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FlashStack Datacenter with Oracle 21c RAC Databases on Cisco UCS X-Series, Pure Storage with NVMe/FC

Design and Deployment Guide

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Published: July 2024



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About the Cisco Validated Design Program

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Executive Summary

The IT industry has been transforming rapidly to converged infrastructure, which enables faster provisioning, scalability, lower data center costs, simpler management infrastructure with technology advancement. There is a current industry trend for pre-engineered solutions which standardize the data center infrastructure and offers operational efficiencies and agility to address enterprise applications and IT services. This standardized data center needs to be seamless instead of siloed when spanning multiple sites, delivering a uniform network and storage experience to the compute systems and end users accessing these data centers.

The FlashStack solution provides best of breed technology from Cisco Unified Computing System (Cisco UCS) and Pure Storage to gain the benefits that converged infrastructure brings to the table. FlashStack solution provides the advantage of having the compute, storage, and network stack integrated with the programmability of the the Cisco Unified Computing System. Cisco Validated Designs (CVDs) consist of systems and solutions that are designed, tested, and documented to facilitate and improve customer deployments.

This Cisco Validated Design (CVD) describes a FlashStack reference architecture for deploying an end-to-end 100Gbps network for deploying highly available Oracle Multitenant RAC 21c Databases environment using NVMe/FC on Pure Storage FlashArray//XL170 using Cisco Unified Computing System X-Series, Cisco Fabric Interconnect Switches, Cisco Nexus Switches, Cisco MDS Switches and Red Hat Enterprise Linux into a Datacenter platform with the ability to monitor and manage components from the cloud using Cisco Intersight.

By moving the management from the fabric interconnects into the cloud, the solution can respond to the speed and scale of your deployments with a constant stream of new capabilities delivered from Cisco Intersight software-as-a-service model at cloud-scale. For those that require management within a secure datacenter, Cisco Intersight is also offered as an on-site appliance with both connected and internet disconnected options.

Solution Overview

This chapter contains the following:

- Introduction
- Audience
- Purpose of this Document
- What's New in this Release?
- FlashStack System Overview
- Key Elements of a Datacenter FlashStack Solution
- Solution Summary
- <u>Physical Topology</u>
- Design Topology

Introduction

The Cisco Unified Computing System X-Series (Cisco UCSX) with Intersight Managed Mode (IMM) is a modular compute system, configured and managed from the cloud. It is designed to meet the needs of modern applications and to improve operational efficiency, agility, and scale through an adaptable, future-ready, modular design. The Cisco Intersight platform is a Software-as-a-Service (SaaS) infrastructure lifecycle management platform that delivers simplified configuration, deployment, maintenance, and support.

Powered by the Cisco Intersight cloud-operations platform, the Cisco UCS X-Series enables the next-generation cloud-operated FlashStack infrastructure that not only simplifies data-center management but also allows the infra-structure to adapt to the unpredictable needs of modern applications as well as traditional workloads.

This CVD describes how the Cisco UCS X-Series can be used in conjunction with Pure Storage FlashArray//XL170 systems to implement a mission-critical application such as an Oracle 21c RAC databases solution using modern SANs on NVMe over Fabrics (NVMe over Fibre-Channel or NVMe/FC).

Audience

The intended audience for this document includes, but is not limited to customers, field consultants, database administrators, IT architects, Oracle database architects, and sales engineers who want to deploy Oracle RAC 21c database solution on FlashStack Converged Infrastructure with Pure Storage and the Cisco UCS X-Series platform using Intersight Managed Mode (IMM) to deliver IT efficiency and enable IT innovation. A working knowledge of Oracle RAC Database, Linux, Storage technology, and Network is assumed but is not a prerequisite to read this document.

Purpose of this Document

The purpose of this document is to provide step-by-step configuration and implementation guide for the FlashStack Datacenter with Cisco UCS X-Series Compute Servers, Cisco Fabric Interconnect Switches, Cisco MDS Switches, Cisco Nexus Switches and Pure Storage to deploy an Oracle RAC Database solution. Furthermore, it provides references for incorporating Cisco Intersight–managed Cisco UCS X-Series platform with end-to-end

100Gbps within a Datacenter infrastructure. This document introduces various design elements and explains various considerations and best practices for a successful deployment.

The document also highlights the design and product requirements for integrating compute, network, and storage systems to Cisco Intersight to deliver a true cloud-based integrated approach to infrastructure management. The goal of this document is to build, validate and evaluate the performance of this FlashStack reference architecture while running various types of Oracle OLTP and DSS database workloads using various benchmarking exercises and showcase Oracle database server read latency, peak sustained throughput and IOPS under various stress tests.

What's New in this Release?

The following design elements distinguish this version of FlashStack from previous models:

- Deploying and managing Cisco UCS X9508 chassis equipped with Cisco UCS X210c M7 compute nodes from the cloud using Cisco Intersight
- Integration of low latency and high performance NVMe Pure Storage FlashArray//XL170
- Support for the NVMe/FC on Cisco UCS and Pure Storage
- Integration of the 5th Generation Cisco UCS 15000 Series VICs into FlashStack Datacenter
- Integration of the Cisco UCSX-I-9108-100G Intelligent Fabric Module into the Cisco X-Series 9508 Chassis
- Implementation of end-to-end 100G network to optimize the I/O path between Oracle databases and the RAC Servers
- Implementation of FC and NVMe/FC on the same architecture
- Validation of Oracle 21c Grid Infrastructure and 21c Databases

FlashStack System Overview

The FlashStack platform, developed by Cisco and Pure Storage, is a flexible, integrated infrastructure solution that delivers pre-validated storage, networking, and server technologies. Composed of defined set of hardware and software, this FlashStack solution is designed to increase IT responsiveness to organizational needs and reduce the cost of computing with maximum uptime and minimal risk.

Cisco and Pure Storage have carefully validated and verified the FlashStack solution architecture and its many use cases while creating a portfolio of detailed documentation, information, and references to assist customers in transforming their data centers to this shared infrastructure model.

FlashStack provides the following differentiators:

- A cohesive, integrated system that is managed, serviced, and tested as a whole
- Reduces Operational Risk Highly available architecture with no single point of failure, non-disruptive operations, and no downtime
- Guarantee customer success with prebuilt, pre-tested drivers and Oracle database software.
- Cisco Validated Designs (CVDs) explaining a variety of reference architectures and use cases

Key Elements of a Datacenter FlashStack Solution

Cisco and Pure storage have carefully validated and verified the FlashStack solution architecture and its many use cases while creating a portfolio of detailed documentation, information, and references to assist customers in transforming their data centers to this shared infrastructure model.

This reference FlashStack Datacenter architecture is built using the following infrastructure components for compute, network, and storage:

- Compute Cisco UCS X-Series Chassis with Cisco UCS X210c M7 Blade Servers
- Network Cisco UCS Fabric Interconnects, Cisco Nexus switches and Cisco MDS switches
- Storage Pure Storage FlashArray//XL170

Networking



All FlashStack components have been integrated so you can deploy the solution quickly and economically while eliminating many of the risks associated with researching, designing, building, and deploying similar solutions from the foundation.

Each of the component families (Cisco UCS, Cisco FI, Cisco Nexus, Cisco MDS and Pure Storage) shown in the figure above offers platform and resource options to scale up or scale out the infrastructure while supporting the same features. The design is flexible enough that the networking, computing, and storage can fit in one data center rack or be deployed according to a customer's data center design. The reference architecture reinforces

the "wire-once" strategy, because as additional storage is added to the architecture, no re-cabling is required from the hosts to the Cisco UCS fabric interconnect.

This FlashStack Datacenter solution for deploying Oracle RAC 21c Databases is built using the following hardware components:

- Fifth-generation Cisco UCS 6536 Fabric Interconnects to support 10/25/40/100GbE and Cisco Intersight platform to deploy, maintain and support UCS and FlashStack components.
- Two Cisco UCS X9508 Chassis with each chassis having two Cisco UCSX-I-9108-100G Intelligent Fabric Modules to deploy end to end 100GE connectivity.
- Total of eight Cisco UCS X210c M7 Compute Nodes (4 Nodes per Chassis) with each node having one Cisco Virtual Interface Cards (VICs) 15231.
- High-speed Cisco NX-OS-based Cisco Nexus C9336C-FX2 switching design to support up to 100GE connectivity and Cisco MDS 9132T Fibre Channel Switches for Storage Networking
- NVMe Pure Storage FlashArray//XL170 with 100GE/32GFC connectivity.

