WHITE PAPER: TECHNICAL

Symantec High Availability Solution for Oracle Enterprise Manager Grid Control 11g and Cloud Control 12c

Table of Contents

Introduction

Oracle Enterprise Manager is Oracle's integrated enterprise IT management product line, which provides the industry's only complete, integrated and business-driven enterprise cloud management solution. Oracle Enterprise Manager creates business value from IT by leveraging the built-in management capabilities of the Oracle stack for traditional and cloud environments, allowing customers to achieve unprecedented efficiency gains while dramatically increasing service levels.

Grid computing is poised to revolutionize the economics of delivering applications and services across the enterprise. Oracle Enterprise Manager Grid Control is Oracle's single, integrated solution for managing all aspects of the Oracle Grid and the applications running on it. Grid Control couples a potent, top-down monitoring approach to deliver the best quality of service for applications with a cost-effective automated configuration management, provisioning, and administration solution. This powerful combination provides unequaled management for Oracle data center of all sizes.

Currently, many organizations rely on Oracle Enterprise Manager Grid Control for their infrastructure to run in grid environment without any disruptions. Any disruption of this infrastructure translates directly into bottom-line business losses. As an organization's information systems become increasingly integrated and interdependent, the potential impact of failures and outages grows to enormous proportions.

The challenge for IT organizations is to maintain continuous Oracle Enterprise Manager Grid Control availability in a complex, interconnected, and heterogeneous application environment. The difficulties are significant:

- There are many potential points of failure or disruption
- The interdependencies between components complicates administration
- The infrastructure itself undergoes constant change

Symantec offers an integrated, out-of-the-box solution to make Oracle Enterprise Manager Grid Control highly available. Symantec's high availability solution for Oracle Enterprise Manager Grid Control enhances the application availability for business critical applications.

The Symantec high availability solution for Oracle Enterprise Manager Grid Control utilizes the following products: Veritas Storage Foundation™, Veritas Storage Foundation Cluster File System™, Veritas Cluster Server™, and the Veritas high availability agent for Oracle Application Server. The result is an out-of-the-box solution that you can quickly deploy to immediately protect critical Oracle Grid Control applications from either planned or unplanned downtime.

This paper describes the Symantec high availability solution for Oracle Enterprise Manager Grid Control.

Symantec's solution for ensuring high availability of Oracle Enterprise Manager Grid Control

Symantec offers an end-to-end, fully integrated solution for ensuring high availability of the Oracle Enterprise Manager Grid Control environment. Symantec's solution reduces planned and unplanned downtime, simplifies the administration of the complex environment with a single interface, and supports global failover for disaster recovery purposes.
Symantec's high availability and Disaster Recovery solution for Oracle Grid Control combines Symantec's industry-leading, hardware independent software for storage management and availability with a deep understanding of the Oracle Grid Control application environment and its essential components.

The components of Symantec's high availability solution

Symantec's high availability solution integrates the following software products:

- **Veritas Storage Foundation** combines Symantec's industry-leading file system and volume management solutions to create a highly available, robust foundation for Oracle data. The journal file system restarts in seconds for fast failovers. Logical volumes support highly available, high performance storage configurations. Database-specific components such as direct I/O accelerate database read and write performance while simplifying the manageability of database data. Storage Foundation provides database-specific optimizations for Oracle, DB/2, Sybase, Microsoft SQL Server, and Oracle RAC databases.
- **Veritas Storage Foundation Cluster File System (CFS)** builds upon Symantec's industry-leading file system to provide a solution that allows parallel access to data across all members of a cluster. Because the file system can be mounted on all nodes in a cluster, the time normally required to mount a file system in the event of a failover is eliminated. This can have a dramatic effect on improving failover times. Cluster File System provides cache coherency and POSIX compliance across nodes, so that data changes are atomically seen by all cluster nodes simultaneously.
- **Veritas Cluster Server (VCS)** eliminates planned and unplanned downtime by clustering critical applications and the resources they require. Specific agents for Oracle Grid Control, the Oracle database, and the file server ensure that all of the critical components of your Grid environment are monitored and managed centrally to ensure maximum application availability.
- **Veritas high availability agent for Oracle Application Server** starts the Oracle Grid Control application while bringing it online, stops the application while taking it offline, monitors critical processes of the application, and cleans the environment in case of any issues. This agent is packaged with the Veritas Cluster Server license.
- **Veritas high availability agent for WebLogic Server** starts the Oracle WebLogic Server at the Oracle Management Service (OMS) layer of Enterprise Manager while bringing it online, stops the Oracle WebLogic Server while taking it offline, monitors it for critical processes, and cleans the environment in case of any issues. This agent is packaged with the Veritas Cluster Server license.
- **Veritas Cluster Server agent for Oracle** contains the Oracle agent that monitors the Oracle database processes and the NetIsnr agent that monitors the listener process. The VCS agent for Oracle starts the Oracle Enterprise Manager metadata repository while bringing it online, stops the repository while taking it offline, monitors it for critical processes, and cleans the environment in case of any issues. This agent is packaged with the Veritas Cluster Server license.

How the components work together

The different components of the Symantec high availability solution work together and help IT organizations improve Oracle Grid Control application availability on a daily basis while offering significant protection from the loss of service and data.

