

WHITE PAPER

Hitachi Cloud Foundation for Oracle E-Business Suite

Reference Architecture Guide

By Jigisha Patel, Hitachi Vantara; Venkatamana Muthadi, Hitachi Consulting; and Bijith Nair, Hitachi Consulting

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Revision History

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Hitachi Cloud Foundation for Oracle E-Business Suite

Reference Architecture Guide

Use this reference architecture guide to deploy an Oracle converged infrastructure with Hitachi Unified Compute Platform (UCP) for Hitachi Cloud Foundation for Oracle E-Business Suite. This scalable converged solution for Oracle database can deploy 250 users, 500 users, and 1500 users.

The converged environment includes Hitachi Unified Compute Platform with Hitachi Virtual Storage Platform G800 (VSP G800) and Hitachi Compute Blade 2500 (CB 2500). Oracle VM Manager enables the cloud infrastructure, all managed from Oracle Enterprise Manager (OEM) Cloud Control 13c. Use this document to design an infrastructure for your requirements and budget.

This validated solution integrates servers, storage systems, network, and storage software, and Oracle virtualization technology to provide a cloud foundation. Deploy Oracle E-Business Suite quickly in a private cloud. Validate virtual machine configurations and centrally monitor Hitachi storage, servers, virtual machines, database and applications.

This Hitachi solution for Oracle provides flexibility to deploy storage and compute resources based on your unique business requirements. This cloud solution features simple provisioning, chargeback/showback, and a centralized user interface using Oracle Enterprise Manager (OEM) Cloud Control 13c.

Cloud Foundation provides reliability, high availability, scalability, and performance while processing small-scale to large-scale Oracle E-Business Suite (EBS) workloads. The database and application servers E-Business Suite run on Oracle VM 3.4.1. The operating system for the virtual machines is Oracle Linux 7.2. The Oracle E-Business Suite version is 12.2.6, which also includes Oracle Database 12c R1.

This reference architecture is for people in the following roles:

- Applications database administrator
- Storage administrator
- IT professionals with the responsibility of planning and deploying an Oracle EBS solution

To use this reference architecture guide, familiarity with the following is required:

- Storage area networks
- Oracle Database administration
- Oracle Database 12c Release 1 with Oracle RAC option
- Oracle E-Business Suite Release 12.2.6
- Oracle Linux
- Oracle Virtual Machine
- Oracle Enterprise Manager (OEM) Cloud Control13c

Note — Testing of this configuration was in a lab environment. Many things affect production environments beyond prediction or duplication in a lab environment. Follow the recommended practice of conducting proof-of-concept testing for acceptable results in a non-production, isolated test environment that otherwise matches your production environment before your production implementation of this solution.

Solution Overview

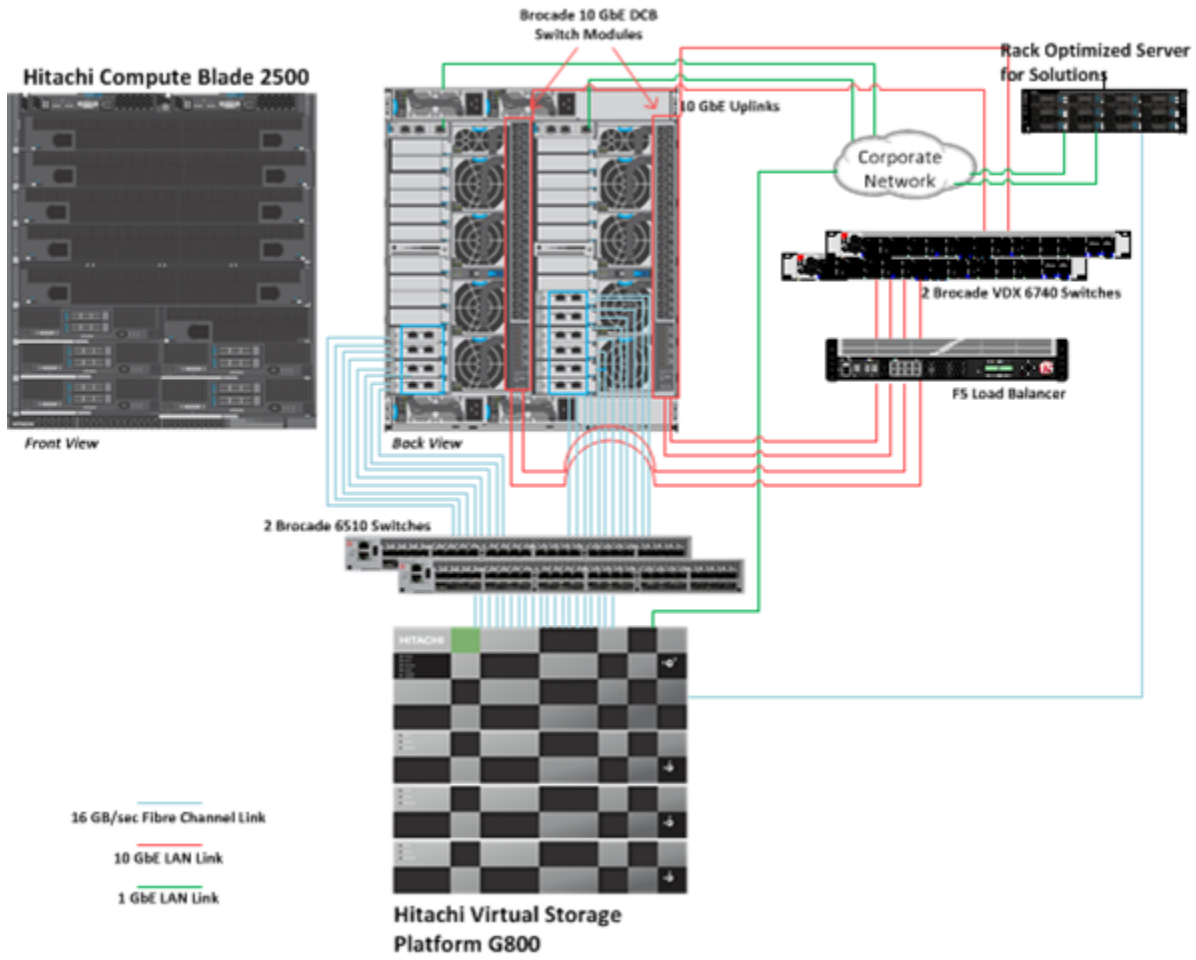
This reference architecture implements Hitachi Unified Compute Platform 6000 (UCP) as a part of Hitachi Cloud Foundation for Oracle E-Business Suite. This solution uses Oracle VM server running on Hitachi Virtual Storage Platform G800. This environment addresses the high availability, performance, and scalability requirements for E-Business Suite workloads. Tailor your implementation of this solution to meet your specific needs.

This reference architecture includes the following:

- Hitachi Compute Blade 2500 with five server blades
- Hitachi Virtual Storage Platform G800
- Rack optimized server for solutions, 2U single node
- Brocade 16 Gb/sec SAN infrastructure
- Brocade 10 GbE LAN infrastructure
- Any standard industry load balancer

Figure 1 shows high-level infrastructure for this solution.

Figure 1



Key Solution Components

Table 1 lists the key hardware components used in this reference architecture.

