

# ORACLE E-BUSINESS SUITE DEPLOYMENT AGILITY ENABLED BY EMC UNIFIED STORAGE AND VMWARE

An Architectural Overview

## EMC GLOBAL SOLUTIONS

### Abstract

This white paper describes best practices of how to accelerate the deployment of virtualized Oracle E-Business Suite (EBS) R12 applications and database instances on an EMC® VNX5700™ unified storage platform with VMware. This unified storage solution deploys the EBS servers as virtual machines on a VMware vSphere™ ESX® 4.1 infrastructure with EMC Unisphere™ providing a centralized management framework for all solution components.

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## Executive summary

### Introduction to the VNX family of unified storage platforms

The EMC® VNX™ family delivers industry-leading innovation and enterprise capabilities for file, block, and object storage in a scalable, easy-to-use solution. This next-generation storage platform combines powerful and flexible hardware with advanced efficiency, management, and protection software to meet the demanding needs of today's enterprises.

All of this is available in a choice of systems ranging from affordable entry-level solutions to high-performance, petabyte-capacity configurations servicing the most demanding application requirements. The VNX family includes the VNXe™ series, purpose-built for the IT manager in entry-level environments, and the VNX series, designed to meet the high-performance, high-scalability requirements of midsize and large enterprises.

The VNX family includes two platform series:

- The VNX series, delivering leadership performance, efficiency, and simplicity for demanding virtual application environments that includes VNX7500™, VNX5700™, VNX5500™, VNX5300™, and VNX5100™
- The VNXe (entry) series with breakthrough simplicity for small and medium businesses that includes VNXe3300™ and VNXe3100™

Customers can benefit from new VNX features as follows:

Feature	VNX series	VNXe series
Next-generation unified storage, optimized for virtualized applications	✓	✓
Capacity optimization features including compression, deduplication, thin provisioning, and application-centric copies	✓	✓
High availability, designed to deliver five 9s availability	✓	✓
Automated tiering with FAST VP (Fully Automated Storage Tiering for Virtual Pools) and FAST Cache that can be optimized for the highest system performance and lowest storage cost simultaneously	✓	
Multiprotocol support for file and block protocols	✓	✓
Object access through Atmos™ Virtual Edition (Atmos VE)	✓	
Simplified management with EMC Unisphere™ for a single management framework for all NAS, SAN, and replication needs	✓	✓
Up to three times improvement in performance with the latest Intel multicore CPUs, optimized for Flash	✓	

**Note:** VNXe does not support block compression.

EMC provides a single, unified storage plug-in to view, provision, and manage storage resources from VMware vSphere™ across EMC Symmetrix®, VNX family, CLARiiON®, and Celerra® storage systems, helping users to simplify and speed up VMware storage management tasks.

The VNX family includes five new software suites and three new software packs, making it easier and simpler to attain the maximum overall benefits.

### Software suites available

- FAST Suite—Automatically optimizes for the highest system performance and the lowest storage cost simultaneously (not available for the VNXe series or the VNX5100).
- Local Protection Suite—Practices safe data protection and repurposing (not applicable to the VNXe3100 as this functionality is provided at no additional cost as part of the base software).
- Remote Protection Suite—Protects data against localized failures, outages, and disasters.
- Application Protection Suite—Automates application copies and proves compliance.
- Security and Compliance Suite—Keeps data safe from changes, deletions, and malicious activity.

### Software packs available

- Total Efficiency Pack—Includes all five software suites (not available for the VNX5100 and VNXe series).
- Total Protection Pack—Includes local, remote, and application protection suites (not applicable to the VNXe3100).
- Total Value Pack—Includes all three protection software suites and the Security and Compliance Suite (the VNX5100 and VNXe3100 exclusively support this package).

### Business case

Traditionally, large, mission-critical ERP Oracle Database applications have been positioned to run on block-based storage over Fibre Channel (FC)-connected SANs (storage area networks). While this is highly scalable and secure, it can be overly complex and cost-prohibitive for small and midsize businesses (SMBs). SMBs require the performance and scalability provided by these platforms, while still retaining ease of use and flexibility.

The EMC VNX family of unified storage platforms delivers Internet Protocol (IP), Internet Small Computer System Interface (iSCSI), FC, and FC over Ethernet (FCoE) connectivity in a single-array solution. This enables Oracle applications to be deployed on a combination of Network File System (NFS) over IP and FC-connected SAN. The VNX family offers smaller IT organizations a low-cost, easy-to-use solution that provides operational flexibility, superior performance, and no-compromise availability.

VMware vSphere with EMC VNX unified storage provides Oracle customers with new levels of efficiency in configuring, provisioning, and scaling Oracle Database 11g, Oracle Application Server 11g, and Oracle E-Business Suite environments as a cohesive solution.

Virtualizing the underlying server infrastructure supporting Oracle software empowers Oracle DBAs with simplified virtual machine templates, tightly integrated with Oracle provisioning and cloning processes, which allows for dramatically faster deployment and scaling of new instances of the Oracle database and applications. In addition, using virtual machine deployments allows for greater utilization of existing Oracle server hardware assets and promotes long-term hardware consolidation.

Combining EMC's long-standing Oracle knowledge and expertise with the latest generation of EMC unified storage platforms and VMware, this solution provides a compelling foundation for Oracle customers to deploy a highly flexible infrastructure for their complete Oracle software stack, and to achieve high levels of economic efficiency as well as operational efficiency.

## Product solution

This white paper describes a unified storage solution for virtualized Oracle E-Business Suite (EBS) Release 12 (R12) applications deployed on a VNX5700 storage array. The Oracle EBS database tier is configured as a multinode Oracle Real Application Cluster (RAC) connected by FC SAN. The applications tier is configured as a shared APPL\_TOP environment connected by NFS over IP. All EBS servers are deployed as virtual machines on a VMware vSphere ESX® 4.1 infrastructure, and EMC Unisphere provides a centralized management framework for block and file storage and VMware.

## Solution benefits

The key benefits of the solution include:

- **Efficiency:** The VNX5700 system provides a single platform for block and file storage on a combination of Flash, SAS, and NL-SAS drives.
- **Accelerated deployment:** VMware virtual machine templates demonstrate the easy deployment of Oracle Applications as a production-ready platform for scaling Oracle EBS.
- **Simplicity:** The Unisphere storage management platform provides an easy-to-use, customizable interface for configuring storage, monitoring the environment, and managing host connections. Unisphere is fully integrated with VMware, which helps simplify VMware storage management tasks.
- **Consolidation:** The VNX platform is optimized for virtual applications with VMware. Virtualization of the Oracle EBS environment serves to contain server sprawl, enabling organizations to optimize their use of resources and gain significant cost savings on hardware and energy consumption.

# Introduction

## Purpose

This white paper describes a unified storage solution for Oracle EBS R12 applications deployed on VNX5700 storage in a virtualized environment.

## Scope

The scope of this white paper is to:

- Present an overview of the technologies involved in the solution.
- Document the storage infrastructure and layout of the Oracle EBS R12 environment for the use case that was implemented to validate the solution.
- Demonstrate the use of Unisphere for simple, centralized management of block and file storage and the VMware virtual environment.
- Provide guidelines for scaling up the Oracle application shared APPL-TOP nodes.

## Audience

This white paper is intended for EMC employees, partners, and customers, including Oracle, storage, and VMware administrators, who want to understand how VNX5700 storage, Unisphere, and VMware vSphere can provide an easy-to-use, unified storage solution for Oracle EBS applications. It is assumed that the reader is familiar with the following EMC, VMware, and Oracle products:

- EMC VNX series
- VMware vSphere and VMware templates
- Oracle E-Business Suite R12, Oracle Database 11gR2 Enterprise Edition, Oracle Grid Infrastructure, Oracle RAC, and Oracle ASM

## Terminology

This white paper includes the following terminology.

Term	Definition
ASM	Oracle Automatic Storage Management
DBUA	Database upgrade assistant
EBS	Oracle E-Business Suite
FC	Fibre Channel
NFS	Network File System
RAC	Real Application Clusters
RDM	Raw device mapping is a method of presenting a SAN/data device directly to a virtual machine. This is an alternative to using VMware VMFS.
SAN	Storage area network
SAS	Serial attached SCSI
UID	Unique Identifier
VAAI	VMware vStorage APIs for Array Integration
vCPU	VMware virtual CPU, as assigned to a virtual machine as a single usable CPU
VIP	Virtual IP
VMFS	VMware file system is a clustered file system on which virtual disks can be configured and subsequently assigned to virtual machines. VMFS can be created on local or external SAN/data devices.
VNX OE	EMC VNX Operating Environment
WWN	World Wide Name

# Key technology components

## Overview

The solution uses the following EMC hardware and software components:

- EMC VNX5700
- EMC Unisphere
- EMC PowerPath®/Virtual Edition (VE)

The solution uses the following VMware technologies:

- VMware vSphere, VMware vCenter™, and VMware templates
- VMware vStorage APIs for Array Integration (VAAI)

The solution uses the following Oracle technologies:

- Oracle E-Business Suite R12
- Oracle Database 11g R2 Enterprise Edition

## EMC VNX5700

EMC VNX implements a modular architecture that integrates hardware components for block or file with concurrent support for native NAS, iSCSI, FC, and FCoE protocols. The VNX series is based on the powerful new family of Intel Xeon-based PCI Express 2.0 processors and delivers file (NAS) functionality through two X-Blade Data Movers and block (iSCSI, FCoE, and FC) storage through dual storage processors using a full 6 Gb SAS disk-drive topology.



### EMC VNX5700

- Maximum drives: 500
- Drive types:
  - Flash, SAS, NL-SAS
- File:
  - X-Blades: 2, 3, or 4
  - Protocols: NFS, CIFS, MPFS, pNFS
- Block:
  - Storage processors: 2
  - Protocols: FC, iSCSI, FCoE

Figure 1. EMC VNX5700

A robust platform designed to deliver five 9s availability, the VNX series enables organizations to dynamically grow, share, and cost-effectively manage multi-protocol file systems and multi-protocol block storage access. The VNX Operating Environment (VNX OE) allows Microsoft Windows and Linux/UNIX clients to share files in multi-protocol (NFS and CIFS) environments. At the same time, VNX OE supports iSCSI, FC, and FCoE access for high-bandwidth and latency-sensitive block applications.

