Short Message Service Centers (SMSC). This configuration may be necessary if redundancy at the SMSC level is a requirement.

6.6 Oracle Sensor Edge Server

This section describes best practices for Oracle Sensor Edge Server. It contains the following topics:

- Section 6.6.1, "Copy edgeserver.xml to Clone Server Configurations"
- Section 6.6.2, "Analyze Requirements to Select Best Dispatcher"

6.6.1 Copy edgeserver.xml to Clone Server Configurations

The process of setting up the system configuration for an Oracle Sensor Edge Server instance can be time consuming. Because all the settings are saved in an XML file, the best way to clone the existing settings is to simply copy the `edgeserver.xml` file.

Implementation Details

Go to `$ORACLE_HOME/edge/config` directory for the application server instance and copy the `edgeserver.xml` file to the appropriate Oracle Sensor Edge Server instance.

6.6.2 Analyze Requirements to Select Best Dispatcher

Oracle Sensor Edge Server provides a big selection of different dispatchers, all with the purpose to deliver the collected events to the enterprise application layer. It is not always clear what dispatcher to use. By understanding the needs for your environment, you can pick the appropriate dispatcher.

Implementation Details

Table 6–1 shows the dispatcher type needed for major environment types.

Table 6–1 Dispatcher

Environment	Dispatcher
Testing or Simple	HTTP or Web Services
J2EE	JMS Dispatcher
Complex Dispatching	Event Flow
High Speed	Streams Dispatcher

7

OracleAS Web Cache

This chapter describes performance best practices for OracleAS Web Cache. It includes the following topics:

- Section 7.1, "Improve Performance, Scalability, and Availability"
- Section 7.2, "Planning and Deployment"
- Section 7.3, "Secure Content to Prevent Tampering"
- Section 7.4, "Configuring OracleAS Web Cache"
- Section 7.5, "Increasing Cache Hits"
- Section 7.6, "Invalidation and Expiration"
- Section 7.7, "Optimizing Response Times"

7.1 Improve Performance, Scalability, and Availability

OracleAS Web Cache improves the scalability, performance and availability of e-business Web sites. Using OracleAS Web Cache, your applications benefit from higher throughput, shorter response times and lower infrastructure costs.

- Unlike legacy cache servers that only handle static data, OracleAS Web Cache combines caching, compression and assembly technologies to accelerate the delivery of both static and dynamically generated Web content.
- OracleAS Web Cache provides support for partial-page caching with Edge-Side Includes (ESI), personalization, and dynamic content assembly at the network edge See Section 7.5.4, "Use Partial Page Caching Where Possible to Increase Cacheability" on page 7-9 for more information.
- OracleAS Web Cache includes clustering functionality that increases capacity for content storage and ensures scalability and availability for cacheable content, even when a member cache experiences a failure or is taken offline for maintenance. See Section 7.2.2, "Cluster Cache Instances to Make Availability, Scalability, and Performance Gains" on page 7-3 for more information.
- OracleAS Web Cache also provides back-end origin server load balancing, failover, and surge protection features that ensure consistent application performance and greater overall reliability. See Section 7.2.4, "Use OracleAS Web Cache Built-In Load Balancing to Improve Availability and Scalability of Origin Servers" on page 7-4 for more information.
- OracleAS Web Cache is designed to run with commodity hardware, reducing the cost. See Section 7.2.1, "Use Two CPUs and Consider Deploying on Dedicated

Hardware to Avoid Operating System Limitations" on page 7-2 for more information.

Using OracleAS Web Cache and its ESI features, your business application performance can improve by several orders of magnitude with very little development effort. The return on investment is also significant, both in terms of developer resources (you no longer need to build your own dynamic caching solution) and hardware cost savings.

7.2 Planning and Deployment

The following sections describe best practices related to planning for and deploying OracleAS Web Cache:

- Section 7.2.1, "Use Two CPUs and Consider Deploying on Dedicated Hardware to Avoid Operating System Limitations"
- Section 7.2.2, "Cluster Cache Instances to Make Availability, Scalability, and Performance Gains"
- Section 7.2.3, "Use a Hardware Load Balancer in Front of OracleAS Web Caches to Avoid a Single Point of Failure"
- Section 7.2.4, "Use OracleAS Web Cache Built-In Load Balancing to Improve Availability and Scalability of Origin Servers"
- Section 7.2.5, "Test Application Upgrades and Patches to Ensure Existing Cache and Session Rules Still Function Correctly"

7.2.1 Use Two CPUs and Consider Deploying on Dedicated Hardware to Avoid Operating System Limitations

You can deploy OracleAS Web Cache on the same node as the application Web server or on a separate node. When making your decision, consider system resources, such as the number of CPUs. OracleAS Web Cache is designed for a dual CPU. Because OracleAS Web Cache is an in-memory cache, it is rarely limited by CPU cycles. Additional CPUs do not increase performance significantly. The speed of the processors is critical; use the fastest CPUs you can afford.

If other resources are competing with OracleAS Web Cache for CPU usage, then you should take the requirements of those resources into account when determining the number of CPUs needed. You can derive a significant performance benefit from OracleAS Web Cache running on the same node as the application Web server, although a separate node for OracleAS Web Cache is often optimal.

For a Web site with more than one OracleAS Web Cache instance, consider installing each instance on a separate two-CPU node, either as part of a cache cluster or as standalone instances. When OracleAS Web Cache instances are on separate nodes, you are less likely to encounter operating system limitations, particularly in network throughput. For example, two caches on two separate two-CPU nodes are less likely to encounter operating system limitations than two caches on one four-CPU node.

Implementation Details

See Also: Chapter 7, "Optimizing OracleAS Web Cache," in the *Oracle Application Server Performance Guide*

7.2.2 Cluster Cache Instances to Make Availability, Scalability, and Performance Gains

To increase the availability, scalability, and performance of your Web site, you can configure multiple instances of OracleAS Web Cache to run as members of a cache cluster. A cache cluster is a loosely coupled collection of cooperating OracleAS Web Cache instances working together to provide a single logical cache.

Cache clusters provide failure detection and failover of caches, increasing the availability of your Web site. If a cache fails, other members of the cache cluster detect the failure and take over ownership of the cached content of the failed cluster member.

By distributing the Web site's content across multiple OracleAS Web Cache instances, you can cache more content and support more client connections, expanding the overall capacity of your Web site and improving its performance.

Implementation Details

See Also: Chapter 3, "Cache Clustering," in the *Oracle Application Server Web Cache Administrator's Guide*

7.2.3 Use a Hardware Load Balancer in Front of OracleAS Web Caches to Avoid a Single Point of Failure

Many customers deploy a single instance of OracleAS Web Cache in front of their application Web server farm. In such deployments, the OracleAS Web Cache acts as the virtual IP address for the application, in addition to providing caching and load balancing services. This deployment is both functionally sufficient and cost-effective for customers that do not require 100 percent application uptime. The OracleAS Web Cache is highly stable and, in the event of a failure, a process monitor will automatically restart the cache.

For customers who cannot tolerate a single point of failure, Oracle recommends that two or more nodes running OracleAS Web Cache be deployed behind a third-party hardware load balancing device. In turn, customers should use the built-in load balancing functionality in OracleAS Web Cache to distribute cache miss traffic over the application Web server farm, as described in Section 7.2.4, "Use OracleAS Web Cache Built-In Load Balancing to Improve Availability and Scalability of Origin Servers" on page 7-4.

If you need a low-cost solution to a hardware load balancer and do not require caching support, you can configure OracleAS Web Cache solely as a software load balancer. This configuration mode is useful for managing traffic to a low-volume, departmental, or test Web site.

Implementation Details

See Also:

- Chapter 5, "OracleAS Web Cache Topologies," in the *Oracle Application Server Web Cache Administrator's Guide* for more information about deploying hardware load balancers with OracleAS Web Cache
- Section "OracleAS Web Cache Solely as a Software Load Balancer or Reverse Proxy" in the *Oracle Application Server Web Cache Administrator's Guide* for more information about configuring OracleAS Web Cache as a load balancer

7.2.4 Use OracleAS Web Cache Built-In Load Balancing to Improve Availability and Scalability of Origin Servers

Situated between Web browser clients and the origin servers, OracleAS Web Cache includes built-in weighted load balancing and failover detection features to ensure that cache misses are directed to the most available, highest performing origin server in the application Web server farm. The cache supports both stateless and stateful load balancing mechanisms, including the use of cookies and URL parameters to maintain server affinity when required. You can configure OracleAS Web Cache to generate its own session-binding cookie, allowing you to use sessions without having to modify your applications.

In addition, OracleAS Web Cache maintains a pool of HTTP connections between the cache and the origin Web servers to reduce connection establishment overhead and improve cache miss performance.

To avoid a single point of failure, you can deploy two or more nodes running OracleAS Web Cache behind a third-party hardware load-balancing device. Oracle also recommends that customers use the built-in load balancing and failure detection functionality in OracleAS Web Cache to route cache miss requests to origin servers. Deploying additional load balancing hardware between the OracleAS Web Cache and origin server tiers is not recommended for the following reasons:

- Cost: Using another tier of load balancing hardware adds significant cost to a deployment, in part because these devices must also be deployed in pairs for high availability reasons.
- Complexity: Another tier of load balancing hardware is another set of systems to configure, manage, and troubleshoot.
- Features: OracleAS Web Cache includes performance assurance and surge protection features that enable customers to sustain higher loads with less application and database server hardware. These features depend on the capacity-based load balancing algorithms in OracleAS Web Cache.

See Also:

- Chapter 1, "Introduction to OracleAS Web Cache," in the *Oracle Application Server Web Cache Administrator's Guide* for more information on load balancing, performance assurance and surge protection functionality
- Whitepapers available from the Oracle Technology Network at `http://www.oracle.com/technology/products/ias/web_cache/index.html`

7.2.5 Test Application Upgrades and Patches to Ensure Existing Cache and Session Rules Still Function Correctly

Although there is a growing trend to specifying the caching rules dynamically with the `Surrogate-Control` response header, some sites continue to use OracleAS Web Cache Manager for configuring the rules statically. Typically, this configuration is done at the start of the deployment cycle. After adequate testing in a staging area to validate the rules, OracleAS Web Cache is deployed in a production environment. Problems may arise when the backend application is upgraded for patches or with new versions and some or all of the earlier statically configured rules become not applicable and void. For example, if a site uses a session-related caching rule and, after applying a patch, the name of the session cookie or session-embedded URL parameter changes,

all the pages related to that rule will no longer be cacheable, resulting in poor performance for the site.

When applying application upgrades and patches, it is important to understand the extent of the application changes and then verify and tune the related caching rules in OracleAS Web Cache. By periodically checking the cache-hit percentage and ensuring that it remains more or less constant, you can guard against unexpected behavior. Whenever there is a major change in the database or the mid-tier layer, such as for upgrades or application patches, you should validate caching rules much the same way as you did during the initial deployment cycle, including, but not limited, to using debug-level event logging. And if possible, include OracleAS Web Cache in your application regression test cycle.

7.3 Secure Content to Prevent Tampering

Depending on the application, you may or may not want requests for secure pages to go through the cache. Be cautious about caching secure content in OracleAS Web Cache. For secure content you do cache, ensure users cannot do URL tampering to see other user content. For this content, then route this traffic directly to the origin server. Because no traffic will be cached in this case, routing traffic to the origin server avoids extra encryption or decryption processing time by OracleAS Web Cache.

See Also:

- *Oracle HTTP Server Administrator's Guide*
- *Oracle Application Server Enterprise Deployment Guide*

7.4 Configuring OracleAS Web Cache

The following sections describe best practices related to configuring OracleAS Web Cache:

- Section 7.4.1, "Configure Enough Memory to Avoid Swapping Objects In and Out of the Cache"
- Section 7.4.2, "Allocate Sufficient Network Bandwidth to Accommodate the Throughput Load"
- Section 7.4.3, "Set a Reasonable Number of Network Connections to Maximize Performance"
- Section 7.4.4, "Create Custom Error Pages to Suit Your Environment"

7.4.1 Configure Enough Memory to Avoid Swapping Objects In and Out of the Cache

To avoid swapping objects in and out of the cache, it is crucial to configure enough memory for the cache. Generally, the amount of memory (maximum cache size) for OracleAS Web Cache should be set to at least 500 MB.

The amount of memory that OracleAS Web Cache uses to store an object depends on whether the object is larger or smaller than 2 KB:

Implementation Details

To determine the maximum amount of memory required, take the following steps:

1. Determine which objects you want to cache, how many are smaller than 2 KB and how many are larger than 2 KB. Determine the average size of the objects that are

larger than 2 KB. Determine the expected peak load—the maximum number of objects to be processed concurrently.

