ORACLE

Oracle Enterprise Manager for Exadata Cloud

Implementation, Management and Monitoring Best Practices

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INTRODUCTION

Oracle Enterprise Manager (EM) is Oracle's integrated enterprise IT management product and provides a complete cloud lifecycle management solution. EM's end-to-end integration with Oracle Engineered Systems, such as the Oracle Exadata Database Machine, provides comprehensive monitoring for traditional on premises systems. In the case of Oracle Exadata Cloud at Customer and Oracle Exadata Cloud Service, collectively Exadata Cloud, EM provides support for monitoring and management of customer visible targets, and this is due to the separation of roles and responsibilities between the customer and Oracle. To help Oracle Exadata customers succeed at their transition to the cloud, this paper compares and contrasts monitoring and management of on-premises and cloud systems, describes the details of EM monitoring for Exadata Cloud, and the best practices for implementing and operating EM in two common Exadata Cloud deployment models:

- Exadata Cloud Service with VPN or Exadata Cloud at Customer
- Exadata Cloud Service without VPN

NOTE: This whitepaper explains how to discover, monitor, and manage Exadata Cloud in Enterprise Manager version 13.3 and 13.2. Enterprise Manager 13.4 builds upon these best practices and introduces an Exadata Cloud Target which provides additional functionality. To take advantage of the improved manageability available with the Exadata Cloud Target, please refer to the Oracle Enterprise Manager Cloud Control for Oracle Exadata Cloud guide for the appropriate version of Enterprise Manager, which replaces the content in this whitepaper. The 13.4 version of the guide can be found [here](#).

THE BUSINESS OF OPERATING EXADATA DATABASE MACHINE AND EXADATA CLOUD

Oracle Exadata Database Machine customers can monitor and manage all of the components of Exadata Database Machine because they purchased all of the hardware and software that makes up the system. Consequently, the Exadata Database Machine Target for EM provides the comprehensive chassis view (Figure 1), and Exadata Database Machine target view (Figure 2) detailing all of the components purchased by the customer. These subsystems include cluster databases, database instances, hosts, Integrated Lights Out Management (ILOM) servers, Exadata Storage Servers, and InfiniBand networks and switches.

Figure 1 Exadata Database Machine EM Chassis View

Figure 2 Exadata Database Machine EM Targets

The EM views into Exadata Cloud (Figure 4) are different than the EM views into Exadata Database Machine because of the differences in management roles and responsibilities between the customer and Oracle (Figure 4).

ORACLE Enterprise Manager Cloud Control 13c

exaspendo-006- Oracle Cloud @

Cluster ▾ Administration ▾

Summary

Status	↑Up
Cluster Name	exaspendo-006
Hosts Status	↑2
Clusterware Status	↑2
Cluster Mode	Flex Cluster
Reconfiguration Activities	Happened

Configuration Changes

Configuration Changes 9

Patch Recommendations

View by ● Classification ○ Target Type

Patch recommendations are not available.

No recommendations to report. Learn More

Job Activity

Summary of jobs whose start date is within the last 7 days.

Show Latest Run ⬍ Search Job Na ⬍ [   ] 🔍

▸ ⓪ Show Jobs

Clusterware

View Clusterware ⬍ View Hub ⬍

View ▾ Detach

Name	St	Incidents △ C C ▲	Compliance Score(%)	Host
has_cfcidv0751m.us2.oraclecloud.com	↑	0 0 0		cfcidv0751m.us2.oraclecloud.com
has_cfcidv0752m.us2.oraclecloud.com	↑	0 0 0		cfcidv0752m.us2.oraclecloud.com

Incidents

View ▾ Target Local target and Related targets ⬍ Category All ⬍ ⬤0 ⬤3

Summary
ora.qosmserver has 1 instances in OFFLINE State
Compliance score 51% is below critical threshold
Compliance score 51% is below critical threshold

Columns H... 14

Cluster Managed Resources

View Cluster Databases ⬍

View ▾ Detach

Database Name	St	Incidents C C △ ▲	Compliance Score(%)	Version
JEFFA.us2.oraclecloud.com	↑	0 0 0 0		12.2.0.1.0
JTWA	▢	0 1 0 0		
JTWB.us2.oraclecloud.com	↑	0 0 0 0		12.2.0.1.0
JTWC.us2.oraclecloud.com	↑	0 0 0 0		12.2.0.1.0
ORCL.us2.oraclecloud.com	↑	0 90 0 0		12.2.0.1.0
ORCLBK1.us2.oraclecloud...	↑	0 0 0 0		12.2.0.1.0

Server Pools

View ▾ Detach

Name	Minim Size	Maximum Size	Impor	Active Servers
Free	0	Entire Clu...	0	
Generic	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.GGCSCDB	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.JEFFA	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.JTWB	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.JTWC	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.ORCL	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.ORCLBK1	0	Entire Clu...	0	cfcidv0751m cfcidv0752m
ora.ORCL_ORCL...	0	Entire Clu...	0	cfcidv0751m
ora.ORCL_ORCL...	0	Entire Clu...	0	cfcidv0752m

Columns H... 2
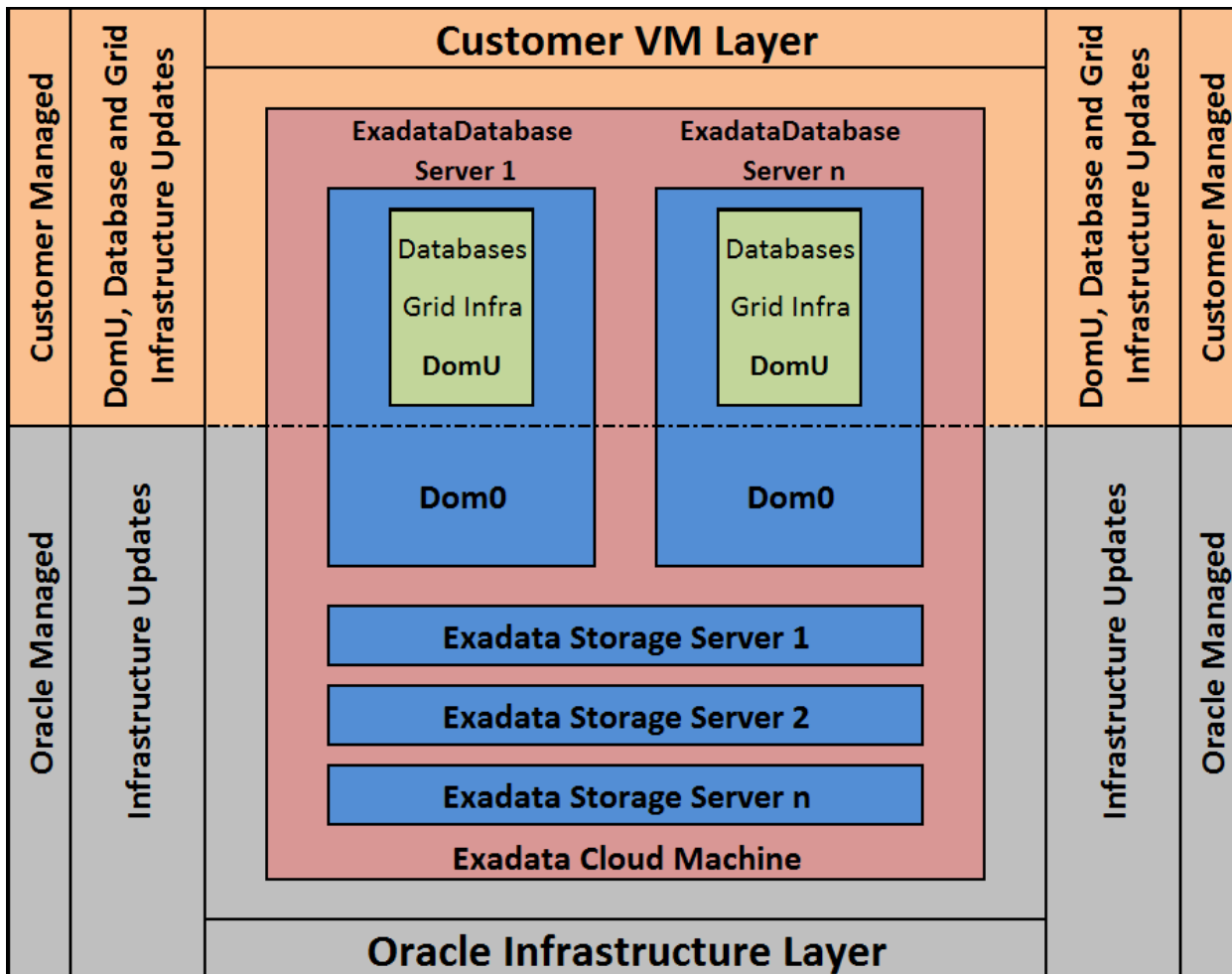
Figure 3 Exadata Cloud EM Targets

Figure 4 Exadata Cloud Management Responsibilities

Customer-managed platform and database components (top of Figure 4) of Exadata Cloud include the following parts of the system:

- Virtual machine (VM) operating systems running the Exadata Compute Node software
- Grid Infrastructure on the Compute Node VM
- Database software on the Compute Node VM

The boxes labeled DomU are the virtual machines running the Exadata Compute Node software, and this is where the customer can install EM agents.

Oracle-managed infrastructure components (bottom of Figure 4) include the following parts of the system:

- Ethernet switches
- InfiniBand switches
- Power supplies
- Exadata Storage Servers
- Hypervisor running on the physical servers

The customer does not have direct access to the Oracle-managed infrastructure components or to the monitoring data from these components. In the case of complex support issues, the customer and Oracle support may exchange information about their respective views into the system as appropriate for the circumstances.