TABLE 1. KEY SOLUTION COMPONENTS

Hardware	Detail Description	Firmware Version	Quantity
Hitachi Virtual Storage Platform G800	2 controllers	83-03-25-60/00	1
	20 x 16 Gb/sec Fibre Channel ports		
	42 x 1.6 TB FMDs (including 2 spares)		
	36 x 1.2 TB 10k RPM SAS HDDs		
	512 GB cache memory		
Hitachi Compute Blade 2500	2 x 10 Gb/sec Brocade DCB LAN switch module 10 fan modules 2 management modules	Management module firmware: A0165-C-1467	1
520H B3 half width server blade*	2 Intel Xeon E5-2699v3 processor CPUs	08-66	5
	384 GB (32 GB x 12) DDR4		
	1 Emulex 16 Gb/sec 2-port Fibre Channel card	10.6.144.21	10
Brocade 6510 Fibre Channel switches	Fibre Channel switches	v7.3.1d	2
Brocade VDX 6740 switches**	Brocade IP network switches	4.1.3a	2
Rack optimized server for solutions, 2U single node	24 CPU cores Intel Xeon E5-2680 v3 processor @ 2.5 GHz 64 GB RAM	3.17	1
Standard industry load balancer***			1

* Although this solution was tested with 520H B3 server blades, it is also certified with the latest 520H B4 server blades, featuring the Intel Xeon E5-2699v4 CPU.

** Optional, if you already have an existing LAN switch with available ports.

*** This solution works with any standard industry load balancer. The test environment used an F5 load balancer (F5-BIG-LTM 7050S, 11.5.4 Build 0.0.256).

Table 2 lists the key software components used in this reference architecture.

TABLE 2. KEY SOFTWARE COMPONENTS

Software	Version	Function
Hitachi Storage Navigator (SN)	Microcode dependent	Storage management software
Hitachi Compute Systems Manager (HCSM)	8.4.1-03	Server management software
Hitachi Storage Adapter for Oracle Enterprise Manager	01.0.0	Storage management software
Hitachi Storage Adapter for Oracle VM	01.0.0	Storage management software
Hitachi Server Adapter for Oracle Enterprise Manager	01.0.0	Server management software
Hitachi Infrastructure Analytics Advisor (HIAA) — Optional	2.1	Analytics software
Oracle VM	3.4.1	Oracle virtualization software
Oracle Linux	7.2	Guest operating system
	6.7	Oracle VM Manager host operating system
Oracle Database 12c	12c Release 1(12.1.0.2.0)	Database software
Oracle Grid Infrastructure 12c	12c Release 1(12.1.0.2.0)	Cluster software
Oracle Enterprise Manager Cloud Control 13c	13c Release 2(13.2.0.0)	OEM software
Oracle Enterprise Manager Cloud Control 13c plug-ins	13c Release2	OEM plugins
Oracle E-Business Suite	12.2.6	Oracle application software
VMware ESXi	6.0.0	Management server host operating system
VMware vCenter Appliance	6.0.0	Centralized management application software

Hitachi Compute Blade 2500

[Hitachi Compute Blade 2500](#) delivers enterprise computing power and performance with unprecedented scalability and configuration flexibility. Lower your costs and protect your investment.

Flexible I/O architecture and logical partitioning allow configurations to match application needs exactly with Hitachi Compute Blade 2500. Multiple applications easily and securely co-exist in the same chassis.

Add server management and system monitoring at no cost with Hitachi Compute Systems Manager. Seamlessly integrate with Hitachi Command Suite in Hitachi storage environments.

Hitachi Compute Blade 2500 provides scalability and flexibility for an Oracle Real Application Cluster configuration.

Hitachi Virtual Storage Platform Gx00 Models

[Hitachi Virtual Storage Platform Gx00 models](#) are based on industry-leading enterprise storage technology. With flash-optimized performance, these systems provide advanced capabilities previously available only in high-end storage arrays. With the Virtual Storage Platform Gx00 models, you can build a high performance, software-defined infrastructure to transform data into valuable information.

Hitachi Storage Virtualization Operating System provides storage virtualization, high availability, superior performance, and advanced data protection for all Virtual Storage Platform Gx00 models. This proven, mature software provides common features to consolidate assets, reclaim space, extend life, and reduce migration effort.

This environment was validated on Virtual Storage Platform G800, which supports Oracle Real Application Clusters.

Rack Optimized Server for Solutions, 2U Single Node

The rack optimized server for solutions, 2U single node, is a rack mounted server designed for optimal performance and power efficiency. It supports up to 1.5 TB highly scalable memory capacity. It is powered by the Intel Xeon E5-2600 v3 processor product family for complex and demanding workloads. It supports flexible OCP and PCIe I/O expansion card options.

The rack optimized server for solutions uses VMware ESXi to deploy virtual machines for the management servers. The management servers include the following:

- Oracle VM Manager
- Oracle Enterprise Manager
- Manager for Hitachi adapters for Oracle Database
- Hitachi Compute Systems Manager (HCSM)

Alternatively, you can host these management servers on an Oracle VM-based virtualized server.

Hitachi Compute Systems Manager

Hitachi Compute Systems Manager is the management software for Hitachi servers. Compute Systems Manager can be purchased with an optional Server Management Module, Network Management Module, or Server Deployment Module. Use Compute System Manager to introduce new servers into your data center environment.

This solution uses Compute Systems Manager to administer the server blades on Hitachi Compute Blade 2500.

Hitachi Infrastructure Analytics Advisor (Optional)

IT analytics solutions from Hitachi include [Hitachi Infrastructure Analytics Advisor](#). This software provides the comprehensive storage performance management and diagnostics required to optimize business application servers with storage system performance. Infrastructure Analytics Advisor includes the tools to properly monitor and analyze performance statistics from the application through its entire data path to the shared storage resources.

Infrastructure Analytics Advisor allows you to define custom storage service level objectives (SLOs) for performance and capacity by virtual machine or application server. Continuously monitor these SLOs to ensure compliance to service level agreements. Alerts provide early notification when exceeding service-level thresholds so for quick analysis with built-in diagnostic aids to efficiently determine the root cause of a service level problem.

Oracle Enterprise Manager

[Oracle Enterprise Manager](#) provides a “single pane of glass” that allows you to manage on-premises and cloud-based IT using the same familiar interface you know and use on-premises every day. Oracle Enterprise Manager today is the nerve center of IT operations among thousands of enterprises. Millions of assets in Oracle’s SaaS and PaaS public cloud operations are managed by Enterprise Manager round the clock.

Enterprise Manager is the industry's first complete cloud solution with [Cloud Management](#). This includes self-service provisioning balanced against centralized, policy-based resource management, integrated chargeback and capacity planning and complete visibility of the physical and virtual environments from applications to disk.

This solution uses Oracle Enterprise Manager Cloud Control version 13c Release 2 and allows you to use the following cloud management features:

- [Cloud Self Service Portal](#)
- [Service Catalog](#)
- [Snap Cloning using "Test Master Snapshot"](#)
- [Chargeback and Consolidation Planner Plugin](#)
 - Ability to apply ad-hoc charges and discounts for a target, day, and so on
 - Ability to modify a plan for a target in a past report cycle
 - New cost center and entities tab in the user interface
 - Tiered Pricing
 - Charge Estimation Advisor

These Enterprise Manager plugins are configured in Oracle E-Business Suite Cloud Foundation:

- Oracle Virtualization plugin
- Oracle Virtual Infrastructure
- Oracle Virtual Networking
- Oracle Cloud Application
- Oracle Storage Management Framework
- Oracle Database plugin

Oracle VM

Designed for efficiency and optimized for performance, [Oracle VM](#) supports x86 and SPARC architectures and a variety of workloads, such as Linux, Microsoft® Windows®, and Oracle Solaris. In addition to solutions that are hypervisor-based, Oracle also offers virtualization built in to hardware and Oracle operating systems to deliver the most complete and optimized solution for your entire computing environment.