2. Calculate the amount of memory needed.

> **See Also:** Chapter 8, "Setup and Configuration," in the *Oracle Application Server Web Cache Administrator's Guide* provides a formula to use in calculating the amount of memory needed to cache your objects

7.4.2 Allocate Sufficient Network Bandwidth to Accommodate the Throughput Load

When you use OracleAS Web Cache, make sure that each node has sufficient network bandwidth to accommodate the throughput load. Otherwise, the network may be saturated even though OracleAS Web Cache has additional capacity. For example, if your application generates more than 100 megabits of data for each second, 10/100 Megabit Ethernet will likely be saturated.

If the network is saturated, consider using Gigabit Ethernet rather than 10/100 Megabit Ethernet. Gigabit Ethernet provides the most efficient deployment scenario to avoid network collisions, retransmissions, and bandwidth starvations.

Additionally, consider using two separate network interface cards (NIC): one for incoming client requests and one for requests from the cache to the application Web server.

If system monitoring tools reveal that the network is under utilized and throughput is less than expected, check whether or not the CPUs are saturated.

7.4.3 Set a Reasonable Number of Network Connections to Maximize Performance

It is important to specify a reasonable number for the maximum connection limit for the OracleAS Web Cache server. If you set a number that is too high, you can affect performance, resulting in slower response time. If you set a number that is too low, fewer requests will be satisfied. You must strike a balance between response time and the number of requests processed concurrently.

Implementation Details

> **See Also:** Chapter 8, "Setup and Configuration," in the *Oracle Application Server Web Cache Administrator's Guide* for information about setting the number of network connections

7.4.4 Create Custom Error Pages to Suit Your Environment

By default, OracleAS Web Cache ships with and is configured to serve the following error pages:

- `network_error.html`: This file is served when OracleAS Web Cache encounters network problems while connecting, sending, or receiving a response from an origin server for a cache miss request.
- `busy_error.html`: This file is served when origin server capacity has been reached.
- `esi_fragment_error.txt`. This file is served when OracleAS Web Cache is unable to fetch the `src` specified in an `<esi:include>` tag and the `alt` attribute, `onerror` attribute, or the `try |attempt |except` block are either not present or fail.

For a production environment, Oracle advises that you modify the defaults or create entirely new error pages to be consistent with other error pages generated by your site.

Implementation Details

> **See Also:** Chapter 8, "Setup and Configuration," in the *Oracle Application Server Web Cache Administrator's Guide* for information on creating or modifying default error pages

7.5 Increasing Cache Hits

The following sections provide tips in increasing the cache-hit rate:

- Section 7.5.1, "Use Cookies and URL Parameters to Increase Cache-hit Ratios"
- Section 7.5.2, "Use Redirection to Cache Entry Pages"
- Section 7.5.3, "Use Surrogate-Control Headers Instead of Caching Rules to Better Manage Cacheability"
- Section 7.5.4, "Use Partial Page Caching Where Possible to Increase Cacheability"
- Section 7.5.5, "Use ESI Variables to Improve Cache-hit Ratios for Personalized Pages"
- Section 7.5.6, "Use the <esi:environment> Tag to Authenticate or Authorize Callbacks"
- Section 7.5.7, "Use JESI to Cache JSP Output"

7.5.1 Use Cookies and URL Parameters to Increase Cache-hit Ratios

OracleAS Web Cache can cache different versions of an object with the same URL based on request cookies or headers. To use this feature, applications may need to implement some simple change, such as creating a cookie or header that differentiates the pages.

On the opposite side of the spectrum, some applications contain some insignificant URL parameters that lead to different URLs representing essentially the same content. If the objects are cached under their full URLs, then the cache-hit ratio becomes very low. You can configure OracleAS Web Cache to ignore the non-differentiating URL parameter values when composing the "cache key" for objects, so a single object will be cached for different URLs, greatly increasing cache-hit ratios.

Sometimes the content for a set of pages is nearly identical, but not exactly the same. For example, the pages may contain hyperlinks composed of the same URL parameters with different session-specific values, or they may include some personalized strings in the page text, such as welcome greetings and shopping cart totals. In this case, OracleAS Web Cache can still store one single copy of the object with placeholders for the embedded URL parameters or the personalized strings, and dynamically substitute the correct values into the placeholders when serving the object to clients.

You can also control whether a cached object is served to a client based on its session state.

Implementation Details

See Also: Chapter 2, "Caching Concepts," in the *Oracle Application Server Web Cache Administrator's Guide* for more information on multiple-version objects, sessions, ignoring URL parameter values, simple personalization, and how to control whether OracleAS Web Cache serves a cached object based on sessions

7.5.2 Use Redirection to Cache Entry Pages

For some popular site entry pages, such as "/", that typically require session establishment, session establishment effectively makes the page non-cacheable to all new users without a session.

To cache these pages while preserving session establishment, you can create a blank page that provides session establishment for all initial requests and redirects to the real popular page. This way, subsequent redirected requests to the popular page will carry the session, enabling the popular page to be served out of the cache.

Implementation Details

See Also: Chapter 12, "Creating Caching Rules," in the *Oracle Application Server Web Cache Administrator's Guide* for more information on configuring caching rules for pages requiring session establishment,

7.5.3 Use Surrogate-Control Headers Instead of Caching Rules to Better Manage Cacheability

There are two ways to specify the caching properties of an HTTP response using OracleAS Web Cache. You can use one or both of the following:

- Administrators can configure caching rules using the Application Server Control Console or OracleAS Web Cache Manager interface.
- Application developers can set caching policies through the `Surrogate-Control` response header. If a given property is set in both a response header and the configuration, the value set by `Surrogate-Control` overrides rules specified in the configuration.

Although caching rules support the setting of more properties than the `Surrogate-Control` header, it is generally more manageable to set properties in the `Surrogate-Control` header whenever possible. For example, if you need to set the expiration policy and the multiple-version property for an object, it is preferable to use the `Surrogate-Control` header.

If you define many different categories of cacheable and non-cacheable objects, you need to carefully define rule selectors and rule priorities so that the appropriate rule is used for any object. Because a `Surrogate-Control` response header is only associated with one response and overrides the configuration, the properties set in `Surrogate-Control` will not be mistakenly replaced by other configuration rules or newly created configuration rules. If you are creating new applications, consider building in `Surrogate-Control` response headers.

On the other hand, sometimes the configuration approach is more convenient. If a small number of rules are sufficient to describe all the caching properties of all objects that OracleAS Web Cache can receive from an origin server, then editing the

configuration using one of the administration interfaces may be simpler than generating `Surrogate-Control` headers for many objects.

Often, a combination of the two approaches is best.

Implementation Details

> **See Also:** Chapter 12, "Creating Caching Rules," in the *Oracle Application Server Web Cache Administrator's Guide* for more information about the `Surrogate-Control` response header

7.5.4 Use Partial Page Caching Where Possible to Increase Cacheability

Many Web pages, such as portal pages, are composed of fragments with unique caching properties. For these pages, full-page caching is not feasible. OracleAS Web Cache provides a partial page caching feature that enables each Web page to be divided into a template and multiple fragments that can, in turn, be further divided into templates and lower-level fragments.

Each fragment or template is stored and managed independently; a full page is assembled from the underlying fragments upon request. Different templates can share the same fragment, so that common fragments are not duplicated to waste cache space. Sharing can also greatly reduce the number of updates required when fragments expire. Depending on the application, updating a fragment is cheaper than updating a full page. In addition, each template or fragment may have its own unique caching policies, such as expiration, validation, and invalidation. You can cache each fragment in a full Web page as long as possible, even when some fragments are not cached or are cached for a much shorter period of time.

For example, a Portal page may include stock quotes that expire in 20 minutes, news that expires in three hours, and rotating ad banners that should not be cached. To serve consistent content, traditional full-page caches need to update the entire page at the highest change frequency of all its fragments. With partial page caching, you can update particular fragments rather than the entire page.

OracleAS Web Cache uses Edge Side Includes (ESI) to achieve flexible partial-page caching. ESI is a simple markup language for partial-page caching. Applications can mark up HTTP responses with two different kinds of tags, `<esi:inline>` and `<esi:include>`, that define the fragment/template structure in the response.

7.5.5 Use ESI Variables to Improve Cache-hit Ratios for Personalized Pages

Personalized information often appears in Web pages, making them unique for each user. For example, many Web pages contain tens or hundreds of hyperlinks embedding application session IDs.

OracleAS Web Cache allows application developers to use variables in an ESI template. Because OracleAS Web Cache can resolve variables to different pieces of request information or response information, you can significantly reduce the uniqueness of templates and fragments when personal information abounds.

There are two kinds of ESI variables: **request variables** and **response variables.** When an ESI template is assembled, a request variable is instantiated to a piece of request information such as a query string parameter, a cookie, or an HTTP header. For example, when a request for a dynamic page carries an application session ID in a query string parameter, this page may contain many hyperlinks with ESI request variables accessing this session ID, so that generated hyperlinks can carry the session ID into the next clicked page.

A response variable is similar to a request variable, except that its value comes not from the request, but from a special fragment called ESI environment. Response variable occurrences in the enclosing template can access an **ESI environment**, which is a type of fragment with a response that defines a set of variables. The tag itself does not contribute to the final assembled output. For example, a dynamic page with a calendar may need to present personal appointments that cannot be stored in Web browser cookies due to cookie size limits. The application can instead refer to a "profile" environment fragment in the template, in effect referring to all appointment in the environment without making separate requests for each appointment. In addition, you can merge multiple small fragments into one environment, so that each fragment can be referenced through response-variable instantiation. This operation reduces storage and retrieval overhead similarly.

7.5.6 Use the <esi:environment> Tag to Authenticate or Authorize Callbacks

Some applications protect certain Web pages with authentication, authorization, or session validation in the HTTP request. Even though you can cache page content, every HTTP request must be authenticated, authorized, or validated by the origin server. For these pages, it is not appropriate to cache the full page. While it is possible to utilize JavaScript to achieve authentication, authorization, and validation through a separate HTTP request, the `<esi:environment>` tag provides a better solution to this problem.

If a page has cacheable content but requires mandatory authentication, authorization, and session validation, you can enclose an `<esi:environment>` tag in the page referencing a non-cacheable environment, and cache the enclosing page. When the cached page is requested, an HTTP request that specifies the environment will always be sent to the origin server, making a callback to the application. In this callback request, if you want to validate a cookie in the enclosing page request for session validation, authorization, or authentication, specify the `<esi:environment>` tag to include that cookie in its request. You can also include other information from the page request in the environment request.

If authentication, authorization, and validation are passed, your application should return HTTP status code 200 and any ESI environment response. OracleAS Web Cache proceeds to finish assembling the page. If the authentication, authorization, or validation fail, your application should return an appropriate HTTP status code (at or more than 500 to denote a server error, or between 400 and 499 to denote a client request error). Then, OracleAS Web Cache will recognize that this environment has failed, and resort to standard ESI exception handling to terminate this page or output an alternative error page or login page.

Implementation Details

> **See Also:** Chapter 16, "Edge Side Includes (ESI) Language Tags," in the *Oracle Application Server Web Cache Administrator's Guide* for more information about using the `<esi:environment>` tag or implementing ESI exception handling

7.5.7 Use JESI to Cache JSP Output

In dynamic applications, you can use Edge Side Includes for Java (JESI) tags.

The JESI specification is a specification and custom JSP tag library that developers can use to automatically generate ESI code. JESI facilitates the programming of Java ServerPages (JSPs) using ESI. While developers can always use ESI tags directly within their JSP code, JESI represents an easy way to express the modularity of JSPs and the

caching of those modules, without requiring developers to learn a new programming syntax. JESI generates the appropriate ESI tags and headers in the JSP output that instruct ESI processors, such as OracleAS Web Cache, to cache (or not) templates and fragments for the appropriate duration. JESI also facilitates the partial execution of JSPs when an ESI processor requests fragments and templates.

7.6 Invalidation and Expiration

The following sections provide tips about invalidating and expiring cache objects:

- Section 7.6.1, "Select the Invalidation Method Best Suited for Your Content to Keep Performance in Check"
- Section 7.6.2, "Build Programmatic Invalidation Into Application Logic to Invalidate Dynamic Content"
- Section 7.6.3, "Combine Invalidation and Expiration Policies to Keep Cache Content Fresh"
- Section 7.6.4, "Use Invalidation Propagation in Clusters to Improve Data Consistency"

7.6.1 Select the Invalidation Method Best Suited for Your Content to Keep Performance in Check

Pick an invalidation type that works best for your content, keeping performance in mind:

- Use basic invalidation for one object based on an exact URL.

  A basic invalidation does not result in a cache traversal, making a basic invalidation highly performant.

- Advanced invalidation for multiple objects that share one or more of the following common elements:
  - Path prefix
  - Host name and port number
  - HTTP request method
  - URL expression
  - `POST` body expression
  - Search keys from the `Surrogate-Key` response-header field
  - Cookies
  - HTTP request headers
  - Embedded URL parameters

  When OracleAS Web Cache receives an advanced invalidation request, it traverses the contents of the cache to locate the objects to invalidate. Depending on the structure and number of objects cached, it can take time for OracleAS Web Cache to invalidate content.