To use EM to monitor and manage Exadata Cloud the customer installs EM agents on the Exadata Cloud Compute nodes, and then discovers the Grid Infrastructure, Cluster Database, and other targets associated with the Oracle Real Application Cluster (RAC) on Exadata Cloud. This process is similar to the discovery performed for those corresponding targets in on-premises Exadata Database Machine. The Exadata Database Machine infrastructure components, however, are not discoverable from the customer's EM for Exadata Cloud.

BEST PRACTICES FOR COMBINED USE OF ENTERPRISE MANAGER AND CLOUD AUTOMATION

NOTE: For Enterprise Manager version 13.4 or later, please do not follow this whitepaper. Refer to this note above for more details.

Deployments of Exadata Cloud are different than deployments of Exadata Database Machine in two important ways:

- Exadata Cloud is a subscription to a service, not a purchase of hardware and software
- The definition of Exadata Cloud service does not include access to the physical hardware or management of the Exadata Storage Server

Because of the differences between Exadata Cloud and on-premises Exadata Database Machine, management actions that require coordination between the customer-accessible database and platform, and the Oracle-managed infrastructure, should be performed through Oracle Cloud Automation. Complete details of available Oracle Cloud Automation are found in the appropriate Oracle Cloud Documentation. For information about using the APIs in Oracle Cloud Infrastructure, see Developer Tools. For information about using the APIs in Oracle Cloud Infrastructure Classic, see Exadata Cloud Service REST APIs or Exadata Cloud at Customer REST APIs. For optimal system deployment and maintenance, Oracle Cloud Automation should be used to perform the following tasks:

- ASM disk group creation
- Stopping, starting, or restarting a database node
- Managing SSH access
- Container Database (CDB) or non-CDB creation and deletion
- Control and monitor Exadata IORM
- Database backup and restore
- Database patching
- Creating, deleting, and viewing database snapshots

Management actions that are performed within the database, and actions not covered by the aforementioned list, and may be performed through EM. For example, EM may be used to perform the following tasks:

- ASM storage space monitoring and management
- Management of In-Memory processing

- Pluggable Database creation, management and deletion
- Scheduling of database jobs
- Database resource management
- Database feature usage
- Schema management
- Database security management beyond SSH access
- Database performance monitoring

By separating platform and infrastructure service-specific tasks from database-specific tasks, users of Exadata Cloud can apply EM to optimize monitoring and management processes. Customers should take care to ensure EM usage follows the established best practices in this document to avoid creating implementations that are difficult to manage. For example, if a customer uses EM to create a database outside of Oracle Cloud Automation, then that database cannot be patched or restarted with Oracle Cloud Automation. Likewise, if a customer uses EM to create database backups, then Oracle Cloud Automation will not have visibility to the backups or the ability to restore from them. These situations can be handled with additional management effort, but for the simplest and fastest experience with Exadata Cloud they should be avoided when possible.

AGENT DEPLOYMENT OPTIONS FOR EXADATA CLOUD TARGETS AND ENTERPRISE MANAGER

NOTE: For Enterprise Manager version 13.4 or later, please do not follow this whitepaper. Refer to this note above for more details.

The screen shots and examples in this paper were created using Oracle Enterprise Manager 13.2. Subsequent versions of Oracle Enterprise Manager and Oracle Enterprise Manager plug-ins may have updated screens and procedures. Please refer to the documentation specific to your release when implementing Oracle Enterprise Manager.

The Enterprise Manager Agent is deployed and configured for Exadata Cloud through the following process:

- Identify deployment model
- Complete deployment pre-installation tasks
- Create named credentials
- Deploy agents
- Discover Cluster
- Discover ASM, Database, and Listener

Deployment Models

There are two deployment models EM agents for Exadata Cloud:

- Standard agents for Exadata Cloud at Customer and Exadata Cloud Service with VPN
- Hybrid Cloud Agents for Exadata Cloud at Customer without VPN

Standard agents are used when network access is open between the Oracle Management Server (OMS) and the Exadata Cloud Compute node VM. This use case is typical when the network is either secured in the customer's on-premises data center, or by a VPN between the customer's data center and the Oracle Public Cloud. In use cases where on-premises EM manages Exadata Cloud Service without a VPN, all communication is secured by ssh connectivity between the OMS servers, and in this use case a Hybrid

Cloud Agent must be installed on the Exadata Cloud Compute Node VMs. Figure 5 shows this use case. Monitoring and management functionality is the same in either deployment model.
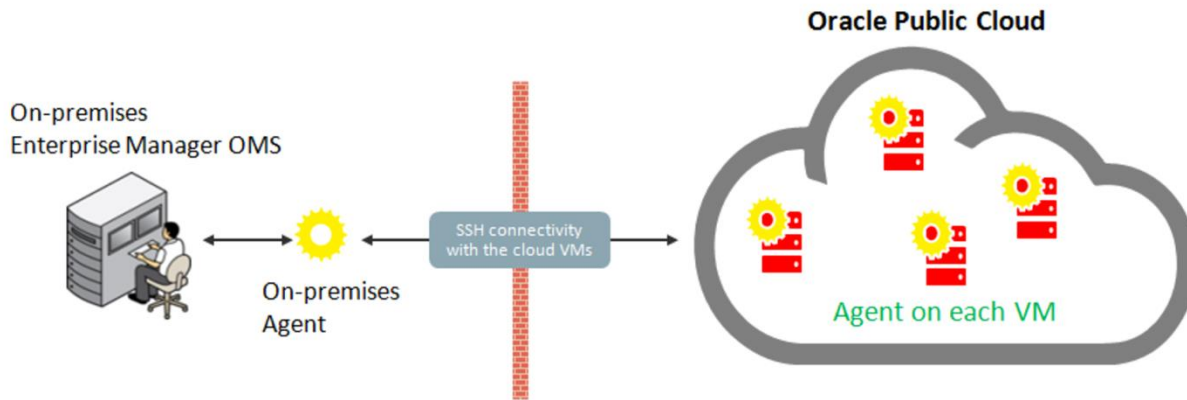

Figure 5 Hybrid Cloud Agent Network Diagram

Preinstallation Tasks

The following prerequisite steps are required for configuring EM to monitor and manage Exadata Cloud:

- Ensure OMSs can resolve the Fully Qualified Domain Names (FQDNs) of the compute nodes
- Install public key file to oracle and opc users on Exadata Cloud Compute Nodes or identify keys used to access accounts
- Copy SSH public and private key files provisioned for access to the compute nodes to the EM console host where the discovery will be performed
- Obtain passwords for accounts used to monitor ASM and databases on the compute nodes
- Select a port to use for the EM agent, and confirm that the port is not currently in use on each compute node
- Identify the path that will be used for the installation directory for the agents on each compute node; e.g., /u02/app/oracle/em/agent_haem
- Ensure there is and will be sufficient disk space available in the installation directory

For more information on requirements for EM agent installation, see Hardware Requirements for Enterprise Manager Cloud Control in the Enterprise Manager Cloud Control Basic Installation Guide at http://docs.oracle.com/cd/E73210_01/EMBSC/GUID-8A43781B-83E3-4BB9-A3DA-A0F6BA9823D8.htm#GUID-D4185A25-EA9C-4610-B6B3-974BD0E874C1.

Create Named Credentials

Enterprise Manager uses Named Credentials to access the Exadata Cloud Compute Nodes. These credentials are private ssh keys configured for access to the opc and oracle users on the compute nodes, and allow for secure passwordless authentication from EM to the Exadata Cloud Compute Nodes. The following sections show how to create named credentials for the oracle and opc users.

Create named credentials for the oracle user

1. Navigate to Setup->Security->Named Credentials
2. Click Create

3. Enter a name for the credential, such as the following NC_HOST_SSH_ORACLE_<VMNAME>_<YYYYMMDD>
4. Ensure Authenticating Target Type is Host
5. Select SSH Key Credentials for Credential type
6. Select Global for Scope
7. Enter oracle for User Name
8. Specify the SSH Private Key that allows access to the oracle user for the VM
9. Click Browse... next to Upload Private Key for the SSH Private Key
10. Navigate to and select the Private Key file for the oracle user for this VM
11. Press Open
12. Specify the SSH Public Key that allows access to the oracle user for the VM
13. Click Browse... next to Upload Public Key for the SSH Public Key
14. Navigate to and select the Public Key file for the oracle user for this VM
15. Press Open
16. Leave Run Privilege as None
17. Optional - If the credentials will be used by other EM users, grant access to the credential
18. Press Save
19. Press Save when presented with the Warning dialog as the credential must be saved without testing because the target has not yet been discovered

Create named credentials for the opc user

1. Navigate to Setup->Security->Named Credentials
2. Click Create
3. Enter a name for the credential, such as the following NC_HOST_SSH_ORACLE_<VMNAME>_<YYYYMMDD>
4. Ensure Authenticating Target Type is Host
5. Select SSH Key Credentials for Credential type
6. Select Global for Scope
7. Enter opc for UserName
8. Specify the SSH Private Key that allows access to the opc user for the VM
    a. Click Browse... next to Upload Private Key for the SSH Private Key
    b. Navigate to and select the Private Key file that allows access to the opc user for this VM
    c. Press Open
9. Specify the SSH Public Key that allows access to the opc user for the VM
    a. Click Browse... next to Upload Public Key for the SSH Public Key
    b. Navigate to and select the Public Key file that allows access to the opc user for this VM
    c. Press Open
10. Select Sudo for Run Privilege
11. Enter root for Run as
12. Optional - If the credentials will be used by other EM users, grant access to the credential
13. Press Save
14. Press Save when presented with the Warning dialog as the credential must be saved without testing because the target has not yet been discovered

Deploy Agents

After ensuring host names resolve, TCP ports are open, and login credentials work, then EM agents can be deployed from the OMS to the Exadata Cloud Compute Nodes. The processes to deploy standard and Hybrid Cloud agents are slightly different, and are detailed in the following sections.