Local Availability

Veritas Storage Foundation and Veritas Cluster Server, which are bundled together as Storage Foundation HA, create a highly available, local data and application availability environment that helps you do the following:

- Manage complexity by providing a single interface for starting, stopping, monitoring, and maintaining Oracle Enterprise Manager Grid Control application services.
- Manage change by proactively moving application services to enable dynamic maintenance and testing.
- Improve availability with automated, application-specific monitoring and failover when problems do occur, and fast reconfiguration when the problem is resolved.
- Consolidate servers and make better use of resources through local clustering and the virtualization of critical services.
- Improve storage utilization and administrator productivity through policy-based storage management.

Architecture of Oracle Enterprise Manager Grid Control

Figure-1 shows the top level architecture of Oracle Enterprise Manager Grid Control. On the very top resides the Management agents, below this are the managed targets that are monitored by the agents. In the middle is the Oracle Management Service (OMS) and in the bottom is the Oracle Management Repository (OMR).

Managed targets are the targets that are being managed or monitored by the management agents. Management agents are installed on each host server. The Management agent collects the information about the target's availability, configuration and performance and passes the information to the OMS. Each management agent talks to only one OMS, but an OMS may provide service to hundreds of management agents. OMS pass information received from OMR and OMS talks to only one OMR although an OMR can service many OMS. OMS is also the point of connection to the administrators. It produces the grid control console web pages and it passes the commands from administrator to the appropriate management agent.

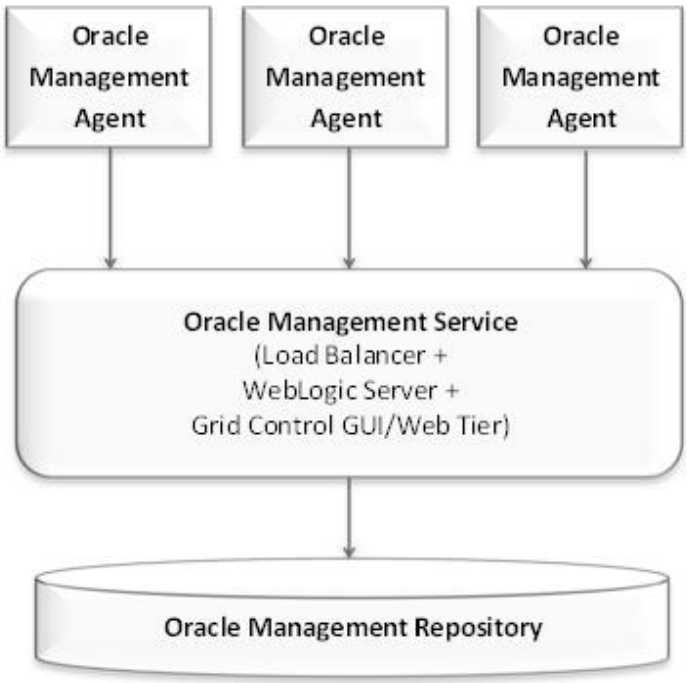


Figure 1: Oracle Enterprise Manager Components

Oracle Enterprise Manager Framework consists of three components:

- Oracle Management Service (OMS)
- Oracle Management Agent (Agent)
- Oracle Management Repository (OMR)

In the context of Oracle Enterprise Manager, the Oracle database repository is named the Oracle Management Repository or OMR. WebLogic is the J2EE platform called the Oracle Management Service or OMS that runs the Oracle Enterprise Manager J2EE application. The administrative Web GUI is named Oracle Enterprise Manager Grid Control. The client side agents are named the Oracle Management Agents or OMA. Monitored hosts are referred to as targets. All of the Oracle Enterprise Manager components are commonly referred to as Oracle Enterprise Manager or Enterprise Manager.

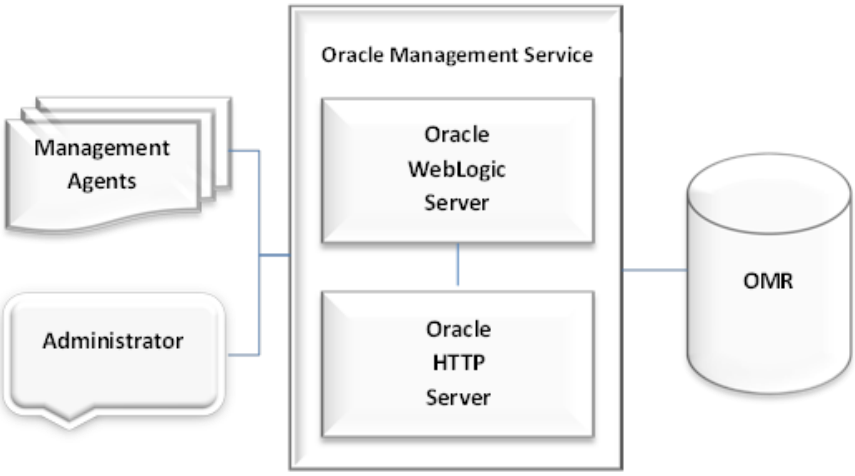


Figure 2: Oracle Management Service

The Oracle Management Repository is an Oracle 11g database that stores all of the information collected by the Oracle Management Agents. The Oracle Management Agent is a software application that runs on all monitored hosts facilitating a two-way communication between the hosts and the Oracle Management Service. The Oracle Management Service is deployed on a WebLogic server or a cluster of WebLogic servers in the Oracle Middleware home. The Oracle Middleware home is the parent directory of the Oracle WebLogic Server home. The Oracle Management Service collects data from the Oracle Management Agents and uploads the data into the Oracle Management Repository. The Oracle Management Repository formats the data which allows the Oracle Management Service to visualize the data in the Oracle Enterprise Manager Grid Control portal. Administrative operations made using the Oracle Enterprise Manager Grid Control console are dispatched to targets from the Oracle Management Service.

