

FlexPod Data Center with Oracle RAC on Oracle VM with 7-Mode

Deployment Guide for FlexPod with Oracle Database 11g Release 2 RAC on Oracle VM 3.1.1 $\,$

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Building Architectures to Solve Business Problems

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FlexPod Data Center with Oracle RAC on Oracle VM

Executive Summary

Industry trends indicate a vast data center transformation toward shared infrastructures. Enterprise customers are moving away from silos of information and moving toward shared infrastructures to virtualized environments and eventually to the cloud to increase agility and operational efficiency, optimize resource utilization, and reduce costs.

FlexPod is a pretested data center solution built on a flexible, scalable, shared infrastructure consisting of Cisco UCS servers with Cisco Nexus® switches and NetApp unified storage systems running Data ONTAP. The FlexPod components are integrated and standardized to help you eliminate the guesswork and achieve timely, repeatable, consistent deployments. FlexPod has been optimized with a variety of mixed application workloads and design configurations in various environments such as virtual desktop infrastructure and secure multitenancy environments.

One main benefit of the FlexPod architecture is the ability to customize the environment to suit a customer's requirements. This is why the reference architecture detailed in this document highlights the resiliency, cost benefit, and ease of deployment of an FCoE-based storage solution. A storage system capable of serving multiple protocols across a single interface is the customer's choice and investment protection.

Large enterprises are adopting virtualization, have much higher I/O requirements. For them, FCoE is a better solution. Customers who have adopted Cisco® MDS 9000 family switches will probably prefer FCoE as it offers inherent coexistence with Fibre Channel, with no need to migrate existing Fibre Channel infrastructures. FCoE will take a large share of the SAN market. It will not make iSCSI obsolete, but it will reduce its potential market.

Virtualization started as a means of server consolidation, but IT needs are evolving as data centers are becoming service providers. An isolated hypervisor cannot provide the speed and time to market required to deploy a complete application stack. To realize the full benefits of virtualization, Oracle offers an integrated virtualization from desktop to the data center and enables you to virtualize and manage your complete hardware and software stack.

Oracle Real Application Clusters (RAC) allows an Oracle Database to run any packaged or custom applications, unchanged across a pool of servers. This provides the highest levels of RAS (Reliability, Availability and Scalability). If a server in the pool fails, the Oracle database continues to run on the remaining servers. When you need more processing power, simply add another server to the pool without



taking users offline. Oracle Real Application Clusters provide a foundation for Oracle's Private Cloud Architecture. Oracle RAC 11g Release 2 in addition enables customers to build a dynamic private cloud infrastructure.

FlexPod Data Center with Oracle RAC on Oracle VM includes NetApp storage, Cisco® networking, Cisco UCS, and Oracle virtualization software in a single package. This solution is deployed and tested on a defined set of hardware and software.

This Cisco Validated Design describes how the Cisco Unified Computing System[™] can be used in conjunction with NetApp FAS storage systems to implement an optimized system to run Oracle Real Application Clusters (RAC) in Oracle VM.

Target Audience

This document is intended to assist solution architects, project managers, infrastructure managers, sales engineers, field engineers, and consultants in planning, designing, and deploying Oracle Database 11g Release 2 RAC hosted on FlexPod. This document assumes that the reader has an architectural understanding of the Cisco Unified Computing System, Oracle 11g Release 2 Grid Infrastructure, Oracle Real Application Clusters, Oracle VM, NetApp storage systems, and related software.

Purpose of this Guide

This FlexPod CVD demonstrates how enterprises can apply best practices to deploy Oracle Database 11g Release 2 RAC using Oracle VM, Cisco Unified Computing System, Cisco Nexus family switches, and NetApp FAS storage. This design solution shows the deployment and scaling of a four-node Oracle Database 11g Release 2 RAC in a virtualized environment using typical OLTP and DSS workloads to demonstrate stability, performance and resiliency design as demanded by mission critical data center deployments.

Business Needs

Business applications are moving into integrated stacks consisting of compute, network, and storage. This FlexPod solution helps to reduce costs and complexity of a traditional Oracle Database 11g Release 2 RAC deployment. Following business needs for Oracle Database 11g Release 2 RAC deployment on Oracle VM are addressed by this solution.

- Increasing DBA's productivity by ease of provisioning and simplified yet scalable architecture.
- Reduced risk for a solution that is tested for end-to-end interoperability of compute, storage, and network.
- Save costs, power, and lab space by reducing the number of physical servers.
- Enable a global virtualization policy.
- Create a balanced configuration that yields predictable purchasing guidelines at the computing, network, and storage tiers for a given workload.
- With Oracle VM and Oracle RAC, which are referred to as complementary technologies, additional high availability can be achieved.

- Oracle VM application-driven server virtualization is designed for rapid application deployment and ease of lifecycle management. Using Oracle VM Templates, entire application stacks can be deployed into your new FlexPod architecture in hours and minutes rather than days and weeks, helping to accelerate time to value, at the same time standardizing your application deployment process to ensure reliability and minimize risks.
- Oracle offers a complete applications-to-disk stack, and virtualization is fully integrated across all layers. Oracle can provision and manage applications, middleware, and databases.
- Benefits of using Oracle VM for Oracle RAC Databases are Sub-capacity licensing, Server Consolidation, Rapid provisioning and Create a virtual cluster.

Solution Overview

Oracle Database 11g Release 2 RAC on FlexPod with Oracle Direct NFS Client

This solution provides an end-to-end architecture with Cisco UCS, Oracle, and NetApp technologies that demonstrate the implementation of Oracle Database 11g Release 2 RAC on FlexPod and Oracle VM. This solution demonstrates the implementation, capabilities and advantages of Oracle Database 11g Release 2 RAC and Oracle VM on FlexPod.

The following infrastructure and software components are used for this solution:

- Cisco Unified Computing System*
- Cisco Nexus 5548UP switches
- NetApp storage components
- NetApp OnCommand[®] System Manager 2.1
- Oracle VM
- Oracle Database 11g Release 2 RAC
- Swingbench benchmark kit for OLTP and DSS workloads.
- * Cisco Unified Computing System includes all the hardware and software components required for this deployment solution.

Figure 1 shows the architecture and the connectivity layout for this deployment model.



Let us look at individual components that define this architecture.

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Technology Overview

Cisco Unified Computing System



The Cisco Unified Computing System is a third-generation data center platform that unites computing, networking, storage access, and virtualization resources into a cohesive system designed to reduce TCO and increase business agility. The system integrates a low-latency, lossless 10 Gigabit Ethernet (10GbE) unified network fabric with enterprise-class, x86-architecture servers. The system is an integrated, scalable, multi-chassis platform in which all the resources participate in a unified management domain that is controlled and managed centrally.

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The main components of the Cisco UCS are:

• Compute

The system is based on an entirely new class of computing system that incorporates blade servers based on Intel Xeon® E5-2600 Series Processors. Cisco UCS B-Series Blade Servers work with virtualized and non-virtualized applications to increase performance, energy efficiency, flexibility and productivity.

• Network

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The system is integrated onto a low-latency, lossless, 80-Gbps unified network fabric. This network foundation consolidates LANs, SANs, and high-performance computing networks which are separate networks today. The unified fabric lowers costs by reducing the number of network adapters, switches, and cables, and by decreasing the power and cooling requirements.

Storage access

The system provides consolidated access to both storage area network (SAN) and network-attached storage (NAS) over the unified fabric. By unifying storage access, Cisco UCS can access storage over Ethernet, Fiber Channel, Fiber Channel over Ethernet (FCoE), and iSCSI. This provides customers with the options for setting storage access and investment protection. Additionally, server administrators can reassign storage-access policies for system connectivity to storage resources, thereby simplifying storage connectivity and management for increased productivity.

Management

The system uniquely integrates all the system components which enable the entire solution to be managed as a single entity by the Cisco UCS Manager. The Cisco UCS Manager has an intuitive graphical user interface (GUI), a command-line interface (CLI), and a robust application programming interface (API) to manage all the system configuration and operations.

The Cisco UCS is designed to deliver:

- A reduced Total Cost of Ownership (TCO), increased Return on Investment (ROI) and increased business agility.
- Increased IT staff productivity through just-in-time provisioning and mobility support.
- A cohesive, integrated system which unifies the technology in the data center. The system is managed, serviced and tested as a whole.
- Scalability through a design for hundreds of discrete servers and thousands of virtual machines and the capability to scale I/O bandwidth to match demand.
- Industry standards supported by a partner ecosystem of industry leaders.

Cisco UCS Blade Chassis

The Cisco UCS 5100 Series Blade Server Chassis is a crucial building block of the Cisco Unified Computing System, delivering a scalable and flexible blade server chassis.

The Cisco UCS 5108 Blade Server Chassis is six rack units (6RU) high and can mount in an industry-standard 19-inch rack. A single chassis can house up to eight half-width Cisco UCS B-Series Blade Servers and can accommodate both half-width and full-width blade form factors.

Four single-phase, hot-swappable power supplies are accessible from the front of the chassis. These power supplies are 92 percent efficient and can be configured to support non-redundant, N+ 1 redundant and grid-redundant configurations. The rear of the chassis contains eight hot-swappable fans, four power connectors (one per power supply), and two I/O bays for Cisco UCS 2208 XP Fabric Extenders.

A passive mid-plane provides up to 40 Gbps of I/O bandwidth per server slot and up to 80 Gbps of I/O bandwidth for two slots. The chassis is capable of supporting future 80 Gigabit Ethernet standards.



UCS5108 with B200M3 and B200M2

Cisco UCS B200 M3 Blade Server

The Cisco UCS B200 M3 Blade Server is a half-width, two-socket blade server. The system uses two Intel Xeon® E5-2600 Series Processors, up to 384 GB of DDR3 memory, two optional hot-swappable small form factor (SFF) serial attached SCSI (SAS) disk drives, and two VIC adaptors that provides up to 80 Gbps of I/O throughput. The server balances simplicity, performance, and density for production-level virtualization and other mainstream data center workloads.

Figure 6	Ci	isco UCS B200	M3 Blade Server
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Cisco UCS Virtual Interface Card 1240

A Cisco innovation, the Cisco UCS VIC 1240 is a four-port 10 Gigabit Ethernet, FCoE-capable modular LAN on motherboard (mLOM) designed exclusively for the M3 generation of Cisco UCS B-Series Blade Servers. When used in combination with an optional port expander, the Cisco UCS VIC 1240 capabilities can be expanded to eight ports of 10 Gigabit Ethernet.

Cisco UCS 6248UP Fabric Interconnect

• The Fabric interconnects provide a single point for connectivity and management for the entire system. Typically deployed as an active-active pair, the system's fabric interconnects integrate all the components into a single, highly-available management domain controlled by Cisco UCS Manager. The fabric interconnects manage all I/O efficiently and securely at a single point, resulting in deterministic I/O latency regardless of a server or virtual machine's topological location in the system.

• Cisco UCS 6200 Series Fabric Interconnects support the system's 80-Gbps unified fabric with low-latency, lossless, cut-through switching that supports IP, storage, and management traffic using a single set of cables. The fabric interconnects feature virtual interfaces that terminate both physical and virtual connections equivalently, establishing a virtualization-aware environment in which blade, rack servers, and virtual machines are interconnected using the same mechanisms. The Cisco UCS 6248UP is a 1-RU fabric interconnect that features up to 48 universal ports that can support 80 Gigabit Ethernet, Fiber Channel over Ethernet, or native Fiber Channel connectivity.

Figure 7 Cisco UCS 6248UP Fabric Interconnect



Cisco UCS Manager

Cisco UCS Manager is an embedded, unified manager that provides a single point of management for Cisco UCS. Cisco UCS Manager can be accessed through an intuitive GUI, a command-line interface (CLI), or the comprehensive open XML API. It manages the physical assets of the server and storage and LAN connectivity, and it is designed to simplify the management of virtual network connections through integration with several major hypervisor vendors. It provides IT departments with the flexibility to allow people to manage the system as a whole, or to assign specific management functions to individuals based on their roles as managers of server, storage, or network hardware assets. It simplifies operations by automatically discovering all the components available on the system and enabling a stateless model for resource use.

Some of the key elements managed by Cisco UCS Manager include:

- Cisco UCS Integrated Management Controller (IMC) firmware
- RAID controller firmware and settings
- BIOS firmware and settings, including server universal user ID (UUID) and boot order
- Converged network adapter (CNA) firmware and settings, including MAC addresses and worldwide names (WWNs) and SAN boot settings
- Virtual port groups used by virtual machines, using Cisco Data Center VM-FEX technology
- Interconnect configuration, including uplink and downlink definitions, MAC address and WWN pinning, VLANs, VSANs, quality of service (QoS), bandwidth allocations, Cisco Data Center VM-FEX settings, and Ether Channels to upstream LAN switches

Cisco UCS is designed from the start to be programmable and self-integrating. A server's entire hardware stack, ranging from server firmware and settings to network profiles, is configured through model-based management. With Cisco virtual interface cards (VICs), even the number and type of I/O interfaces is programmed dynamically, making every server ready to power any workload at any time.

With model-based management, administrators manipulate a desired system configuration and associate a model's policy driven service profiles with hardware resources, and the system configures itself to match requirements. This automation accelerates provisioning and workload migration with accurate and rapid scalability. The result is increased IT staff productivity, improved compliance, and reduced risk of failures due to inconsistent configurations. This approach represents a radical simplification

compared to traditional systems, reducing capital expenditures (CAPEX) and operating expenses (OPEX) while increasing business agility, simplifying and accelerating deployment, and improving performance.

UCS Service Profiles



A server's identity is made up of many properties such as UUID, boot order, IPMI settings, BIOS firmware, BIOS settings, RAID settings, disk scrub settings, number of NICs, NIC speed, NIC firmware, MAC and IP addresses, number of HBAs, HBA WWNs, HBA firmware, FC fabric assignments, QoS settings, VLAN assignments, remote keyboard/video/monitor etc. I think you get the idea. It's a LONG list of "points of configuration" that need to be configured to give this server its identity and make it unique from every other server within your data center. Some of these parameters are kept in the hardware of the server itself (like BIOS firmware version, BIOS settings, boot order, FC boot settings, etc.) while some settings are kept on your network and storage switches (like VLAN assignments, FC fabric assignments, QoS settings, ACLs, and so on.). This results in following server deployment challenges:

Lengthy deployment cycles

- Every deployment requires coordination among server, storage, and network teams
- Need to ensure correct firmware & settings for hardware components
- Need appropriate LAN & SAN connectivity

Response time to business needs

- Tedious deployment process
- Manual, error prone processes, that are difficult to automate

• High OPEX costs, outages caused by human errors

Limited OS and application mobility

- · Storage and network settings tied to physical ports and adapter identities
- Static infrastructure leads to over-provisioning, higher OPEX costs

Cisco UCS has uniquely addressed these challenges with the introduction of service profiles (see Figure 9) that enables integrated, policy based infrastructure management. UCS Service Profiles hold the DNA for nearly all configurable parameters required to set up a physical server. A set of user defined policies (rules) allow quick, consistent, repeatable, and secure deployments of UCS servers.



UCS Service Profiles contain values for a server's property settings, including virtual network interface cards (vNICs), MAC addresses, boot policies, firmware policies, fabric connectivity, external management, and high availability information. By abstracting these settings from the physical server into a Cisco Service Profile, the Service Profile can then be deployed to any physical compute hardware within the Cisco UCS domain. Furthermore, Service Profiles can, at any time, be migrated from one physical server to another. This logical abstraction of the server personality separates the dependency of the hardware type or model and is a result of Cisco's unified fabric model (rather than overlaying software tools on top).

This innovation is still unique in the industry despite competitors claiming to offer similar functionality. In most cases, these vendors must rely on several different methods and interfaces to configure these server settings. Furthermore, Cisco is the only hardware provider to offer a truly unified management platform, with UCS Service Profiles and hardware abstraction capabilities extending to both blade and rack servers.

Some of key features and benefits of UCS service profiles are:

• Service Profiles and Templates

A service profile contains configuration information about the server hardware, interfaces, fabric connectivity, and server and network identity. The Cisco UCS Manager provisions servers utilizing service profiles. The UCS Manager implements a role-based and policy-based management focused on service profiles and templates. A service profile can be applied to any blade server to provision

it with the characteristics required to support a specific software stack. A service profile allows server and network definitions to move within the management domain, enabling flexibility in the use of system resources.

Service profile templates are stored in the Cisco UCS 6200 Series Fabric Interconnects for reuse by server, network, and storage administrators. Service profile templates consist of server requirements and the associated LAN and SAN connectivity. Service profile templates allow different classes of resources to be defined and applied to a number of resources, each with its own unique identities assigned from predetermined pools.

The UCS Manager can deploy the service profile on any physical server at any time. When a service profile is deployed to a server, the Cisco UCS Manager automatically configures the server, adapters, Fabric Extenders, and Fabric Interconnects to match the configuration specified in the service profile. A service profile template parameterizes the UIDs that differentiate between server instances.

This automation of device configuration reduces the number of manual steps required to configure servers, Network Interface Cards (NICs), Host Bus Adapters (HBAs), and LAN and SAN switches.

Programmatically Deploying Server Resources

Cisco UCS Manager provides centralized management capabilities, creates a unified management domain, and serves as the central nervous system of the Cisco UCS. Cisco UCS Manager is embedded device management software that manages the system from end-to-end as a single logical entity through an intuitive GUI, CLI, or XML API. Cisco UCS Manager implements role- and policy-based management using service profiles and templates. This construct improves IT productivity and business agility. Now infrastructure can be provisioned in minutes instead of days, shifting IT's focus from maintenance to strategic initiatives.

Dynamic Provisioning

Cisco UCS resources are abstract in the sense that their identity, I/O configuration, MAC addresses and WWNs, firmware versions, BIOS boot order, and network attributes (including QoS settings, ACLs, pin groups, and threshold policies) all are programmable using a just-in-time deployment model. A service profile can be applied to any blade server to provision it with the characteristics required to support a specific software stack. A service profile allows server and network definitions to move within the management domain, enabling flexibility in the use of system resources. Service profile templates allow different classes of resources to be defined and applied to a number of resources, each with its own unique identities assigned from predetermined pools.

Cisco Nexus 5548UP Switch

The Cisco Nexus 5548UP is a 1RU 1 Gigabit and 10 Gigabit Ethernet switch offering up to 960 gigabits per second throughput and scaling up to 48 ports. It offers 32 1/10 Gigabit Ethernet fixed enhanced Small Form-Factor Pluggable (SFP+) Ethernet/FCoE or 1/2/4/8-Gbps native FC unified ports and three expansion slots. These slots have a combination of Ethernet/FCoE and native FC ports.

Figure 10 Cisco Nexus 5548UP switch

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The Cisco Nexus 5548UP Switch delivers innovative architectural flexibility, infrastructure simplicity, and business agility, with support for networking standards. For traditional, virtualized, unified, and high-performance computing (HPC) environments, it offers a long list of IT and business advantages, including:

- Architectural Flexibility
 - Unified ports that support traditional Ethernet, Fiber Channel (FC), and Fiber Channel over Ethernet (FCoE)
 - Synchronizes system clocks with accuracy of less than one microsecond, based on IEEE 1588
 - Supports secure encryption and authentication between two network devices, based on Cisco TrustSec IEEE 802.1AE
 - Offers converged Fabric extensibility, based on emerging standard IEEE 802.1BR, with Fabric Extender (FEX) Technology portfolio, including:
 - Cisco Nexus 2000 FEX
 - Adapter FEX
 - VM-FEX

• Infrastructure Simplicity

- Common high-density, high-performance, data-center-class, fixed-form-factor platform
- Consolidates LAN and storage
- Supports any transport over an Ethernet-based fabric, including Layer 2 and Layer 3 traffic
- Supports storage traffic, including iSCSI, NAS, FC, RoE, and IBoE
- Reduces management points with FEX Technology
- Business Agility
 - Meets diverse data center deployments on one platform
 - Provides rapid migration and transition for traditional and evolving technologies
 - Offers performance and scalability to meet growing business needs
- Specifications at a Glance
 - A 1 -rack-unit, 1/10 Gigabit Ethernet switch
 - 32 fixed Unified Ports on base chassis and one expansion slot totaling 48 ports
 - The slot can support any of the three modules: Unified Ports, 1/2/4/8 native Fiber Channel, and Ethernet or FCoE
 - Throughput of up to 960 Gbps

NetApp Storage Technologies and Benefits

NetApp storage platform can handle different type of files and data from various sources—including user files, e-mail, and databases. Data ONTAP is the fundamental NetApp software platform that runs on all the NetApp storage systems. Data ONTAP is a highly optimized, scalable operating system that supports mixed NAS and SAN environments and a range of protocols, including Fiber Channel, iSCSI, FCoE, NFS, and CIFS. The platform includes the Write Anywhere File Layout (WAFL[®]) file system and storage virtualization capabilities. By leveraging the Data ONTAP platform, the NetApp Unified Storage Architecture offers the flexibility to manage, support, and scale to different business environments by using a common knowledge base and tools. This architecture enables users to collect, distribute, and

FAS/V6280

manage data from all locations and applications at the same time. This allows the investment to scale by standardizing processes, cutting management time, and increasing availability. Figure 11 shows the various NetApp Unified Storage Architecture platforms.

Figure 11 NetApp Unified Storage Architecture Platforms

- Unified architecture
- Highly efficient

136 Drives

Extremely flexible



Unified Storage Architecture

The NetApp storage hardware platform used in this solution is the FAS3270A. The FAS3200 series is an excellent platform for primary and secondary storage for an Oracle Database 11g Release 2 Grid Infrastructure deployment.

A number of NetApp tools and enhancements are available to augment the storage platform. These tools assist in deployment, backup, recovery, replication, management, and data protection. This solution makes use of a subset of these tools and enhancements.

Storage Architecture

The storage design for any solution is a critical element that is typically responsible for a large percentage of the solution's overall cost, performance, and agility.

The basic architecture of the storage system's software is shown in the figure below. A collection of tightly coupled processing modules handles CIFS, FCP, FCoE, HTTP, iSCSI, and NFS requests. A request starts in the network driver and moves up through network protocol layers and the file system, eventually generating disk I/O, if necessary. When the file system finishes the request, it sends a reply back to the network. The administrative layer at the top supports a command line interface (CLI) similar to UNIX® that monitors and controls the modules below. In addition to the modules shown, a simple real-time kernel provides basic services such as process creation, memory allocation, message passing, and interrupt handling.

The networking layer is derived from the same Berkeley code used by most UNIX systems, with modifications made to communicate efficiently with the storage appliance's file system. The storage appliance provides transport-independent seamless data access using block- and file-level protocols from the same platform. The storage appliance provides block-level data access over an FC SAN fabric using FCP and over an IP-based Ethernet network using iSCSI. File access protocols such as NFS, CIFS, HTTP, or FTP provide file-level access over an IP-based Ethernet network.





RAID-DP

RAID-DP[®] is NetApp's implementation of double-parity RAID 6, which is an extension of NetApp's original Data ONTAP WAFL[®] RAID 4 design. Unlike other RAID technologies, RAID-DP provides the ability to achieve a higher level of data protection without any performance impact, while consuming a minimal amount of storage. For more information on RAID-DP, see: http://www.netapp.com/us/products/platform-os/raid-dp.html

Snapshot

NetApp Snapshot technology provides zero-cost, near-instantaneous backup and point-in-time copies of the volume or LUN by preserving the Data ONTAP WAFL consistency points.

Creating Snapshot copies incurs minimal performance effect because data is never moved, as it is with other copy-out technologies. The cost for Snapshot copies is at the rate of block-level changes and not 100% for each backup, as it is with mirror copies. Using Snapshot can result in savings in storage cost for backup and restore purposes and opens up a number of efficient data management possibilities.

FlexVol

NetApp® FlexVol® storage-virtualization technology enables you to respond to changing storage needs fast, lower your overhead, avoid capital expenses, and reduce disruption and risk. FlexVol technology aggregates physical storage in virtual storage pools, so you can create and resize virtual volumes as your application needs change.

With FlexVol you can improve—even double—the utilization of your existing storage and save the expense of acquiring more disk space. In addition to increasing storage efficiency, you can improve I/O performance and reduce bottlenecks by distributing volumes across all the available disk drives.

NetApp Flash Cache

NetApp® Flash Cache controller-attached PCIe intelligent caching instead of more hard disk drives (HDDs) or solid-state drives (SSDs) to optimize your storage system performance.

Flash Cache speeds data access through intelligent caching of recently read user data or NetApp metadata. No setup or ongoing administration is needed, and operations can be tuned. Flash Cache works with all the NetApp storage protocols and software, enabling you to:

- Increase I/O throughput by up to 75%
- Use up to 75% fewer disk drives without compromising performance
- Increase e-mail users by up to 67% without adding disk drives

For more information on RAID-DP, see: http://www.netapp.com/us/products/storage-systems/flash-cache/index.aspx

NetApp OnCommand System Manager 2.1

System Manager is a powerful management tool for NetApp storage that allows administrators to manage a single NetApp storage system as well as clusters, quickly and easily.

Some of the benefits of the System Manager Tool are:

- Easy to install
- Easy to manage from a Web browser
- Does not require storage expertise
- Increases storage productivity and response time
- Cost effective
- · Leverages storage efficiency features such as thin provisioning and compression

Oracle VM 3.1.1

Oracle VM is a platform that provides a fully equipped environment with all the latest benefits of virtualization technology. Oracle VM enables you to deploy operating systems and application software within a supported virtualization environment. Oracle VM is a Xen-based hypervisor that runs at nearly bare-metal speeds.

Oracle VM Architecture

Figure 13 shows the Oracle VM architecture.



Figure 13 Oracle VM Architecture

The Oracle VM architecture has three main parts:

Oracle VM Manager

Provides the user interface, which is a standard ADF (Application Development Framework) web application, to manage Oracle VM Servers. Manages virtual machine lifecycle, including creating virtual machines from installation media or from a virtual machine template, deleting, powering off, uploading, deployment and live migration of virtual machines. Manages resources, including ISO files, virtual machine templates and sharable hard disks.

• Oracle VM Server

A self-contained virtualization environment designed to provide a lightweight, secure, server-based platform for running virtual machines. Oracle VM Server is based upon an updated version of the underlying Xen hypervisor technology, and includes Oracle VM Agent.

• Oracle VM Agent

Installed with Oracle VM Server. It communicates with Oracle VM Manager for management of virtual machines.

Advantage of Using Oracle VM for Oracle RAC Database

Oracle's virtualization technologies are an excellent delivery vehicle for Independent Software Vendors (ISV's) looking for a simple, easy-to-install and easy-to-support application delivery solution.

Oracle VM providing software based virtualization infrastructure (Oracle VM) and the market leading high availability solution Oracle Real Application Clusters (RAC), Oracle now offers a highly available, grid-ready virtualization solution for your data center, combining all the benefits of a fully virtualized environment.

The combination of Oracle VM and Oracle RAC enables a better server consolidation (RAC databases with under utilized CPU resources or peaky CPU utilization can often benefit from consolidation with other workloads using server virtualization) sub-capacity licensing, and rapid provisioning. Oracle RAC on Oracle VM also supports the creation of non-production virtual clusters on a single physical server for production demos and test/dev environments. This deployment combination permits dynamic changes to pre-configured database resources for agile responses to changing service level requirements common in consolidated environments.

Oracle VM is the only software based virtualization solution that is fully supported and certified for Oracle real Application Clusters.

There are several reasons why you may want to run Oracle RAC in an Oracle VM environment. The more more common reasons are:

• Server consolidation

Oracle RAC databases or Oracle RAC One Node databases with under utilized CPU resources or variable CPU utilization can often benefit from consolidation with other workloads using server virtualization. A typical use case for this scenario would be the consolidation of several Oracle databases (Oracle RAC, Oracle RAC One Node or Oracle single instance databases) into a single Oracle RAC database or multiple Oracle RAC databases where the hosting Oracle VM guests have pre-defined resource limits configured for each VM guest.

Sub-capacity licensing

The current Oracle licensing model requires the Oracle RAC database to be licensed for all CPUs on each server in the cluster. Sometimes customers wish to use only a subset of the CPUs on the server for a particular Oracle RAC database. Oracle VM can be configured in such way that it is recognized as a hard partition. Hard partitions allow customers to only license those CPUs used by the partition instead of licensing all CPUs on the physical server. More information on sub-capacity licensing using hard partitioning can be found in the Oracle partitioning paper. For more information on using hard partitioning with Oracle VM refer to the "Hard Partitioning with Oracle VM" white paper.

• Create a virtual cluster

Oracle VM enables the creation of a virtual cluster on a single physical server. This use case is particularly interesting for product demos, educational settings, and test environments. This configuration should never be used to run production Oracle RAC environments. The following are valid deployments for this use case:

- Test and development cluster
- Demonstration cluster
- Education cluster
- Rapid provisioning

The provisioning time of a new application consists of the server (physical or virtual) deployment time, and the software install and configuration time. Oracle VM can help reduce the deployment time for both of these components. Oracle VM supports the ability to create deployment templates. These templates can then be used to rapidly provision new (Oracle RAC) systems.

For Oracle RAC, currently only para-virtualized VM (PVM) mode is supported. Some of the advantages of using para-virtualized VM mode is mentioned in the next sub-section.

Para-virtualized VM (PVM)

Guest virtual machines running on Oracle VM server should be configured in para-virtualized virtualization mode. In this mode the kernel of the guest operating system is modified to distinguish that it is running on a hypervisor instead of on the bare metal hardware. As a result, I/O actions and system clock timers in particular are handled more efficiently, as compared with non para-virtualized systems where I/O hardware and timers have to be emulated in the operating system. Oracle VM supports PV kernels for Oracle Linux and Red Hat Enterprise Linux, offering better performance and scalability.

Oracle Database 11g Release 2 RAC

Oracle Database 11g Release 2 provides the foundation for IT to successfully deliver more information with higher quality of service, reduce the risk of change within IT, and make more efficient use of IT budgets.