Standard Agent: Exadata Cloud Service with VPN or Exadata Cloud at Customer

Access to Exadata Cloud Service with VPN or Exadata Cloud at Customer makes use of a standard agent. The following prerequisites must be met before deploying the standard agent in these environments:

- Ensure that required ports are open on the compute nodes; the OMSs must be able to communicate to the listener and agent on the compute nodes, and the agents on the compute nodes must be able to communicate with the configured upload port for the OMSs.
- Ensure that the compute nodes can resolve the FQDN for the configured upload port for the OMSs

For more information about enabling access to a compute node port on Exadata Cloud Service, see Enabling Access to a Compute Node Port in Using Oracle Database Exadata Cloud Service http://docs.oracle.com/en/cloud/paas/exadata-cloud/csexa/enable-access-port.html.

For more information about enabling access to a compute node port on Exadata Cloud at Customer, see Enabling Access to a Compute Node Port in Oracle Public Cloud Machine Using Oracle Exadata Cloud at Customer https://docs.oracle.com/cloud-machine/latest/exadatacm/EXACM/GUID-AD275C82-1D35-41E8-B958-B872F97E4D90.htm#EXACM-GUID-AD275C82-1D35-41E8-B958-B872F97E4D90.

For more information about ports required for Enterprise Manager see Configuring Enterprise Manager for Firewalls in the Enterprise Manager Cloud Control Advanced Installation and Configuration Guide http://docs.oracle.com/cd/E73210_01/EMADV/GUID-E00C6B3B-D5E2-4E2F-9F94-8A136E3D696E.htm#EMADV625.

Perform the following steps in EM for each Exadata Cloud Compute Node VM

1. Navigate to Setup -> Add Target -> Add Targets Manually
2. Select Install Agent on Host
3. Press Add
4. Enter the FQDN or IP address for the Compute Node VM as the Host
5. Select Linux x86-64 for the Platform
6. Press Next
7. Specify the Installation Base Directory (e.g., /u02/app/oracle/em/agent_haem)
8. Select the named credential for the oracle user for this VM for Named Credential
9. Select the named credential for the opc user for this VM for Root Credential
10. Update the Port as necessary to the port identified for use for the agents in this environment
11. Press Next
12. Review the information on the Add Host Targets: Review page and if correct, press Deploy Agent

For further detail see Installing Oracle Management Agents in the Oracle Enterprise Manager Cloud Control Basic Installation Guide at http://docs.oracle.com/cd/E73210_01/EMBSC/GUID-D08C7C37-7BCD-4E32-A74B-7C5FD266D151.htm#EMBSC181.

Some jobs within Enterprise Manager are executed via the agent's ability to ssh into the local host. Therefore, after the successful installation of the Oracle Management Agent, follow the steps below to ensure that the compute nodes have the ability to ssh to localhost.

1. Connect as the root user on the compute node where the EM agent will be installed
2. Change into the /etc/ssh directory
3. Edit sshd_config
4. Add "ListenAddress 127.0.0.1" after the line containing "Address Family" as in the example below:
      AddressFamily inet
      ListenAddress 127.0.0.1
   NOTE: the ListenAddress line must be after the AddressFamily line in the sshd_conf file. If it is not, sshd will not restart.
5. Restart sshd:
   service sshd restart
6. Repeat for each compute node

Hybrid Cloud Agent: Exadata Cloud Service without VPN

Access to Exadata Cloud Service without VPN requires Hybrid Cloud Management with the EM Hybrid Cloud Agent. The following prerequisites must be met before deploying the Hybrid Cloud Agent:

- At least one agent in the Enterprise Manager environment is configured as a Hybrid Cloud Gateway Agent. Consider configuring additional hybrid cloud gateway agents in different locations for availability
- Hybrid Cloud Gateway Agent(s) can resolve the FQDNs of the compute nodes or access Compute Nodes by IP address
- Hybrid Cloud Gateway Agent(s) can access Compute Nodes via ssh directly or through a proxy server. If direct communication is not possible, configure an external proxy
- Ensure OMSs will be able to communicate with the compute nodes via ssh. If direct communication is not possible, the OMS uses the My Oracle Support (MOS) Proxy by default or another Agent Proxy can be configured

Additional details are shown in Prerequisites for Installing Agents on Oracle Cloud VMs in Enabling Hybrid Cloud Management in the Oracle Enterprise Manager Cloud Control Administrator's Guide http://docs.oracle.com/cd/E73210_01/EMADM/GUID-5D80BFCD-AA60-4805-89EE-26B4C1E9E4B0.htm#EMADM15148.

For more information on configuring an external proxy for use with the Hybrid Cloud Gateway Agents, see Configuring an External Proxy to Enable Gateways to Communicate with the Oracle Cloud in the Oracle Enterprise Manager Cloud Control Administrator's Guide http://docs.oracle.com/cd/E73210_01/EMADM/GUID-5D80BFCD-AA60-4805-89EE-26B4C1E9E4B0.htm#EMADM15295.

For more information on configuring a proxy for the OMSs, see Registering the Proxy Details for My Oracle Support in the Oracle Enterprise Manager Lifecycle Management Administrator's Guide http://docs.oracle.com/cd/E73210_01/EMLCM/GUID-DFB714BE-7400-46E8-99E7-6F6B1138A6EF.htm#GUID-B4ED6C20-9427-417F-A227-2A61DDB1EBDC.

After validating the aforementioned prerequisites, perform the following steps for each of the Compute Node VMs of the Exadata Cloud Service:

1. Navigate to Setup -> Add Target -> Add Targets Manually
2. Select Install Agent on Host
3. Press Add
4. Enter the FQDN or IP address for the Compute Node VM as the Host
5. Select Linux x86-64 for the Platform

6. Press Next
7. Specify the Installation Base Directory (e.g., /u02/app/oracle/em/agent_haem)
8. Select the Configure Hybrid Cloud Agent checkbox
9. Select a Hybrid Cloud Gateway Agent
10. Confirm the Hybrid Cloud Gateway Proxy Port
11. Select or add the named credential for the oracle user for this VM for Named Credential
12. Select or add the named credential for the opc user for this VM for Root Credential
13. Update the Port as necessary to the port identified for use for the agents in this environment
14. Press Next
15. Review the information on the Add Host Targets: Review page and if correct, press Deploy Agent

For further detail see Hybrid Cloud Management Prerequisites and Basic Setup in the Oracle Enterprise Manager Cloud Control Administrator's Guide at http://docs.oracle.com/cd/E73210_01/EMADM/GUID-5D80BFCD-AA60-4805-89EE-26B4C1E9E4B0.htm#EMADM15292 and Enabling Hybrid Cloud Management in the Oracle Enterprise Manager Cloud Control Administrator's Guide at http://docs.oracle.com/cd/E73210_01/EMADM/GUID-5D80BFCD-AA60-4805-89EE-26B4C1E9E4B0.htm#EMADM15141.

Some jobs within Enterprise Manager are executed via the agent's ability to ssh into the local host. Therefore, after the successful installation of the Oracle Management Agent, follow the steps below to ensure that the compute nodes have the ability to ssh to localhost.

1. Connect as the root user on the compute node where the EM agent will be installed
2. Change into the /etc/ssh directory
3. Edit sshd_config
4. Add "ListenAddress 127.0.0.1" after the line containing "Address Family" as in the example below:
   AddressFamily inet
   ListenAddress 127.0.0.1
   NOTE: the ListenAddress line must be after the AddressFamily line in the sshd_conf file. If it is not, sshd will not restart.
5. Restart sshd:
   service sshd restart
6. Repeat for each compute node

Discover Cluster

After the agents are deployed the next step is to discover the Oracle High Availability Service and Cluster targets using the following steps:

1. Navigate to Setup -> Add Target -> Add Targets Manually
2. Select Add Using Guided Process
3. Select Oracle Cluster and High Availability Service
4. Press Add
5. Press the magnifying glass next to Specify Host
6. Filter as necessary and select the first VM target
7. Press Select
8. Press Discover Target
9. Review the Cluster Target Properties, updating the target name if desired
10. Press Save

For further detail see Discovering and Adding Cluster Targets in the Oracle Enterprise Manager Cloud Control Administrator's Guide http://docs.oracle.com/cd/E73210_01/EMADM/GUID-86BE0C0D-552C-4968-BF2E-BD8DC2ACD081.htm#EMADM13658.

Discover ASM, Database, and Listener

After discovering the Oracle High Availability Service and Cluster targets Enterprise Manager can discover ASM, databases, and listeners using the following steps:

1. Wait for the Oracle High Availability Service and Cluster targets discovered previously to show Up
2. Navigate to Setup -> Add Target -> Add Targets Manually
3. Select Oracle Database, Listener and Automatic Storage Management
4. Press Add
5. Press the magnifying glass next to Specify Host or Cluster
6. Filter as necessary and select the cluster discovered previously
7. Press Select
8. Press Next
9. Review the discovery results for the Cluster Database, Cluster ASM, and Listener targets
10. Confirm/edit the Monitoring Credentials for the cluster databases, select the row, and press Test Connection to ensure the monitoring credentials are correct
11. Confirm/edit the Monitoring Credentials for the cluster ASM, select the row, and press Test Connection to ensure the monitoring credentials are correct
12. Select the Cluster Database(s), ASM Cluster, and Listeners to be discovered.
13. Press Next
14. Review the targets being discovered and ensure information is correct.
15. Once the information is correct, press Save
16. Review the status on the Confirmation dialog and press Close

For further detail see Discovering and Adding Database Targets in the Oracle Enterprise Manager Cloud Control Administrator's Guide at http://docs.oracle.com/cd/E73210_01/EMADM/GUID-86BE0C0D-552C-4968-BF2E-BD8DC2ACD081.htm#EMADM15517.