The VNX series has been expressly designed to take advantage of the latest innovation in Flash drive technology, maximizing the storage system's performance and efficiency while minimizing cost per GB.

The VNX series is delivered with built-in features to help ensure redundant, inactive, or anticipated data does not consume valuable storage resources. VNX Block Compression, intended for relatively inactive LUNs such as backup copies and static data repositories, automatically compresses data, allowing customers to recapture capacity and reduce data footprint by up to 50 percent. VNX File Deduplication and Compression reduces disk space used by up to 50 percent by selectively compressing and deduplicating inactive files. Because these features operate as background tasks, there is minimal system performance overhead.

The VNX series is the ideal midtier system for virtualized application environments. Whether the customer environment is VMware, Microsoft Hyper-V, or Xen-based, VNX is fully certified for all supported protocols to ensure successful deployments of virtualized infrastructures through all phases of implementation.

## EMC Unisphere

### Unified management

EMC Unisphere is the central management platform for the EMC VNX family. Unisphere 1.1.0 introduces a single combined view of file and block systems, with all features and functions available through a common interface. Unisphere's approach to storage management fosters simplicity, flexibility, self-help, and automation—all key requirements for the journey to the private cloud.

With Unisphere's modular architecture, it is easily extensible, and seamlessly supports other midtier and enterprise storage platforms, as well as data protection, security, and replication solutions. New products and features can also be easily integrated as modules or plug-ins.

### Enhanced management, intuitive navigation, and customization

Unisphere's unified management approach provides single sign-on, aggregated alerts, common navigation, and a single dashboard for all storage resources. The interface is easy-to-use, customizable, and 100 percent web-based for remote management of storage environments:

- Application-aware wizards deliver simplified storage provisioning, management, and reporting.
- System dashboards offer at-a-glance management, monitoring, and reporting, providing administrators with instant and actionable knowledge of how their storage resources have been deployed and what resources are available for management operations. Detailed examination of key system information is also available.

- The customizable interface enables users to adapt dashboards, system views, and reports to meet their particular business needs.

### VMware integration

Unisphere is optimized for virtual applications and provides industry-leading VMware integration. It automatically discovers all virtual machines and ESX Servers and provides end-to-end, virtual-to-physical mapping. Unisphere delivers an integrated point of control for storage and VMware administrators. Each can use their familiar management interface to view both virtual and physical resources, transparently provision storage, and offload storage-related functions from the server to the array. This enables more efficient use of server resources for increased performance and consolidation.

To enable this tight VMware integration, EMC also delivers VMware vStorage APIs for Array Integration (VAAI) support and a Virtual Storage Integrator (VSI) plug-in.

### Integrated, contextual support

Unisphere offers single-click, contextual access for all support and service needs, providing integrated online access to EMC-assisted support resources and to customer communities.

### EMC PowerPath/VE

EMC PowerPath is server-resident software that enhances performance and application availability by supporting multiple I/O paths to logical devices and intelligently distributing I/O requests across all available paths. PowerPath also provides automatic failover in the event of a hardware failure by automatically detecting the path failure and redirecting I/O to another path.

EMC PowerPath/VE delivers PowerPath multipathing features to optimize VMware vSphere virtual environments. It enables customers to automate optimal server, storage, and path utilization in a dynamic virtual environment. This eliminates the need to manually load balance hundreds or thousands of virtual machines and I/O-intensive applications in hyper-consolidated environments.

### VMware vSphere

#### VMware vSphere 4.1

The industry's most widely deployed virtualization platform, VMware vSphere abstracts applications and information from the complexity of underlying infrastructure, through comprehensive virtualization of server, storage, and networking hardware.

#### VMware vCenter

A scalable and extensible platform for centralized management of VMware vSphere environments, providing control and visibility at every level of the virtual infrastructure.

#### VMware virtual machine templates

A virtual machine template is a virtual machine image loaded with an operating system, applications, and data. After you define and publish a virtual machine template, you can quickly and easily create multiple virtual machines based on the virtual machine template without having to reinstall software or redo setup tasks on each virtual machine. Using virtual machine templates ensures that virtual machines are consistently configured across an entire organization.

## Customization specifications

Customization specifications, held in VMware vCenter, further simplify rollout of virtual machines. A deployment wizard uses these to automatically pre-create or request server settings (such as server name, time zone, and network configuration) prior to building the new virtual machine.

## EMC Virtual Storage Integrator

The EMC Virtual Storage Integrator (VSI) plug-in introduces the following functionality within the VMware vSphere client:

- Discover and identify EMC VNX and EMC Symmetrix arrays
- Present details of the storage allocated to the virtual infrastructure from each array
- Create pools of virtually provisioned storage and provide those to VMware teams to use while protecting other workloads from any impact, and enabling VMware teams to self-provision the storage allocated to them
- Allocate storage to specific VMware infrastructure objects or share it across the entire cluster
- Extend and reconfigure VMFS and block storage

## Oracle

### Oracle E-Business Suite R12

Oracle E-Business Suite (EBS) is a comprehensive suite of integrated business applications based on Oracle's core database management system technology. It provides a complete and integrated system for managing and optimizing enterprise-wide processes. Oracle EBS R12 has numerous configuration options that can be chosen to suit particular business scenarios, uptime requirements, hardware capabilities, and availability requirements.

### Oracle Database 11gR2 Enterprise Edition

This white paper presents a virtualized storage solution for consolidated Oracle Database 11gR2 OLTP environments. The solution takes advantage of features of Oracle Database 11gR2 such as Real Application Clusters (RAC) and Automatic Storage Management (ASM).

In Oracle Database 11gR2, Oracle ASM and Oracle Clusterware have been integrated into a single set of binaries and named Oracle Grid Infrastructure. This now provides all the cluster and storage services required to run an Oracle RAC database. Oracle ASM has also been extended to include support for Oracle Cluster Registry (OCR) and voting files to be placed within ASM disk groups.

# Solution architecture and design

## Solution architecture

EMC solution use cases are designed to reflect and validate real-world deployments. Figure 2 depicts the physical architecture of the use case developed for the solution described in this white paper.

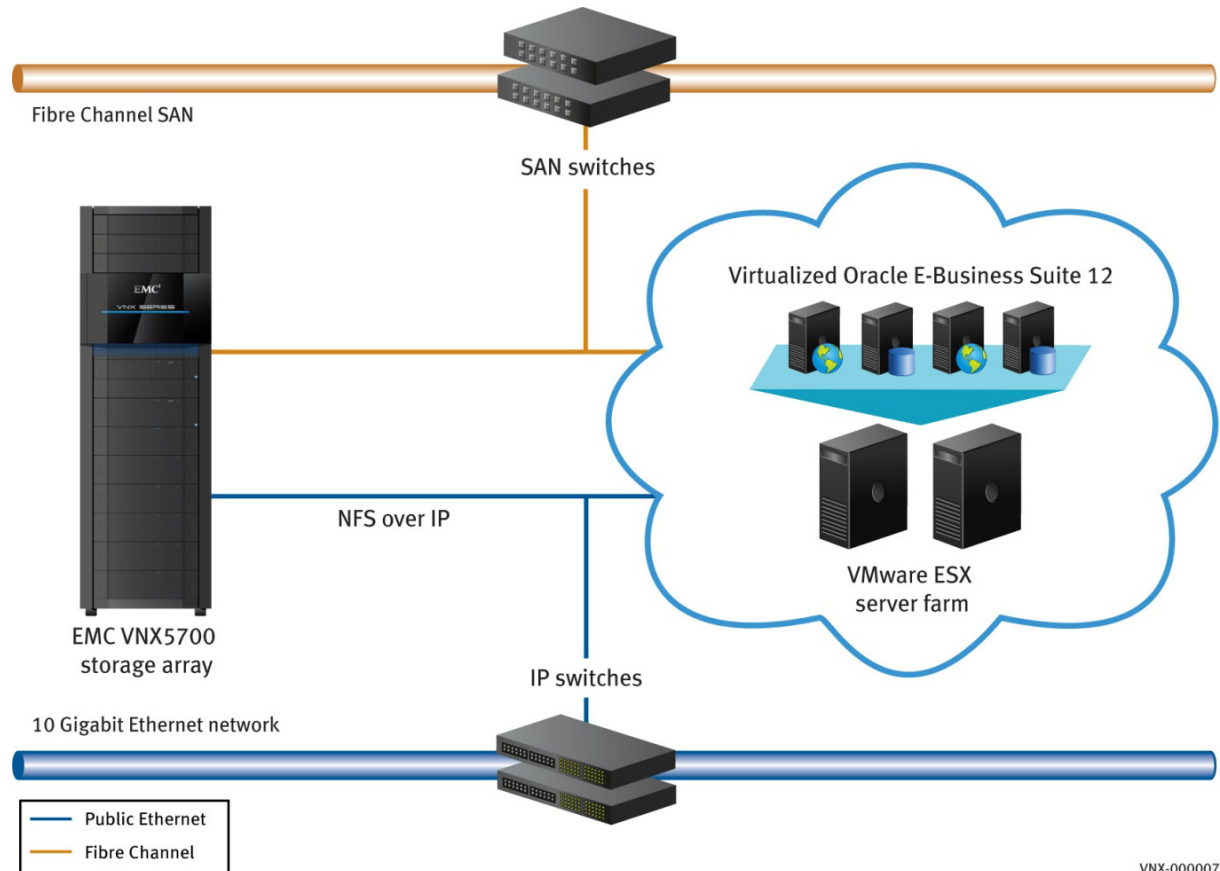


Figure 2. Solution architecture

## Use case description

This use case details an implementation of Oracle E-Business Suite on an EMC VNX5700 array. The shared APPL\_TOP multinode environment is built on VMware virtual machines; each virtual machine has access to NFS shared folders on the VNX5700.

