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Configuration Management and Provisioning of Sun Oracle Exadata Database Machine Using Enterprise Manager

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Executive Overview

This white paper will familiarize you with the Oracle Enterprise Manager Lifecycle and Configuration Management capabilities for maximizing the availability and minimizing operational overhead for the Oracle (Sun) Exadata Database Machine.

Enterprise Manager's Lifecycle and Configuration Management can be used to automate:

Provisioning and Setup of your Exadata Database Machine. Profiles, automated deployment procedures, and push-button deployment eliminate errors in manual processes and ensure that recommended Oracle standards are followed during provisioning and setting up the Exadata Database Machine.

Patching of your Exadata Database Machine. Standard Database patch management features provided by Enterprise Manager provide high value to any Exadata Database Machine-enabled enterprise.

Configuration Management of Exadata Database Machine's tiers, including Operating System, Database (both Real Application Clusters and Single Instance Databases), Grid Infrastructure, ASM and Exadata storage server. Configuration management functions include comparing configurations, searching for configuration parameters, history and change tracking, and enforcing compliance using policies and policy groups across tiers.

Implementation of Exadata Database Machine "Best Practices" using user-defined policies and policy groups. Leverage the powerful and extensible custom policy and policy group functionality of Enterprise Manager to monitor and maintain both new and existing Exadata installations within defined "best practice" parameters for performance, security, and scalability.

These capabilities and others within Oracle Enterprise Manager combine to overcome many of the persistent database management challenges inherent to high-performance, high-demand datacenters running Sun Oracle Exadata Database Machine and other Oracle Databases:

Maximize performance & availability—automatically monitor the Oracle Exadata Database Machine and proactively resolve issues before they turn into emergencies. Automate

detection and notification of any violation of best practices for Oracle Exadata Database configuration, automate the patching process with minimal downtime, and maximize application availability

Elevate administrator productivity—give your administrators the tools they need to manage more databases, more effectively, while increasing their value to the organization.

Eliminate failures from manual processes—take control of your IT environment by addressing the number one cause of unplanned downtime through extensive out-of-the-box automation, configuration and change management capabilities.

Terminology

This paper uses the terms **Oracle (Sun) Database Machine**, **Oracle Exadata Database Machine** and **Exadata Database Machine** interchangeably in the discussion that follows.

The term **Database** refers to the Real Application Cluster (RAC) or Single Instance database in your Exadata Database Machine.

RAC refers to **Real Application Cluster Database**, **ASM** refers to **Automatic Storage Management** and **GI** refers to **Grid Infrastructure**.

The terms **user-defined** and **custom** are used interchangeably in the context of Enterprise Manager Policies and Policy groups.

Introduction

There is a growing need for an optimal solution for all database workloads ranging from scan-intensive data warehouse applications and highly concurrent OLTP applications to the accelerating growth of virtualization. The SUN Oracle Database Machine provides this solution. Critical to maintaining optimal performance across all workloads and applications, are: ensuring configuration consistency; compliance to best practices; and deployment of the latest patches and security recommendations. Oracle Enterprise Manager with its Configuration Management and Provisioning and Patch Automation packs will ensure your SUN Oracle Database Machine meets these challenges. By using the Configuration Management, Provisioning and Patch Automation packs along with Oracle Enterprise Manager's familiar interface, administrators can easily manage the entire SUN Oracle Database Machine.

Oracle Enterprise Manager's Configuration Management and Provisioning and Patch Automation Packs take SUN Oracle Database Machine management to a new level by:

Providing a simple interface to set-up and provision of your mission critical data warehouse Exadata Database Machine using a few clicks and making the whole process skill-agnostic.¹

Enabling your administrators to secure your databases by automating the patch deployment process in zero downtime fashion. The automation of the patch deployment process enables administrators to regularly and proactively patch your critical data warehouse databases, thus ensuring compliance and boosting administrator productivity.

Simplifying and automating configuration management operations for different tiers of your Exadata Database Machine using a simple interface which does not require any additional specialized training or skill set. From detecting and alerting administrators about unauthorized changes, to maintaining a history of all changes, to troubleshooting performance and operational issues due to incorrect or unwanted configuration changes, to proactively testing the security of the system using policies, to providing rich out-of-the-box compliance dashboards – configuration management features provide all the necessary tools for an administrator to easily and effectively manage your Exadata Database Machine.

¹ This is an upcoming feature, and not available at the time of publication of this whitepaper.

The sections that follow describe the Patching and Configuration Management features which lower the total cost of ownership of your SUN Oracle Database Machine, increase availability, and give you total control of your warehouse solution.

Oracle Exadata Database Machine and Oracle Enterprise Manager

The Oracle Exadata Database Machine delivers extreme performance and scalability for all your database applications including Online Transaction Processing (OLTP), Data Warehousing (DW), and consolidation of mixed workloads. Built using industry-standard hardware from Sun, and intelligent database and storage software from Oracle, the Sun Oracle Exadata Database Machine is a complete optimized package of software, servers, and storage.

A typical Oracle Exadata Database Machine is a self-contained unit with – depending on the model selected – multiple database servers, Exadata storage as required, and network switches as required to run multi-node Real Application Cluster (RAC) database or multiple single instance databases.

Oracle Enterprise Manager can be used for monitoring and managing all the components of your Exadata Database Machine. Hosts (servers), Databases and Grid Infrastructure, and Automated Storage Management (ASM) are automatically discovered and added as managed targets in Enterprise Manager when Enterprise Manager Agents are deployed on the servers.

Monitoring Plug-In for Exadata Storage Server (Storage Cells) is installed as a one-time activity for Enterprise Manager to discover and add Exadata Storage cells as Enterprise Manager managed targets. A simplified diagram of Exadata Database Machine and how it is monitored by Oracle Enterprise Manager is shown below:

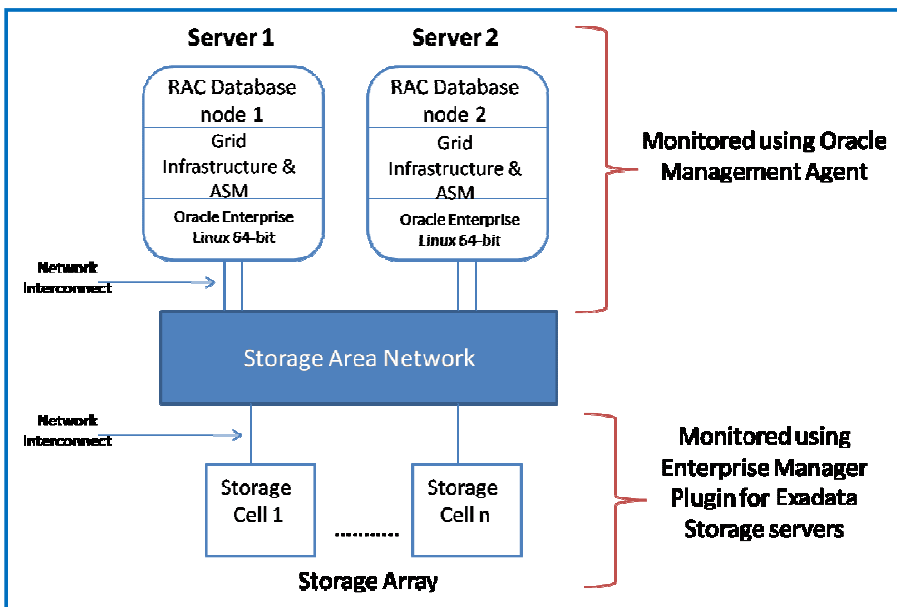


Figure 1: Simplified diagram of Exadata Database Machine showing the different tiers managed by Enterprise Manager.