EXADATA CLOUD VS EXADATA DATABASE MACHINE: MONITORING TARGETS

NOTE: For Enterprise Manager version 13.4 or later, please do not follow this whitepaper. Refer to this note above for more details.
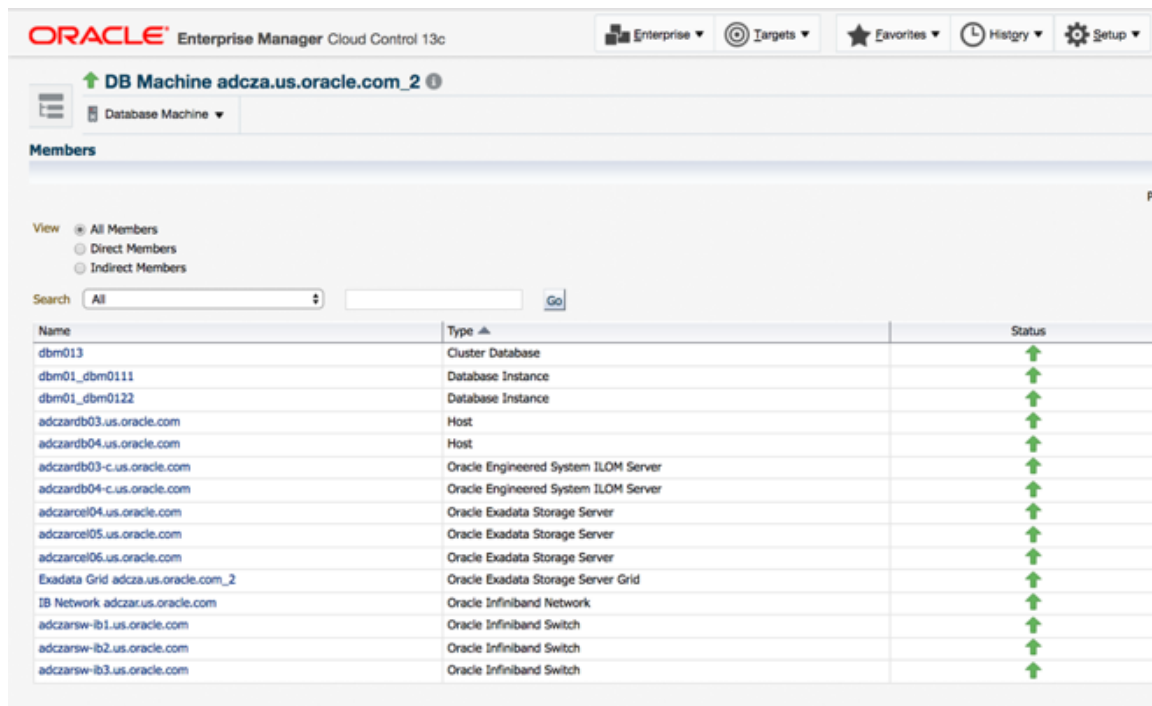
This section compares and contrasts Exadata Cloud and Exadata Database Machine in the context of the following monitoring tasks:

- General database and Grid Infrastructure administration
- Database performance and Oracle Automated Workload Repository (AWR)
- Database server operating system
- IO Resource Management (IORM)
- Exadata Storage Servers
- ASM storage space monitoring

Target Overview

This section provides an overview of available targets for Exadata Database Machine with Exadata Cloud. In this section, side by side screen shots are shown highlighting the similarities and differences between the Exadata Cloud Service and Exadata Cloud at Customer. Specific notes are called out for what can be discovered by an Exadata target compared to a database server target, and how Oracle support reports on the infrastructure not visible to the customer.

EM can discover databases, database instances, Grid Infrastructure, hosts, Exadata Storage Servers, InfiniBand Network, InfiniBand Switches, and Integrated Lights Out Management (ILOM) consoles from the Exadata Database Machine targets (Figure 6). This gives customers full control of managing all aspects of the Exadata Database Machine, including visibility into unused space on Exadata Storage Servers and a unified view of the storage consumed by all databases on a given Exadata Storage Server.

Figure 6: Exadata Database Machine EM Targets

EM can discover databases, database Instances, and Grid Infrastructure from the agents deployed on the Compute Node VM Host targets of Exadata Cloud (Figure 7). Oracle Cloud Operations monitors and manages the hypervisors supporting the Compute Node VMs, Exadata Storage Servers, InfiniBand Network, InfiniBand Switches, and Integrated Lights Out Management (ILOM) consoles to complete end-to-end management of Exadata Cloud. This arrangement gives customers full monitoring and management of individual databases and Grid Infrastructure, but restricts visibility into the Exadata Storage Cell. For example, customers can see how much space is used and available in a given ASM disk group, but the customer cannot see storage capacity on the Exadata Storage Server that has not been allocated to an ASM disk group. In the context of Exadata Cloud this restriction poses no practical limitation because all of the storage in an Exadata Storage Server is provisioned and available in the ASM disk group in Exadata Cloud deployments.
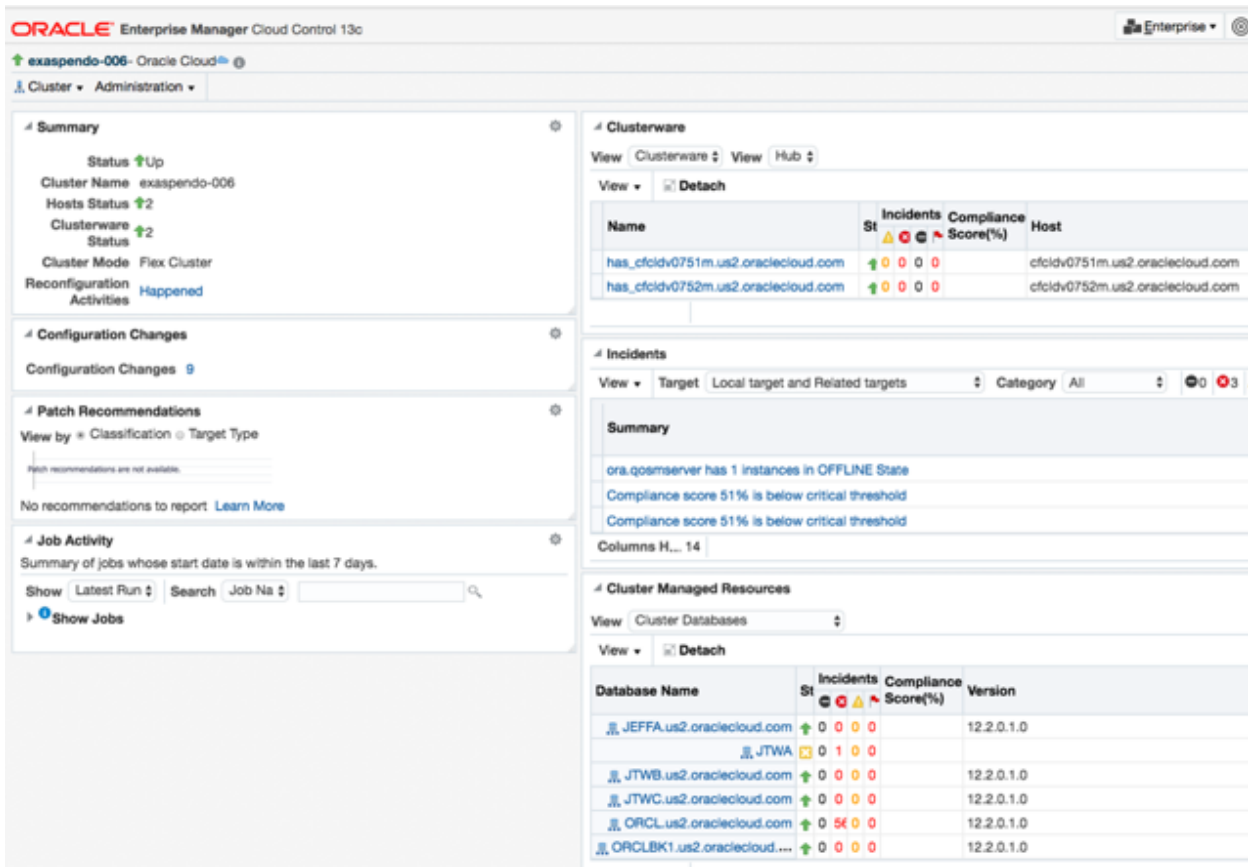
Figure 7 Exadata Cloud Cluster Target

Host, Database, Grid Infrastructure, and Exadata Storage Server Administration

The EM Grid Infrastructure views for Exadata Cloud and Exadata Database Machine provide similar information for cluster databases, database instances, and Grid Infrastructure. Variations in the display of the material are due to the differences in the general purpose targets and the Exadata Database Machine target. Similarly, the EM Cluster Database views for Exadata Cloud (Figure 8) and Exadata Database Machine (Figure 9) are the same.