Oracle Database 11g Release 2 Enterprise Edition provides industry-leading performance, scalability, security, and reliability on a choice of clustered or single-servers with a wide range of options to meet user needs. Cloud computing relieves users from concerns about where data resides and which computer processes the requests. Users request information or computation and have it delivered - as much as they want, whenever they want it. For a DBA, the cloud is about resource allocation, information sharing, and high availability. Oracle Database with Real Application Clusters provide the infrastructure for your database cloud. Oracle Automatic Storage Management provides the infrastructure for a storage cloud. Oracle Enterprise Manager Cloud Control provides you with holistic management of your could.

Oracle Database 11g Direct NFS Client

Direct NFS client is an Oracle developed, integrated, and optimized client that runs in user space rather than within the operating system kernel. This architecture provides for enhanced scalability and performance over traditional NFS v3 clients. Unlike traditional NFS implementations, Oracle supports asynchronous I/O across all operating system environments with Direct NFS client. In addition, performance and scalability are dramatically improved with its automatic link aggregation feature. This allows the client to scale across as many as four individual network pathways with the added benefit of improved resiliency when Network connectivity is occasionally compromised. It also allows Direct NFS client to achieve near block level Performance. For more information on Direct NFS Client comparison to block protocols, see: http://media.netapp.com/documents/tr-3700.pdf.

Design Topology

This section presents physical and logical high-level design considerations for Cisco UCS networking and computing on NetApp storage for Oracle Database 11g Release 2 RAC deployments.

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Hardware and Software used for this Solution

Table 1 shows the Software and Hardware Used for Oracle Database 11g Release 2 Grid Infrastructure with the Oracle RAC Option Deployment

Vendor	Name	Version/Model	Description
Cisco	Cisco 6248UP	UCSM 2.1(1a)	Cisco UCS 6200UP Series Fabric Interconnects
Cisco	Cisco UCS Chassis	5108	Chassis
Cisco	Cisco UCS IOM	2208	IO Module
Cisco	Nexus 5548UP Switch	NX-OS	Nexus 5500 series Unified Port switch
Cisco	UCS Blade Server	B200 M3	Half width Blade server (Database Server)
Cisco	Cisco UCS VIC Adaptor	1240	mLOM Virtual Interface Card
Oracle	Oracle VM	3.1.1 update 819	Virtualization technology
Oracle	Oracle Linux with RedHat Kernel	6.2 64-bit	Operating System
Oracle	Oracle 11g Release 2 Grid	11.2.0.3	Grid Infrastructure software
Oracle	Oracle 11g Release 2 Database	11.2.0.3	Database Software
Oracle	Oracle SwingBench	2.4	Oracle Benchmark kit
NetApp	NetApp OnCommand Manager	2.1	
NetApp	FAS 3270 controller	Data ONTAP 8.1.2	NetApp storage controller FC, FCoE, Ethernet
NetApp	DS 4243	600GB, 15k RPM	Shelves
			SAS drives

 Table 1
 Software and Hardware Used for Oracle Database 11g Release 2 Grid Infrastructure with the Oracle RAC Option Deployment

Cisco UCS Networking and NetApp NFS Storage Topology

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This section explains Cisco UCS networking and computing design considerations when deploying Oracle Database 11g Release 2 RAC in an NFS Storage Design. In this design, the NFS traffic is isolated from the regular management and application data network using the same Cisco UCS infrastructure by defining logical VLAN networks to provide better data security. Figure 14, presents a detailed view of the physical topology, and some of the main components of Cisco UCS in an NFS network design.



Figure 14 Cisco UCS Networking and NFS Storage Network Topology

Network	vPC	VLAN ID	
Public	33	760,761,191,120,121	
Private	34	760,761,191,120,121	
NetApp-Storage1	3	120,121	
NetApp-Storage2	4	120,121	

As shown in Figure 14, a pair of Cisco UCS 6248UP fabric interconnects carries both storage and network traffic from the blades with the help of Cisco Nexus 5548UP switch. The 10GB FCoE traffic leaves the UCS Fabrics through Nexus 5548 Switches to NetApp Array. As larger enterprises are adopting virtualization, they have much higher I/O requirements. To effectively handle the higher I/O requirements, FCoE boot is a better solution.

Both the fabric interconnect and the Cisco Nexus 5548UP switch are clustered with the peer link between them to provide high availability. Two virtual Port Channels (vPCs) are configured to provide public network, private network and storage access paths for the blades to northbound switches. Each vPC has VLANs created for application network data, NFS storage data, and management data paths. For more information about vPC configuration on the Cisco Nexus 5548UP Switch, see:

http://www.cisco.com/en/US/prod/collateral/switches/ps9441/ps9670/configuration_guide_c07-54356 3.html

As illustrated in Figure 14, 8 (4 per chassis) links go to Fabric Interconnect A (ports 1 through 8). Similarly, 8 links go to Fabric Interconnect B. Fabric Interconnect A links are used for Oracle Public network and NFS Storage Network traffic and Fabric Interconnect B links are used for Oracle private interconnect traffic and NFS Storage network traffic.

Note

For an Oracle RAC configuration on UCS, we recommend to keep all private interconnects local on a single Fabric interconnect. In such case, the private traffic will stay local to that fabric interconnect and will not be routed via northbound network switch. In other words, all inter blade (or Oracle RAC node private) communication will be resolved locally at the fabric interconnect and this significantly reduces latency for Oracle Cache Fusion traffic.

Cisco UCS Manager Configuration Overview

High Level Steps for Cisco UCS Configuration

Given below are high level steps involved for a Cisco UCS configuration:

- 1. Configuring Fabric Interconnects for Chassis and Blade Discovery
 - a. Configure Global Policies
 - b. Configuring Server Ports
- 2. Configuring LAN and SAN on UCS Manager
 - a. Configure and Enable Ethernet LAN uplink Ports
 - b. Configure and Enable FC SAN uplink Ports
 - c. Configure VLAN
 - d. Configure VSAN
- 3. Configuring UUID, MAC, WWWN and WWPN Pool
 - a. UUID Pool Creation
 - **b.** IP Pool and MAC Pool Creation
 - c. WWNN Pool and WWPN Pool Creation
- 4. Configuring vNIC and vHBA Template
 - a. Create vNIC templates
 - **b.** Create Public vNIC template
 - c. Create Private vNIC template
 - d. Create Storage vNIC template
 - e. Create HBA templates
- 5. Configuring Ethernet Uplink Port Channels
- 6. Create Server Boot Policy for SAN Boot

Details for each step are discussed in the following subsequent sections.

Configuring Fabric Interconnects for Blade Discovery

Cisco UCS 6248 UP Fabric Interconnects are configured for redundancy. It provides resiliency in case of failures. The first step is to establish connectivity between the blades and fabric interconnects.

Configure Global Policies

To configure global policies, follow theses steps

- 1. Log into UCS Manager.
- 2. Click the Equipment tab in the navigation pane.
- 3. Choose Equipment > Policies > Global Policies.
- 4. Under Chassis/FEX Discovery Policy field select 4-link from the Action drop-down list.

Figure 15 Configure Global Policy

Equipment Servers LAN SAN VM Admin	📲 🌐 Main Topology View 🔤 Fabric Interconnects 🥪 Servers 🧹 Thermal 🖏 Decommissioned 🚔 Firmware Management 🔰 Policies
Filter: All	Global Policies Autoconfig Policies Server Inheritance Policies Blade Server Discovery Policies SEL Policy Power Groups
	Chassis/FEX Discovery Policy Action: 4 Link Link Grouping Preference: None Port Channel
Servers	Rack Server Discovery Policy
Fabric Interconnects Fabric Interconnect A (subordinate) Fixed Module	Action: Immediate User Acknowledged Scrub Policy: <not set=""> Rack Management Connection Policy Action: Auto Acknowledged User Acknowledged Power Policy Redundancy: Non Redundant N+1 Grid</not>
	MAC Address Table Aging Aging Time: Never Mode Default other Global Power Allocation Policy Allocation Method: Manual Blade Level Cap Policy Driven Chassis Group Cap

Configuring Server Ports

To configure server ports, follow these steps:

- 1. Log into UCS Manager.
- 2. Click the Equipment tab in the navigation pane.
- 3. Choose Equipment > Fabric Interconnects > Fabric Interconnect A > Fixed Module > Ethernet Ports.

- 4. Select the desired number of ports by using the CTRL key and mouse click combination.
- 5. Right click and choose **Configure as Server Port** as show in Figure 16.

General Faults Events FSM Statistics Equipment Servers LAN SAN VM Admin Filter: Al -Fault Summary Physical Display **A** Δ \otimes V ± = 0 0 🖃 📑 Equipment Coupment Chassis Ack-Mounts Status 📕 Up 🧮 Admin Down 📕 Fail 🔜 Link Down Overall Status: 1 Up - E Fabric Interconnects Properties Babric Interconnect A (subordinate) Additional Info: Slot ID: 1 Admin State: Enabled ID: 10 Fixed Module - Ethernet Ports User Label: Action đ MAC: 54:7F:EE:56:CA:11 -C Por Mode: Trunk Enable Port Type: Physical Role: Network -0 Disable sable Port - Por Configure as Server Port Transceiver sconfigure Configure as Uplink Port -I Por Type: H10GB CU1M -I Por nconfigure Model: 74752-9519 Configure as FCoE Uplink Port Vendor: CISCO-MOLEX now Interface Configure as FCoE Storage Port -01 Serial: MOC1619037Y -0 Configure as Appliance Port Unconfigure đ License Details -L Por -L Por -L Por License State: License Ok Unconfigure Uplink Port License Grace Period: 10058400 Unconfigure FCoE Storage Port - Por Unconfigure Appliance Port -I Por Unconfigure both -I Por Сору Ctrl+C -I Por Ctrl+L Copy XML Por - Por Delete Ctrl+D Port 20 1000

Figure 16

Configuring Ethernet Ports as Server Ports

Figure 17

Configured Server Ports

Equipment Servers LAN SAN VM Admin Filter: All -• • Equipment 🗈 🥡 Chassis 😥 🐲 Rack-Mounts - Fabric Interconnects - Eabric Interconnect A (subordinate) Eixed Module - 🔳 🖥 Port 1 - Port 2 -I Port 3 -I Port 4 -I Port 5 -I Port 6 -I Port 7 -I Port 8 -I Port 9 - Port 10 -I Port 11 -I Port 12 -Port 13 -I Port 14 -I Port 15 - Port 16 - Port 17 -I Port 18 -I Port 19 -I Port 20 - Port 21 -I Port 22 -I Port 23 -I Port 24 Port 25 - Port 26

I

🔍 Filter	👄 Export	😸 Print If Role: 💟 All	Unconfigured	Vetwork [Server 🔽 FCoE Uplink 📝	Unified Uplink 📝 Appliance S
Slot	Port ID	MAC	If Role	If Type	Overall Status	Administrative State
1	1	54:7F:EE:56:CA:08	Server	Physical	🕇 Up	1 Enabled
1	2	54:7F:EE:56:CA:09	Server	Physical	🕇 Up	1 Enabled
1	3	54:7F:EE:56:CA:0A	Server	Physical	🕇 Up	1 Enabled
L .	4	54:7F:EE:56:CA:0B	Server	Physical	🕇 Up	1 Enabled
	5	54:7F:EE:56:CA:0C	Server	Physical	👽 Sfp Not Present	1 Enabled
	6	54:7F:EE:56:CA:0D	Server	Physical	💎 Sfp Not Present	1 Enabled
	7	54:7F:EE:56:CA:0E	Server	Physical	💎 Sfp Not Present	1 Enabled
	8	54:7F:EE:56:CA:0F	Server	Physical	💎 Sfp Not Present	1 Enabled
	9	54:7F:EE:56:CA:10	Network	Physical	1 Up	1 Enabled
	10	54:7F:EE:56:CA:11	Network	Physical	1 Up	1 Enabled
	11	54:7F:EE:56:CA:12	Server	Physical	1 Up	1 Enabled
	12	54:7F:EE:56:CA:13	Server	Physical	1 Up	1 Enabled
	13	54:7F:EE:56:CA:14	Server	Physical	1 Up	1 Enabled
	14	54:7F:EE:56:CA:15	Server	Physical	1 Up	1 Enabled
	15	54:7F:EE:56:CA:16	Server	Physical	V Sfp Not Present	1 Enabled
	16	54:7F:EE:56:CA:17	Server	Physical	👽 Sfp Not Present	1 Enabled
	17	54:7F:EE:56:CA:18	Server	Physical	1 Up	1 Enabled
	18	54:7F:EE:56:CA:19	Server	Physical	1 Up	1 Enabled
	19	54:7F:EE:56:CA:1A	Server	Physical	1 Up	1 Enabled
	20	54:7F:EE:56:CA:1B	Server	Physical	1 Up	1 Enabled
	21	54:7F:EE:56:CA:1C	Server	Physical	1 Up	1 Enabled
	22	54:7F:EE:56:CA:1D	Server	Physical	1 Up	1 Enabled
	23	54:7F:EE:56:CA:1E	Server	Physical	1 Up	1 Enabled
	24	54:7F:EE:56:CA:1F	Server	Physical	1 Up	1 Enabled
	25	54:7F:EE:56:CA:20	Server	Physical	1 Up	1 Enabled
	26	54:7F:EE:56:CA:21	Server	Physical	1 Up	1 Enabled
	27	54:7F:EE:56:CA:22	Server	Physical	1 Up	1 Enabled
	28	54:7F:EE:56:CA:23	Server	Physical	1 Up	1 Enabled
	29	54:7F:EE:56:CA:24	Fcoe Uplink	Physical	1 Up	1 Enabled
1	30	54:7F:EE:56:CA:25	Fcoe Uplink	Physical	1 Up	1 Enabled
	21	FAJE-FE-FE-CA-OC	Alabarad.	Obvisional	A 11-	A Factorial

Configuring LAN and SAN on UCS Manager

Perform LAN and SAN configuration steps in UCS Manager as shown in the figures below.

Configure and Enable Ethernet LAN Uplink Ports

To configure and enable Ethernet LAN uplink ports, follow these steps:

- 1. Log into UCS Manager.
- 2. Click the Equipment tab in the navigation pane.

Ethernet Ports

- 3. Choose Equipment > Fabric Interconnects > Fabric Interconnect A > Fixed Module > Ethernet Ports.
- 4. Select the desired number of ports by using the CTRL key and click the combination.
- 5. Right-click and choose Configure as Uplink Port as shown in Figure 18.

Configure Ethernet LAN Uplink Ports

ipment Servers LAN SAN VM Admin	Eila		Print If Pole: 7 Al		d 🔽 Network	Server CECoE Liplink	Lipified Liplick 🔽 Appliance
Filter: All 🗸	Clas	Devit ID	MAC	TED ala	TE Turne	Ouerall Status	Administrative Chate
- 1	SIOC	Port ID	MAC	IF Role	Ir type	Overall Status	Administrative State
	1	1	54:7F:EE:56:CA:08	Server	Physical	1 Up	1 Enabled
Equipment	1	2	54:7F:EE:56:CA:09	Server	Physical	1 Up	1 Enabled
Chassis Back-Mounts	1	3	54:7F:EE:56:CA:0A	Server	Physical	1 Up	1 Enabled
Sector Pounts	1	4	54:7F:EE:56:CA:0B	Server	Physical	1 Up	1 Enabled
Eabric Interconnects A (subordinate)	1	5	54:7F:EE:56:CA:0C	Server	Physical	V Sfp Not Present	1 Enabled
Exercision Fixed Module	1	6	54:7F:EE:56:CA:0D	Server	Physical	💙 Sfp Not Present	1 Enabled
Ethernet Ports	1	7	54:7F:EE:56:CA:0E	Server	Physical	💙 Sfp Not Present	1 Enabled
Port 1	1	8	54:7F:EE:56:CA:0F	Server	Physical	💎 Sfp Not Present	1 Enabled
	1	9	54:7F:EE:56:CA:10	Network	Physical	🕇 Up	1 Enabled
	1	10	54:7F:EE:56:CA:11	Network	Physical	1 Up	1 Enabled
	1	11	54:7F:EE:56:CA:12	Server	Physical	1 Up	1 Enabled
	1	12	54:7F:EE:56:CA:13	Server	Physical	🕇 Up	1 Enabled
Port 6	1	13	54:7F:EE:56:CA:14	Server	Physical	1 Up	1 Enabled
Port 7	1	14	54:7F:EE:56:CA:15	Server	Physical	1 Up	1 Enabled
Port 8	1	15	54:7F:EE:56:CA:16	Server	Physical	V Sfp Not Present	1 Enabled
Port 10	1	16	54:7F:EE:56:CA:17	Server	Physical	V Sfp Not Present	1 Enabled
Port 11	1	17	54:7F:EE:56:CA:18	Server	Physical	1 Up	1 Enabled
	1	18	54:7F:EE:56:CA:19	Server	Physical	1 Up	1 Enabled
	1	19	54:7F:EE:56:CA:1A	Server	Physical	1 Up	1 Enabled
	1	20	54:7E:EE:56:CA:18	Server	Physical	1 Un	Enabled
	1	21	54:7E:EE:56:CA:1C	Server	Physical	1 Up	Enabled
	1	22	54:7E:EE:56:CA:1D	Server	Physical	1 Up	Enabled
	1	22	54:7E:EE:56:CA:1E	Conver	Physical	* Up	Enabled
Port 18	1	24	54:7E:EE:56:CA:1E	Server	Physical	* Up	Enabled
Port 19	<u> </u>	27	54.75.55.56.6A.00	Carryan	Dhusical	• Op	
Port 20	1	20	54:7F:EE:56:CA:20	Server	Physical	∎ up	
Port 21	1	20	54:7F:EE:56:CA:21	Server	Physical	T Up	T Enabled
Port 22	1	27	54:/F:EE:56:CA:22	Server	Physical	T Up	T Enabled
Port 24	1	28	54:7F:EE:56:CA:23	Server	Physical	1 Up	1 Enabled
	1	29	54:7F:EE:56:CA:24	Fcoe Uplink	Physical	1 Up	1 Enabled
	1	30	54:7F:EE:56:CA:25	Fcoe Uplink	Physical	1 Up	1 Enabled
	1	31	54:7F:EE:56:CA:26	Network	Physical	1 Up	Tenabled
	1	32	54:7F:EE:56:CA:27	Network	Physical	🕇 Up	1 Enabled

As shown Figure 18, we have selected Port 31 and 32 on Fabric interconnect A and configured them as Ethernet uplink ports. Repeat the same step on Fabric interconnect B to configure Port 31 and 32 as Ethernet uplink ports. We have selected port 29 and Port 30 on both the fabrics and configured them as FCoE Uplink ports for FCoE boot.



You will use these ports to create port channels in later sections.

Important Oracle RAC Best Practices and Recommendations for vLANs and vNIC Configuration

• For Direct NFS clients running on Linux, best practices recommend always to use multipaths in separate subnets. If multiple paths are configured in the same subnet, the operating system invariably picks the first available path from the routing table. All the traffic flows through this path and the load balancing and scaling do not work as expected. Please refer to Oracle metalink note 822481.1 for more details.

For this configuration, we have created VLAN 120 and VLAN 121 for storage access, and VSAN 101 and VSAN 102 for FCoE boot.

Oracle Grid Infrastructure can activate a maximum of four private network adapters for availability
and bandwidth requirements. If you want to configure HAIP for Grid Infrastructure, you will need
to create additional vNICs. We strongly recommend using a separate VLAN for each private vNIC.
For Cisco UCS, a single UCS 10GE private vNIC configured with failover does not require HAIP
configuration from bandwidth and availability perspective. As a general best practice, it is a good
idea to localize all the private interconnect traffic to single fabric interconnect. For more information
on Oracle HAIP, please refer to Oracle metalink note 1210883.1.

Note

After selection of VLAN and vNICs, you can configure vLANs for this setup.

Configure VLAN

To configure VLAN, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Click the LAN tab in the navigation pane.
- 3. Choose LAN > LAN Cloud > VLAN.
- 4. Right click and choose Create VLANs.

In this solution, we need to create five VLANs:

- One for private (VLAN 191)
- One for public network (VLAN 760)
- Two for storage traffic (VLAN 120 and 121)
- One for live migration (VLAN 761).

Note

These five VLANs will be used in the vNIC templates.

	Figure 19	Create VLAN for Publ	lic Network	
Create VLANs	14	-		X
Create VLANs				Ø
VLAN Name/Prefix: Publ	ic			
Multicast Policy Name: https://www.science.com	set> 💌 🗄 Cre	ate Multicast Policy		
⊖ Corr	mon/Global 💿 Fabric A	Fabric B 🔵 Both Fabrics Configured	Differently	
Warning: Configuring a VLAN configuring single-fabric VLAN	on a single fabric may resu Ns.	lt in vNIC failover issues between fabric	s. Use caution when	
You are creating local VLANs	in fabric A that map to VLAM	IDs that exists only in fabric A.		
Enter the range of VLAN ID	s.(e.g. "2009-2019", "29,35	5,40-45", "23", "23,34-45")	•	
VLAN IDs: 760				
Sharing Type: None	Primary 🔘 Isolated			
			Check Overlap	OK Cancel

In Figure 19, we have highlighted VLAN 760 creation for public network. It is also very important that you create both VLANs as global across both fabric interconnects. This way, VLAN identity is maintained across the fabric interconnects in case of NIC failover.

Create VLANs for public, storage and live migration. In case you are using Oracle HAIP feature, you may have to configure additional vlans to be associated with additional vnics as well.

Here is the summary of VLANs once you complete VLAN creation.

- VLAN ID 760 for public interfaces.
- VLAN ID 191 for Oracle RAC private interconnect interfaces.
- VLAN ID 120 and VLAN 121 for storage access.
- VLAN ID 761 for live migration.



Even though private VLAN traffic stays local within UCS domain during normal operating conditions, it is necessary to configure entries for these private VLANs in northbound network switch. This will allow the switch to route interconnect traffic appropriately in case of partial link failures. These scenarios and traffic routing are discussed in details in later sections.

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Figure 20 summarizes all the VLANs for Public and Private network and Storage access.

VLAN Sharing

None

None

None

None

None

-

Transport

Ether

Ether

Native

No

No

No

No

No

Figure 20



VLAN Summary

Configure VSAN

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To configure VSAN, follow these steps:

- 1. Log into Cisco UCS Manager
- 2. Click the SAN tab in the navigation pane.
- 3. Choose SAN > SAN Cloud > VSANs.
- 4. Right-click and choose Create VSAN. See Figure 21.



In this study we created VSAN 25 for SAN Boot.

Figure 21

Configuring VSAN in UCS Manager

Equipment Servers LA	N SAN VM Admin					
Filter: All	-					
•						
E-== SAN						
🖻 🟉 SAN Cloud						
🛨 💷 Fabric A						
🛨 💷 Fabric B						
SAN Pin Gr	oups					
🕀 🗐 Threshold	Policies					
🗄 🚍 VSANs						
🖻 🟉 Storage C	Show Navigator					
🕂 🏧 Fabric	Create VSAN					
🕀 🏧 Fabric	Crocke (SAI)					
🖻 🚿 Policies						
E SAN Cloud						
Threshold Policies						

Figure	9 <i>22</i>	Creating VSAN for	r Fabric A	
Create VSAN			-	23
Create VSAN				0
Name: FlexPod-OVM-VSAN-A	_			
FC Zoning: FC Zoning: FC Zo	d if the fabric inter bled on the same fabric B O Both	connect is connected to an a VSAN. I Fabrics Configured Different	ły	
You are creating a local VSAN in fabric a VSAN ID that exists only in fabric A.	A that maps to	A VLAN can be used to this VSAN.	to carry FCoE traffic and ca	an be mapped
Enter the VSAN ID that maps to this V VSAN ID:	SAN.	Enter the VLAN ID th	nat maps to this VSAN.	
			OK	Cancel

We have created a VSAN on both the Fabrics. For the VSAN on Fabric A the VSAN ID is 101 and FCoE VLAN ID is 101 and similarly, for Fabric B the VSAN ID is 102 and the FCoE VLAN ID is 102.

٩, Note

It is mandatory to specify VLAN ID even if FCoE traffic for SAN Storage is not used.

Figure 23 shows the created VSANs in UCS Manager.

Figure 23

VSAN Summary

Equipment Servers LAN SAN VM Admin		VSANs							
Filter: All		Name	ID	Eabric ID	If Type	If Role	Transport	ECOE VLAN ID	Operational State
± =		B-== VSANs			//-	2.000			
B-= SAN Grant Cloud Grant Pabric A Grant Pabric B		Fabric A SANs							
		VSAN FlexPod-OVM-VSAN-A (101)	101	A	Virtual	Network	Fc	101	Ok
SAN Pin Groups Jone Share S			102		Usebaard	Mahurada	5-	102	ch.
Coud			102	в	VIRCUAI	Network	PC .	102	UK
Hamiltonia A Hamiltonia B									
⊕ = ♥ VSANs ⊖- ∰ Policies									
SAN Cloud									

Configure Pools

After VLANs and VSAN are created, configure pools for UUID, MAC Addresses, Management IP and WWN.

UUID Pool Creation

To create UUID pools, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Click the Servers tab in the navigation pane.
- 3. Choose Servers > Pools > UUID Suffix Pools.

Create UUID Pools

4. Right-click and choose Create UUID Suffix Pool, to create a new pool. See Figure 24.

Equipment Servers LAN SAN VM Admin					
Filter: Pools					
• •					
⊡ - ∲ Pools ⊨ - ∳ root ⊕ - ⇔ Server Pools					
i∰ <mark>i∰ UUID Suffix Pool</mark> i∰ <mark>i</mark> ță, Sub-Organiz.	UUID Suffix Pools				
	Create UUID Suffix Pool				

Figure 24

As shown in Figure 25, we have created Flexpod-OVM-UUID.

- Figure 25
- UUID Pool Summary

Servers Law Star Law Law	-001	ID Suffix Pools							
pment Bervers LAN SAN VM Admin	VM Admin	🖃 🔍 Filter 🖨 Export 😸 Print	🔍 Filter 🔿 Export 😸 Print						
Filer, Foots	Nar	ne	Pool Name	UUID Prefix	From	То			
		Pool FlexPod-OVM-UUID	FlexPod-OVM-UUID	82AAF622-1C28-11E2					
Pools		[0000-00000000001 - 0000-00000000020]			0000-000000000001	0000-0000000002			
⊡- <mark>À</mark> root	÷	Pool FlexPod_JDE	FlexPod_JDE	82AAF622-1C28-11E2					
E Server Pools		Pool FlexPod_Oracle	FlexPod_Oracle	82AAF622-1C28-11E2					
E-att UUID Suffix Pools	÷	Pool LR_UUID	LR_UUID	82AAF622-1C28-11E2					
A Mai Pool FlexPod IDE	.	Pool OVMU_UID	OVMU_UID	82AAF622-1C28-11E2					
Pool FlexPod_Soc		Pool default	default	82AAF622-1C28-11E2					
Bool LR_UUID									
Pool OVMU_UID									
Pool default									
🗄 🦾 Sub-Organizations									

IP Pool and MAC Pool Creation

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To create IP and MAC pools, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Click the LAN tab in the navigation pane.
- 3. Choose LAN > Pools > IP Pools
- 4. Right-click and choose Create IP Pool Ext-mgmt.

Figure 26 shows the creation of ext-mgmt IP pool.

Figure 26	Create IP Pool		
Equipment Servers LAN SAN VM Admin	IP Pools-		
a el	Name	Size	Assigned
	IP Pool EBS_Windows	2	2
	😑 🛄 IP Pool ext-mgmt	15	15
	[10.65.121.131 - 10.65.121.135]		
	[10.65.121.141 - 10.65.121.145]		
	[10.65.121.146 - 10.65.121.150]		
- A Poils	IP Pool ip-pool	5	4
e tool	IP Pool iscsi-initiator-pool	0	0
IP Pool EBS_Windows IP Pool EBS_Windows I0.65.121.131 - 10.65.121.135 I0.65.121.141 - 10.65.121.145 I0.65.121.146 - 10.65.121.150			

To create MAC pools, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Click the LAN tab in the navigation pane.
- 3. Choose LAN > Pools > MAC Pools
- 4. Right-click and choose Create MAC Pools.

Figure 27 shows the creation of all the vNIC MAC pool addresses for Flexpod-OVM-A and Flexpod-OVM-B.



quipment Servers LAN SAN VM Admin	MAC Pools					
Filter: All	Name	Size	Assigned			
t =	MAC POOL FlexPod-OVM-A	32	14			
∃	[00:25:85:07:0A:00 - 00:25:85:07:0A	s:1F]				
LAN Cloud	MAC POOL FlexPod-OVM-B	32	14			
Appliances	[00:25:85:07:08:00 - 00:25:85:07:08	:1F]				
Internal LAN Seliciec	MAC POOL FlexPod_MAC_FIA	24	21			
Policies	MAC POOL FlexPod_MAC_FIB	24	21			
e tool	HAC POOL FlexPod_Oracle_MAC	70	46			
IP Pools	MAC POOL FlexPod_Oracle_MAC1	20	19			
ALC Pools	HAC POOL JDE_MAC_FIA	24	6			
MAC POOL FlexPod-OVM-A	HAC POOL JDE_MAC_FIB	24	3			
[00:25:85:07:0A:00 - 00:25:85:07:0A:1F]	MAC POOL MAC-JDE-FIA	24	22			
MAC POOL FlexPod-OVM-B	HIM MAC POOL MAC-JDE-FIB	24	19			
[UU:25:85:07:08:00 - 00:25:85:07:08:1F]	MAC POOL default	0	0			

Note

The IP pools will be used for console management, while MAC addresses will be used for the vNICs.

WWNN Pool and WWPN Pool Creation

To create WWNN and WWPN pools, follow these steps:

- 1. Log into UCS Manager
- 2. Click the SAN tab in the navigation pane.
- 3. Choose SAN > Pools > WWNN Pools.
- 4. Right-click and choose Create WWNN Pools.
- 5. Choose SAN > Pools > WWPN Pools.
6. Right-click and choose Create WWPN Pools.