The database tier nodes run in an Oracle RAC 11gR2 environment; again, each database node is built on a virtual machine. The virtual machines used in the RAC environment access Oracle ASM disk groups built on the VNX5700. The ASM disk groups are available through the SAN.

## Use case profile

Table 1 details the use case profile.

**Table 1. Use case profile**

Profile Characteristic	Value
Database type	OLTP
Database size	200 GB
Drive types	600 GB 10k SAS

## Hardware environment

Table 2 shows the hardware environment for the solution.

**Table 2. Hardware**

Purpose	Resources
Storage array	VNX5700, with: <ul style="list-style-type: none"><li>• 8 Gb FC connectivity</li><li>• 1 Gb network connectivity</li><li>• 300 GB 15k SAS drives</li><li>• 600 GB 10k SAS drives</li><li>• 2 x Data Movers</li><li>• 4 x GbE NICs</li><li>• 1 x Control Station</li><li>• VNX Operating Environment (VNX OE)</li></ul>
Virtual infrastructure	2 x VMware vSphere ESX Servers, with: <ul style="list-style-type: none"><li>• 4 x 2.26 GHz eight-core processors</li><li>• 128 GB RAM</li><li>• 2 x 8 Gb HBAs</li><li>• 2 x 1 Gb NICs</li></ul>
Virtual machines	<ul style="list-style-type: none"><li>• 2 x Oracle Database servers</li><li>• 2 x Oracle EBS application servers <sup>1</sup></li></ul>
FC switches	2 x 8 GB/s FC switches
Ethernet switches	2 x 1 Gigabit Ethernet switches

<sup>1</sup> Initially, two nodes were deployed; additional nodes were added later.

## Software environment

Table 3 shows the software used for the solution.

**Table 3. Software**

Software	Configuration
Red Hat Enterprise Linux 5	Server OS for database and application servers
Oracle E-Business Suite R12.1	Vision database install Shared APPL-TOP configuration
Oracle Database 11gR2	Database and cluster software (two-node RAC)
VMware vSphere 4.1	ESX and vCenter
EMC Unisphere 1.1.0	VNX management software

## Storage architecture

The environment consists of a two-node Oracle RAC 11g that accesses a single production database. Each cluster node resides on a virtual machine. The two RAC nodes communicate with each other through a dedicated 1 Gb private network. This cluster interconnection synchronizes cache across various database instances between user requests. Two 8 Gb FC switches were used to provide FC SAN connectivity.

EMC PowerPath/VE is used in this solution and works with the storage system to intelligently manage I/O paths. In this solution, for each server, PowerPath/VE manages two active I/O paths to each device and two passive I/O paths to each device.

It is a best practice to use ASM external redundancy for data protection when using EMC arrays. VNX also provides protection against loss of media, as well as transparent failover in the event of a specific disk or component failure. Five separate ASM disk groups are used for the database in this use case. The disk groups used are: DATA, REDO, CRS, FRA, and TEMP.

## VMware virtual machine architecture

The following virtual machines are deployed on each ESX Server node to compose the applications tier and the database tier. Table 4 and Table 5 list the virtual hardware and software components for each tier type.

**Table 4. Application tier virtual machine components**

Component	Quantity and description
2.26 GHz eight-core processors	2 vCPUs
Memory	8 GB
1 GbE virtual NICs	1 used for public network 1 used for NFS

**Table 5. Database tier virtual machine components**

<b>Component</b>	<b>Quantity and description</b>
2.26 GHz eight-core processors	4 vCPUs
Memory	24 GB
1 GbE Ethernet virtual NICs	1 used for public network 1 used for cluster interconnect
8 Gb HBAs	2 used for SAN

## Virtualized Oracle EBS R12 deployment architecture on an EMC VNX5700

The solution described in this white paper describes an easy and repeatable deployment method for building a virtualized Oracle EBS R12 on an Oracle RAC 11gR2 on a VNX5700.

Oracle EBS is installed as a multinode environment. This consists of four nodes: two nodes for the applications tier, and two nodes for the database tier. A virtual machine is deployed for each of the four nodes. The virtual machines are built on a VMware vSphere 4.1 cluster composed of two ESX Server nodes.

The applications tier consists of multiple nodes, and each node is installed using Oracle shared APPL\_TOP. The shared APPL\_TOP file systems are created on NFS shared folders on the VNX5700 storage array. The shared folders are accessed over the IP protocol. The load-balancing feature is provided by a software-based load balancer.

The database tier nodes are deployed using an Oracle RAC 11gR2 database. Each RAC node has access over FC SAN to ASM disk groups created on the VNX5700. The Oracle database binaries are installed on the virtual machines. All database files such as datafile, controlfiles, and online redo logfiles are deployed on the ASM disk groups.

The virtual infrastructure that supports the production or other independent environments includes two physical ESX Server hosts running VMware ESX Server 4.1, which are connected in a two-node cluster environment. Configuration files for each of the virtual machines are stored on an NFS share accessible over IP on the VNX array.

## Virtualized Oracle EBS R12 environment

The environment consists of a two-node applications tier with a shared file system and a two-node RAC database, all of which are deployed on virtual machines as shown in Figure 3.

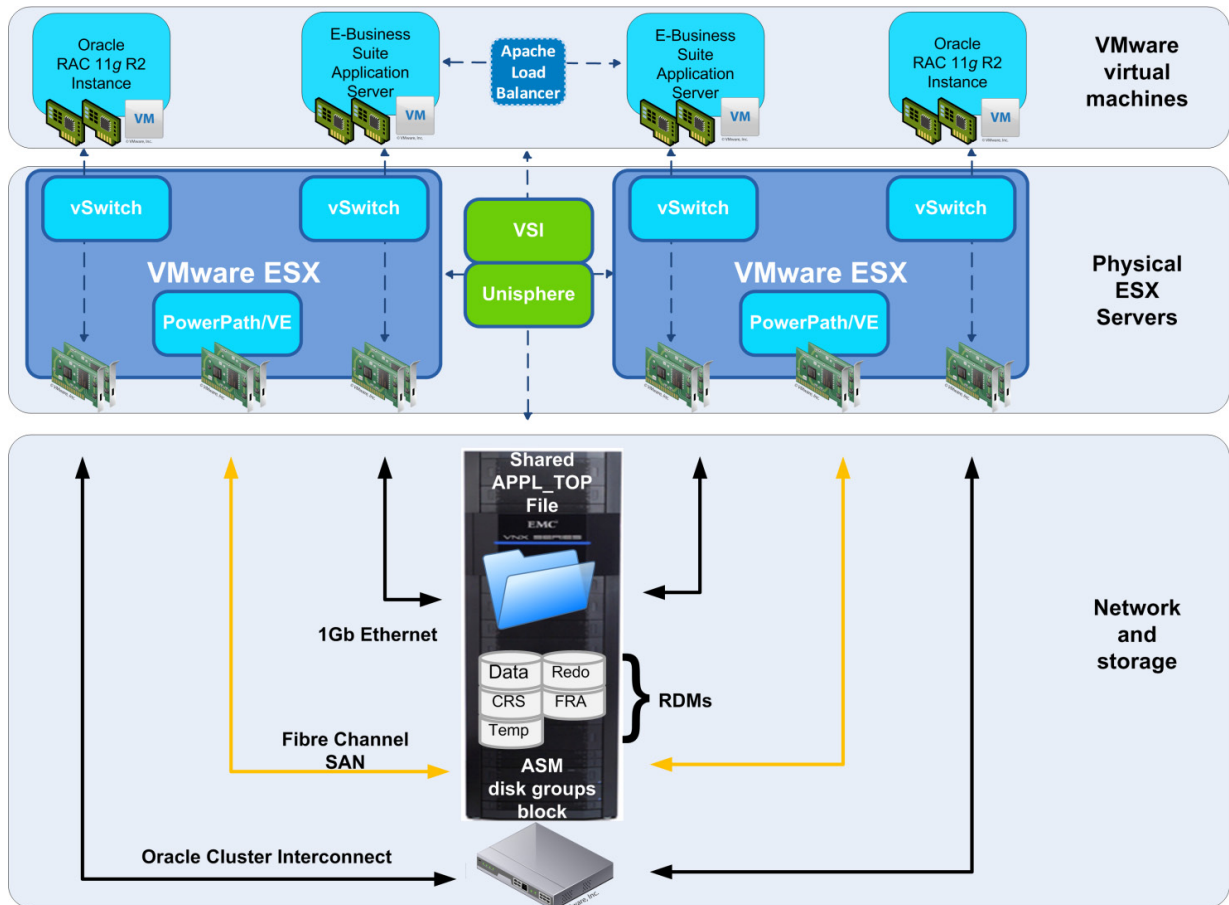


Figure 3. Virtualized Oracle E-Business Suite environment

- Each node has at least two virtual network adapters: one for the public network interface; the other for the private network interface (interconnect).
- Database nodes are connected to the VNX5700 using the FC protocol to access the ASM disk groups. Each ESX Server contains two FC HBAs to facilitate FC connectivity.
- A dedicated vSwitch is used for the RAC interconnect.
- ASM provides the file system semantics for Oracle Database and Oracle RAC 11gR2 when deployed on block storage.
- IP addresses are required as follows for Oracle RAC:
  - An IP address and associated hostname registered in the DNS or the /etc/hosts file for each public network interface.
  - Each node requires one unused virtual IP (VIP) address and an associated VIP name, registered in the DNS or the /etc/hosts file, which are configured for the primary public network interface. The VIP address must be in the same subnet as the associated public interface. After installation, the clients can be configured to

use the VIP name or VIP address. If a node fails, its VIP address fails over to another node.

- Oracle recommends that private network IP addresses are used for the private IP address and optional hostname.
- Applications nodes are connected to the VNX5700 using IP protocol to access NFS shares.

## EMC Unisphere/VMware integration

EMC Unisphere is fully integrated with VMware vCenter. The Unisphere Dashboard has a **Virtualization** tab on the **Hosts** dropdown menu (as shown in Figure 4) that enables the discovery of the entire VMware vSphere environment. This includes the cluster, virtual machines, and storage mapping.