There are two modes to configure Cisco UCS, one is UCSM (UCS Managed), and the other is IMM (Intersight Managed Mode). This reference solution was deployed using Intersight Managed Mode (IMM). The best practices and setup recommendations are described later in this document.

Note: In this validated and deployed solution, the Cisco UCS X-Series is only supported in IMM mode.

Solution Summary

This solution provides an end-to-end 100Gbps Ethernet/FCoE-capable architecture to demonstrate the benefits for running Oracle RAC Database 21c environment with superior performance, scalability and high availability using NVMe over Fibre Channel (NVMe/FC).

NVMe-oF extends the high-performance and low-latency benefits of NVMe across network fabrics that connect servers and storage. NVMe-oF takes the lightweight and streamlined NVMe command set, and the more efficient queueing model, and replaces the PCle transport with alternate transports, like Fibre Channel, RDMA over Converged Ethernet (RoCE v2), TCP. NVMe over Fibre Channel (NVMe/FC) is implemented through the Fibre Channel NVMe (FC-NVMe) standard which is designed to enable NVMe based message commands to transfer data and status information between a host computer and a target storage subsystem over a Fibre Channel network fabric.

Most high-performance latency sensitive applications and workloads are running on FCP today. Since the NVMe/FC and Fibre Channel networks use the same underlying transport protocol (FCP), they can use common hardware components. It's even possible to use the same switches, cables, and storage to communicate with both protocols at the same time. The ability to use either protocol by itself or both at the same time on the same hardware makes transitioning from FCP to NVMe/FC both simple and seamless.

Large-scale block flash-based storage environments that use Fibre Channel are the most likely to adopt NVMe over FC. FC-NVMe offers the same structure, predictability, and reliability characteristics for NVMe-oF that Fibre Channel does for SCSI. Plus, NVMe-oF traffic and traditional SCSI-based traffic can run simultaneously on the same FC fabric.

This FlashStack solution showcases the Cisco UCS System with Pure Storage FlashArray//XL170 running on NVMe over FibreChannel (NVMe/FC) which can provide efficiency and performance of NVMe, and the benefits of

all-flash robust scale out storage system that combines low-latency performance with comprehensive data management, built-in efficiencies, integrated data protection, multiprotocol support, and nondisruptive operations.

Physical Topology

<u>Figure 1</u> shows the architecture diagram of the FlashStack components to deploy an eight node Oracle RAC 21c Database solution on NVMe/FC. This reference design is a typical network configuration that can be deployed in a customer's environment.



Figure 1. FlashStack components architecture

As shown in <u>Figure 1</u>, a pair of Cisco UCS 6536 Fabric Interconnects (FI) carries both storage and network traffic from the Cisco UCS X210c M7 server with the help of Cisco Nexus 9336C-FX2 switches and Cisco MDS 9132T

switches. The Fabric Interconnects and the Cisco Nexus Switches are clustered with the peer link between them to provide high availability.

As illustrated in Figure 1, 16 (8 x 100G link per chassis) links from the blade server chassis go to Fabric Interconnect – A. Similarly, 16 (8 x 100G link per chassis) links from the blade server chassis go to Fabric Interconnect – B. Fabric Interconnect – A links are used for Oracle Public Network Traffic (VLAN-135) and Storage Network Traffic (VSAN 151) shown as green lines while Fabric Interconnect – B links are used for Oracle Private Interconnect Traffic (VLAN 10) and Storage Network Traffic (VSAN 152) shown as red lines. Two virtual Port-Channels (vPCs) are configured to provide public network and private network traffic paths for the server blades to northbound Nexus switches.

FC and NVMe/FC Storage access from both Fabric Interconnects to MDS Switches and Pure Storage Array are shown as orange lines. Eight 32Gb links are connected from FI – A to MDS – A Switch. Similarly, eight 32Gb links are connected from FI – B to MDS – B Switch. The Pure Storage FlashArray//XL170 has twelve active FC connections that go to the Cisco MDS Switches. Six FC ports are connected to MDS–A, and the other six FC ports are connected to MDS–B Switch.

The Pure Storage FlashArray//XL170 SAN ports CT1 and CT2 SAN ports FC4, FC6 and FC32 are connected to MDS – A Switch while the Controller CT1 and Controller CT2 SAN ports FC5, FC7 and FC33 are connected to MDS – B Switch. Also, two FC Port-Channels (PC) are configured (vPC 41 & vPC 42) to provide storage network paths from the server blades to storage array. Each port-channel has VSANs (VSAN 151 & VSAN 152) created for application and storage network data access.

Note: For the Oracle RAC configuration on Cisco Unified Computing System, we recommend keeping all private interconnect network traffic local on a single Fabric interconnect. In this case, the private traffic will stay local to that fabric interconnect and will not be routed through the northbound network switch. This way all the inter server blade (or RAC node private) communications will be resolved locally at the fabric inter-connects and this significantly reduces latency for Oracle Cache Fusion traffic.

Additional 1Gb management connections are needed for an out-of-band network switch that is apart from this FlashStack infrastructure. Each Cisco UCS FI, Cisco MDS and Cisco Nexus switch is connected to the out-of-band network switch, and each Pure Storage FA controller also has two connections to the out-of-band network switch.

Although this is the base design, each of the components can be scaled easily to support specific business requirements. For example, more servers or even blade chassis can be deployed to increase compute capacity, additional storage disk shelves can be deployed to improve I/O capability and throughput, and special hardware or software features can be added to introduce new features. This document guides you through the detailed steps for deploying the base architecture, as shown in <u>Figure 1</u>. These procedures cover everything from physical cabling to network, compute, and storage device configurations.

Design Topology

This section describes the hardware and software components used to deploy an eight node Oracle RAC 21c Database Solution on this architecture.

The inventory of the components used in this solution architecture is listed in <u>Table 1</u>.

Table 1	Table for Hardware	Inventory and	Bill of Material
Table I.	Table for Hardware	inventory and	i Dill Of Material

Name	Model/Product ID	Description	Quantity
Cisco UCS X Blade Server Chassis	UCSX-9508	Cisco UCS X Series Blade Server Chassis, 7RU which can house a combination of compute nodes and a pool of future I/O resources that may include GPU accelerators, disk storage, and nonvolatile memory.	2
Cisco UCS 9108 100G IFM (Intelligent Fabric Module)	UCSX-I-9108-100G	Cisco UCS 9108 100G IFM connects the I/O fabric between the Cisco UCS X9508 Chassis and 6536 Fabric Interconnects 800 Gb/s (8x100Gb/s) Port IO Module for compute nodes	4
Cisco UCS X210c M7 Compute Server	UCSX-210c-M7	Cisco UCS X210c M7 2 Socket Blade Server (2x 4th Gen Intel Xeon Scalable Processors)	8
Cisco UCS VIC 15231	UCSX-ML-V5D200G	Cisco UCS VIC 15231 2x100/200G mLOM for X Compute Node	8
Cisco UCS 6536 Fabric Interconnect	UCS-FI-6536	Cisco UCS 6536 Fabric Interconnect providing both network connectivity and management capabilities for the system	2
Cisco MDS Switch	DS-C9132T-8PMESK9	Cisco MDS 9132T 32-Gbps 32-Port Fibre Channel Switch	2
Cisco Nexus Switch	N9K-9336C-FX2	Cisco Nexus 9336C-FX2 Switch	2
Pure Storage FlashArray	FlashArray//XL170	Pure Storage All Flash NVMe Array	1

Note: In this solution design, we used 8 identical Cisco UCS X210c M7 Blade Servers to configure the Red Hat Linux 8.9 Operating system and then deploy an 8 node Oracle RAC Databases. The Cisco UCS X210c M7 Server configuration is listed in <u>Table 2</u>.