  For the quickest advanced invalidation, specify a substring match instead of regular expression match.

- Inline invalidation to support either basic or advanced invalidation requests from the HTTP response, marked with the ESI `<esi:invalidate>` tag.

Inline invalidation reduces the connection overhead associated with sending out-of-band invalidations.

Implementation Details

To send a basic invalidation request:

- Use the step-by-step Invalidation wizard provided in Application Server Control Console. To get started:
  1. Navigate to the **Web Cache Home** page > **Administration** tab > **Operations** > **Invalidation**.
  2. In the first page of the Invalidation wizard, select **The single object that matches this URL**.
  3. Enter the complete URL patch and file name in the **Object to Invalidate** field.
- For a standalone OracleAS Web Cache installation, use the OracleAS Web Cache Manager.

  To get started, navigate to **Operations** > **Basic Content Invalidation.**
- Use the `BASICSELECTOR` element in a manual invalidation request

To send an advanced invalidation request:

- Use the step-by-step Invalidation wizard provided in Application Server Control Console. To get started:
  1. Navigate to the **Web Cache Home** page > **Administration** tab > **Operations** > **Invalidation**.
  2. In the first page of the Invalidation wizard, select **Specified Objects**.
- For a standalone OracleAS Web Cache installation, use the OracleAS Web Cache Manager.

  To get started, navigate to **Operations** > **Advanced Content Invalidation.**
- Use the `ADVANCEDSELECTOR` element in a manual invalidation request.

> **See Also:** Chapter 13, "Sending Invalidation Requests," in the *Oracle Application Server Web Cache Administrator's Guide* for further information about sending basic and advanced invalidation requests, as well as inline invalidations

7.6.2 Build Programmatic Invalidation Into Application Logic to Invalidate Dynamic Content

OracleAS Web Cache is designed for caching highly dynamic Web pages. There are several ways to safeguard the correctness of the cached content. For those cached pages with content that changes following unpredictable actions by Web site users, the most effective way to ensure correct content is to build programmatic invalidation into application logic.

The application Web server and database are two areas that may benefit from embedded programmatic invalidation. On the application Web server, you can build invalidation into CGIs, JSPs and Java servlets using the OracleAS Web Cache Java invalidation API, `jawc.jar`. For example, page A displays information about a certain bike in stock. This page is cacheable. Page B provides users a way to reserve one bike for purchase. On the mid-tier, there is a Java servlet or JSP to service page B. To make this servlet cache-aware, use `jawc.jar` to invalidate page A.

Similarly, you can build invalidation into PL/SQL applications using the OracleAS Web Cache PL/SQL invalidation API `wxvutil.sql` and `wxvappl.sql`. This way, developers can embed the invocation of invalidation PL/SQL procedure calls into the PL/SQL Web page.

To facilitate the caching of JSPs, developers can use the JESI custom tag library included with OC4J and Oracle JDeveloper. One of the tags,`<jesi:invalidate>`, enables programmatic invalidation when the JSP engine processes a page containing this tag.

Alternatively, developers can tie invalidation logic to database updates. In the same bike example, you can use a PL/SQL invalidation procedure call to invalidate pages that rely on inventory data stored in the database. In other words, you can apply a database trigger to the row or table containing information about the bike.

Implementation Details

See Also:

- Chapter 13, "Sending Invalidation Requests," in the *Oracle Application Server Web Cache Administrator's Guide*
- *Oracle Application Server Containers for J2EE JSP Tag Libraries and Utilities Reference*. for further information about JESI

7.6.3 Combine Invalidation and Expiration Policies to Keep Cache Content Fresh

With expiration, cached objects are marked as invalid after a certain amount of time in the cache. Expirations are useful if you can accurately predict when content will change on an origin server or database. To prevent objects from remaining in the cache indefinitely, Oracle recommends creating expiration policies for all cached objects.

With invalidation, OracleAS Web Cache marks objects as invalid. When objects are marked as invalid and a client requests them, they are removed and then refreshed with new content from the origin servers. You can choose to remove and refresh invalid objects immediately, or base the removal and refresh on the current load of the origin servers. You can automate invalidation policies, as described in Section 7.6.2, "Build Programmatic Invalidation Into Application Logic to Invalidate Dynamic Content" on page 7-12.

7.6.4 Use Invalidation Propagation in Clusters to Improve Data Consistency

In a cache cluster, you can send invalidation messages to one cache, and that cache propagates the invalidation messages to the other caches in the cluster or hierarchy.

The benefits of invalidation propagation include data consistency across cluster members and ease of use for the administrator.

Under the following circumstances, you may want to disable invalidation propagation and send the invalidation messages to each individual member of the cluster:

- When the cluster membership is in flux. For example, as you begin deployment, you may have made changes to cluster members but have not yet propagated the configuration changes to all members. In this case, the invalidation messages are not propagated to the members with different configurations.
- If you do not want to invalidate data for all cluster members. For example, because of time zone differences, you want to send invalidation messages to only some of the cluster members at one time.

If you do not invalidate data for all cluster members, the cached data may become inconsistent. In addition, cluster members may serve stale data, not only in response to requests from clients, but also in response to requests from their peers.

Implementation Details

> **See Also:** Chapter 13, "Sending Invalidation Requests," in the *Oracle Application Server Web Cache Administrator's Guide*

7.7 Optimizing Response Times

The following sections describe best practices in optimizing response times:

- Section 7.7.1, "Tuning Origin Server and OracleAS Web Cache Settings to Optimize Response Time"
- Section 7.7.2, "Use Compression to Improve Response Times and Reduce Network Bandwidth"
- Section 7.7.3, "Use Only Warning or Notification Logging Levels to Conserve Resources"

7.7.1 Tuning Origin Server and OracleAS Web Cache Settings to Optimize Response Time

If you have not configured the origin server or the cache correctly, response time may be slower than anticipated. If the origin server is responding more slowly than expected or if the origin server is not responding to requests from the cache because it has reached its capacity, check the origin server and the OracleAS Web Cache settings.

Implementation Details

Check the values of the network-related parameters in OracleAS Web Cache and the application Web server configuration file (`httpd.conf`).

> **See Also:** Section 7.6, "Tune Network-Related Parameters," in the *Oracle Application Server Performance Guide* contains information on how to set turning parameters in OracleAS Web Cache and the application server

If these resources are set reasonably, check the following:

- Caching rules. Make sure that you are caching the appropriate objects including popular objects.
- Priority rankings of the caching rules. Give the non-cacheable objects a higher priority than the cacheable objects.
- The number of rules. If you have a large number of rules, parsing of rules will take additional time.

If the settings for the origin server and OracleAS Web Cache are set correctly, but the response times are still higher than expected, check system resources, especially:

- Network bandwidth. See Section 7.4.2, "Allocate Sufficient Network Bandwidth to Accommodate the Throughput Load" on page 7-6.
- CPU usage. See Section 7.2.1, "Use Two CPUs and Consider Deploying on Dedicated Hardware to Avoid Operating System Limitations" on page 7-2.

- The TCP time-wait setting. This setting controls the amount of time that the operating system holds a port, not allowing new connections to use the same port. See Section 7.6, "Tune Network-Related Parameters," in the *Oracle Application Server Performance Guide*.

7.7.2 Use Compression to Improve Response Times and Reduce Network Bandwidth

OracleAS Web Cache features automatic compression of dynamically generated content. On average, using the standard GZIP algorithm, OracleAS Web Cache is able to compress text files, such as HTML and XML by a factor of four. Because compressed objects are smaller in size, they require less bandwidth to transmit and can be delivered faster to Web browsers. With compression, everyone benefits: Internet Service Providers (ISPs), Hosting Service Provider (HSPs), corporate networks and content providers reduce their transmission costs, while end-users enjoy more rapid response times. Since 1997, all major Web browsers support the expansion of GZIP encoded objects.

Most application Web servers on the market are capable of serving compressed pages, but few enable caching of compressed output. With OracleAS Web Cache, compression is a simple yes or no option that an administrator selects when specifying a caching rule. Because OracleAS Web Cache supports regular expression for caching rules, you can apply compression to responses using criteria other than just file extension. Regular expression makes it very easy to select which pages to compress and which pages not to compress, as well as whether or not a particular Web browser should receive compressed content. Unlike the typical application Web server, OracleAS Web Cache offers compression and caching for pages that have been dynamically generated and for ESI fragments specified in a `Surrogate-Control` response header. By caching compressed output, OracleAS Web Cache reduces the processing burden on the application Web server, which would otherwise have to re-generate and compress dynamic pages each time they are requested. Because compressed objects are smaller in size, they are delivered faster to Web browsers with fewer round-trips, reducing overall latency. In addition, compressed objects consume less cache memory.

Do not compress images, as well as executables and files that are already zipped with utilities like WinZip and GZIP. Compressing these files incurs additional overhead without the benefits of compression. Also, do not compress JavaScript includes (`.js`) and Cascading Style Sheets (`.css`), as some Web browsers have difficulty expanding these file types.

Implementation Details

> **See Also:** Chapter 12, "Creating Caching Rules," in the *Oracle Application Server Web Cache Administrator's Guide* for instructions about how to enable compression, as well as a complete listing of objects not compressed by OracleAS Web Cache

7.7.3 Use Only Warning or Notification Logging Levels to Conserve Resources

You can specify the level of detail for the event log. The trace or debug levels are useful for debugging purposes. Using either of these levels of event logging consumes system resources. For example, the log file might fill up disk space, causing OracleAS Web Cache to fail. Unless you need to diagnose problems, you should the Warning or Notification levels. With these levels, OracleAS Web Cache writes only typical events to the event log. Also, consider disabling access logging unless you are monitoring end-user performance and access.

Implementation Details

See Also: Chapter 15, "Using Diagnostics Tools," in the *Oracle Application Server Web Cache Administrator's Guide* for more information about logging

8

Oracle Business Intelligence

This chapter describes best practices for business intelligence. It includes the following topics:

- Section 8.1, "Oracle Application Server Reports Services"
- Section 8.2, "Oracle Business Intelligence Discoverer Best Practices"

8.1 Oracle Application Server Reports Services

This section describes best practices for Oracle Reports. It contains the following topics:

- Section 8.1.1, "Leverage High Availability to Replace Separate Clustering Solutions for Each Component"
- Section 8.1.2, "Design Your Paper Layout to Display Report Output in Microsoft Excel"
- Section 8.1.3, "Select Paper Layout to Control Pagination and Web Layout to Control HTML Output"
- Section 8.1.4, "Use Dynamic Environment Switching to Consolidate Reports Servers"

8.1.1 Leverage High Availability to Replace Separate Clustering Solutions for Each Component

A cluster is a virtual grouping of servers into a community for sharing the request-processing load efficiently across members of the cluster.

Because modern IT environments require high availability of the entire IT infrastructure, it is better to have a centralized high availability solution at the level of the application server, instead of a separate clustering solution for each component.

OracleAS High Availability Solutions provides the industry's most reliable, resilient, and fault-tolerant application server platform. Oracle Reports integration with OracleAS High Availability Solutions ensures that your enterprise-reporting environment is extremely reliable and fault-tolerant. With OracleAS High Availability Solutions providing a centralized clustering mechanism and several cutting-edge features, clustering in Oracle Reports is now deprecated. If you are using Reports Server clustering, switch to OracleAS High Availability Solutions in 10g Release 2 (10.1.2).

Implementation Details

To implement this best practice:

1. Become familiar with the overview of enterprise deployment in the *Oracle Application Server Enterprise Deployment Guide*.

   An enterprise deployment is one of the Oracle Application Server configurations described in this guide, designed to support large-scale, mission-critical business software applications. The hardware and software in an enterprise deployment configuration delivers several benefits, including high availability.

2. Become familiar with the overview of high availability and the Oracle Application Server High Availability Solutions framework.

   See Also: *Oracle Application Server High Availability Guide*

3. Set up high availability for the middle tier.

   See Also:

   - Chapter 3, "Middle-tier High Availability" in the *Oracle Application Server High Availability Guide*
   - Chapter 4, "Managing and Operating Middle-tier High Availability " in the *Oracle Application Server High Availability Guide*

4. Set up high availability for Oracle Reports, and other middle tier components.

   See Also: Chapter 5, "High Availability for Middle-tier Components," of the *Oracle Application Server High Availability Guide*

5. Follow the steps in the other chapters of *Oracle Application Server High Availability Guide* to set up a complete high availability environment.

6. Optionally, configure Oracle Reports Services Server Targets in Application Server Control Console.

   This step is mandatory if you plan to use Secure Socket Layer (SSL) to execute your reports.

   See Also: Chapter 8, "Installing and Configuring the myBIFCompany Application Infrastructure," in the *Oracle Application Server Enterprise Deployment Guide*

   This procedure completes the configuration for OracleAS High Availability Solutions. You are now ready to execute your reports. Table 8–1 lists the differences between running report requests using OracleAS High Availability Solutions, and running report requests using Reports Server clustering.