The WWNN and WWPN entries will be used for Boot from SAN configuration.

Figure 28 shows the creation of Flexpod-OVM WWNN, and Flexpod-OVM-A WWPN and Flexpod-OVM-B WWPN.

Figure 28 Create WWNN and WWPN Pool

Equipment Servers LAN SAN VM Admin
Filter: All
• -
🖃 🚍 SAN
🖶 🙆 SAN Cloud
🕀 🙆 Storage Cloud
🕀 🖳 💆 Policies
E ··· 😨 Pools
IQN Pools
WWINI Pools
100 120 00 00 25 85 01 00 00 - 20 00 00 25 85 01 00 1E
WWIN Pool ElexPod DE
WWNN Pool FlexPod Oracle WWNN
WOWNER Pool pode-default
🖶 🍈 WWPN Pools
🚊 💮 WWPN Pool FlexPod-OVM-WWPN-A
[20:00:00:25:85:01:0A:00 - 20:00:00:25:85:01:0A:1F]
🖨 🌚 WWPN Pool FlexPod-OVM-WWPN-B
[20:00:00:25:85:01:08:00 - 20:00:00:25:85:01:08:1F]



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This completes pool creation for this setup. Next, you need to create vNIC and vHBA templates.

Set Jumbo Frames in Both the Cisco UCS Fabrics

To configure jumbo frames and enable quality of service in the Cisco UCS Fabric, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Click the LAN tab in the navigation pane.
- 3. Choose LAN > LAN Cloud > QoS System Class.
- 4. In the right pane, click the General tab.
- 5. On the Best Effort row, enter 9216 in the box under the MTU column.
- 6. Click Save Changes.
- 7. Click OK.

-	_							
Equipment Servers LAN SAN VM Admin	General Events F	-SM						
Filter: All 🗸	Priority	Enabled	CoS	Packet Drop	Weight	Weight (%)	мти	Multicast Optimized
• -	Platinum		5		10	• 27	normal 🔻	
B- IAN	Gold	Ĭ.	4	V	8	• 22	normal	
LAN Cloud Fabric A	Silver	Č.	2	V	6	• 16	normal	
* Fabric B	Bronze	Č.	1	✓	2	▼ 5	normal	
QoS System Class	Best Effort	<u>_</u>	Any		5	• 13	9216 💌	
	Fibre Channel		3		5	• 17	fc 🔹	N/A
VLAN Groups								

1

Figure 29

Setting Jumbo Frame

Configure vNIC and vHBA Templates

Create vNIC Templates

To create vNIC templates, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Choose the LAN tab in the navigation pane.
- 3. Choose LAN > Policies > vNIC Templates.
- 4. Right-click and choose Create vNIC Template. See Figure 30.

Figure 30

Create vNIC Template

Filter: Policies Policies Policies	Equipment Servers LAN SAN	VM Admin
Policies Appliances Appliances C Appliances C Appliances Default vNIC Behavior Default vNIC Behavior Dynamic vNIC Connection Policies Dynamic vNIC Connection Policies Dynamic vNIC Connectivity Policies Dynam	Filter: Pol	icies 💌
Policies Appliances LAN Cloud Content of the state of	• •	
Appliances LAN Cloud Appliances Lan Cloud Appliances Toot Soft and the policies	E-S Policies	
LAN Cloud Solution Lan Cloud Solution Threshold Policies Solution	🔄 🦲 Appliances	
Threshold Policies Toot Solution Solutio	E LAN Cloud	
root Default vNIC Behavior S Default vNIC Connection Policies S Flow Control Policies S LAN Connectivity Policies Multicast Policies S Multicast Policies S QoS Policies S Threshold Policies	😥 🗐 Threshold Policies	
Default vNIC Behavior Dynamic vNIC Connection Policies Solution So	🚊 🧔 root	
Dynamic vNIC Connection Policies Second Stress	🗐 Default vNIC Behavi	ior
Flow Control Policies LAN Connectivity Policies Sulticast Policies	- S Dynamic vNIC Conn	ection Policies
LAN Connectivity Policies Multicast Policies Solution Solution Solution Solution Solution Solution Solution Solution Solution	Flow Control Policies	
Multicast Policies Solution Moltiverk Control Policies Solution Solution Solution Solution Solution	S LAN Connectivity Po	licies
S Network Control Policies S OoS Policies S Threshold Policies S Threshold Policies	🐑 🖉 Multicast Policies	
OoS Policies Solution Threshold Policies Solution	😟 🖳 🖉 Network Control Poli	icies
	😟 🗐 🖉 QoS Policies	
B VNIC Templa	Interstold Policies	
Show Navigator		how Navigator
	🕀 🧛 Sub-Organiz	in our rearing accord
Create vNIC Template	0	Create vNIC Template

Figure 31 and Figure 32 show vNIC templates for Fabric A and Fabric B.

		lata				0
reate vivic	remp	late				U
		claupad units a		_		-
	Name:	FIEXPOO-VNIC-A				
Ľ	Description:					
	Fabric ID:	🧿 Fabric A 🕥 Fab	ric B 📃 E	inable Failover		
		Target				
		🔽 Adapter				
		VM				
Warning	port profile ł	w the came name will	he created			
u vini is selecceu, a j	porc prome i	by the same name will	De createu	b Sanada aka di Akaa Mila araa a	euwithon.	
If a port profile of th	ne same nam	e exists, and updating	j template i	is selected, it will be over	rwnccen	
If a port profile of th	ne same nam	e exists, and updating	i template i	is selected, it will be over	rwhitten	
If a port profile of th Temj	ne same nam plate Type:	e exists, and updating) template i	ng Template	rwnicen	
If a port profile of th Temj VLANs	ne same nam plate Type: (e exists, and updating O Initial Template	• Updatir	is selected, it will be over	rwntten	E
If a port profile of th Tem VLANs Select	plate Type: (e exists, and updating O Initial Template	 Updatir 	ng Template Native VLAN	TWILLEH	Ξ
If a port profile of th Temp VLANs Select	ne same nam plate Type: (e exists, and updating Initial Template	 Updatir 	ng Template Native VLAN		E
If a port profile of th Tem VLANS Select	plate Type:	e exists, and updating Initial Template D Name default LiveMigration	 Updatir 	ng Template Native VLAN		E
If a port profile of th Tem VLANS Select	ne same nam plate Type: (e exists, and updating Initial Template Name default LiveMigration NetApp-Storage1	 Updatir 	ng Template Native VLAN O		E
If a port profile of th Tem VLANS Select	ne same nam	e exists, and updating Initial Template D Name default LiveMigration NetApp-Storage1 NetApp-Storage2	 Updatir 	ng Template		Ξ
If a port profile of th Temp VLANS Select	plate Type:	e exists, and updating Initial Template Dame default LiveMigration NetApp-Storage1 NetApp-Storage2	 Updatir 	Native VLAN		E
If a port profile of th Tem VLANS Select 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	plate Type:	e exists, and updating Initial Template default LiveMigration NetApp-Storage1 NetApp-Storage2	 Updatir 	ng Template		E
If a port profile of th Tem VLANS Select	plate Type: (e exists, and updating Initial Template default LiveMigration NetApp-Storage1 NetApp-Storage2	 Updatir 	ng Template		E
If a port profile of th Tem VLANS Select V Create VLAN	plate Type: MTU: MAC Pool:	e exists, and updating Initial Template default LiveMigration NetApp-Storage1 NetApp-Storage2 9000 FlexPod-OVM-A	Updatir	ng Template		E
If a port profile of th Tem VLANS Select V Create VLAN	MTU: MAC Pool: QoS Policy:	e exists, and updating Initial Template default LiveMigration NetApp-Storage1 NetApp-Storage2 9000 FlexPod-OVM-A <not set=""></not>	Updatir	ng Template		E
If a port profile of th Tem VLANS Select V Create VLAN	MTU: MAC Pool: QoS Policy: ntrol Policy:	e exists, and updating Initial Template Dame default LiveMigration NetApp-Storage1 NetApp-Storage2 9000 FlexPod-OVM-A <not set=""> FlexPod-OVM-CDP</not>	Updati Updati	ng Template		-
If a port profile of th Tem VLANS Select V Create VLAN	MTU: MAC Pool: QoS Policy: ntrol Policy: Pin Group:	e exists, and updating Initial Template Dame default LiveMigration NetApp-Storage1 NetApp-Storage2 9000 FlexPod-OVM-A <not set=""> FlexPod-OVM-CDP Cnot set></not>	Updatir Updatir	ng Template		-
If a port profile of th Tem VLANS Select V Create VLAN Ocreate VLAN Network Cor Stats Thres	MTU: MAC Pool: QoS Policy: ntrol Policy: Pin Group: hold Policy:	e exists, and updating Initial Template D Initial Template default LiveMigration NetApp-Storage1 NetApp-Storage2 9000 FlexPod-OVM-A <not set=""> FlexPod-OVM-CDP D <not set=""> default</not></not>	Updati Updati	ng Template		E

Figure 31 vNIC Template for Fabric A

Γ

Create vNIC Template				Σ
reate vNIC Te	emplate			(
Α	Vame: FlexPod-vNIC-B	_		
Descri	ption:			
Fabr	ric ID: C Fabric A G Fabric B	Enable Failover		
	Target			
	Adapter			
Warning				
Warning If VM is selected, a port p	rofile by the same name will be cr	reated.		
Warning If VM is selected, a port p If a port profile of the sam	rofile by the same name will be cr ne name exists, and updating tem	reated. plate is selected, it will be over	written	
Warning If VM is selected, a port p If a port profile of the sam	profile by the same name will be cr ne name exists, and updating tem	reated. plate is selected, it will be over	rwritten	
Warning If VM is selected, a port p If a port profile of the sam Template	rofile by the same name will be cr ne name exists, and updating tem Type: Initial Template U	reated. plate is selected, it will be over Ipdating Template	rwritten	
Warning If VM is selected, a port p If a port profile of the sam Template VLANs	rofile by the same name will be cr e name exists, and updating tem Type: Initial Template O U	reated. plate is selected, it will be over Ipdating Template	written	
Warning If YM is selected, a port p If a port profile of the sam Template YLANs Select	rofile by the same name will be cr e name exists, and updating tem Type: Initial Template O U Name	reated. plate is selected, it will be over ipdating Template Native VLAN	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANs Select	rofile by the same name will be cr ne name exists, and updating tem Type: I Initial Template I U Name default	reated. plate is selected, it will be over ipdating Template Native VLAN	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select	Type: Initial Template I U Name default LiveMigration	reated. plate is selected, it will be over pdating Template Native VLAN	written	
Warning If VM is selected, a port pr If a port profile of the sam Template VLANS Select C	Type: Initial Template U Name default LiveMigration NetApp-Storage1	reated. plate is selected, it will be over pdating Template Native VLAN O	written	
Warning If VM is selected, a port pr If a port profile of the sam Template VLANS Select C C C C C C	Type: Initial Template U Name default LiveMigration NetApp-Storage1 NetApp-Storage2	reated. plate is selected, it will be over pdating Template Native VLAN O O	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Conste VLON	Type: Initial Template U Name default LiveMigration NetApp-Storage2	reated. plate is selected, it will be over pdating Template Native VLAN	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Create VLAN Create VLAN	Type: Initial Template I U Name default LiveMigration NetApp-Storage1	reated. plate is selected, it will be over pdating Template Native VLAN O O O	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Create VLAN Create VLAN	rofile by the same name will be or re name exists, and updating tem Type: Initial Template I U Name default LiveMigration NetApp-Storage1 NetApp-Storage2	reated. plate is selected, it will be over pdating Template Native VLAN O O O	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Create VLAN Create VLAN MAC	rofile by the same name will be cr re name exists, and updating tem Type: Initial Template I U Name default LiveMigration NetApp-Storage1 NetApp-Storage2 MTU: 9000 Pool: FlexPod-OVM-B	reated. plate is selected, it will be over pdating Template Native VLAN	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Create VLAN MAC QoS F	Type: Initial Template U Name default LiveMigration NetApp-Storage1 NetApp-Storage2 MTU: 9000 Pool: FlexPod-OVM-B V Policy: Knot set>	reated. plate is selected, it will be over ipdating Template Native VLAN	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Create VLAN MAC QoS F Network Control F	rofile by the same name will be cr re name exists, and updating tem Type: Initial Template • U Name default LiveMigration NetApp-Storage1 NetApp-Storage2 MTU: 9000 Pool: FlexPod-OVM-B • Policy: Knot set> • Policy: FlexPod-OVM-CDP •	reated. plate is selected, it will be over ipdating Template Native VLAN	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Create VLAN MAC QoS F Network Control F Pin G	rofile by the same name will be or re name exists, and updating tem Type: Initial Template • U Name default LiveMigration NetApp-Storage1 NetApp-Storage2 MTU: 9000 Pool: FlexPod-OVM-B • Policy: Knot set> •	reated. plate is selected, it will be over pdating Template	written	
Warning If VM is selected, a port p If a port profile of the sam Template VLANS Select Select Create VLAN MAC QoS F Network Control F Pin G Stats Threehold F	rofile by the same name will be or ne name exists, and updating tem Type: Initial Template I U Name default LiveMigration NetApp-Storage1 NetApp-Storage2 MTU: 9000 Pool: FlexPod-OVM-B Pool: FlexPod-OVM-B Pool: FlexPod-OVM-CDP Pool: FlexPod-OVM-CDP Pool: FlexPod-OVM-CDP	reated. plate is selected, it will be over pdating Template	written	

Figure 33 shows the vNIC template summary.

Figure 33

vNIC Template Summary

Equipment Servers LAN SAN VM Admin	vNIC Templates					
Filter: Policies	the state of the s					
These Points	Name	VLAN	Native VLAN			
* =						
- S Policies		Public		۲		
Appliances	VNIC Template FlexPod-vNIC-B					
E-O LAN Cloud		Private		۲		
Inreshold Policies	- WIC Template testvnic					
S Default vNIC Behavior	Network Public	Public		۲		
E-S Flow Control Policies						
S LAN Connectivity Policies						
Multicast Policies Multicast Policies						
. Sons Policies						
Threshold Policies						
WIC Templates						
VIIC Template FlexPod-vNIC-A						
VNIC Template FlexPod-vNIC-B						
VNIC Template testvnic						

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Create vHBA templates

To create vHBA templates, follow these steps:

1. Log into Cisco UCS Manager.

- 2. Click the SAN tab in the navigation pane.
- **3**. Choose SAN > Policies > vHBA Templates.
- 4. Right-click and choose Create vHBA Template. See Figure 34.

Figure 34	Create vHBA	Templates



Figure 35 vHBA Template for Fabric A

🛕 Create vHBA Templat	e	×
Create vHBA	Template	0
Name:	FlexPod-vHBA-A	
Description:		
Fabric ID:	• A B	
Select VSAN:	FlexPod-OVM-VSA Create VSAN	
Template Type:	 Initial Template Output Updating Template 	
Max Data Field Size:	2048	
WWPN Pool:	FlexPod-OVM-WWP	
QoS Policy:		
Pin Group:	FlexPod-OVM-WWPN-A	
Stats Threshold Policy:	FlexPod_Oracle_WWPN =	
	FlexPod_wwpn_A	
	FlexPod_wwpn_B	
	ovm_wwpn_A +	
		Canal
	OK	Cancel

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	Figure 36	vHBA Template f	or Fabric B	
🛕 Create vHBA Templat	e			×
Create vHBA	Template			0
Name:	FlexPod-vHBA-B			
Description:				
Fabric ID:	○ A			
Select VSAN:	FlexPod-OVM-VSA		🗄 Create VSAN	
Template Type:	 Initial Template Oupdating Template 	ate		
Max Data Field Size:	2048			
WWPN Pool:	FlexPod-OVM-WWP			
QoS Policy:				
Pin Group:	FlexPod-OVM-WWPN-B			
Stats Threshold Policy:	FlexPod_Oracle_WWPN =			
	FlexPod_wwpn_B			
	default			
	ovm_wwpn_A			
			ОК	Cancel
•				

Figure 35 and Figure 36 show two vHBA templates created, HBA Template Flexpod-vHBA-A, and HBA Template Flexpod-vHBA-B.

Next, we will configure Ethernet uplink port channels.

Configure Ethernet Uplink Port Channels

To configure Ethernet uplink port channels, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Choose the LAN tab in the navigation pane.
- **3**. Choose LAN > LAN Cloud > Fabric A > Port Channels.
- 4. Right-click and choose Create Port-Channel.
- 5. Select the desired Ethernet Uplink ports configured earlier for Channel A.
- 6. Choose LAN > LAN Cloud > Fabric B> Port Channels.
- 7. Right-click and choose Create Port-Channel.
- 8. Select the desired Ethernet Uplink ports configured earlier for Channel B.

۵, Note

In the current setup, we have used ports 31 and 32 on Fabric A and configured as port channel 33. Similarly, ports 31 and 32 on Fabric B are configured to create port channel 34.

Figure 37 and Figure 38 show the configuration of port channels for Fabric A and Fabric B.

Figure 37 Configuring Port Channels



Figure 38 Fabric A Ethernet Port-Channel Details



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Figure 39 shows the configured port-channels on Fabric A and Fabric B.

LAN Uplinks VLANs Server Links MAC Identity Assignment IP Identity Assignment QoS Global Policies Faults Events FS Equipment Servers LAN SAN VM Admin Port Channels and Uplinks Filter: All • 🛨 🖃 💐 Filter 👄 Export 😸 Print • = ₽ Fabric ID Administrative State Name C LAN Cloud - + Port Channels ė. E Estric A E Fabric A - + Port Channels Port-Channel 33 (vPC-33-N5548) 1 Enabled Α Port-Channel 33 (vPC-33-N5548) -I Eth Interface 1/31 t Enabled -I Eth Interface 1/31 -Eth Interface 1/32 t Enabled -Eth Interface 1/32 Fabric B Uplink Eth Interfaces IVLAN Optimization Sets VLANs 🕆 En - Fabric B Eth Interface 1/31 в 1 Enabled • Port Channels -Eth Interface 1/32 в 1 Enabled Port-Channel 34 (vPC-34-N5548) - Eth Interface 1/31 -Eth Interface 1/32 - Uplink Eth Interfaces VLAN Optimization Sets VLANs

Port-Channels on Fabric A and Fabric B

Once the above preparation steps are complete we are ready to create a service template from which the service profiles can be easily derived.

Create Local Disk Configuration Policy (Optional)

Figure 39

A local disk configuration for the Cisco UCS environment is necessary if the servers in the environment do not have a local disk.

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This policy should not be used on servers that contain local disks.

To create a local disk configuration policy, follow these steps:

- 1. Log into Cisco UCS Manager,
- 2. Click the Servers tab in the navigation pane.
- **3**. Choose **Policies** > **root**.
- 4. Right-click Local Disk Config Policies.
- 5. Choose Create Local Disk Configuration Policy.
- 6. Enter SAN-Boot as the local disk configuration policy name.
- 7. Change the mode to No Local Storage.
- 8. Click **OK** to create the local disk configuration policy. See Figure 40.

Figure 40	Creating Local Disk Configuration Policy	
🛕 Create Lo	ocal Disk Configuration Policy	23
Create	Local Disk Configuration Policy	0
Name: Description:	FlexPod-OVM-Boot	
Mode:	No Local Storage	
		OK Cancel

Create FCoE Boot Policies

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This procedure applies to a Cisco UCS environment in which the storage FCoE ports are configured in the following ways:

- The FCoE ports 5a on storage controllers 1 and 2 are connected to the Cisco Nexus 5548 switch A.
- The FCoE ports 5b on storage controllers 1 and 2 are connected to the Cisco Nexus 5548 switch B.

Two boot policies are configured in this procedure:

- The first configures the primary target to be FCoE port 5a on storage controller 1.
- The second configures the primary target to be FCoE port 5b on storage controller 1.

To create boot policies for the Cisco UCS environment, follow these steps:

- 1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
- 2. Choose **Policies** > **root**.
- 3. Right-click on Boot Policies. and choose Create Boot Policy.
- 4. Enter Boot-FCoE-OVM-A as the name of the boot policy.
- 5. Enter a description for the boot policy. This field is optional.
- 6. Uncheck the Keep the Reboot on Boot Order Change check box.
- 7. Expand the Local Devices drop-down menu and choose Add CD-ROM.
- 8. Expand the vHBAs drop-down menu and choose Add SAN Boot.
- 9. In the Add SAN Boot dialog box, enter Fabric-A in the vHBA field.

Figure 41

- 10. Select the **Primary** radio button as the SAN boot type.
- 11. Click **OK** to add the SAN boot initiator. See Figure 41.

🚔 Add SAN Boot	×
Add SAN Boot	0
VHBA: Fabric-A	
Type: 🗭 Primary 🔿 Secondary	
	OK Cancel

Adding SAN Boot Initiator for Fabric A

- 12. From the vHBA drop-down menu, choose Add SAN Boot Target.
- **13**. Keep 0 as the value for **Boot Target LUN**.
- 14. Enter the WWPN for FCoE port 5a on storage controller 1.

۵. Note

To obtain this information, log in to storage controller 1 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

- 15. Select the **Primary** radio button as the SAN boot target type.
- **16.** Click **OK** to add the SAN boot target. See Figure 42.

Figure 42	Adding SAN Boot Target for Fabric A	
📥 Add SAN	Boot Target	×
Add S	AN Boot Target	0
Boot Ta	rget LUN: 0	
Boot Targe	t WWPN: 50:0A:09:81:9D:02:4C:1A	
	Type: Primary Secondary	
	ОК	Cancel

- 17. From the vHBA drop-down menu, choose Add SAN Boot Target.
- **18**. Enter **0** as the value for **Boot Target LUN**.
- **19.** Enter the WWPN for FCoE port 5a on storage controller 2.

Ŷ, Note

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To obtain this information, log in to storage controller 2 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

20. Click **OK** to add the SAN boot target. See Figure 43.

Figure 43 Adding Secondary SAN Boot Target for Fabric A

🚔 Add SAN Boot Target	×
Add SAN Boot Target	0
_	
Boot Target LUN: 0	
Boot Target WWPN: 50:0A:09:81:8D:02:4C:1A	
Type: C Primary C Secondary	
	OK Cancel

- 21. From the vHBA drop-down menu, choose Add SAN Boot.
- 22. In the Add SAN Boot dialog box, enter Fabric-B in the vHBA box.

- **23.** The SAN boot type should automatically be set to **Secondary**, and the **Type** option should be greyed out and unavailable.
- 24. Click OK to add the SAN boot initiator. See Figure 44.

Figure 44 Adding SAN Boot Initiator for Fabric B

🚔 Add SAN Boot		×
Add SAN Boot		0
vHBA: Fabric-B	_	
Type: O Primary O Secondary		
	ОК	Cancel

- 25. From the vHBA drop-down menu, choose Add SAN Boot Target.
- **26**. Keep **0** as the value for **Boot Target LUN**.
- **27.** Enter the WWPN for FCoE port 5b on storage controller 1.

S. Note

To obtain this information, log in to storage controller 1 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

- 28. Select the Primary radio button as the SAN boot target type.
- **29.** Click **OK** to add the **SAN** boot target. See Figure 45.

Figure 45	Adding Primary SAN Boot Target for Fabric I	В
📥 Add SAN	Boot Target	×
Add S	AN Boot Target	0
Boot Ta	rget LUN: 0	
Boot Targe	t WWPN: 50:0A:09:82:9D:02:4C:1A	
	Type: Primary Secondary	
	ОК	Cancel

- 30. From the vHBA drop-down menu, choose Add SAN Boot Target.
- **31**. Enter **0** as the value for **Boot Target LUN**.
- **32.** Enter the WWPN for FCoE port 5b on storage controller 2.

Note

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To obtain this information, log in to storage controller 2 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

33. Click **OK** to add the SAN boot target. See Figure 46.

Figure 46 Adding Secondary SAN Boot Target

🌧 Add SAN Boot Target	×
Add SAN Boot Target	0
Ū	
Boot Target LUN: 0	
Boot Target WWPN: 50:0A:09:82:8D:02:4C:1A	
Type: 🖸 Primary 💿 Secondary	
OK	Cancel

- 34. Click OK, and then OK again to create the boot policy.
- 35. Right-click Boot Policies, and choose Create Boot Policy.

- **36.** Enter **Boot-FCoE-OVM-B** as the name of the boot policy.
- **37.** Enter a description of the boot policy. This field is optional.
- 38. Uncheck the Reboot on Boot Order Change check box.
- 39. From the Local Devices drop-down menu choose Add CD-ROM.
- 40. From the vHBA drop-down menu choose Add SAN Boot.
- 41. In the Add SAN Boot dialog box, enter Fabric-B in the vHBA box.
- 42. Select the Primary radio button as the SAN boot type.
- 43. Click OK to add the SAN boot initiator. See Figure 47.

Figure 47 Adding SAN Boot Initiator for Fabric B

🚔 Add SAN Boot	×
Add SAN Boot	0
vHBA: Fabric-B Type: • Primary • Secondary	
	X Cancel

- 44. From the vHBA drop-down menu, choose Add SAN Boot Target.
- **45.** Enter **0** as the value for Boot Target LUN.
- **46.** Enter the WWPN for FCoE port 5b on storage controller 1.



To obtain this information, log in to storage controller 1 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

- 47. Select the **Primary** radio button as the SAN boot target type.
- **48.** Click **OK** to add the SAN boot target. See Figure 48.

×
0
ancel

- 49. From the vHBA drop-down menu, choose Add SAN Boot Target.
- 50. Enter 0 as the value for Boot Target LUN.
- **51.** Enter the WWPN for FCoE port 5b on storage controller 2.

Note

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To obtain this information, log in to storage controller 2 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

52. Click OK to add the SAN boot target. See Figure 49.

Figure 49	Adding Secondary SAN Boot Target for F	abric B
🍌 Add SAN	Boot Target	×
Add S	AN Boot Target	0
Boot Ta Boot Targe	rget LUN: 0 It WWPN: 50:0A:09:82:8D:02:4C:1A Type: Primary © Secondary	
	ОК	Cancel

- **53.** From the **vHBA** menu, choose **Add SAN Boot**.
- 54. In the Add SAN Boot dialog box, enter Fabric-A in the vHBA box.
- **55.** The SAN boot type should automatically be set to **Secondary**, and the **Type** option should be greyed out and unavailable.

1

56. Click OK to add the SAN boot initiator. See Figure 50.

Figure 50 Adding SAN Boot for Fabric A

🚔 Add SAN Boot	×
Add SAN Boot	0
VHBA: Fabric-A	
Type: O Primary O Secondary	
	OK Cancel

57. From the vHBA menu, choose Add SAN Boot Target.

- **58**. Enter **0** as the value for **Boot Target LUN**.
- **59.** Enter the WWPN for FCoE port 5a on storage controller 1.

Note

To obtain this information, log in to storage controller 1 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

- 60. Select the **Primary** radio button as the SAN boot target type.
- 61. Click OK to add the SAN boot target. See Figure 51.

Figure 51 Adding Primary SAN Boot Target for Fabric A

🚔 Add SAN Boot Target	×
Add SAN Boot Target	0
Boot Target LUN: 0 Boot Target WWPN: 50:0A:09:81:9D:02:4C:1A Type: • Primary • Secondary	
	OK Cancel

- 62. From the vHBA drop-down menu, choose Add SAN Boot Target.
- **63**. Enter **0** as the value for **Boot Target LUN**.
- **64.** Enter the WWPN for FCoE port 5a on storage controller 2.

Note

To obtain this information, log in to storage controller 2 and run the **fcp show adapters** command. Ensure you enter the port name and not the node name.

65. Click OK to add the SAN boot target. See Figure 52.



66. Click OK, and then click OK again to create the boot policy.

After creating the FCoE boot policies for Fabric A and Fabric B, you can view the boot order in the UCS Manager GUI. To view the boot order, navigate to **Servers > Policies > Boot Policies**. Select Boot Policy Boot-FCoE-OVM-A to view the boot order for Fabric A in the right pane of the UCS Manager. Similarly, select Boot Policy Boot-FCoE-OVM-B to view the boot order for Fabric B in the right pane of the UCS Manager. Figure 53 and Figure 54 show the boot policies for Fabric A and Fabric B respectively in the UCS Manager.



```
Boot Policy for Fabric A
```



Figure 54 Boot Policy for Fabric B

ment Servers LAN SAN VM Admin	General Events						
Filter: Al	Actions	Properties					
-1	🛗 Delete	Name: Boo	-FCoE-OVM-B				
	Show Policy Usage	Description:					
Servers		Reboot on Boot Order Chapter					
Service Profile Templater		Report of boot of doir change.					
		Enforce vNIC/vHBA/iSCSI Name: V					
- O. root							
- S Adapter Policies	Warning						
BIOS Defaults	The type (primary/secondary	does not indicate a boot order presence					
BIOS Policies	The effective order of boot of	devices within the same device class (LAN)	Storage/iSCSI) is determi	ned by PCIe bus scan order.			
🖃 🔊 Boot Policies	If Enforce vNIC/vHBA/iS0	SI Name is selected and the vNIC/vHBA	/iSCSI does not exist, a c	config error will be reported.			
Boot Policy Boot-FCoE-OVM-A	order is used.	symbas/ibc51 are selected in they exist,	otherwise the VNIC/VHDA	VIDCDI WITH THE IOWEST PCIE D	us scan		
Boot Policy Boot-FCoE-OVM-B	order is used.						
Boot Policy Boot_Local							
Boot Policy Boot_BCSI =		Boot Order					
Soot Policy IDE EleyPod	Local Devices		13				
Boot Policy IDE_OVM_BootPol		Expor	Print				
Boot Policy JDE_OVM_INSTALL	v NICs	Name	Order	VNIC/VHBA/ISCSI VNIC	Туре	Lun ID	WWN
		CD-ROM	1				
	vHBAs	Storage	2				
S Boot Policy LR-boot		SAN primary	-	Eabric-B	Primary		
5 Boot Policy boot_jde	iSCSI vNICs	SAN Target pr	mary	T GOTIC D	Primary	0	50-04-09-86-90-93-40-76
Boot Policy default			tondaru		Secondary	0	50:04:09:96:90:03:40:75
Boot Policy diag		SAN rarget se	.ondary	Eabric-A	Secondary		3010H10910010D19311017F
Boot Policy ebs-app-bootpol		SAN Secondary	the lines of	FOULT	Drimonu	0	E0:04:00:9E:00:02:40:7E
Soot Policy ISCSI-100			nidi y		Frimary	0	50:0A:09:05:9D:93:40:7F
Rest Policy utility		SAN Target se	ondary		secondary	U	50:0A:09:85:8D:93:40:7F

Service Profile creation and Association to UCS Blades

Service profile templates enable policy based server management that helps ensure consistent server resource provisioning suitable to meet predefined workload needs.