Oracle VM Server provides application-driven virtualization. Going beyond simple server consolidation, Oracle VM server virtualization enables rapid enterprise application deployment and simplifies lifecycle management. Oracle VM provides a foundation for Cloud. It is fully integrated virtual machine lifecycle and cloud management solution with Oracle Enterprise Manager Cloud Control 13c.

Oracle Tools and Adapters from Hitachi Vantara

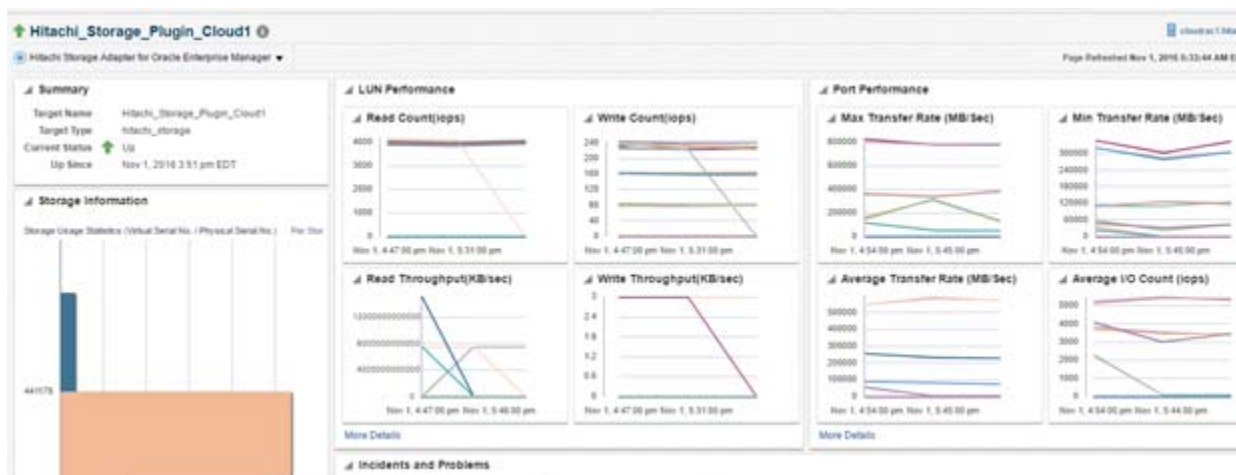
This solution uses these [Oracle tools and adapters from Hitachi Vantara](#):

■ Hitachi Storage Adapter for Oracle Enterprise Manager

Hitachi Storage Adapter for Oracle Enterprise Manager presents an integrated, detailed view of the Hitachi storage or converged infrastructure supporting your Oracle databases. By gaining visibility into capacity, performance and configuration information, administrators can manage service levels more effectively, and ensure service level agreements (SLAs) are met to support business goals.

When you log on to Oracle Cloud Control, the home page for Storage Adapter for Oracle Enterprise Manager shows a summary of the storage and performance statistics graphs shown in Figure 2.

Figure 2



■ Hitachi Storage Adapter for Oracle VM

Hitachi Storage Adapter for Oracle VM enables monitoring and managing storage for virtual machines from Oracle VM Manager.

Provision storage for virtual machines. Instantly clone of Oracle virtual machines with storage using a single user interface that manages and monitors virtual machines and storage infrastructure.

■ Hitachi Server Adapter for Oracle Enterprise Manager

Hitachi Server Adapter for Oracle Enterprise Manager makes possible monitoring in Oracle Enterprise Manager of Hitachi Compute Blade 2500, Hitachi Compute Blade 500, and rack optimized server for solutions. This adapter provides you visibility of the status, health, and attributes for the servers. The adapter also supplies information about any Oracle database instances running on the servers.

When you log on to Oracle Cloud Control, the home page for Server Adapter for Oracle Enterprise Manager shows a summary of performance statistics graphs for Hitachi Compute Blade and the rack optimized server for solutions shown in Figure 3 on page 9.

Figure 3



Oracle Database With the Real Application Cluster Option

[Oracle Database](#) has a multitenant architecture so you can consolidate many databases quickly and manage them as a cloud service. Oracle Database also includes in-memory data processing capabilities for analytical performance. Additional database innovations deliver efficiency, performance, security, and availability. Oracle Database comes in two editions: Enterprise Edition and Standard Edition 2.

[Oracle Real Application Clusters](#) (Oracle RAC) is a clustered version of Oracle Database. It is based on a comprehensive high-availability stack that can be used as the foundation of a database cloud system, as well as a shared infrastructure. This ensures high availability, scalability, and agility for any application.

[Oracle Automatic Storage Management](#) (Oracle ASM) is a volume manager and a file system for Oracle database files. This supports single-instance Oracle Database and Oracle Real Application Clusters configurations. Oracle ASM is the recommended storage management solution that provides an alternative to conventional volume managers, file systems, and raw devices.

[Oracle Clusterware](#) is portable cluster software that allows clustering of independent servers so that they cooperate as a single system. Oracle Clusterware is the required cluster technology for Oracle Real Application Clusters.

Oracle E-Business Suite

[Oracle E-Business Suite](#) is the most comprehensive suite of integrated, global business applications that enable organizations to make better decisions, reduce costs, and increase performance.

With hundreds of cross-industry modules spanning enterprise resource planning, customer relationship management, and supply chain planning, Oracle E-Business Suite applications help customers manage the complexities of global business environments no matter if the organization is small, medium, or large. As part of Oracle's Applications Unlimited strategy, Oracle E-Business Suite applications will continue to be enhanced, thus protecting and extending the value of your software investment.

Brocade Switches

[Brocade and Hitachi Vantara](#) partner to deliver storage networking and data center solutions. These solutions reduce complexity and cost, as well as enable virtualization and cloud computing to increase business agility.

The solution uses the following Brocade products:

- Brocade VDX 6740 10 GbE switch module
- Brocade 6510 Fibre Channel switch

Solution Design

This describes this implementing Oracle E-Business Suite solution on Hitachi Unified Compute Platform with Oracle Real Application Cluster using Hitachi Virtual Storage Platform G800.

Specific infrastructure configuration details include the following:

- **Storage System**

The LDEVs are mapped to each Fibre Channel port. They are presented to the server as LUNs.

- **Server**

Server blades are configured in an Oracle VM Server pool cluster.

- **SAN Connection**

Connect each Fibre Channel HBA port to the storage front-end port using the switched SAN environment.

Storage Architecture

The storage architecture of this reference architecture takes into consideration Hitachi Vantara and Oracle recommended practices for the deployment of database and applications storage design.

Storage Configuration

Figure 4 on page 11 shows the layout of the storage configuration used for this solution.