Table 8–1 Running Report Requests Using OracleAS High Availability Solutions

Method to Call Oracle Reports	Using Reports Server Clustering (Before 10g Release 2 (10.1.2)	Using OracleAS High Availability Solutions (In 10g Release 2 (10.1.2)
URL	In the URL, specify the hostname and port number of theOracle HTTP Server where the cluster is running. You can specify the cluster name in the URL using the command line parameter: `server=clustername`	In the URL, specify the hostname and port number of the load balancer. The load balancer subsequently redirects the request to one of the nodes where Reports Server is running. Therefore, do not specify the Reports Server name in the URL, so that the request is served by the in-process server.
`RUN_REPORT_OBJECT` (from OracleAS Forms Services)	Specify the cluster name as the value for the report object property `REPORTS_SERVER`.	Option 1: Start a Reports Server with the same name as the Reports Server cluster name. OracleAS Forms Services code remains same as 10*g* Release 1 (9.0.4). Option 2: Use the property `REPORTS_SERVERMAP` to map the cluster name to the Reports Server name, as described in Section 3.4.19, "Specifying the Network Configuration File," in the *Oracle Application Server Reports Services Publishing Reports to the Web* OracleAS Forms Services code remains the same as 10*g* Release 1 (9.0.4).
`WEB.SHOW_DOCUMENT` (from OracleAS Forms Services)	To get the job output with `getjobid`, specify the Reports Server cluster name in the URL using the command line option: `server=clustername`	To get the job output with `getjobid`, specify the Reports Server cluster name in the URL using the command line option: `server=clustername`

Table 8–2 compares Reports Server clustering with OracleAS High Availability Solutions.

Table 8–2 Feature Comparison of Reports Server Clustering and OracleAS High Availability Solutions

Using Reports Server Clustering (Before 10g Release 2 (10.1.2)	Using OracleAS High Availability Solutions (In 10g Release 2 (10.1.2)
Load balancing: The load for report requests is shared between multiple Reports Servers. Reports Server may either be on the same computer or on different computers.	**Load balancing:** The load for report requests is shared between multiple nodes of an OracleAS Cluster, each node having one Reports Server.
Failover: If one Reports Server fails, incoming jobs will be sent to other Reports Servers in the cluster. Thus, the failure of one Reports Server does not bring down the cluster. When any Reports Server fails, its current and scheduled jobs are not transferred to other Reports Servers, and these jobs are lost. **See Also:** Section 1.2.1, "Terminology," of the the *Oracle Application Server High Availability Guide*	**Failover:** If one node containing a Reports Server fails, incoming jobs will be sent to other nodes in the OracleAS Cluster, and the Reports Server running on that node will process the jobs. Thus, the failure of one node does not bring down the cluster. When any Reports Server fails, its current and scheduled jobs are not transferred to other Reports Server, and these jobs are lost.

Table 8–2 (Cont.) Feature Comparison of Reports Server Clustering and OracleAS High Availability Solutions

Using Reports Server Clustering (Before 10g Release 2 (10.1.2)	Using OracleAS High Availability Solutions (In 10g Release 2 (10.1.2)
Component-based clustering: Reports Server clustering provides benefits for OracleAS Reports Services only. For ensuring the high availability of other components of OracleAS, you need set up and maintain separate mechanisms.	**High availability for OracleAS:** One mechanism provides high availability to the entire application server, eliminating the need to set up and maintain a unique high availability mechanism for each application server component.
Mechanism for detecting duplicate jobs: When the cluster is identifying where an upcoming scheduled or immediate request should be processed, it considers whether any Reports Server in the cluster has information in cache that matches the request. As a result, if the job has been processed in the past by any Reports Server in the cluster, the duplicate job request will be sent to the same Reports Server. This mechanism maximizes the usage of the Reports Server cache.	**Mechanism for detecting duplicate jobs:** The load balancer does not consider whether any Reports Server has information in cache that matches the request. If you want to maximize the usage of Reports cache with the load balancer, you will have to do manual configuration on the load balancer that makes sure that requests with the same URL are always sent to the same node. **See Also:** Load balancer documentation for the manual configuration steps
Consolidated view of the job queue: When you use Reports Server clustering, it is possible to view `rwservlet` Web commands like `showjobs` for the entire cluster. When you do this, you get a single window to all the past, current, and scheduled jobs on the cluster. As a result, you can send a `killjobid` request to the cluster, and it will route the request to the same Reports Server that processed the request.	**Consolidated view of the job queue:** You do not get a single window to the job queue by default. Instead, every Reports Server will show only its own job queue. To get a consolidated view of the jobs submitted to all the nodes, you can perform the following steps: 1. Configure the job status repository for each Reports Server using the `jobStatusRepository` element in the Reports Server configuration file. Make sure that the `jobStatusRepository` element is configured to use the same repository in all Reports Servers. This element stores the job information for all Reports Servers in a common table in the database. **See Also:** Section 3.2.1.12, "jobStatusRepository," in the *Oracle Application Server Reports Services Publishing Reports to the Web* 2. Write a custom application that can query this table and show you a consolidated list of jobs processed by all Reports Servers. Note that operations like `killjobid` will still work, since you will specify the option `server=`*`server_name`* in the URL. As a result, `rwservlet` will send the request to the specified Reports Server.

See Also:

- Section "Deprecated Functionality" in whitepaper *A Guide to Changed Functionality between Oracle Reports 6i and 10g* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/reports/10gr2/Reports_guide_to_changed_functionality.pdf`
- Section 1.5.4, "Choosing a High Availability Environment," in *Oracle Application Server Reports Services Publishing Reports to the Web* for further information about the `<environment>` section of the server configuration file

8.1.2 Design Your Paper Layout to Display Report Output in Microsoft Excel

Oracle Reports 10*g* Release 2 (10.1.2) introduces a new output format `DESFORMAT=SPREADSHEET`, which enables you to generate output from paper layout reports to HTML files, which you can directly open with Microsoft Excel 2000. Using this output format, it is very easy to generate the output of your paper reports to files, which you can open with Microsoft Excel. There are certain inherent differences between `SPREADSHEET` output and paginated output formats, such as PDF. Due to this reason, you may need special considerations in designing your report especially for output to Excel, or if you want your paginated and your output in Excel to look exactly alike. This section covers these special considerations.

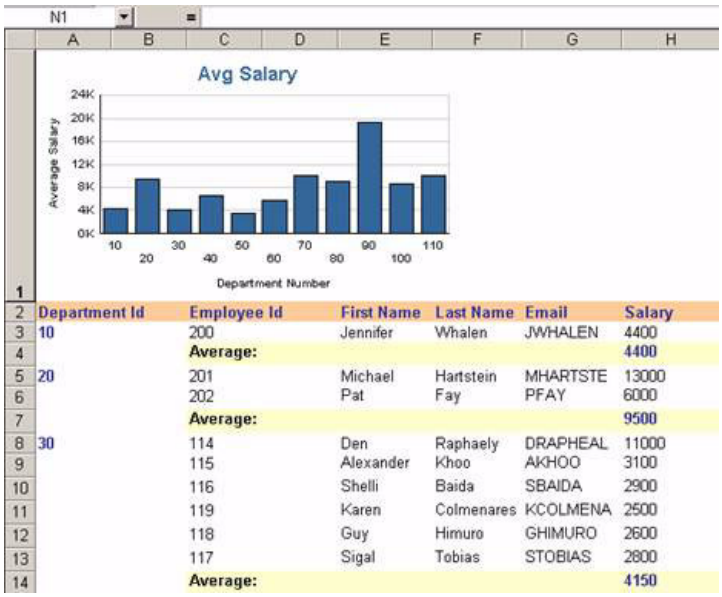
Implementation Details

Suppose you create a simple report, such as a group-left employees report, in Reports Builder using the Report Wizard, and add a bar graph using the Graph Wizard. If you generate the output in PDF format, you will see the company logo, the report title, background colors, and so on. If you generate the output of the same report in spreadsheet output format and view the output in Excel, you will notice a few differences between the Excel and PDF outputs, as seen in Figure 8–1 and Figure 8–2.

Figure 8–1 PDF Output of a Simple Report Created Using the Report Wizard

Department Id	Employee Id	First Name	Last Name	Email	Salary
10	200	Jennifer	Whalen	JWHALEN	4400
	Average:				4400
20	201	Michael	Hartstein	MHARTSTE	13000
	202	Pat	Fay	PFAY	6000
	Average:				9500
30	114	Den	Raphaely	DRAPHEAL	11000
	115	Alexander	Khoo	AKHOO	3100
	116	Shelli	Baida	SBAIDA	2900
	119	Karen	Colmenares	KCOLMENA	2500
	118	Guy	Himuro	GHIMURO	2600
	117	Sigal	Tobias	STOBIAS	2800
	Average:				4150

Figure 8–2 Spreadsheet Output in Excel of a Simple Report Created Using the Report Wizard



Department Id	Employee Id	First Name	Last Name	Email	Salary
10	200	Jennifer	Whalen	JWHALEN	4400
	Average:				4400
20	201	Michael	Hartstein	MHARTSTE	13000
	202	Pat	Fay	PFAY	6000
	Average:				9500
30	114	Den	Raphaely	DRAPHEAL	11000
	115	Alexander	Khoo	AKHOO	3100
	116	Shelli	Baida	SBAIDA	2900
	119	Karen	Colmenares	KCOLMENA	2500
	118	Guy	Himuro	GHIMURO	2600
	117	Sigal	Tobias	STOBIAS	2800
	Average:				4150

Table 8–3 describes the differences between the PDF and Excel outputs.

Table 8–3 PDF and Excel Output Differences

Difference	Explanation	Guideline
The company logo is missing. The report title is missing.	The Report Wizard creates the company logo and the report title in the page margin area. Since spreadsheet-based applications like Microsoft Excel do not have a page or page margin concept, the objects created in the report margin area are ignored in spreadsheet output.	Do not define any objects in the page margin.
There are no page breaks.	There are no page breaks in Excel. Any formatting that you do in Reports Builder to honor the exact page boundaries will be lost in the output to Excel.	Avoid any formatting that is dependent on honoring of page dimensions or page breaks.
The background colors and font colors do not exactly match those in PDF output.	The color palette available in Microsoft Excel does not match the color palette of Reports Builder. In fact, the current versions of Microsoft Excel (2003 or earlier) are limited to the 40 colors that you see in the color palette, and any color outside of this palette is mapped to one of these 40 colors. As a result, if you use a color that is not exactly represented in the Excel color palette, Excel will do a closest match to replace it with one of the colors available in its color palette. In some cases, this close match may be not as close as you would like it to be, and may bring in an unwanted change in the look-and-feel of the report.	Use colors that are available in Microsoft Excel's color palette. Alternatively, you can manually match the color palettes used in Reports Builder and in Microsoft Excel. To do this, you need to define the colors available in Microsoft Excel's color palette inside Reports Builder, and then stick to only those colors in your report. **See Also:** Reports Builder Online Help for more information on the color palette. This help is also available on Oracle Technology Network at `http://www.oracle.com/technology/products/reports/index.html`

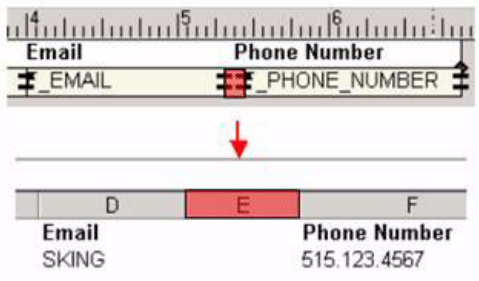
Additional Guidelines

Keep the following additional guidelines in mind for ensuring proper output in Microsoft Excel:

- Do not leave any space between two adjacent objects.

  Any space, including a few pixels, between two adjacent objects will result in an empty cell or column in Excel output. Figure 8–3 shows this result.

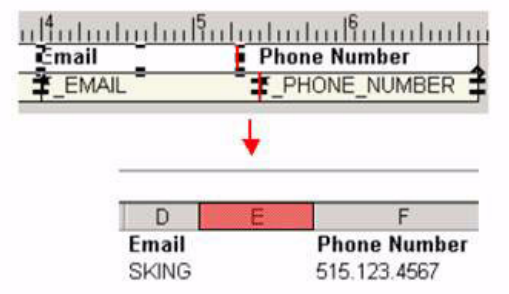
Figure 8–3 Empty Cells in Excel Output Due to Space Between Adjacent Cells



- Make sure that the widths of all objects are vertically consistent.

  If the objects are not exactly aligned vertically, that is, have inconsistent widths, it is likely to result in insertion of unwanted cells/columns in Excel. Figure 8–4 shows this result.

Figure 8–4 Empty Cells in Excel Output Due to Failure to Align Cells Vertically



- Make sure that the vertical elasticity of the frames and repeating frames is not fixed unless you are sure you have allocated enough space to accommodate all the records.

  If you set the Vertical Elasticity property of a frame to `Fixed`, the output in Excel will show only as many records as could appear on the first page of the paper output. Since Excel does not have a page concept, it is not able to overflow the remaining rows to the next page.

