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Enterprise Manager Ops Center 12c Release 1 Deployment Considerations

ORACLE

Executive Overview

Oracle Enterprise Manager is Oracle's integrated enterprise IT management product line and provides the industry's first complete cloud lifecycle management solution. Oracle Enterprise Manager's Business-Driven IT Management capabilities allow you to quickly set up, manage and support enterprise clouds and traditional Oracle IT environments from applications to disk. Enterprise Manager allows customers to achieve:

- *Best service levels for traditional and cloud applications* through management from a business perspective including Oracle Fusion Applications
- *Maximum return on IT management* investment through the best solutions for intelligent management of the Oracle stack and engineered systems
- *Unmatched customer support experience* through real-time integration of Oracle's knowledgebase with each customer environment

Introduction

Oracle Enterprise Manager provides the industry's first converged hardware management solution for the market-leading Sun server and storage portfolio, Solaris Virtualization, Oracle VM and Solaris and other Operating Systems. Oracle Enterprise Manager Ops Center provides System Administrators with a comprehensive solution including change and configuration management, firmware and O/S patching, bare metal and VM provisioning, hardware telemetry ("phone home"), performance management, integrated diagnostics and automatic tuning.

Product Design and Resource Utilization

Overview

Oracle Enterprise Manager Ops Center is designed to scale from small installations up through large installations. To enable this, key components of the product architecture must be deployed appropriately to meet the requirements. The following are the key components of the product with which you should be familiar:

1. **Browser user interface.** Enterprise Manager Ops Center provides a rich interface inside a browser. The user interface heavily leverages JavaScript and AJAX technology to provide a highly dynamic and asynchronously updating user view.

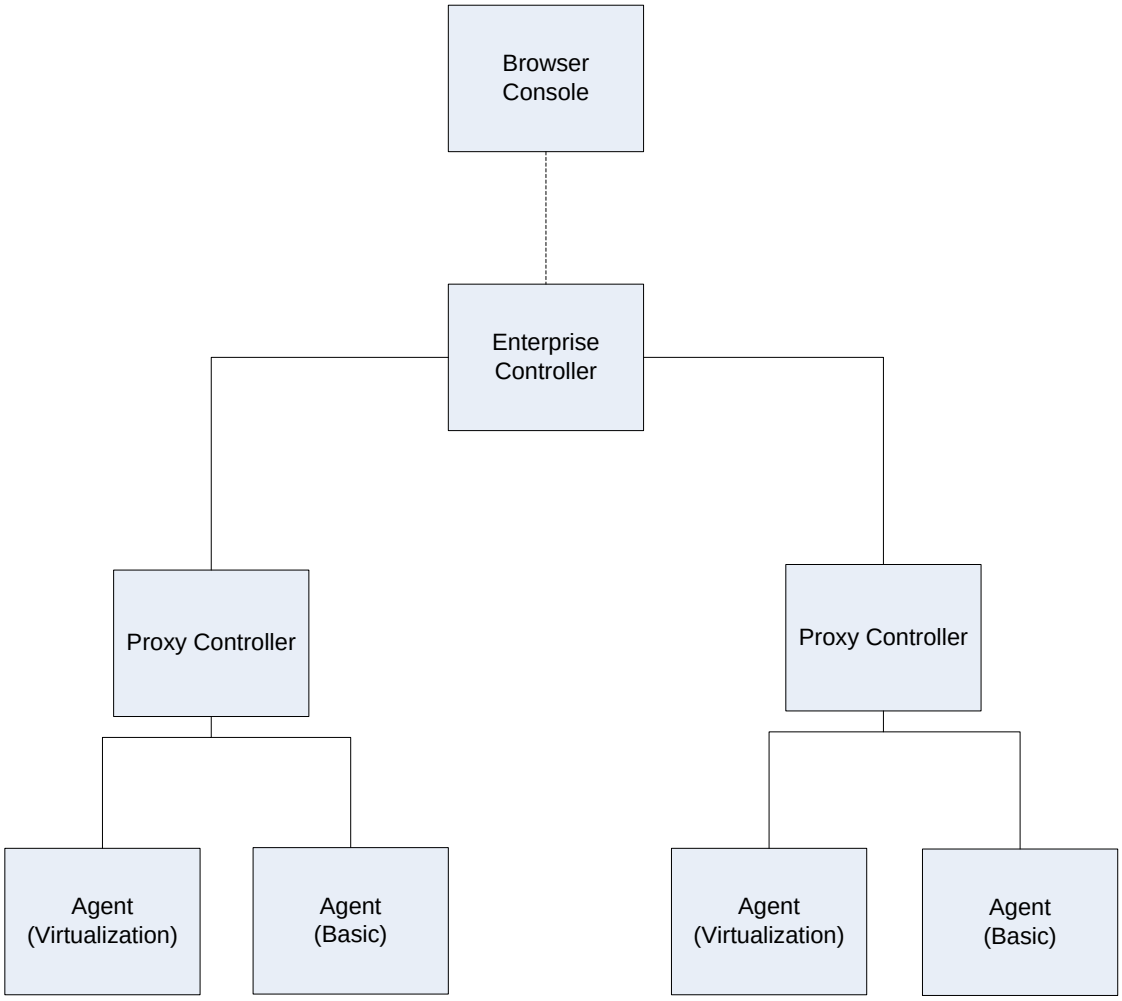
2. **Enterprise Controller.** The Enterprise Controller is the core component of Enterprise Manager Ops Center, it provides a centralized place where management information is stored and from which operations are initiated. The browser user interface connects into a standard API that the Enterprise Controller provides.