Note that you can manage your Exadata Database Machine(s) using your corporate Enterprise Manager environment.

Target Discovery and Data & Metrics Collections

NOTE: As new capabilities get added to Exadata Database Machine, the monitoring methodologies will change accordingly. Refer to My Oracle Support (MOS) Note 1110675.1 for the latest information on this topic.

The agents and the plug-in allow Enterprise Manager to automate patching along with periodically collecting configuration-related data and metrics (CPU usage, memory statistics, file system space, etc.) for each tier of the Exadata Database Machine and store them in the Enterprise Manager repository as snapshots. These collections can include the following*:

Target Type	Configuration Properties collected by Oracle Management Agents/Plugin
Host	<p>Operating System details like version, platform, properties and configuration (like kernel parameters), installed packages, File System details</p> <p>Oracle software installed on the server along with details of the Oracle Home, Products installed, applied patches and components. Also details of non-Oracle software registered with the operating system</p> <p>Hardware information like configuration details of CPUs, IO Devices, Network Interfaces</p>
Database	<p>Oracle Home details including the details of the patches and components present in an Oracle Home</p> <p>Listener configuration details and detailed information about Database instance, Initialization parameters, SGA configuration, Datafiles, Control files, Redologs, Rollback Segments, High Availability configuration like Backup, FRA and recovery settings and license usage</p>
Grid Infrastructure & ASM	<p>Oracle Home details including the details of the patches and components present in an Oracle Home</p> <p>Disks and Disk Group details, Disk discovery path and other configuration parameters details</p>

Exadata Storage Server	<p>Oracle Cell configuration details like cell and kernel version, IP addresses, SMTP server details</p> <p>Cell Griddisk configuration details like Realm name, status, size and cell disks</p> <p>Cell Celldisk Configuration details like celldisk names, status, size, associated LUN, free space and device partition</p> <p>Cell LUN Configuration details like id, device name, size, raid levels and others</p> <p>Cell Physicaldisk configuration details like status, id, physical interface, size</p> <p>Cell IORM configuration details like directive type, database name, priorities of different levels</p>
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*** Not a complete list of metrics/configuration properties collected by Enterprise Manager.**

Refer to the metric manuals available here for a comprehensive list:

http://download.oracle.com/docs/cd/E11857_01/nav/reference.htm

Monitoring Enables Intelligent, Automated Management

The agent-based or plug-in based monitoring and metric collection described in the preceding section comprise the essential data foundation for all the other deep, feature-rich functions of Enterprise Manager's Configuration Management and Provisioning and Patch Automation packs. With this configuration information available, Enterprise Manager can:

A. Automate Patch Management

- o While the software for database server is initially installed by Oracle; customers are required to patch and maintain the database and OS software on their own. Knowledge articles like the MOS Notes **835032.1** and **888828.1** identify the patches and bundles applicable to Exadata Database Machine Software for database versions 11.1 and 11.2 respectively. Enterprise Manager's integration with My Oracle Support automates the task of patch identification (for RAC and Single Instance Databases), helps in identifying patch conflicts, and finding or requesting merge patches.
- o Provide out-of-the-box orchestration via deployment procedures to deploy these patches in a completely unattended and automated fashion. This covers the entire patch application lifecycle from downloading of patches, and shutdown and startup of services, to checking for prerequisites like Opatch upgrades, inventory checks and more.

B. Automate Configuration Management

- o Save configuration baselines for each target (Database, GI/ASM, Exadata Storage cells and hosts).
- o Compare configurations between multiple live targets or against a saved baseline. Helps in troubleshooting and detection of unwanted changes in a deployment.

- Search for specific configuration properties against a set of targets. Identify drift from standards, during auditing or for ad hoc reporting.
- Show history of configuration changes that have taken place for a target. Helps in auditing, change tracking, and troubleshooting.
- Enforce compliance using out-of-the-box or custom user-defined policies to validate collected configuration data and notify administrators when a policy is violated. Allows implementation of rules for compliance to Best Practices or regulatory standards such as SOX, COBIT, and HIPPA.

C. Automate enforcement of Exadata Database Machine Best Practice Configurations

- Create custom policies/policy groups based on best practice recommendations, evaluate these policies against your Database Exadata Machine and report any violations.

The following sections cover these capabilities in more detail.

Patching Your Exadata Database Machine

Simplification of Critical Patch Activities

After initial deployment, your Exadata Database Machine will require recommended patches to be deployed on an ongoing basis. It is very important that you keep your Database Machine up to date with the latest Exadata Database Machine patches, and regularly released CPUs and PSUs.

In addition to automating the patching of your Exadata Database Machine, Enterprise Manager now integrates with My Oracle Support to further simplify the patching experience of your Exadata Database Machine. In the following section, we look at how using Oracle Enterprise Manager and My Oracle Support you can:

- Identify recommended patches for your Exadata Database Machine by searching knowledge articles - MOS Notes **835032.1** and **888828.1**. Then select these recommended patches for application. All patches listed in these notes are tested and released specifically for Exadata Database Machine software.
 - For the latest list of patches specific to Exadata Database Machine, refer to My Oracle Support (MOS) Notes 835032.1 and 888828.1.
 - MOS note 835032.1 documents requirements for Oracle Database 11.1 (V1) systems
 - MOS note 888828.1 documents requirements for Oracle Database 11.2 (V1 and V2) systems
 - Customers should sign up for automated alerts for changes to these MOS notes
- Optionally identify any additional patches applicable for your databases and validate them for any conflicts along with the recommended patches
- In case of conflicts, find or request merge patches
- Mass deploy multiple patches in an automated fashion using Enterprise Manager Provisioning and Patch Automation.

These steps are described in the sections below. Note that in the current release Enterprise Manager does not support patching of Exadata Storage server (Storage Cells).

Identify Recommended Patches

The My Oracle Support interface in Enterprise Manager is accessed via the **My Oracle Support** tab. The **Patch Recommendations** region indicates if Enterprise Manager has identified any patches (security or recommended patches) applicable for your databases. Clicking on the recommendations brings up a detailed view with patch descriptions and the targets listed to which they should be applied.

The **Knowledge** tab provides a powerful alternate path to learning about available maintenance, where you can easily search and bookmark knowledge articles and identify the associated recommended patches. You can then search for the patches directly that may be recommended in the notes.