- For reliable formatting of spreadsheet output, enclose the whole layout area in a frame.

  This action prevents the possibility of parallel objects displaying in different vertical positions, one following the other.

Restrictions

Keep the following restrictions when using spreadsheet output:

- The following paper layout objects are not supported in spreadsheet output: graphic arc, polygon, rectangle, rounded rectangle, stretchable line, underlined text, and OLE external object. (OLE objects are only applicable to reports developed prior to Oracle9*i* Reports).

  Space for these drawn objects is reserved, but there is no visible representation in the output. This limitation does not apply to horizontal lines.

- Graphs embedded in spreadsheet output are static image files, and are not interactive.

  Thus, the Graph Hyperlink property is not supported in spreadsheet output.

- If you rotate a boilerplate object in the paper layout, the object will appear horizontal in the spreadsheet output.

- Images included in the paper layout of the report will appear in the spreadsheet output on the browser, for example, using `DESTYPE=CACHE` or `getjobid`, only if the Reports Server is running in non-secure mode.

  In the case of a secure Reports Server, images will not appear in the spreadsheet output on the browser. Generating images in the output involves multiple calls from the browser to the Reports Server (one call for each image). Once the user is

authenticated, Oracle Reports passes the user's identity between the browser and the secure Reports Server using cookies. Excel does not support cookies. As a result, the call to the secure Reports Server seems like a call from a non-authenticated user. Thus, the Reports Server refuses to pass on the images. Images will appear correctly in the spreadsheet output if you generate the output to any other destination, such as file, FTP, OracleAS Portal, or WebDAV.

- XML-based bursting and distribution is not yet supported for `SPREADSHEET` output format.

See Also:

- "About spreadsheet output" in the Reports Builder Online Help for a complete list of features supported in spreadsheet output. This help is also available on Oracle Technology Network at `http://www.oracle.com/technology/products/reports/index.html`
- Section D.1.9, "Displaying Report Output in Microsoft Excel," in the *Oracle Application Server Reports Services Publishing Reports to the Web*

8.1.3 Select Paper Layout to Control Pagination and Web Layout to Control HTML Output

In order to be able to serve the requirements of Oracle Reports customers that use J2EE architecture for their enterprise applications, Oracle Reports introduced Web layout in addition to the paper layout. The Web layout is completely code-based as opposed to the paper layout, which is based on graphical frames, repeating frames, boilerplate objects and so on. When Oracle Reports users need to deploy their reports on the Web, they have two options:

- Design the reports in paper layout and access the report in HTML/HTMLCSS format
- Design the Web layout and access the JSP

The paper layout offers you minute control over pagination. In case you would like to generate HTML output, it also provides several properties that you can use to affect the HTML code in the output. In spite of all its capabilities, this format does not offer you full control over the look-and-feel of the HTML output. For example, if you want to alter the width and other attributes of the table that shows your data, it can only be done within the constraints of the graphical capabilities of the report layout designer, and you may not be able to make full use of the HTML or CSS capabilities. The paper layout is quite useful in situations when you do not want to hand-code your HTML report, and you would like to present exactly the same report in HTML as in paginated formats like PDF.

Because Web layout is code-based, it offers minute control over the HTML that appears in the output. You can design your reports to look exactly like the rest of the pages in your application. Using Java code inside the JSP report is more direct and easier than in the paper layout because you have to use PL/SQL logic to call the Java business logic. Once you have designed the report, you can package the JSP with the rest of the application and deploy it on a J2EE application server. The Web layout is useful when you plan to have a J2EE-based Web application and have expertise in writing Java and HTML code. You can use Web application wizards, such as Oracle Reports Wizard or Oracle Graph Wizard to generate JSP code for you. You will not experience the full potential of a JSP report unless you have a JSP-based Web application team.

8.1.4 Use Dynamic Environment Switching to Consolidate Reports Servers

Oracle Reports contains a feature called dynamic environment switching. Previously, the Oracle Reports server could only serve reports that were compatible with the operating environment in place when the Oracle Reports server was started. For example, the reports had to be compatible with the value of the `NLS_LANG` parameter at the time the Oracle Reports server was started. This restriction meant that you needed to have one Oracle Reports server running for each processing language. The new environment switching feature available in Oracle Reports eliminates this restriction by enabling one instance of Oracle Reports server to serve reports with any number of environment settings, including language.

Implementation Details

To use this feature, add as many `<environment>` tags in the Oracle Reports server configuration file as needed. Each of these tags can have values such as the `NLS_LANG` setting, a currency symbol, or a calendar. When processing a job, use the `EnvID` parameter in the command line to specify which `<environment>` setting you want to use. The Oracle Reports server reads the relevant environment settings from the configuration file, and if an engine is not already running with these settings, a new engine is started. The new engine, started with appropriate environment settings, will be used to process the job.

> **See Also:** *Oracle Application Server Reports Services Publishing Reports to the Web* for further information about the `<environment>` section of the server configuration file

8.2 Oracle Business Intelligence Discoverer Best Practices

This section describes best practices for OracleBI Discoverer. It contains the following sections:

- Section 8.2.1, "Identify Worksheets That Need Tuning to Improve Performance"
- Section 8.2.2, "Establish Scalability to Share the Workload"

8.2.1 Identify Worksheets That Need Tuning to Improve Performance

The performance of an OracleBI Discoverer system refers to the time OracleBI Discoverer takes to complete a specific operation. The operation that most users are concerned with is the running of a worksheet - the execution of a query and display of the data. OracleBI Discoverer worksheet performance is largely determined by how well the database has been designed and tuned for queries.

> **See Also:** The following documents in the Oracle Database documentation library:
>
> - *Oracle Database Data Warehousing Guide*
> - *Oracle Database Performance Tuning Guide*
> - *Oracle OLAP Applicaton Developer's Guide*

You can achieve additional performance benefits when reporting on relational data by designing your Business Areas and Worksheets with performance in mind. You can use the Discoverer EUL Status workbooks to identify worksheets that may need additional tuning.

See Also:

- *Oracle Business Intelligence Discoverer Configuration Guide*
- *Oracle Business Intelligence Discoverer Administration Guide* from the Business Intelligence Tools product CD for further information about migrating EUL data

8.2.2 Establish Scalability to Share the Workload

The scalability of an OracleBI Discoverer installation refers to the ability of OracleBI Discoverer to handle increasing numbers of users or queries without compromising performance. To take advantage of the inherently scalable architecture of OracleBI Discoverer, install it on multiple computers and share the workload between the computers as the number of users increase.

See Also:

- *Oracle Business Intelligence Discoverer Configuration Guide*, especially Chapters 5, 7, 8, and 12 regarding optimizing performance and scalability of OracleBI Discoverer
- *Capacity Planning Sizing Guide* and *Capacity Planning Sizing Calculator* available from the Oracle Technology Network at `http://www.oracle.com/technology/products/discoverer/index.html`

9

Platform Security and Identity Management

This chapter describes security and management best practices for Oracle Application Server. It includes the following topics:

- Section 9.1, "General Best Practices"
- Section 9.2, "Oracle Application Server Java Authentication and Authorization Service (JAAS) Provider Best Practices"
- Section 9.3, "J2EE Security Best Practices"
- Section 9.4, "OracleAS Single Sign-On Best Practices"
- Section 9.5, "Oracle Internet Directory Deployment Best Practices"

9.1 General Best Practices

This section describes general best practices for security and management. It includes the following topics:

- Section 9.1.1, "HTTPS Best Practices"
- Section 9.1.2, "Assign Lowest-Level Privileges Adequate for the Task to Contain Security Leaks"
- Section 9.1.3, "Cookie Security Best Practices"
- Section 9.1.4, "Systems Setup Best Practices"
- Section 9.1.5, "Certificates Use Best Practices"
- Section 9.1.6, "Review Code and Content Against Already Known Attacks to Minimize the Attack Recurrence"
- Section 9.1.7, "Firewall Best Practices"
- Section 9.1.8, "Leverage Declarative Security"
- Section 9.1.9, "Use Switched Connections in DMZ"
- Section 9.1.10, "Place Application Server in the DMZ to Prevent Security Issues"
- Section 9.1.11, "Use Secure Sockets Layer Encryption to Secure LDAP and HTTP Traffic"
- Section 9.1.12, "Tune the SSLSessionCacheTimeout Directive to Meet Your Application Needs"
- Section 9.1.13, "Plan Out The Final Topology Before Installing Oracle Application Server Security Components"

9.1.1 HTTPS Best Practices

The following are recommended for using HTTPS with Oracle Application Server:

- **Configure Oracle Application Server to fail attempts that use weak encryption.** You can configure Oracle Application Server to use only specific encryption ciphers for HTTPS connections. Connections from all old Web browsers that have not upgraded the client-side Secure Sockets Layer (SSL) library to 128-bit can be rejected. This functionality 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.** Huge performance overhead of HTTPS forces a trade-off in some situations. Use of HTTPS to HTTP appliances can change throughput from 20 to 30 transactions for each second on a 500 MHz Unix to 6000 transactions for each second for a relatively low cost, making this trade-off decision easier. This solution is better than math and crypto cards, which can be added to UNIX, Windows NT, and Linux computers.
- **Ensure that sequential HTTPS transfers are requested through the same Web server.** Expect 40/50 milliseconds CPU time for initiating SSL sessions on a 500 MHz computer. Most of this CPU time is spent in the key exchange logic, where the bulk encryption key is exchanged. Caching the bulk encryption key will significantly reduce CPU overhead on subsequent access, provided that the access is routed to the same Web server.
- Keep secure pages and pages not requiring security on separate servers. While it may be easier to place all pages for an application on one HTTPS server, the resulting performance cost is very high. Reserve your HTTPS server for pages that require SSL. Put pages that do not require SSL on an HTTP server.

  If secure pages are composed of many GIF, JPEG, or other files that would be displayed on the same screen, it is probably not worth the effort to segregate secure from non-secure 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

9.1.2 Assign Lowest-Level Privileges Adequate for the Task to Contain Security Leaks

When assigning privileges to modules, use the lowest levels adequate to perform the modules functions. This assignment is essentially fault containment, that is, if security is compromised, it is contained within a small area of the network and cannot invade the entire intranet.

9.1.3 Cookie Security Best Practices

Use the following as guidelines for cookies:

- **Make sure that cookies have proper expiration dates.** Permanent cookies should have relatively short expiration dates of about three months or less. This configuration will avoid cluttering client Web browsers, which may cause errors if the Web browser cannot transmit all the valid cookies. Set non-permanent cookies to expire when the relevant application exits.
- **Make sure that information in cookies contains Method Authentication.** Use authentication to ensure that cookie data has not been changed since the application set the data. This authentication helps ensure that the cookie cannot be

modified and deceive the application. Also, this helps prevent application failures if the cookie is inadvertently corrupted.

- **Make sure that the size and varieties of cookies are kept low.** There is a finite number and aggregate size of cookies that Web browsers support. If this is exceeded, then the Web browsers will not send all the relevant cookies leading to application failures. Also, very large cookies can result in performance degradation.
- **Carefully use cookie domain name facilities.** Use of cookie domains should ensure that the domain is the smallest possible. Making the domain `oracle.com`, for instance, would mean that any host in `oracle.com` would get the cookie. With hundreds of applications on different parts of `oracle.com`, a domain of `oracle.com` for each of them results in attempts to send hundreds of cookies for each HTTP input operation.

9.1.4 Systems Setup Best Practices

Use the following as guidelines for system setup:

- **Apply all relevant security patches.** Check MetaLink (`http://metalink.oracle.com`) and OTN (`http://www.oracle.com/technology/index.html`) for current security alerts. Many of these patches address publicly announced security issues.
- When deploying software, change all default passwords and close accounts used for samples and examples.
- **Remove unused services from all hosts.** Examples of unused services are FTP, SNMP, NFS, BOOTP, and NEWS. HTTP or WebDAV may be good alternatives.
- **Limit the number of people with root and administrative privileges.**
- **In UNIX, disable the "r" commands if you do not need them.** For example, `rhost` and `rcp`.

9.1.5 Certificates Use Best Practices

Use the following guidelines when using certificates:

- **Ensure that certificate organization unit plus issuer fields uniquely identify the organization across the Internet.** One way to accomplish this would be to include the Dun and Bradstreet or IRS identification as identification for the issuer and the organizational unit within the certificate.
- **Ensure that certificate issuer plus distinguished name uniquely identify the user.** If the combination of issuer and distinguished name is used as identification, there is no duplication risk.
- **Include expiring certificates in tests of applications using certificates.** Expiration is an important consideration for a number of reasons. Unlike most username/password-based systems, certificates expire automatically. With longer duration certificates, fewer re-issues are required, but revocation lists become larger.

  In systems where certificates replace traditional usernames/passwords, expiring certificate situations may result in unexpected bugs. Careful consideration of the effects of expiration is required and new policies will have to be developed because most application and infrastructure developers have not worked in systems where authorization might change during transactions.