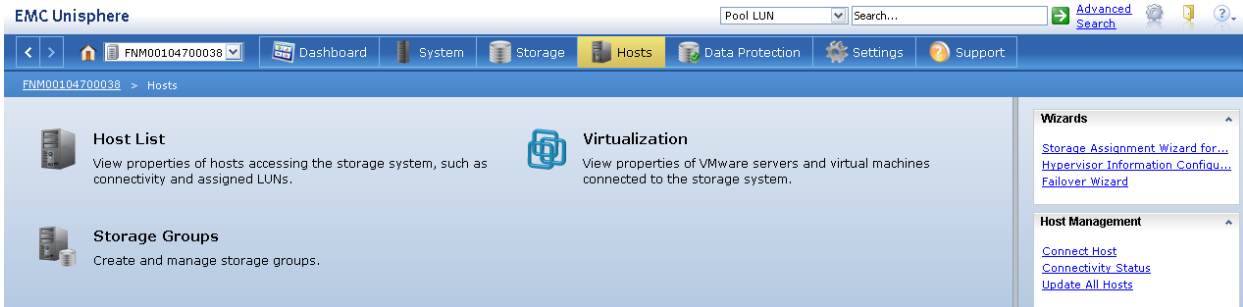


Figure 4. EMC Unisphere Dashboard

The user can select the discovery method as shown in Figure 5.

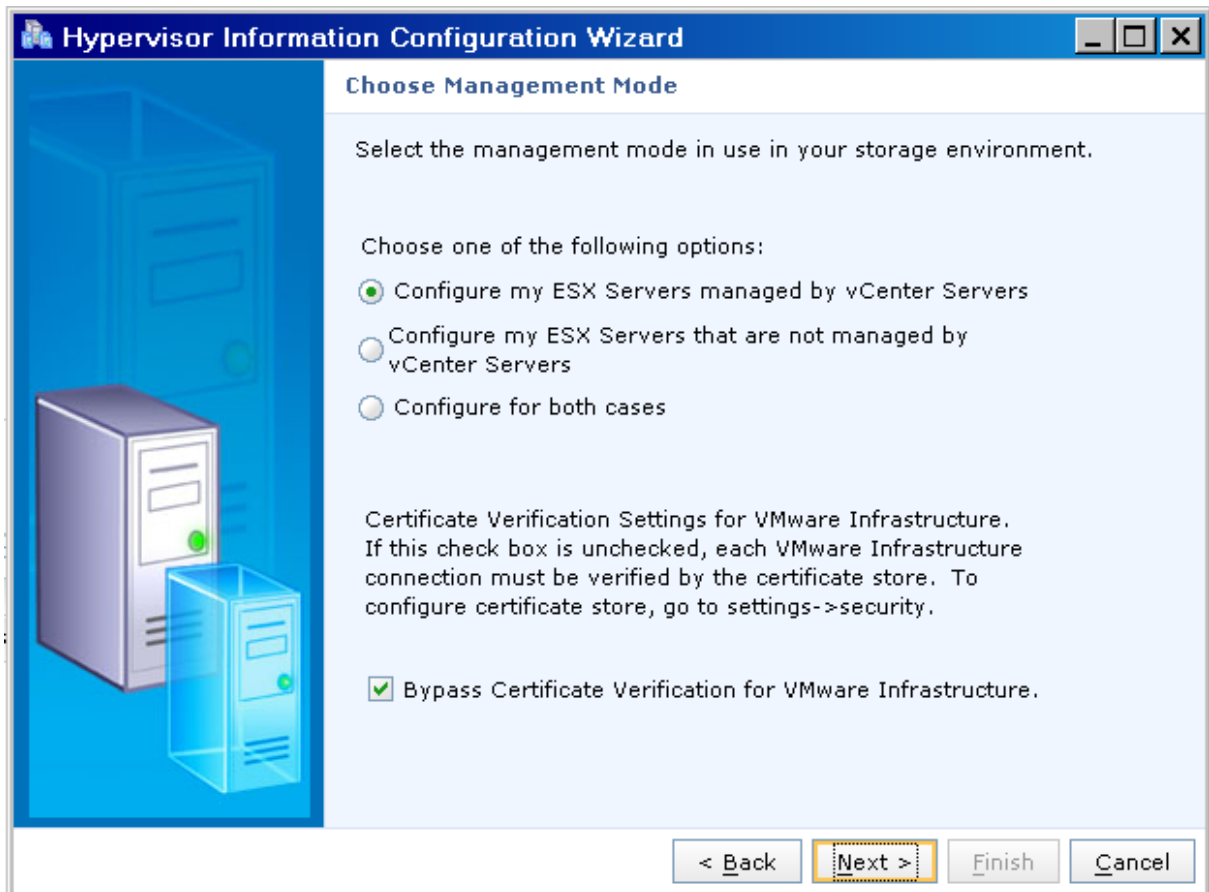


Figure 5. EMC Unisphere Hypervisor Wizard – Choose Management Mode

As shown in Figure 6, EMC Unisphere gives the storage administrator deep insight into the virtualized environment. In as little as eight clicks, Unisphere can discover all ESX Servers and virtual machines within the VMware vCenter server.

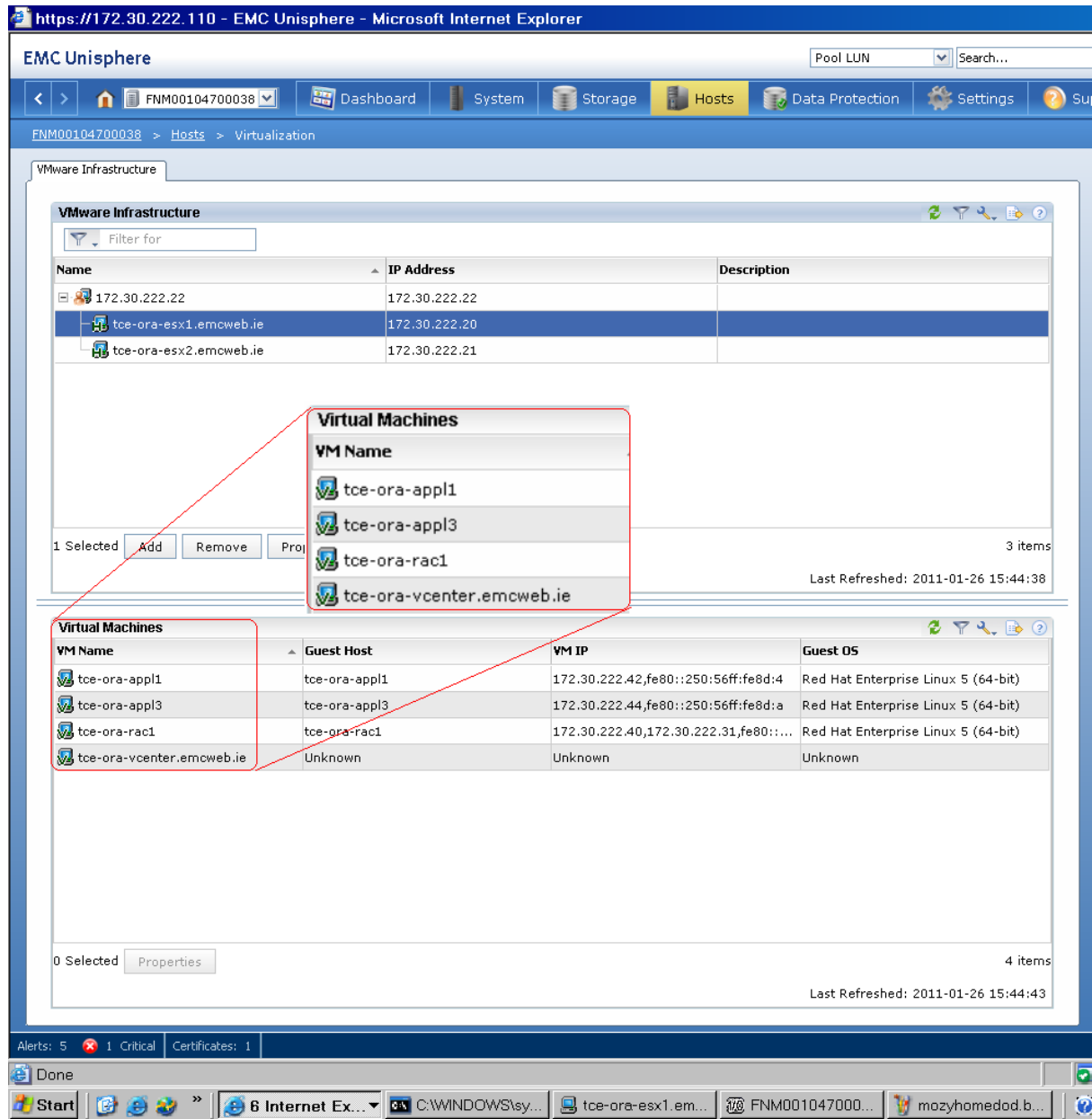


Figure 6. EMC Unisphere Hypervisor Wizard – Managing ESX Servers and virtual machines

All LUNs and storage devices are also discovered automatically, providing end-to-end discovery of the entire environment (as shown in Figure 7). This gives the storage administrator a complete end-to-end view of the virtual environment.