Figure 4

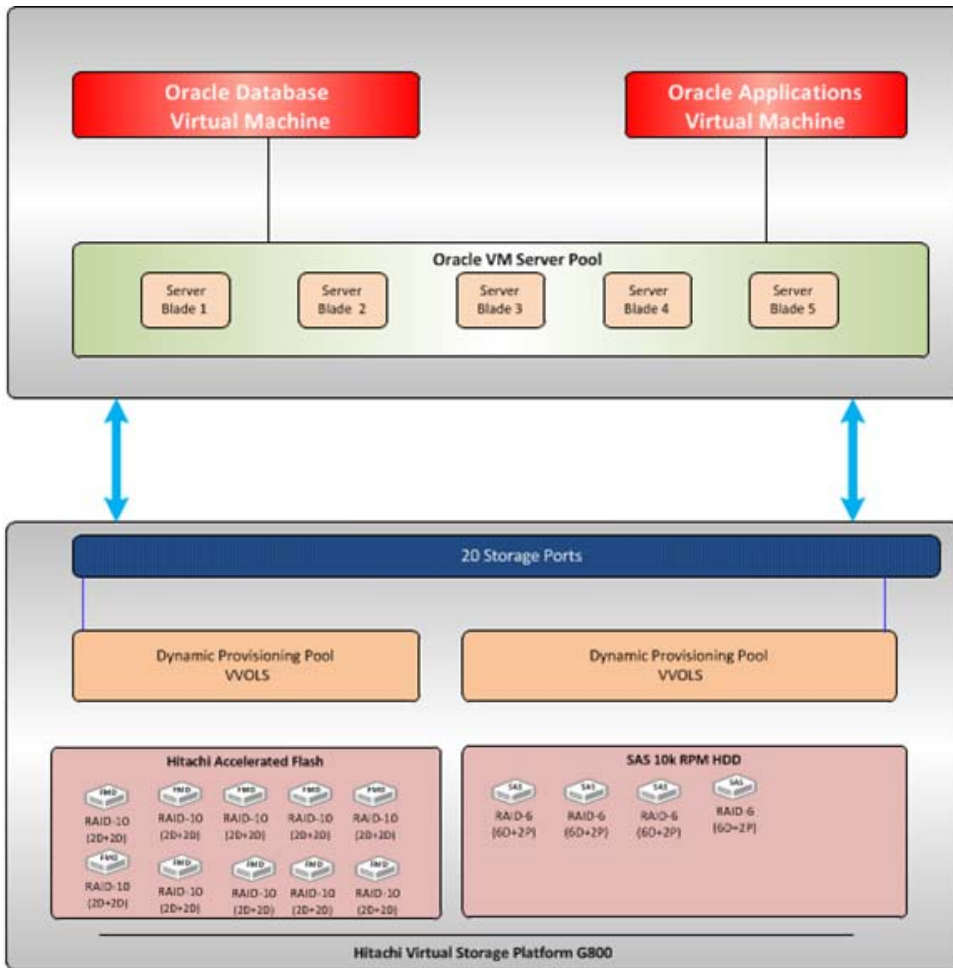


Table 3 shows an example storage pool configuration.

TABLE 3. EXAMPLE STORAGE POOL CONFIGURATION

Pool ID	Ora_dp_fmd_01	Ora_dp_sas_01
Pool Type	Dynamic Provisioning Pool	Dynamic Provisioning Pool
RAID Group	1-5 to 1-14	1-1 to 1-4
RAID Level	RAID-10 (2D+2D)	RAID-6 (6D+2P)
Drive Type	1.6 TB Flash Module Drive (FMD)	1.2 TB 10k RPM SAS Drive
Number of Drives	40	32
Number of Spare Drives	2	4
Number of LDEVs	320 (32 per raid group)	16 (4 per raid group)
LDEV Size(s)	102.08 GB	1610 GB
Pool Capacity	31.9TB	25.16TB

Table 4 shows an example logical storage configuration for the Oracle E-Business Suite production instance. You may use a different configuration.

TABLE 4. EXAMPLE LOGICAL STORAGE CONFIGURATION FOR ORACLE E-BUSINESS SUITE PRODUCTION INSTANCE

Dynamic Provisioning Pool ID	Ora_dp_fmd_01	Ora_dp_sas_01
Total Number of DP-VOLs	12	15
DP-VOL Sizes	15 GB, 100GB, 300 GB	10 GB, 20 GB, 100GB, 500 GB
Purpose	All Tablespaces Redo Logs Software Binary Undo Temp	Operating System FRA (Incremental Backups, Archived Redo Logs, Control File Autobackups) Oracle Cluster Registry Voting Disk Backup Stage
Storage Port	1A, 2A, 3A, 4A, 1B, 2B, 3B, 4B, 1C, 2C, 3C, 4C, 1D, 2D, 3D, 4D, 1E, 2E, 3E, 4E	

Table 5 shows an example of the logical storage configuration for the Oracle E-Business Suite non-production instance. It only uses SAS drives. You may use a different configuration.

TABLE 5. LOGICAL STORAGE CONFIGURATION — ORACLE E-BUSINESS SUITE NON-PRODUCTION INSTANCE

Dynamic Provisioning Pool ID	Ora_dp_fmd_01	Ora_dp_sas_01
Total Number of DP-VOLs	0	25
DP-VOL Sizes	N/A	10 GB, 15 GB, 20 GB 100 GB, 300 GB
Purpose		All Tablespaces Operating System FRA (Incremental Backups, Archived Redo Logs, Control File Autobackups) E-Business Suite Apps File System Undo Temp Redo Logs Oracle Cluster Registry Voting Disk
Storage Port	1A, 2A, 3A, 4A, 1B, 2B, 3B, 4B, 1C, 2C, 3C, 4C, 1D, 2D, 3D, 4D, 1E, 2E, 3E, 4E	

Database Layout

To configure the database, use the best practices for database layout from [Hitachi Unified Compute Platform 6000 for Oracle Real Application Clusters on Four Nodes Using Hitachi Virtual Storage Platform F800, Hitachi Accelerated Flash, and Hitachi Compute Blade 2500 Reference Architecture Guide](#) (AS-542-01 or later, PDF).

The database layout design uses recommended practices from Hitachi Vantara for Hitachi Virtual Storage Platform G800 using Hitachi Accelerated Flash for small random I/O traffic, such as OLTP transactions. The layout also takes into account Oracle ASM best practices when using Hitachi storage.

Base the storage design on the requirements of a specific application implementation. The design can vary greatly from one implementation to another. The components in this solution set have the flexibility for use in various deployment scenarios to provide the right balance between performance and ease of management.

- **Data and Indexes Tablespace**

Assign a data ASM disk group for the data and index tablespaces. Set the tablespace to a small initial size with **auto extend** enabled to maximize storage utilization.

- **TEMP Tablespace**

Create a temporary tablespace from a data ASM disk group in this configuration.

■ **Undo Tablespace**

Create two UNDO tablespaces from the data ASM disk group. Assign one UNDO tablespace for each database instance in the Oracle RAC database.

■ **Online Redo Logs**

Assign an ASM disk group REDO for online redo logs.

■ **Oracle Cluster Registry and Voting Disk**

Place each of these files in the OCR ASM disk group.

■ **Size Settings**

Set the database block size to 8 KB.

■ **ASM FILE SYSTEM I/O Settings**

Set the Oracle ASM I/O operations for database files as follows:

FILESYSTEMIO_OPTIONS = setall

Table 6 has the Oracle RAC database configuration.

TABLE 6. ORACLE RAC DATABASE SETTINGS

For This Environment	Use This Value
RAC configuration	Yes
ASM	Yes — Oracle RAC Database

Table 7 lists sample Oracle environment parameters for a 250 user environment.