- **Use certificate re-issues to update certificate information.** Because certificates expire, infrastructure for updating expired certificates will be required. Take advantage of the re-issue to update organizational unit or other fields. In cases of mergers, acquisitions, or status changes of individual certificate holders, consider re-issuing even when the certificate has not yet expired. But pay attention to key management. If the certificate for a particular person is updated before it expires, for example, put the old certificate on the revocation list.
- **Audit certificate revocations.** Revocation audit trails can help you reconstruct the past when necessary. An important example is replay of a transaction to ensure the same results on the replay as during the original processing. If the certificate of a transaction participant was revoked between the original and the replay, failures may occur. These errors may not have occurred when the original transaction was processed. For these cases, view the audit trail to simulated authentication at the time when the transaction was initially processed.

9.1.6 Review Code and Content Against Already Known Attacks to Minimize the Attack Recurrence

It is quite common for viruses or known attacks to resurface in slightly altered shape or form. Thus, just because a threat has been apparently eliminated does not mean it will not resurface. Use the following as guidelines to minimize the recurrence of the threat:

- **Ensure that programs are reviewed against double encoding attacks.** There area many cases where special characters, such as <, >, | are encoded to prevent cross-site scripting attacks or for other reasons. For example, `<` might be substituted for >. In a double encoding, the attacker might encode the `&` so that later decoding might involve the inadvertent processing of a >, <, or | character as part of a script. Prevention of this attack, unfortunately, can only be provided by careful program review. You can use some utilities to filter escape characters that might result in double-encoding problems in later processing.
- **Ensure that programs are reviewed against buffer overflow for received data.**
- **Ensure that programs are reviewed against cross-site scripting attacks.** This attack typically tricks HTML and XML processing through input from Web browsers (or processes that act like Web browsers) to invoke scripting engines inappropriately. However, it is not limited to the Web technologies, and you should evaluate all code for this.

9.1.7 Firewall Best Practices

The following are some common recommended practices pertaining to firewalls; while not unique to Oracle Application Server, these are important to overall Oracle Application Server security:

- Place servers providing Internet services behind an exterior firewall of the stateful inspection type. Stateful inspection means that the firewall keeps track of various sessions by protocol and ensures that illegal protocol transitions are disallowed through the firewall. This configuration blocks the types of intrusion that exploit illegal protocol transitions.
- Set exterior firewall rules to allow Internet-initiated traffic only through specific IP and PORT addresses where SMTP, POP3, IMAP, or HTTP services are running. Some protocols, such as IIOP, leave ports open without receiving processes. Port and IP combinations that are not assigned to running programs should not be permitted.

- Set interior firewall rules to allow messages through to the intranet only if they originate from servers residing on the perimeter network. All incoming messages must first be processed in the perimeter network.
- Send outgoing messages through proxies on the perimeter network.
- Do not store the information of record on bastion hosts. Bastion hosts are fortified servers on the perimeter network. Segment information and processing such that the bastion hosts provide initial protocol server processing and generally do not contain information of a sensitive nature. The database of record and all sensitive processing should reside on the intranet.
- Disallow all traffic types unless specifically allowed. allow only the traffic required by Oracle Application Server for better security. For example, HTTP, AJP, OCI, LDAP.

9.1.8 Leverage Declarative Security

Oracle HTTP Server has several features that provide security to an application without requiring the application to be modified. Leverage or evaluate these features before programming similar functionality as those features into the application. Specifically:

- Authentication: Oracle HTTP Server can authenticate users and pass the authenticated user-id to an application in a standard manner. It also supports single sign-on, thus reusing existing login mechanisms.
- Authorization: Oracle HTTP Server 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: Oracle HTTP Server can provide transparent SSL communication to end customers without any code change on the application.

Leverage these three features before designing any application-specific security mechanisms.

9.1.9 Use Switched Connections in DMZ

Oracle recommends that all DMZ attached devices be connected by switched, not bussed connections. Furthermore, devices such as the Cisco 11000 series devices, which can provide IP, port, and protocol rules between each pair of connected devices are preferred.

9.1.10 Place Application Server in the DMZ to Prevent Security Issues

Application servers should exist in the DMZ. In this architecture OracleAS Web Cache only forwards requests to computers containing Web servers. Web servers only forward requests to application servers or through PL/SQL to database servers. The application servers only forward inward requests to the database or, perhaps, special message processing processors in the intranet. This configuration provides excellent fault containment because a compromised Web server must somehow compromise an application server before the database can be attacked.

9.1.11 Use Secure Sockets Layer Encryption to Secure LDAP and HTTP Traffic

You can use Secure Sockets Layer (SSL) encryption to secure both LDAP and HTTP traffic that passes between the various components of the Oracle Application Server. To ensure that all LDAP queries being sent to Oracle Internet Directory are

SSL-encrypted, you need to configure your Oracle Internet Directory instance to run with a configuration set that supports only SSL-encrypted LDAP connections. The default mode installed with Oracle Application Server allows a given Oracle Internet Directory instance to be configured to listen on both SSL and non-SSL ports.

SSL encryption is unrelated to the installation or use of HTTPS, which allows users to access Oracle Application Server components over HTTP while using SSL to encrypt Web client packets.

> **See Also:** *Oracle Internet Directory Administrator's Guide* for more details on configuring Oracle Internet Directory instances with SSL

9.1.12 Tune the SSLSessionCacheTimeout Directive to Meet Your Application Needs

The Apache server in Oracle Application Server caches a client 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 five connections was approximately 11.4 seconds without SSL session caching as opposed to approximately 1.9 seconds when session caching was enabled.

The default `SSLSessionCacheTimeout` is 300 seconds. Note that the duration of a SSL session is unrelated to the use of HTTP persistent connections. You can change the `SSLSessionCacheTimeout` directive in `httpd.conf` file to meet your application needs.

9.1.13 Plan Out The Final Topology Before Installing Oracle Application Server Security Components

Consult the *Oracle Application Server Enterprise Deployment Guide* and the *Oracle Identity Management Concepts and Deployment Planning Guide* documents when planning out the final target topology. Identify the steps in installing and configuring the various Oracle Application Server components consistent with the options of the Oracle Universal Installer, rather than approaching the desired topology on an adhoc basis.

9.2 Oracle Application Server Java Authentication and Authorization Service (JAAS) Provider Best Practices

Oracle Application Server provides an implementation of OracleAS JAAS Provider for J2EE applications that is fully integrated with J2EE declarative security. This implementation allows J2EE applications to take advantage of the JAAS constructs, such as principal-based security and pluggable login modules. Optionally, the OracleAS JAAS Provider implementation allows J2EE applications running on OC4J to leverage the central security services of Oracle Identity Management.

9.3 J2EE Security Best Practices

This section describes J2EE security best practices. It includes the following topics:

- Section 9.3.1, "Avoid Writing Custom User Managers and Instead Use Included APIs to Focus Time on Business Logic"
- Section 9.3.2, "Use the Authentication Mechanism with the JAAS Provider to Leverage Benefits"
- Section 9.3.3, "Use Fine-Grained Access Control"

- Section 9.3.4, "Use Oracle Internet Directory as the Central Repository to Provide LDAP Standard Features"
- Section 9.3.5, "Develop Appropriate Logout Functionality to Prevent Users from Closing the Web Browsers"

9.3.1 Avoid Writing Custom User Managers and Instead Use Included APIs to Focus Time on Business Logic

The OC4J container continues to provide several methods and levels of extending security providers. You can extend the `UserManager` class to build a custom user manager that enables you to leverage the functionality provided by the OracleAS JAAS Provider. Both OracleAS Single Sign-On and Oracle Internet Directory provide APIs to integrate with external authentication servers and directories respectively, thus allowing developers more time to focus on actual business logic instead of infrastructure code.

9.3.2 Use the Authentication Mechanism with the JAAS Provider to Leverage Benefits

OC4J allows different authentication options for J2EE applications. Oracle recommends leveraging the OracleAS Single Sign-On server whenever possible for the following reasons:

- It is the default mechanism for most Oracle Application Server components such as OracleAS Portal, OracleAS Forms Services, OracleAS Reports Services, and OracleAS Wireless.
- It is easy to setup in a declarative fashion and does not require any custom programming.
- It provides a seamless way for PKI integration.

For environments where OracleAS Single Sign-On is not available, and custom authentication is required, one should use JAAS-compliant `LoginModules` to extend OC4J authentication. When using `LoginModules`, it is important to only use application relevant principals (roles) associated with the authenticated subject to preserve least privilege.

9.3.3 Use Fine-Grained Access Control

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.

For example, you can write a servlet with `Subject.doAs` or `Subject.doPrivileged` to control code that executes sensitive operations.

9.3.4 Use Oracle Internet Directory as the Central Repository to Provide LDAP Standard Features

Although the OracleAS JAAS Provider supports a flat-file XML-based repository useful for development and testing environments, configure it 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 of the database properties of scalability, reliability, manageability, and performance. To optimize performance, adjust the caching configurations appropriate for your environment.

9.3.5 Develop Appropriate Logout Functionality to Prevent Users from Closing the Web Browsers

Simple J2EE applications using HTTP Basic authentication do not support the concept of logout, relying instead on the user to close the Web browser. When using other forms of authentication, including OracleAS Single Sign-On, it is important to plan out various logout and timeout flows. OC4J has an adjustable HTTP session inactivity parameter that is set to 20 minutes by default. If J2EE applications are leveraging OracleAS Single Sign-On and want to support full logout functionality, write them with the appropriate logout dynamic directives.

> **See Also:** *Oracle Application Server Single Sign-On Administrator's Guide*.

9.4 OracleAS Single Sign-On Best Practices

This section describes Oracle Application Server Single Sign-On (OracleAS Single Sign-On) best practices. It features the following topics:

- Section 9.4.1, "Configure for High Availability to Prevent Inaccessible Applications"
- Section 9.4.2, "Leverage OracleAS Single Sign-On to Optimize Administration and Customer Experience"
- Section 9.4.3, "Use an Enterprise-Wide Directory to Eliminate User Data in Multiple Systems"
- Section 9.4.4, "Use OracleAS Single Sign-On to Validate User Credentials"
- Section 9.4.5, "Always Use SSL with Oracle Application Server to Protect Applications"
- Section 9.4.6, "Provide Username and Password Only on Login Screen to Prevent Users from Providing Credentials to Inappropriate Servers"
- Section 9.4.7, "Log Out to Prevent Active Cookies"

9.4.1 Configure for High Availability to Prevent Inaccessible Applications

Single sign-on failure is catastrophic, since it means no single sign-on protected application can be accessed. Two recommendations for high availability of OracleAS Single Sign-On are:

- Carefully consider inclusion of any other types of processing on the single sign-on servers since this can make instability more likely.
- Consider deploying multiple single sign-on servers fronted by load balancing hardware to protect against failures in single sign-on listeners. In this case, the address of the load balancer is used as the single sign-on address and the single sign-on listener configuration information is replicated. Oracle also recommends that the database be a RAC configured for additional improvements in availability.

> **See Also:** Whitepaper *Expose your Intranet Portal to the Outside World in a Secured Manner* available from the Oracle Technology Network at `http://www.oracle.com/technology/index.html` for configuring multiple single sign-on servers

9.4.2 Leverage OracleAS Single Sign-On to Optimize Administration and Customer Experience

Use OracleAS Single Sign-On as the primary point of security. This component provides benefits from an administrative point of view and is a major convenience to application customers. Also, OracleAS Single Sign-On is well integrated with the rest of Oracle Application Server Infrastructure and can, with Oracle Internet Directory and other means, be integrated with non-Oracle application and infrastructure. Also, as single sign-on becomes a single point for authentication, opportunities to attack the multiple authentication entities of sites today are reduced.

OracleAS Single Sign-On single authenticated user for all applications allows better control for more uniform authorization.

9.4.3 Use an Enterprise-Wide Directory to Eliminate User Data in Multiple Systems

In order to deploy an effective single sign-on solution, the user population must be centralized in a directory, preferably an LDAP-based directory, such as Oracle Internet Directory. Having users represented in multiple systems, such as in multiple Microsoft Windows NT domains, makes setting up the infrastructure for a common identity more difficult. In addition, clearly defining and automating the user provisioning process makes managing the single sign-on environment much easier.

9.4.4 Use OracleAS Single Sign-On to Validate User Credentials

OracleAS Single Sign-On provides the infrastructure to validate credentials and allows for various different authentication mechanisms, such as username, password, and X.509 certificates. Moreover, since these mechanisms can be shared across different applications and Web sites, end users do not have to create a new username, password for each different corporate application.

9.4.5 Always Use SSL with Oracle Application Server to Protect Applications

The OracleAS Single Sign-On server simplifies user interaction by providing a mechanism to have a single username and password, which can be used by multiple partner applications. With this ease of use, comes the caution that the single sign-on server should always be accessed in the correct fashion. A breach of the common password can now put all partner applications at risk. Therefore, always configure the single sign-on server to allow connections in SSL mode only. This configuration protects the end user's credentials going across the wire. Applications where security and data confidentiality are important should also be protected by SSL. From a performance perspective, use of SSL hardware accelerators is recommended.