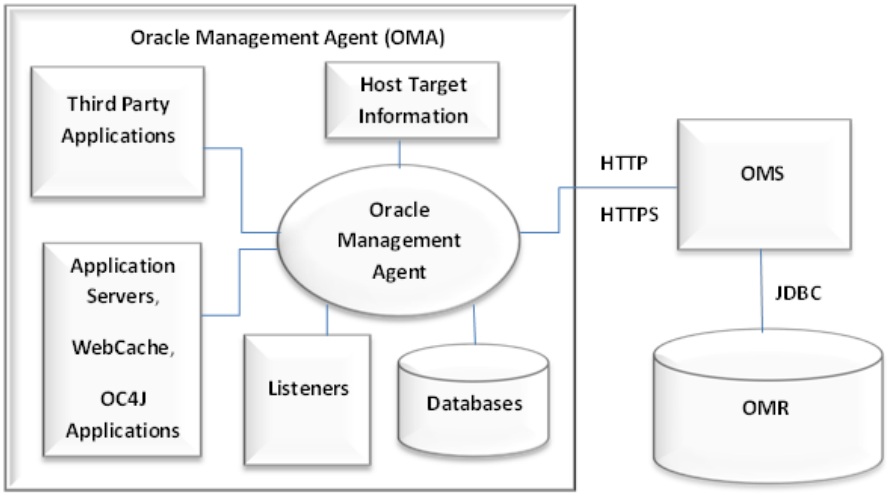


Figure 3: Oracle Management Agent

Oracle Management Repository (OMR)

Oracle Management Repository resides in the Oracle Database as a group of approximately 4000 schema objects stored in two table spaces and belong to the SYSMAN user. These schema objects contain information about the Oracle Enterprise Manager administrators, targets and applications that are managed by the Oracle Enterprise Manager. Oracle-Net is used for the communication between the OMS and OMR via the OMR database listener. OMR can be installed as fresh database or inside a pre-existing database or in a RAC database.

Managed Targets

Managed Targets are managed and monitored by the Management Agents on host machines. Managed Targets may include:

- Oracle Databases
- Oracle Database Listeners
- Oracle Application Servers
- Oracle Applications
- Oracle Collaboration Suite
- Oracle E-Business Suite
- Most operating systems that are certified to run Oracle products
- Third-party products and applications

Installing Oracle Enterprise Manager Grid Control on a virtual IP address

1) Modify the results of the `uname -n` command and the `hostname` command to give the output of the virtual hostname.
2) Install the Grid Control software.

   `$runInstaller ORACLE_HOSTNAME=<virtual hostname>`

   NOTE: Ensure that the `hostname` and `uname -n` commands give the output as virtual hostname throughout the installation. For more information, refer to Oracle Metalink Doc Id : 405642.1
3) If the WebLogic domain is secured, that is, if it uses the HTTPS protocol for ADMIN_URL, you must enable tunneling for both the Enterprise Manager Grid Control (EMGC) servers —EMGC_ADMINSERVER and EMGC_OMS.

   To enable tunneling:
   a. Log on to the Oracle WebLogic Server Administration Console.
   b. On the Summary of Servers page, from the Servers table, click the appropriate server <EMGC_*ServerName*>.
   c. On the Settings for the < EMGC_*ServerName* > page, click the **Protocols** tab, and then click the **HTTP** subtab.
   d. On the HTTP page, select **Enable Tunneling**, and click **Save**.
4) Update the WebTier opmnctl file to add the $OracleInstance environment variable.

   11g: Copy the line with the value of "$OracleInstance" from the *$InstallDir/11gR1/Oracle/gc_inst/WebTierIH1/bin/opmnctl* file to the *$InstallDir/11gR1/Oracle/Middleware/Oracle_WT/opmn/bin/opmnctl* file.
   Example value of $OracleInstance: *$OracleInstance = '/oraem/11gR1/Oracle/gc_inst/WebTierIH1';*

   12c: Copy the line with the value of "$OracleInstance" from the *$InstallDir/12c/gc_inst/WebTierIH1/bin/opmnctl* file to the *$InstallDir/12c/Oracle_WT/opmn/bin/opmnctl* file.
   Example value of $OracleInstance: *$OracleInstance = '/oraem/12c/gc_inst/WebTierIH1';*

   This is the path of the Grid Control WebTier Oracle Instance Home also called as ORACLE_INSTANCE.
5) Configure the OPMN daemon to work in a cluster.

   The agent for Oracle Application Server is designed to manage and monitor individual Oracle Application Server components. Therefore, you must configure the OPMN daemon to not take any automatic action if it detects a failure of a component under cluster control.

   For all Oracle Application Server components, disable the restart-on-death option in the opmn.xml Oracle Application Server configuration file. This file is typically located in the $ORACLE_HOME/opmn/conf directory.

   The restart-on-death parameter is defined in the process-set section of each Oracle Application Server component. For components like OC4J that have multiple instances, you must make this change for the process-set section under each process-type.

Configuring service groups for Oracle Enterprise Manager Grid Control

About service groups

Veritas Cluster Server provides application failover by encapsulating the resources required for each application into a service group – creating virtualized application services that can be moved among cluster nodes. Operations staff can operate on the cluster itself, on the service group (starting, stopping, switching over, and so on), or on the specific resources within the service group. A VCS service group is the smallest unit of failover.