3. **A Management Repository.** The management repository is based on an Oracle Enterprise Edition Database and provides a permanent storage location for all management data used by the Enterprise Controller. In this release the management repository can either be co-located in the same operating system instance as the Enterprise Controller or deployed onto an external database server.

4. **Proxy Controller.** The Proxy Controller is designed to be distributed throughout the networks. It provides proxy capabilities for operations that must be logically located close to the targets due to network considerations, for example OS provisioning activities. It also provides a fan out for minimizing network load. In Enterprise Manager Ops Center 12*c* Release 1, an additional feature of proxy load balancing and failover has been introduced. Using this technology, proxies can be configured to see the same assets and can load balance traffic as well as provide a failover model between proxies. The deployer must use the information provided in the deployment guides to decide where proxies should be best placed.

5. **Agent.** Agents run in two modes, the basic Agent provides support for monitoring and updating of the host operating system. The virtualization management Agent supports basic and virtualization control.

The following illustration shows the relationship between the browser console, Enterprise Controller, Proxy Controller, and multiple Agents:



Product Design

To fully understand the best approach to a deployment, it is important to understand how the product uses resources and under what use conditions.

Enterprise Manager Ops Center provides such a wide range of potential use cases that it is difficult to provide an accurate and simple answer as to how far a particular product deployment can scale.

Enterprise Manager Ops Center is designed around two key design models:

1. **A distributed state machine** that maintains the information about all of the managed assets and what can be done to the assets under Enterprise Manager Ops Center's control. This state machine is incremented by discovering new assets, adding new services or metrics to the machine or creating new logical groups of assets. The state machine is decreased in size by deleting assets. Each modification of a variable, for example a CPU utilization measure, causes a change in the state machine.

2. **An asynchronous job dispatch system**. All actions that are requested through the Enterprise Manager Ops Center console are dispatched asynchronously through the system. The job system has a throttle that prevents the overloading of the system and manages queues of pending jobs.

Enterprise Manager Ops Center's State Machine

Enterprise Manager Ops Center's state machine is maintained in a combination of memory and database. As the managed environment of assets increase, so will the resource utilization (mostly in terms of memory required) of the system. In 12*c* Release 1, the database and interfaces between the database and the state machine have been changed significantly. They are redesigned to improve performance, particularly during the initialization (start up) phases of the Enterprise Controller.