Create Service Profile Template

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To create service profile template, follow these steps:

- 1. Log into Cisco UCS Manager.
- 2. Click the Servers tab in the navigation pane,
- 3. Choose Servers > Service Profile Templates > root.
- 4. Right-click on root and choose Create Service Profile Template.



5. Enter template name, and select UUID Pool that was created earlier. See Figure 56.

I

6. Click Next.

Figure 56 Creating Service Profile Template - Identify

	You must enter a name for the convice profile template and specify the template type. You can also specify how a LILIID
1. √ <u>Identify Service Profile</u> <u>Template</u>	will be assigned to this template and enter a description.
2. D <u>Networking</u> 3. Storage	Name: FlexPod_OVM-Fabric-A
4. Zoning	The template will be created in the following organization. Its name must be unique within this organization.
5. VNIC/VHBA Placement	Where: org-root
7. Maintenance Policy	The template will be created in the following organization. Its name must be unique within this organization.
8. Server Assignment	Type: 💿 Initial Template 💿 Updating Template
9. Doperational Policies	O Specify how the UUID will be assigned to the server associated with the service generated by this template.
	UUID
	UUID Assignment: FlexPod-OVM-UUID(22/32)
	The UUID will be assigned from the selected pool. The available/total UUIDs are displayed after the pool name.
	Optionally enter a description for the profile. The description can contain information about when and where the service profile should be used.

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7. In the **Networking** window, select the **Dynamic vNIC** that was created earlier and move on to the next window. See Figure 57.

ate Service Profile Template				
Unified (Computi	ng System M	lanager	
Service Profile Template 1. ✓ Identify Service Profile Template	Networking Optionally specif Dynamic vNIC Connecti	y LAN configuration information. on Policy: Select a Policy to use (no Dynan	nic vNIC Policy by defa▼	Create Dynamic vNIC Connection Polic
	How we	ould you like to configure LAN connect or more vNICs that the server should use t	tivity? Simple Expert	No vNICs Use Connectivity Policy
	Name	MAC Address	Fabric ID	Native VLAN

🛕 Cre

Create

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|--|

8. In the **Networking** page create **vNICs**, one on each fabric and associate them with the VLAN policies created earlier.

🕂 Add

🛨 Add 🍵 Delete 📓 Modif

iSCSI Adapter Policy

9. Select **Expert Mode**, and click **Add** to add one or more vNics that the server should use to connect to the LAN.

MAC Address

<Prev Next > Finish Cancel

- 10. In the Create vNIC page, select Use vNIC template and adapter policy as Flexpod-OVM.
- 11. Enter vNIC Storage1 as the vNIC name.

Click Add to specify one or more iSCSI vNICs that the server should use

Overlay vNIC Name

Name

🚖 Create vNIC	×
Create vNIC	0
Name: Storage1	
Use vNIC Template:	
Create vNIC Template	
vNIC Template: FlexPod-vNIC-A	
Adapter Performance Profile	
Adapter Policy: FlexPod-OVM 🔹 🛨 Create Ethernet Adapter Policy	
ОК	Cancel

Figure 58 Creating Service Profile Template – Create vNIC

12. Similarly, create vNIC Storage2, and vNIC for Public. Private and for Live Migration for side A & B with appropriate vNIC template mapping for each vNIC.

1

Once vNICs are created, we need to create vHBAs.

In the storage page, select expert mode, choose the WWNN pool created earlier and click **Add** to create vHBAs.

Creating Service Profile Template - Storage

🛕 Create Service Profile Template

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Figure 59

Unified C	computing System	Manager
Create Service Profile Template 1. / Identify Service Profile Template 2. / Networking 3. / Storage 4. Zoning 5. //NIC//HBA Placement 6. Server Boot Order 7. Maintenance Policy 8. Server Assignment 9. Operational Policies	Storage Optionally specify disk policies and SAN conf	guration information.
	Select a local disk configuration policy. Local Storage: FlexPod-OVM-Boot Create Local Disk Configuration Policy How would you like to configure SAN A server is identified on a SAN by its World Wide Node Name WWNN Assignment: FlexPod-OVM-WWNN(28/32)	Mode: No Local Storage Protect Configuration: Yes If Protect Configuration is set, the local disk configuration is preserved if the service profile is disassociated with the server. In that case, a configuration error will be raised when a new service profile is associated with connectivity? Simple • Expert • No vHBAs • Use Connectivity Policy (WWNN). Specify how the system should assign a WWNN to the server associated with this
	The WWNN will be assigned from the selected pool. The available/total WWNNs are displayed after the pool	name.
	Name	wwni
	rvanie	WWFN
		Pelete 🕂 Add 🔤 Modify
	•	····

We have created two vHBAs that are shown below.

- Fabric-A using template Flexpod-vHBA-A.
- Fabric-B using template Flexpod-vHBA-B.



For this Flexpod configuration, we used Nexus 5548UP for zoning, so we will skip the zoning section and use default vNIC/vHBA placement.

A Modify vNIC/vH	BA Placement	of the other part lines	-		×
Modify vNI	C/vHBA Placeme vNICs and vHBAs are placeme	ent red on physical network adapte	rs		0
vNIC/vHBA Placement in a server hardware c	specifies how vNICs and vHBAs onfiguration independent way.	are placed on physical network adap	oters (mezzanine)		^
Select Placement:	FlexPod-OVM	▼			
Virtual Network In vNICs and vHBAs performed explicit automatically by s vNIC/vHBA placen Please select one	terface connection provides a m are assigned to one of Virtual N y by selecting which Virtual Net electing "any". ent on physical network interfa Virtual Network Interface and or	echanism of placing vNICs and vHBA letwork Interface connection specifie work Interface connection is used by ice is controlled by placement prefere ne or more vNICs or vHBAs Virtual Network Interfaces Policy (r	s on physical network a d below. This assignme vNIC or vHBA or it can inces. ead only)	idapters. nt can be be done	E
		Name	Order	Selection Preference	
		E- SyCop 1	0.001	Assigned Only	
Name	œ.	VHBA Fabric-A	1	Honghod only	
Storage1		VHBA Fabric-B	2		
Storage2	>> assign >>	VNIC VNIC-A	3		
VMotion1	< <re><</re>	-I VNIC VNIC-B	4		
AMOUNTS		🗊 vCon 2		All	
		🕤 vCon 3		All	
		🦾 🗐 vCon 4		All	-
•					•
				ОК	Cancel

Figure 61 Creating Service Profile Template – vNIC/vHBA Placement

Server Boot Policy

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In the Server Boot Order page, choose the Boot Policy we created for SAN boot and click Next.

Create Service Profile Template		ingure Server Bool P	oncy	_	_	_			X
Unified Computing System Manager Create Service Profile Template ✓ (identify Service Profile Template ✓ (identify Service Profile Server Boot Order ✓ (identify Service Profile © (identify Service Profile Template ✓ (identify Service Profile © (identify Service Profile © (identify Service Profile Template ✓ (identify Service Profile © (identify Service Profile © (identify Service Profile © (identify Service Profile © (identify Service Profile Colored Profile © (identify Service Profile Secondary) does not indicate a boot order presence. The effective order of boot devices within the same device dass (UAN)Storage/(SCSI) is determined by PCIe bus scan order. If it is not selected, the vAIIC/vHBA/(SCSI with the lowest PCIe bus scan order. Ø (identify Service Profile © (if it is not selected, it wAIIC/vHBA/(SCSI vAIIC) is determined by PCIe bus scan order. Ø (identify Service VIIC/vHBA/(SCSI vAIIC) is determined by PCIe bus scan order. Ø (identify Service VIIC/vHBA/(SCSI vAIIC) is determined by PCIe bus scan order. Ø (if it is not selected, it wAIIC/vHBA/(SCSI vAIIC) is determined by PCIe bus scan order.<th>Create Service Profile Template</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th>	Create Service Profile Template								
Create Service Profile Template Server Boot Order 1. √Identify Service Profile Optionally specify the boot policy for this service profile template. 2. √Idetworking 3. √Storage 4. ⊇zoning 5. ↓ √UC/MBA Placement 6. √Server Boot Order 7. ↓ Marktenane Policy 8. ↓ ⊇zoning 9. ↓ ⊇operational Policies Boot Policy: Boot-FCoE-OVM-A 8. ↓ ⊇server Assignment Description: 9. ↓ ⊇operational Policies Reboot on Boot Order Change: No Enforce VIL/UMBA/SCSI Name: Yes WARNINGS: The type (primary/secondary) does not indicate a boot order presence. The type (primary/secondary) does not indicate a boot order presence. T If Inforce VIL/UMBA/SCSI Name: Yes WARNINGS: Warkinspect If it is not selected, the vNIL/VHBA/SCSI are selected if they exist, a config error will be reported. If it is not selected, the vNIL/VHBA/SCSI Name: Yes WARNINGS: Name Order VIL/VHBA/SCSI will the VIL/VHBA/SCSI will the VIL/VHBA/SCSI will the lowest PCIE bus scan order. If it is not selected, the vNIL/VHBA/SCSI are selected if they exist, otherwise the vNIL/VHBA/SCSI will the lowest PCIE bus	Unified C	Computing S	Syste	m Mana	ger				
Image: SAN primary Fabric-A Primary 0 50:004:09:85 SAN Target primary Fabric-B Secondary 0 50:004:09:86	Create Service Profile Template 1. √ Identify Service Profile Template 2. √ Networking 3. √ Storage 4. □ Zoning 5. □ VIIC/VHBA Placement 6. √ Server Boot Order 7. □ Maintenance Policy 8. □ Server Assignment 9. □ Operational Policies	Server Boot Order Optionally specify the boot Select a boot policy. Boot Policy: Boot-FCOE-OVM-A Name: Boo Description: Reboot on Boot Order Change: No Enforce vNIC/vHBA/ISCSI Name: Yes WARNINGS The type (primary/secondary) does r The offective order of boot devices v If Enforce vNIC/vHBA/ISCSI Name If it is not selected, the vNICs/vHBA	policy for this c c c c c c c c	service profile template. reate Boot Policy A ot order presence. levice class (LAN/Storage/ISC d the vNIC/vHBA/ISCSI does red if they exist, otherwise th	SI) is determini not exist, a co	ad by PCIe bi rfig error will SCSI with the	us scan order. be reported. s lowest PCIe bus scan order is :	used.	•
Name Order vNIC/VHBA/iSCSI vNIC Type Lun ID WWN CD-ROM 1 Storage 2 Storage SAN Target primary Fabric-A Primary 0 50:0A:09:85 SAN Target secondary Fabric-B Secondary 0 50:0A:09:86 SAN Target primary Fabric-B Secondary 0 50:0A:09:86 SAN Target secondary Fabric-B Secondary 0 50:0A:09:86 SAN Target secondary San Target secondary Secondary 0 50:0A:09:86		🛨 🖃 🔍 Filter 👄 Export 📚 F	Print						
CD-ROM 1 Storage 2 Storage 2 Storage Storage Storage 2 Storage Storage Storage St		Name	Order	VNIC/VHBA/ISCSI VNIC	Туре	Lun ID	WWN		
Storage 2 SAN primary Fabric-A Primary SAN Target secondary Primary 0 SAN secondary Fabric-B Secondary SAN Target primary Primary 0 SAN Target primary Primary 0 SAN Target primary Primary 0 SAN Target primary Secondary Primary SAN Target primary Secondary Socondary		CD-ROM	1					^	
SAN primary Fabric-A Primary SAN primary Primary 0 SAN rarget primary Secondary 0 SAN secondary Secondary Secondary SAN secondary Fabric-B Secondary SAN rarget primary Primary 0 SAN rarget primary Secondary Secondary SAN rarget primary Secondary Sociola:09:86 SAN rarget primary Secondary Sociola:09:86			2						
SAN Target primary Primary 0 50:04:09:85 SAN Target primary Secondary 0 50:04:09:85 SAN Target primary Fabric-B Secondary 0 SAN Target primary Primary 0 50:04:09:85 SAN Target primary Fabric-B Secondary 0 SAN Target primary Primary 0 50:04:09:86 SAN Target primary Secondary 0 50:04:09:86		SAN primary		Fabric-A	Primary				
SAN Farget secondary Secondary 0 50:04:09:05 SAN Secondary Fabric-B Secondary 0 50:04:09:05 SAN Target secondary Primary 0 50:04:09:86 SAN Target secondary 0 50:04:09:86		SAN Target primary			Primary	0	50:0A:09:85:9D:93:40:7F		
ANN Secondary Pabric-5 Secondary Primary 0 50:0A:09:86		SAN Target secondar	Ŷ	Cabula D	Secondary	U	50:0A:09:85:8D:93:40:7F	- 11	
Southarget primary 50.04.09.06 Southarget secondary 50.04.09.86		SAN secondary		Fabric-B	Deimoreu	0	E0-04-00-96-0D-02-40-7E		
		SAN Target secondar	~~		Secondary	0	50:0A:09:86:8D:93:40:7E		
		Shiri Target Secondar	/		bocondary	•	COLONIOS/COLOD/SOFTOIN		
								-	
<pre> Next ></pre>					[< Prev	Next > Finish	Cani	cel

1

Figure 62 Configure Server Boot Policy

The Maintenance and Assignment policies are kept at default in our configuration. However, they may vary from site to site depending on your work loads, best practices and policies.

Create Service Profiles from Service Profile Templates

To create service profiles from service profile templates, follow these steps:

- 1. Log into Cisco UCS Manager,
- 2. Click on the Servers tab in the navigation pane
- 3. Choose Servers > Service Profile Templates and
- 4. Right-click and choose Create Service Profiles from Template. See Figure 63.

Equipment S	iervers	LAN SAN VM Admin				
Filter: All						
• •						
⊡~~ Server. ⊡ 5 Ser ⊡ ∰ ⊡ ∰ Ser ⊡ ∰ Ser	s rvice Prof rvice Prof rvice Prof	iles ile Templates				
⊡… j≦) Pol	licie: ro	Show Navigator				
e 🌚 Po	ols ro	Create Service Profile (expert)				
Create Service Profiles From Template						
±		Create Service Profile				
🗄 🚮 Sch	hedi	Create Service Profile Template				
		Start Fault Suppression				
		Stop Fault Suppression				
		Сору				
		Copy XML				
		Delete				

Figure 63 Create Service profile from Service Profile template



A Create Service Profiles From Template	x
Create Service Profiles From Template	0
Naming Prefix: Flexpod-OVM-11	
Service Profile Template: Service Template HexPod-OVM-Fabric-A	•
OK	Cancel

We have created four service profiles:

- Flexpod-OVM-11
- Flexpod-OVM-21
- Flexpod-OVM-31
- Flexpod-OVM-41

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Associating Service Profile to Servers

As service profiles are created now, we are ready to associate them to the servers. To associate service profiles to servers, follow these steps:

1

- 1. Log into Cisco UCS Manager
- 2. Click the Servers tab in the navigation pane
- **3.** Under the **Servers** tab, select the desired service profile, and select change service profile association. See Figure 65.

Figure 65 Associating Service Profile to UCS Blade Servers

Equipment Servers LAN SAN VM /	Admin						
Filter: All							
+ - I	Show Navigator						
	Boot Server						
Service Profiles	Shutdown Server						
📄 🧔 root 🕀 📰 EBS Windows Test	Reset						
FlexPod-OVM-11	KVM Console						
FlexPod-OVM-21	SSH Console						
FlexPod-OVM-31	Rename Service Profile						
	Create a Clone						
	Create a Service Profile Template						
	Disassociate Service Profile						
	Change Service Profile Association						

- 4. In the **Change Service Profile Association** page, from the **Server Assignment** drop-down, select existing server that you would like to assign.
- 5. Click OK. See Figure 66.

ure 66	Char	nging Service	e Profile Assoc	eiation				
Associa	ate Service	Profile	C Married	-		_		×
Asso	ciate \$	Service	Profile	iouely-dieco	varad carva	rhunama ari	manual	?
spe at ti	cify a cus hat locati	stom server t on, the syste	boor of a prev by entering its em waits until	chassis an one is disc	d slot ID. If overed.	no server curre	ntly ex	(ists
Warr	ning If	This serv you procee	ice profile is a d the current	associated s t associatio	with a serv n will be re	er. placed.]
You can want to) select an e Lassociate (existing server with this service	or server pool, c e profile.	or specify the p	ohysical locatio	on of the server y	ou	
Serv	er Assignme	ent: Select ex	isting Server	•				
			 Available Set 	rvers 🔘 All S	iervers			
Sel	lect	Chassis ID	Slot	Rack ID	Procs	Memory	E	
	\bigcirc	3	8		2	98304		
_	۲	4	1		2	196608		
							-	
•							F.	
Res	strict Migral	tion:						

6. Repeat the same steps to associate remaining 3 service profiles for the respective Blade servers. Ensure all the service profiles are associated as shown in Figure 67.

Figure 67 Associated Service Profiles Summary

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Equipment Servers LAN SAN VM Admin	Service Profiles								
Filter: All	All Failed Active Passive Disassociated Pending Hierar	Failed Active Passive Disassociated Pending Hierarchical Pending Activities							
• •	🔍 Filter 🖨 Export 😸 Print								
E- Servers	Name /	Liser Label	Overall Status	Assor State	Server				
Service Profiles	Service Profile FlexPod-OVM-11		1 Ok	1 Associated	sys/chassis-4/blade-7				
EBS Windows Test	Service Profile FlexPod-OVM-21		1 Ok	1 Associated	sys/chassis-1/blade-7				
FlexPod-OVM-11	Service Profile FlexPod-OVM-31		1 Ok	1 Associated	sys/chassis-1/blade-8				
E FlexPod-OVM-21	Service Profile FlexPod-OVM-41		1 Ok	1 Associated	sys/chassis-4/blade-8				
😥 🚭 FlexPod-OVM-31	Service Profile JDE-BAK		Unassociated	Unassociated					
FlexPod-OVM-41	Service Profile JDE-OVM-1		1 Ok	1 Associated	sys/chassis-4/blade-2				

Nexus 5548UP Configuration for FCoE Boot and NFS Data Access

Enable Licenses

Cisco Nexus A

To license the Cisco Nexus A switch on <<var_nexus_A_hostname>>, follow these steps:

- **1**. Log in as admin.
- 2. Run the following commands:

config t feature fcoe

feature npiv

feature lacp

feature vpc

Cisco Nexus B

To license the Cisco Nexus B switch on <<var_nexus_B_hostname>>, follow these steps:

- 1. Log in as admin.
- **2**. Run the following commands:

config t feature fcoe feature npiv feature lacp

feature vpc

Set Global Configurations

Cisco Nexus 5548 A and Cisco Nexus 5548 B

To set global configurations, follow these steps on both switches:

Run the following commands to set global configurations and jumbo frames in QoS:

I

- 1. Login as admin user
- 2. Run the following commands

conf t

spanning-tree port type network default

spanning-tree port type edge bpduguard default

port-channel load-balance ethernet source-dest-port

policy-map type network-qos jumbo class type network-qos class-default mtu 9216 exit class type network-qos class-fcoe pause no-drop mtu 2158 exit exit exit system qos service-policy type network-qos jumbo exit copy run start

Create VLANs

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Cisco Nexus 5548 A and Cisco Nexus 5548 B

To create the necessary virtual local area networks (VLANs), follow these steps on both switches: From the global configuration mode, run the following commands:

- 1. Login as admin user
- 2. Run the following commands conf t vlan 760 name Public-VLAN exit vlan 191 name Private-VLAN exit vlan 120 name Storage1-VLAN exit vlan 121 name Storage2-VLAN exit vlan 761 name LM-VLAN exit

Add Individual Port Descriptions for Troubleshooting

Cisco Nexus 5548 A

To add individual port descriptions for troubleshooting activity and verification for switch A, follow these steps:

From the global configuration mode, run the following commands:

- 1. Login as admin user
- **2.** Run the following commands

conf t interface Eth1/1 description Nexus5k-B-Cluster-Interconnect exit interface Eth1/2 description Nexus5k-B-Cluster-Interconnect exit interface Eth1/3 description NetApp_Storage1:e5a exit interface Eth1/4 description NetApp_Storage2:e5a exit interface Eth1/5 description Fabric_Interconnect_A:1/31 exit interface Eth1/6 description Fabric_Interconnect_B:1/31 exit interface eth1/17 description FCoE_FI_A:1/29 exit interface eth1/18 description FCoE_FI_A:1/30 exit

Cisco Nexus 5548 B

To add individual port descriptions for troubleshooting activity and verification for switch B, follow these steps:

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From the global configuration mode, run the following commands:

- 1. Login as admin user
- 2. Run the following commands

conf t interface Eth1/1 description Nexus5k-A-Cluster-Interconnect exit interface Eth1/2 description Nexus5k-A-Cluster-Interconnect exit interface Eth1/3 description NetApp_Storage1:e5b exit interface Eth1/4 description NetApp_Storage2:e5b exit interface Eth1/5 description Fabric_Interconnect_A:1/32 exit interface Eth1/6 description Fabric_Interconnect_B:1/32 exit interface eth1/17 description FCoE_FI_B:1/29 exit interface eth1/18 description FCoE_FI_B:1/30 exit

Create Port Channels

I

Cisco Nexus 5548 A and Cisco Nexus 5548 B

To create the necessary port channels between devices, follow these steps on both switches: From the global configuration mode, run the following commands:

- 1. Login as admin user
- 2. Run the following commands conf t

1

interface Po1 description vPC peer-link exit interface Eth1/1-2 channel-group 1 mode active no shutdown exit interface Po3 description NetApp_Storage1 exit interface Eth1/3 channel-group 3 mode active no shutdown exit interface Po4 description NetApp_Storage2 exit interface Eth1/4 channel-group 4 mode active no shutdown exit interface Po33 description Fabric_Interconnect_A exit interface Eth1/5 channel-group 33 mode active no shutdown exit interface Po34 description Fabric_Interconnect_B exit interface Eth1/6 channel-group 34 mode active no shutdown exit copy run start

Configure Port Channels

I

Cisco Nexus 5548 A and Cisco Nexus 5548 B

To configure the port channels, follow these steps on both switches: From the global configuration mode, run the following commands:

- 1. Login as admin user
- 2. Run the following commands conf t interface Po1 switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 1,760,761,191,120,121 spanning-tree port type network no shutdown exit interface Po3 switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 120,121 spanning-tree port type edge trunk no shutdown exit interface Po4 switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 120,121 spanning-tree port type edge trunk no shutdown exit interface Po33 switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 760,761,191,120,121 spanning-tree port type edge trunk no shutdown exit interface Po34

switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 760,761,191,120,121 spanning-tree port type edge trunk no shutdown exit copy run start

Configure Virtual Port Channels

Cisco Nexus 5548 A

To configure virtual port channels (vPCs) for switch A, follow these steps: From the global configuration mode, run the following commands:

1. Login as admin user 2. Run the following commands conf t vpc domain 1 role priority 10 peer-keepalive destination <<var_nexus_B_mgmt0_ip>> source <<var_nexus_A_mgmt0_ip>> auto-recovery exit interface Po1 vpc peer-link exit interface Po3 vpc 3 exit interface Po4 vpc 4 exit interface Po5 vpc 5 exit interface Po6 vpc 6 exit copy run start
Cisco Nexus 5548 B

To configure vPCs for switch B, follow these steps:

From the global configuration mode, run the following commands.

- 1. Login as admin user
- 2. Run the following commands

conf t

vpc domain 1

role priority 20

peer-keepalive destination <<var_nexus_A_mgmt0_ip>> source <<var_nexus_B_mgmt0_ip>> auto-recovery

exit interface Po1 vpc peer-link exit interface Po3

vpc 3

exit

interface Po4 vpc 4

exit

interface Po5

vpc 5

exit

interface Po6

vpc 6 exit

CAIL

copy run start

Create VSANs, Assign and Enable Virtual Fibre Channel Ports

This procedure sets up Fibre Channel over Ethernet (FCoE) connections between the Cisco Nexus 5548 switches, the Cisco UCS Fabric Interconnects, and the NetApp storage systems.

Cisco Nexus 5548 A

To configure virtual storage area networks (VSANs), assign virtual Fibre Channel (vFC) ports, and enable vFC ports on switch A, follow these steps:

From the global configuration mode, run the following commands:

1. Login as admin user

2. Run the following commands conf t vlan 101 name FCoE_Fabric_A fcoe vsan 101 exit interface po3 switchport trunk allowed vlan add 101 exit interface vfc3 switchport description NetApp_Storage1:5a bind interface Eth1/3 switchport trunk allowed vsan 101 no shutdown exit interface po4 switchport trunk allowed vlan add 101 exit interface vfc4 switchport description NetApp_Storage2:5a bind interface Eth1/4 switchport trunk allowed vsan 101 no shutdown exit interface po35 description Fabric_Interconnect_A:FCoE exit interface Eth1/17-18 channel-group 35 mode active exit interface po35 switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 101 spanning-tree port type edge trunk no shutdown exit interface vfc35

switchport description Fabric_Interconnect_A:FCoE bind interface po35 switchport trunk allowed vsan 101 no shutdown vsan database vsan 101 name Fabric_A vsan 101 interface vfc3 vsan 101 interface vfc4 vsan 101 interface vfc35 exit

Cisco Nexus 5548 B

I

To configure VSANs, assign vFC ports, and enable vFC ports on switch B, follow these steps: From the global configuration mode, run the following commands:

- 1. Login as admin user
- 2. Run the following commands conf t vlan 102 name FCoE_Fabric_B fcoe vsan 102 exit interface po3 switchport trunk allowed vlan add 102 exit interface vfc3 switchport description NetApp_Storage1:5b bind interface Eth1/3 switchport trunk allowed vsan 102 no shutdown exit interface po4 switchport trunk allowed vlan add 102 exit interface vfc4 switchport description NetApp_Storage2:5b bind interface Eth1/4 switchport trunk allowed vsan 102

no shutdown exit interface po35 description Fabric_Interconnect_B:FCoE exit interface Eth1/17-18 channel-group 35 mode active exit interface po35 switchport mode trunk switchport trunk native vlan 1 switchport trunk allowed vlan 102 spanning-tree port type edge trunk no shutdown exit interface vfc35 switchport description Fabric_Interconnect_B:FCoE bind interface po35 switchport trunk allowed vsan 102 no shutdown vsan database vsan 102 name Fabric_B vsan 102 interface vfc3 vsan 102 interface vfc4 vsan 102 interface vfc35 exit

Create Device Aliases for FCoE Zoning

Cisco Nexus 5548 A

To configure device aliases and zones for the primary boot paths of switch A on <<**var_nexus_A_hostname**>>>, follow these steps:

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From the global configuration mode, run the following commands:

- 1. Login as admin user
- **2.** Run the following commands

conf t

device-alias database

device-alias name Storage-FlexPod-A-5a pwwn 50:0a:09:85:9d:93:40:7f device-alias name Storage-FlexPod-B-5a pwwn 50:0a:09:85:8d:93:40:7f device-alias name OVM-Host-FlexPod-01-A pwwn 20:00:00:25:b5:01:0a:00 device-alias name OVM-Host-FlexPod-02-A pwwn 20:00:00:25:b5:01:0a:01 device-alias name OVM-Host-FlexPod-03-A pwwn 20:00:00:25:b5:01:0a:02 device-alias name OVM-Host-FlexPod-04-A pwwn 20:00:00:25:b5:01:0a:03 exit

device-alias commit

Cisco Nexus 5548 B

To configure device aliases and zones for the boot paths of switch B on <<**var_nexus_B_hostname**>>, follow these steps:

From the global configuration mode, run the following commands:

- 1. Login as admin user
- 2. Run the following commands
 - conf t

device-alias database

device-alias name Storage-FlexPod-A-5b pwwn 50:0a:09:86:9d:93:40:7f device-alias name Storage-FlexPod-B-5b pwwn 50:0a:09:86:8d:93:40:7f device-alias name OVM-Host-FlexPod-01-B pwwn 20:00:00:25:b5:01:0b:00 device-alias name OVM-Host-FlexPod-02-B pwwn 20:00:00:25:b5:01:0b:01 device-alias name OVM-Host-FlexPod-03-B pwwn 20:00:00:25:b5:01:0b:02 device-alias name OVM-Host-FlexPod-04-B pwwn 20:00:00:25:b5:01:0b:03 exit

device-alias commit

Create Zones

Cisco Nexus 5548 A

To create zones for the service profiles on switch A, follow these steps:

1. Create a zone for each service profile.

Login as admin user.