TABLE 7. ORACLE ENVIRONMENT PARAMETERS — 250 USERS

For This Setting	Use This Value
SGA_TARGET	8G
SGA_MAX_SIZE	8G
PGA_AGGREGATE_TARGET	3G
LOG_BUFFER	50M
USE_LARGE_PAGES	TRUE
FILESYSTEMIO_OPTIONS	setall

Table 8 lists sample Oracle environment parameters for a 500 user environment.

TABLE 8. ORACLE ENVIRONMENT PARAMETERS — 500 USERS

For This Setting	Use This Value
SGA_TARGET	24G
SGA_MAX_SIZE	24G
PGA_AGGREGATE_TARGET	6G
LOG_BUFFER	50M
USE_LARGE_PAGES	TRUE
FILESYSTEMIO_OPTIONS	Setall

Table 9 lists sample Oracle environment parameters for a 1500 user environment.

TABLE 9. ORACLE ENVIRONMENT PARAMETERS — 1500 USERS

For This Setting	Use This Value
SGA_TARGET	40G
SGA_MAX_SIZE	40G
PGA_AGGREGATE_TARGET	12G
LOG_BUFFER	50M
USE_LARGE_PAGES	TRUE
FILESYSTEMIO_OPTIONS	setall

Table 10 lists the details for a sample disk mappings from the LUNs to the operating system devices and to the ASM disk groups for Oracle RAC Database tablespaces. Use the same disks and sizes for a 250, 500, and 1500 user environment.

TABLE 10. ORACLE ASM DISK CONFIGURATION

ASM Disk Group	ASM Disk	LUN Path	LUNs Count	Purpose
OCR	OCR1	/dev/xvdz	3	Oracle Cluster Registry
	OCR2	/dev/xvdaa		
	OCR3	/dev/xvdae		Voting Disk

TABLE 10. ORACLE ASM DISK CONFIGURATION (CONTINUED)

ASM Disk Group	ASM Disk	LUN Path	LUNs Count	Purpose
REDO	REDO01	/dev/xvdv	4	Online REDO Logs
	REDO02	/dev/xvdw		
	REDO03	/dev/xvdx		
	REDO04	/dev/xvdy		
DATA	DADISK01	/dev/xvdl	8	Application Data Undo System Sysaux TEMP Control Files
	DADISK02	/dev/xvdm		
	DADISK03	/dev/xvdm		
	DADISK04	/dev/xvdo		
	DADISK05	/dev/xvdp		
	DADISK06	/dev/xvdab		
	DADISK07	/dev/xvdac		
	DADISK08	/dev/xvdad		
FRA	FRDISK01	/dev/xvdd	8	Archive Logs Incremental Backups Control File Autobackups
	FRDISK02	/dev/xvde		
	FRDISK03	/dev/xvdf		
	FRDISK04	/dev/xvdg		
	FRDISK05	/dev/xvdh		
	FRDISK06	/dev/xvdi		
	FRDISK07	/dev/xvdj		
	FRDISK08	/dev/xvdk		

Server and Application Architecture

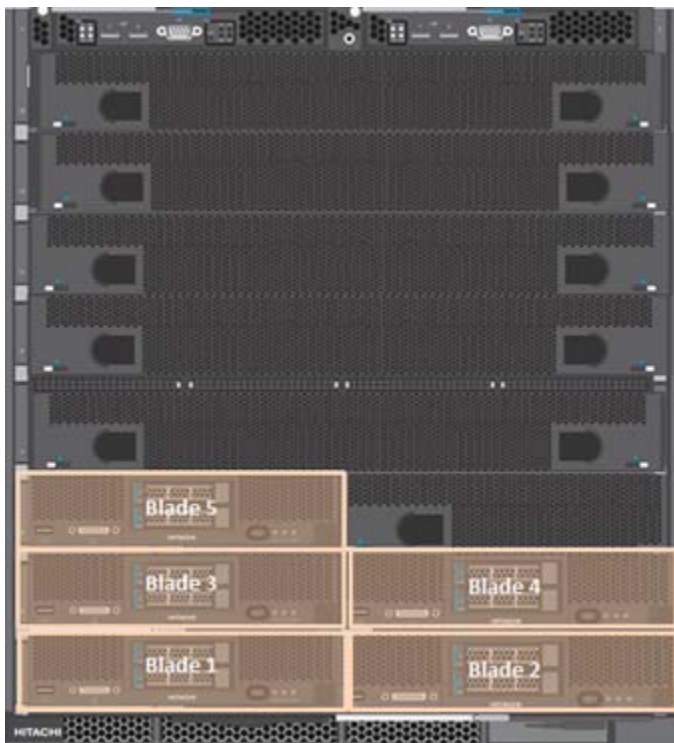
This reference architecture uses a single Hitachi Compute Blade 2500 chassis with five server blades. This provides the compute power for Oracle E-Business Suite to handle complex database queries and a large volume of transaction processing in parallel. Table 11 describes the details of the server configuration for this solution.

TABLE 11. SERVER DETAILS

Server Blade	Form Size	Server Name	Role	CPU Core	RAM
1	Half-width	computenode01	Oracle VM Server	36	384 GB
2	Half-width	computenode02	Oracle VM Server	36	384 GB
3	Half-width	computenode03	Oracle VM Server	36	384 GB
4	Half-width	computenode04	Oracle VM Server	36	384 GB
5	Half-width	computenode05	Oracle VM Server	36	384 GB

Figure 5 shows the server infrastructure for the reference architecture.

Figure 5



SAN Architecture

Map the provisioned LDEVs to multiple ports on Hitachi Virtual Storage Platform G800. These LDEV port assignments provide multiple paths to the storage system from the host for high availability.

Each server blade uses four Fibre Channel ports, with two ports from each of the PCIe HBA cards from Emulex listed in Table 1, “Key Solution Components,” on page 4.

Hitachi Virtual Storage Platform G800 HBA Connections

Table 12 shows the SAN connection from the HBA of the server blades to the Hitachi Virtual Storage Platform G800 ports.