Figure 8 Exadata Cloud Cluster Database Target
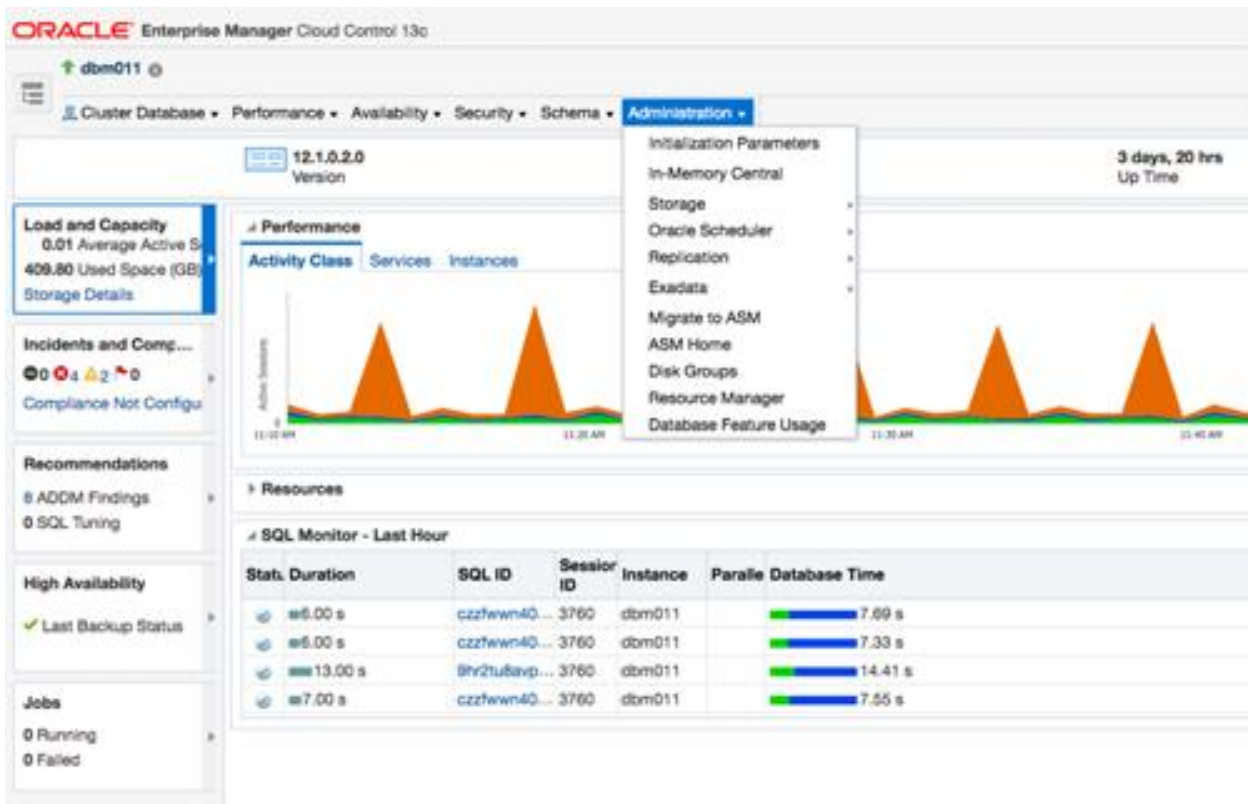
Figure 9 Exadata Database Machine Cluster Database Target

Both views can tell that the Cluster Database is running on an Exadata platform, however, when the Exadata Storage System Home view is opened for Exadata Cloud (Figure 10) there is no data from the Exadata Storage Servers, while the same view for Exadata Database Machine (Figure 11) shows complete data from the Exadata Storage Servers. This is due to the separation of roles and responsibilities in Exadata Cloud, specifically, Oracle Cloud Operations manages the Exadata Storage Server so the customer's EM view does not have access to the Exadata Storage Server in Exadata Cloud.
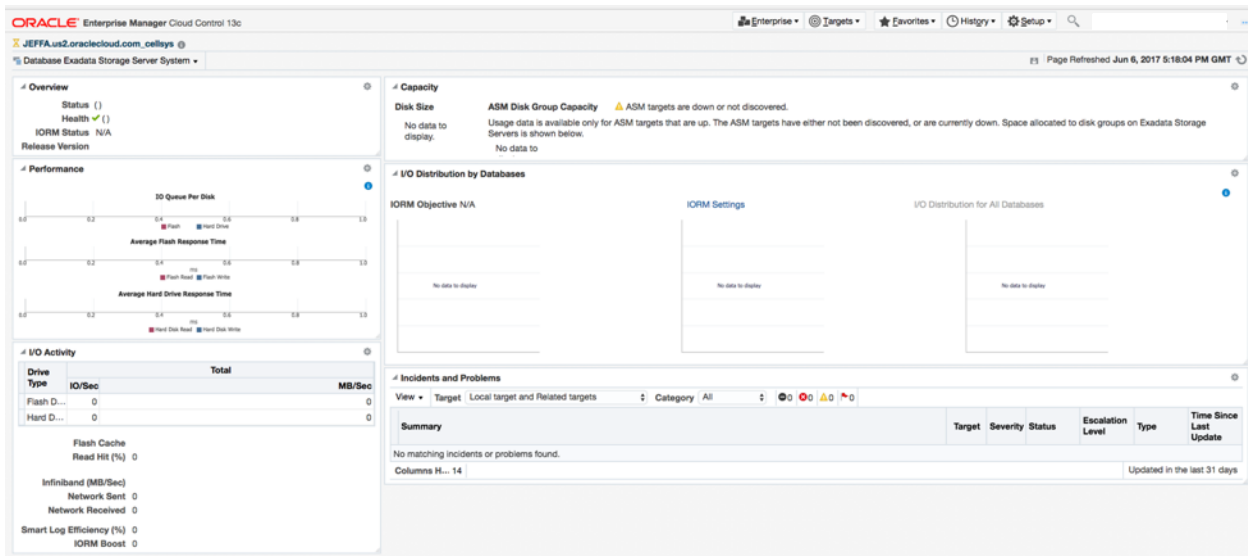
Figure 10 Exadata Storage Server System for Exadata Cloud
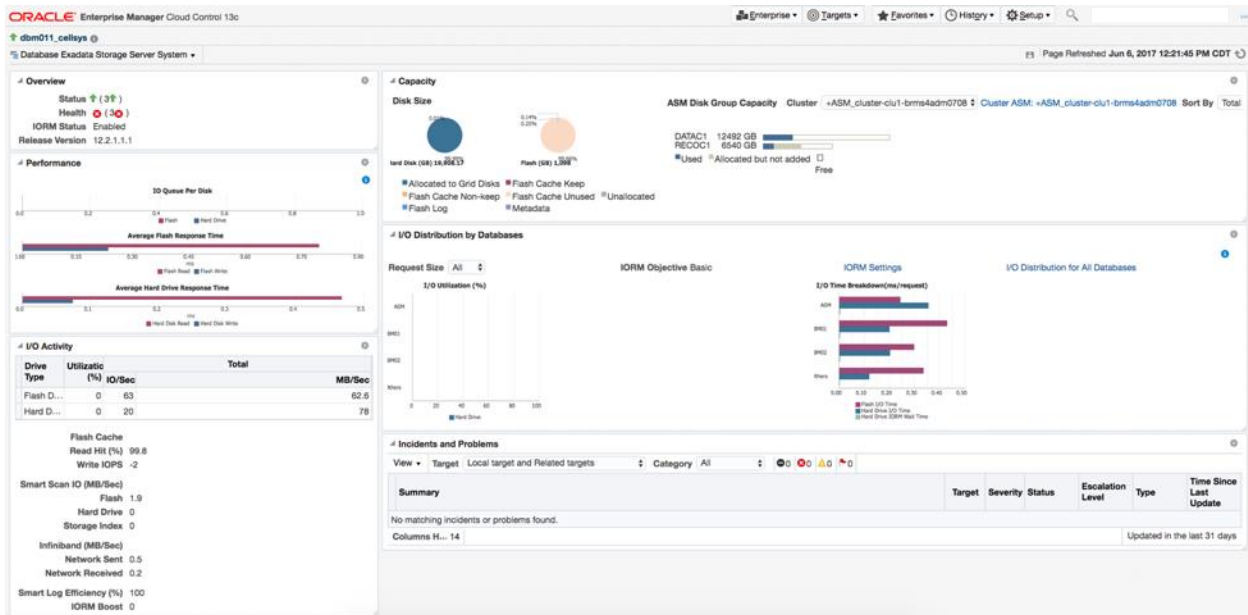
Figure 11 Exadata Storage Server System for Exadata Database Machine

EXADATA CLOUD VS EXADATA DATABASE MACHINE: MANAGEMENT BEST PRACTICES

NOTE: For Enterprise Manager version 13.4 or later, please do not follow this whitepaper. Refer to this note above for more details.

Monitoring best practices are similar for Exadata Cloud and Exadata Database Machine, but management practices are different due to Oracle Cloud Automation in Exadata Cloud deployments. For Oracle Cloud Automation to be aware of configuration changes, such as creating or deleting a database, Oracle Cloud Automation must make the changes. This means that configuration best practices when using EM for Exadata Cloud are to use Oracle Cloud Automation to perform platform management tasks, and to use EM to perform management tasks within the database. In the event that changes are made through EM then subsequent work may be required to reconcile the changes with the Oracle Cloud Automation, or the Oracle Cloud Automation may not function correctly.

Creating and deleting databases

Creating a database can be accomplished by web user interfaces and programmatic interfaces in both Oracle Cloud Infrastructure (Gen 2) and Oracle Cloud Infrastructure Classic (Gen 1) Exadata Cloud Services and in Oracle Cloud Infrastructure (Gen 2) and Oracle Cloud Infrastructure Classic (Gen 1) Exadata Cloud at Customer. For information about using the APIs in Oracle Cloud Infrastructure, see Developer Tools. For information about using the APIs in Oracle Cloud Infrastructure Classic, see Exadata Cloud Service REST APIs or Exadata Cloud at Customer REST APIs.