Run the following commands:

conf t

zone name OVM-Host-FlexPod-01-A vsan 101

member device-alias OVM-Host-FlexPod-01-A

member device-alias Storage-FlexPod-A-5a

member device-alias Storage-FlexPod-B-5a exit zone name OVM-Host-FlexPod-02-A vsan 101 member device-alias OVM-Host-FlexPod-02-A member device-alias Storage-FlexPod-A-5a member device-alias Storage-FlexPod-B-5a exit zone name OVM-Host-FlexPod-03-A vsan 101 member device-alias OVM-Host-FlexPod-03-A member device-alias Storage-FlexPod-A-5a member device-alias Storage-FlexPod-B-5a exit zone name OVM-Host-FlexPod-04-A vsan 101 member device-alias OVM-Host-FlexPod-04-A member device-alias Storage-FlexPod-A-5a member device-alias Storage-FlexPod-B-5a exit

2. After the zone for the Cisco UCS service profiles has been created, create the zone set and add the necessary members.

zoneset name FlexPod-OVM vsan 101 member OVM-Host-FlexPod-01-A member OVM-Host-FlexPod-02-A member OVM-Host-FlexPod-03-A member OVM-Host-FlexPod-04-A exit

Activate the zone set.
 zoneset activate name FlexPod-OVM vsan 101
 exit
 copy run start

Cisco Nexus 5548 B

To create zones for the service profiles on switch B, follow these steps:

 Create a zone for each service profile. Login as admin user. Run the following commands: zone name OVM-Host-FlexPod-01-B vsan 102

FlexPod Data Center with Oracle RAC on Oracle VM

member device-alias OVM-Host-FlexPod-01-B member device-alias Storage-FlexPod-A-5b member device-alias Storage-FlexPod-B-5b exit zone name OVM-Host-FlexPod-02-B vsan 102 member device-alias OVM-Host-FlexPod-02-B member device-alias Storage-FlexPod-A-5b member device-alias Storage-FlexPod-B-5b exit zone name OVM-Host-FlexPod-03-B vsan 102 member device-alias OVM-Host-FlexPod-03-B member device-alias Storage-FlexPod-A-5b member device-alias Storage-FlexPod-B-5b exit zone name OVM-Host-FlexPod-04-B vsan 102 member device-alias OVM-Host-FlexPod-04-B member device-alias Storage-FlexPod-A-5b member device-alias Storage-FlexPod-B-5b

exit

2. After all of the zones for the Cisco UCS service profiles have been created, create the zone set and add the necessary members.

zoneset name FlexPod-OVM vsan 102 member OVM-Host-FlexPod-01-B member OVM-Host-FlexPod-02-B member OVM-Host-FlexPod-03-B member OVM-Host-FlexPod-04-B

exit

3. Activate the zone set.

zoneset activate name FlexPod-OVM vsan 102 exit copy run start

When configuring the Cisco Nexus 5548UP with vPCs, be sure that the status for all the vPCs are up for connected Ethernet ports by running the commands shown in Figure 68 from the CLI on the Cisco Nexus 5548UP Switch.

🛃 10.6	5.121.94 - PuTT	Y			
FlexP Flags	od-OVM-N5K- : D - Down I - Ind: s - Susp S - Swit U - Up M - Not	-A# sh po ividual pended cched (port-cha in use.	rt-channel P - Up in p H - Hot-sta r - Module- R - Routed nnel) Min-links n	summary ort-channel (: ndby (LACP on removed ot met	members) Ly)
Group	Port- Channel	Туре	Protocol	Member Port	3
1 3 4 33 34	Po1 (SU) Po3 (SU) Po4 (SU) Po33 (SU) Po34 (SU)	Eth Eth Eth Eth Eth	LACP NONE NONE LACP LACP	Eth1/1(P) Eth1/3(P) Eth1/4(P) Eth1/5(P) Eth1/6(P)	Eth1/2(P)
35	Po35(SU)	Eth	LACP	Eth1/17(P)	Eth1/18(P) -

Figure 68 Port Channel Status on Cisco Nexus 5548UP

The command show vpc status should show the following for successful configuration.

Figure 69 Virtual PortChannel Status on Cisco Nexus 5548UP Fabric A switch

🛃 10.65.	121.94 - PuTTY		-		
vPC sta	atus				~
id 	Port 	Status	Consistency	Reason	Active vlans
3 4	Po3 Po4	up up	success success	success success	101,120-121 101,120-121
33	Po33	up	success	success	101,120-121 ,191,760-76 1
34	Po34	up	success	success	101,120-121 ,191,760-76 1

Figure 70 Virtual PortChannel Status on Cisco Nexus 5548UP on Fabric B Switch

🛃 10.65.	121.95 - PuTTY		(Prose of	pr status should show the to	- • ×	
vPC sta	atus					^
 id	Port	Status	Consistency	Reason	Active vlans	
3 4 33	Po3 Po4 Po33	սր սր սր	success success success	success success success	102,120-121 102,120-121 102,120-121 102,120-121 ,191,760-76	
34	Po34	up	success	success	102,120-121 ,191,760-76 1	
FlexPoo	a-ovm-nsk-b#					Ŧ

NetApp Storage Configuration Overview

This section discusses the NetApp storage layout design considerations when deploying an Oracle Database 11g Release 2 RAC on Flexpod and Oracle VM 3.1.1.

Figure 71 depicts a high-level storage design overview of a NetApp FAS3270 HA storage system.





Table 3 shows the NetApp storage layout with volumes and LUNs created for various purposes.

Table 3	NetApp Storage Layout with Volumes and LUNs
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NetApp Storage Layout					
Aggregation and NetApp Controller	NetApp FlexVol / LUN	Comments (LUNs are only used for Boot)			
OS_Aggr_A on Controller A	OVM_OS_A / FlexPod-OVM-1, FlexPod-OVM-3	FCoE boot LUNs for Oracle VM Server			

OS_Aggr_A on Controller A	GuestVM_OS_A / GuestVM-LUN-A	Shared FCoE LUN for Guest VMs
OS_Aggr_B on Controller B	OVM_OS_B / FlexPod-OVM-2, FlexPod-OVM-4	FCoE boot LUNs for Oracle VM Server
OS_Aggr_B on Controller B	GuestVM_OS_B / GuestVM_LUN_B	Shared FCoE LUN for Guest VMs
DB_Aggr_A on Controller A	OCR_VOTE_VOL	NFS Volumes used for OCR and Voting disk files
DB_Aggr_A on Controller A	DB_VOL_A	NFS Volumes used for OLTP Database datafiles (even number files) and copy of control files
DB_Aggr_A on Controller A	LOG_VOL_A	NFS Volumes used for OLTP Database redo log files and copy of control files
DB_Aggr_B on Controller B	DB_VOL_B	NFS Volumes used for OLTP Database datafiles (odd number files) and copy of control files
DB_Aggr_B on Controller B	LOG_VOL_B	NFS Volumes used for OLTP Database's redo log files and copy of control files
DB_Aggr_A on Controller A	DB_VOL_DSS_A	NFS Volumes used for DSS Database datafiles (even number files) and copy of control files
DB_Aggr_A on Controller A	LOG_VOL_DSS_A	NFS Volumes used for DSS Database redo log files and copy of control files
DB_Aggr_B on Controller B	DB_VOL_DSS_B	NFS Volumes used for DSS Database datafiles (odd number files) and copy of control files
DB_Aggr_B on Controller B	LOG_VOL_DSS_B	NFS Volumes used for DSS Database redo log files and copy of control files

Table 3 NetApp Storage Layout with Volumes and LUNs

Use the following commands to configure the NetApp storage systems to implement the storage layout design described here.

Storage Configuration for FCoE Boot

Create and Configure Aggregate, Volumes and Boot LUNs

NetApp FAS3270HA Controller A

1. Creation of Aggregate, Volumes and LUN for FCoE boot of Oracle VM Server on NetApp Storage as given below.

Create **OS_Aggr_A** with a RAID group size of 6 with 6 number of disks, and RAID_DP redundancy for hosting NetApp FlexVol volumes and LUNs, as shown in Table 3.

FlexPod-Oracle-A > aggr create OS_Aggr_A -t raid_dp -r 6 6

Create NetApp FlexVol volumes on OS_Aggr_A for hosting FCoE Boot LUNs, as shown in Table 3. These LUNs are exposed to UCS blades for Booting Oracle VM Server over FCoE.

FlexPod-Oracle-A > vol create OVM_OS_A OS_Aggr_A 500g

3. Create Boot LUNs on NetApp FlexVol volumes for booting Oracle VM Server over FCoE. Here we have shown the example of creating Boot LUN for one Oracle VM Server "FlexPod-OVM-1".

FlexPod-Oracle-A > lun create -s 200g -t FlexPod-OVM-1

/vol/OVM_OS_A

4. Repeat step 3, to create Boot LUN for the Oracle VM Server hosts FlexPod-OVM-3

NetApp FAS3270HA Controller B

1. Create OS_Aggr_B with a RAID group size of 6 with 6 number of disks, and RAID_DP redundancy for hosting NetApp FlexVol volumes and LUNs, as shown in Table 3.

FlexPod-Oracle-B > aggr create OS_Aggr_B -t raid_dp -r 6 6

 Create NetApp FlexVol volumes on OS_Aggr_B for hosting FC Boot LUNs, as shown in Table 3. These volumes are exposed to UCS blades for booting Oracle VM Server over FCoE.

FlexPod-Oracle-B > vol create OVM_OS_B OS_Aggr_B 500g

3. Create Boot LUNs on NetApp FlexVol volumes for booting Oracle VM Server over FCoE. Here we have shown the example of creating Boot LUN for Oracle VM Server "FlexPod-OVM-2"

FlexPod-Oracle-B > lun create -s 200g -t FlexPod-OVM-2 /vol/ OVM_OS_B

4. Repeat step 3, to create Boot LUN for the Oracle VM Server hosts FlexPod-OVM-4.

Create and Configure Initiator Group (igroup) and LUN mapping

NetApp FAS3270HA Controller A

 Create Initiator group (Igroup) and map the LUNs to the specific host OraRac-node1. FlexPod-Oracle-A > igroup create -f -t xen FlexPod-OVM-A1 20:00:00:25:b5:01:0a:00 20:00:00:25:b5:01:0b:00

FlexPod-Oracle-A > lun map /vol/OVM_OS_A/FlexPod-OVM-1 FlexPod-OVM-A1 0

2. Repeat step 1, to create Initiator group and map Boot LUN to the Oracle VM Server hosts FlexPod-OVM-3.

NetApp FAS3270HA Controller B

1. Create Initiator group (Igroup) and map the LUNs to the specific host OraRac-node3.

FlexPod-Oracle-B > igroup create -f -t xen FlexPod-OVM-B2 20:00:00:25:b5:01:0a:01 20:00:00:25:b5:01:0b:01 FlexPod-Oracle-B > lun map /vol/OVM_OS_B/FlexPod-OVM-3 FlexPod-OVM-B2 0

2. Repeat step 1, to create Initiator group and map Boot LUNs to the Oracle VM Server hosts FlexPod-OVM-4.

Create and Configure Volumes and LUNs for Guest VMs

NetApp FAS3270HA Controller A

 Create NetApp FlexVol volumes on OS_Aggr_A for hosting FCoE LUNs, as shown in Table 3. These LUNs are exposed to Oracle VM Servers and shared across all the Oracle VM Servers for storing Guest VMs.

FlexPod-Oracle-A > vol create GuestVM_OS_A OS_Aggr_A 1024g

 Create LUN on NetApp FlexVol volume for storing Guest VMs access through FCoE. FlexPod-Oracle-A > lun create -s 1000g -t GuestVM_LUN_A /vol/GuestVM_OS_A

NetApp FAS3270HA Controller B

 Create NetApp FlexVol volumes on OS_Aggr_B for hosting FCoE LUNs, as shown in Table 3. These LUNs are exposed to Oracle VM Servers and shared across all the Oracle VM Servers for storing Guest VMs.

FlexPod-Oracle-B > vol create GuestVM_OS_B OS_Aggr_B 1024g

 Create LUN on NetApp FlexVol volume for storing Guest VMs access through FCoE. FlexPod-Oracle-B > lun create -s 1000g -t GuestVM_LUN_B /vol/GuestVM_OS_B

Create and Configure Initiator Group (igroup) and Mapping of LUN for Guest VM

NetApp FAS3270HA Controller A

Create Initiator group (Igroup) and map the LUN to all of the Oracle VM Server.

FlexPod-Oracle-A > igroup create -f -t xen FlexPod-GuestVM-A 20:00:00:25:b5:01:0a:03 20:00:00:25:b5:01:0b:03 20:00:00:25:b5:01:0a:02 20:00:00:25:b5:01:0b:02 20:00:00:25:b5:01:0a:01 20:00:00:25:b5:01:0b:01 20:00:00:25:b5:01:0a:00 20:00:00:25:b5:01:0b:00

FlexPod-Oracle-A > lun map /vol/GuestVM_OS_A/GuestVM_LUN_A FlexPod-GuestVM-A 0

NetApp FAS3270HA Controller B

Create Initiator group (Igroup) and map the LUN to all of the Oracle VM Server.

FlexPod-Oracle-B > igroup create -f -t xen FlexPod-GuestVM-B 20:00:00:25:b5:01:0a:03 20:00:00:25:b5:01:0b:03 20:00:00:25:b5:01:0a:02 20:00:00:25:b5:01:0b:02 20:00:00:25:b5:01:0a:01 20:00:00:25:b5:01:0b:01 20:00:00:25:b5:01:0a:00 20:00:00:25:b5:01:0b:00

FlexPod-Oracle-B > lun map /vol/GuestVM_OS_B/GuestVM_LUN_B FlexPod-GuestVM-B 0

Storage Configuration for NFS Storage Network

Create and Configure Aggregate, Volumes

NetApp FAS3270HA Controller A

1. Create DB_Aggr_A with a RAID group size of 10, with 40 disks, and RAID_DP redundancy for hosting NetApp FlexVol volumes, as shown in Table 3.

FlexPod-Oracle-A > aggr create DB_Aggr_A -t raid_dp -r 10 40

2. Create NetApp FlexVol volumes on DB_Aggr_A for oltp & dss data files as shown in the Table 3. These volumes are exposed directly to Guest VMs are part of Oracle RAC nodes.

FlexPod-Oracle-A > vol create DB_VOL_A DB_Aggr_A 3072g FlexPod-Oracle-A > vol create DB_VOL_DSS_A DB_Aggr_A 2048g FlexPod-Oracle-A > vol create LOG_VOL_A DB_Aggr_A 500g FlexPod-Oracle-A > vol create LOG_VOL_DSS_A DB_Aggr_A 500g

FlexPod-Oracle-A > vol create OCR_VOTE_VOL DB_Aggr_A 20g

NetApp FAS3270HA Controller B

1. Create DB_Aggr_B with a RAID group size of 10, with 40 disks, and RAID_DP redundancy for hosting NetApp FlexVol volumes, as shown in Table 3.

FlexPod-Oracle-B > aggr create DB_Aggr_B -t raid_dp -r 10 40

 Create NetApp FlexVol volumes on DB_Aggr_B for oltp & dss data files as shown in the Table 3. These volumes are exposed directly to Guest VMs are part of Oracle RAC nodes.

FlexPod-Oracle-B > vol create DB_VOL_B DB_Aggr_B 3072g

FlexPod-Oracle-B > vol create DB_VOL_DSS_B DB_Aggr_B 2048g

FlexPod-Oracle-B > vol create LOG_VOL_B DB_Aggr_B 500g

FlexPod-Oracle-B > vol create LOG_VOL_DSS_B DB_Aggr_B 500g

NFS export all the flexible volumes (data volumes, redo log volumes, and OCR and voting disk volumes) from both Controller A and Controller B, providing read/write access to the root user of all hosts created in the previous steps.

Create and Configure VIF Interface (Multimode)

Ensure NetApp multimode virtual interface (VIF) feature is enabled on NetApp storage systems on 10 Gigabit Ethernet ports (e5a and e5b) for NFS Storage access. We used the same VIF to access all the flexible volumes created to store Oracle Database files that use using the NFS protocol. Your best practices may vary depending upon setup.

VIF Configuration on Controller A

FlexPod-Oracle-A >ifgrp create multi VIF0-a -b ip e5a e5b

FlexPod-Oracle-A > vlan create VIF0-a 120 121

FlexPod-Oracle-A >ifconfig VIF0-a-120 120.191.1.5 netmask 255.255.255.0 mtusize 9000 partner VIF0-b-120

FlexPod-Oracle-A >ifconfig VIF0-a-121 121.191.1.5 netmask 255.255.255.0 mtusize 9000 partner VIF0-b-121

FlexPod-Oracle-A >ifconfig VIF0-a-120 up FlexPod-Oracle-A >ifconfig VIF0-a-121 up

VIF Configuration on Controller B

FlexPod-Oracle-B>ifgrp create multi VIF0-b -b ip e5a e5b

FlexPod-Oracle-B> vlan create VIF0-b 120 121

FlexPod-Oracle-B>ifconfig VIF0-b-120 120.191.1.6 netmask 255.255.255.0 mtusize 9000 partner VIF0-a-120

FlexPod-Oracle-B>ifconfig VIF0-b-121 121.191.1.6 netmask 255.255.255.0 mtusize 9000 partner VIF0-a-121

FlexPod-Oracle-B>ifconfig VIF0-b-120 up FlexPod-Oracle-B>ifconfig VIF0-b-121 up



Ensure to make the changes persistent by editing /etc/rc file of NetApp Storage controller.

FlexPod-Oracle-A:: /etc/rc #Regenerated by registry Thu Jan 10 09:37:52 GMT 2013 #Auto-generated by setup Mon Nov 5 02:37:43 GMT 2012 hostname FlexPod-Oracle-A ifgrp create multi VIF0-a -b ip e5a e5b vlan create VIF0-a 120 121 ifconfig e0M `hostname`-e0M flowcontrol full netmask 255.255.255.0 ifconfig e0a `hostname`-e0a mediatype auto flowcontrol full netmask 255.255.255.0 ifconfig VIF0-a-120 `hostname`-VIF0-a-120 netmask 255.255.255.0 partner VIF0-b-120 mtusize 9000 trusted wins up ifconfig VIF0-a-121 `hostname`-VIF0-a-121 netmask 255.255.255.0 partner VIF0-b-121 mtusize 9000 trusted wins up route add default 10.65.121.1 1 routed on options dns.enable off options nis.enable off savecore

FlexPod-Oracle-B:: /etc/rc
#Auto-generated by setup Tue Jan 8 09:08:45 GMT 2013
hostname FlexPod-Oracle-B
ifgrp create multi VIF0-b -b ip e5a e5b
vlan create VIF0-b 120 121
ifconfig e0M `hostname`-e0M flowcontrol full netmask 255.255.255.0
ifconfig VIF0-b-120 `hostname`-VIF0-b-120 netmask 255.255.255.0 partner VIF0-a-120 mtusize
9000 trusted wins up
ifconfig VIF0-b-121 `hostname`-VIF0-b-121 netmask 255.255.255.0 partner VIF0-a-121 mtusize
9000 trusted wins up
route add default 10.65.121.1 1
routed on
options dns.enable off
options nis.enable off
savecore

Check the NetApp Configuration

Run the following commands to check the NetApp configuration:

FlexPod-Oracle-A> vif status VIF0-a

FlexPod-Oracle-B> vif status VIF0-b

Ensure that the MTU is set to 9000 and that jumbo frames are enabled on the Cisco UCS static and dynamic vNICs and on the upstream Cisco Nexus 5548UP switches.

Figure 72 shows the virtual interface "VIF0-a" created with the MTU size set to 9000 and the trunk mode set to multiple, using two 10 Gigabit Ethernet ports (e5a and e5b) on NetApp storage Controller A. Verify the same on NetApp Controller B.



Figure 72 Virtual Interface (VIF) on NetApp Storage

This completes storage configuration. Next, we will review boot from FCoE details.

UCS Servers and Stateless Computing via FCoE Boot

Boot from FCoE Benefits

Booting from FCoE is another key feature which helps in moving towards stateless computing in which there is no static binding between a physical server and the OS / applications it is tasked to run. The OS is installed on a SAN LUN and boot from FCoE policy is applied to the service profile template or the service profile. If the service profile were to be moved to another server, the pwwn of the HBAs and the Boot from SAN (BFS) policy also moves along with it. The new server now takes the same exact character of the old server, providing the true unique stateless nature of the UCS Blade Server.

The key benefits of booting from the network:

• Reduce Server Footprints

Boot from FCoE alleviates the necessity for each server to have its own direct-attached disk, eliminating internal disks as a potential point of failure. Thin diskless servers also take up less facility space, require less power, and are generally less expensive because they have fewer hardware components.

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• Disaster and Server Failure Recovery

All the boot information and production data stored on a local SAN can be replicated to a SAN at a remote disaster recovery site. If a disaster destroys functionality of the servers at the primary site, the remote site can take over with minimal downtime.

Recovery from server failures is simplified in a SAN environment. With the help of snapshots, mirrors of a failed server can be recovered quickly by booting from the original copy of its image. As a result, boot from SAN can greatly reduce the time required for server recovery.

• High Availability

A typical data center is highly redundant in nature - redundant paths, redundant disks and redundant storage controllers. When operating system images are stored on disks in the SAN, it supports high availability and eliminates the potential for mechanical failure of a local disk.

• Rapid Redeployment

Businesses that experience temporary high production workloads can take advantage of SAN technologies to clone the boot image and distribute the image to multiple servers for rapid deployment. Such servers may only need to be in production for hours or days and can be readily removed when the production need has been met. Highly efficient deployment of boot images makes temporary server usage a cost effective endeavor.

With Boot from SAN, the image resides on a SAN LUN and the server communicates with the SAN through a host bus adapter (HBA). The HBAs BIOS contain the instructions that enable the server to find the boot disk. All the FC-capable Converged Network Adapter (CNA) cards supported on Cisco UCS B-series blade servers support Boot from SAN.

After power on self-test (POST), the server hardware component fetches the boot device that is designated as the boot device in the hardware BOIS settings. Once the hardware detects the boot device, it follows the regular boot process.

Quick Summary for Boot from SAN Configuration

At this time, we have completed following steps that are essential for Boot from SAN configuration.

- SAN Zoning configuration on the Nexus 5548UP switches
- NetApp Storage Array Configuration for Boot LUN
- Cisco UCS configuration of Boot from SAN policy in the service profile

At this time, you are ready to perform OS install. We will not cover steps to complete OS install in a FCoE boot configuration.

Oracle VM Server Install Steps and Recommendations

For this solution, we configured a 4-node Oracle Database 11g Release 2 RAC cluster using 4-Guest VM each created on one Oracle VM Server. There are four Cisco B200 M3 servers used boot from SAN to enable stateless computing in case if a need arises to replace/swap the server using UCS unique service profile capabilities. While OS boot is using FCoE, the databases and grid infrastructure components are configured to use NFS protocol on the NetApp storage. Oracle VM Server 3.1.1 with Patch 819 (Oracle VM Server 3.1.1.819) is installed on each server.



Contact Oracle Customer Support for patch 819 for Oracle VM server 3.1.1.

This patch will allow you to enable jumbo frames (MTU= 9000) on Ethernet ports of Oracle VM server as well as Guest VM. Without this patch the Oracle VM server as well as guest VM reboots, when you set MTU size 9000 on Ethernet ports of Oracle VM server and guest VM.

Following table summarizes hardware and software configuration details.

Component	Details	Description
Server	4xB200 M3	2 Sockets with 8 cores with HT enabled
Memory	256 GB	Physical memory
Static vNIC1	Public Access	Management and Public Access, MTU Size 1500
Static vNIC2	Private Interconnect	Private Interconnect configured for HAIP, MTU Size 9000
Static vNIC3	NFS Storage Access	Database access through NFS Storage to Filer A, MTU size 9000
Static vNIC4	NFS Storage Access	Database access through NFS Storage to Filer B, MTU size 9000
Static vNIC5	Live Migration	Database access through NFS Storage to Filer A, MTU size 9000

Table 4 Host Configuration

Here we show few major steps to Install Oracle VM Server in one Cisco UCS blade server B200M3 using FCoE boot. There is no local disks available in Cisco UCS blade server B200M3.

1. Attach OVS ISO to KVM virtual media, as elaborated on figure below.



Ensure to use OVS build 3.1.1.819 or later. Please contact Oracle support to download the same.

/ FlexPod-OVM	-31 (Chassis - 1 Server - 8) - k	VM Console					_ 🗆 ×
le Help							
🖇 Boot Server 🔍	🖢 Shutdown Server 🛛 🧕 Reset						
VM Console Prope	erties						
VM Virtual Media							
Client View							
Mapped	Read Only Drive						Exit
	🗹 🚽 🕞 A: - Floppy						Create Image
	🗹 📄 E: - Removable	e Disk					
	🔽 🛛 🔊 D: - CD/DVD						Add Image
	🔽 🛃 E:\share\OVM:	8.1.1\OV5-3.1.1.is	so - ISO Image I	File			Remove Image
					1		Details 🗶
1							
Details	Mapped To	Dead Byter	Write Butes	Duration		1	
Virtual CD/DVD	E:\share\OVM3.1.1\OV.	. 0	0	00:00:20			LISB Reset
Removable Disk	Not mapped						
Floopy	Not mapped						
	noc mapped						
Logged in asco	mputeToken_@10.65.121.73 N	ot registered with	UCS Central				System Time: 2013-10-16T04:1

Figure 73 OVS ISO attached to as Virtual Media to KVM Console

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2. Click **Reset** to start the server for the Installation.



3. NetApp LUN is discovered from all the FCoE Paths.

🌲 / FlexPod-OVM-31 (Chassis - 1 Server - 8) - KVM Console	
File View Macros Tools Help	
🚙 Boot Server 🔄 Shutdown Server 🤤 Reset	
KVM Console Properties	
KVM Virtual Media	
	 өмв
0 JBOD(s) found on the host adapter 0 JBOD(s) handled by BIOS	
0 Virtual Drive(s) found on the host adapter.	
Adapter BIOS Disabled. No Logical Drive Handled by BIOS on HA - 0 0 Virtual Drive(s) handled by BIOS Press <ctrl><h> to Enable BIOS</h></ctrl>	
Cisco VIC FC, Boot Driver Version 2.1(1a) (C) 2010 Cisco Sustems, Inc. NETAPP 500a09859d93407f:000 NETAPP 500a09858d93407f:000 Option ROM installed successfully	
Cisco VIC FC, Boot Driver Version 2.1(1a) (C) 2010 Cisco Systems, Inc. NETAPP 500a09869d93407f:000 NETAPP 500a09868d93407f:000 Option RUM installed successfully	
Cogged in ascomputeToken_@10.65.121.73 Not registered with UCS Central	System Time: 2013-10-16T04:19

Figure 75 NetApp LUN Discovered

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4. Press **Enter** to continue the Installation.



-
File View Macros Tools Help
Boot Server 💐 Shutdown Server 🧕 Reset
KVM Console Properties
KVM Virtual Media
Welcome to Oracle UM Server
Package Installation
Size :
Summary:
Install Starting
Starting install process. This may
take several minutes Time
Comple
Remaini
8%
(The second
(lab)/(Hit-lab) between elements ((Space) selects ((Fi2) next screen

Figure 77

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OVS Installation Status

Figure 78 shows the finish of Oracle VM Server Installation after we provide all the required values during the Installation like configure the management Ethernet interface with appropriate ip. Ensure to verify the displayed MAC address with the static vNIC ethernet interface created on Service Profile for public/ management access.

rigure / 6 Completion of installatio	Fiaure 78	Completion of Installation
--------------------------------------	-----------	----------------------------

🌲 / FlexPod-OVM-31 (Chassis - 1 Server - 8) - KVM Console
File View Macros Tools Help
🚙 Boot Server 🔄 Shutdown Server 🥝 Reset
KVM Console Properties
KVM Virtual Media
Oracle VM Server 3.1.1 Console [Alt-F2 for login console]
Local hostname : FlexPod-OVM-3 Manager UUID : 0004fb0000010000a4545b8df3f98b69 Hostname : FlexPod-OVM-3 Server IP : 172.76.0.94 Server Pool : Clustered : Yes Server Pool Virtual IP : 172.76.0.16 Cluster state : DLM_Ready Master Server : No Cluster type : lun Cluster storage : /dev/mapper/360a9800037534332795d4366754d4834
OVS Agent : Running VMs running : 1 System memory : 262005 Free memory : 256753 Uptime : 2 days, 9 hours, 1 minutes
Connected to IP: 10.65.121.139 Not registered with UCS Central System Time: 2013-10-16T04:05

Use the above Oracle VM Server Installation steps to complete the Installation for all the four Cisco UCS B200M3 Server.

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Oracle VM Server Network Architecture

Figure 79 shows the Network Architecture of each Oracle VM Server.



Figure 79 Oracle VM Server Network Architecture

Oracle VM Manager Installation

Oracle VM Manager is installed as a production level; this is the preferred installation type, with options for selecting Oracle SE or EE database as the location for the Oracle VM Manager repository, as well as setting individual passwords for each component. Ensure that Oracle SE Database is installed; prior to installing Oracle VM Manager. Please follow the steps below to successfully install OVM Manager.

- 1. Prepare a physical server / virtual machine to Install Oracle Linux 5.8 or above.
- 2. Install Oracle Database server SE or EE on server prepared in step 1.
- 3. Download Oracle VM Manager binary "V32480-01.iso" and stage it on Oracle Linux server.
- 4. Extract the ISO file on Oracle Linux Server.
- 5. Run the file runInstaller.sh from the ISO extracted folder as follows.

[root@ovmmanager ovmmanager]# ./runInstaller.sh

Oracle VM Manager Release 3.1.1 Installer

Oracle VM Manager Installer log file: /tmp/install-2013-06-10-164951.log Please select an installation type: Demo Production Uninstall Help

Select Number (1-4): 2

Starting production installation ...

Verifying installation prerequisites ...

Oracle Database Repository

Use an existing Oracle database Enter the Oracle Database hostname [localhost]: ovmmanager Enter the Oracle Database System ID (SID) [XE]: orcl Enter the Oracle Database SYSTEM password:

Enter the Oracle Database listener port [1521]: 1521 Enter the Oracle VM Manager database schema [ovs]: ovs1 Enter the Oracle VM Manager database schema password:

Invalid password.