For each patch, the search interface allows you to look at detailed information, such as bugs fixed, the patch readme, and associated knowledge articles. Additionally, the UI links to Oracle Forums, enabling users to review feedback from other users about the patches, including information on the impact, and patch workarounds, if any. One can also get information on the number of patch downloads and the download trend from the community.

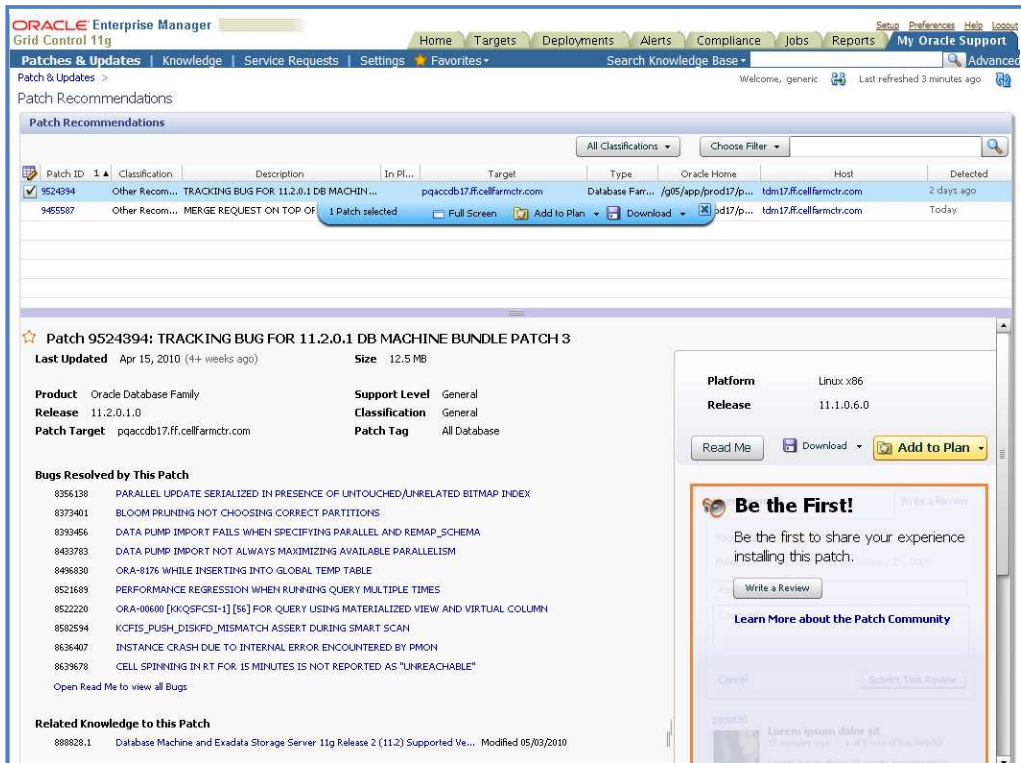


Figure 5: The Patch recommendations show applicable patches and patch details like bugs fixed, readme, and community feedback, and allow adding patches to a Plan for further validation.

Validation and Mass Deployment of Patches

After identifying recommended patches, you can add patches to a **Plan**. A plan allows you to collect multiple patches and validate them for any potential conflicts against a set of targets before rolling them out. For example a series of patches can be combined in a single plan for validation.

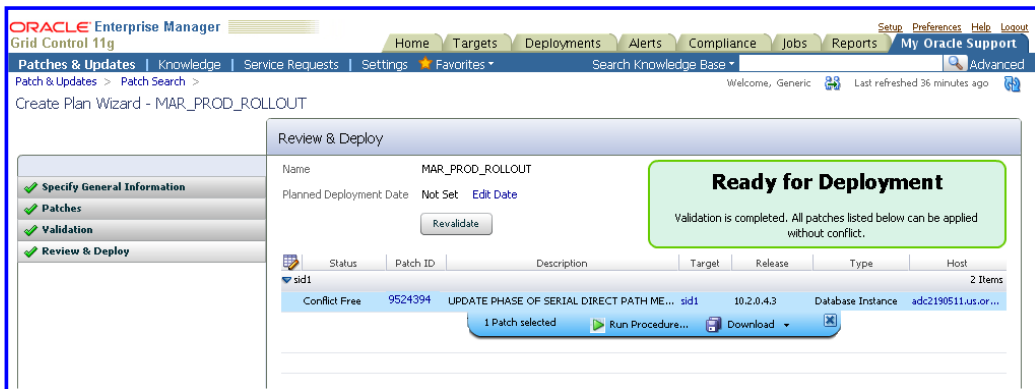


Figure 6: Multiple patches can be put into a Plan and validated for conflicts against a number of targets.

If conflicts are found Enterprise Manager will proactively determine if a merge patch is available and present the information to you. If a merge patch is not available for a given conflict, you can file an Oracle Support Service Request right within the interface to request one.

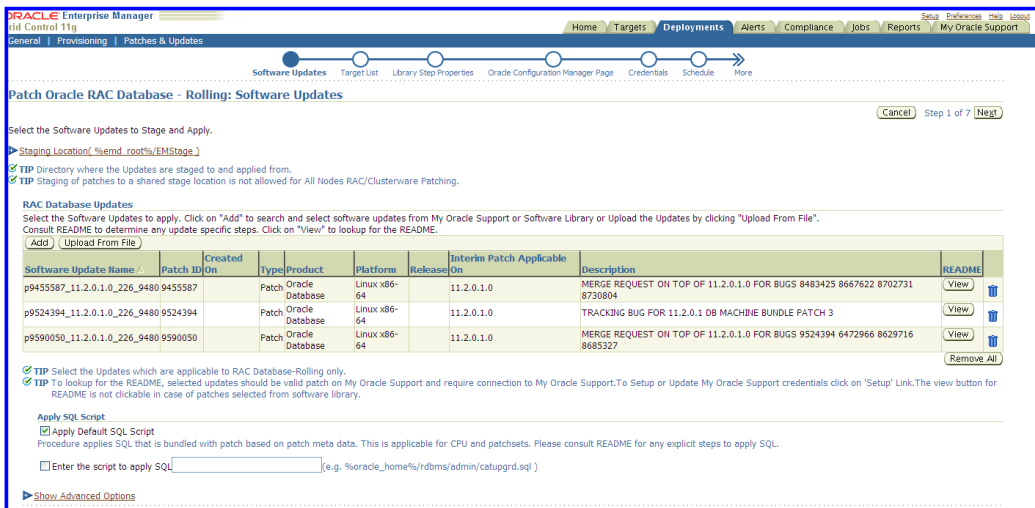


Figure 7: Multiple patches can be deployed using automated patch deployment procedures against multiple targets.

Once a plan is validated and no conflicts are detected, it can be deployed on a set of targets by running a patching deployment procedure.