Table 2. Cisco UCS X210c M7 Compute Server Co	onfiguration
---	--------------

Cisco UCS X210c M7 Server Configuration		
Processor	2 x Intel(R) Xeon(R) Gold 6448H CPU @ 2.4 GHz 250W 32C 60MB Cache (2 x 32 CPU Cores = 64 Core Total)	PID - UCSX-CPU-I6448H
Memory	16 x Samsung 32GB DDR5-4800-MHz (512 GB)	PID - UCSX-MRX32G1RE1
VIC 15231	Cisco UCS VIC 15231 Blade Server MLOM (200G for compute node)	PID - UCSX-ML-V5D200G

(2x100G through	each fabric)
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Table 3. vNIC and vHBA Configured on each Linux Host

vNIC Details	
vNIC 0 (eth0)	Management and Public Network Traffic Interface for Oracle RAC. MTU = 1500
vNIC 1 (eth1)	Private Server-to-Server Network (Cache Fusion) Traffic Interface for Oracle RAC. MTU = 9000
vHBA0	FC Network Traffic & Boot from SAN through MDS-A Switch
vHBA1	FC Network Traffic & Boot from SAN through MDS-B Switch
vHBA2	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-A Switch
vHBA3	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-B Switch
vHBA4	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-A Switch
vHBA5	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-B Switch
vHBA6	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-A Switch
vHBA7	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-B Switch
vHBA8	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-A Switch
vHBA9	NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-B Switch

Note: For this solution, we configured 2 VLANs to carry public and private network traffic as well as two VSANs to carry FC and NVMe/FC storage traffic as listed in <u>Table 4</u>.

Table 4. VLAN and VSAN Configuration

VLAN Configuration		
VLAN		
Name	ID	Description
Default VLAN	1	Native VLAN
Public VLAN	135	VLAN for Public Network Traffic
Private VLAN	10	VLAN for Private Network Traffic

VLAN Configuration		
VSAN		
Name	ID	Description
VSAN-A	151	FC and NVMe/FC Network Traffic through for Fabric Interconnect A
VSAN-B	152	FC and NVMe/FC Network Traffic through for Fabric Interconnect B

This FlashStack solution consists of Pure Storage FlashArray//XL170 as listed in Table 5.

Table 5.	Pure Storage	FA//XL170	Storage	Configuration
Table 5.	i uic otoiuge		otorage	Connigaration

Storage Components	Description
Pure Storage FA//XL170	Pure Storage FlashArray//XL170 (30 x 3.9 TB NVMe SSD Drives)
Capacity	116.9 TB
Connectivity	12 x 32 Gb/s redundant FC, NVMe/FC 1 Gb/s redundant Ethernet (Management port)
Physical	4 Rack Units

Table 6. Software and Firmware Revision	ons
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Software and Firmware	Version
Cisco UCS FI 6536	Bundle Version 4.3(4.240066) or NX-OS Version - 9.3(5)I43(4a) Image Name - intersight-ucs-infra-5gfi.4.2.3e.bin
Cisco UCS X210c M7 Server	5.2(0.230041) Image Name - intersight-ucs-infra-5gfi.4.3.4.240066.bin
Cisco UCS Adapter VIC 15231	5.3(3.85)
Cisco eNIC (Cisco VIC Ethernet NIC Driver) (modinfo enic)	4.6.0.0-977.3 (kmod-enic-4.6.0.0-977.3.rhel8u9_4.18.0_513.5.1.x86_64)
Cisco fNIC (Cisco VIC FC HBA Driver) (modinfo fnic)	2.0.0.96-324.0 (kmod-fnic-2.0.0.96-324.0.rhel8u9.x86_64)
Red Hat Enterprise Linux Server	Red Hat Enterprise Linux release 8.9

Software and Firmware	Version
	(Kernel - 4.18.0-513.5.1.el8_9.x86_64)
Oracle Database 21c Grid Infrastructure for Linux x86-64	21.3.0.0.0
Oracle Database 21c Enterprise Edition for Linux x86-64	21.3.0.0.0
Cisco Nexus 9336C-FX2 NXOS	NXOS System Version - 9.3(7) & BIOS Version - 05.45
Cisco MDS 9132T Software	System Version - 9.3(2) & BIOS Version - 1.43.0
Pure Storage FA//XL170	Purity//FA 6.5.2
FIO	fio-3.19-4.el8.x86_64
Oracle Swingbench	2.7
SLOB	2.5.4.0

Solution Configuration

This chapter contains the following:

- <u>Cisco Nexus Switch Configuration</u>
- Cisco UCS X-Series Configuration Intersight Managed Mode (IMM)
- <u>Cisco MDS Switch Configuration</u>
- Pure Storage FlashArray//XL170 Storage Configuration

Cisco Nexus Switch Configuration

This section details the high-level steps to configure Cisco Nexus Switches.

Figure 2 illustrates the high-level overview and steps to configure various components to deploy and test the Oracle RAC Database 21c for this FlashStack reference architecture.



Figure 2. Cisco Nexus Switch configuration architecture

The following procedures describe how to configure the Cisco Nexus switches to use in a base FlashStack environment. This procedure assumes you're using Cisco Nexus 9336C-FX2 switches deployed with the 100Gb end-to-end topology.

Note: On initial boot and connection to the serial or console port of the switch, the NX-OS setup should automatically start and attempt to enter Power on Auto Provisioning.

Cisco Nexus A Switch

Procedure 1. Initial Setup for the Cisco Nexus A Switch

Step 1. To set up the initial configuration for the Cisco Nexus A Switch on <nexus-A-hostname>, run the following: Abort Power on Auto Provisioning and continue with normal setup? (yes/no) [n]: yes Do you want to enforce secure password standard (yes/no) [y]: Enter Enter the password for "admin": <password> Confirm the password for "admin": <password> Would you like to enter the basic configuration dialog (yes/no): yes Create another login account (yes/no) [n]: Enter Configure read-only SNMP community string (yes/no) [n]: Enter Configure read-write SNMP community string (yes/no) [n]: Enter Enter the switch name: <nexus-A-hostname> Continue with Out-of-band (mgmt0) management configuration? (yes/no) [y]: Enter Mgmt0 IPv4 address: <nexus-A-mgmt0-ip> Mgmt0 IPv4 netmask: <nexus-A-mgmt0-netmask> Configure the default gateway? (yes/no) [y]: Enter IPv4 address of the default gateway: <nexus-A-mgmt0-gw> Configure advanced IP options? (yes/no) [n]: Enter Enable the telnet service? (yes/no) [n]: Enter Enable the ssh service? (yes/no) [y]: Enter Type of ssh key you would like to generate (dsa/rsa) [rsa]: Enter Number of rsa key bits <1024-2048> [1024]: Enter Configure the ntp server? (yes/no) [n]: y NTP server IPv4 address: <global-ntp-server-ip> Configure default interface layer (L3/L2) [L3]: L2 Configure default switchport interface state (shut/noshut) [noshut]: Enter Configure CoPP system profile (strict/moderate/lenient/dense/skip) [strict]: Enter Would you like to edit the configuration? (yes/no) [n]: Enter

Cisco Nexus B Switch

Similarly, follow the steps in the procedure <u>Initial Setup for the Cisco Nexus A Switch</u> to setup the initial configuration for the Cisco Nexus B Switch and change the relevant switch hostname and management IP address according to your environment.

Procedure 1. Configure Global Settings

Configure the global setting on both Cisco Nexus Switches.

Step 1. Login as admin user into the Cisco Nexus Switch A and run the following commands to set the global configurations on switch A:

configure terminal feature interface-vlan feature hsrp

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```
feature lacp
feature vpc
feature lldp
spanning-tree port type network default
spanning-tree port type edge bpduguard default
port-channel load-balance src-dst l4port
policy-map type network-qos jumbo
class type network-qos class-default
mtu 9216
system qos
service-policy type network-qos jumbo
vrf context management
ip route 0.0.0/0 10.29.135.1
copy run start
```

Step 2. Login as admin user into the Nexus Switch B and run the same above commands to set global configurations on Nexus Switch B.

Note: Make sure to run copy run start to save the configuration on each switch after the configuration is completed.

Procedure 2. VLANs Configuration

Create the necessary virtual local area networks (VLANs) on both Cisco Nexus switches.

- Step 1. Login as admin user into the Cisco Nexus Switch A.
- Step 2. Create VLAN 135 for Public Network Traffic and VLAN 10 for Private Network Traffic.