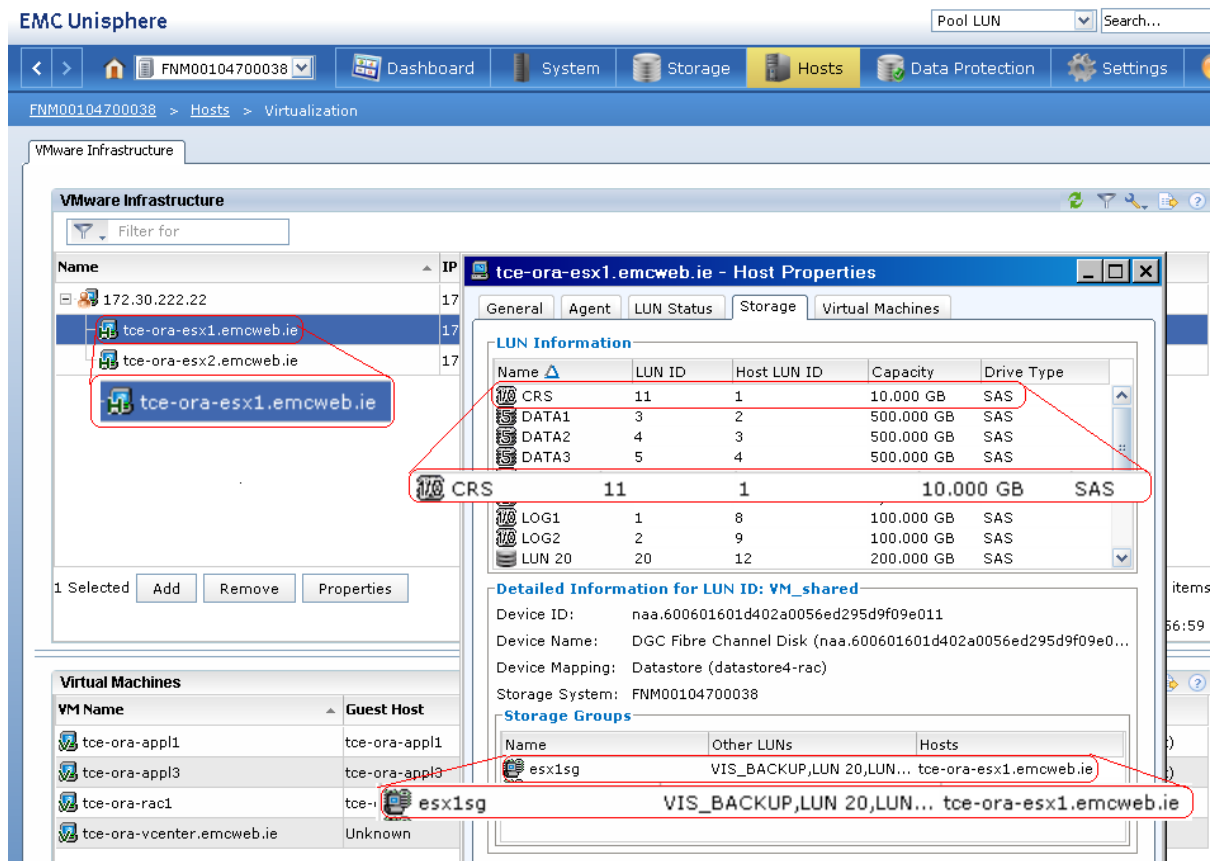
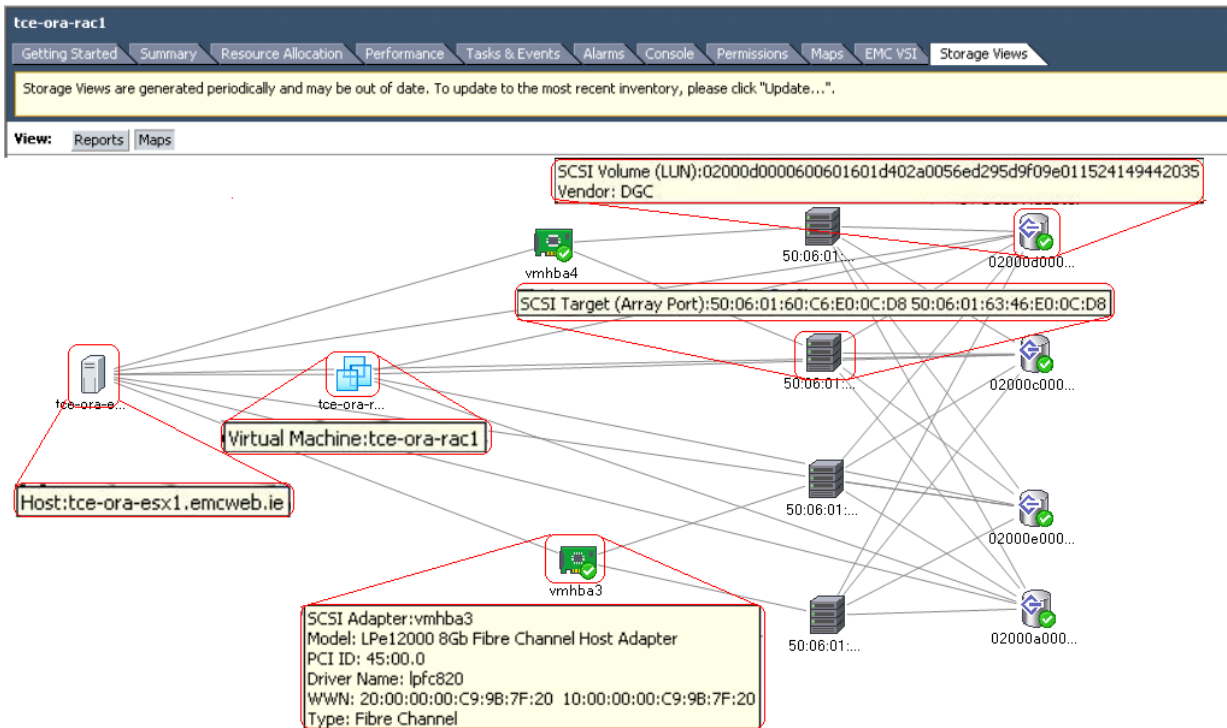


Figure 7. EMC Unisphere automatically discovering LUNs and storage devices

The integration of Unisphere and VMware vCenter is enhanced even further by the use of free EMC plug-ins for VMware vCenter. With the plug-ins, VMware administrators have the ability to manage their VMware vSphere cluster, virtual machines, and storage all from within the VMware vCenter management console. This provides the system administrator with an end-to-end view of the entire infrastructure as shown in Figure 8.



**Figure 8. VMware vCenter: Storage Views – Maps**

The VMware vCenter > Storage Views > Maps view provides the following information:

- ESX Server name
- Virtual machine name
- SCSI adapters – HBA type, WWN, and driver version
- SCSI Target - Array port WWN
- SCSI volume – Array LUN UID

As shown in Figure 9, these capabilities are offered on all of EMC's storage platforms and include provisioning, configuration, management, and monitoring of both block and file storage provided by the VNX array.

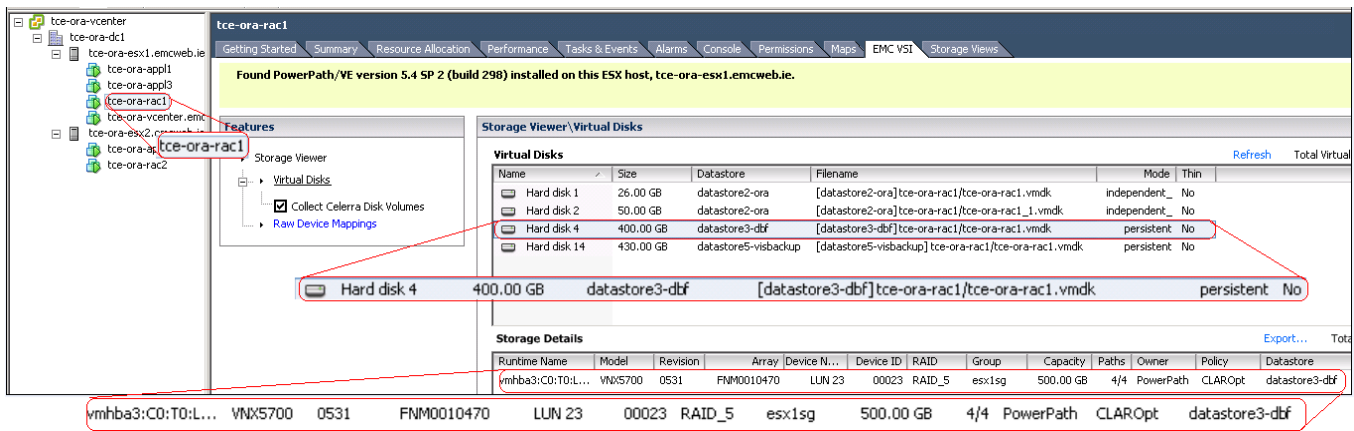


Figure 9. VMware vCenter EMC VSI – Storage Viewer

EMC is the only storage vendor to provide this deep integration in both directions—from Unisphere and the VNX array to vCenter and from vCenter to Unisphere and the VNX array. This enables a new breed of administrator, the “virtual administrator”, to manage the entire infrastructure, allowing a single resource to manage virtual machines and storage systems.

## Oracle storage design

Table 6 lists the Oracle database files allocation in ASM disk groups in this solution. All of these files are accessed using ASM.