Passwords need to be between 8 and 16 characters in length. Passwords must contain at least 1 lower case and 1 upper case letter. Passwords must contain at least 1 numeric value. Enter the Oracle VM Manager database schema password:

Enter the Oracle VM Manager database schema password (confirm):

Oracle Weblogic Server 11g

Enter the Oracle WebLogic Server 11g user [weblogic]: Enter the Oracle WebLogic Server 11g user password:

Enter the Oracle WebLogic Server 11g user password (confirm):

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FlexPod Data Center with Oracle RAC on Oracle VM

Passwords do not match Enter the Oracle WebLogic Server 11g user password:

Enter the Oracle WebLogic Server 11g user password (confirm):

Oracle VM Manager application

Enter the username for the Oracle VM Manager administration user [admin]: Enter the admin user password:

Enter the admin user password (confirm):

Verifying configuration ...

Start installing the configured components:

1: Continue

2: Abort

Select Number (1-2): 1

Step 1 of 9 : Database ... Installing Database ... Database installation skipped ...

Step 2 of 9 : Java ... Installing Java ...

Step 3 of 9 : Database Schema ... Creating database schema 'ovs1' ...

Step 4 of 9 : WebLogic ... Retrieving Oracle WebLogic Server 11g ... Installing Oracle WebLogic Server 11g ...

Step 5 of 9 : ADF ...

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Retrieving Oracle Application Development Framework (ADF) ... Unzipping Oracle ADF ... Installing Oracle ADF ... Installing Oracle ADF Patch...

Step 6 of 9 : Oracle VM ... Retrieving Oracle VM Manager Application ... Extracting Oracle VM Manager Application ... Installing Oracle VM Manager Core ...

Step 7 of 9 : Domain creation ...
Creating Oracle WebLogic Server domain ...
Starting Oracle WebLogic Server 11g ...
Configuring data source 'OVMDS' ...
Creating Oracle VM Manager user 'admin' ...

Step 8 of 9 : Deploy ...
Deploying Oracle VM Manager Core container ...
Deploying Oracle VM Manager UI Console ...
Deploying Oracle VM Manager Help ...
Enabling HTTPS ...
Granting ovm-admin role to user 'admin' ...

Step 9 of 9 : Oracle VM Manager Shell ... Retrieving Oracle VM Manager Shell & API ... Extracting Oracle VM Manager Shell & API ... Installing Oracle VM Manager Shell & API ...

Retrieving Oracle VM Manager Upgrade tool ... Extracting Oracle VM Manager Upgrade tool ... Installing Oracle VM Manager Upgrade tool ... Copying Oracle VM Manager shell to '/usr/bin/ovm_shell.sh' ... Installing ovm_admin.sh in '/u01/app/oracle/ovm-manager-3/bin' ... Installing ovm_upgrade.sh in '/u01/app/oracle/ovm-manager-3/bin' ... Enabling Oracle VM Manager service ... Shutting down Oracle VM Manager instance ... Restarting Oracle VM Manager instance ... Waiting 15 seconds for the application to initialize ...

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Oracle VM Manager is running ... Oracle VM Manager installed.

Please wait while WebLogic configures the applications... This can take up to 5 minutes.

Installation Summary

Database configuration:

Database host name : ovmmanager

Database instance name (SID): orcl

Database listener port : 1521

Application Express port : None

Oracle VM Manager schema : ovs1

Weblogic Server configuration:

Administration username : weblogic

Oracle VM Manager configuration:

Username	: admin
Core management po	rt : 54321
UUID	: 0004fb00000100000a5c59c7f7487ffe

Passwords:

There are no default passwords for any users. The passwords to use for Oracle VM Manager, Oracle Database 11g XE, and Oracle WebLogic Server have been set by you during this installation. In the case of a default install, all the passwords are the same.

Oracle VM Manager UI:

http://ovmmanager:7001/ovm/console

https://ovmmanager:7002/ovm/console

Log in with the user 'admin', and the password you set during the installation.

Please note that you need to install tightvnc-java on this computer to access a virtual machine's console.

For more information about Oracle Virtualization, please visit:

http://www.oracle.com/virtualization/

Oracle VM Manager installation complete.

Please remove configuration file /tmp/ovm_configzFYrq_.

Post Oracle VM Manager installation, apply Oracle VM Manager 3.1.1 Patch Update (Build 365) [ID 1530546.1]. This would help in resolution of time out issues on creation of ovm 3.1.1.

Oracle VM Server Configuration Using Oracle VM Manager

Some of the important steps to configure Oracle VM environment are elaborated in the figure below.

Figure 80

Oracle VM Server Configuration and Guest VM Creation Steps



1. Discover Oracle VM Servers. We would see that the servers are listed as Unassigned Server under Servers and VMs tab.

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Figure 81 Oracle VM Servers Listed in the VM Manager

ORACLE' VM Manager				
Servers and VMs Repositories Network	ing Storage Tools a	nd Resources Jobs		
B, 10 22 at 1 4 0	View - Perspective: E	rents 💌 🛷 Acknowledge	🚯 Acknowledge	e All Display
Server Pools	Timestamp	Type	Severity	Summary
▼ Imassigned Servers Imassigned Servers Imassigned Virtual Machines	Jul 03, 2013 2:13:03 pm	InformationalEvent	Informational	Discover Server

2. Configure Oracle VM Server Network.

Figure 82	Network Configuration
I Iguic oz	Network Conniguration

ORACLE. V	M Manager							Logged in as: admin Logout H	lelp ≠
Servers and VMs	Repositories	Networking	St <u>o</u> rage NICs	Tools and I	R <u>e</u> sources	<u>J</u> obs			
	Intro Notwork		N	etwork Channe	ls				
Name	Server	Server Management	Cluster Heartbeat	Live Migrate	Storage	Virtual Machine	VLAN Segment	Description	
Private			1			1		For Oracle Interconnect	
Public		1	1			1			
Storage1					1	1		NFS storage from NetApp controller1	
Storage2					1	1		NFS storage from NetApp controller 2	_
LiveMigration				1		1		For Live migration	-
•									- • E
Columns Hidden 1									

3. Configure all the Ethernet ports of each Oracle VM Server appropriately and set the MTU size properly.

Figure 8	3		Setting	η ΜΤυ	Size						
ORACLE: VM Manager									Logge	ed in as: admin <mark>Logout</mark>	Help •
Servers and VMs Repositories Netv	vorkin	g St	rage	Tools and	Resources Jo	bs					
	1				1						
V 🖻 Server Pools	1	View -	Perspect	ive: Ethe	net Ports 💌	/		Address	sina	Bond Po	rts
V P FlexPod-OVM			Status	Name	MAC Address	MTU	Туре	IP Address	Netmask	Bond Name	Bond I
FlexPod-OVM-1		1)	Up	eth0	00:25:b5:07:0a:00	1500	None			FlexPod-OVM-1 Bond Port.	. Active
FlexPod-OVM-2	14	2)	Up	eth1	00:25:b5:07:0b:00	9000	Static	191.168.1.11	255.255.255.0		
FlexPod-OVM-3	1	3)	Up	eth2	00:25:b5:07:0b:09	9000	Static	173.76.0.15	255.255.255.0		
FlexPod-OVM-4		4)	Up	eth3	00:25:b5:07:0a:07	9000	Static	120.191.1.11	255.255.255.0		
Unassigned Vidual Machines		5)	Up	eth4	00:25:b5:07:0b:07	9000	Static	121.191.1.11	255.255.255.0		-
Chassigned virtual machines		•									•

4. Create Server Pool with the cluster LUN as the repository.

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Figure 84

Cluster Pool

Servers and VMs Repositories Network	ing Storage Tools and Resource	s Jobs		Logged in as: admin Logout Help -
Server Pools FlexPod-OVM FlexPod-OVM-1 FlexPod-OVM-2 FlexPod-OVM-3 FlexPod-OVM-4 Unassigned Servers Unassigned Virtual Machines	Server Pool Name: FlexP Server Count: Clustered: Master Server: Virtual IP: Keymap used for VM Creation:	4 Yes FlexPod-OVM-1 172.76.0.16 en-us	Secure VM Migrate: Pool File System Type: Pool File System Ownerst File Servers:	No Storage Element nip: Owned by You Local FS FlexPod-OVM-2, Local FS FlexPod-OVM-3, Local FS FlexPod-OVM-4,
	Pool File System: Unm Pool File System Storage Device: NET NFSINAS File System: ID: 0004 Description:	anaged FibreChannel Storag APP (7) 16000002000065668ac75ec	ge Array/devimapper/360a9800(6ed8c	137534332795d4366754d4834

1

Figure 85

Status of all the Servers

DRACLE: VM Manager							Logge	ed in as: admin	Logout Help -
Servers and VMs <u>R</u> epositories <u>N</u> etw	orkin	g St <u>o</u> rage	Tools and Reso	urces <u>J</u> ot)S				
B, m Pl & / A V Q 0	1	View • Persp	ective: Servers		:/X□>		Ba		
✓ [™] Server Pools		Name	Status	Utilization (%)	Maintenance Mode	IP Address	Memory (GiB)	Processors	Speed (GHz)
FlexPod-OVM-1		FlexPod-OVM-1	Running	1	Off	172.76.0.92	255.94	32	2.7
FlexPod-OVM-2	1	FlexPod-OVM-2	Running	1	Off	172.76.0.93	255.94	32	2.7
FlexPod-OVM-3		FlexPod-OVM-3	Running	0	Off	172.76.0.94	255.94	32	2.7
FlexPod-OVM-4		FlexPod-OVM-4	Running	1	Off	172.76.0.95	255.94	32	2.7
Unassigned Servers Unassigned Virtual Machines		•							
		Columns Hidder	12						
	_								

5. Create Storage Repository for each of the data LUNs configured for Oracle VM Server.

Servers and VMs Repositories Network	king St <u>o</u> rage	Tools and Resource	is Jobs	Logged in as: adm	nin Logout Help -
🖄 🖹 🖊 (🧿	View - Pers	ective: Physical Disks	• + / X 🔓 🗟 🗟		
File Servers	Name	Event Severity	Size (GiB) Server		Description
	NETAPP (1)	Normal	75.0 FlexPod-OVM-1		
V 📙 Unmanaged FibreChannel Storage Arr	NETAPP (2)	Normal	75.0 FlexPod-OVM-2	OS Boot LUN	
FibreChannel Volume Group	NETAPP (3)	Normal	75.0 FlexPod-OVM-3		
Unmanaged iSCSI Storage Array	NETAPP (4)	Normal	75.0 FlexPod-OVM-4		
Local File Systems	NETAPP (5)	Normal	850.01 FlexPod-OVM-1, Flex	Pod-OVM-2, FlexPod-OVM-3, FlexPod-OVM-4	
Shared File Systems	NETAPP (6)	Normal	850.01 FlexPod-OVM-1, Flex	Pod-OVM-2, FlexPod-OVM-3, FlexPod-OVM-4	
	 NETAPP (7) 	Normal	50.0 FlexPod-OVM-1, Flex	Pod-OVM-2, FlexPod-OVM-3, FlexPod-OVM-4	
			Cluster LUN		Guest VM OS LUN
۲					

Figure 86 Storage Repository

6. Create one Guest VM in each Oracle VM Server as elaborated in Figure 87. In accordance with Oracle recommendations, PVM Guest VMs are created. We created four Guest VMs for the Oracle RAC nodes, each one created on individual Oracle VM Server to configure four node Oracle RAC.

Figure 8	87	Guest V	Ms Detai	ls				
ORACLE: VM Manager						Logged in as:	admin <u>L</u> ogout	t Help -
Servers and VMs Repositories Network	ing	St <u>o</u> rage Tools an	d R <u>e</u> sources	Jobs				
B, 🖿 📴 🟦 🥒 🗙 🔍 🎯		View - Perspective: Virtu	ual Machines 💌			ta to 10		
V Server Pools		Name Status	Event Severity	Utilization (%)	Max. Memory (MB) Memory	(MB) Max. Process	sors Proces	Keymap C
FlexPod-OVM		ORA-Node3 Offline	Normal	0 1	102400 102400	16	16	en-us C
FlexPod-OVM-2		Configuration	+ Networks	G Disks				
FlexPod-OVM-3		Name:	ORA-Node3	Memory (MB):	102400	Boot Order:	Disk	
Insectioned Servers		Status:	Offline	Processor Cap:	100	Network Boot Path:		
Unassigned Virtual Machines		Operating System:	Oracle Linux 6	Priority:	50			
		Keymap:	en-us	Mouse Type:	Default	_		
	1	Max. Processors:	16	Domain Type:	Xen PVM	1		
		Processors:	16	High Availability:	false			
		Max. Memory (MB):	102400	Repository for Co	onfiguration File: Guest O	S A		
		ID:	0004fb00000600	003122b55e77d5c9	5e			
		Domain ID:	N/A					
		Origin:						
		Description:						
								•

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7. Ensure that Oracle RAC node VMs are configured with Private network nics, as elaborated on Figure 82, Network Configuration.

Figure 88	Guest VMs	Network	Ports

MAC Address	Network	Action
00:21:f6:a0:01:35	Public	×
00:21:f6:a0:01:19	Private	× 🛆
00:21:f6:a0:01:5f	Storage1	×
00:21:f6:a0:01:18	Storage2	×
00:21:f6:a0:01:61	LiveMigration 💌	×
Add a Virtual NIC to this Virtual Machine:		
Add a Virtual NIC to this Virtual Machine: Jnassigned VNICs: 00:21:f6:a0:01:44	Network: Storage1	Add VNIC
Add a Virtual NIC to this Virtual Machine: Unassigned VNICs: 00:21:f6:a0:01:44 Create more Virtual NICs: Create VNICs	Network: Storage1	Add VNIC

8. Guest VMs are configured with Virtual Disk for OS, Grid and DB binary installation whereas, NFS volumes from NetApp Storage are used for Databases.

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Disk Configuration for Oracle RAC Node

Slot	Disk Type		Contents	Actions	Actions	
)	Virtual Disk	-	HDD0-ORA4	Q 🕂 / 🗙		
	Empty	-				
2	Empty	-				
3	Empty	•				
1	Empty	-				
5	Empty	•				
6	Empty	•				
7	Empty	-				
3	Empty	•				
3	Empty	-				
10	Empty	-				
11	Empty					

Once the Guest VMs are created we can proceed to Installation of Oracle Linux 6.2 on each of the Guest VMs.

Oracle Linux Installation

Some of the important steps during Oracle Linux installation are:

1. Configure HTTP server location for PVM Guest OS Installation.

Figure 90 http Setup for PVM Installation



2. Ensure Text Mode is selected for PVM installation.





3. Select Virtual Disk for OS installation.

Figure 92 Selecting Virtual Disk				
Partitioning Type				
Installation requires partitioning of your hard drive. The default layout is reasonable for most users. You can either choose to use this or create your own.				
Remove all partitions on selected drives and create default layout. Remove linux partitions on selected drives and create default layout. Use free space on selected drives and create default layout. Create custom layout.				
Which drive(s) do you want to use for this installation? [*] xvda 184316 MB (Xen Virtual Block Device) ■				
OK Back				

4. Once OS is installed Reboot the VM and proceed to post installation steps.



Some of the important steps executed post Oracle Linux installation are detailed below:

- 1. Edit /etc/grub.conf file to select the RedHat comparable Kernel and reboot the Guest VM to boot the OS with RedHat kernel.
- **2.** Edit private network vNIC, Storage network vNIC and Live Migration Network vNIC of Oracle RAC nodes and set the MTU size to 9000.
- 3. Configure all the network ports of Guest VMs and provide the appropriate IP addresses.
| [root@ORA-
ethO | -Node1 ~] # ifconfig
Link encap:Ethernet HWaddr 00:21:F6:A0:01:63
inet addr:172.76.0.41 Bcast:172.76.0.255 Mask:255.255.255.0
inet6 addr: fe80::221:f6ff:fea0:163/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:27354358 errors:0 dropped:0 overruns:0 frame:0
TX packets:44433257 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:6289977984 (5.8 GiB) TX bytes:4754866600 (4.4 GiB)
Interrupt:85 |
|--------------------|---|
| eth1 | Link encap:Ethernet HWaddr 00:21:F6:A0:01:10
inet eddr:191.168.1.41 Bcast:191.168.1.255 Mask:255.255.255.0
inet6 addr: fe80::221:f6ff:fea0:110/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:9000 Metric:1
RX packets:948513900 errors:0 dropped:0 overruns:0 frame:0
TX packets:94449602 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1029334161547 (958.6 GiB) TX bytes:1045188421252 (973.4 GiB)
Interrupt:86 |
| eth2 | Link encap:Ethernet HWaddr 00:21:F6:A0:01:34
inet addr 120.191.1.41 Bcast:120.191.1.255 Mask:255.255.255.0
inet6 addr: feb0::221:f6ff:fea0:134/64 Scope:Link
UP BROADCAST RUNNING MULTICAST OTU:9000 Metric:1
RX packets:390553821 errors:0 dropped:0 overruns:0 frame:0
TX packets:148775036 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:2930572425724 (2.6 TiB) TX bytes:293642085397 (273.4 GiB)
Interrupt:87 |
| eth3 | Link encap:Ethernet HWaddr 00:21:F6:A0:01:11
inet addr 121.191.1.41 Bcast:121.191.1.255 Mask:255.255.255.0
inet6 addr: feb0::221:f6ff:fea0:111/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:9000 Metric:1
RX packets:388121188 errors:0 dropped:0 overruns:0 frame:0
TX packets:145741181 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:2893383968360 (2.6 TiB) TX bytes:297160314065 (276.7 GiB)
Interrupt:88 |
| eth4 | Link encap:Ethernet HWaddr 00:21:F6:A0:01:62
inet addr:173.77.0.41 Bcast:173.77.0.255 Mask:255.255.255.0
inet6 addr: feou:221:f6ff:fea0:162/64 Scope:Link |

Figure 94 MTU Size 9000 and IP Configured for all Ethernet Ports

Once OS installation is complete, we can proceed to the Oracle Grid install in next section.

Oracle Database 11g Release 2 Grid Infrastructure with RAC Option Deployment

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This section describes high level steps for Oracle Database 11g Release 2 RAC install. Prior to Grid and database install, verify all the prerequisites are completed. You can install Oracle validated RPM that will ensure most of the OS prerequisites are met before Oracle Grid install. We will not cover

step-by-step install for Oracle Grid in this document but will provide partial summary of details that is relevant. As a best practice recommended from Oracle, ready-to-go Oracle VM Templates for Oracle RAC can be downloaded from Oracle Software Delivery Cloud for faster deployment

Use the following Oracle document for pre-installation tasks, such as setting up the kernel parameters, RPM packages, user creation, and so on.

(http://download.oracle.com/docs/cd/E11882_01/install.112/e10812/prelinux.htm#BABHJHCJ)

1. Create required oracle users and groups in each Oracle RAC nodes.

groupadd -g 1000 oinstall groupadd -g 1200 dba useradd –u 2000 –g oinstall –G dba grid passwd grid useradd -u 1100 -g oinstall -G dba oracle passwd oracle

2. We created following local directory structure and ownerships on each RAC nodes

mkdir -p /u01/app/11.2.0/grid mkdir -p /u01/app/oracle mkdir /oltp_data_A mkdir /oltp_data_B mkdir /dss_data_B mkdir /dss_data_B mkdir /oltp_log_A mkdir /oltp_log_B mkdir /dss_log_A mkdir /dss_log_B mkdir /ocrvote

chown -R oracle:oinstall /u01/app/oracle / oltp_data_A /oltp_data_B /dss_data_A /dss_data_B /oltp_log_A /oltp_log_B /dss_log_A /dss_log_B

chmod -R 775 /u01/app/oracle / oltp_data_A /oltp_data_B /dss_data_A /dss_data_B /oltp_log_A /oltp_log_B /dss_log_A /dss_log_B

chown -R grid:oinstall /u01/app /ocrvote

chmod -R 775 /u01/app /ocrvote

In this test case, we used local directory for Grid Installation and Database binary Installation. As an alternate. these binaries can be installed in a shared directory on NFS volumes.

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Following table summarizes NFS Volumes mapping with mount points for each Oracle RAC node.

Local Directory	NetApp NFS Volumes	Owner	Purpose
/u01/app/11.2.0/grid	NA	grid	Oracle Grid binary installation
/u01/app/oracle	NA	oracle	Oracle Database binary installation
/oltp_data_A	/vol/OVM_OLTP_Data_A	oracle	OLTP Datafiles and control files
/oltp_data_B	/vol/OVM_OLTP_Data_B	oracle	OLTP Datafiles and control files
/oltp_log_A	/vol/OVM_OLTP_LOG_A	oracle	Redo log files for OLTP DB
/oltp_log_B	/vol/OVM_OLTP_LOG_B	oracle	Redo log files for OLTP DB
/dss_data_A	/vol/OVM_DSS_Data_A	oracle	DSS datafiles and control files
/dss_data_B	/vol/OVM_DSS_Data_B	oracle	DSS datafiles and control files
/dss_log_A	/vol/OVM_DSS_LOG_A	oracle	Redo log files for DSS DB
/dss_log_B	/vol/OVM_DSS_LOG_B	oracle	Redo log files for DSS DB
/ocrvote	/vol/ocrvote	grid	OCR and voting disks

 Table 5
 Local Mount Points and NetApp NFS volumes.

3. Edit /etc/fstab file in each Oracle RAC node and add mount points for all database and Grid NFS volumes with the appropriate mount options. Please note that these mount points need to be created first.

<pre>StorageA-1:/vol/FlexPod_OVM_OCR /ocrvote</pre>	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	00
Storagel-1:/vol/OVM_OLTP_Data_l /oltp_data_l	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	0 0
Storagel-1:/vol/OVM_OLTP_LOG_l /oltp_log_l	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	0 0
StorageB-2:/vol/OVM_OLTP_Data_B_/oltp_data_B	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	0 0
StorageB-2:/vol/OVM_OLTP_LOG_B /oltp_log_B	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	0 0
Storagel-1:/vol/OWW DSS Data) /dss data)	nfs	ru ha hard reize=65536 ueize=65536 uere=3 actimen=0 nointr suid timen=600 ton	0.0
Storages 11/ vor/ vvi bbb baca x / abb aaca x	HL0	1, , , , , , , , , , , , , , , , , , ,	
StorageA-1:/vol/OVM_DSS_LOG_A /dss_log_A	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	00
StorageB-2:/vol/OVM_DSS_Data_B_/dss_data_B	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	00
StorageB-2:/vol/OVM_DSS_LOG_B /dss_log_B	nfs	rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,suid,timeo=600,tcp	00

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Note Oracle Direct NFS (dNFS) configuration steps will need to be performed at a later stage after database creation.

Here is sample output from mount command on Node 1:

[root@orarac1 ~]# mount

StorageA-1:/vol/FlexPod_OVM_OCR on /ocrvote type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageA-1:/vol/OVM_OLTP_Data_A on /oltp_log_A type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageA-1:/vol/OVM_OLTP_LOG_A on /oltp_log_A type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageB-2:/vol/OVM_OLTP_Data_B on /oltp_data_B type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=121.191.1.6) StorageB-2:/vol/OVM_OLTP_LOG_B on /oltp_log_B type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=121.191.1.6) StorageA-1:/vol/OVM_OLTP_LOG_B on /oltp_log_B type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageA-1:/vol/OVM_DSS_Data_A on /dss_data_A type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageA-1:/vol/OVM_DSS_Data_A on /dss_data_A type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageA-1:/vol/OVM_DSS_LOG_A on /dss_log_A type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageB-2:/vol/OVM_DSS_Data_B on /dss_log_A type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=120.191.1.5) StorageB-2:/vol/OVM_DSS_LOG_B on /dss_log_B type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=121.191.1.6) StorageB-2:/vol/OVM_DSS_LOG_B on /dss_log_B type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=121.191.1.6) StorageB-2:/vol/OVM_DSS_LOG_B on /dss_log_B type nfs (rw,bg,hard,rsize=65536,wsize=65536,vers=3,actimeo=0,nointr,timeo=600,tcp,addr=121.191.1.6)

To determine the proper mount options for different file systems of Oracle 11g Release 2, see:

https://kb.netapp.com/support/index?page=content&id=3010189&actp=search&viewlocale=en_U S&searchid



- **Note** An rsize and wsize of 65536 is supported by NFS v3 and used in this configuration to improve performance.
- 4. Configure the private and public NICs with the appropriate IP addresses.
- 5. Identify the virtual IP addresses and SCAN IPs and have them setup in DNS as per Oracle's recommendation, see: Oracle Real Application Clusters Overview of SCAN (PDF). Alternatively, you can update the /etc/hosts file with all the details (private, public, SCAN and virtual IP) if you do not have DNS services available.
- 6. Create files for OCR and voting devices under /ocrvote local directories as follows.

Login as "grid" user from any one node and create the following raw files

dd if=/dev/zero of=/ocrvote/ocr/ocr1 bs=1m count=1024

dd if=/dev/zero of=/ocrvote/ocr/ocr2 bs=1m count=1024

dd if=/dev/zero of=/ocrvote/ocr/ocr3 bs=1m count=1024

dd if=/dev/zero of=/ocrvote/vote1 bs=1m count=1024

dd if=/dev/zero of=/ocrvote/vote/vote2 bs=1m count=1024

dd if=/dev/zero of=/ocrvote/vote3 bs=1m count=1024

7. Configure ssh option (with no password) for the Oracle user and grid user. For more information about ssh configuration, refer to the Oracle installation documentation.

Note

Oracle Universal Installer also offers automatic SSH connectivity configuration and testing.

 Configure "/etc/sysctl.conf" and update shared memory and semaphore parameters required for Oracle Grid Installation. Also configure "/etc/security/limits.conf" file by adding user limits for oracle and grid users.



You generally do not have to perform these steps if Oracle Validated RPM is installed.

9. Configure hugepages.

Hugepages is a method to have larger page size that is useful for working with very large memory. For Oracle Databases, using HugePages reduces the operating system maintenance of page states, and increases Translation Lookaside Buffer (TLB) hit ratio.

Advantages of HugePages

- HugePages are not swappable so there is no page-in/page-out mechanism overhead.
- Hugepage uses fewer pages to cover the physical address space, so the size of "book keeping" (mapping from the virtual to the physical address) decreases, so it requiring fewer entries in the TLB and so TLB hit ratio improves.
- Hugepages reduces page table overhead.
- Eliminated page table lookup overhead: Since the pages are not subject to replacement, page table lookups are not required.
- Faster overall memory performance: On virtual memory systems each memory operation is actually two abstract memory operations. Since there are fewer pages to work on, the possible bottleneck on page table access is clearly avoided.

For our configuration, we used hugepages for both OLTP and DSS workloads. Please refer to Oracle metalink document 361323.1 for hugepages configuration details.

Once hugepages are configured, You are now ready to install Oracle Grid Infrastructure and the Oracle Database 11g Release 2 including Oracle RAC.

Installing Oracle RAC 11g Release 2

It is not within the scope of this document to include the specifics of an Oracle RAC installation; you should refer to the Oracle installation documentation for specific installation instructions for your Environment. For best practices recommended by Oracle. See:

- www.oracle.com/technetwork/products/clusterware/overview/interconnect-vlan-06072012-1657506. pdf
- www.oracle.com/technetwork/products/clustering/oracle-rac-in-oracle-vm-environment-131948.pdf

To install Oracle, follow these steps:

- 1. Download the Oracle Database 11g Release 2 Grid Infrastructure (11.2.0.3.0) and Oracle Database 11g Release 2 (11.2.0.3.0) for Linux x86-64.
- **2.** For this configuration, we used NFS shared volumes for OCR and voting disks for Oracle Grid Infrastructure install.



Figure 95Oracle Grid Infrastructure - Selecting Configuration Option

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Figure 96

Oracle Grid Infrastructure - Grid Plug and Play

0	Oracle Grid Infrastructure - Setting up Grid Infrastructure - Step 2 of 11			
Grid Plug and Play Informa	ation			
Configuration Option Grid Plug and Play Cluster Node Information Network Interface Usage Storage Option OCR Storage Voting Disk Storage Prerequisite Checks Summary Install Product Finish	Single Client Ac the cluster as a Cluster Name: SCAN Name: SCAN Port: Configure Cl GNS Sub Dor CNS <u>VI</u> P Add	Construction of the second sec		
Help		< <u>§</u> ack <u>N</u> ext > [install Cancel		

	Figure 97	Oracle Grid Iı	nfrastructu	ıre - Network I	nterface
0	racle Grid Infrastructure - S	Setting up Grid Infrastructu	re - Step 3 of 11		
Cluster Node Information					11 ^g
Configuration Option	Provide the list of nodes Virtual Hostname. If Oracle Grid Naming Sei is automatically configur	to be managed by Oracle (rvice (GNS) has been selec ed for each Public Node.	Grid Infrastructure red and DHCP is e	e with their Public Hostnar nabled, then the Virtual H	me and ostname
Υ	Public	Hostname		Virtual Hostname	
<u>Network Interface Usage</u>	orarac1.cisco.com		orarac1-vip.cise	co.com	
Storage Option	orarac2.cisco.com		orarac2-vip.cis	o.com	
OCP Storage	orarac3.cisco.com		orarac3-vip.cis	co.com	
OCK Storage	orarac4.cisco.com		orarac4-vip.cise	co.com	
Summary Install Product	SSH <u>C</u> onnectivity	Use Clus	ter Configuration	File	Remove
	OS Username: oracle		OS Password:	*******	
	User home is shared	by the selected nodes			
	Reuse private and pu	iblic <u>K</u> eys existing in the u	ser home	Test	Setup
Help			< <u>B</u> ack	Next > Install	Cancel

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3. Make sure you click the Shared File System radio button if you are using NFS volumes for OCR and voting files.