Each Oracle Enterprise Manager service group contains a set of dependent resources – the lower-level components that an application requires to operate successfully. Resources include disk groups, disk volumes, file systems, IP addresses, and dependent application processes. The resources within a service group have dependencies which define the start and stop order that Veritas Cluster Server uses to bring the service group online and offline, respectively.

Veritas Cluster Server starts, stops, monitors, and switches service groups on any server in the cluster in response to server or resource faults. In addition, an administrator can proactively move a service group between cluster nodes to perform preventative maintenance or apply patches. The service group includes logic about the dependencies between application components.

Disk groups

Each service group requires a dedicated file system, volume, and disk group to store the service group's data and programs. By importing and deporting this set of storage objects on different servers in the cluster without affecting other service groups, Veritas Cluster Server allows the service groups themselves to be independent of the underlying architecture and be mobile across the cluster.

For example, when Veritas Cluster Server shuts down a service group, the resources are shutdown in the following hierarchy:

1) As the file system resource is shutdown, the file system is un-mounted
2) As the volume is shutdown, the volume is stopped
3) As the disk group is shutdown, the disk group is deported

Veritas Cluster Server initiates startup of the service group on another system in the cluster where each resource is started in dependent order. On the new system, the disk group will be imported, the volume started and the file system will be mounted. This entire process happens automatically in the event of a failure, significantly reducing the downtime associated with a failure or outage. It would not be possible to accomplish this sequence if the Oracle Grid Control components were installed on a local system disk on one node in the cluster.

By deploying the Veritas Storage Foundation Cluster File System, the steps outlined in the preceding section can be eliminated. While each service group still requires a dedicated file system, volume, and disk group, by deploying Cluster File System, the file system, disk, and volume groups will already be started on all nodes in the cluster.

Therefore, there is no need to unmount the file system, shutdown the volumes, and deport the disk groups. Additionally, there is no need for Veritas Cluster Server to start the corresponding groups on the other node, as they will have already been started. Veritas Cluster Server will still have the role of ensuring that the Cluster File System has been started and is running on all of the nodes in a cluster.

Network resources

In addition to disk groups, applications also require specific network resources, such as Network Interface Cards (NICs) and IP addresses.

Sample Configurations

Sample Resource Configuration

Veritas Cluster Server uses application-specific agents to start, stop, monitor, and switch over different applications and infrastructure components. A Veritas Cluster Server environment running Oracle Enterprise Manager Grid Control 11g/12c uses the VCS high availability agents for WebLogic Server and Oracle Application Server for the purpose.
The VCS high availability agent for WebLogic Server starts, stops, and monitors the EMGC_MACHINE1, EMGC_ ADMINSERVER, and EMGC_OMS1 servers.

Sample configuration for a Node Manager resource (WebLogic Server)

The following table shows a sample configuration for the VCS resource of EMGC_MACHINE1.
EMCG_MACHINE1 is the Node Manager component of WebLogic Server.

Attribute	Value
BEA_HOME	"/oraem/11gR1/Oracle/Middleware"
WlstScript	"/oraem/11gR1/Oracle/Middleware/wlserver_10.3/common/bin/wlst.sh"
DomainDir	"/oraem/11gR1/Oracle/gc_inst/user_projects/domains/GCDomain"
nmListenAddressPort	"vcslx203.vxindia.veritas.com:7403"
nmHome	"/oraem/11gR1/Oracle/Middleware/wlserver_10.3/common/emnodemanager"
ServerName	EMGC_MACHINE1
ServerRole	NodeManager
User	oraem
WLSUser	weblogic
WLSPassword	ftmRrtItfRgtItiLglHli
nmUser	nodemanager
nmPassword	amoMnoAmbOdoDgbGcgD

Sample configuration for an Administration Server resource (WebLogic Server)

The following table shows a sample configuration for the VCS resource of EMGC_ ADMINSERVER.
EMGC_ ADMINSERVER is the Administrative Server component of WebLogic Server.

Attribute	Value
AdminURL	"https://vcslx203.vxindia.veritas.com:7101"
BEA_HOME	"/oraem/11gR1/Oracle/Middleware"
WlstScript	"/oraem/11gR1/Oracle/Middleware/wlserver_10.3/common/bin/wlst.sh"
DomainDir	"/oraem/11gR1/Oracle/gc_inst/user_projects/domains/GCDomain"
ListenAddressPort	"vcslx203.vxindia.veritas.com:7101"
nmListenAddressPort	"vcslx203.vxindia.veritas.com:7403"
nmHome	"/oraem/11gR1/Oracle/Middleware/wlserver_10.3/common/emnodemanager"
ServerName	EMGC_ADMINSERVER
ServerRole	Administrative
User	Oraem
WLSUser	Weblogic
WLSPassword	ftmRrtItfRgtItiLglHli

nmUser	Nodemanager
nmPassword	amoMnoAmbOdoDgbGcgD

Sample configuration for a Managed Server resource (WebLogic Server)

The following table shows a sample configuration for the VCS resource of EMGC_OMS1.

EMGC_OMS1 is the Managed Server component of WebLogic Server.