```
configure terminal
```

```
vlan 135
name Oracle_RAC_Public_Traffic
no shutdown
vlan 10
name Oracle_RAC_Private_Traffic
no shutdown
interface Ethernet 1/29
```

```
description To-Management-Uplink-Switch
switchport access vlan 135
speed 1000
```

copy run start

Step 3. Login as admin user into the Nexus Switch B and similar way, create all the VLANs 135 for Oracle RAC Public Network Traffic and VLAN 10 for Oracle RAC Private Network Traffic.

Note: Make sure to run copy run start to save the configuration on each switch after the configuration is completed.

Virtual Port Channel (vPC) Summary for Network Traffic

A port channel bundles individual links into a channel group to create a single logical link that provides the aggregate bandwidth of up to eight physical links. If a member port within a port channel fails, traffic previously carried over the failed link switches to the remaining member ports within the port channel. Port channeling also load balances traffic across these physical interfaces. The port channel stays operational as long as at least one physical interface within the port channel is operational. Using port channels, Cisco NX-OS provides wider bandwidth, redundancy, and load balancing across the channels.

In the Cisco Nexus Switch topology, a single vPC feature is enabled to provide HA, faster convergence in the event of a failure, and greater throughput. The Cisco Nexus vPC configurations with the vPC domains and corresponding vPC names and IDs for Oracle Database Servers are listed in <u>Table 7</u>.

vPC Domain	vPC Name	vPC ID
1	Peer-Link	1
51	vPC FI-A	51
52	vPC FI-B	52

Table	7.	vPC	Summary
-			

As listed in <u>Table 7</u>, a single vPC domain with Domain ID 1 is created across two Nexus switches to define vPC members to carry specific VLAN network traffic. In this topology, we defined a total number of 3 vPCs.

vPC ID 1 is defined as Peer link communication between the two Cisco Nexus switches. vPC IDs 51 and 52 are configured for both Cisco UCS Fabric Interconnects.



Note: A port channel bundles up to eight individual interfaces into a group to provide increased bandwidth and redundancy.

Procedure 3. Create vPC Peer-Link

Note: For vPC 1 as Peer-link, we used interfaces 1 to 4 for Peer-Link. You may choose an appropriate number of ports based on your needs.

Create the necessary port channels between devices on both Cisco Nexus Switches.

Step 1. Login as admin user into the Cisco Nexus Switch A:

```
configure terminal
vpc domain 1
 peer-keepalive destination 10.29.135.56 source 10.29.135.55
 auto-recovery
interface port-channel 1
 description vPC peer-link
 switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  spanning-tree port type network
 vpc peer-link
 no shut
interface Ethernet 1/1
  description Peer link connected to FS-ORA-N9K-B-Eth-1/1
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
 channel-group 1 mode active
  no shut
interface Ethernet 1/2
 description Peer link connected to FS-ORA-N9K-B-Eth-1/2
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  channel-group 1 mode active
 no shut
interface Ethernet 1/3
  description Peer link connected to FS-ORA-N9K-B-Eth-1/3
```

```
switchport mode trunk
switchport trunk allowed vlan 1,10,135
channel-group 1 mode active
no shut
interface Ethernet 1/4
description Peer link connected to FS-ORA-N9K-B-Eth-1/4
switchport mode trunk
switchport trunk allowed vlan 1,10,135
channel-group 1 mode active
no shut
exit
```

copy run start

Step 2. Login as admin user into the Cisco Nexus Switch B and repeat step 1 to configure the second Cisco Nexus Switch.

Note: Make sure to change the description of the interfaces and peer-keepalive destination and source IP addresses.

Step 3. Configure the vPC on the other Cisco Nexus switch. Login as admin for the Cisco Nexus Switch B: configure terminal

```
vpc domain 1
 peer-keepalive destination 10.29.135.55 source 10.29.135.56
 auto-recovery
interface port-channel 1
 description vPC peer-link
 switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  spanning-tree port type network
 vpc peer-link
 no shut
interface Ethernet 1/1
  description Peer link connected to FS-ORA-N9K-A-Eth-1/1
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
 channel-group 1 mode active
  no shut
```

```
interface Ethernet 1/2
  description Peer link connected to FS-ORA-N9K-A-Eth-1/2
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  channel-group 1 mode active
 no shut
interface Ethernet 1/3
 description Peer link connected to FS-ORA-N9K-A-Eth-1/3
 switchport mode trunk
  switchport trunk allowed vlan 1,10,135
 channel-group 1 mode active
 no shut
interface Ethernet 1/4
 description Peer link connected to FS-ORA-N9K-A-Eth-1/4
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
 channel-group 1 mode active
 no shut
exit
copy run start
```

Create vPC Configuration between Cisco Nexus and Fabric Interconnect Switches

This section describes how to create and configure port channel 51 and 52 for network traffic between the Cisco Nexus and Fabric Interconnect Switches.



Table 8 lists the vPC IDs, allowed VLAN IDs, and ethernet uplink ports.

Table 8.vPC IDs and VLAN IDs

vPC Description	vPC ID	Fabric Interconnects Ports	Cisco Nexus Switch Ports	Allowed VLANs
Port Channel FI-A	51	FI-A Port 1/27	N9K-A Port 1/9	10,135
		FI-A Port 1/28	N9K-A Port 1/10	Note: VLAN 10 is needed for failover.
		FI-A Port 1/29	N9K-B Port 1/9	
		FI-A Port 1/30	N9K-B Port 1/10	
Port Channel FI-B	52	FI-B Port 1/27	N9K-A Port 1/11	10,135
		FI-B Port 1/28	N9K-A Port 1/12	Note: VLAN 135 is needed for failover.
		FI-B Port 1/29	N9K-B Port 1/11	
		FI-B Port 1/30	N9K-B Port 1/12	

Verify the Port Connectivity on both Cisco Nexus Switches

Figure 3. Cisco Nexus A Connectivity

```
FS-ORA-N9K-A# show lldp neighbors
Capability codes:
  (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
  (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
Device ID
                     Local Intf
                                      Hold-time Capability
                                                              Port ID
FS-ORA-N9K-B
                      Eth1/1
                                      120
                                                  BR
                                                              Ethernet1/1
FS-ORA-N9K-B
                      Eth1/2
                                      120
                                                  BR
                                                              Ethernet1/2
FS-ORA-N9K-B
                                      120
                      Eth1/3
                                                  BR
                                                              Ethernet1/3
FS-ORA-N9K-B
                     Eth1/4
                                      120
                                                  BR
                                                              Ethernet1/4
FS-ORA-FI-A
                     Eth1/9
                                      120
                                                              Eth1/27
                                                  BR
FS-ORA-FI-A
                      Eth1/10
                                      120
                                                  BR
                                                              Eth1/28
FS-ORA-FI-B
                                                              Eth1/27
                      Eth1/11
                                      120
                                                  BR
FS-ORA-FI-B
                     Eth1/12
                                      120
                                                              Eth1/28
                                                  BR
Total entries displayed: 8
```

Figure 4. Cisco Nexus B Connectivity

[FS-ORA-N9K-B# show l	ldp neighbors					
Capability codes:						
(R) Router, (B) Br	idge, (T) Teleph	one, (C) DO	CSIS Cable De	evice		
(W) WLAN Access Po	int, (P) Repeate	r, (S) Stat:	ion, (O) Othe	er		
Device ID	Local Intf	Hold-time	Capability	Port ID		
FS-ORA-N9K-A	Eth1/1	120	BR	Ethernet1/1		
FS-ORA-N9K-A	Eth1/2	120	BR	Ethernet1/2		
FS-ORA-N9K-A	Eth1/3	120	BR	Ethernet1/3		
FS-ORA-N9K-A	Eth1/4	120	BR	Ethernet1/4		
FS-ORA-FI-A	Eth1/9	120	BR	Eth1/29		
FS-ORA-FI-A	Eth1/10	120	BR	Eth1/30		
FS-ORA-FI-B	Eth1/11	120	BR	Eth1/29		
FS-ORA-FI-B	Eth1/12	120	BR	Eth1/30		
Total entries displa	Total entries displayed: 8					

Procedure 1. Configure the port channels on the Cisco Nexus Switches

Step 1. Login as admin user into Cisco Nexus Switch A and run the following commands:

configure terminal

```
interface port-channel 51
  description connect to FS-ORA-FI-A
  switchport mode trunk
```

```
switchport trunk allowed vlan 1,10,135
spanning-tree port type edge trunk
mtu 9216
vpc 51
no shutdown
interface port-channel 52
description connect to FS-ORA-FI-B
switchport mode trunk
switchport trunk allowed vlan 1,10,135
spanning-tree port type edge trunk
mtu 9216
vpc 52
no shutdown
interface Ethernet 1/9
description Fabric-Interconnect-A-27
```

switchport mode trunk switchport trunk allowed vlan 1,10,135

spanning-tree port type edge trunk