Deployment Procedures prompt you for the target details, credentials, and a schedule, and then perform patching of your Exadata RAC or Single Instance Databases in an unattended manner. In the case of a RAC Database the patch application is done in a zero downtime or rolling fashion where applicable. The entire patch application process, from downloading the patch, preparing the home for patching (e.g., upgrading OPatch), shutting down and restarting processes, application of patches and associated SQLs, and validating the patch application, is completely automated out-of-the-box.

Searching for Targets without the Recommended Patches

Enterprise Manager allows you to ensure that all the Exadata mission critical databases have been patched with the recommended patches. This can be accomplished by utilizing the Search capabilities in Oracle Enterprise Manager, or by writing a policy to enforce compliance to a list of standard patches.

The **Search Oracle Patches** feature under the **Deployments tab** can be used to manually find Exadata targets which do not have the necessary patches.

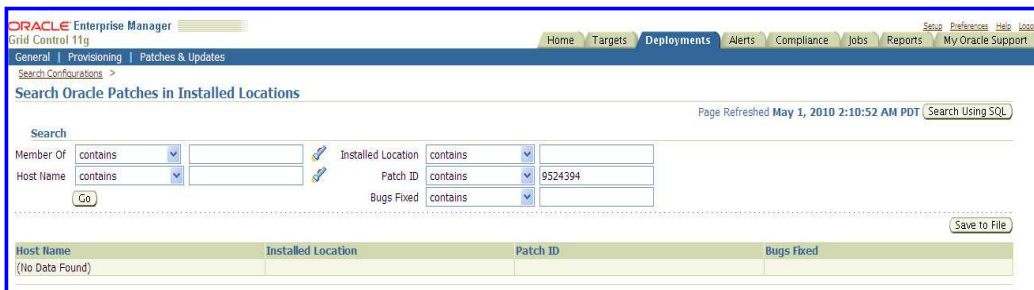


Figure 8: The Search feature can be used to find a given or multiple patches across targets.

Alternatively, Oracle recommends defining a Patch Policy to proactively identify deployments that are missing necessary patches. The Patch Policy is evaluated against your database environments on a regular basis and violations are reported to administrators via alerts and notifications. Creation of such a custom policy is described in the following section **Enforcing Database Exadata Best Practice Configuration Using Configuration Management Framework**.

Automating Configuration Management

The collected configuration information for the different tiers of Exadata Database Machine can be found:

By clicking on the **View Configuration** link on a Exadata Storage server target page

By clicking on the **Last Collected Configuration** under the **Software and Support** tab of a Cluster Database or Database Instance target page

Under the **Configuration** tab on a Host target page.

These Enterprise Manager pages display the details of the configuration properties collected from Exadata Database Machine targets and stored in the Enterprise Manager repository. You can utilize this view to view your settings, compare them against recommendations or best practices.

Additionally there are links to **Save** a configuration baseline, **Compare** the target configuration with an existing baseline or other targets, and view the **History** of configuration changes that have been made on a given target on these pages.

Cluster: stbdh01 > Cluster Database: r7 > Database Instance: r7_r71 >
Last Collected Configuration
 Save Change History Compare Configuration Compare to Multiple Configurations(Job)
 Collected From Target May 2, 2010 2:10:21 AM Refresh

Name	Value
Database Name	R7
Instance Name	r71
Global Name	R7
Version	Oracle Database 11g Enterprise Edition Release 11.1.0.6.0 - Production
Host Name	stbdh01
Instance Start Time	April 29, 2010 1:47:14 AM
Restricted Mode	NO
Archive Log Mode	NOARCHIVELOG

Related Links
 Change History

Figure 9: Multiple configuration properties collected for a RAC Database. Available functions include saving, comparing, or looking at the configuration change history of a target.

In addition to the configuration properties listed on the pages mentioned above, Enterprise Manager Agents and the Exadata Database Monitoring Plug-In proactively collect *metrics* about targets to check against performance and operational parameters. For example: Exadata Configuration Cell Performance metrics and Realm LUN performance.

To view the metrics for any target, go to the target page in Enterprise Manager and click on the **All Metrics** link under the **Related Links** section. Metrics are discussed further in the **Enforcing Database Exadata Best Practice Configuration Using Configuration Management Framework** section.

Compare: Oracle Cell Configuration

First [dscgicel01.us.oracle.com](#) Second [dscgicel02.us.oracle.com](#)
 Host [dscgicel01.us.oracle.com](#) Host [dscgicel01.us.oracle.com](#)
 Collected [May 4, 2010 1:07:03 PM](#) Collected [May 4, 2010 1:07:07 PM](#)

Summary

- Oracle Cell Configuration
- Cell Griddisk Configuration
- Cell Celldisk Configuration
- Cell LUN Configuration
- Cell Physicaldisk Configuration
- Cell IORM Configuration

Oracle Cell Configuration

Result /	Attribute	dscgicel01.us.oracle.com	dscgicel02.us.oracle.com
✖	Name	dscgicel01	dscgicel02
✖	Id	0937XFG007	0936XFG004
✖	IP Address 1	192.168.75.94/22	192.168.75.95/22

Cell Griddisk Configuration

Result	Name	Cell Name	Realm Name	Cell Disk	dscgicel01.us.oracle.com	dscgicel02.us.oracle.com
✔	DATA_CD_00_dscgicel01	dscgicel01	dscgii	CD_00_dscgicel01	✔	✔
✔	DATA_CD_01_dscgicel01	dscgicel01	dscgii	CD_01_dscgicel01	✔	✔
✔	DATA_CD_02_dscgicel01	dscgicel01	dscgii	CD_02_dscgicel01	✔	✔
✔	DATA_CD_03_dscgicel01	dscgicel01	dscgii	CD_03_dscgicel01	✔	✔
✔	DATA_CD_04_dscgicel01	dscgicel01	dscgii	CD_04_dscgicel01	✔	✔
✔	DATA_CD_05_dscgicel01	dscgicel01	dscgii	CD_05_dscgicel01	✔	✔
✔	DATA_CD_06_dscgicel01	dscgicel01	dscgii	CD_06_dscgicel01	✔	✔
✔	DATA_CD_07_dscgicel01	dscgicel01	dscgii	CD_07_dscgicel01	✔	✔
✔	DATA_CD_08_dscgicel01	dscgicel01	dscgii	CD_08_dscgicel01	✔	✔
✔	DATA_CD_09_dscgicel01	dscgicel01	dscgii	CD_09_dscgicel01	✔	✔

Cell Celldisk Configuration

Figure 10: Shows results of a comparison of two Exadata storage cells. Enterprise Manager identifies matching or divergent configurations across cells in a single click.

Configuration History

Enterprise Manager automatically collects configuration information for targets such as hosts and databases. Changes to these configurations are recorded and may be viewed from this page. Page Refreshed: [May 4, 2010 4:34:56 PM PDT](#) [Search Using SQL](#)

Category: [Oracle Exadata Storage Sener](#)
Changing the category clears any existing results.