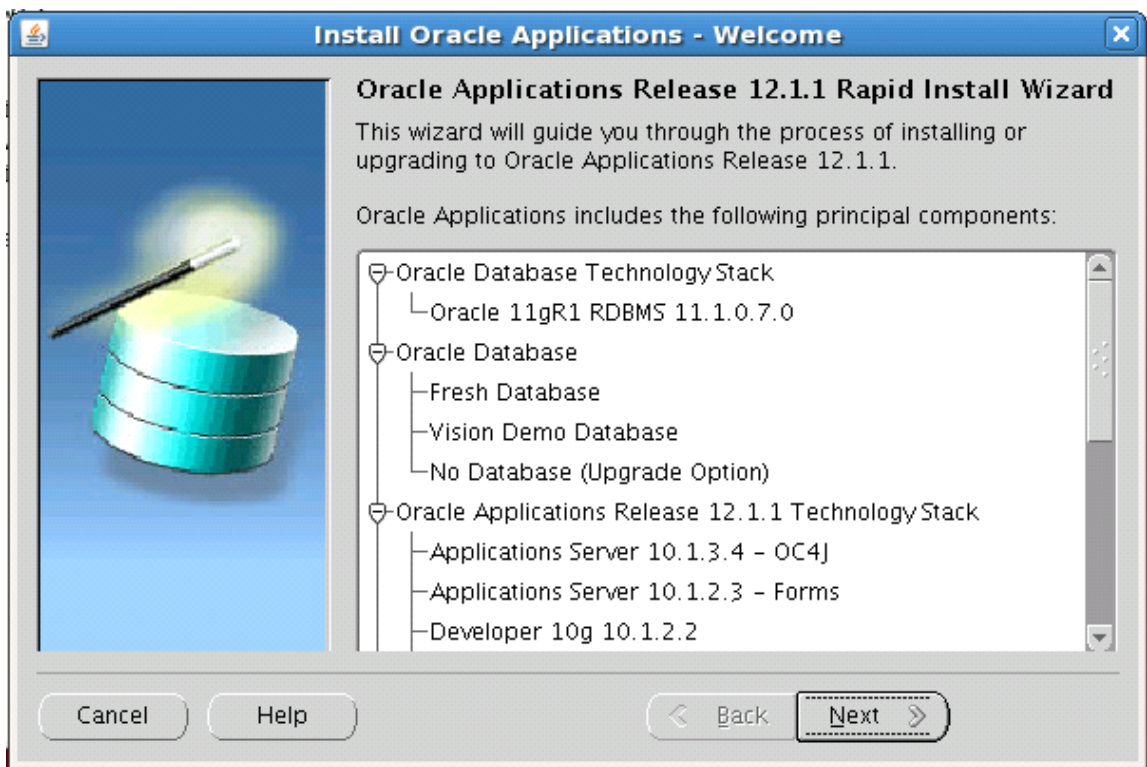
**Table 6. Database files allocation**

Content	Location (ASM disk group)	RAID type
Datafiles	DATA	RAID 5
Tempfiles	TEMP	RAID 5
Online redo log files, controlfiles	Mirrored across: LOG1, LOG2	RAID 10
Archived logfiles	FRA	RAID 5
OCR and voting disk files	CRS	RAID 10

RAID 5-protected disk groups are designed to meet the I/O demands of particular database objects. Online redo log files and control files should be put on RAID 1 or RAID 10 devices instead of RAID 5, because sequential write performance of distributed parity (RAID 5) is not as high as that of mirroring (RAID 1).

### Oracle E-Business Suite Shared APPL\_TOP

Oracle Rapid Install Release 12.1.1 creates a system that shares not only the APPL\_TOP and COMMON\_TOP file systems but the applications tier technology stack file system as well (as shown in Figure 10). Rapid Install sets up this configuration as the default for nodes that are running the same operating system. These files make up the applications tier file system and can be shared across multiple applications nodes (provided they are running the same operating system).



**Figure 10. Oracle Applications R12 Rapid Install Wizard**

With a shared applications tier file system, all applications node files are installed on a single shared disk resource that is mounted under the same name from each applications tier machine. Any applications node can be used to provide standard services, such as serving forms or Web pages, or concurrent processing. A shared applications tier file system offers several benefits:

- Most administration, patching, and maintenance tasks need be performed only once, on a single applications node.
- Changes made to the shared file system are immediately accessible on all applications nodes.
- It distributes processing tasks to run in parallel on multiple nodes (Distributed AD).
- It reduces overall disk requirements.
- It makes adding additional applications tier nodes easier.

Table 7 provides an overview for the file system layout of the Oracle EBS R12 applications tier. These file systems are accessed using Kernel NFS.

**Table 7. File system layout of the applications tier**

File system	Path	Mounted on
COMMON_TOP	/d01/shared_app/apps/apps_st/common	Mounted on all of the applications nodes
APPL_TOP	/d01/shared_app/apps/apps_st/appl	
OracleAS 10.1.2 ORACLE_HOME	/d01/shared_app/apps/tech_st/10.1.2	
OracleAS 10.1.3 ORACLE_HOME	/d01/shared_app/apps/tech_st/10.1.3	
INST_TOP for primary node	/d01/local/apps/VIS_tce-ora-appl1	Locally mounted
INST_TOP for secondary node	/d01/local/apps/VIS_tce-ora-appl2	Locally mounted

In this solution, the primary and secondary applications tier nodes are virtual machines created on a VMware vSphere 4.1 infrastructure.

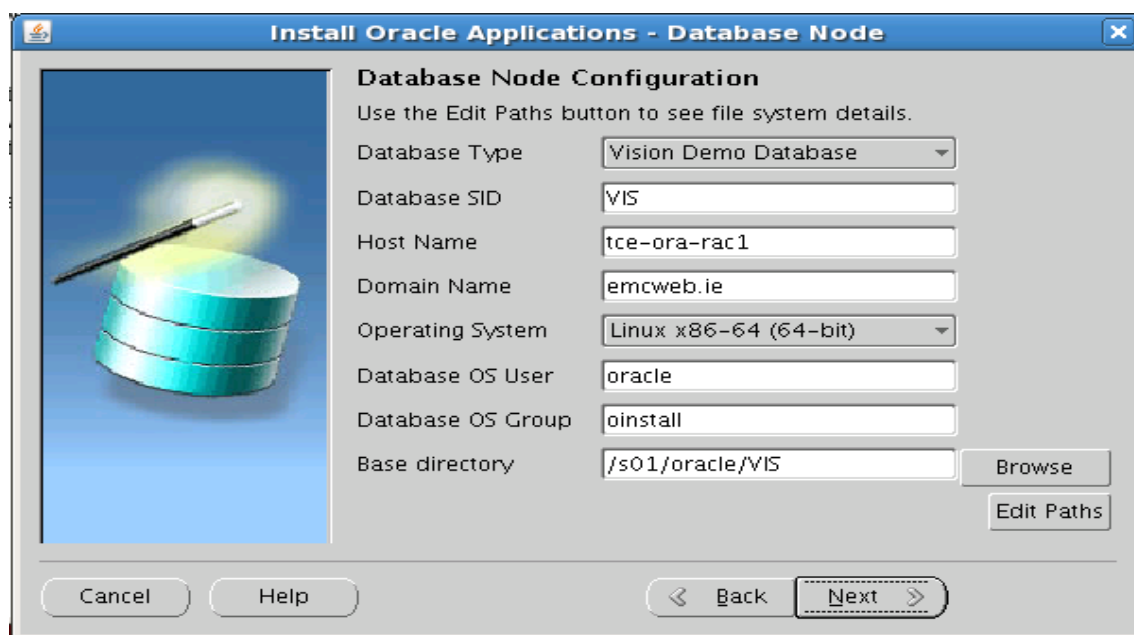
The applications tier nodes (in this solution named VIS\_tce-ora-appl1 and VIS\_tce-ora-appl2) use the /d01/local and /d01/shared\_app file systems. The /d01/shared\_app file system is mounted on the NFS folders exported from the VNX5700 array. The shared APPL\_TOP directory contains APPL\_TOP, COMMON\_TOP, OracleAS 10.1.2, and ORACLE\_HOME, all components of Oracle Applications.

The /d01/local file system contains the instance Home (INST\_TOP); this is created on the local disks in each applications tier node. Instance Home (INST\_TOP) cannot be shared by applications tier nodes and must be available on the respective applications nodes.

### Database Node Configuration

On the **Database Node Configuration** screen, enter the type of database required, the name used to identify it, the machine on which it will run, and that machine's domain name. You then select the appropriate operating system from the drop-down list, specify the Oracle user's operating system account name and group, then identify the base directory under which the installation is to take place.

As shown in Figure 11, a **Vision Demo** database was selected for the purpose of this use case. The default database name "VIS" was also selected.



**Figure 11. Database Node Configuration**

**Note** By default, when using Rapid Install to deploy Oracle E-Business Suite, the database is created as a single instance on a file system. Once the installation is complete, the database can then be migrated from file to ASM on block storage. The single-instance database can then be converted to RAC. This solution uses an interim file system, /s01/oracle/VIS, to hold the single-instance database files.

Figure 12 shows the Rapid Install Primary Applications Node Configuration screen for a Linux system. The configuration information used is specific to the use case environment.

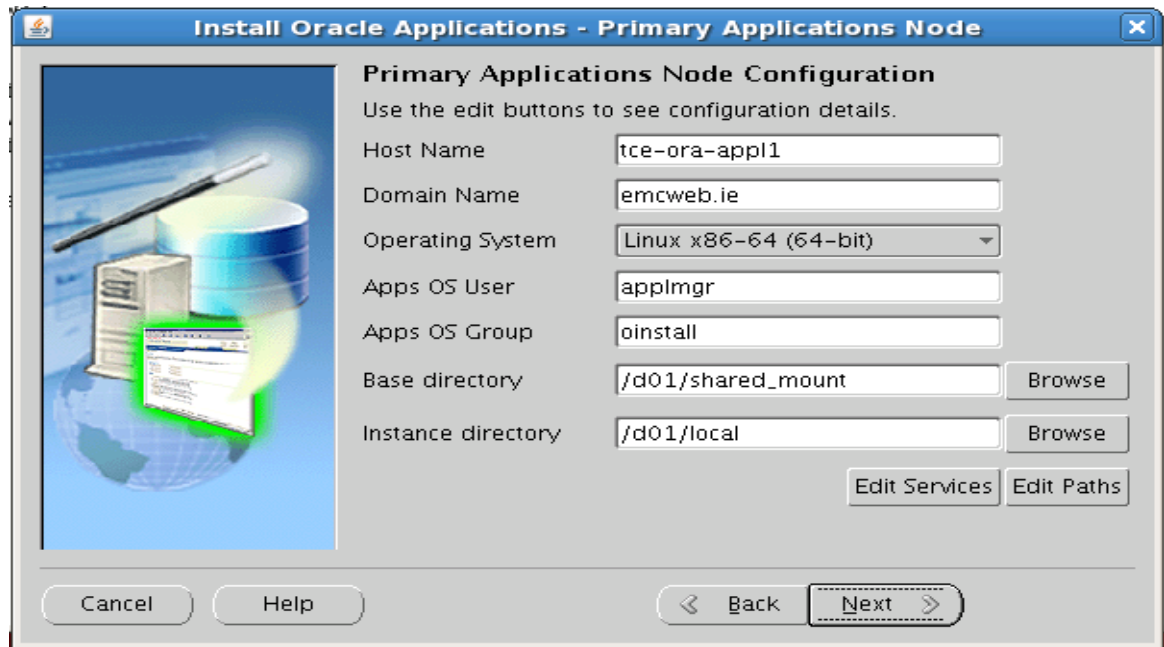


Figure 12. Primary Applications Node Configuration

Figure 13 shows the completion of the upgrade process of the "VIS" database from Oracle version 11.1.0.7.0 to 11.2.0.2.0.