```
mtu 9216
channel-group 51 mode active
```

```
no shutdown
```

```
interface Ethernet 1/10
  description Fabric-Interconnect-A-28
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  spanning-tree port type edge trunk
  mtu 9216
  channel-group 51 mode active
  no shutdown
```

```
interface Ethernet1/11
  description Fabric-Interconnect-B-27
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  spanning-tree port type edge trunk
  mtu 9216
```

```
channel-group 52 mode active
no shutdown
interface Ethernet 1/12
description Fabric-Interconnect-B-28
switchport mode trunk
switchport trunk allowed vlan 1,10,135
spanning-tree port type edge trunk
mtu 9216
channel-group 52 mode active
no shutdown
```

copy run start

Step 2. Login as admin user into Cisco Nexus Switch B and run the following commands to configure the second Cisco Nexus Switch:

configure terminal

```
interface port-channel 51
  description connect to FS-ORA-FI-A
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  spanning-tree port type edge trunk
  mtu 9216
  vpc 51
  no shutdown
```

interface port-channel 52 description connect to FS-ORA-FI-B switchport mode trunk switchport trunk allowed vlan 1,10,135 spanning-tree port type edge trunk mtu 9216 vpc 52 no shutdown

interface Ethernet 1/9
description Fabric-Interconnect-A-29
switchport mode trunk

```
switchport trunk allowed vlan 1,10,135
  spanning-tree port type edge trunk
 mtu 9216
 channel-group 51 mode active
  no shutdown
interface Ethernet 1/10
  description Fabric-Interconnect-A-30
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
 spanning-tree port type edge trunk
 mtu 9216
 channel-group 51 mode active
 no shutdown
interface Ethernet 1/11
 description Fabric-Interconnect-B-29
 switchport mode trunk
 switchport trunk allowed vlan 1,10,135
 spanning-tree port type edge trunk
 mtu 9216
 channel-group 52 mode active
 no shutdown
interface Ethernet 1/12
 description Fabric-Interconnect-B-30
 switchport mode trunk
  switchport trunk allowed vlan 1,10,135
 spanning-tree port type edge trunk
 mtu 9216
 channel-group 52 mode active
 no shutdown
```

copy run start

Verify All vPC Status

Procedure 1. Verify the status of all port-channels using Cisco Nexus Switches

Step 1. Cisco Nexus Switch A Port-Channel Summary:

[FS-OR/ Flags	A-N9K-A# shor D - Down I - Indiv s - Suspe b - BFD S S - Switc U - Up (p p - Up in M - Not i	w port-ch P idual H nded r ession Wa hed R ort-chann delay-la n use. Mi	t-channel summary P - Up in port-channel (members) H - Hot-standby (LACP only) r - Module-removed Mait R - Routed channel) y-lacp mode (member) e. Min-links not met			
Group	Port– Channel	Туре	Protocol	Member Ports		
1	Po1(SU)	Eth	LACP	Eth1/1(P) Eth1/4(P)	Eth1/2(P)	Eth1/3(P)
51 52	Po51(SU) Po52(SU)	Eth Eth	LACP LACP	Eth1/9(P) Eth1/11(P)	Eth1/10(P) Eth1/12(P)	

Step 2. Cisco Nexus Switch B Port-Channel Summary:

FS-OR/	FS-ORA-N9K-B# show port-channel summary					
Flags	: D – Down	Р	– Up in po:	rt-channel (m	embers)	
200	I – Indiv:	idual H	- Hot-stan	dby (LACP only	y)	
	s – Suspei	nded r	- Module-r	emoved		
	b – BFD Se	ession Wa	it			
	S – Switcl	ned R	- Routed			
	U – Up (po	ort-chann	el)			
	p - Up in	delay-la	cp mode (m	ember)		
	M - Not i	n use. Mi	n—links no [.]	t met		
Group	Port-	Туре	Protocol Member Ports			
	Channel					
1	 Po1(SU)	 Fth		 Fth1/1(P)	 Fth1/2(P)	 Fth1/3(P)
-	101(00)	2.011	2/10/	Eth1/4(P)		
51	Po51(SU)	Eth	LACP	Eth1/9(P)	Eth1/10(P)	
52	Po52(SU)	Eth	LACP	Eth1/11(P)	Eth1/12(P)	

Step 3. Cisco Nexus Switch A vPC Status:

FS-ORA-N9K-A# <mark>show</mark> vpc brief	
Legend:	
(*) - local vPC i	is down, forwarding via vPC peer-link
vPC domain id	: 1
Peer status	: peer adjacency formed ok
vPC keep-alive status	: peer is alive
Configuration consistency status	success
Per-vlan consistency status	: success
Type-2 consistency status	: success
vPC role	: secondary
Number of vPCs configured	: 2
Peer Gateway	: Disabled
Dual-active excluded VLANs	÷ •
Graceful Consistency Check	: Enabled
Auto-recovery status	: Enabled, timer is off. (timeout = 240s)
Delay-restore status	: limer is off.(timeout = 30s)
Delay-restore SVI status	: limer is off.(timeout = 10s)
Vietusl naceliek mode	: Disabled
Virtual-peerlink mode	: Disabled
vPC Peer-link status	
id Port Status Active vlans	
1 Po1 up 1,10,135	
vPC status	
Id Port Status Consis	stency Reason Active vlans
	·····
51 Po51 up succes	ss success 1,10,135
52 Po52 up succes	ss success 1,10,135
Please check "show vpc consistenc consistency reason of down vpc an any vpc.	cy-parameters vpc <vpc-num>" for the nd for type-2 consistency reasons for</vpc-num>

Step 4. Cisco Nexus Switch B vPC Status:

FS-0R	A-N9K-B;	# show v	vpc brie	ef		
Legend	d:		•			
		(*)	- local	l vPC is dow	n, forwarding via vPC	peer-link
vPC do	omain i	d		: 1		
Peer	status			: pe	er adjacency formed ok	
vPC ke	eep-ali	ve statı	ls	: pe	er <mark>is</mark> alive	
Config	guratio	n consis	stency s	status : su	ccess	
Per-v	lan cons	sistency	y status	s : su	ccess	
Type-2	2 consi	stency s	status	: su	ccess	
vPC ro	ole			: pr	imary	
Numbe	r of vP	Cs conf:	igured	: 2		
Peer (Gateway			: Di	sabled	
Dual-a	active (exclude	d VLANs	: -		
Grace	ful Con	sistency	y Check	: En	abled	
Auto-	recover	y status	5	: En	abled, timer is off.(t	imeout = 240s)
Delay	-restor	e status	5	: Ti	<pre>.mer is off.(timeout =</pre>	30s)
Delay	-restore	e SVI st	tatus	: Ti	<pre>.mer is off.(timeout =</pre>	10s)
Opera	tional	Layer3	Peer-rou	uter : Di	sabled	
Virtua	al-peer	link moo	de	: Di	.sabled	
vPC Pe	eer-lin	k statu:	5			
id	Port	Status	Active	vlans		
1	Po1	up	1,10,13	35		
vPC st	tatus					
Id	Port		Status	Consistency	/ Reason	Active vlans
	D-E1					1 10 105
ът	P051		up	success	success	1,10,135
52	Po52		up	success	success	1,10,135
Please consis any vp	e <mark>check</mark> stency pc.	"show reason (vpc cons of down	sistency-par vpc and for	rameters vpc <vpc-num>" type-2 consistency re</vpc-num>	for the asons for

Cisco UCS X-Series Configuration - Intersight Managed Mode (IMM)

This section details the high-level steps for the Cisco UCS X-Series Configuration in Intersight Managed Mode.



Cisco Intersight Managed Mode standardizes policy and operation management for Cisco UCS X-Series. The compute nodes in Cisco UCS X-Series are configured using server profiles defined in Cisco Intersight. These server profiles derive all the server characteristics from various policies and templates. At a high level, configuring Cisco UCS using Intersight Managed Mode consists of the steps shown in Figure 5.

Figure 5. Configuration Steps for Cisco Intersight Managed Mode



Procedure 1. Configure Cisco UCS Fabric Interconnect for Cisco Intersight Managed Mode

During the initial configuration, for the management mode, the configuration wizard enables you to choose whether to manage the fabric interconnect through Cisco UCS Manager or the Cisco Intersight platform. You can switch the management mode for the fabric interconnects between Cisco Intersight and Cisco UCS Manager at

any time; however, Cisco UCS FIs must be set up in Intersight Managed Mode (IMM) for configuring the Cisco UCS X-Series system.

Step 1. Verify the following physical connections on the fabric interconnect:

- The management Ethernet port (mgmt0) is connected to an external hub, switch, or router.
- The L1 ports on both fabric interconnects are directly connected to each other.
- The L2 ports on both fabric interconnects are directly connected to each other.

Step 2. Connect to the console port on the first fabric interconnect and configure the first FI as shown below:



Step 3. Connect the console port on the second fabric interconnect B and configure it as shown below:

```
Enter the configuration method. (console/gui) ? console

Installer has detected the presence of a peer Fabric interconnect. This Fabric interconnect will be added to the cluster. Continue (y/n) ? y

Enter the admin password of the peer Fabric interconnect.. done

Retrieving config from peer Fabric interconnect... done

Peer Fabric interconnect magneent mode : intersight

Peer Fabric interconnect Mgmt0 IPv4 Address: 10.29.135.53

Peer Fabric interconnect Mgmt0 IPv4 Netmask: 255.255.255.0

Peer Fi is IPv4 Cluster enabled. Please Provide Local Fabric Interconnect Mgmt0 IPv4 Address

Physical Switch Mgmt0 IP address : 10.29.135.54

Apply and save the configuration (select 'no' if you want to re-enter)? (yes/no): yes

Applying configuration. Please wait.

Configuration file - 0k

XML interface to system may become unavailable since ssh is disabled

Completing basic configuration setup

2024 Jan 9 20:29:65 FS-0RA-FI-B % VDC-1 %$ %SECURITYD-2-FEATURE_ENABLE_DISABLE: User has enabled the feature bash-shell

2024 Jan 9 20:29:53 FS-0RA-FI-B % VDC-1 %$ %SECURITYD-2-FEATURE_ENABLE_INSABLE: Feature nxapi is being enabled on HTTPS.

Cisco UCS 6400 Series Fabric Interconnect

FS-0RA-FI-B login: ■
```

Step 4. After configuring both the FI management address, open a web browser and navigate to the Cisco UCS fabric interconnect management address as configured. If prompted to accept security certificates, accept, as necessary.

Settings Intersight × 10.29.138	.53/ × +	~
← → C ○ A ~ https://10.29.135.53	uliuliu cisco	
	DEVICE CONSOLE	
	Sign In ^{Username *} admin ©	
1 1	Password * @	
© 2017-2021 Cisc C	o Systems,Inc. Cisco, Cisco Systems and Cisco Systems logo are registered tradema isco Systems,Inc. and/or its affiliates in the U.S and certain other countries.	ares of

- **Step 5.** Log into the device console for FI-A by entering your username and password.
- **Step 6.** Go to the Device Connector tab and get the DEVICE ID and CLAIM Code as shown below:

🐌 🔴 💼 🚈 Settings Intersight	× 10.29.136.53/ × +	~
← → C O A o	- https://10.29.135.53/an/device-connector/	150% 公 😌 🕄 🗏
cisco DEVICE C	ONSOLE FS-ORA-FI	0 -
SYSTEM INFORMATION		DATA
The Device Connector is an platform. For detailed inform	embedded management controller that enables the capabilities c nation about configuring the device connector, please visit Help C	f Cisco Intersight, a cloud-based management enter
Device Connector		$\textcircled{3}$ Settings $\mid $ Refresh
	ACCESS MODE ALLOW CONTROL	vice ID
		aim Code
Device Connector	Internet Intersight	
	٥	
▲ Not Claimed		
The connection to the Ciso still not claimed. To claim account and follow the gu	co Intersight Portal is successful, but device is the device open Cisco Intersight, create a new Open idance or go to the Targets page and click Claim Intersight	
a New Device for existing	account.	

Procedure 2. Claim Fabric Interconnect in Cisco Intersight Platform

After setting up the Cisco UCS fabric interconnect for Cisco Intersight Managed Mode, FIs can be claimed to a new or an existing Cisco Intersight account. When a Cisco UCS Fabric Interconnect is successfully added to the Cisco Intersight platform, all future configuration steps are completed in the Cisco Intersight portal. After getting the device id and claim code of FI, go to https://intersight.com/.



Step 7. Sign in with your Cisco ID or if you don't have one, click Sing Up and setup your account.

Note: We created the "FlashStack-ORA21C" account for this solution.
Cisco Inters	sight $ imes$ +				
$\leftarrow \rightarrow \mathbf{G}$	🗘 👌 https://us-east-1. intersi	ght.com/acct/onboarding/w	izard/signup/		
"listo Intersight					
			Account Creation		
		Account Name *			
		FlashStack-ORA21C		0	
			Cancel	Create	

Step 8. After logging into your Cisco Intersight account, go to > ADMIN > Targets > Claim a New Target.

••• 🖻 🔤	argets Intersight × 10.29.135.53/	× +			
$\leftarrow \ \rightarrow \ G$	O 👌 ≅ https://us-east-1.intersight.com	n/an/system/an/asset/targets/?\$currentPage	e=1&\$pageSize=10&\$orderby=ModTime desc&\$cu	irrentCus 🟠	⊠ ⊕ එ ≣
≡ "ludu Intersiç	ght 🛛 📲 System 🗸		Q Search	ତ ୟ କ୍ 🔍	D ⑦ A
 Settings Admin 	Targets			Cia	aim a New Target
Targets Tech Support Bur	★ All Targets ◎ + // □ // □		C Export 0 items found	10 → per page 📧 🤇 (0 of 0 🔉 🗵
Audit Logs	Connection	Top Targets by Types	Vendor		
Sessions Licensing	No data available	No Types	No data available		
	Name	‡ Status ‡	Type ‡ Claimed Time	Claimed By	\$
New Command Palet Navigate Intersight with #4 to Help > Command Palette	te × Korgo	Ν	IO ITEMS AVAILABLE		
					0 of 0 🔉 🕅

Step 9. For the Select Target Type, select "Cisco UCS Domain (Intersight Managed)" and click Start.

ilters	Q Search			
Available for Claiming	Compute / Fabric			
ategories		eisco 🍄		
All	Cisco UCS Server (Standalone)	Cisco UCS Domain (Intersight Managed)	HPE OneView	
) Cloud				
Compute / Fabric				
) Hyperconverged	Cisco UCS Domain (UCSM Managed)	Cisco UCS C890	Redfish Server	
) Hypervisor				
) Network	Platform Services			
Orchestrator				
Platform Services				
) Storage	Cisco Intersight Appliance	Cisco Intersight Assist	Intersight Workload Engine	
	Cloud			
	D			
	Amazon Web Services	Terraform Cloud		
	Hypervisor			
	*	2 *		
	Microsoft Hyper-V	VMware vCenter		

Step 10. Enter the Device ID and Claim Code which was previously captured. Click Claim to claim this domain in Cisco Intersight.

	Claim Cisco UCS Domai (Intersight Managed) Ta To claim your target, provide the Der Code and select the appropriate Res	in arget vice ID, Claim source Groups.
General		
Device ID * Claim Code *		
Resource Groups		
• Select the Resource Groups if required. However, this selection type 'All'.	is not mandatory as one or more Resource Group type is	'All'. The claimed target will be part of all Organizations with the Resource Group
		0 items found 10 ~ per page 区
Name	Usage	Description
		K < 0 of 0 > >

When you claim this domain, you can see both FIs under this domain and verify it's under Intersight Managed Mode:

- Targets	ntersight	× 10.29.135.53/	× +				~
C	○ 읍 ē ² htt	ps://us-east-1.intersight.com	/an/system/an/asset/targets/?\$	currentPage=1&\$p	ageSize=10&\$orderby=ModTime desc&\$	currentCus 🟠	⊠ 8 වූ ≣
lisco Intersight	🖷 🖥 Systen	n ∨			Q Search	0 A C (● ▲ 1 ⑦ │ ႙
Settings	Та	rgets					Claim a New Target
Admin							
argets		∗ All Targets ⊚ +					
ech Support Bundles					Export 1 items found	10 ∨ per page 🗵	< 1 of 1 > > >
Audit Logs		Connection	Top Targets by Typ	pes	Vendor		
Sessions		O Connected 1					
icensing				nage I	• Cisco Systems, Inc. 1		
		Name	≎ Status	: Type	2 Claimed Time	Claimed By	: \$
Command Palette			© Connected	Intersig	ht Managed Dom a few seconds ag	10	
e Intersight with ೫+K or go > Command Palette							ব 1 of1 চা সা
- command Palette							
	C Intersight lettings admin argets ech Support Bundles uudit Logs eessions icensing Command Palette https://www.setk.orgo.com/argenters/setk.orgenters/setk.orgenters/setk.orgenters	C A F2 htt Histo Intersight B System Admin ^ argets Admin ^ Action Support Bundles udit Logs dech Support Bundles udit Logs dech Support Bundles budit Logs dech Support Bundles dech Support Bundles budit Logs dech Support Bundles dech Support Bundles budit Logs dech Support Bundles dech Su	C Command Palette Command Pal	C Command Palette × entersight with 24+K or go > Command Palette × entersight with 24+K or go > Command Palette × entersight with 24+K or go	C Command Palette Command Pal	Command Palette Command Palette Comma	C C C Intersight Intersight Intersight Intersight