The EM Guided Discovery Process should be used to add database, listener, and Automatic Storage Management on one of the host targets for Exadata Cloud (Figure 12 through Figure 15) after creating a database with the Cloud Automation Web UI or REST API. The following figures provide an example of how to do this with the EM Web UI. Note, the password for the dbsnmp user is the same as the adminPassword used in the JSON payload to create the database.
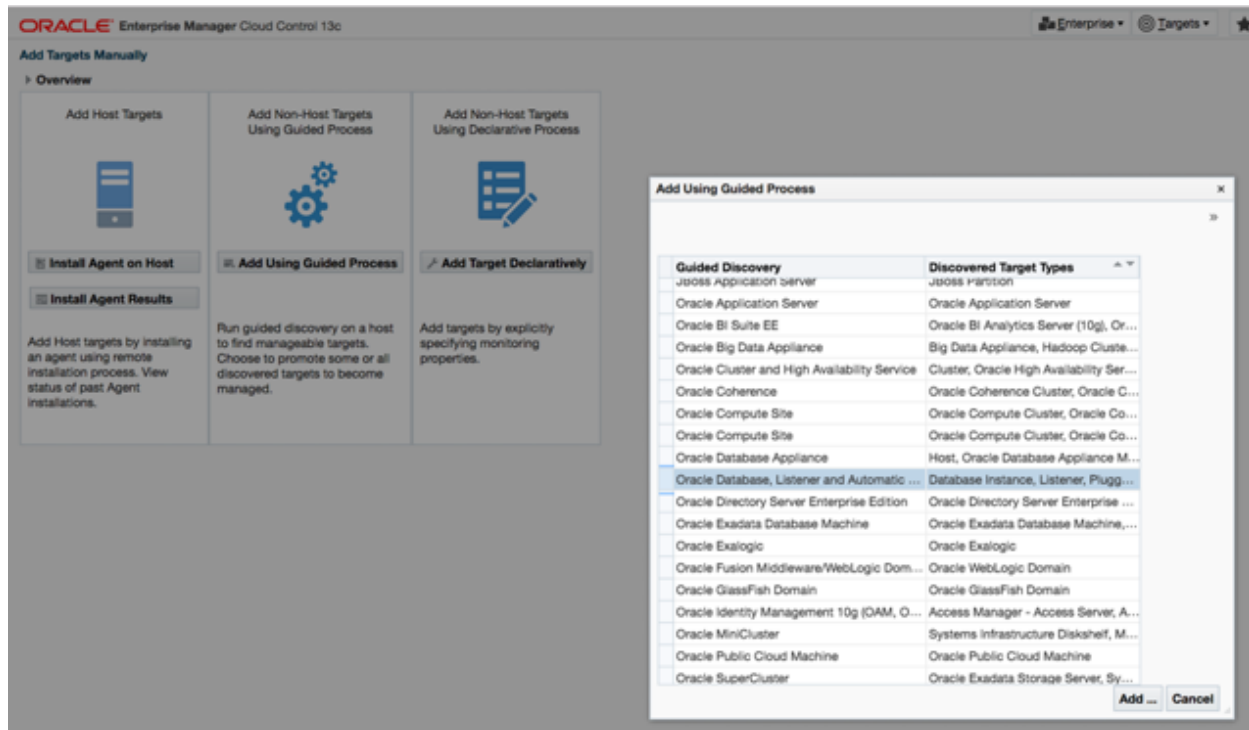
Figure 12 Oracle Database, Listener, and Automatic Storage Target Using Guided Process
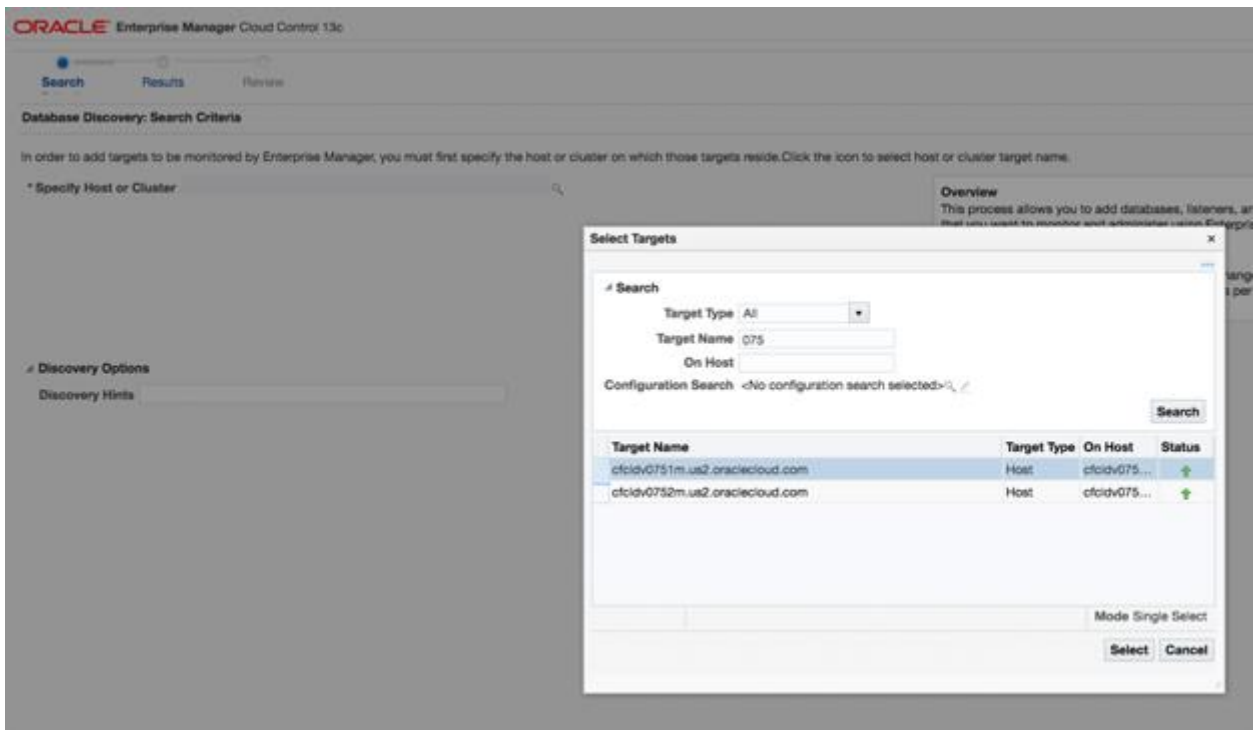
Figure 13 EM Discovery of Target on Compute Node VM
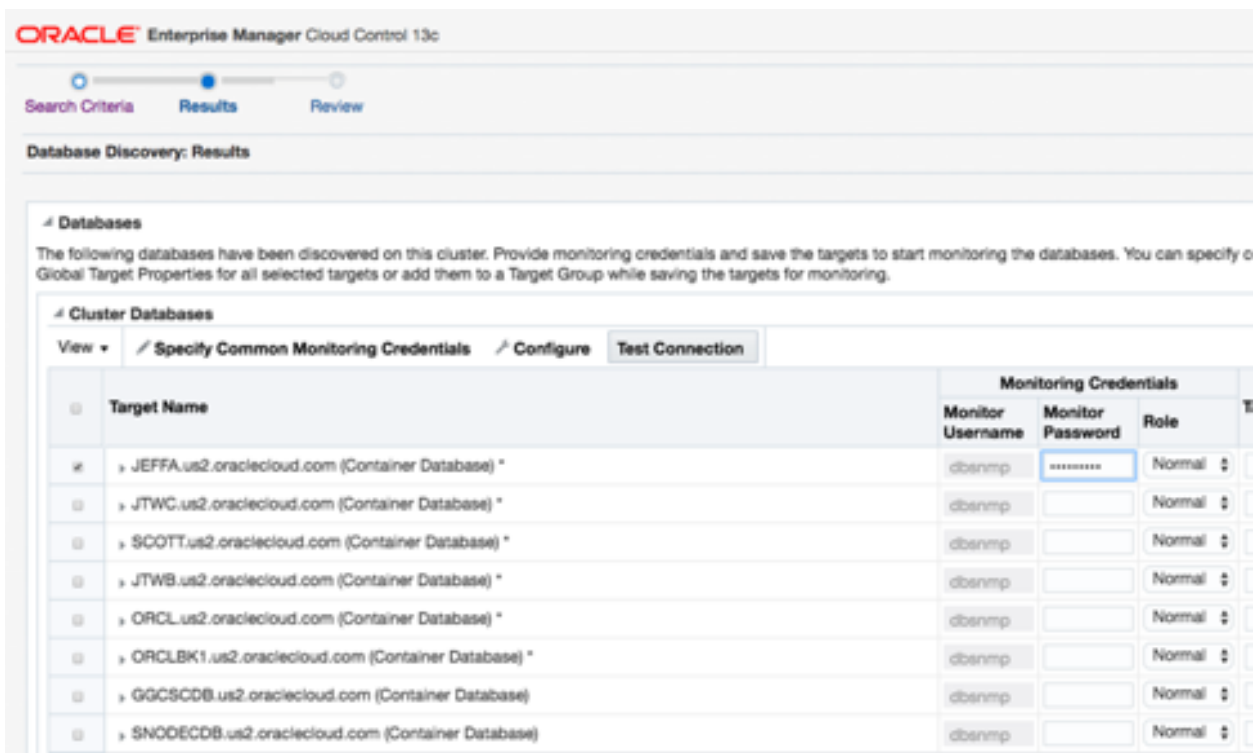
Figure 14 Finalizing discovered targets
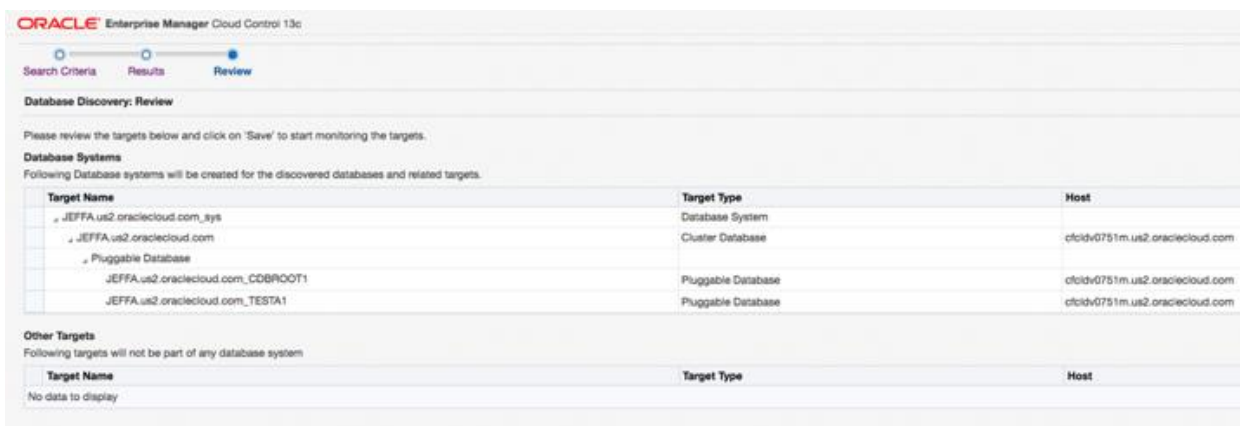
Figure 15 Database System discovery complete