TABLE 12. FIBRE CHANNEL SAN CONNECT CONFIGURATION ON HITACHI VIRTUAL STORAGE PLATFORM G800

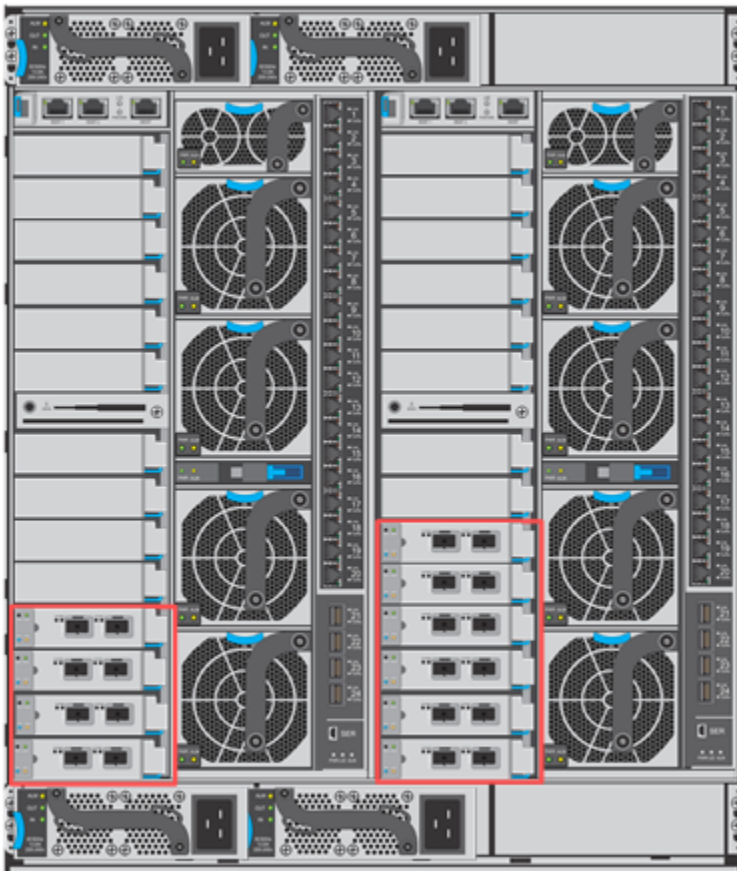
Host	HBA	Storage Port	Storage Host Group	Zone Name
BLADE 1	HBA1-1	1A	BLADE1_OVS1	CB2500_20_B1_HBA1_1_ASE42_43_1A
	HBA1-2	2A	BLADE1_OVS1	CB2500_20_B1_HBA1_2_ASE42_43_2A
	HBA2-1	3A	BLADE1_OVS1	CB2500_20_B1_HBA2_3_ASE42_43_3A
	HBA2-2	4A	BLADE1_OVS1	CB2500_20_B1_HBA2_4_ASE42_43_4A
BLADE 2	HBA1-1	1B	BLADE2_OVS2	CB2500_20_B2_HBA1_1_ASE42_43_1B
	HBA1-2	2B	BLADE2_OVS2	CB2500_20_B2_HBA1_2_ASE42_43_2B
	HBA2-1	3B	BLADE2_OVS2	CB2500_20_B2_HBA2_3_ASE42_43_3B
	HBA2-2	4B	BLADE2_OVS2	CB2500_20_B2_HBA2_4_ASE42_43_4B
BLADE 3	HBA1-1	1C	BLADE3_OVS3	CB2500_20_B3_HBA1_1_ASE42_43_1C
	HBA1-2	2C	BLADE3_OVS3	CB2500_20_B3_HBA1_2_ASE42_43_2C
	HBA2-1	3C	BLADE3_OVS3	CB2500_20_B3_HBA2_3_ASE42_43_3C
	HBA2-2	4C	BLADE3_OVS3	CB2500_20_B3_HBA2_4_ASE42_43_4C
BLADE 4	HBA1-1	1D	BLADE4_OVS4	CB2500_20_B4_HBA1_1_ASE42_43_1D
	HBA1-2	2D	BLADE4_OVS4	CB2500_20_B4_HBA1_2_ASE42_43_2D
	HBA2-1	3D	BLADE4_OVS4	CB2500_20_B4_HBA2_3_ASE42_43_3D
	HBA2-2	4D	BLADE4_OVS4	CB2500_20_B4_HBA2_4_ASE42_43_4D
BLADE 5	HBA1-1	1E	BLADE5_OVS5	CB2500_20_B5_HBA1_1_ASE42_43_1E
	HBA1-2	2E	BLADE5_OVS5	CB2500_20_B5_HBA1_2_ASE42_43_2E
	HBA2-1	3E	BLADE5_OVS5	CB2500_20_B5_HBA2_3_ASE42_43_3E
	HBA2-2	4E	BLADE5_OVS5	CB2500_20_B5_HBA2_4_ASE42_43_4E

Hitachi Compute Blade 2500 HBA Card Connections

This describes the configuration for the Emulex 16 Gb/sec PCIe HBA cards that are used on the server blades. Figure 6 shows the Emulex 16 Gb/sec HBA PCIe cards that are installed in Hitachi Compute Blade 2500.

Figure 6

Hitachi Compute Blade 2500



Back View

Set the following parameters for each of the Emulex HBA PCIe cards, following Table 13.

TABLE 13. EMULEX HBA PCIE CARD CONFIGURATION

For This	Use This
Boot From SAN	Enable
Force Link Speed	16Gbps
Topology	Fabric Point to Point

Network Architecture

This architecture requires the following separate networks:

- **Private Network (also called Cluster Interconnect)**

This network must be scalable. In addition, it must meet the low latency needs of the network traffic generated by cache synchronization of Oracle RAC and inter-node communication amongst the nodes in the cluster.

- **Public Network**

This network provides client connections to the applications and Oracle RAC.

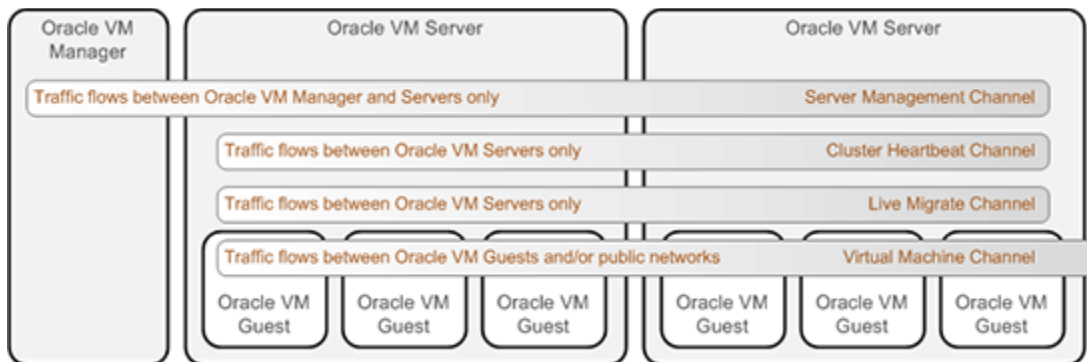
Hitachi Vantara recommends using a pair of 10 Gb/sec NICs for the cluster interconnect and public network.

Each server blade in this reference architecture has a quad port 10 Gb/sec onboard NIC. The NIC ports have interconnected links to the two internal 10 Gb/sec Ethernet switches in the chassis.

Observe these points when configuring private and public networks in your Oracle RAC environment:

- For each server in the Oracle RAC clusterware configuration, use at least two identical, high bandwidth, low-latency NICs for the interconnection.
- Use NIC bonding to provide fail over and load balancing of interconnections within a server.
- Set all NICs to full duplex mode.
- Oracle VM environment recommended network layout is shown in Figure 7.

Figure 7



Configure each sever blade with two bonding interfaces:

- Management/Public
- Private network

Each virtual machine has public and private vNICs. The recommendation is to use separate VLANs for the following:

- Oracle VM management network
- Oracle RAC database public network interface

Table 14 lists the network configuration for this solution. Configure the VLAN to fit your network environment.

TABLE 14. NETWORK CONFIGURATION

Server	NIC Ports	NIC BOND	VLAN	Network	Bandwidth (Gb/Sec)
Computenode01	B1-CNIC-0	Bond0	1201	Management/Public for Oracle VM Sever	10
	B1-CNIC-1				10
	B1-CNIC-2	Bond1	1200	Private	10
	B1-CNIC-3				10
Computenode02	B2-CNIC-0	Bond0	1201	Management/Public	10
	B2-CNIC-1				10
	B2-CNIC-2	Bond1	1200	Private	10
	B2-CNIC-3				10
Computenode03	B3-CNIC-0	Bond0	1201	Management/Public	10
	B3-CNIC-1				10
	B3-CNIC-2	Bond1	1200	Private	10
	B3-CNIC-3				10
Computenode04	B4-CNIC-0	Bond0	1201	Management/Public	10
	B4-CNIC-1				10
	B4-CNIC-2	Bond1	1200	Private	10
	B4-CNIC-3				10
Computenode05	B5-CNIC-0	Bond0	1201	Management/Public	10
	B5-CNIC-1				10
	B5-CNIC-2	Bond1	1200	Private	10
	B5-CNIC-3				10

Oracle E-Business Suite Virtual Machine Configuration

These are virtual machine configurations for 1500, 500, and 250 users. Configure virtual machines in your implementation of this solution based on your total user requirement.