Search

Target Name: [is exactly](#) [dscgicel01.us.oracle.com](#) [Change Discovered after](#) (Example: 12/15/02)

Target Property: [Deployment Type](#) [Change Discovered before](#) (Example: 12/15/02)

On Host: [contains](#) [Change Discovered before](#) (Example: 12/15/02)

Member Of: [contains](#)

Type of Change: [is](#) [All](#)

[Go](#) [Clear](#)

View History Records: [Grouped](#) [Save to File](#)

Change Discovered	Target Name	On Host	Category	History Records
May 1, 2010 1:07:03 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell Celldisk Configuration	28
May 1, 2010 1:07:03 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell LUN Configuration	28
May 1, 2010 1:07:03 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell Physicaldisk Configuration	28
Apr 24, 2010 1:07:03 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell Griddisk Configuration	2
Apr 24, 2010 1:07:03 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell LUN Configuration	1
Apr 24, 2010 1:07:03 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell Physicaldisk Configuration	28
Apr 22, 2010 5:10:38 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell Celldisk Configuration	16
Apr 22, 2010 5:10:38 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell LUN Configuration	16
Apr 22, 2010 5:10:38 PM PDT	dscgicel01.us.oracle.com	dscgicel01.us.oracle.com	Oracle Exadata Storage Sener: Cell Physicaldisk Configuration	10

Compliance Policies and Policy Groups

Enterprise Manager provides 200+ out-of-the-box policy and pre-defined policy groups to support compliance enforcement. Violations of these policies are flagged as alerts and administrators are proactively notified about events which are, or can lead to, potential security threats or performance issues on the Exadata Database Machine.

Enterprise Manager Policy and Policy Groups can be found under the **Compliance** tab. The policies range from rules to check whether default passwords have been reset, to checking parameter settings – like checking if the AUDIT_SYS_OPERATIONS is enabled or not, to restrict access to database views and tables.

One or more of these policies can be selected and evaluated against multiple targets when required. Alternatively, Oracle recommends including these in a policy group and applying them on a set of targets for evaluation on a regular basis.

Enterprise Manager allows creation of policy groups which can be evaluated against a list of targets. It also provides the following out-of-the-box Policy Groups which pre-define the most critical security policies and can be applied to targets for checking whether the Exadata Database Machine violates any best practice for Database deployments and is left vulnerable:

- Secure Configuration for Oracle Real Application Clusters

- Secure Configuration for Oracle Database

- Secure Configuration for Oracle Listener

These policy groups are available under the **Compliance Policy Group Library** tab. Once evaluated against a set of targets the Evaluation results are printed as shown in the figure below. The policies are listed on the left side, and the right-hand side of the page provides the compliance score (under the **Summary** tab), details of the violations, and the trend of a specific violation.

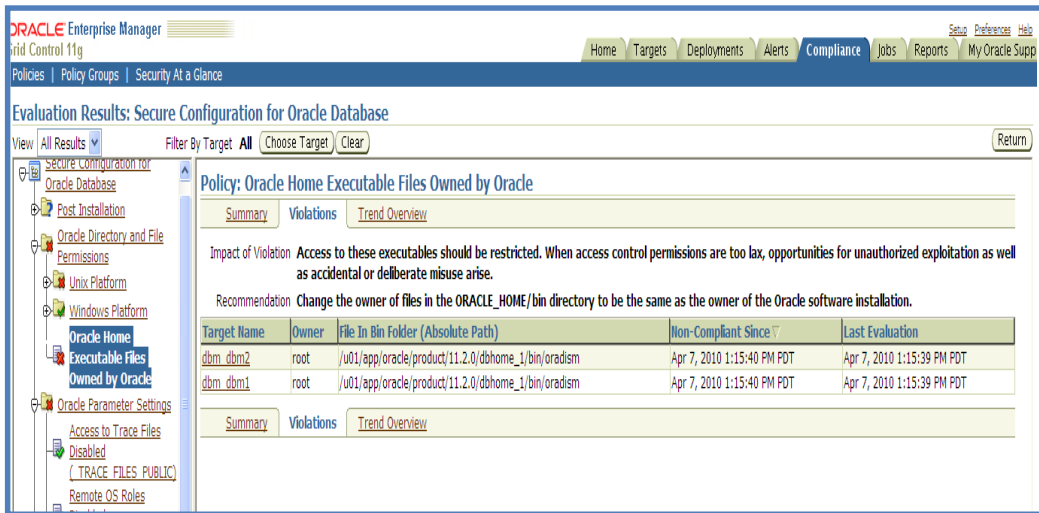


Figure 12: The results of a Secure Configuration for Oracle Database Policy Group evaluation against the RAC database of Exadata Database Machine. Clicking on the policy violation (indicated by an icon with a red X) displays the details on the right-hand side details pane.

Enterprise Manager also provides a dashboard view of the Security Policy compliance of your Exadata Database Machine. This is found under the **Compliance Tab — Security at a glance**. As shown in the figure below, this dashboard shows the flux of violations, the overall compliance score of your database machine, severity statistics, and details of all violations. Clicking on a link under **Distinct Rules Violated** or **Severity Statistics** brings up the details of the policy violation.

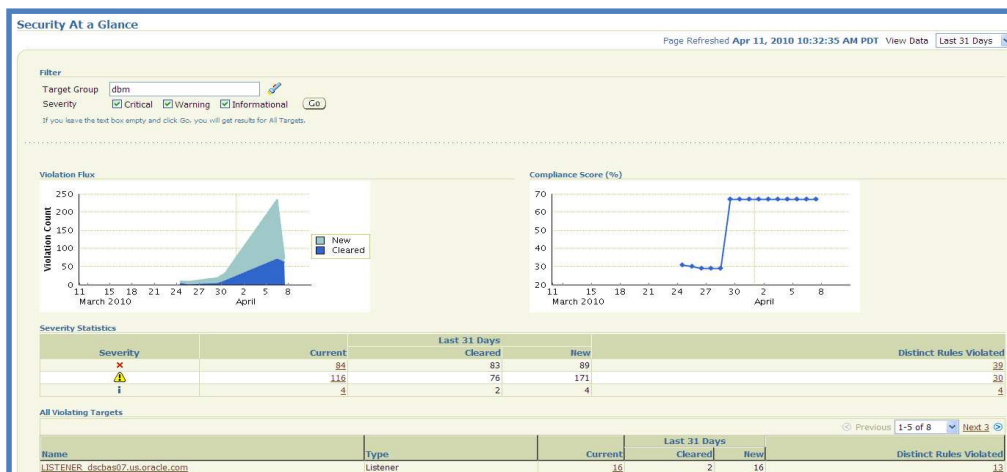


Figure 13: Security-at-a-glance dashboard showing the trend of policy violations and the overall compliance score of the managed databases relative to standards and best practices.

Enforcing Exadata Database Best Practice Configuration Using Configuration Management Framework

This section describes how you can use the Enterprise Manager Configuration Management Policy and Policy Group framework to create and enforce policies to ensure that your Exadata Database Machine adheres to best practices recommended by Oracle.