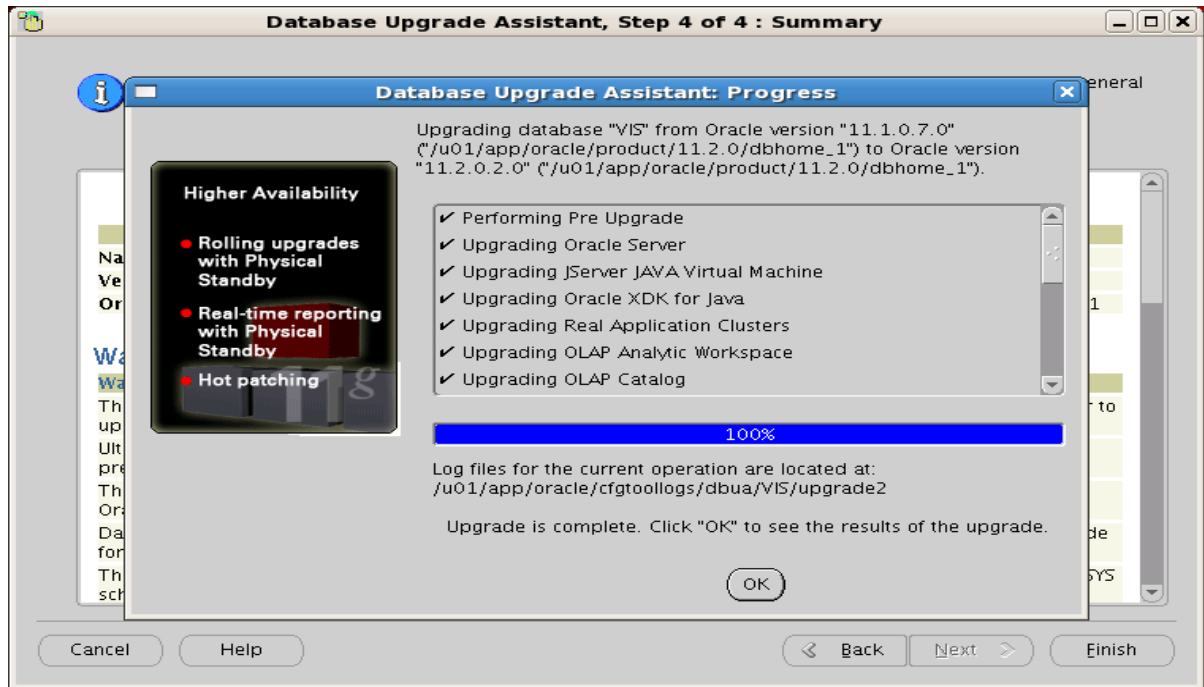


Figure 13. Database Upgrade Assistant (DBUA)

The database is upgraded to 11.2.0.2 using DBUA. The Oracle tool rconfig is used to convert the single-instance database to RAC. Figure 14 shows RAC and ASM running after the conversion.

```
[oracle@tce-ora-rac1 ~]$ srvctl status database -d VIS
Instance VIS1 is running on node tce-ora-rac1
Instance VIS2 is running on node tce-ora-rac2
[oracle@tce-ora-rac1 ~]$ srvctl status asm
ASM is running on tce-ora-rac1,tce-ora-rac2
[oracle@tce-ora-rac1 ~]$
```

Figure 14. Cluster and ASM

## Test and validation

The following tasks provide a summary and characterization of the tests that were performed to validate the solution, including storage configuration and Oracle E-Business Suite R12 configuration.

### Task 1: Configure an EBS application shared file system and ASM on an EMC VNX5700 storage array

To configure the EBS application shared file system /d01/shared\_app through IP on EMC VNX5700, follow these steps:

1. Confirm all mount points are exported to the production host.
2. Confirm all mount points are added to the /etc/fstab entries.
3. Confirm all file systems are mounted with the /etc/fstab entries.

To configure ASM, follow these steps:

1. Install the ASMLib including:  
`oracleasm, oracleasm-lib, oracleasm-support`
2. Use the following command to configure ASMLib:  
`oracleasm configure`
3. Use the following command to partition all the disks that need to be used as ASM disks by Linux:  
`fdisk`
4. Use the following command (example) to create all the ASM disks:  
`oracleasm createdisk DISK_LOG1 /dev/emcpowers1`
5. Use the following commands to check that all the ASM disks are created:  
`oracleasm scandisks`  
`oracleasm listdisks`

### Task 2: Configure VMware vSphere 4.1 and create virtual machines

#### VMware vSphere 4.1 configuration

Configuration of VMware vSphere 4.1 includes VMware ESX Server 4.1 installation, VMware vCenter 4.1 installation and configuration, VMware ESX Server cluster configuration, and the creation of four virtual machines, used as applications tier and database tier nodes.

**Note** Refer to the relevant VMware vSphere installation documents for detailed information about installing VMware ESX Server and vCenter.

Refer to the system administrator documents for how to configure a VMware ESX Server cluster and how to create a virtual machine with VMware vSphere Client. Ensure that the virtual machines' files are installed on NFS shared folders.

## VMware template creation

For this solution, VMware virtual machine templates are used to enable rapid deployment of new virtual machines to the environment. Two separate templates were created:

- **AppsTier\_Template01:** Template for deploying virtual machines for the Oracle EBS applications tier.
- **DBTier\_Template01:** Template for deploying virtual machines for the Oracle database tier.

The templates were configured (in VMware vSphere Client) with the requirements and prerequisites for the Oracle software, including:

- Operating system and rpm packages
- Kernel configuration
- OS users
- Supporting software

## Applications tier template

Table 8 shows the specifications for the AppsTier\_Template01 template.

**Table 8. AppsTier\_Template01 template specifications**

Part	Description
CPU	2 vCPUs
Memory	8 GB
Operating system	Red Hat Enterprise Linux 5 (64-bit) release 5.5
Kernel	2.6.18-194.el5 #1 SMP
OS users (users created and passwords set)	Username: oracle UserID:1101 Username: applmgr UserID:1100
OS groups	Group: dba GroupID:1200 Group: oper GroupID:1201 Group: asmdba GroupID:1300 Group: asmoper GroupID:1301
rpm packages installed (as Oracle prerequisites)	See the relevant Oracle installation guide
Disk configuration	Root 12 GB virtual disk
System configuration (as Oracle prerequisites)	See the relevant Oracle installation guide

## Database tier template

Table 9 shows the specifications for the DBTier\_Template01 template.

**Table 9. DBTier\_Template01 template specifications**

Part	Description
CPU	4 vCPUs
Memory	24 GB
Operating system	Red Hat Enterprise Linux 5 (64-bit) release 5.5
Kernel	2.6.18-194.el5 #1 SMP
OS users (users created and passwords set)	Username: oracle UserID:1101 Username: applmgr UserID:1100
OS groups	Group: dba GroupID:1200 Group: oper GroupID:1201 Group: asmdba GroupID:1300 Group: asmoper GroupID:1301
rpm packages installed (as Oracle prerequisites)	See the relevant Oracle installation guide
Disk configuration	Root 12 GB virtual disk
System configuration (as Oracle prerequisites)	See the relevant Oracle installation guide

## Deploying new virtual machines

For the solution, four virtual machines were deployed from the template images held in VMware vSphere vCenter. The **Deploy Virtual Machine from this Template** option in vSphere Client was used to do this. This option runs the **Deploy Template** wizard, where the name and location for new virtual machines are specified, as well as the customization option for the guest operating system.

For this solution, a pre-created custom specification (held in vCenter) defines the network configuration for new virtual machines, as shown in Figure 15.