Prior to deleting a database, the target should be removed from EM using the EM CLI or EM Web UI. An example of deleting an EM database target via EMCLI is shown below.

```
$ emcli delete_target -name="JEFFA.us2.oraclecloud.com" -type="rac_database" -
delete_members
```

Deleting a database is performed using the Cloud Automation via a Web UI, or a simple REST DELETE call to the endpoint defined by the database service, as shown below.

```
$ curl -X DELETE --connect-timeout 2 --user XXX --header "X-ID-TENANT-NAME:a462468"
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/a462468/JEFFA
```

Database Performance and Oracle Automated Workload Repository (AWR)

AWR reports pull data directly from Oracle database tables. Since the Oracle database runs within the customer's control, the AWR data is the same for Exadata Database Machine and Exadata Cloud (Figure 16). This feature allows customers to monitor the efficacy of certain Exadata Database Machine features, such as Smart Scan and Flash Cache, in Exadata Cloud deployments using the same methods they use for Exadata Database Machine.

ORACLE Enterprise Manager Cloud Control 13c

⬆ JTWB.us2.oraclecloud.com (Container Database)- Oracle Cloud ⬆ ▣ ⓘ

☰ ▥ Cluster Database ▾   Performance ▾   Availability ▾   Security ▾   Schema ▾   Administration ▾

Exadata Storage Server Model

- Model information of Servers
- CPU Count refers to logical CPUs, including cores and hyperthreads

Model	CPU Count	Memory (GB)	# Cells	Cells
Oracle Corporation ORACLE SERVER X6-2L High Capacity	40/40	126	3	cfclcx2743, cfclcx2744, cfclcx2745

Back to Exadata Server Configuration

Exadata Storage Server Version

- Version information of packages on the storage server

Package Type	Package Version	Cells
Kernel	2.6.39-400.294.1.el6uek.x86_64	All (3)
Cell	cell-12.1.2.3.4_LINUX.X64_170111-1.x86_64	All (3)
Offload	cellofl-11.2.3.3.1_LINUX.X64_151006	All (3)
Offload	cellofl-12.1.2.3.4_LINUX.X64_170111	All (3)

Back to Exadata Server Configuration

Exadata Storage Information

- Storage information per cell
- 'Total' is the sum for all cells

# Cells	Flash Cache Size (GB)	Flash Log Size (GB)	# Celldisks Hard Disk	# Celldisks Flash	# Griddisks	Cell Name
3	11,922.56	0.50	12	4	68	All (3)
Total (3)	35,767.69	1.50	36	12	204	All (3)

Back to Exadata Server Configuration

Exadata Griddisks

- Griddisks on the storage servervs
- Disk Type <F|H>/<size>: F-Flash, H-Harddisk
- Size (GB) - Griddisk: indicates size of individual Griddisks in the cells
- Size (GB) - Cell Total: indicates total size per cell

Griddisk Name Prefix	# Griddisks	Size (GB) Griddisk	Size (GB) Cell Total	Disk Type	Cells
ACFSC3_DG1_CD02_cell1	1	24.00	24.00	H/7.2T	(1): cfclcx2743
ACFSC3_DG1_CD02_cell2	1	24.00	24.00	H/7.2T	(1): cfclcx2744
ACFSC3_DG1_CD02_cell3	1	24.00	24.00	H/7.2T	(1): cfclcx2745
ACFSC3_DG1_CD03_cell1	1	24.00	24.00	H/7.2T	(1): cfclcx2743
ACFSC3_DG1_CD03_cell2	1	24.00	24.00	H/7.2T	(1): cfclcx2744
ACFSC3_DG1_CD03_cell3	1	24.00	24.00	H/7.2T	(1): cfclcx2745
ACFSC3_DG1_CD04_cell1	1	24.00	24.00	H/7.2T	(1): cfclcx2743
ACFSC3_DG1_CD04_cell2	1	24.00	24.00	H/7.2T	(1): cfclcx2744
ACFSC3_DG1_CD04_cell3	1	24.00	24.00	H/7.2T	(1): cfclcx2745
ACFSC3_DG1_CD05_cell1	1	24.00	24.00	H/7.2T	(1): cfclcx2743
ACFSC3_DG1_CD05_cell2	1	24.00	24.00	H/7.2T	(1): cfclcx2744

Figure 16 Exadata Details for Exadata Cloud AWR Report

IO Resource Management (IORM)

IORM is a feature of the Exadata Storage Server and requires access to the Exadata Storage Server for management and monitoring. To maintain the separation of roles and responsibilities between the customer and Oracle, and to provide the customer with all of the Exadata Database Machine features in Exadata Cloud, Oracle Cloud Automation provides methods to safely and effectively manage IORM in Exadata Cloud. IORM may be configured and monitored by the Oracle Cloud web UI (Figure 17 and Figure 18), and by the Exadata Cloud Service REST interface (Figure 19). IORM functionality is identical in Exadata Database Machine and Exadata Cloud deployments.

Figure 17 Update IORM using Oracle Cloud Automation Web Interface

Figure 18 Display and Configure IORM on Exadata Cloud Web UI

```
CreateIORM.json
{
  "dbPlan": [
    {
      "dbName": "JTWA",
      "share":"16"
    }
    ]
}

$ curl  -X POST --include --connect-timeout 5 --include --user XXX --header "X-ID-TENANT-
NAME:a462468" --header "Content-Type:application/json" --data @CreateIORM.json
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/a462468/JTWA

$ curl --connect-timeout 2 --user XXX --header "X-ID-TENANT-NAME:a462468"
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/a462468/JTWA/iorm
```

Figure 19 Configure and Monitor IORM using REST API

Database Server Operating System

Database server operating system views are similar in Exadata Cloud (Figure 20) and Exadata Database Machine (Figure 21). Subtle differences in the presentation of the data are present between the views, but equivalent views into resource utilization and operating system details are available.
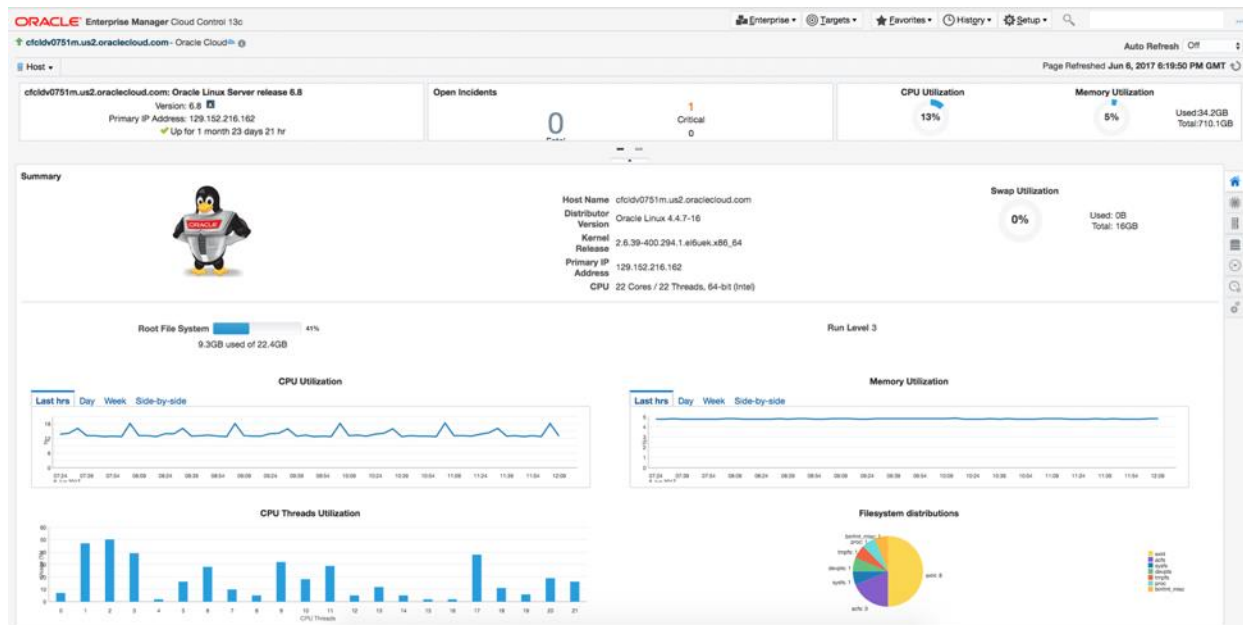
Figure 20 Exadata Compute Node View for Exadata Cloud
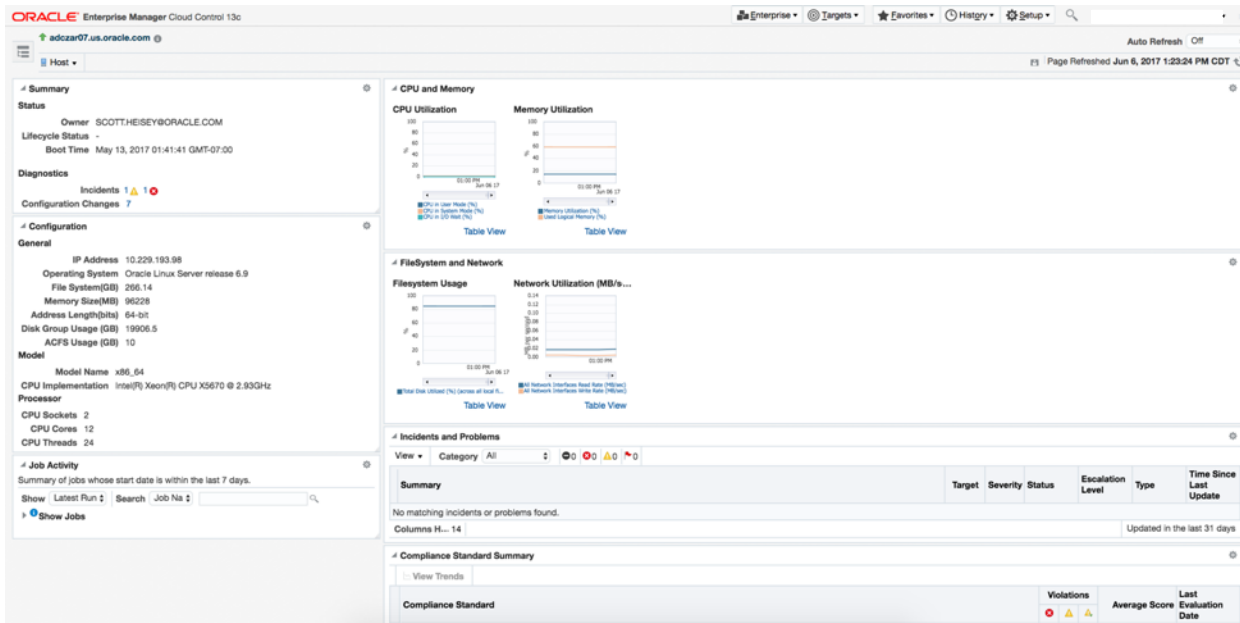
Figure 21 Exadata Compute Node View for Exadata Database Machine