Attribute	Value
AdminURL	"https://vcslx203.vxindia.veritas.com:7101"
BEA_HOME	"/oraem/11gR1/Oracle/Middleware"
WlstScript	"/oraem/11gR1/Oracle/Middleware/wlserver_10.3/common/bin/wlst.sh"
DomainDir	"/oraem/11gR1/Oracle/gc_inst/user_projects/domains/GCDomain"
ListenAddressPort	"vcslx203.vxindia.veritas.com:7301"
nmListenAddressPort	"vcslx203.vxindia.veritas.com:7403"
nmHome	"/oraem/11gR1/Oracle/Middleware/wlserver_10.3/common/emnodemanager"
ServerName	EMGC_OMS1
ServerRole	Managed
User	Oraem
WLSUser	Weblogic
WLSPassword	ftmRrtItfRgtItiLglHli
nmUser	Nodemanager
nmPassword	amoMnoAmbOdoDgbGcgD

The Veritas Cluster Server agent for Oracle Application Server starts, stops, and monitors the OPMN, Oracle HTTP Server and EMAgent.

Sample configuration for OPMN resource

Attribute	Value
User	Oraem
OracleHome	"/oraem/11gR1/Oracle/Middleware/Oracle_WT"
ComponentProcessType	OPMN

Sample configuration for Oracle HTTP Server (OHS) resource

Attribute	Value
User	Oraem
OracleHome	"/oraem/11gR1/Oracle/Middleware/Oracle_WT"
ComponentProcessType	OHS

Sample configuration for Oracle HTTP Server (OHS) resource

Attribute	Value
User	Oraem
OracleHome	"/oraem/11gR1/Oracle/Middleware/Oracle_WT"
ComponentProcessType	Agent

The VCS high availability agent provides the ability to start, stop, and monitor each of these Oracle Enterprise Manager Components. Additionally, if a component fails, the VCS agent cleans the node and removes any remaining system processes and shared resources.

Veritas Cluster Server provides multiple levels of monitoring for Oracle Enterprise Manager Grid Control services:

- The first level confirms the existence of essential processes in the process table. This is the default level.
- The second level, which is optional and additional to the first, runs Oracle supplied tools to check the health of the Oracle Enterprise Manager.
- The third level, which is also optional, invokes an external monitoring program, allowing the user to provide custom scripts for application monitoring.

For more information about configuring the VCS Agents for Oracle Application Server, refer to the *Veritas High Availability Agent for Oracle Application Server Installation and Configuration Guide*.

Sample service group with resource dependency

Figure 4 shows resource dependencies within a sample service group for Oracle Enterprise Manager Grid Control.

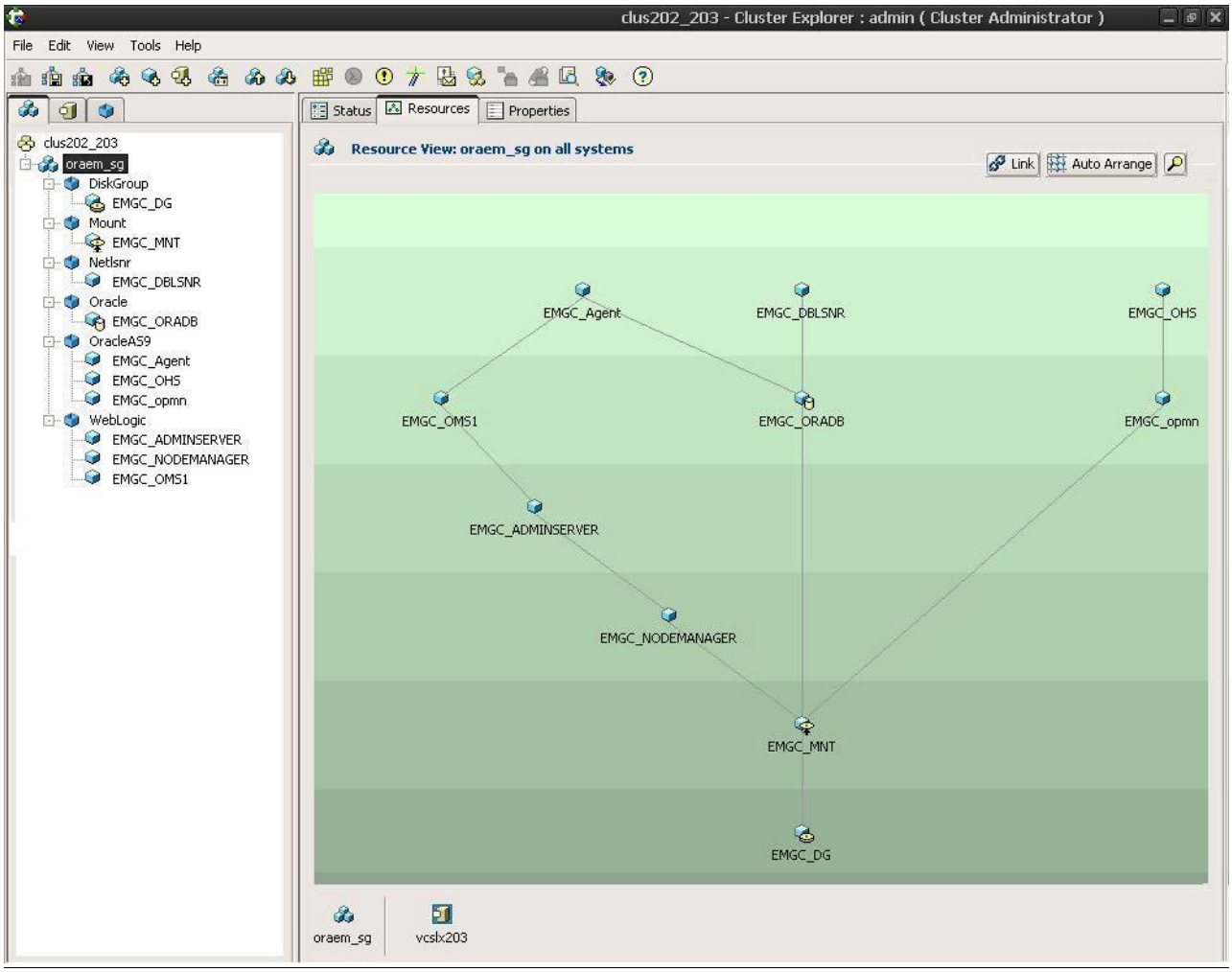


Figure 4: Resource dependency example for Oracle Enterprise Manager Instance

The service group includes a Veritas Cluster Server resource for the Network Interface Card (NIC). It also includes a resource for the IP. This resource plumbs an IP address to the host when the resource is brought online and un-plumbs the IP when the resource is taken offline.