	Figure 98	Oracle Grid In	frastructure	- Setting Storage Opt
	Oracle Grid Infrastructu	are - Setting up Grid Infrastruc	ture - Step 5 of 11	
Storage Option Informati	on			ORACLE 11g
Configuration Option Grid Plug and Play Cluster Node Information Network Interface Usage Storage Option OCR Storage Prerequisite Checks Summary Install Product Finish	You can place Oracli file system. Oracle <u>A</u> utomati Choose this opt <u>S</u> hared File Syste Choose this opt	le Cluster Registry (OCR) files ic Storage Management (Orac ition to configure OCR and vo em ition to configure OCR and vo	and voting disk files le ASM) ting disk files on Ora ting disk files on an e	on Oracle ASM storage, or on a ccle ASM storage. existing shared file system.
Help			< <u>B</u> ack	Next > Install Cancel

Figure 99

Oracle Grid Infrastructure - Setting OCR Storage Option

1

	Oracle Grid Infrastructure - Setting up Grid Infrastructure - Step 6 of 11	
OCR Storage Option		11 ^g
Configuration Option Grid Plug and Play Cluster Node Information Network Interface Usage	Oracle Cluster Registry (OCR) files store cluster and database configuration information. S locations on shared Cluster File System (CFS) partitions that have an identical path on all n cluster with at least 256 MB of available space. Ormal Redundancy OCR File Location	elect OCR odes of the
OCR Storage		DTOMOG
Voting Disk Storage	/ocrvote/ocr/ocr2	Browse
Prerequisite Checks	/ocrvote/ocr/ocr3	Browse
Summary Install Product Finish	© External Redundancy OCR File Location /ocrvote/ocr/ocr	Browse
Help	< <u>Back</u> <u>N</u> ext > Install	Cancel

Figure 100 Oracle Grid Infrastructure - Setting Voting Disk Storage Option

Voting Disk Storage Opti	Oracle Grid Infrastructure - Setting up Grid Infrastructure - Step 7 of 11
Configuration Option Grid Plug and Play Cluster Node Information Network Interface Usage Storage Option	Oracle Grid Infrastructure voting disk files contain cluster membership information. If a network failu occurs, then voting disks determine cluster ownership among cluster nodes. Select voting disk locations on shared Cluster File System (CFS) partitions that have an identical path on all nodes of the cluster, and with at least 256 MB of available space. Onrmal Redundancy <u>Voting Disk File Location</u>
OCR Storage	/ocrvote/vote1 Browse
Voting Disk Storage	/ocrvote/vote2 Browse
Prerequisite Checks Summary Install Product Finish	/ocrvote/vote3 Brogse External Redundancy Use external redundancy with storage devices such as RAID, or other similar devices that provid their own data protection mechanisms.
	Voting Disk File Location /ocrvote/storage/vdsk. Browse
Help	<back next=""> Install Canc</back>

Figure 101

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1 Oracle Grid Infrastructure - Performance Prerequisite Checks

	Dracle Grid Infrastructure - Setting up Grid Infrastructure - Step 9 of 12		a 📋
Perform Prerequisite Chec		ACLE 11	g
Configuration Option Grid Plug and Play Cluster Node Information Network Interface Usage Storage Option OCR Storage Voting Disk Storage Failure Isolation Prerequisite Checks Summary Install Product Finish	DAT Some of the minimum requirements for installation are not completed. Review a in the following table, and recheck the system. Check Again Eix & Check Again Show Failed All Nodes Checks Checks Checks Task resolv.conf Integrity	ABASE Ind fix the issues liste	ed able
Help	This task verifies cluster time synchronization on clusters that use Network Tim details) Check Failed on Nodes: [orarac4, orarac3, orarac2, orarac1]	e Protocol (NTP). (mr	ore

Figure 102

cture - Setting un Grid Infra ORACLE 118 Summary -Oracle Grid Infrastructure Global Settings -Install Option: Configure Oracle Grid Infrastructure for a Cluster -Oracle base for Oracle Grid Infrastructure: /oracle/admin/GRID -Grid home: /oracle/product/grid_home -Privileged Operating System Groups: dba (OSDBA), dba (OSOPER), dba (OSASM) Grid Infrastructure Settings Cluster Name: flexpod -Local Node: orarac1 -Remote Nodes: orarac2.orarac3.orarac4 Prerequisite Checks Single Client Access Name (SCAN): flexpod-scan.cisco.com Summary SCAN Port: 1521 Public Interfaces: eth0 -Private Interfaces: eth1 -Storage Information -Storage Type: Shared File OCR Redundancy: Normal Redundancy OCR Location: /ocrvote/ocr/ocr1 -OCR Location: /ocrvote/ocr/ocr2 -OCR Location: /ocrvote/ocr/ocr3 Voting Disk Redundancy: Normal Redundancy Voting Disk Location: /ocrvote/vote/vote1.dbf Voting Disk Location: /ocrvote/vote/vote2.dbf -Voting Disk Location: /ocrvote/vote/vote3.dbf Save Response File... Install Cancel Help <<u>Back</u> Next

Oracle Grid Infrastructure - Summary

- 4. Click **Install** and complete remaining steps such as executing root.sh on all the nodes. Once install is complete, you can verify install via "crsctl check cluster –all" command. For a sample crsctl command output, see "Appendix B: Verify Oracle RAC Cluster Status Command Output" section on page 146.
- 5. Once Oracle Grid install is complete, install Oracle Database 11g Release 2 Database "Software Only"; do not create the database after Oracle Database binary installation as oracle user. Real Application Clusters Installation Guide for Linux and UNIX for detailed installation instructions, see:

http://www.oracle.com/pls/db112/to_toc?pathname=install.112/e10813/toc.htm

6. Run the dbca tool as oracle user to create OLTP and DSS databases. Ensure to place the datafiles, redo logs and control files in proper directory paths as created in above steps. We will discuss additional details about OLTP and DSS schema creation in workload section.

Table 6 shows the configuration of OLTP and DSS Databases:

Table 6 Configuration Details of OLTP and DSS Databases

Database Configuration	OLTP	DSS
SGA_max_size	48 GB	32 GB
SGA_target	48 GB	32 GB

Database Configuration	OLTP	DSS
PGA_aggregate_target	5 GB	5 GB
DB_Name	OLTPORCL	dssorcl
Swingbech Schema	soe	sh
Swingbench Schema Tablespace	soe	sh
Swingbench Schema datafiles (even) location	/oltp_data_A	/dss_data_A
Swingbench Schema datafiles (odd) location	/oltp_data_B	/dss_data_B
Redo log file location (even file)	/oltp_log_A	/dss_log_A
Redo log file location (odd file)	/oltp_log_B	/dss_log_B
Size of Database	1.8 TB	1 TB

Table 6 Configuration Details of OLTP and DSS Databases

7. Configure Direct NFS client.

For improved NFS performance, Oracle recommends using the Direct NFS Client shipped with Oracle 11g. The direct NFS client looks for NFS details in the following locations:

- \$ORACLE_HOME/dbs/oranfstab
- /etc/oranfstab
- /etc/mtab

In RAC configuration with Direct NFS, the oranfstab must be configured on all the nodes. Here is oranfstab configuration from RAC node 1.

[oracle@orarac1 dbs]\$ vi oranfstab

server: 120.191.1.5

path: 120.191.1.5

path: 121.191.1.5

server: 121.191.1.6

path: 121.191.1.6

path: 120.191.1.6

export:/ocrvote mount:/vol/FlexPod_OVM_OCR

export:/oltp_data_A mount:/vol/OVM_OLTP_Data_A

export:/oltp_log_A mount:/vol/OVM_OLTP_Data_A

export:/oltp_data_B mount:/vol/OVM_OLTP_Data_B

export:/oltp_log_B mount:/vol/OVM_OLTP_LOG_B

export:/dss_data_A mount:/vol/OVM_DSS_Data_A

export:/dss_log_A mount:/vol/OVM_DSS_LOG_A

 $export:/dss_data_B\ mount:/vol/OVM_DSS_Data_B$

export:/dss_log_B mount:/vol/OVM_DSS_LOG_B

Since the NFS mount point details were defined in the "/etc/fstab", and therefore the "/etc/mtab" file also, there is no need to configure any extra connection details. When setting up your NFS mounts, reference the Oracle documentation for guidance on what types of data can/cannot be accessed via Direct NFS Client. For the client to work we need to switch the libodm11.so library for the libnfsodm11.so library, as shown below.

srvctl stop database -d OLTPORCL

srvctl stop database -d dssorcl

cd \$ORACLE_HOME/lib

mv libodm11.so libodm11.so_stub

ln -s libnfsodm11.so libodm11.so

srvctl start database -d OLTPORCL

srvctl start database -d dssorcl



For 11.2, DNFS can also be enabled via "make -f ins_rdbms.mk dnfs_on" command.

With the configuration complete, you can see the direct NFS client usage via the following views:

- v\$dnfs_servers
- v\$dnfs_files
- v\$dnfs_channels
- v\$dnfs_stats

Here is an example from OLTP database configuration

SQL> select SVRNAME, DIRNAME from v\$DNFS_SERVERS;

SVRNAME DIRNAME

StorageA-1 /vol/OVM_OLTP_Data_A

StorageB-2 /vol/OVM_OLTP_Data_B

StorageA-1 /vol/OVM_OLTP_LOG_A

StorageB-2 /vol/OVM_OLTP_LOG_B



The Direct NFS Client supports direct I/O and asynchronous I/O by default.

Workloads and Database Configuration

We used Swingbench for workload testing. Swingbench is simple to use, free, Java based tool to generate database workload and perform stress testing using different benchmarks in Oracle database environments. Swingbench provides four separate benchmarks, namely, Order Entry, Sales History, Calling Circle, and Stress Test. For the tests described in this paper, Swingbench Order Entry benchmark was used for OLTP workload testing and the Sales History benchmark was used for the DSS workload testing. The Order Entry benchmark is based on SOE schema and is similar to TPC-C by types of transactions. The workload uses a very balanced read/write ratio around 60/40 and can be designed to run continuously and test the performance of a typical Order Entry workload against a small set of tables, producing contention for database resources. The Sales History benchmark is based on the SH schema and is TPC-H kind. The workload is query (read) centric and is designed to test the performance of the queries against large tables.

As discussed in previous section, two independent databases were created earlier for Oracle Swingbench OLTP and DSS workloads. Next step is to pre create the order entry and sales history schema for OLTP and DSS workload. Swingbench Order Entry (OLTP) workload uses SOE tablespace and Sales History workload uses SH tablespaces. We pre created these schemas in order to associate multiple datafiles with tablespaces and also evenly distributing them across two storage controllers. For our setup, we created 90 datafiles for SOE tablespace with odd number files for storage controller A and even number of files for storage controller B. In the same way, we used 50 datafiles for Sales history workload and evenly distributed them across both the storage controllers. Once schema for workloads was created, we populated both databases with Swingbench datagenerator as shown below.

OLTP Database

The OLTP database was populated with the following data:

[oracle@orarac1 ~]\$ sqlplus soe/soe

SQL*Plus: Release 11.2.0.3.0 Production on Wed Mar 27 12:02:01 2013

Copyright (c) 1982, 2011, Oracle. All rights reserved.

Connected to:

Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production

With the Partitioning, Real Application Clusters, Oracle Label Security, OLAP,

Data Mining, Oracle Database Vault and Real Application Testing options

SQL> select table_name, num_rows from user_tables;

TABLE_NAME	NUM_ROWS
CUSTOMERS	230000000
WAREHOUSES	1000
ORDER_ITEMS	7762397098
ORDERS	2822094567
INVENTORIES	900524

PRODUCT_INFORMA	1000	
LOGON	1283813440	
PRODUCT_DESCRIPTIONS		1000
ORDERENTRY_META	ADATA	4

DSS (Sales History) Database

The DSS database was populated with the following data:

[oracle@orarac1 ~]\$ sqlplus sh/sh SQL*Plus: Release 11.2.0.3.0 Production on Wed Mar 27 12:11:45 2013 Copyright (c) 1982, 2011, Oracle. All rights reserved. Connected to: Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production With the Partitioning Real Application Clusters Oracle Label Security OL Al

With the Partitioning, Real Application Clusters, Oracle Label Security, OLAP, Data Mining, Oracle Database Vault and Real Application Testing options

SQL> select table_name, num_rows from user_tables;

TABLE_NAME	NUM_ROW	'S
CHANNELS	5	
COUNTRIES	23	
CUSTOMERS	130000000	
PROMOTIONS	503	
PRODUCTS	72	
SUPPLEMENTARY	_DEMOGRAPHICS	130000000
SALES	650000000	
TIMES	6209	

As typically encountered in the real world deployments, we tested scalability and stress related scenarios that ran on current 4-node Oracle RAC cluster configuration.

- 1. OLTP user scalability and OLTP cluster scalability representing small and random transactions
- 2. DSS workload representing larger transactions
- 3. Mixed workload featuring OLTP and DSS workloads running simultaneously for 24 hours

Performance Data from the Tests

Once the databases were created, we started out with OLTP database calibration about number of users and database configuration. For Order Entry workload, we used 48GB SGA and ensured that the hugepages were in use. Each OLTP scalability test was run for at least 12 hours and we ensured that the results are consistent for the duration of full run.

OLTP Workload

For OLTP workloads, the common measurement metrics are Transactions Per Minute (TPM), users scalability with IOPs and CPU utilization. Here are the scalability charts for Order Entry workload.



Figure 103 OLTP Transactions

For OLTP TPM tests, we ran tests with 50, 100, 200 and 400 users across 4-node cluster. During tests, we validated that Oracle SCAN listener fairly and evenly distributed the load balanced users across all the 4 nodes of the cluster. We also observed appropriate scalability in TPMs as number or users across clusters increased. Next graph shows increased IO and scalability as number of users across increased.



Figure 104 OLTP IOPs and Scalability

As indicated in the graph, we observed about 26850 IO/Sec across 4-node cluster. The Oracle AWR report below also summarizes Physical Reads/Sec and Physical Writes/Sec per instance. During OLTP tests, we observed some resource utilization variations due to random nature of the workload as depicted by 200 users IOPs. We ran each test multiple times to ensure consistent numbers that are presented in this solution.