Types of Best Practice and Metrics Stored

TABLE 1 lists best practice recommendations supplied by Oracle that can be automated by Oracle Enterprise Manager Configuration Management Pack (some of these checks may only be required for a given version of the Exadata Database Machine). More current best practice recommendations may be available at <http://www.oracle.com/technology/products/bi/db/exadata/index.html> or in the following Note at My Oracle Support: 757552.1.

TABLE 1: BEST PRACTICE CONFIGURATION CHECKS

REQUIREMENT TYPE	REQUIREMENT DETAILS	INFORMATION STORED IN EM REPOSITORY VIEWS
DATABASE RELATED CHECKS	Check if Flashback is enabled or not	mgmt\$ha_info
	DB_FLASHBACK_RETENTION_TARGET should at least be set to 120 and the value should be same on both Primary and standby database if Dataguard is being used	mgmt\$db_init_params
	DB_BLOCK_CHECKSUM should be set to TYPICAL or FULL	mgmt\$db_init_params
	DB_BLOCK_CHECKING should be set to MEDIUM	mgmt\$db_init_params
	DB_LOST_WRITE_PROTECT should be set to TYPICAL	mgmt\$db_init_params
	LOG_BUFFER should be set to at least 8 MB. If SGA is more than 4 GB, then LOG_BUFFER should be in range of 32-64 MB	mgmt\$db_init_params
	PARALLEL_EXECUTION_MESSAGE_SIZE should be set to at least 8192	mgmt\$db_init_params
	ARCHIVELOG mode and Force Logging should be set	mgmt\$ha_info
	Patches 9524394, 9590050, 9455587 should be applied	mgmt\$applied_patches
Depending on Exadata Database Machine version V1 or V2 the database software version and compatible parameter should be 11.1.0.7 or 11.2.0.1	mgmt\$target_properties	
GRID INFRASTRUCTURE/ASM RELATED CHECKS	Version of ASM should be at least be 11.2.0.1 for Exadata Database Machine V2 and 11.1.0.7 for V1 for ASM disk groups	mgmt\$target_properties
EXADATA STORAGE CELLS RELATED CHECKS	Check Cell/eth0 interface of the cell is up and a connection can be made to the cell	mgmt\$metric_current
	Check that all the Cell services should be online	mgmt\$metric_current
	Check that small I/O Latency (for both reads and writes) is less than 1 second	mgmt\$metric_current

The above table also lists the Enterprise Manager Repository views which can be used to query for the configuration data required to perform the corresponding checks. Please refer to the Enterprise Manager Extensibility Guide for a complete list of Enterprise Manager Repository views:

http://download.oracle.com/docs/cd/B16240_01/doc/em.102/b40007.pdf

Clauses for User-Defined Policies

Once you have identified the checks that you want to automate and the list of Enterprise Manager Repository Views where the information can be obtained, you can then go ahead and write **User-Defined Policies** for automating these checks.

A User-Defined Policy has two parts:

SQL statement to retrieve configuration data items from the repository views

WHERE clause for the policy which defines the actual check that has to be performed on the configuration data. This defines the criteria for creating a violation. The WHERE clause can be provided by writing a SQL or using the Enterprise Manager Policy Creation wizard

TABLE 2 shows the list of SQL statements and WHERE clauses required for implementing policies corresponding to the configuration checks listed in **TABLE 1**.

Once you have the SQL statements ready you can start authoring the User-Defined Policies. The WHERE clause for a policy can be defined while authoring a policy. The process to create a user-defined or custom policy is described in the next section.

TABLE 2 – SQL STATEMENTS AND WHERE CLAUSE FOR IMPLEMENTING POLICIES FOR THE CHECKS MENTIONED IN TABLE 1

REQUIREMENT TYPE	SQL FOR THE POLICY	WHERE CLAUSE FOR THE POLICY
DATABASE PARAMETER REQUIREMENTS	select target_guid as TARGET_GUID,name, value from mgmt\$db_init_params where NAME='db_flashback_retention_target'	VALUE <> 120
	select target_guid as TARGET_GUID,name, value from mgmt\$db_init_params where NAME='db_block_checksum'	VALUE <> TYPICAL or VALUE <> FULL
	select target_guid as TARGET_GUID,name, value from mgmt\$db_init_params where NAME='db_block_checking'	VALUE <> MEDIUM
	select target_guid as TARGET_GUID,name, value from mgmt\$db_init_params where NAME='db_lost_write_protect'	VALUE <> TYPICAL
	select target_guid as TARGET_GUID,name, value from mgmt\$db_init_params where NAME='log_buffer'	VALUE < 8
	select target_guid as TARGET_GUID,name, value from mgmt\$db_init_params where NAME='parallel_execution_message_size'	VALUE < 8192
	select target_guid as TARGET_GUID,log_mode from mgmt\$ha_info	Log_mode <> Archivelog
	select target_guid as TARGET_GUID,force_logging from	Force_logging <> True

	mgmt\$ha_info	
	select target_guid as TARGET_GUID,flashback_on from mgmt\$ha_info	Flashback_on <> Yes
	select target_guid as TARGET_GUID,name,value from mgmt\$db_init_params where NAME='compatible'	VALUE <> 11.1.0.7 Or VALUE <>11.2.0.1 for Exadata V1 and V2 respectively
	select target_guid as TARGET_GUID,property_name,property_value from mgmt\$target_properties where property_name='DBVersion'	VALUE <> 11.1.0.7 Or VALUE <>11.2.0.1 for Exadata V1 and V2 respectively
GRID INFRASTRUCTURE/ASM RELATED CHECKS	select target_guid as TARGET_GUID,property_name,property_value from mgmt\$target_properties where property_name='Version'	VALUE <> 11.1.0.7 Or VALUE <>11.2.0.1 for Exadata V1 and V2 respectively
EXADATA STORAGE CELLS RELATED CHECKS	select target_guid as TARGET_GUID,value from mgmt\$metric_current where metric_name='Response' and column_label='Response Status'	VALUE<>1 (Value 1 indicates status is Up and one can connect to it)
	select s.target_guid,e.status from mgmt_ecm_gen_snapshot s, MGMT_EMX_CELL_C_CONFIG e where e.ecm_snapshot_id=s.snapshot_guid and s.is_current='Y'	STATUS<>ONLINE
	select target_guid as TARGET_GUID,value from mgmt\$metric_current where metric_name='Cell_Summary_Statistics' and metric_column='max_celldisk_small_write_latency'	Value<1000 (Value returned is in milliseconds)
	select target_guid as TARGET_GUID,value from mgmt\$metric_current where metric_name='Cell_Summary_Statistics' and metric_column='max_celldisk_small_read_latency'	Value<1000

NOTE: All the policies described above are available for download on Oracle Technology Network here:

http://www.oracle.com/technology/products/oem/mgmt_solutions/config_mgmt.html

You can download these policies and policy groups from OTN and review them based on the specific needs of your environment. The next few sections explain how you can create your own policies using the details in **TABLE 1** and **TABLE 2**.