	_	* #	All Fabric Interconn 🧕	_ + r						🗗 Export 💠	2 items found	d (12 ~
terconnects												
v Clusters			Health	Conne	ction 7	Co	ntract Status 🛛	Bur	ndle Versi	on	NX-C	S Version
x oldstold				⊘ Conn	ected 2		Not Covered 2	10		0.00000) 0	$ _{C}$	- 0.0/5/140/4
d Systems			2 • Healthy 2					$ \zeta$	2 • 4.3(4	1.240066) 2		9.3(5)143(4
			Name	‡ Health	≎ Mo	del ‡	Bundle Version 💲	Total L	Ports Jsed Ava	ail User Labe	el 🗘 A	dmin Ev 🗘
0	~		FS-ORA-FI FI-A	C Healthy	UC	S-FI-6536	4.3(4.240066)	42 2	24 18			Disabled
			FS-ORA-FI FI-B	Healthy	UC	S-FI-6536	4.3(4.240066)	42 2	24 18			Disabled
			Ø									
	x Clusters d Systems	terconnects x Clusters d Systems	terconnects x Clusters d Systems	terconnects x Clusters d Systems	terconnects Image: second connects x Clusters d Systems Image: second connected 2 <	terconnects x Clusters d Systems Image: Connected 2 Image:	terconnects x Clusters d Systems Image: Connection in the image: Connected 2 in the image: Connected	terconnects Kerconnects K Clusters d Systems Image: Connection in the stress of	terconnects x Clusters d Systems e Fs-ORA-FI FI-B Healthy UCS-FI-6536 4.3(4.240066) 42 24 18 Fs-ORA-FI FI-B Healthy UCS-FI-6536 4.3(4.240066) 42 24 			

Procedure 3. Configure Policies for Cisco UCS Chassis

Note: For this solution, we configured Organization as "ORA21." You will configure all the profile, pools, and policies under this common organization to better consolidate resources.

Step 1. To create Organization, go to Cisco Intersight > Settings > Organization and create depending upon your environment.

Note: We configured the IP Pool, IMC Access Policy, and Power Policy for the Cisco UCS Chassis profile as explained below.

Procedure 4. Create IP Pool

Step 1. To configure the IP Pool for the Cisco UCS Chassis profile, go to > Infrastructure Service > Configure > Pools > and then select "Create Pool" on the top right corner.

ep	2. Select option	n "IP" a	as sh	own below to create	the IP Pool.		
≡	cisco Intersight	. ** I	nfrastru	ucture Service 🗸			
Ĵ.	Overview		د مر Cr	eate			
	Operate	~					
ç	Configure	^		🔍 Search			
	Profiles			 IP 	◯ MAC		
	Templates Policies				Resource	O WWNN	
	Pools						

WWPN

Step 3. In the IP Pool Create section, for Organization select "ORA21" and enter the Policy name "ORA-IP-Pool" and click Next.

Ξ	cisco Intersight	}% Ir	nfrastructure Service 🗸			
:¢:	Overview					
0 9	Operate Configure	~ ~	0 General		General Pool represents a collection of IPv4 and/or IPv6 addres	sses that can b
	Profiles Templates		2 IPv4 Pool Detail 3 IPv6 Pool Detail	s	Organization * ORA21	
(Policies Pools				Name * ORA-IP-Pool	
					Set Tags	
					Description	= 1024

Step 4. Enter Netmask, Gateway, Primary DNS, IP Blocks and Size according to your environment and click Next.

Pools > IP Pool Create			
General IPv4 Pool Details	IPv4 Pool Details Network interface configuration data for IPv4 interfaces Configure IPv4 Pool		
3 IPv6 Pool Details	Configuration Netmask * 255.255.255.0 Primary DNS	Gateway O Secondary DNS	
	IP Blocks From	Size © 20	● ← 1 - 1024

Note: For this solution, we did not configure the IPv6 Pool. Keep the Configure IPv6 Pool option disabled and click Create to create the IP Pool.

Procedure 5. Configure IMC Access Policy

- **Step 1.** To configure the IMC Access Policy for the Cisco UCS Chassis profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- Step 2. Select the platform type "UCS Chassis" and select "IMC Access" policy.

≡	"livelite Intersight	🎥 Inf	frastructure Service 🗸			Q Search	
.©:	Overview		← Policies Create				
$\langle \widehat{\boldsymbol{O}} \rangle$	Operate						
	Configure		Filters				
	Profiles						
	Templates		Platform Type	IMC Access	Power		
	Policies						
	Pools		UCS Server UCS Domain UCS Chassis HyperFlex Cluster Kubernetes Cluster				

Step 3. In the IMC Access Create section, for Organization select "ORA21" and enter the Policy name "ORA-IMC-Access" and click Next.

≡	'''' Intersight	°s In	nfrastructure Service 🗸		
:@:	Overview		Policies > IMC Access		
(<u>0</u>) •	Operate Configure	~ ~	1 General	General Add a name, description and tag for the policy.	
	Profiles Templates		2 Policy Details	Organization * ORA21 ~	
	Policies			Name *	
	Pools			ORA-IMC-Access	
				Set Tags	
				Description ///	



(Ö)	Operate Servers		General Policy Details	Policy Details Add policy details
	Chassis			All Platforms UCS Server (FI-Attached) UCS Server (FI-Attached) UCS Server (FI-Attached)
	Fabric Interconnects			A minimum of one configuration must be enabled. Policies like SNMP, vMedia, KMIP and Syslog are supported via Out-Of-Band. Check here for more info. Help. Captra.
	HyperFlex Clusters			to more into, nep centre
	Integrated Systems			In-Band Configuration 💿
ତ୍	Analyze			VLAN ID* © 135 4 - 4093
,e	Configure			✓ IPv4 address configuration ①
	Profiles			Pv6 address configuration ①
6	Templates			IP Pool* Selected IP Pool ORA-IP-Pool
	Policies			Out-Of-Band Configuration O

Step 5. Click Create to create this policy.

Procedure 6. Configure Power Policy

- **Step 1.** To configure the Power Policy for the Cisco UCS Chassis profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- Step 2. Select the platform type "UCS Chassis" and select "Power."

≡	disco Intersight	💝 Infrastructure Service $ \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! $			Q Search	
.ġ.	Overview	← Policies Create				
$\langle \widehat{\mathbf{O}} \rangle$	Operate					
	Configure	A Filters				
	Profiles					
	Templates	Platform Type	O IMC Access	• Power		 Thermal
	Policies	All				
	Pools	UCS Domain UCS Chassis HyperFlex Cluster				

Step 3. In the Power Policy Create section, for Organization select "ORA21" and enter the Policy name "ORA-Power" and click Next.

≡	'llıılı' Intersight of Infrastructure Service ∨							
:©:	Overview		Policies > Power		General Add a name, description and tag for the policy. Organization * ORA21 Name * ORA-Power Set Tags Description			
0	Operate Configure Profiles Templates Policies	*	① General ② Policy Details		General Add a name, description and tag for the policy. Organization * ORA21			
					Description /// <= 1024			

Step 4. In the Policy Details section, for Power Redundancy select N+1 and turn off Power Save Mode.



Step 5. Click Create to create this policy.

Procedure 7. Create Cisco UCS Chassis Profile

A Cisco UCS Chassis profile enables you to create and associate chassis policies to an Intersight Managed Mode (IMM) claimed chassis. When a chassis profile is associated with a chassis, Cisco Intersight automatically configures the chassis to match the configurations specified in the policies of the chassis profile. The chassis-related policies can be attached to the profile either at the time of creation or later. For more information, go to: https://intersight.com/help/saas/features/chassis/configure#chassis_profiles.

The chassis profile in a FlashStack is used to set the power policy for the chassis. By default, Cisco UCSX power supplies are configured in GRID mode, but the power policy can be utilized to set the power supplies in non-redundant or N+1/N+2 redundant modes