Table 15 lists the configuration for virtual machines used with Oracle E-Business Suite in this solution **for 1500** users.

TABLE 15. VIRTUAL MACHINE CONFIGURATION FOR 1500 USERS

Virtual Machine Name	Role	vCPU	Virtual Memory	Oracle Linux Version
EBSPRODDB1	EBS Production Database Sever 1	16	128	7.2
EBSPRODDB2	EBS Production Database Sever 2	16	128	7.2
EBSPRODAPP1	EBS Production Application Server 1	12	96	7.2
EBSPRODAPP2	EBS Production Application Server 2	12	96	7.2
EBSUATDB1	EBS UAT Database Sever 1	8	64	7.2
EBSUATDB2	EBS UAT Database Sever 2	8	64	7.2
EBSUATAPP1	EBS UAT Application Server 1	6	48	7.2
EBSUATAPP2	EBS UAT Application Server 2	6	48	7.2
EBSDEVDB1	EBS DEV Database Sever	8	64	7.2
EBSDEVAPP1	EBS DEV Application Server	6	48	7.2
EBSTESTDB1	EBS TEST Database Sever	8	64	7.2
EBSTESTAPP1	EBS TEST Application Server	6	48	7.2
OEM13C	Oracle Cloud Control Server	8	32	7.2

Table 16 lists the configuration for virtual machines used with the Oracle E-Business Suite in this solution for **500** users.

TABLE 16. VIRTUAL MACHINE CONFIGURATION FOR 500 USERS

Virtual Machine Name	Role	vCPU	Virtual Memory	Oracle Linux Version
EBSPRODDB1	EBS Production Database Sever 1	8	32	7.2
EBSPRODDB2	EBS Production Database Sever 2	8	32	7.2
EBSPRODAPP1	EBS Production Application Server 1	8	32	7.2
EBSPRODAPP2	EBS Production Application Server 2	8	32	7.2
EBSUATDB1	EBS UAT Database Sever 1	4	16	7.2

TABLE 16. VIRTUAL MACHINE CONFIGURATION FOR 500 USERS (CONTINUED)

Virtual Machine Name	Role	vCPU	Virtual Memory	Oracle Linux Version
EBSUATDB2	EBS UAT Database Sever 2	4	16	7.2
EBSUATAPP1	EBS UAT Application Server 1	4	16	7.2
EBSUATAPP2	EBS UAT Application Server 2	4	16	7.2
EBSDEVDB1	EBS DEV Database Sever	2	16	7.2
EBSDEVAPP1	EBS DEV Application Server	2	16	7.2
EBSTESTDB1	EBS TEST Database Sever	2	16	7.2
EBSTESTAPP1	EBS TEST Application Server	2	16	7.2
OEM13C	Oracle Cloud Control Server	8	32	7.2

Table 17 lists the configuration for virtual machines used with Oracle E-Business Suite in this solution for 250 users.

TABLE 17. VIRTUAL MACHINE CONFIGURATION FOR 250 USERS

Virtual Machine Name	Role	vCPU	Virtual Memory	Oracle Linux Version
EBSPRODDB1	EBS Production Database Sever 1	2	16	7.2
EBSPRODDB2	EBS Production Database Sever 2	2	16	7.2
EBSPRODAPP1	EBS Production Application Server 1	2	16	7.2
EBSPRODAPP2	EBS Production Application Server 2	2	16	7.2
EBSUATDB1	EBS UAT Database Sever 1	2	16	7.2
EBSUATDB2	EBS UAT Database Sever 2	2	16	7.2
EBSUATAPP1	EBS UAT Application Server 1	2	16	7.2
EBSUATAPP2	EBS UAT Application Server 2	2	16	7.2
EBSDEVDB1	EBS DEV Database Sever	2	16	7.2
EBSDEVAPP1	EBS DEV Application Server	2	16	7.2
EBSTESTDB1	EBS TEST Database Sever	2	16	7.2
EBSTESTAPP1	EBS TEST Application Server	2	16	7.2
OEM13C	Oracle Cloud Control Server	8	32	7.2

Oracle E-Business Suite Application Configuration

Use Oracle E-Business Suite in this solution configured as follows:

- Multinode application with shared application tier
- With OCFS2 configured as a cluster filesystem. shared between two application nodes.
- Parallel concurrent processing with managers distributed between the nodes for high availability and load distribution
- With application nodes having all the application services (Apache, OACORE, OAFM, FORMS, Internal Controls Manager) enabled and admin server running on primary node

Table 18 lists managed server configuration used in this solution.

TABLE 18. MANAGED SERVERS CONFIGURATION

Server Size	Server Name	OACORE Server	OAFM Server	FORMS Server
250 Users	EBSPRODAPP1	1	1	1
	EBSPRODAPP2	1	1	1
500 Users	EBSPRODAPP1	2	2	2
	EBSPRODAPP2	2	2	2
1500 Users	EBSPRODAPP1	4	4	4
	EBSPRODAPP2	4	4	4

Load Balancer Configuration

This solution may use any standard industry load balancer.

When validating this solution, the laboratory used a F5 BIG LTM 7050S load balancer. These were the setup and features enabled for the load balancer during evaluation:

- Multinode feature
- Round robin load balancing method, which shares the load equally to the pool members (nodes or servers)
- Port basis services
- Redundancy (whenever a server fails in a pool, it automatically diverts the traffic to other pool members)
- Security features that hides the original servers to face the direct traffic
- Health monitoring to all servers, traps, and SNMP services
- Permitted internal and external networks

Oracle E-Business Suite Installation

Deploy this Oracle E-Business Suite solution on a Hitachi Cloud Foundation infrastructure. This provides rapid deployment of E-Business Suite applications from a basic configuration of a single node to a complex multi node application with Oracle RAC. The following are the highlights of this E-Business Suite solution:

- Single node E-Business Suite application and database for development and test environments
- Provision of Oracle RAC (including Cluster) database
- Provision of multi-node application tiers for production and user acceptance testing environments
- The ability to configure a load balancer in multi-node environments
- The ability to configure parallel concurrent processing
- Additional managed servers to support, based on instance sizing (small, medium, and large)

Achieve rapid provisioning of Oracle E-Business Suite using Oracle Enterprise Manager Cloud Control 13c by leveraging deployment procedures with the following:

- A preconfigured database template, including gold images of grid home, database home, and database files
- 12.2.6 application templates uploaded to the Oracle Enterprise Manager software library
Use Oracle Enterprise Manager Cloud Control 13c self-service portal for provisioning a virtual machine as part of Oracle Virtual Machine services.