The next few sections describe how to:

- Create a user-defined policy for implementing a Exadata Database Machine best practice

- Create a user-defined policy group to apply multiple custom policies on a set of targets.

User-Defined Policies – Putting It All Together

To create a User-Defined Policy, log into Enterprise Manager and go to **Compliance** Tab — **Policies** sub-tab — **Library** sub-tab, and click on the **Create** button. This will bring up the **Details** page of **Create Policy** wizard, which will guide you through authoring and testing your policy.

Example 1: Shows how to create a policy to check DB_BLOCK_CHECKSUM. This policy is based on the configuration parameters of the database collected by the Enterprise Manager.

On the Details Page enter a suitable name of the policy, select the Target Type as Database Instance, Severity as Critical and provide a recommendation to be followed in case of the policy is violated. Additionally provide the link to any documents or online resources where users can find more details about the policy and the nature of corrective actions

On the SQL Query page specify a SQL for the policy. For this example use the SQL present in TABLE 2 to check for the DB_BLOCK_CHECKING parameter. Click the Validate button to check the SQL.

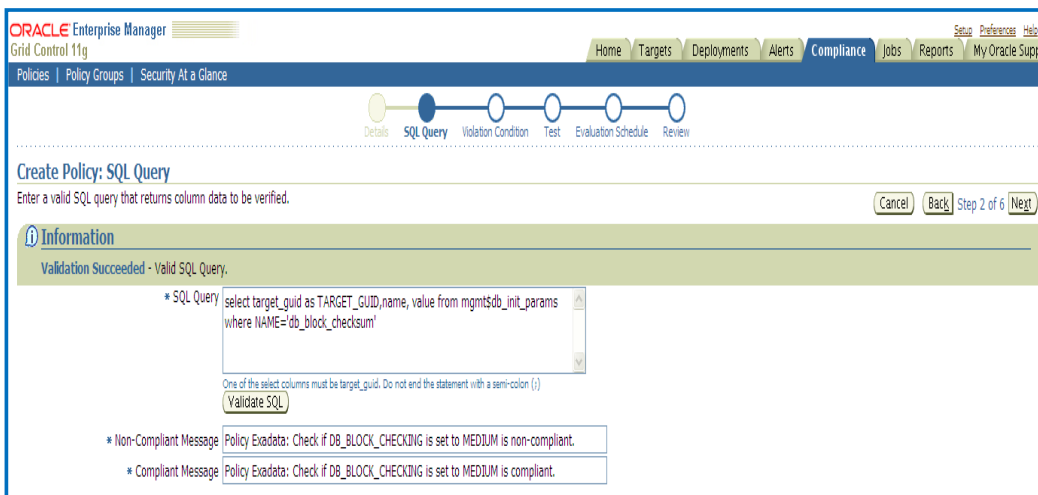


Figure 14: Shows SQL Query step of the Policy creation wizard

On the next page you specify the WHERE clause or the condition which defined the policy violation criteria. Based on the number of key columns in the SQL you will see corresponding entries in the Condition section. You can either set Thresholds for the key columns by selecting a suitable comparison operation and value for comparison as shown below, or you can provide a SQL statement.

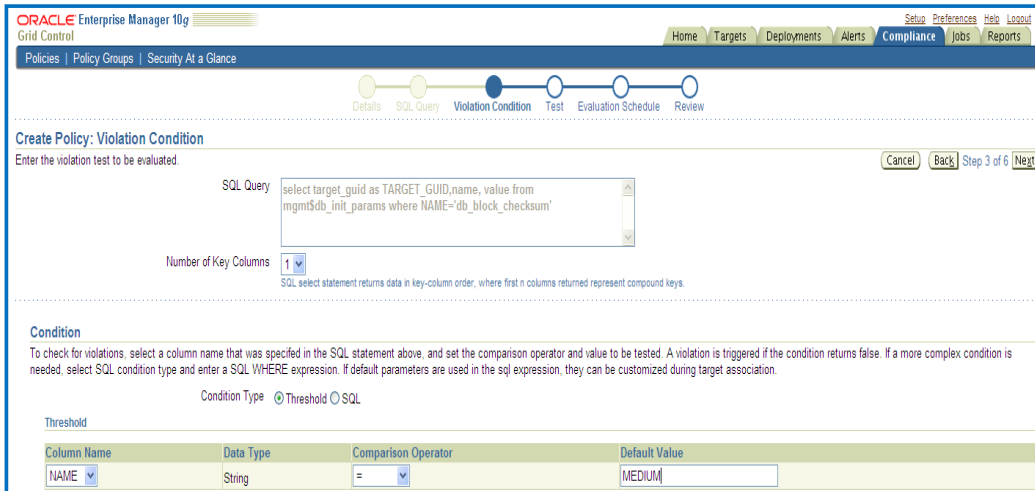


Figure 15: You can specify a condition for policy violation by specifying thresholds or SQL.

Next, test your SQL Query and violation condition by selecting a single target. Clicking on the Run Test button will evaluate the policy of against this target and display the results. Once satisfied go ahead and provide a schedule for policy evaluation (this can be daily, hourly, or every time the agent on the target server uploads fresh configuration information). Review the policy and finish the policy creation process.

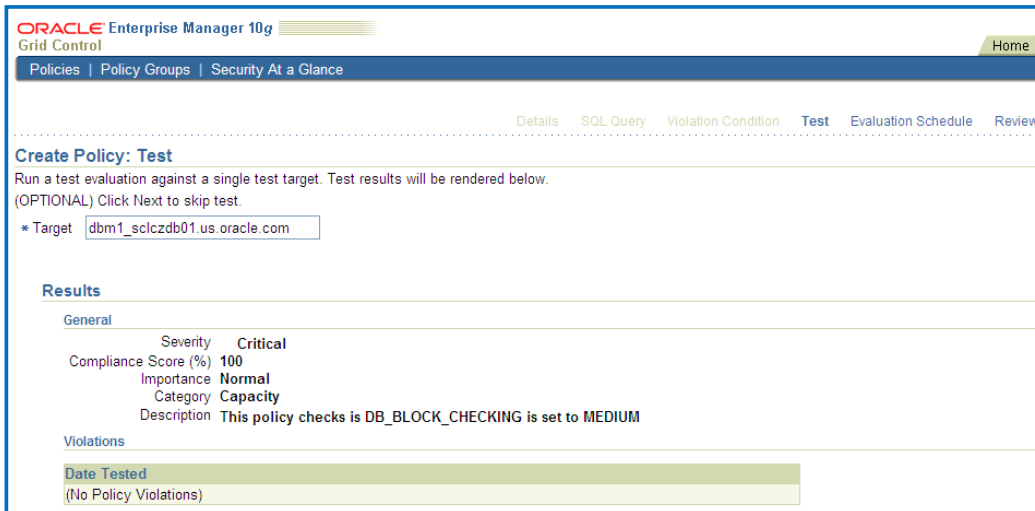


Figure 16: Test Policy using a target before creating the policy.