The service group includes resources to manage the disk groups and mount the file systems (Mount) for the Oracle Enterprise Manager and Oracle DB.

Finally, the service group includes the VCS high availability agent for Oracle Application Server (OracleAS9) resources to manage Oracle Enterprise Manager Grid Control. These resources are used to start and stop the application.

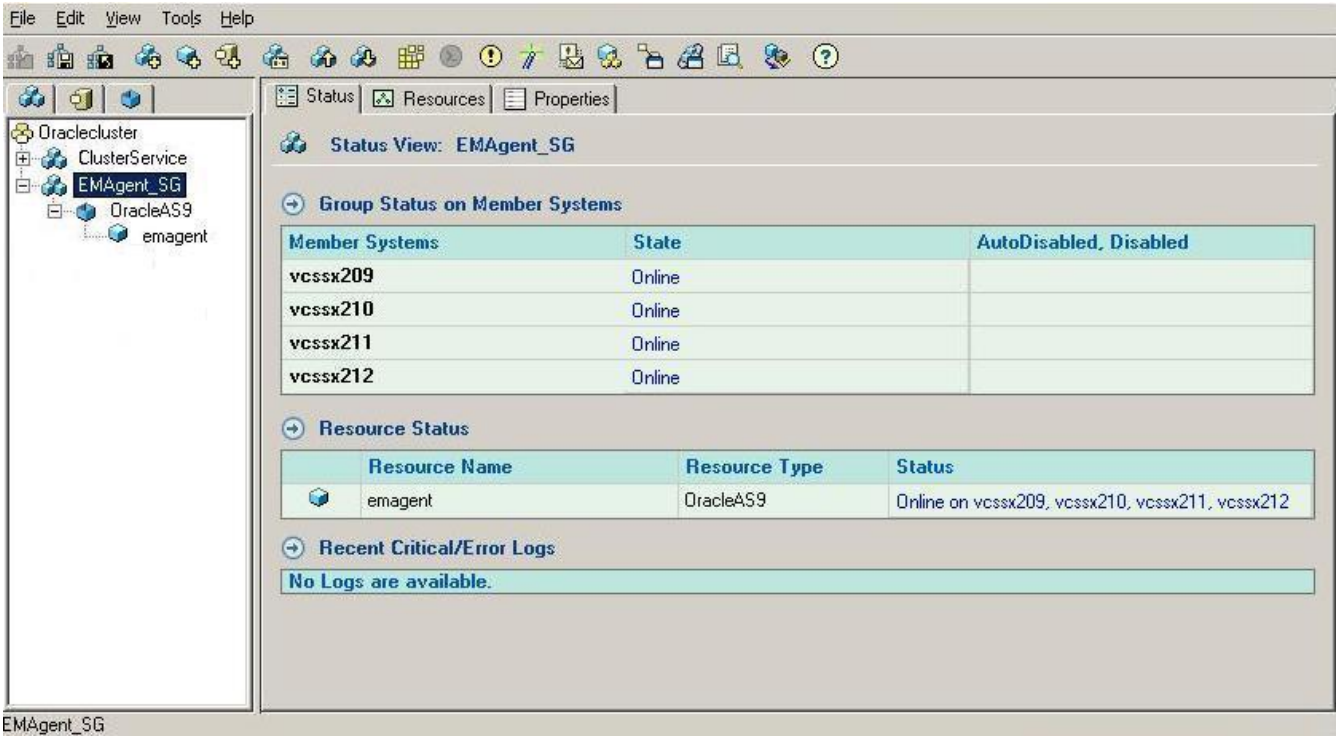
To support automated failover, Oracle Enterprise Manager components should be configured with virtual IP addresses. If a service group becomes unavailable, Veritas Cluster Server frees the virtual IP address so it can be reconfigured on the failover host. In this way, users connect to the application regardless of its physical location.