The diagram above shows a simple deployment of Enterprise Manager Ops Center. Each component of Enterprise Manager Ops Center manages part of the state machine. A basic Agent will add the asset information for the operating system being managed and insert all of the relevant metrics, data, and operations that are supported as part of a discovery action. This part of the state machine is then pushed up to the Proxy Controller, which manages the part of the state machine for all of the assets it is managing and ultimately up to the Enterprise Controller, which can see the entire state machine.

The state machine imparts the highest load on the managed systems during discovery actions. Every part of the system is involved, beginning with the initial location of the asset by way of network requests to the addition of the asset into the state machine, through to the propagation and automated correlation of the new asset in the Enterprise Controller.

Steady state operation of the state machine involves the changing of metrics on the assets themselves. For example, an operating system's asset will have metrics showing network I/O utilization; these are sampled periodically by the Agent from the operating system and updated into the state machine on the Agent. The Agent caches to the state machine, per policy updates, and then sends the updates up to the Proxy Controller. The Proxy

Controller follows a similar process up to the Enterprise Controller. The network load in steady state is very low because only changes to metrics are sent and connection management caching is in place to reduce the SSL handshake overhead between the tiers.

The browser user interface reflects a view of the state machine. Assets and their relationships as they exist in the state machine are displayed in the navigation panels, details of the assets are displayed in the center panels and actions associated with the assets are displayed in the Action panel. The Enterprise Controller manages the translation of data from the state machine into a form the browser can display. Viewing different assets or asset groups can place a processing load on the Enterprise Controller. Each user performing these actions in parallel will increase the processing load on the Enterprise Controller. In addition, a small amount of memory is dedicated to each user session.

Enterprise Manager Ops Center's Job Management System

The job management system is used to perform actions that have been requested by the user. The job management system is completely asynchronous and active jobs are capped and queued to manage resource utilization by the entire Enterprise Manager Ops Center system. Depending on the particular action, job actions can run on the Agent, the Proxy Controller, or the Enterprise Controller, or a combination of all three.

For example, an OS provisioning job is managed from the Proxy Controller that is managing the system that is the target of the action. The Proxy Controller will run the majority of the processes during such an action and will impart the majority of the CPU load that is used during such an action.

However, a software patch install will execute on the OS and be run by the Agent on the hosting OS. Here the Agent performs all of the requests required to fulfill the required action and will impart a minor CPU load on the host through job completion.

Enterprise Manager Ops Center's Management Repository

Enterprise Manager Ops Center's Management Repository is now built upon an Oracle Enterprise Edition Database. The installation of the Enterprise Controller supports two deployment modes for the Repository:

1. **Co-located**. In this mode, similar to prior releases, the repository is installed in the same operating system context as the Enterprise Controller. This is recommended for small to mid- size deployments, as it cannot support the High Availability modes that are new to 12*c* Release 1 release.

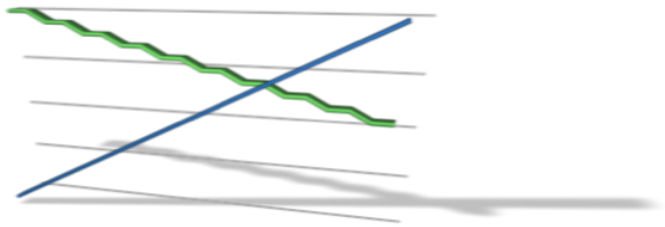
2. **Remote Repository**. In this mode, a preexisting database server must be provided during the installation of the Enterprise Controller. A new schema is deployed to the supplied database and used by the Enterprise Controller. The configuration of the database and the management of its availability is at the deployers discretion. It is however recommended that if the Enterprise Controller is to be configured in HA, the repository is also configured using an HA technology.

How Different Use Patterns Affect Resource Utilization

Use Patterns

Enterprise Manager Ops Center is designed to support an increasing number of administration and management actions. Each type of action and management analysis imparts a certain resource utilization on the underlying systems that support the Enterprise Manager Ops Center deployment. The management features that are used throughout a deployment will greatly affect the resource utilization and the demands of Enterprise Manager Ops Center on its host systems. It is therefore critical to understand the problems that are to be solved by Enterprise Manager Ops Center, as this will greatly affect the number of assets a deployment can manage.