9.4.6 Provide Username and Password Only on Login Screen to Prevent Users from Providing Credentials to Inappropriate Servers

The OracleAS Single Sign-On server provides a standard login screen. This login page is serviced from the single sign-on server, which typically is installed on a different computer from the one the end user is trying to access. Thus, it is critical that before the end user enters their login and password, that a valid single sign-on screen is observed. This screen prevents users from unknowingly providing their username or password to inappropriate servers.

9.4.7 Log Out to Prevent Active Cookies

Most users do not log out of Internet applications and this issue creates problems at two levels:

1. A security risk. Another person accessing the work station can now reuse the cookie. Also, since the session remains valid until it times out, a hacker from another computer has a longer time window to guess the session ID or cookie value.
2. The system resources on the server associated with the cookie are not released until the session is ended or invalidated.

For application developers and administrators, configure single sign-on session duration and inactivity timeouts appropriately. For example, configure one-hour inactivity timeouts for sensitive applications.

For external applications, OracleAS Single Sign-On is unable cannot logout users. Therefore, closing all Web browser windows is important.

9.5 Oracle Internet Directory Deployment Best Practices

This section describes Oracle Internet Directory deployment best practices. It includes the following topics:

- Section 9.5.1, "Use bulkload.sh Utility to Bootstrap System"
- Section 9.5.2, "Replicate to Provide High Availability"
- Section 9.5.3, "Use SSL Binding to Secure Traffic"
- Section 9.5.4, "Use Backup and Restore Utilities to Secure Data"
- Section 9.5.5, "Monitor and Audit Oracle Internet Directory to Improve Availability"
- Section 9.5.6, "Assign Oracle Internet Directory Privileges to Limit Access"
- Section 9.5.7, "Change Access Control Policies to Control User Administration"
- Section 9.5.8, "Best Practice for Directory Integration Platform"
- Section 9.5.9, "Incorporate Group Assignment During User Creation to Avoid Multiple Steps"
- Section 9.5.10, "Use opmnctl instead of oidmon and oidctl to Manage Processes"
- Section 9.5.11, "Configure Active Directory Synchronization"
- Section 9.5.12, "Use User Attributes and Password Hints to Make Resetting Credentials Easier"

Additionally, Oracle also recommends the following documentation for deployment of Oracle Internet Directory:

- *Oracle Internet Directory Administrator's Guide*
- *Oracle Application Server Administrator's Guide*
- *Oracle Identity Management Concepts and Deployment Planning Guide*
- *Oracle Process Manager and Notification Server Administrator's Guide*
- *Oracle Application Server Single Sign-On Administrator's Guide*

9.5.1 Use bulkload.sh Utility to Bootstrap System

The `bulkload.sh` utility checks standard LDIF formatted files for schema violations and duplicates, and generates SQL*Loader intermediate files for fast loading into the database tables underlying Oracle Internet Directory. Use the `bulkload.sh` utility whenever there is an initial bootstrap required. For example, when setting up synchronization with Microsoft Active Directory or other LDAP directory servers.

Oracle recommends passing the LDIF file output from third-party LDAP directories into `bulkload.sh -check` mode, which will alert you to any problems with your existing LDAP schema.

Most third-party LDAP directories (including Oracle Internet Directory) support output to LDIF without any operational attributes (which typically cannot be loaded into another vendor's directory). If you are loading data into Oracle Internet Directory from another directory, which does not support this, you will have to manually remove any operational attributes prior to sending the LDIF file to `bulkload.sh -generate` mode.

If your input LDIF file is from another Oracle Internet Directory instance, then you must use the `-restore` option to `bulkload.sh` to preserve these operational attributes as is during the bulkload.

> **See Also:** Chapter 4, "Oracle Internet Directory Data Management Tools," in the *Oracle Identity Management User Reference*

9.5.2 Replicate to Provide High Availability

Oracle Internet Directory supports both multimaster and fan-out styles of directory replication.

For high availability, consider placing an Oracle Internet Directory multimaster replication group behind a network load balancer to provide a single IP address to your LDAP client applications. If a replicated node becomes unavailable, you can configure the load balancer to re-route requests automatically to an available server.

Additionally, each Oracle Internet Directory node can run on Oracle Application Server RAC, further improving availability through increased database uptime and data availability.

> **See Also:** Chapter 3, "Oracle Internet Directory Management Planning," in the *Oracle Identity Management Concepts and Deployment Planning Guide* for more details about configuring Oracle Internet Directory for high availability

9.5.3 Use SSL Binding to Secure Traffic

SSL is considered the Internet standard protocol for highly secure transportation of data. In addition to the strong PKI authentication using digital certificates, SSL also provides multiple data integrity and data encryption layers to protect your communication channels. SSL provides multiple cipher suites with varieties of encryption algorithms for many security levels.

Oracle Internet Directory supports three SSL authentication modes:

1. Confidentiality mode (no-authentication mode)

   In this mode, SSL cipher suites use the Diffie-Hellman algorithm to generate a session key for client or server at run time. The session key will be used to encrypt

the communication channel. No server or user SSL wallet is necessary. In this mode, the channel will be encrypted using a Diffie-Hellman key.

2. Server Authentication only mode

   This mode essentially uses certificates for authentication. The client needs to verify the server certificate. This mode is most commonly used in the Internet environment since any client that needs to communicate with aa SSL server does not require a certificate. A client can use their user and password identification to authenticate itself to the server. The username and password are protected by SSL encryption when being transferred on the wire.

3. Server and Client Authentication mode (Mutual authentication)

   In this mode, both client and server use RSA certificates to authenticate each other. First, the client authenticates the server by validating its certificate. In return, the server also requires the client to send its certificate to prove its authenticity.

In addition to choosing an authentication mode, you should choose appropriate security algorithms.

> **See Also:** Chapter 13, "Secure Sockets Layer (SSL) and the Directory," in the *Oracle Internet Directory Administrator's Guide*

9.5.4 Use Backup and Restore Utilities to Secure Data

Depending on your Oracle Application Server enterprise topology, you may want to consider backing up Oracle Internet Directory as part of backing up your entire application server environment.

> **See Also:**
>
> - Chapter 11, "Backup and Restoration of a Directory," in the *Oracle Application Server Administrator's Guide* before deciding on an overall backup and recovery strategy for all of your Oracle Identity Management Infrastructure component
> - Chapter 19, "Introduction to Backup and Recovery," in the *Oracle Application Server Administrator's Guide* for general application server backup and recovery strategies

9.5.5 Monitor and Audit Oracle Internet Directory to Improve Availability

You can monitor and audit Oracle Internet Directory in one of three ways:

1. The Oracle Enterprise Manager LDAP page provides a very simple way to monitor the LDAP service and determine if it is up and running under its associated load.
2. You can also check the log files of various LDAP processes to ensure there are no errors showing up.
3. LDAP audit log service provides more granular information such as security violation information or sensitive events. You can further customize the audit log to specific directory operations and events.

Oracle recommends that you perform, at the very least, a weekly review of the audit and error logs. System administrators can do a more regular review with Enterprise Manager to provide better availability.

9.5.6 Assign Oracle Internet Directory Privileges to Limit Access

While it is possible to install Oracle Application Server as an Oracle Internet Directory super user, Oracle recommends that this not be done, as it imparts more privileges than required.

To install Oracle Application Server, a user needs to be a member and owner of the Oracle Application Server administrator's group.

When installing Oracle Application Server, the directory administrator should add the installation user as a member and owner of the administrator's group. The administrator should then remove the member as the owner once the installation has completed.

9.5.7 Change Access Control Policies to Control User Administration

Oracle Internet Directory administrators should change the default access control policies to better control user administration as required.

Oracle Internet Directory administrators should adjust the default access control and password policies using Oracle Directory Manager, in accordance with specific administrative policies for directory access and passwords. This adjustment includes both value and state parameters.

> **See Also:** Chapter 12, "Directory Security Concepts " in the *Oracle Internet Directory Administrator's Guide*

9.5.8 Best Practice for Directory Integration Platform

This section includes the following topics:

- Section 9.5.8.1, "Use Identity Management Realms to Build Connectivity Between Oracle Internet Directory and Third-Party Directories"
- Section 9.5.8.2, "Configure Synchronization Service to Enable Users to Interact with Deployed Applications"
- Section 9.5.8.3, "Synchronize Oracle Human Resources and Oracle Internet Directory to Provide Access to OracleAS Single Sign-On and Oracle Delegated Administration Services"

9.5.8.1 Use Identity Management Realms to Build Connectivity Between Oracle Internet Directory and Third-Party Directories

Use Oracle Directory Integration and Provisioning to build connectivity between Oracle Internet Directory and third-party directories. This feature provides seamless integration with other Oracle products. It enables the Oracle products to work in the presence of third-party directories in the enterprise and also provides sharing with the same identities in other directories.

You can join or unify the different identities for the same enterprise user from multiple LDAP directories into a single global identity in Oracle Internet Directory using Oracle Directory Integration and Provisioning. Oracle Directory Integration and Provisioning facilitates a true single sign-on environment in an enterprise using Oracle Internet Directory and Oracle Application Server Single Sign-On.

Oracle Internet Directory supports representation of multiple applications and multiple realms or administration Contexts in the Oracle Internet Directory. You can provision various enterprise applications for a single or multiple realms. There are automated tools to create new realms and to provision applications for various realms.

These tools setup the various levels of access required by the application to manage the realm.

Synchronize user definitions from third-party identity management systems with the Oracle Directory Integration and Provisioning into the appropriate realms to create an enterprise view of all relevant user namespaces and their defined services.

> **See Also:** *Oracle Identity Management Integration Guide*

9.5.8.2 Configure Synchronization Service to Enable Users to Interact with Deployed Applications

When configuring Oracle Directory Integration and Provisioning, specify only the containers and attributes, which are required in the connected directory or in Oracle Internet Directory. You can use LDAP filters as part of mapping configuration profiles to screen out unwanted attribute data and keep synchronization simple.

Set each connector and its associated mapping configuration file to an appropriate scheduling interval. No connector needs to fire at the same time or at the same interval as any another, as they are completely independent of one another.

When synchronizing external users and groups into Oracle Internet Directory for use with Oracle Application Server, be sure to establish connectors to the appropriate Identity Management Realm `cn=users` and `cn=groups` container. Oracle Directory Integration and Provisioning will then provision all inbound user entries with the Oracle-specific attributes needed to enable users to interact with their deployed Oracle applications.

A synchronization Profile has to be disabled before altering any status attributes through the Oracle Directory Manager. After the change, it needs to be enabled once again.

> **See Also:** Chapter 10, "Synchronization with Oracle Human Resources," in the *Oracle Identity Management Integration Guide*

9.5.8.3 Synchronize Oracle Human Resources and Oracle Internet Directory to Provide Access to OracleAS Single Sign-On and Oracle Delegated Administration Services

If you use Oracle Human Resources as the source of truth for employee data in your enterprise, then you must synchronize between it and Oracle Internet Directory. Since the `Last Successful Execution Time` connector profile attribute is used to fetch the desired changes from connected directories at a given time, set it initially to some date in the past. Then enable the profile. Note this technique will potentially cause all entries in the connected directory to be synchronized all at once into Oracle Internet Directory. If this is not the desired effect, use the `bulkload.sh` technique for bootstrapping Oracle Internet Directory, and then set the last change number appropriately to begin synchronizing incrementally from the connected directory instead.

It is a good idea to synchronize user data from connected directories to the public `cn=users` container within an Oracle Internet Directory Identity Management realm. This way, all users are immediately accessible to OracleAS Single Sign-On and Oracle Delegated Administration Services, such as the Self-Service Console.

Synchronize the nickname attribute from the connected directory or derived from some attribute that is unique in the connected directory, so that the user can use this identifier with OracleAS Single Sign-On.

Since the `Last Successful Execution Time` connector needs appropriate privilege to read and write to the cn=users container under the Identity Management Realm, add the profile distinguished name (DN) to the groups `DASCreateUserGroup`, `DASEditUserGroup`, and `DASDeleteUserGroup` for that realm.

See Also:

- Chapter 4, "Oracle Internet Directory Data Management Tools," in the *Oracle Identity Management User Reference* for further information about `bulkload.sh`
- Chapter 10, "Synchronization with Oracle Human Resources," in the *Oracle Identity Management Integration Guide*

9.5.9 Incorporate Group Assignment During User Creation to Avoid Multiple Steps

Rather than creating users and assigning them to groups as separate steps, consider incorporating the group assignment step during user creation. To do this:

1. Log in to the Oracle Internet Directory Self-Service Console as a Oracle Delegated Administration Services privileged user (`orcladmin` or designate).
2. Select the **Configuration** tab.
3. Select **User Entry** > **Add Role**.
4. Search for and select any commonly-subscribed group entries.