Deployment Scenario

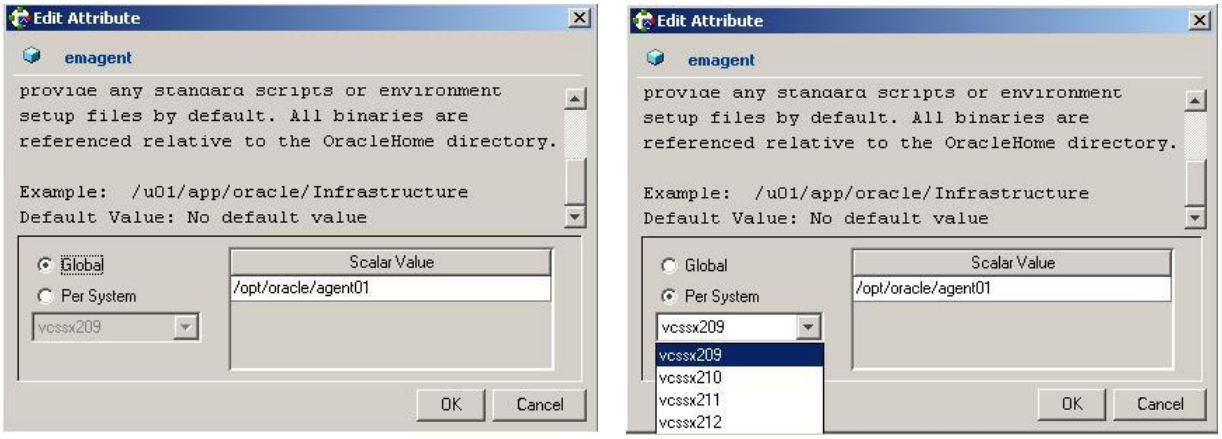
Consider the following deployment scenario.
The Oracle Enterprise Manager Grid Control agent (EMAgent) is installed on all the nodes in a cluster. The expectation is that the agent must be online on all nodes at the same time. However, during a failover, the EMAgent service group fails over to another node. The Oracle DB service group fails over independently to the other nodes without any interference from the EMAgent resource.
In such a scenario, during a failover, in order to ensure that the EMAgent restarts on the same node instead of failing over to another node, you can configure a parallel service group for EMAgent. While a failover service group runs on only one system at a time, a parallel service group runs concurrently on multiple systems.

Solution Configuration:

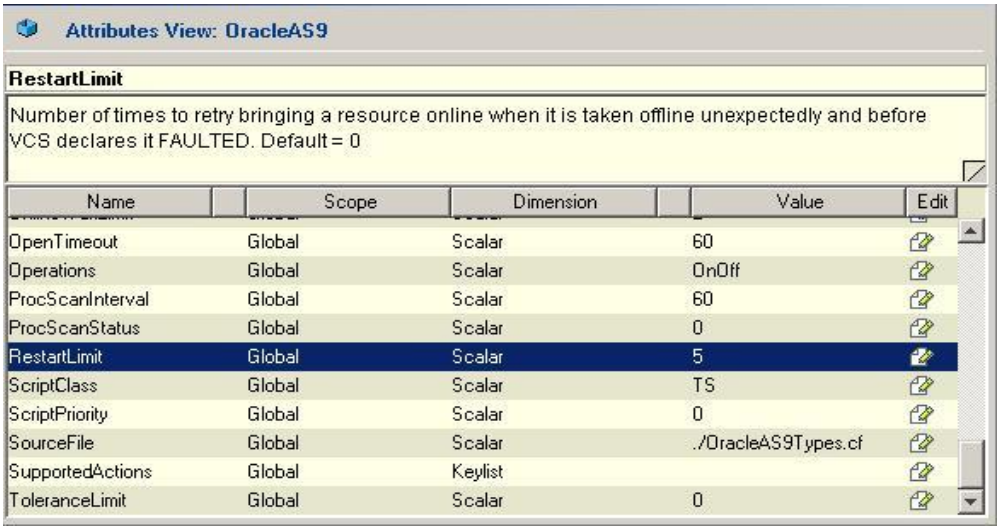
1) Create a parallel service group (EMAgent_SG) for EMAgent.
   The emagent resource (of type OracleAS9) can be online on all the nodes simultaneously and during a failure, it will not failover to any other node.



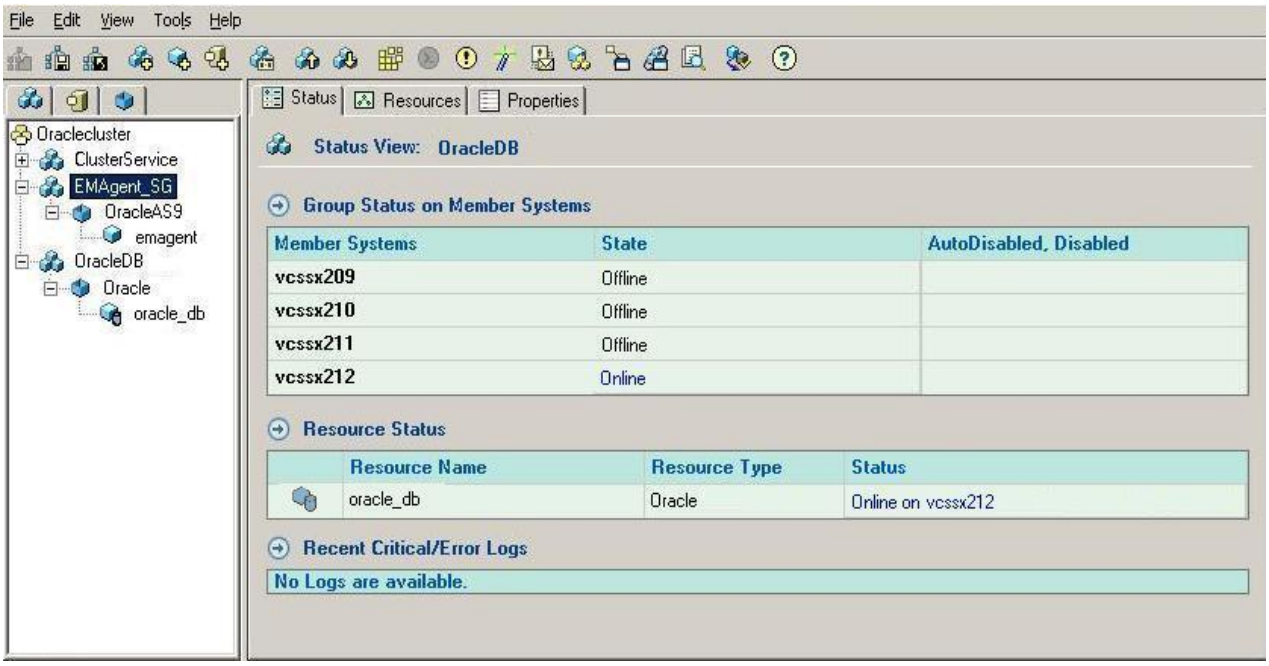
Note : If you have set global values for the OracleHome and User attributes for EMAgent, then these values must be the same on all the nodes. If you have set local values for these attributes, you can set different values on different nodes.