The graph below shows the relationship between the number of services or use patterns that Enterprise Manager Ops Center supports in the blue, with the maximum number of assets a deployment can manage. The relationship between these two axis varies according to the particular services being used and the availability of resources from the underlying platform that is being used in the Enterprise Manager Ops Center deployment.



Which services are enabled is often related to the Enterprise Manager Ops Center deployment model. For example, deploying an Agent to an Oracle Solaris 10 OS system will automatically enable virtualization management for Oracle Solaris Zones, which in turn increases the size of the state machine for that particular managed asset.

Use Pattern Catagories

To simplify deployment, the following five use patterns are identified and compared:

- Hardware Management. Management of server and chassis hardware through Enterprise Manager Ops Center.
- Hardware Management and OS Provisioning. Management of server and chassis hardware and the ability to provision operating systems to the managed hardware.
- Hardware, OS and Update Management. Management of hardware, operating systems and deploying software updates to the operating systems.
- Hardware, OS and Virtualization Management. Management of hardware, operating systems, and virtualization features of Oracle Solaris 10 and 11.
- All Management features.

Hardware Management

Hardware management is performed from the Proxy Controller through the systems management Ethernet port on the servers or chassis. In this mode the majority of the utilization occurs at the proxy, which is responsible for performing initial discovery of the hardware and subsequent polling of the hardware for status and configuration changes.

Network sessions are initiated directly from the Proxy Controller to the hardware using specific server and chassis-type protocols that include, IPMI, SSH and SNMP.

Hardware management imparts relatively low resource impact on the Enterprise Manager Ops Center host OS. The largest impact is on the network traffic emanating from the Proxy Controller to the target servers and the Proxy Controllers should be scaled appropriately.

Hardware and OS Provisioning

Agents are not deployed for OS provisioning or pure hardware management, as no operating systems are being managed. OS provisioning is an action taken on managed servers and is executed primarily from the Enterprise Manager Ops Center Proxy Controller. The number of OS provisioning jobs that can occur in parallel is metered by the job management system, but OS provisioning does impart a greater load on the infrastructure.

Hardware, OS and Update Management

This mode applies to Oracle Solaris 8, Oracle Solaris 9, and Linux-managed operating systems. Oracle Solaris 10 and 11 operating systems implicitly enable virtualization management. In this use pattern, Agents are deployed to the managed operating systems and update / software provisioning jobs can be completed. This increases the size of the state machine, as operating systems and their configuration are modeled and made available to the update and monitoring capabilities of Enterprise Manager Ops Center.

Hardware, OS, Virtualization and Cloud Management

Oracle Solaris 10 and 11 Management adds in sophisticated virtualization management for Oracle Solaris Zones and Oracle VM Server for SPARC (formerly known as Sun Logical Domains.) Managing these virtualization features involves exposing significantly greater operating system configuration and metrics to the state machine. This will increase the memory utilization at the Enterprise and Proxy Controller tiers. Oracle VM Manager for x86 requires the deployment of an Oracle VM Server x86 management environment. This does not add as much load as the Oracle Solaris technologies as the Oracle VM management infrastructure is managing much of the scale load.

All Management Features

Enabling all management features of Enterprise Manager Ops Center will place the largest resource utilization burden on Enterprise Manager Ops Center's host infrastructure. It is recommended that a co-located Proxy Controller and Enterprise Controller are not deployed, unless the deployment is small.

Scaling Guidelines

As the previous sections have described, many factors can affect the resources used by Enterprise Manager Ops Center and ultimately its ability to scale to manage large deployments. The scaling guidelines provided here are based on the use of an external repository.