Now, whenever you or any other Oracle Delegated Administration Services privileged user performs a **Create User** sequence, the list of specified groups will appear in the next-to-last step, in a section called **Roles Assignment**. Simply click whichever checkboxes are relevant to the newly-created user, and that user will automatically be made a member of all the groups you specify.

See Also: Chapter 5, "Managing Users and Groups with the Oracle Internet Directory Self-Service Console," in the *Oracle Identity Management Guide to Delegated Administration*

9.5.10 Use opmnctl instead of oidmon and oidctl to Manage Processes

In Oracle Application Server, you no longer need to run `oidmon` and `oidctl` to start and stop Oracle Internet Directory processes. OPMN stores the proper sequences and controls these services.

See Also: *Oracle Process Manager and Notification Server Administrator's Guide*

9.5.11 Configure Active Directory Synchronization

Prior to configuring Windows Native Authentication, be sure to first configure the Active Directory Connector and bootstrap the appropriate `cn=users` and `cn=groups` containers within your desired Oracle Identity Management Realm. Do not configure the External Authentication Plug-in for Active Directory if your goal is to enable Windows Native Authentication

See Also:

- *Oracle Application Server Single Sign-On Administrator's Guide*
- Chapter 18, "Integration with the Microsoft Active Directory Environment," in the *Oracle Identity Management Integration Guide*

9.5.12 Use User Attributes and Password Hints to Make Resetting Credentials Easier

Users that forget their OracleAS Single Sign-On passwords can reset them on their own by using the Oracle Internet Directory Self-Service Console. You must authenticate yourself in one of the following ways:

- If, while previously changing their password, a user specified a password hint question, then the Confirm Additional Personal Information window will prompt the user for the correct answer to the reminder question when attempting a password reset.
- Users who have not previously set a password hint will be presented with the Confirm Additional Personal Information window. This window prompts the user for other personal data, as configured by your administrator.

See Also: Chapter 4, "Managing Your Profile with the Oracle Internet Directory Self-Service Console," in the *Oracle Identity Management Guide to Delegated Administration*

10

Oracle Application Server High Availability Solutions

This chapter describes best practices for various highly available configurations and features for OracleAS High Availability Solutions. It contains the following topics:

- Section 10.1, "Oracle Application Server Cluster (Identity Management)"
- Section 10.2, "Oracle Application Server Cold Failover Clusters"
- Section 10.3, "Load Balancers"
- Section 10.4, "Oracle Application Server Guard"

10.1 Oracle Application Server Cluster (Identity Management)

Use a consistent and standardized configuration for the instances that participate in an OracleAS Cluster (Identity Management). From the OracleAS Single Sign-On perspective, all the instances in the cluster are seen as a single entity that provide a single service. To avoid errors in updates to the configuration, follow these tips:

- Use the same Oracle home path for the instances in your OracleAS Cluster (Identity Management).
- Use the same basic name for the instances. The host name prefix would ensure that the application server instance is unique.
- While Oracle allows the HTTP listen server to be different on each SSP/Oracle Delegated Administration Services host, Oracle recommends to use the same ports.
- It is better to have same ports used for all other services. Use `staticports.ini` for all installs to achieve this.
- Standardize on the port for Application Server Control for all Identity Management installs.
- The Distributed Configuration Management cluster name used in an OracleAS Cluster (Identity Management) installation is case sensitive. During installation, it is a good practice to use always upper case or lower case to avoid possible configuration errors.

See Also:

- Section 9.6, "OracleAS Cluster (Identity Management) Topology," in the *Oracle Application Server High Availability Guide*
- Chapter 12, "Installing in High Availability Environments: OracleAS Cluster (Identity Management)," in the *Oracle Application Server Installation Guide*

10.2 Oracle Application Server Cold Failover Clusters

This section contains these topics:

- Section 10.2.1, "Use Shared Oracle Home Installs for OracleAS Cold Failover Cluster (Middle-Tier) to Simplify Administration"
- Section 10.2.2, "Use Oracle Universal Installer Commands to Attach OracleAS Cold Failover Cluster Oracle Home with the oraInventory"
- Section 10.2.3, "Use Disk Redundancy for OracleAS Cold Failover Cluster to Avoid Oracle Home Failures"
- Section 10.2.4, "Allocate Ports to the OracleAS Cold Failover Cluster Instance to Avoid Failures"

10.2.1 Use Shared Oracle Home Installs for OracleAS Cold Failover Cluster (Middle-Tier) to Simplify Administration

Installing OracleAS Cold Failover Cluster in a multiple Oracle home configuration will require every administration change to be applied twice, including the deployment of J2EE applications. Oracle recommends using a shared drive for all install types, including the ones where non-shared is possible.

10.2.2 Use Oracle Universal Installer Commands to Attach OracleAS Cold Failover Cluster Oracle Home with the oraInventory

An OracleAS Cold Failover Cluster installation updates the `oraInventory` directory in a local file system unless the installer is specifically pointed to an `oraInventory` directory in a shared location. If you install additional software from the node in the hardware cluster that was not used for the OracleAS Cold Failover Cluster installation, the cold failover cluster installation will not be detected. Use Oracle Universal Installer to attach your OracleAS Cold Failover Cluster Oracle home with the `oraInventory` directory on the non-install nodes.

Implementation Details

In order to associate and attach the Oracle home to the `oraInventory` directory, use the following command:

```
./runInstaller -silent -attachHome -invPtrLoc <oraInst.loc location> ORACLE_
HOME="<Oracle_Home_Location>" ORACLE_HOME_NAME="<Oracle_Home_Name>" CLUSTER_
NODES="{}" LOCAL_NODE="<node_name>"
```

See Also: Chapter 11, "Installing in High Availability Environments: OracleAS Cold Failover Cluster," in the *Oracle Application Server Installation Guide*

10.2.3 Use Disk Redundancy for OracleAS Cold Failover Cluster to Avoid Oracle Home Failures

Resize the disk to hold all application deployments, maximum JMS messages persisted, and hold OracleAS Portal and Oracle Identity Management data when applicable. It is critical to use some kind of disk redundancy to secure all the binaries, data and metadata used by an OracleAS Cold Failover Cluster. If you are using Automatic Storage Management (ASM) and co-existing with other databases that use ASM, upgrade to clustered ASM for the entire cold failover cluster

10.2.4 Allocate Ports to the OracleAS Cold Failover Cluster Instance to Avoid Failures

If the ports are not available when the active instances fails over to the passive node, Oracle Application Server will not be able to start. Keep record of the ports used by your active-passive installations and use `staticports.ini` to install any other Oracle Application Server instances so that those ports remain free.

See Also:

- Section 4.5, "Managing OracleAS Cold Failover Cluster (Middle-Tier)," and Section 9.2, "OracleAS Cold Failover Cluster (Infrastructure) Topology," in the *Oracle Application Server High Availability Guide*
- Chapter 11, "Installing in High Availability Environments: OracleAS Cold Failover Cluster," in the *Oracle Application Server Installation Guide*

10.3 Load Balancers

This section contains these topics:

- Section 10.3.1, "Use Fault-Tolerant Hardware Load Balancers to Avoid Single Points of Failure"
- Section 10.3.2, "Use Monitoring of Services to Automatically Disable Traffic to Unavailable Nodes"
- Section 10.3.3, "Configure All Idle Time Timeouts to Maximize Time for Unused or Idle Service"

10.3.1 Use Fault-Tolerant Hardware Load Balancers to Avoid Single Points of Failure

The load balancer will be the entry point to many different services. Independent of providing redundancy for these services, the load balancer itself must be highly available. Use load balancers that can be configured for automatic failover in case of load-balancer failures.

10.3.2 Use Monitoring of Services to Automatically Disable Traffic to Unavailable Nodes

It is common in most load balancer products not to detect the failure of a service through one of its monitors. For these products, connections will remain idle and requests will hang.

Implementation Details

Make sure that the load balancer has been configured to monitor the services and fails over all the traffic to other nodes immediately in case of a failure.

10.3.3 Configure All Idle Time Timeouts to Maximize Time for Unused or Idle Service

Set the idle timeouts to the maximum time you expect a service to be unused or idle. Otherwise, the load balancer will cut the connections even when they appear as available to the invocation clients

See Also: Load balancer product documentation

10.4 Oracle Application Server Guard

This section contains these topics:

- Section 10.4.1, "Clean Up Invalid Records to Avoid Instantiation and Synchronization Errors"
- Section 10.4.2, "Use the Same Ports for OracleAS Guard in Avoid Manual Configuration Steps in Synchronization Operations"
- Section 10.4.3, "Use Different Labels and Colors in OracleAS Guard Shells to Avoid Errors"
- Section 10.4.4, "Enable High-Logging Level to Troubleshoot OracleAS Guard Operations"

10.4.1 Clean Up Invalid Records to Avoid Instantiation and Synchronization Errors

Remove all invalid Oracle software (invalid Oracle Databases or Oracle Application Server installation) from the `oraInventory` directory. You can accomplish this task by using the Oracle Universal Installer. For example, an instance is installed and later removed manually by deleting an Oracle home. Manually remove this instance's information from the `Inventory.xml` file; otherwise, OracleAS Guard may fail to perform the instantiation and synchronization operations.

10.4.2 Use the Same Ports for OracleAS Guard in Avoid Manual Configuration Steps in Synchronization Operations

Try to use the same OracleAS Guard ports in the primary and standby sites. Otherwise, you will have to manually edit the `dsa.conf` file to enable the communication between production and standby site peers.

10.4.3 Use Different Labels and Colors in OracleAS Guard Shells to Avoid Errors

Due to the host name symmetry requirements for OracleAS Guard, shells in both environments may appear under the same host name and prompt. It is a very common mistake to perform operations in a standby shell that were intended to be preferred in the production site, causing errors and inconsistent configuration changes. Use a fixed and standard way to label and position command shells to make sure that operations are issued in the correct site.

10.4.4 Enable High-Logging Level to Troubleshoot OracleAS Guard Operations

You can trace OracleAS Guard operations to a great detail by using the `set trace on all` command. By default, the trace level is set to `off`. Use this type of logging when trying to solve issues with OracleAS Guard.

Implementation Details

From the OracleAS Guard prompt, enter:

```
set trace on | off <traceflags>
```

See Also: Chapter 14, "OracleAS Guard asgctl Command-line Reference," in the *Oracle Application Server High Availability Guide*

10.5 Backup and Recovery

This section contains these topics:

- Section 10.5.1, "Use Application Server Control as the Standard Way to Perform Backup and Recovery to Avoid Errors and Typos"
- Section 10.5.2, "Use Instance-Level Backup to Guarantee Consistency"
- Section 10.5.3, "Perform an Image Backup to Recover from Loss of Host Scenario"
- Section 10.5.4, "Use Incremental Backups to Save Time and Disk Space"

10.5.1 Use Application Server Control as the Standard Way to Perform Backup and Recovery to Avoid Errors and Typos

Application Server Control provides an easy and convenient way to configure Oracle Application Server Backup and Recovery Tool and perform backup and recovery operations. You can view the OracleAS Backup and Recovery Tool operational log files through Application Server Control. This interface is less error prone than the command line.

Implementation Details

See Also: Section 21.2.4, "Performing an Instance Backup of Oracle Application Server Using Application Server Control Console," in the *Oracle Application Server Administrator's Guide*

10.5.2 Use Instance-Level Backup to Guarantee Consistency

The instance-level backup includes the configuration and repository backup. The repository can be database-based or file-based. This functionality offers consistency between configuration and repository backups. You should try to use this option as much as possible as opposed to backing up configuration and repository separately.

Implementation Details

See Also: Chapter 21, "Backup Strategy and Procedures," in the *Oracle Application Server Administrator's Guide* for information about the available instance-level backup options

10.5.3 Perform an Image Backup to Recover from Loss of Host Scenario

The OracleAS Backup and Recovery Tool offers recovery from loss of host scenarios. After doing an install, make sure to take an image backup that includes the Oracle home, `OraInventory` directory, Registry entries, instance backup, and so on. You can use this information to recover from a loss of host.

Implementation Details

In order to create an image backup, use the following commands

On UNIX:

```
bkp_restore.sh -m node_backup -o image_backup -P <archive path>
```

On Windows:

```
bkp_restore.bat -m node_backup -o image_backup -P <archive path>
```

> **See Also:** Section 20.6, "OracleAS Backup and Recovery Tool Usage Summary," and Chapter 21, "Backup Strategy and Procedures," in the *Oracle Application Server Administrator's Guide*

10.5.4 Use Incremental Backups to Save Time and Disk Space

The OracleAS Backup and Recovery Tool offers incremental backup both for configuration files and database, by which only the modified data gets backed up. You should choose this option if you do not want to backup redundant data every time and you like the backups to be small in size.

> **See Also:** Section 20.6, "OracleAS Backup and Recovery Tool Usage Summary," and Chapter 21, "Backup Strategy and Procedures," in the *Oracle Application Server Administrator's Guide*

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