Exadata Storage Servers

Exadata Cloud deployments do not externalize Exadata Storage Server details to EM. This means there are no Exadata Storage Server views when EM monitors Exadata Cloud, and no direct access to Exadata Storage Server accounting statistics. This does not pose a practical limitation due to the separation of roles and responsibilities between the customer and Oracle. In Exadata Cloud, Oracle Cloud Operations has sole responsibility for maintaining service level agreements on the Exadata Storage Server, and Oracle Cloud Operations performs all requisite monitoring, management, and maintenance of the Exadata Storage Servers.

Storage Space Consumption

EM has full access to monitor storage space consumption through the ASM target that is discovered through the host agents deployed on the Exadata Cloud Service Compute Node VMs. This target is available on Exadata Cloud (Figure 22) and Exadata Database Machine (Figure 23), and provides a database-by-database view of storage consumption on the Exadata Cloud. The ASM target views should be used for monitoring and management of storage space consumption within the Exadata Cloud Service just like with Exadata Database Machine.
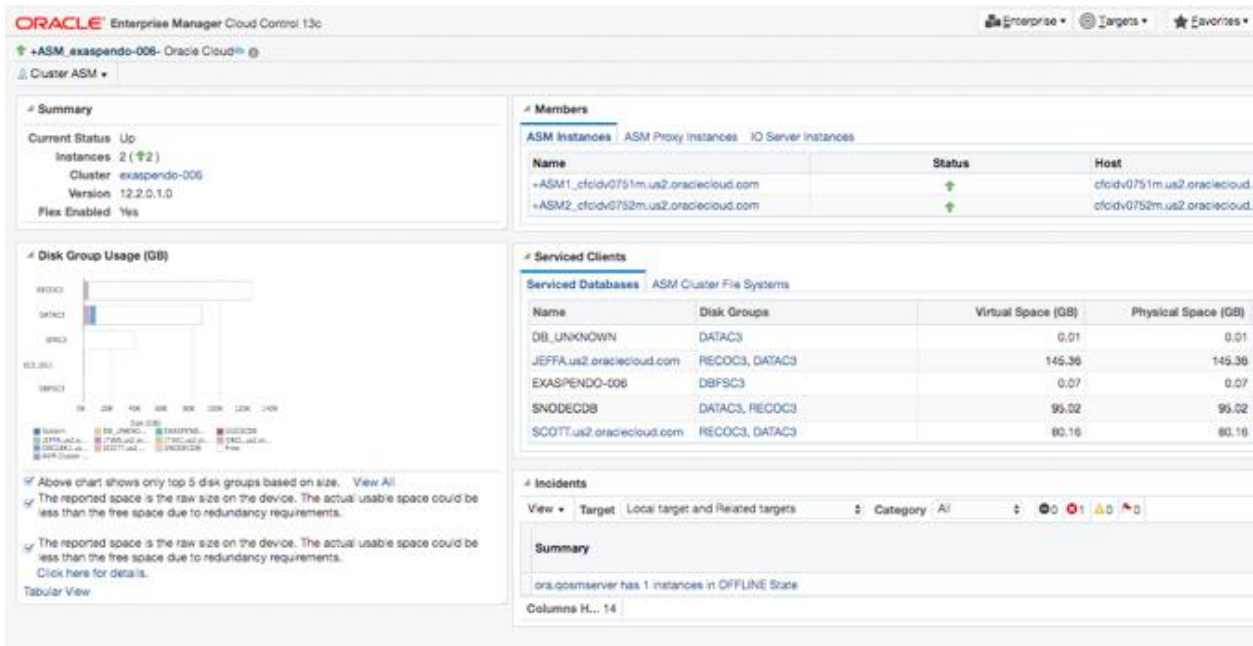
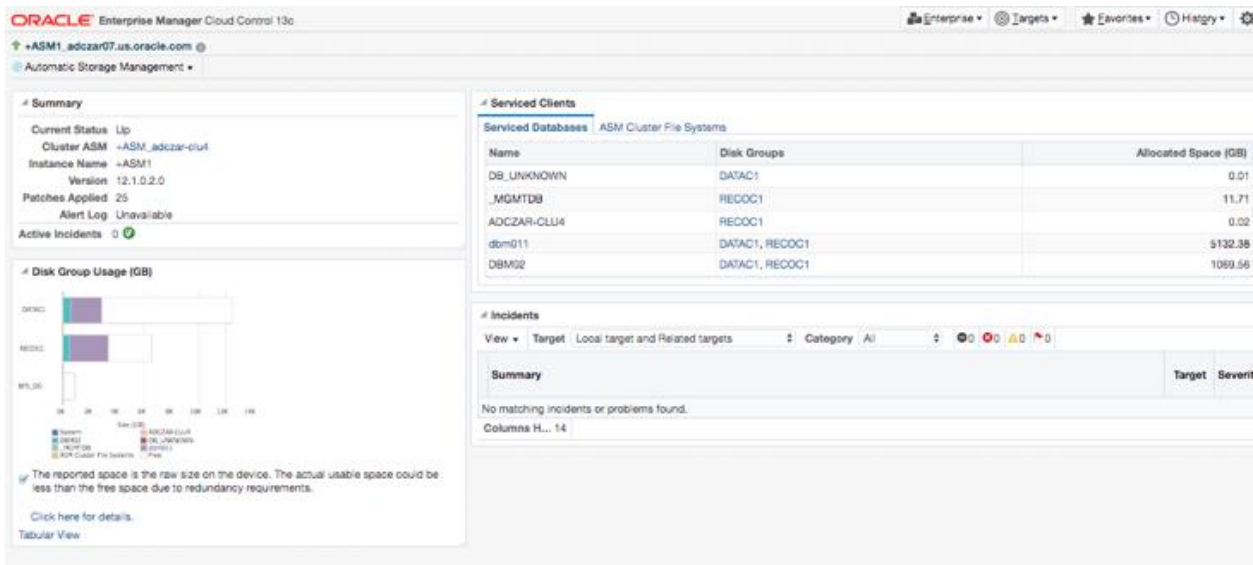*Figure 22 Exadata Cloud ASM Storage Consumption View*

Figure 23 Exadata Database Machine ASM Storage Consumption View

SUMMARY

Oracle Enterprise Manager and Oracle Cloud Automation provide a simple way to comprehensively monitor and manage Exadata Cloud. Implementation of Enterprise Manager with Exadata Cloud is accomplished with standard agents for Exadata Cloud at Customer and Exadata Cloud Service with VPN, and with Hybrid Cloud Agents with Exadata Cloud Service without VPN. After the agents are installed and configured, monitoring and management is the same in either deployment model. Differences in roles and responsibilities between the customer and Oracle for Exadata Cloud compared to Exadata Database Machine lead to subtle differences in monitoring and management best practices. In general, monitoring and management of components within the database can be executed with Enterprise Manager, while database deployment operations (create, delete, backup, restore) and Exadata IORM configuration and monitoring should be executed with Oracle Cloud Automation. Special circumstances may require deviation from these processes, and in these case additional management effort may be necessary. Performance monitoring with AWR is the same for Exadata Cloud and Exadata Database Machine, and AWR provides full visibility into Exadata Storage Server performance for customers seeking to understand and optimize how their applications benefit from the Exadata platform.

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