The provisioned Oracle E-Business Suite comprises the following:

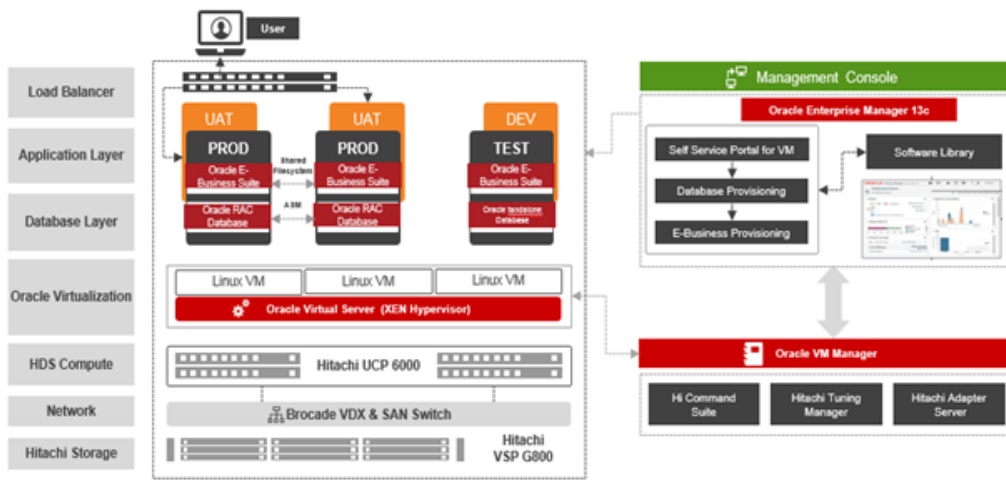
- Oracle E-Business Suite 12.2.6
- Oracle Database 12.1.0.2
- Applications DBA (AD) and Technology Stack (TXK) Delta 8 patchset
- Oracle Database October 2016 CPU patches
- Applications Technology Group (ATG) Rollup (RUP) 6 patch level
- Oracle WebTier 11.1.1.9

The E-Business Suite appliance leverages Oracle Enterprise Manager Cloud Control 13c to deploy Oracle E-Business Suite 12.2.6 application. It self-provisions and administers the following integrated technology stack:

- Storage
- Oracle Virtual Machine
- E-Business Suite database
- E-Business Suite applications

Figure 8 represents Hitachi Cloud Foundation for Oracle E-Business Suite architecture.

Figure 8



This solution includes preconfigured hardware-sized virtual machine templates for Oracle E-Business Suite application and database. The benchmark for small, medium, and large environments are in Table 19.

TABLE 19. PRECONFIGURED E-BUSINESS SUITE ENVIRONMENTS

Users	Size
250 Users	Small
500 Users	Medium
1500 Users	Large

Hitachi Infrastructure Analytics Advisor

Hitachi Infrastructure Analytics Advisor (HIAA) can be used for infrastructure performance monitoring and identifying any storage performance bottlenecks.

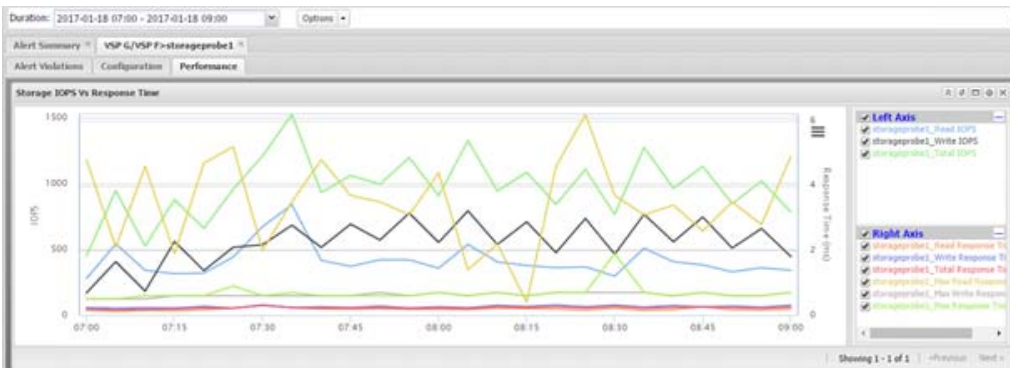
Figure 9 shows data path between server, SAN switch, and storage.

Figure 9



Figure 10 shows storage IOPS versus response time. The left axis has read IOPS, write IOPS, and total IOPS. The right axis shows different colored response times, including read, write, total, and maximum response time.

Figure 10



Engineering Validation

Validation of this environment used the hardware and software described in “Key Solution Components” on page 4.

The test lab used an F5 load balancer (F5-BIG-LTM 7050S, 11.5.4 Build 0.0.256). Your implementation of this solution may use any industry-standard load balancer.

Table 20 lists the validated applications DBA test cases for this solution.

TABLE 20. VALIDATED APPLICATIONS DBA TEST CASE

Test Case	Test Description	Evaluation for 250, 500, 1500 Users
1	Perform complete online patching cycle including fs_clone (Includes application)	Online patching was successful and worked as expected
2	Application tar backups & Database RMAN Backups	Application TAR backups and RMAN backup was successful
3	Basic E-Business Suite Sanity check (OAF, Forms & Concurrent Managers)	All the components (OAF, Forms & Concurrent Managers) up and running as expected
4	E-Business instance clone from PROD to another VM	Production to non-production clone was successful.
5	Perform Database patching (RAC & GRID)	Database patching for RAC and GRID was successful
6	Workflow Mailer configuration and test notifications (dependency on IMAP/SMTP)	Workflow notification email sent to recipient successfully
7	Parallel Concurrent Processing testing	Concurrent manager load balancing and failover test was successful
8	Load Balancing Testing	Load Balancer distributed external users connections between application nodes
9	OS Watcher/SAR Graph	Assigned server resources handled user load without any stress
10	OEM	Assigned server resources handled user load without any stress

Test Results

This summarizes the key observations from testing Hitachi Cloud Foundation for Oracle E-Business Suite on concurrent users by executing the top seven business workflow transactions using Oracle Application Testing Suite (OATS). It shows the end-to-end transaction response times, which include the following:

- The think times that was used while executing script run
- The associated server processing time to make it real user scenarios.

Table 21 lists the test case results.

TABLE 21. TEST CASE RESULTS

Metric	E-Business Suite Transactions	250 Users	500 Users	1500 Users
Response Times	AP-GL Transfer	17.789	17.294	17.222
	AP Payments	17.356	10.6	10.58
	AR-GL Transfer	17.21	16.752	16.715
	AR Invoices Entry	12.856	12.758	12.619
	AP Invoices Entry	11.028	10.607	10.532
	GL Journals Entry	10.227	10.133	10.155
	Journal Posting	17.379	20.461	20.459
CPU Utilizations (%)	App server1	30	40	40
	App server2	20	20	21
	DB server1	35	10	10
	DB server2	15	8	10
Memory Utilizations (%)	App server1	62.50	81	47.92
	App server2	50.00	53	27.08
	DB server1	96.88	90	72.66
	DB server2	78.13	92	37.50

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Hitachi Vantara



Corporate Headquarters
2845 Lafayette Street
Santa Clara, CA 96050-2639 USA
www.HitachiVantara.com | community.HitachiVantara.com

Regional Contact Information
Americas: +1 408 970 1000 or info@hitachivantara.com
Europe, Middle East and Africa: +44 (0) 1753 618000 or info.emea@hitachivantara.com
Asia Pacific: +852 3189 7900 or hds.marketing.apac@hitachivantara.com

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