System	Statistics	-	Per	Second	DB/Inst:	FLEXPOD /flexpod1	Snaps:	255- 257		
I#	Logical Reads/s	Physical Reads/s	Physical Writes/s	Redo Size(k)/s	Block Changes /s	User Calls/s	Execs/s	Par ses/ s	Log ons/ s	Txns/s
1	165,035.03	3,804.50	2,885.90	5,156.40	35,784.9 0	1,658.30	15,233.80	1.8	0.07	2,399.60
2	150,835.48	3,900.10	2,452.50	5,006.70	31,686.4 0	1,447.00	14,262.70	1.7	0.07	2,231.30
3	145,783.24	4,030.00	2,565.50	4,662.30	31,335.8 0	1,532.20	14,116.70	1.7	0.07	2,209.10
4	160,397.02	3,808.00	2,650.00	5,092.60	35,615.3 0	1,614.20	13,862.00	1.8	0.08	2,482.90
~~~	~~~~~		างการการการการการการการการการการการการการก	กมกมกมกมกมกม กมกมกมกม	ณณณณณณ ณณณณณ	ณณณณณณณณ ณณณณ	ามาระการเกมาระ	~~~~		~~~~
Sum	622,050.77	15,542.6 0	10,553.90	19,918.0 0	134,422. 4	6,251.70	57,475.2	7.00	0.29	93,22.90
Avg	155,512.69	3,885.65	2,638.475	4,979.5	33,605.6 0	1,562.925	14,368.80	1.75	0.07	2,330.73

The table below shows interconnect traffic for the 4-node Oracle RAC cluster during 400 user run. The average interconnect traffic was 215 MB/Sec for the duration of the run.

1

Interconnect Traffic	Sent (MB/s) Total	Received (MB/s) Total
Instance 1	55.5	56.1
Instance 2	54.2	51.1
Instance 3	52.5	50.6
Instance 4	55.4	56.3
Total MB/Sec	217.6	214.1

The chart below indicates cluster CPU utilization as the number of users scale from 12 users/node to 100 users/node.



#### Figure 105 CPU Utilization

### **DSS Workload**

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DSS workloads are generally sequential in nature, read intensive and exercise large IO size. DSS workloads run a small number of users that typically exercise extremely complex queries that run for hours. For our tests, we ran Swingbench Sales history workload with 12 users. The charts below show DSS workload results.



For 24 hour DSS workload test, we observed total IO bandwidth ranging between 1.5 GBytes/Sec and 1.7 GBytes/Sec. As indicated on the charts, the IO was also evenly distributed across both NetApp FAS storage controllers and we did not observe any significant dips in performance and IO bandwidth for a sustained period of time.

### **Mixed Workload**

Next test is to run both OLTP and DSS workloads simultaneously. This test will ensure that configuration in this test is able to sustain small random queries presented via OLTP along with large and sequential transactions submitted via DSS workload. We ran the tests for 24 hours. Here are the results.



Figure 107 Mixed Workload - I/O Bandwidth

For mixed workloads running for 24 hours, we observed approximately 1.4 GBytes/Sec. IO bandwidth. The OLTP transactions also averaged between 220K and 230K transactions per minute.

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# **Destructive and Hardware failover Tests**

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The goal of these tests is to ensure that reference architecture withstands commonly occurring failures either due to unexpected crashes, hardware failures or human errors. We conducted many hardware, software (process kills) and OS specific failures that simulate real world scenarios under stress conditions. In the destructive testing, we also demonstrate unique failover capabilities of Cisco VIC 1240 adapter. We have highlighted some of those test cases as below.

Scenario	Test	Status
Test 1 – Chassis 1-	Run the system on full mixed work load.	Network Traffic from
IOM2 Link Failure	Disconnect the private links from first chassis and	IOM2 will failover
test	reconnect the links after 5 minutes.	without any disruption
		to IOM1.
Test 2 – UCS 6248	Run the system on full load as above.	Fabric failovers did not
Fabric-B Failure	Reboot Fabric B, let it join the cluster back and	cause any disruption to
test	then Reboot Fabric A.	Private and Storage
		traffic.
Test 3 – Nexus	Run the system on full mixed work load.	No disruption to the
5548 Fabric-A	Reboot the Nexus5548 Fabric-A Switch, wait for 5	Public and Storage
Failure test	minutes, connect it back and repeat for	Traffic
	Nexus5548 Fabric-B Switch.	

#### Figure 109

Flexpod Test Details

## FlexPod Testing



## Conclusion

FlexPod is built on leading computing, networking, storage, and infrastructure software components. With Flexpod based solution, customers can leverage a secure, integrated, and optimized stack that includes compute, network and storage resources that are sized, configured and deployed as a fully tested unit running industry standard applications such as Oracle Database 11g RAC over D-NFS (Direct NFS). The following factors make the combination of Cisco UCS with NetApp storage so powerful for Oracle environments:

- Cisco UCS stateless computing architecture provided by the Service Profile capability of UCS allows for fast, non-disruptive workload changes to be executed simply and seamlessly across the integrated UCS infrastructure and Cisco x86 servers.
- Cisco UCS combined with a highly scalable NAS platform from NetApp provides the ideal combination for Oracle's unique, scalable, and highly available NFS technology.
- All of this is made possible by Cisco's Unified Fabric with its focus on secure IP networks as the standard interconnect for the server and data management solutions.

The availability of Oracle VM overcomes this obstacle. Providing software based virtualization infrastructure (Oracle VM) and the market leading high availability solution Oracle Real Application Clusters (RAC), Oracle now offers a highly available, grid-ready virtualization solution for your data center, combining all the benefits of a fully virtualized environment. The combination of Oracle VM and Oracle RAC enables a better server consolidation (RAC databases with under utilized CPU resources or

peaky CPU utilization can often benefit from consolidation with other workloads using server virtualization) sub-capacity licensing, and rapid provisioning. Following are the major advantages of using Oracle RAC on Oracle VM.

- Server Consolidation
- Sub-Capacity Licensing
- Create Virtual Cluster
- Rapid Provisioning

As a result, customers can achieve dramatic cost savings when leveraging Ethernet based products plus deploy any application on a scalable Shared IT infrastructure built on Cisco and NetApp technologies. Finally, FlexPodTM, jointly developed by NetApp and Cisco, is a flexible infrastructure platform composed of pre-sized storage, networking, and server components. It's designed to ease your IT transformation and operational challenges with maximum efficiency and minimal risk.

FlexPod differs from other solutions by providing:

- Integrated, validated technologies from industry leaders and top-tier software partners.
- A single platform, built from unified compute, fabric, and storage technologies, that lets you scale to large-scale data centers without architectural changes.
- Centralized, simplified management of infrastructure resources, including end-to-end automation.
- A choice of validated FlexPod management solutions from trusted partners who work through our open APIs
- A flexible cooperative support model that resolves issues rapidly and spans across new and legacy products.

## Appendix

### Appendix A: Nexus 5548UP Configuration

Here is an example shows Nexus 5548 Fabric Zoning Configuration for all the Oracle RAC Servers. Login Nexus 5548 through .ssh and issue the following:

#### **Nexus 5548 Fabric A Configuration**

!Command: show running-config!Time: Sun Jun 23 14:15:49 2013

version 5.2(1)N1(5) feature fcoe logging level feature-mgr 0 hostname FlexPod-OVM-N5K-A feature npiv feature telnet cfs ipv4 distribute cfs eth distribute feature interface-vlan feature lacp feature vpc feature lldp username admin password 5 \$1\$vpEkx23F\$z6XbIT42vQBg7a7UNQfwt0 role network-admin

banner motd #Nexus 5000 Switch

class-map type qos class-fcoe

#### #

ip domain-lookup

class-map type queuing class-fcoe match qos-group 1 class-map type queuing class-all-flood match qos-group 2 class-map type queuing class-ip-multicast match qos-group 2 class-map type network-qos class-fcoe match qos-group 1 class-map type network-qos class-all-flood match qos-group 2 class-map type network-qos class-ip-multicast match qos-group 2 policy-map type network-qos jumbo class type network-qos class-fcoe pause no-drop mtu 2158 class type network-qos class-default mtu 9216 multicast-optimize system qos service-policy type network-qos jumbo service-policy type queuing input fcoe-default-in-policy service-policy type queuing output fcoe-default-out-policy service-policy type qos input fcoe-default-in-policy policy-map type control-plane copp-system-policy-customized

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class copp-system-class-default

police cir 2048 kbps bc 6400000 bytes

snmp-server user admin network-admin auth md5 0x3b4a509acab94035eeca94b761a50cba priv 0x3b4a509acab94035eeca94b761a50cba localizedkey

vrf context management

ip route 0.0.0.0/0 10.65.121.1 vlan 1,10 vlan 101 fcoe vsan 101 vlan 120 name Storage1 vlan 121 name Storage2 vlan 191 name private vlan 760 name public vlan 761 name vmotion spanning-tree port type edge bpduguard default spanning-tree port type network default port-channel load-balance ethernet source-dest-port vpc domain 1 peer-keepalive destination 10.65.121.95 source 10.65.121.94 auto-recovery port-profile default max-ports 512 vsan database vsan 101 device-alias database device-alias name Storage-FlexPod-A-5a pwwn 50:0a:09:85:9d:93:40:7f device-alias name Storage-FlexPod-B-5a pwwn 50:0a:09:85:8d:93:40:7f device-alias name OVM-Host-FlexPod-01-A pwwn 20:00:00:25:b5:01:0a:00 device-alias name OVM-Host-FlexPod-02-A pwwn 20:00:00:25:b5:01:0a:01 device-alias name OVM-Host-FlexPod-03-A pwwn 20:00:00:25:b5:01:0a:02 device-alias name OVM-Host-FlexPod-04-A pwwn 20:00:00:25:b5:01:0a:03 device-alias commit

fcdomain fcid database

vsan 101 wwn 21:2f:54:7f:ee:56:ca:3e fcid 0xad0000 dynamic vsan 101 wwn 50:0a:09:85:9d:93:40:7f fcid 0xad0001 dynamic 1 [Storage-FlexPod-A-5a] vsan 101 wwn 50:0a:09:85:8d:93:40:7f fcid 0xad0002 dynamic ! [Storage-FlexPod-B-5a] vsan 101 wwn 20:00:00:25:b5:01:0a:00 fcid 0xad0003 dynamic ! [OVM-Host-FlexPod-01-A] vsan 101 wwn 21:7c:54:7f:ee:56:ca:3e fcid 0xad0004 dynamic vsan 101 wwn 20:00:00:25:b5:01:0a:01 fcid 0xad0005 dynamic ! [OVM-Host-FlexPod-02-A] vsan 101 wwn 20:00:00:25:b5:01:0a:02 fcid 0xad0006 dynamic [OVM-Host-FlexPod-03-A] ! vsan 101 wwn 20:00:00:25:b5:01:0a:03 fcid 0xad0007 dynamic ! [OVM-Host-FlexPod-04-A] vsan 101 wwn 22:56:54:7f:ee:56:ca:3e fcid 0xad0020 dynamic vsan 101 wwn 22:57:54:7f:ee:56:ca:3e fcid 0xad0040 dynamic

interface Vlan1

interface Vlan120 no shutdown ip address 120.191.1.1/24

interface Vlan121 no shutdown ip address 121.191.1.2/24

interface Vlan760 no shutdown ip address 172.76.0.5/24

interface port-channel1 description VPC peer port-channel switchport mode trunk switchport trunk allowed vlan 120-121,191,760-761 spanning-tree port type network vpc peer-link

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interface port-channel3 description netApp storage A, port e5A switchport mode trunk switchport trunk allowed vlan 101,120-121 spanning-tree port type edge trunk vpc 3

interface port-channel4 description netApp storage B, port e5A switchport mode trunk switchport trunk allowed vlan 101,120-121 spanning-tree port type edge trunk vpc 4

interface port-channel33 switchport mode trunk spanning-tree port type edge trunk vpc 33

interface port-channel34 switchport mode trunk spanning-tree port type edge trunk vpc 34

interface port-channel35 description FlexPod-OVM-A:FCoE switchport mode trunk spanning-tree port type edge trunk

interface vfc3 bind interface Ethernet1/3 switchport trunk allowed vsan 101 switchport description NetApp_StorageA:5a no shutdown

interface vfc4 bind interface Ethernet1/4

I

switchport trunk allowed vsan 101 switchport description NetApp_StorageB:5a no shutdown

interface vfc35 bind interface port-channel35 switchport trunk allowed vsan 101 switchport description FlexPod-OVM-A:FCoE no shutdown vsan database vsan 101 interface vfc3 vsan 101 interface vfc4 vsan 101 interface vfc35

interface Ethernet1/1 description N5K-Interconnect switchport mode trunk switchport trunk allowed vlan 120-121,191,760-761 channel-group 1 mode active

interface Ethernet1/2 description N5K-Interconnect switchport mode trunk switchport trunk allowed vlan 120-121,191,760-761 channel-group 1 mode active

interface Ethernet1/3 description NetApp-A:e5a switchport mode trunk switchport trunk allowed vlan 101,120-121 channel-group 3

interface Ethernet1/4 description NetApp-B:e5a switchport mode trunk switchport trunk allowed vlan 101,120-121 channel-group 4

interface Ethernet1/5 description FI-A:31 switchport mode trunk spanning-tree port type edge trunk channel-group 33 mode active

interface Ethernet1/6 description FI-B:31 switchport mode trunk spanning-tree port type edge trunk channel-group 34 mode active

interface Ethernet1/7

interface Ethernet1/8

interface Ethernet1/9

interface Ethernet1/10

interface Ethernet1/11

interface Ethernet1/12

interface Ethernet1/13

interface Ethernet1/14

interface Ethernet1/15 description uplink to 3750:eth1/1/23 switchport mode trunk switchport trunk allowed vlan 760 speed 1000

interface Ethernet1/16

interface Ethernet1/17 switchport mode trunk

I

channel-group 35 mode active interface Ethernet1/18 switchport mode trunk channel-group 35 mode active interface Ethernet1/19 description FI-A:e2/4 shutdown switchport mode trunk switchport trunk native vlan 4049 switchport trunk allowed vlan 16,20,101-102,4048-4049 interface Ethernet1/20 interface Ethernet1/21 interface Ethernet1/22 interface Ethernet1/23 interface Ethernet1/24 interface Ethernet1/25 interface Ethernet1/26 interface Ethernet1/27 interface Ethernet1/28 interface Ethernet1/29 interface Ethernet1/30 interface Ethernet1/31 interface Ethernet1/32

interface mgmt0 ip address 10.65.121.94/24 line console line vty boot kickstart bootflash:/n5000-uk9-kickstart.5.2.1.N1.5.bin boot system bootflash:/n5000-uk9.5.2.1.N1.5.bin logging logfile mylogfile 7 !Full Zone Database Section for vsan 101 zone name OVM-Host-FlexPod-01-A vsan 101 member pwwn 20:00:00:25:b5:01:0a:00 ! [OVM-Host-FlexPod-01-A] member pwwn 50:0a:09:85:9d:93:40:7f 1 [Storage-FlexPod-A-5a] member pwwn 50:0a:09:85:8d:93:40:7f ! [Storage-FlexPod-B-5a] zone name OVM-Host-FlexPod-02-A vsan 101 member pwwn 20:00:00:25:b5:01:0a:01 ! [OVM-Host-FlexPod-02-A] member pwwn 50:0a:09:85:9d:93:40:7f ! [Storage-FlexPod-A-5a] member pwwn 50:0a:09:85:8d:93:40:7f [Storage-FlexPod-B-5a] ! zone name OVM-Host-FlexPod-03-A vsan 101 member pwwn 20:00:00:25:b5:01:0a:02 1 [OVM-Host-FlexPod-03-A] member pwwn 50:0a:09:85:9d:93:40:7f ! [Storage-FlexPod-A-5a] member pwwn 50:0a:09:85:8d:93:40:7f [Storage-FlexPod-B-5a] ! zone name OVM-Host-FlexPod-04-A vsan 101 member pwwn 20:00:00:25:b5:01:0a:03 ! [OVM-Host-FlexPod-04-A] member pwwn 50:0a:09:85:9d:93:40:7f ! [Storage-FlexPod-A-5a] member pwwn 50:0a:09:85:8d:93:40:7f

[Storage-FlexPod-B-5a]

zoneset name FlexPod-OVM vsan 101 member OVM-Host-FlexPod-01-A member OVM-Host-FlexPod-02-A member OVM-Host-FlexPod-03-A member OVM-Host-FlexPod-04-A zoneset activate name FlexPod-OVM vsan 101

### **Nexus 5548 Fabric B Configuration**

!

!Command: show running-config !Time: Wed Oct 16 14:01:45 2013 version 5.2(1)N1(5) feature fcoe logging level feature-mgr 0 hostname FlexPod-OVM-N5K-B feature npiv feature telnet cfs ipv4 distribute cfs eth distribute cfs eth distribute feature interface-vlan feature interface-vlan feature lacp feature vpc feature lldp username admin password 5 \$1\$IFnIMBVR\$n9AfQk9MyjzKf8SG.QE8v. role network-admin

banner motd #Nexus 5000 Switch

#### #

ip domain-lookup class-map type qos class-fcoe class-map type queuing class-fcoe match qos-group 1 class-map type queuing class-all-flood match qos-group 2 class-map type queuing class-ip-multicast

match qos-group 2

class-map type network-qos class-fcoe

match qos-group 1

class-map type network-qos class-all-flood

match qos-group 2

class-map type network-qos class-ip-multicast

match qos-group 2

policy-map type network-qos jumbo

class type network-qos class-fcoe

pause no-drop

mtu 2158

class type network-qos class-default

mtu 9216

multicast-optimize

system qos

service-policy type network-qos jumbo

service-policy type queuing input fcoe-default-in-policy

service-policy type queuing output fcoe-default-out-policy

service-policy type qos input fcoe-default-in-policy

policy-map type control-plane copp-system-policy-customized

class copp-system-class-default

police cir 2048 kbps bc 6400000 bytes

snmp-server user admin network-admin auth md5 0x67460926462d8f2665a0523b8647a042 priv 0x67460926462d8f2665a0523b8647a042 localizedkey

vrf context management

ip route 0.0.0.0/0 10.65.121.1

vlan 1

vlan 102

fcoe vsan 102

vlan 120

name Storage1

vlan 121

name Storage2

vlan 191

name private

vlan 760

name public

vlan 761 name vmotion spanning-tree port type edge bpduguard default spanning-tree port type network default port-channel load-balance ethernet source-dest-port vpc domain 1 peer-keepalive destination 10.65.121.94 source 10.65.121.95 auto-recovery port-profile default max-ports 512 vsan database vsan 102 device-alias database device-alias name Storage-FlexPod-A-5b pwwn 50:0a:09:86:9d:93:40:7f device-alias name Storage-FlexPod-B-5b pwwn 50:0a:09:86:8d:93:40:7f device-alias name OVM-Host-FlexPod-01-B pwwn 20:00:00:25:b5:01:0b:00 device-alias name OVM-Host-FlexPod-02-B pwwn 20:00:00:25:b5:01:0b:01 device-alias name OVM-Host-FlexPod-03-B pwwn 20:00:00:25:b5:01:0b:02 device-alias name OVM-Host-FlexPod-04-B pwwn 20:00:00:25:b5:01:0b:03 device-alias commit fcdomain fcid database vsan 102 wwn 21:30:54:7f:ee:56:c8:3e fcid 0xdf0000 dynamic vsan 102 wwn 50:0a:09:86:9d:93:40:7f fcid 0xdf0001 dynamic

! [Storage-FlexPod-A-5b]

vsan 102 wwn 50:0a:09:86:8d:93:40:7f fcid 0xdf0002 dynamic

[Storage-FlexPod-B-5b]

!

vsan 102 wwn 20:00:00:25:b5:01:0b:00 fcid 0xdf0003 dynamic

! [OVM-Host-FlexPod-01-B]

vsan 102 wwn 21:7d:54:7f:ee:56:c8:3e fcid 0xdf0004 dynamic vsan 102 wwn 20:00:00:25:b5:01:0b:01 fcid 0xdf0005 dynamic

! [OVM-Host-FlexPod-02-B]

vsan 102 wwn 20:00:00:25:b5:01:0b:02 fcid 0xdf0006 dynamic

! [OVM-Host-FlexPod-03-B]

vsan 102 wwn 20:00:00:25:b5:01:0b:03 fcid 0xdf0007 dynamic

! [OVM-Host-FlexPod-04-B]

vsan 102 wwn 22:58:54:7f:ee:56:c8:3e fcid 0xdf0020 dynamic

interface Vlan1

interface Vlan120 no shutdown ip address 120.191.1.2/24

interface Vlan121 no shutdown ip address 121.191.1.1/24

interface port-channel1 description vpc peer port-channel switchport mode trunk switchport trunk allowed vlan 120-121,191,760-761 spanning-tree port type network vpc peer-link

interface port-channel3 description netApp storage A, port e5B switchport mode trunk switchport trunk allowed vlan 102,120-121 spanning-tree port type edge trunk vpc 3 interface port-channel4 description netApp storage B, port e5B switchport mode trunk switchport trunk allowed vlan 102,120-121 spanning-tree port type edge trunk vpc 4

interface port-channel33 switchport mode trunk spanning-tree port type edge trunk vpc 33

interface port-channel34 switchport mode trunk spanning-tree port type edge trunk

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#### vpc 34

interface port-channel35 description FlexPod-OVM-B:FCoE switchport mode trunk spanning-tree port type edge trunk

interface vfc3

bind interface Ethernet1/3 switchport trunk allowed vsan 102 switchport description NetApp_StorageA:5b no shutdown

interface vfc4

bind interface Ethernet1/4 switchport trunk allowed vsan 102 switchport description NetApp_StorageB:5b no shutdown

interface vfc35 bind interface port-channel35 switchport trunk allowed vsan 102 switchport description FlexPod-OVM-B:FCoE no shutdown vsan database vsan 102 interface vfc3 vsan 102 interface vfc4 vsan 102 interface vfc4 vsan 102 interface vfc35 interface Ethernet1/1 description N5K-Interconnect switchport mode trunk switchport trunk allowed vlan 120-121,191,760-761 channel-group 1 mode active

interface Ethernet1/2 description N5K-Interconnect switchport mode trunk switchport trunk allowed vlan 120-121,191,760-761

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channel-group 1 mode active

interface Ethernet1/3

description NetApp-A:e5b switchport mode trunk switchport trunk allowed vlan 102,120-121 channel-group 3

interface Ethernet1/4 description NetApp-B:e5b switchport mode trunk switchport trunk allowed vlan 102,120-121 channel-group 4

interface Ethernet1/5 description FI-A:32 switchport mode trunk spanning-tree port type edge trunk channel-group 33 mode active

interface Ethernet1/6 description FI-B:32 switchport mode trunk spanning-tree port type edge trunk channel-group 34 mode active

interface Ethernet1/7

interface Ethernet1/8

interface Ethernet1/9

interface Ethernet1/10

interface Ethernet1/13

interface Ethernet1/14

I

interface Ethernet1/15 description uplink 3750:eth1/1/24 switchport mode trunk switchport trunk allowed vlan 760 spanning-tree port type edge trunk speed 1000

interface Ethernet1/16

interface Ethernet1/17 switchport mode trunk channel-group 35 mode active

interface Ethernet1/18 switchport mode trunk channel-group 35 mode active

interface Ethernet1/19 description FI-B:e2/4 shutdown switchport mode trunk switchport trunk native vlan 4049 switchport trunk allowed vlan 16,20,101-102,4048-4049

interface Ethernet1/20

interface Ethernet1/21

interface Ethernet1/22

interface Ethernet1/23

interface Ethernet1/24

interface Ethernet1/25

interface Ethernet1/26 interface Ethernet1/27

FlexPod Data Center with Oracle RAC on Oracle VM
```
interface Ethernet1/28
interface Ethernet1/29
interface Ethernet1/30
interface Ethernet1/31
interface Ethernet1/32
interface mgmt0
ip address 10.65.121.95/24
line console
line vty
boot kickstart bootflash:/n5000-uk9-kickstart.5.2.1.N1.5.bin
boot system bootflash:/n5000-uk9.5.2.1.N1.5.bin
logging logfile mylogfile 7
!Full Zone Database Section for vsan 102
zone name OVM-Host-FlexPod-01-B vsan 102
  member pwwn 20:00:00:25:b5:01:0b:00
!
         [OVM-Host-FlexPod-01-B]
  member pwwn 50:0a:09:86:9d:93:40:7f
!
         [Storage-FlexPod-A-5b]
  member pwwn 50:0a:09:86:8d:93:40:7f
!
         [Storage-FlexPod-B-5b]
zone name OVM-Host-FlexPod-02-B vsan 102
  member pwwn 20:00:00:25:b5:01:0b:01
!
         [OVM-Host-FlexPod-02-B]
  member pwwn 50:0a:09:86:9d:93:40:7f
!
         [Storage-FlexPod-A-5b]
  member pwwn 50:0a:09:86:8d:93:40:7f
!
         [Storage-FlexPod-B-5b]
zone name OVM-Host-FlexPod-03-B vsan 102
  member pwwn 20:00:00:25:b5:01:0b:02
         [OVM-Host-FlexPod-03-B]
!
```

member pwwn 50:0a:09:86:9d:93:40:7f ! [Storage-FlexPod-A-5b] member pwwn 50:0a:09:86:8d:93:40:7f 1 [Storage-FlexPod-B-5b] zone name OVM-Host-FlexPod-03-B vsan 102 member pwwn 20:00:00:25:b5:01:0b:02 ! [OVM-Host-FlexPod-03-B] member pwwn 50:0a:09:86:9d:93:40:7f ! [Storage-FlexPod-A-5b] member pwwn 50:0a:09:86:8d:93:40:7f ! [Storage-FlexPod-B-5b] zone name OVM-Host-FlexPod-04-B vsan 102 member pwwn 20:00:00:25:b5:01:0b:03 ! [OVM-Host-FlexPod-04-B] member pwwn 50:0a:09:86:9d:93:40:7f ! [Storage-FlexPod-A-5b] member pwwn 50:0a:09:86:8d:93:40:7f ! [Storage-FlexPod-B-5b]

zoneset name FlexPod-OVM vsan 102 member OVM-Host-FlexPod-01-B member OVM-Host-FlexPod-02-B member OVM-Host-FlexPod-03-B member OVM-Host-FlexPod-04-B

zoneset activate name FlexPod-OVM vsan 102

# **Appendix B: Verify Oracle RAC Cluster Status Command Output**

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NAME TARGET STATE SERVER STATE_DETAILS _____ Local Resources _____ ora.LISTENER.lsnr ONLINE ONLINE orarac1 ONLINE ONLINE orarac2 ONLINE ONLINE orarac3 ONLINE ONLINE orarac4 ora.gsd OFFLINE OFFLINE orarac1 **OFFLINE OFFLINE** orarac2 OFFLINE OFFLINE orarac3 **OFFLINE OFFLINE** orarac4 ora.net1.network ONLINE ONLINE orarac1 ONLINE ONLINE orarac2 ONLINE ONLINE orarac3 ONLINE ONLINE orarac4 ora.ons ONLINE ONLINE orarac1

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	ONLINE ONLINE	orarac2	
	ONLINE ONLINE	orarac3	
	ONLINE ONLINE	orarac4	
Cluster R	Resources		
ora.LIST	ENER_SCAN1.lsnr		
1	ONLINE ONLINE	orarac2	
ora.cvu			
1	ONLINE ONLINE	orarac2	
ora.oc4j			
1	ONLINE ONLINE	orarac2	
ora.orara	c1.vip		
1	ONLINE ONLINE	orarac1	
ora.orara	c2.vip		
1	ONLINE ONLINE	orarac2	
ora.orara	c3.vip		
1	ONLINE ONLINE	orarac3	
ora.orara	c4.vip		
1	ONLINE ONLINE	orarac4	
ora.scan1	l.vip		
1	ONLINE ONLINE	orarac2	

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[root@orarac4 etc]# /oracle/product/grid_home/bin/ocrcheck
Status of Oracle Cluster Registry is as follows :

Version : 3	
Total space (kbytes) : 2	62120
Used space (kbytes) :	2776
Available space (kbytes) :	259344
ID : 12598045	530
Device/File Name : /oc	rvote/ocr/ocr1
Device/File	e integrity check succeeded
Device/File Name : /oc	rvote/ocr/ocr2
Device/File	e integrity check succeeded
Device/File Name : /oc	rvote/ocr/ocr3
Device/File	e integrity check succeeded

Device/File not configured

Device/File not configured

Cluster registry integrity check succeeded

Logical corruption check succeeded

[root@orarac4 etc]# /oracle/product/grid_home/bin/crsctl query css votedisk
## STATE File Universal Id File Name Disk group
-- ----1. ONLINE a875a4c1879b4f61bf544b2d0cda92b0 (/ocrvote/vote/vote1) []
2. ONLINE 38abe170624c4f22bf7282de03573233 (/ocrvote/vote/vote2) []
3. ONLINE 3895853059f14f4fbfd8ffc2e2be770b (/ocrvote/vote/vote3) []
Located 3 voting disk(s).

Performing post-checks for cluster services setup

Checking node reachability...

 Check: Node reachability from node "orarac4"

 Destination Node
 Reachable?

 ------ ------ 

 orarac1
 yes

 orarac2
 yes

 orarac3
 yes

Result: Node reachability check passed from node "orarac4"

Checking user equivalence...

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Check: User equivalence for user "oracle"

Node Name	Status	
orarac4	passed	
orarac3	passed	

orarac2 passed orarac1 passed Result: User equivalence check passed for user "oracle"

Checking node connectivity...

Checking hosts config file...

Status	
passed	
passed	
passed	
passed	
	Status passed passed passed passed passed

## Verification of the hosts config file successful

### Interface information for node "orarac4"

Name	IP Address	Subnet	Gateway	Def. Gateway	HW Address	MTU
eth0	10.29.134.104	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:10	1500
eth0	10.29.134.114	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:10	1500
eth1	192.168.134.10	4 192.168.134	4.0 0.0.0.0	10.29.134.1	00:25:B5:11:13:	0F 9000
eth1	169.254.131.14	2 169.254.0.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0	F 9000
eth2	10.10.20.104	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0E	9000
eth3	10.10.20.204	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0D	9000

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#### Interface information for node "orarac3"

Name	IP Address	Subnet	Gateway	Def. Gateway	HW Address	MTU
eth0	10.29.134.103	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0	C 1500
eth0	10.29.134.113	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0	C 1500
eth1	192.168.134.10	3 192.168.134	4.0 0.0.0.0	10.29.134.1	00:25:B5:11:13	:0B 9000
eth1	169.254.56.29	169.254.0.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0	B 9000
eth2	10.10.20.103	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:0A	9000
eth3	10.10.20.203	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:09	9000

Interface information for node "orarac2"

eth010.29.134.10210.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth010.29.134.11210.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth010.29.134.13010.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth1192.168.134.102192.168.134.00.0.0.010.29.134.100:25:B5:11:13:079000eth1169.254.64.204169.254.0.00.0.0.010.29.134.100:25:B5:11:13:079000eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:069000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:059000	Name	IP Address	Subnet	Gateway	Def. Gateway	HW Address	MTU
eth010.29.134.10210.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth010.29.134.11210.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth010.29.134.13010.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth1192.168.134.102192.168.134.00.0.0.010.29.134.100:25:B5:11:13:079000eth1169.254.64.204169.254.0.00.0.0.010.29.134.100:25:B5:11:13:079000eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:069000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:059000							
eth010.29.134.11210.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth010.29.134.13010.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth1192.168.134.102192.168.134.00.0.0.010.29.134.100:25:B5:11:13:079000eth1169.254.64.204169.254.0.00.0.0.010.29.134.100:25:B5:11:13:079000eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:069000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:059000	eth0	10.29.134.102	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:08	1500
eth010.29.134.13010.29.134.00.0.0.010.29.134.100:25:B5:11:13:081500eth1192.168.134.102192.168.134.00.0.0.010.29.134.100:25:B5:11:13:079000eth1169.254.64.204169.254.0.00.0.0.010.29.134.100:25:B5:11:13:079000eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:069000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:059000	eth0	10.29.134.112	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:08	1500
eth1192.168.134.102192.168.134.00.0.0.010.29.134.100:25:B5:11:13:079000eth1169.254.64.204169.254.0.00.0.0.010.29.134.100:25:B5:11:13:079000eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:069000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:059000	eth0	10.29.134.130	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:08	1500
eth1169.254.64.204169.254.0.00.0.0.010.29.134.100:25:B5:11:13:079000eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:069000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:059000	eth1	192.168.134.10	2 192.168.134	4.0 0.0.0.0	10.29.134.1	00:25:B5:11:13:	07 9000
eth210.10.20.10210.10.20.00.0.0.010.29.134.100:25:B5:11:13:06 9000eth310.10.20.20210.10.20.00.0.0.010.29.134.100:25:B5:11:13:05 9000	eth1	169.254.64.204	169.254.0.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:07	7 9000
eth3 10.10.20.202 10.10.20.0 0.0.0.0 10.29.134.1 00:25:B5:11:13:05 9000	eth2	10.10.20.102	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:06 9	9000
	eth3	10.10.20.202	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:05 9	9000

Interface information for node "orarac1"

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Name	IP Address	Subnet	Gateway	Def. Gateway	HW Address	MTU
eth0	10.29.134.101	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:04	1500
eth0	10.29.134.111	10.29.134.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:04	1500
eth1	192.168.134.10	1 192.168.134	4.0 0.0.0.0	10.29.134.1	00:25:B5:11:13:	03 9000
eth1	169.254.152.69	169.254.0.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:03	8 9000
eth2	10.10.20.101	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:02 9	9000
eth3	10.10.20.201	10.10.20.0	0.0.0.0	10.29.134.1	00:25:B5:11:13:01 9	9000

# Check: Node connectivity for interface "eth0"

Source	Destination	Connected?	
orarac4[10.29.134.104]	] orarac4[10.29.134	.114] ye	s
orarac4[10.29.134.104]	] orarac3[10.29.134	.103] ye	s
orarac4[10.29.134.104]	] orarac3[10.29.134	.113] ye	s
orarac4[10.29.134.104]	] orarac2[10.29.134	.102] ye	s
orarac4[10.29.134.104]	] orarac2[10.29.134	.112] ye	s
orarac4[10.29.134.104]	] orarac2[10.29.134	.130] ye	es
orarac4[10.29.134.104]	] orarac1[10.29.134	.101] ye	es
orarac4[10.29.134.104]	] orarac1[10.29.134	.111] ye	es
orarac4[10.29.134.114]	] orarac3[10.29.134	.103] ye	es
orarac4[10.29.134.114]	] orarac3[10.29.134	.113] ye	es
orarac4[10.29.134.114]	] orarac2[10.29.134	.102] ye	es
orarac4[10.29.134.114]	] orarac2[10.29.134	.112] ye	es
orarac4[10.29.134.114]	] orarac2[10.29.134	.130] ye	es

orarac4[10.29.134.114]	orarac1[10.29.134.101]	yes
orarac4[10.29.134.114]	orarac1[10.29.134.111]	yes
orarac3[10.29.134.103]	orarac3[10.29.134.113]	yes
orarac3[10.29.134.103]	orarac2[10.29.134.102]	yes
orarac3[10.29.134.103]	orarac2[10.29.134.112]	yes
orarac3[10.29.134.103]	orarac2[10.29.134.130]	yes
orarac3[10.29.134.103]	orarac1[10.29.134.101]	yes
orarac3[10.29.134.103]	orarac1[10.29.134.111]	yes
orarac3[10.29.134.113]	orarac2[10.29.134.102]	yes
orarac3[10.29.134.113]	orarac2[10.29.134.112]	yes
orarac3[10.29.134.113]	orarac2[10.29.134.130]	yes
orarac3[10.29.134.113]	orarac1[10.29.134.101]	yes
orarac3[10.29.134.113]	orarac1[10.29.134.111]	yes
orarac2[10.29.134.102]	orarac2[10.29.134.112]	yes
orarac2[10.29.134.102]	orarac2[10.29.134.130]	yes
orarac2[10.29.134.102]	orarac1[10.29.134.101]	yes
orarac2[10.29.134.102]	orarac1[10.29.134.111]	yes
orarac2[10.29.134.112]	orarac2[10.29.134.130]	yes
orarac2[10.29.134.112]	orarac1[10.29.134.101]	yes
orarac2[10.29.134.112]	orarac1[10.29.134.111]	yes
orarac2[10.29.134.130]	orarac1[10.29.134.101]	yes
orarac2[10.29.134.130]	orarac1[10.29.134.111]	yes
orarac1[10.29.134.101]	orarac1[10.29.134.111]	yes

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Result: Node connectivity passed for interface "eth0"

Check: TCP connectivity of subnet "10.29.134.0"

Source	Destination	Connected?
orarac4:10.29.134.104	orarac4:10.29.134	.114 passed
orarac4:10.29.134.104	orarac3:10.29.134	.103 passed
orarac4:10.29.134.104	orarac3:10.29.134	.113 passed
orarac4:10.29.134.104	orarac2:10.29.134	.102 passed
orarac4:10.29.134.104	orarac2:10.29.134	.112 passed
orarac4:10.29.134.104	orarac2:10.29.134	.130 passed
orarac4:10.29.134.104	orarac1:10.29.134	.101 passed
orarac4:10.29.134.104	orarac1:10.29.134	.111 passed

Result: TCP connectivity check passed for subnet "10.29.134.0"

Check: Node connectivity for interface "eth1"

Source	e	Destina	tion	Connected?	
orarac	 4[192 168 134 1	041	orarac3[192 168	134 1031	ves
orarac	4[192.168.134.1	.04]	orarac2[192.168.	.134.102]	yes
orarac	4[192.168.134.1	04]	orarac1[192.168.	.134.101]	yes
orarac	3[192.168.134.1	03]	orarac2[192.168.	134.102]	yes
orarac	3[192.168.134.1	03]	orarac1[192.168.	134.101]	yes
orarac	2[192.168.134.1	02]	orarac1[192.168.	134.101]	yes
Result:	Node connectivi	ity passed	l for interface "e	th1"	

Check: TCP connectivity of subnet "192.168.134.0"

Source	Dest	tination	Connected	1?
orarac4:192.168.	134.104	orarac3:19	2.168.134.103	passed
orarac4:192.168.	134.104	orarac2:19	2.168.134.102	passed
orarac4:192.168.	134.104	orarac1:19	2.168.134.101	passed
Result: TCP conn	ectivity che	ck passed for	subnet "192.168.	134.0"

Checking subnet mask consistency...

Subnet mask consistency check passed for subnet "10.29.134.0". Subnet mask consistency check passed for subnet "192.168.134.0". Subnet mask consistency check passed.

Result: Node connectivity check passed

Checking multicast communication...

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Checking subnet "10.29.134.0" for multicast communication with multicast group "230.0.1.0"... Check of subnet "10.29.134.0" for multicast communication with multicast group "230.0.1.0" passed.

Checking subnet "192.168.134.0" for multicast communication with multicast group "230.0.1.0"... Check of subnet "192.168.134.0" for multicast communication with multicast group "230.0.1.0" passed. Check of multicast communication passed. Check: Time zone consistency Result: Time zone consistency check passed

Checking OCR device "/ocrvote/ocr/ocr2" for sharedness...

OCR device "/ocrvote/ocr/ocr2" is shared...

Checking size of the OCR location "/ocrvote/ocr/ocr2" ...

Size check for OCR location "/ocrvote/ocr/ocr2" successful... Check for compatible storage device for OCR location "/ocrvote/ocr/ocr3"...

Check for compatible storage device for OCR location "/ocrvote/ocr/ocr3" is successful...

Checking OCR device "/ocrvote/ocr/ocr3" for sharedness...

OCR device "/ocrvote/ocr/ocr3" is shared...

Checking size of the OCR location "/ocrvote/ocr/ocr3" ...

Size check for OCR location "/ocrvote/ocr/ocr3" successful...

This check does not verify the integrity of the OCR contents. Execute 'ocrcheck' as a privileged user to verify the contents of OCR.

OCR integrity check passed Checking CRS integrity... Clusterware version consistency passed The Oracle Clusterware is healthy on node "orarac4" The Oracle Clusterware is healthy on node "orarac3" The Oracle Clusterware is healthy on node "orarac2" The Oracle Clusterware is healthy on node "orarac1"

CRS integrity check passed

Node Nar	ne Required	Rur	nning?	Comment
orarac4	yes	yes	passed	1
orarac3	yes	yes	passed	1
orarac2	yes	yes	passed	1
orarac1	yes	yes	passed	1
VIP node a	pplication check	passed		

Checking node application existence...

Checking existence of VIP node application (required)

Checking existence of NETWORK node application (required)

Node Nam	ne Required	Ru	inning?	Comment
orarac4	yes	yes	passed	
orarac3	yes	yes	passed	
orarac2	yes	yes	passed	
orarac1	yes	yes	passed	

NETWORK node application check passed

### Checking existence of GSD node application (optional)

Node Nam	ne Required		Running?	Comment
orarac4	no	no	exists	
orarac3	no	no	exists	
orarac2	no	no	exists	
orarac1	no	no	exists	

GSD node application is offline on nodes "orarac4, orarac3, orarac2, orarac1"

Checking exist	ence of ONS	node application (optional)	
Node Name	Required	Running?	С

Node Nan	ne Required	Runn	ning?	Comment
orarac4	no	yes	passed	
orarac3	no	yes	passed	
orarac2	no	yes	passed	
orarac1	no	yes	passed	

ONS node application check passed

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Checking Single Client Access Name (SCAN)						
SCAN Name	Node	Running?	ListenerNam	e Port	Running	?
flexpod-scan.cis	co.com ora	rac2 true	LISTENE	R_SCAN1	1521	true
Checking TCP co	nnectivity t	o SCAN Lister	ners			
Node Liste	enerName	ТСР со	nnectivity?			
orarac4 LIST	FENER_SC	AN1 ye	es			
TCP connectivity	to SCAN L	isteners exists	on all cluster r	nodes		
Checking name resolution setup for "flexpod-scan.cisco.com"						
ERROR:						
PRVG-1101 : SC	AN name "f	lexpod-scan.ci	sco.com" faile	d to resolve	e	
SCAN Name	IP Address	Statu	18	Comment		
flexpod-scan.cis	co.com 10.	29.134.130	failed	 N	IS Entry	
ERROR:						
PRVF-4657 : Nan 10.29.134.130) fa	ne resolutio iled	n setup check	for "flexpod-sc	an.cisco.co	om" (IP add	lress:
ERROR:						

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PRVF-4664 : Found inconsistent name resolution entries for SCAN name "flexpod-scan.cisco.com"

Verification of SCAN VIP and Listener setup failed

Checking OLR integrity...

Checking OLR config file...

OLR config file check successful

Checking OLR file attributes...

OLR file check successful

This check does not verify the integrity of the OLR contents. Execute 'ocrcheck -local' as a privileged user to verify the contents of OLR.

OLR integrity check passed

Checking to Ensure user "oracle" is not in "root" group

	Node Name	e Status	Comment
	orarac4	passed	does not exist
	orarac3	passed	does not exist
	orarac2	passed	does not exist
	orarac1	passed	does not exist
]	Result: User	"oracle" is not part	of "root" group. Check passed

Checking if Clusterware is installed on all nodes... Check of Clusterware install passed

Checking if CTSS Resource is running on all nodes...

Check: CTSS Resource running on all nodes

Node Name	Status	
orarac4	passed	
orarac3	passed	
orarac2	passed	
orarac1	passed	

Result: CTSS resource check passed

Querying CTSS for time offset on all nodes... Result: Query of CTSS for time offset passed

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orarac1 Active
CTSS is in Active state. Proceeding with check of clock time offsets on all nodes...
Reference Time Offset Limit: 1000.0 msecs
Check: Reference Time Offset
Node Name Time Offset Status
------orarac4 0.0 passed

orarac3	0.0	passed
orarac2	0.0	passed
orarac1	0.0	passed

Time offset is within the specified limits on the following set of nodes:

"[orarac4, orarac3, orarac2, orarac1]"

Result: Check of clock time offsets passed

Oracle Cluster Time Synchronization Services check passed

Checking VIP configuration.

Checking VIP Subnet configuration.

Check for VIP Subnet configuration passed.

Checking VIP reachability

Check for VIP reachability passed.

Post-check for cluster services setup was unsuccessful on all the nodes.< - This is because of resolv.conf and scan not getting resolved through DNS

# References

- Cisco UCS: http://www.cisco.com/en/US/netsol/ns944/index.html
- NetApp Data Storage Systems: http://www.netapp.com/us/products/storage-systems/
- Cisco Nexus: http://www.cisco.com/en/US/products/ps9441/Products_Sub_Category_Home.html
- Cisco Nexus 5000 Series NX-OS Software Configuration Guide:

http://www.cisco.com/en/US/docs/switches/datacenter/nexus5000/sw/configuration/guide/cli/CLI ConfigurationGuide.html

• FCoE Boot - FlexPod Data ONTAP Operating in 7-Mode Deployment Guide:

http://www.cisco.com/en/US/docs/unified_computing/ucs/UCS_CVDs/esxi51_ucsm2_7modedepl oy.html#wp517210

- NetApp TR-3298: RAID-DP: NetApp Implementation of RAID Double Parity for Data Protection: http://www.netapp.com/us/library/technical-reports/tr-3298.html
- Oracle Real Application Clusters (RAC) and Oracle Clusterware Interconnect Virtual Local Area Networks (VLANs) Deployment:

http://www.oracle.com/technetwork/products/clusterware/overview/interconnect-vlan-06072012-1 657506.pdf

- Oracle Real Application Clusters in Oracle VM Environments:
- http://www.oracle.com/technetwork/products/clustering/oracle-rac-in-oracle-vm-environment-13194 8.pdf
- Oracle Single Client Access Name (SCAN):

http://www.oracle.com/technetwork/products/clustering/overview/scan-129069.pdf

References

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