Creating a User-Defined Policy Group

Once you have created user-defined policies then you can combine multiple such policies in a custom policy group. To create a User-Defined Policy Group, log into Enterprise Manager and go to **Compliance Tab — Policy Groups sub-tab — Library sub-tab**, and click on the **Create** button.

On the page that comes up provide the details about the Policy Group that you are creating and Add one or more policies to the policy group and complete the policy group creation process.

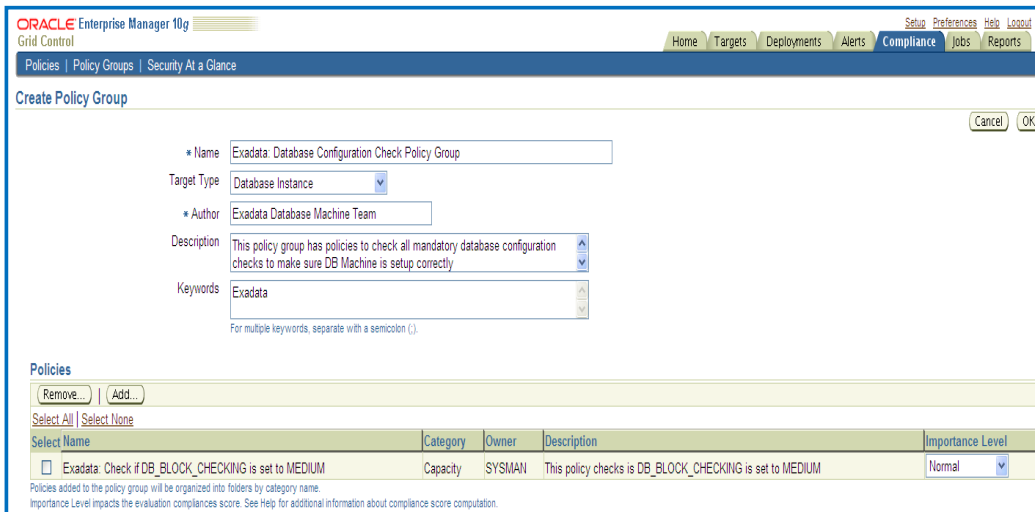


Figure 17: Select one or more policies to create a policy group.

Select the policy group you have created and click on the **Schedule Evaluation** button to provide multiple targets and schedule for evaluation of this policy group. The schedule can be recurring or a one-time on-demand evaluation of policies in the group against a set of targets.

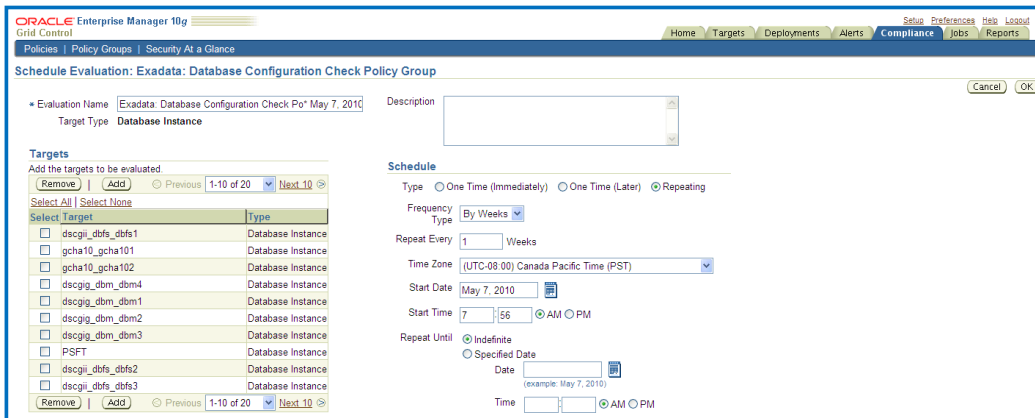


Figure 18: Schedule the policy evaluation against one or multiple targets.

To see the results go to the **Evaluation Results** sub-tab and search for evaluation results based on the policy group name. Click on the results to see compliance score and violations related the policy group.

Importing and Exporting Policies and Policy Groups

Both policies and policy groups can be exported and imported between Enterprise Manager environments as XML files. The option for export and import is available on the Policy Library or Policy Group Library page.

Summary and Conclusion

Oracle Enterprise Manager provides a deep and comprehensive solution for the lifecycle management of your Oracle Exadata Database Machine. Using the Provisioning & Patch Automation and Configuration Management solution of Oracle Enterprise Manager, IT organizations achieve:

Agility

Increased administrator productivity

Improved efficiency

Better quality of service with existing resources

Compliance assurance while keeping operational costs in check.

Customers across industry segments have benefited from the configuration management, patching and provisioning features of Oracle Enterprise Manager. A recent multi-customer study by Forrester indicated a risk-adjusted ROI of 122% with a payback period of 15 months¹.

Configuration Management Pack

Configuration Management automates discovery and monitoring of your Exadata Database Machine tiers, detects drifts from standard configuration baselines, enables you to enforce compliance to standards using automated policies, and helps identify and troubleshoot issues by using features like search, compare and change history tracking.

These features are all part of the Oracle Enterprise Manager Configuration Management Pack.

In addition to the specific functions detailed in this whitepaper, the Configuration Management Pack provides features to:

enable continuous and real time event capture for changes made to your Exadata Database Machine

perform reconciliation with Change Management Systems

provide comprehensive reporting of changes: Who made the change, what change was made, when was it made, and where was the change made.

For more details on the Configuration Management Pack visit:

http://www.oracle.com/technology/products/oem/mgmt_solutions/config_mgmt.html

¹ "The Total Economic Impact™ Of Oracle Enterprise Manager Configuration Management Pack, And Provisioning And Patch Automation Pack", Forrester, March 2009

Provisioning and Patch Automation

Provisioning features orchestrate the otherwise manual process of setting up Exadata Database Machine by automating all the best practice steps out of the box. Provisioning and Patch Automation automates the deployment and ongoing patch management of your Exadata Database Machine. Patch Management features assist administrators in deploying patches in an error-free manner – from identifying the correct patches to orchestrating a mass deployment of patches with a few clicks.

These features are part of the Oracle Enterprise Manager Provisioning and Patch Automation Pack.

In addition to the specific functions discussed in this whitepaper, the Provisioning and Patch Automation pack provides out-of-the-box features like Single Click Extension of RAC Databases, Descale-Delete of a RAC Database, Conversion from single instance to RAC Database, Provisioning of Single Instance Database, Dataguard Configuration and others. These features can be used to create HA environments for your Exadata Database Machine.

For more details on the Provisioning and Patch Automation Pack visit:

http://www.oracle.com/technology/products/oem/mgmt_solutions/provisioning.html



Configuration Management and
Provisioning of Sun Oracle Exadata
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Author: Rajat Nigam

Contributing Authors: John Van Pelt

Andy Oppenheim, Sudip Datta

Adeesh Fulay, Jim Viscusi

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200
oracle.com



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