General Platform Considerations

The following topics are covered:

- Enterprise Controller
- Proxy Controller
- Management Repository

Enterprise Controller

When selecting a platform for the Enterprise Controller consider the following factors:

- The Enterprise Controller has a number of parallel executing processes and a multi-core system will significantly improve performance.
- If you want to manage Oracle Solaris 11 Operating Systems or virtualized environments, the Enterprise Controller must be installed on an Oracle Solaris 11 operating system.
- Memory is consumed by the core Java virtual machine and its resource utilization will increase proportionally with the number of assets being managed. Should the Java virtual machine be forced into virtual memory, then Enterprise Manager Ops Center performance will reduce significantly.
- Start-up times of the Enterprise Controller can be minimized by ensuring that the network link to the repository is as low latency as possible. The start-up process involves a large number of queries as the state machine is being built. It is recommended that a 10GigE connection be available between the Enterprise Controller and Management Repository.

Proxy Controller

The following factors should be considered when selecting a platform and environment for the Enterprise Controller:

- Proxy Controllers can be configured in non global zones if the assets being managed are Oracle Solaris 11 only, otherwise it cannot be used in non-global zones. This is because the Proxy

Controller includes the capabilities to perform OS provisioning, which are not supported by non-global zones.

- Network I/O. If the Proxy Controller is supporting operating system provisioning then it is recommended that the Proxy Controller should be utilizing GigE network cards.

Management Repository

Use the following sizing guidelines to estimate the maximum size of the database based upon the number of assets managed.

- Operational Data – 74 megabytes (MB) per asset.
- Reporting Data – 166 MB per asset. Steady state is reached at 180 days when the default rollup schedule is used.
- UCE Data – 4 gigabytes (GB) needed for 10 channels. 12GB additional for disconnected mode. 400 M for each additional channel, though largest we have seen is a 600 M channel.
- Schema Backups – Each backup dump will require 40% of Enterprise Manager Ops Center Schema Size on the database server in the OC_DUMP_DIR directory location. Seven (7) copies of the backup are kept online by default.

The following table shows the estimated database size for when 1000 assets and 100 assets are managed and 10 UCE channels are configured in connected mode.

USE PATTERN	SIZE FOR 1000 ASSETS	SIZE FOR 100 ASSETS
SYSTEM Tablespace	1000	1000
UNDO Tablespace	275	275
SYSAUX	1200	1200
USERS Tablespace (Operational)	74000	7400
USERS Tablespace (Reporting)	166000	16600
USERS Tablespace (UCE)	4000	4000
TEMP	200	200
TOTAL DB Size	247395	30675
Space Reserved for Backups	683000	78400

Reference Systems

Scalability figures are based on SPARC and Intel reference systems that are running Oracle Solaris 11 Memory access is affected by DIMM count and placement, therefore these configurations include the

maximum number of DIMMs of lowest density available to achieve the best possible memory access times.

Any departure from the stated specifications might have a measurable effect on the overall performance and scalability of the reference configurations.

The scalability figures in System Sizing are quoted from the following reference systems:

- Enterprise Controller on a SPARC Platform
- Proxy Controller on a SPARC Platform
- Enterprise Controller on an Intel Platform
- Proxy Controller on an Intel Platform
- Enterprise Controller on a SPARC Virtualized Platform (Oracle VM Server for SPARC)

Enterprise Controller on a SPARC Platform

Hardware

- SPARC Enterprise T4-1 with 8-Core processor
- CPU Specification: 8 core 2.85-GHz UltraSPARC T4 processor
- Memory: 64 GB (4 x 16 GB DIMM)

Storage (8 drive configuration)

Volume 1: OS root, swap, and dump:

- Internal or FC/SAN Storage:
  - Hardware RAID 10 (1+0) for redundancy and performance
  - 4 x 300 GB Disks @ 10,000 RPM
  - 600 GB Volume, 600 GB LUN (whole Volume)

Volume 2: Enterprise Manager Ops Center Shared Data and Local Libraries:

- Internal or FC/SAN Storage:
  - Hardware RAID 10 (1+0) for redundancy and performance
  - 4 x 300 GB @ 10,000 RPM
  - 600 GB Volume, 600 GB LUN (whole Volume)