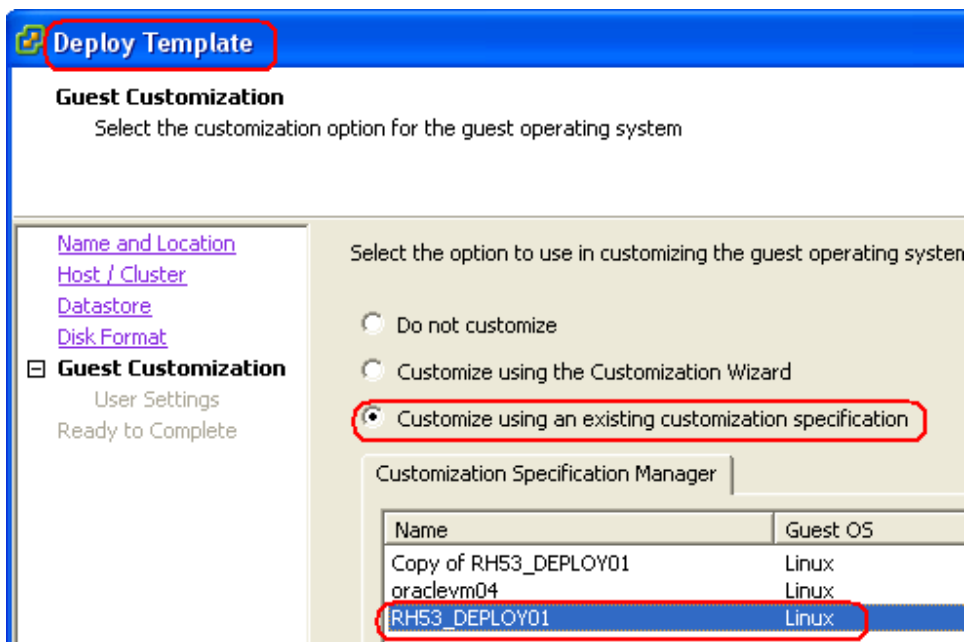
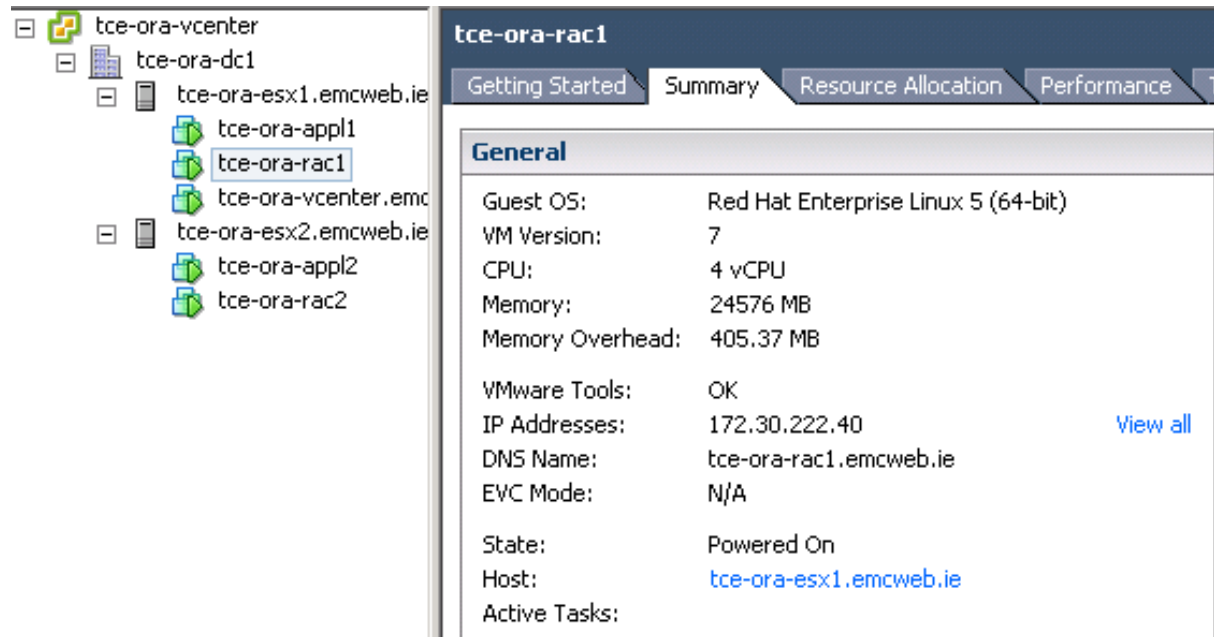


Figure 15. Custom specification in VMware vSphere vCenter

Using the pre-created template images and custom specification with the **Deploy Template** wizard, all four virtual machines required for the solution were deployed in less than 10 minutes.

Figure 16 shows the virtual machines deployed, with summary details for one of the machines.



**Figure 16. Summary details of a virtual machine**

Once new virtual machines are deployed from a template, additional virtual disks (RDMs) can be added to different virtual machines as needed.

**Note** An alternative to manually building the VMware template images would be to use VMware vCenter Converter, an add-on plug-in for vCenter Server. VMware vCenter Converter clones the physical source to create a target virtual machine and does a system reconfiguration to enable the guest operating system to function on virtual hardware. A template can then be created from the captured virtual machine.

### Task 3: Deploy an Oracle EBS R12 environment

By default, Oracle EBS R12 is installed as a single-instance configuration on an NFS file system. The environment was converted to a shared file system using RAC with ASM after completion of the installation.

## Task 4: Functional test of the applications tier

The Gather Schema Statistics concurrent program is used as a functional test of the environment. As shown in Figure 17, this concurrent program gathers the specified schema level statistics. Gather Statistics is a useful method for verifying the availability of both the database and the applications tiers. The collection of database schema statistics is executed from the applications tier.

The screenshot shows a window titled "Request Detail - 5808069" with the following details:

Name	Gather Schema Statistics		
Operating Unit			
Parameters	ALL:10::NOBACKUP::LASTRUN:GATHER::Y		
Phase	Completed	Status	Normal
Date Submitted	20-DEC-2010 04:40:51	Requestor	OPERATIONS
Date Started	03-JAN-2011 04:42:28	Date Completed	03-JAN-2011 08:39:18
Completion Text	Normal completion		
Language	American English	Languages...	
Schedule Options			
Run the Job	As Soon As Possible	Schedule...	
Priority	50	Requested Start Date	20-DEC-2010 04:40:51
Upon Completion...			
Layout:			
Notify:			
Print To:	noprint	Options...	
Help		OK	Cancel

Figure 17. Gather Schema Statistics

## Task 5: Add additional applications nodes in the applications tier

Additional applications tier nodes can be deployed using the pre-created applications tier template images and Custom Specification with the VMware vSphere Client Deploy Template wizard.

1. Deploy the virtual machine using the Template option in vSphere Client.
2. Create the necessary user and group in the third applications tier node.
3. Execute the Rapid Clone pre-script on the primary applications node. For example:

```
[applmgr@tce-ora-appl1 ~]$ cd $INST_TOP/admin/scripts
[applmgr@tce-ora-appl1 scripts]$ perl adpreclone.pl appsTier
```
4. Copy the context file to the third applications node from the primary applications node. For example:

```
[applmgr@tce-ora-appl1 ~]$ scp /d01/local/apps/VIS_tce-ora-appl1/appl/admin/VIS_tce-ora-appl1.xml tce-ora-appl3:/home/applmgr
```

5. Configure the third node to be added with adclonctx.pl and adconfig.pl scripts. For example:

```
[applmgr@tce-ora-appl3 ~]$ cd $COMMON_TOP/clone/bin
[applmgr@tce-ora-appl3 bin]$ perl adclonctx.pl addnode
contextfile=/home/applmgr/VIS_tce-ora-appl1.xml
[applmgr@tce-ora-appl3 bin]$ cd $AD_TOP/bin/
[applmgr@tce-ora-appl3 bin]$ perl adconfig.pl
contextfile=/d01/shared_mount/apps/apps_st/comn/clone/bin/VIS_tce-ora-appl3.xml
```

After the new virtual machine is created, it can be added into the applications tier with the shared file system as shown in Figure 18.

The screenshot shows the Oracle Applications Manager interface. At the top, it says 'ORACLE Applications Manager'. Below that, there's a navigation bar with 'Applications Dashboard' and 'Site Map'. The main content area is titled 'Applications Dashboard: VIS' and has several tabs: 'Overview', 'Performance', 'Critical Activities', 'Business Flows', 'Security', and 'Software Updates'. The 'Overview' tab is selected. Below the tabs, there's a section titled 'Applications System Status' with a timestamp 'Data Retrieved: 20-Jan-2011 22:35:15'. A table below shows the status of various hosts.

Host	Platform	Host Status	Admin	Database	Concurrent Processing	Forms	Web
<a href="#">TCE-ORA-RAC1</a>	Linux x86-64 (64-bit)	✓		✓			
<a href="#">TCE-ORA-APPL2</a>	Linux x86-64 (64-bit)	✓	✓		✓	✓	✓
<a href="#">TCE-ORA-APPL3</a>	Linux x86-64 (64-bit)	✓	✓		✓	✓	✓
<a href="#">TCE-ORA-RAC2</a>	Linux x86-64 (64-bit)	✓		✓			
<a href="#">TCE-ORA-APPL1</a>	Linux x86-64 (64-bit)	✓	✓		✓	✓	✓

Figure 18. Oracle Applications Manager showing three applications nodes

## Conclusion

### Summary

This white paper demonstrates the ease of use and flexibility of the EMC VNX5700 unified storage platform within an Oracle E-Business Suite environment. The VNX platform enables connection to multiprotocol environments, enabling continued return on investment on current data center infrastructures.

### Findings

The key findings of the solution include:

- Oracle on VMware:
  - VMware vSphere infrastructure provides a framework for creating and deploying encapsulated virtual machines for Oracle EBS applications and database tiers.
  - VMware vSphere provides templates that can be used to quickly provision virtual machines preconfigured with Oracle software.
  - Oracle database tier includes support for both single instance and RAC on virtual machines.
- Simplified management:
  - EMC VNX5700 system provides a single platform for both block and file storage.
  - VNX enables Oracle applications to be deployed on a combination of NFS over IP and FC-connected SAN.
  - EMC Unisphere provides a single combined view of file and block systems, with all features and functions available through a common interface.
- VMware integration:
  - EMC Unisphere provides discovery of the complete VMware vSphere environment.
  - EMC VSI provides end-to-end mapping and configuration of the storage environment within the VMware vSphere Client.
- EMC Unisphere and EMC plug-ins for VMware vCenter together give EMC the unique ability to view the entire infrastructure from both directions:
  - Top-down view VMware to Unisphere
  - Bottom-up view Unisphere to VMware

### Next steps

EMC can help accelerate assessment, design, implementation, and management while lowering the implementation risks and costs of an end-to-end solution for an Oracle EBS R12 environment.

To learn more about this and other solutions contact an EMC representative or visit: <http://www.emc.com/solutions/application-environment/oracle/index.htm>

## References

### Product documentation

For additional information, see the product documents listed below.

- *VMware vSphere Basic System Administration*
- *ESX and vCenter Server Installation Guide*

### Other documentation

For additional information, see the documents listed below.

- *Oracle Applications Concepts R12*
- *Oracle Applications Installation Guide: Using Rapid Install Release 12*
- *Oracle Real Application Clusters Guide*
- *Shared Application Tier File System in Oracle Applications Concepts*
- My Oracle Support Knowledge Document 384248.1: *Sharing the Application Tier File System in Oracle E-Business Suite R12*
- For detailed information about installing Oracle E-Business Suite R12, refer to [Oracle MetaLink Note 761566.1](#).
- For detailed information for how to upgrade a single-instance database to 11.2.0.2 from 11.0.1.7, refer to [Oracle MetaLink Note 1058763.1](#).
- For detailed information for how to convert a single instance into a RAC database, refer to [Oracle MetaLink Note 823587.1](#).
- For detailed information on adding a new node into the application tier, refer to [Oracle MetaLink Note 384248.1](#).