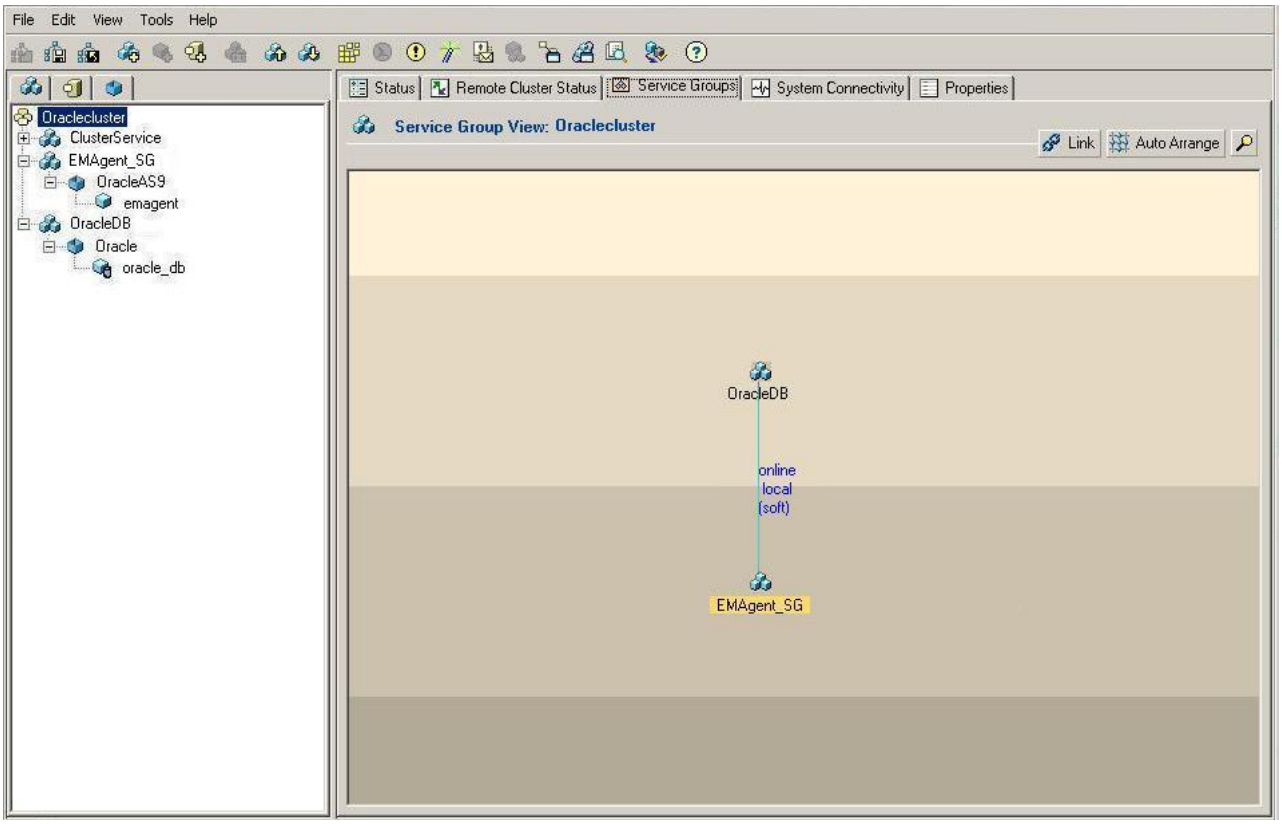
2) Set the value of the RestartLimit attribute for the OracleAS9 agent to a numeric value. This value denotes the number of attempts VCS makes to restart the resource, if the resource goes offline unexpectedly.
For example, if you set the value of this attribute to 5, VCS tries to restart the resource 5 times before reporting it as FAULTED.



3) Create the other Oracle resources in a separate failover service group. For example, create the Oracle Database resource (oracle_db) in a separate failover service group (OracleDB).



4) Set the dependency between the parallel service group (EMAgent_SG)) and the failover service group (OracleDB).
The failover service group can be an independent service group, that is, no depenedancy exists on the parallel service group.
Alternatively, you can assign an online local soft service group dependancy with OracleDB as the parent and EMAgent_SG as the child service group. In this case, the OracleDB service group does not come online untill the EMAgent service group is online on the same node. However, if the EMAgent service group fails, it does not take the Oracle DB service group offline.



About Symantec

Symantec is a global leader in infrastructure software, enabling businesses and consumers to have confidence in a connected world. The company helps customers protect their infrastructure, information, and interactions by delivering software and services that address risks to security, availability, compliance, and performance. Headquartered in Mountain View, Calif., Symantec has operations in 40 countries. More information is available at www.symantec.com.

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