Proxy Controller on a SPARC Platform

Hardware

- SPARC Enterprise T4-1 with 8-Core processor
- CPU Specification: 8 core 2.85-GHz UltraSPARC T4 processor
- Memory: 32 GB (8 x 4 GB DIMMs)

Storage (6 drive configuration)

Volume 1: OS root, swap and dump:

- Internal or FC/SAN Storage:
  - ZFS mirror for redundancy
  - 2 x 300 GB Disks @ 10,000 RPM
  - 300 GB Volume, 300 GB LUN (whole Volume)

Volume 2: Enterprise Manager Ops Center Shared Data and Local Libraries:

- Internal or FC/SAN Storage:
  - Hardware RAID 10 (1+0) for redundancy and performance
  - 4 x 300 GB Disks @ 10,000 RPM
  - 600 GB Volume, 600 GB LUN (whole Volume)

Enterprise Controller on an Intel Platform

Hardware

- Sun Fire X4170 M3 with Intel Xeon E5-2690
- CPU Specification: 2 x E5-2690, 2.9 GHz processors
- Memory: 64 GB (8 x 8 GB DIMMs)

Storage (8 drive configuration)

Volume 1: OS root, swap and dump:

- Internal or FC/SAN Storage:
  - Hardware RAID 10 (1+0) for redundancy and performance
  - 4 x 300 GB Disks @ 10,000 RPM
  - 600 GB Volume, 600 GB LUN (whole Volume)

Volume 2: Enterprise Manager Ops Center Shared Data and Local Libraries:

- Internal or FC/SAN Storage:
  - Hardware RAID 10 (1+0) for redundancy and performance
  - 4 x 300 GB Disks @ 10,000 RPM
  - 600 GB Volume, 600 GB LUN (whole Volume)

Proxy Controller on an Intel Platform

Hardware

- Sun Fire X4170 M3 with Intel Xeon E5-2660
- CPU Specification: 2 x E5-2660, 2.2 GHz processors
- Memory: 32 GB (8 x 4 GB DIMMs)

Storage (6 drive configuration)

Volume 1: OS root, swap and dump:

- Internal or FC/SAN Storage:
  - ZFS mirror for redundancy
  - 2 x 300 GB Disks @ 10,000 RPM
  - 300 GB Volume, 300 GB LUN (whole Volume)

Volume 2: Enterprise Manager Ops Center Shared Data and Local Libraries:

- Internal or FC/SAN Storage:
  - Hardware RAID 10 (1+0) for redundancy and performance
  - 4 x 300 GB Disks @ 10,000 RPM
  - 600 GB Volume, 600 GB LUN (whole Volume)

Enterprise Controller on a SPARC Virtualized Platform (Oracle VM Server for SPARC)

Hardware

- SPARC Enterprise T4-1 with 8-Core processor
- CPU Specification: 8-core 2.85-GHz UltraSPARC T4 processor

Virtual Resources provided to virtual domain

- 64 GB Memory
- 4 Cores
- Direct I/O configuration to Network

Disk Considerations

The following configurations are applicable for SPARC platforms:

- The OS disk configuration is on a Fiber Channel hardware RAID.
- The Oracle Enterprise Manager Ops Center data is on a Fiber Channel hardware RAID.

The following configurations are applicable for Intel platforms:

- All storage is on an internal hardware RAID 10

System Sizing

It is generally recommended that the deployer use proxy fan out as it makes sense in the network to be deployed. For example, OS provisioning capabilities are often restricted to a network subnet.

Changing the resource configuration of the system will affect the numbers, as will more complex mixing of the services across the deployment.

System Matrix

The following table describes the number of systems that each Enterprise Controller and Proxy Controller can support based on the use pattern.

USE PATTERN	ENTERPRISE CONTROLLER	PROXY CONTROLLER
Hardware management	5500 systems	1000 systems
All Services	3500 systems	1000 systems

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