Step 1. To create a Cisco UCS Chassis Profile, go to Infrastructure Service > Configure > Profiles > UCS Chassis Domain Profiles tab > and click Create UCS Chassis Profile.



Step 2. In the Chassis Assignment menu, for the first chassis, click "FS-ORA-FI-1" and click Next.

Ö	Operate Servers Chassis		0	General Chassis Assignment	Choose to assign a chassis to the profile now or assign it later. Assign Now Assign Later						
	Fabric Interconnects		3	Chassis Configuration							
	HyperFlex Clusters		4	Summary	6	Choose to assign a Assign Chassis Lat	a chassis now o ter, click Next t	or later. If you choose o select and associat	Assign Chassis, e policies.	select a chassis you	want to deploy
	Integrated Systems					Show Assigned					
_						🖉 🕴 🔍 🗛 🕅	ter		🗋 🖸 Expor	t 1 items found	10 ~
Q	Analyze	~				Name	\$	Health	:	Model	\$
	Configure					FS-ORA-FI-1		G Healthy		UCSX-9508	
	Profiles					Selected 1 of 1	Show All	Unselect All			
	Templates										
	Policies										
	Pools										

Step 3. In the Chassis configuration section, for the policy for IMC Access select "ORA-IMC-Access" and for the Power policy select "ORA-Power."

Profiles Create UCS Chassis Profile							
General	Chassis Configuration Create or select existing policies that you want to associate with this chassis profile.						
Chassis Assignment	IMC Access	• ORA-IMC-Access					
Chassis Configuration	Power	ORA-Power					
Chassis Configuration Summary	Power	• ORA-Power 🗐					
3 Chassis Configuration 4 Summary	Power SNMP Thermal	• ORA-Power					

Step 4. Review the configuration settings summary for the Chassis Profile and click Deploy to create the Cisco UCS Chassis Profile for the first chassis.

Note: For this solution, we created two Chassis Profile (ORA-Chassis-1 and ORA-Chassis-2) and assigned to both the chassis as shown below:

:¢:	Overview	Prof	iles							
	Operate	HyperFl	ex Cluster Profiles	UCS Chass	is Profiles	UCS Domain Pro	iles	UCS Server Profiles		
	Servers									
	Chassis	* A	II UCS Chassis Pr 🐵							
	Fabric Interconnects		0 0 ū q	Add Filter					🗋 🔂 Export	2 items found
	HyperFley Clusters		Name	:	Status	:	С	hassis	UCS Chassis 1	emplate
	Hypernex clusters				⊘ ОК			S-ORA-FI-2		
	Integrated Systems		ORA-Chassis-1		0 OK			S-ORA-FI-1		
ଙ୍	Analyze									
	Configure									
	Profiles									
	Templates									
	Policies									
	Pools									

Configure Policies for Cisco UCS Domain

Procedure 1. Configure Multicast Policy

Step 1. To configure Multicast Policy for a Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for Policy, select "Multicast Policy."

≡	cisco Intersight	e in	nfrastructure Service 🗸			Q Search	
:¢:	Overview		PoliciesCreate				
	Operate						
ø	Configure		Filters				
	Profiles						
	Templates		Platform Type	Ethernet Network Control	Link Control	O Port	O System QoS
	Policies			Ethernet Network Group	Multicast Policy	SNMP	
			UCS Server	Flow Control	Network Connectivity	Switch Control	O VSAN
	Pools		UCS Domain	Link Aggregation		Syslog	
			UCS Chassis				
			HyperFlex Cluster				
			Kubernetes Cluster				

Step 2. In the Multicast Policy Create section, for the Organization select "ORA21" and for the Policy name "Multicast-ORA." Click Next.

Step 3. In the Policy Details section, select Snooping State and Source IP Proxy State.

≡	cisco Intersight	See Infrastructure Service V
:¢:	Overview	Policies > Multicast Policy > Multicast-ORA Edit
Õ	Operate Servers	General Policy Details Add policy details
	Chassis	2 Policy Details Multicast Policy
	HyperFlex Clusters	Snooping State ©
	Integrated Systems	Querier State 💿
÷	Configure Profiles	Source IP Proxy State ©
	Templates	
	Policies	
	Pools	

Step 4. Click Create to create this policy.

Procedure 2. Configure VLANs

- **Step 1.** To configure the VLAN Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the Policy select "VLAN."
- **Step 2.** In the VLAN Policy Create section, for the Organization select "ORA21" and for the Policy name select "VLAN-FI." Click Next.

≡	uluulu Intersight structure Service V								
:¢:	Overview								
0	Operate Configure Profiles Templates Policies	~	 General Policy Details 		General Add a name, description and tag for the policy. Organization * ORA21 ~ Name * VLAN-FI Set Tags				
					Description ///				

Step 3. In the Policy Details section, to configure the individual VLANs, select "Add VLANs." Provide a name, VLAN ID for the VLAN and select the Multicast Policy as shown below:

		Overste V/LAN		
		Create VLAN		
	Operate ^	Add VLANs		
	Servers	Add VLANs to the policy		
	Chassis	1	M VI ANS should have one Multinast policy associated to	it
	Fabric Interconnects	l		
	HyperFlex Clusters		Configuration	
	Integrated Systems		Name / Prefix *	VLAN IDs *
ତ୍	Analyze ^		ORA-Public O	135
	Explorer New			
،	Configure ^		● Auto Allow On Uplinks ◎	
	Profiles		● Enable VLAN Sharing ○	
	Templates		Multicast Policy *	
	Policies		Selected Policy Multicast-ORA \mid $ imes$ \mid \oslash \mid \checkmark	
	Pools			

Step 4. Click Add to add this VLAN to the policy. Add another VLAN 10 and provide the names to various network traffic of this solution.

0	General Policy Details	Policy Details Add policy details										
•		i This policy is applicable only for UCS Domains										
		VLA	VLANs									
		Show VLAN Ranges										
			Û 9.		l Filter		3 ite	ems found	10	∽ per page	1_ of 1 ⊃ ⊃	
			VLAN ID	\$	Name ‡	Sharing T	\$	Primary	÷	Multicast Policy	Auto Allow On	Ş
					default	None					Yes	
				10	ORA-Private_10	None				Multicast-ORA	Yes	
				135	ORA-Public_135	None				Multicast-ORA	Yes	
		_ s	et Native VLAN	ID								

Step 5. Click Create to create this policy.

Procedure 3. Configure VSANs

- **Step 1.** To configure the VSAN Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the Policy select "VSAN."
- **Step 2.** In the VSAN Policy Create section, for the Organization select "ORA21" and for the Policy name select "VLAN-FI-A." Click Next.

Policies > VSAN		
Create		
1 General	General	
2 Policy Details	Add a name, description and tag for the policy.	
	ORA21	~
	Name *	
	VSAN-FI-A	
	Set Tags	
	Description	
	<= (1024

Step 3. In the Policy Details section, to configure the individual VSAN, select "Add VSAN." Provide a name, VSAN ID, FCoE VLAN ID and VSAN Scope for the VSAN on FI-A side as shown below:

Add VSAN		
Name * VSAN-FI-A		<u></u>
VSAN Scope ©		
○ Storage & Uplink ◎	Storage 💿 🧿	Uplink 💿
VSAN ID *		
151		() ()
FCoE VLAN ID *		
251		() ()
	Cancel	Add

Note: Storage & Uplink VSAN scope allows you to provision SAN and Direct Attached Storage, using the fabric interconnect running in FC Switching mode. You must externally provision the zones for the VSAN on upstream FC/FCoE switches. Storage VSAN scope allows you to connect and configure Direct Attached Storage, using the fabric interconnect running in FC Switching mode. You can configure local zones on this VSAN using FC Zone policies. All unmanaged zones in the fabric interconnect are cleared when this VSAN is configured for the first time. Do NOT configure this VSAN on upstream FC/FCoE switches.

Note: Uplink scope VSAN allows you to provision SAN connectivity using the Fabric Interconnect.

Step 4. Click Add to add this VSAN	l to	the	policy.
------------------------------------	------	-----	---------

⊘ 2	General Policy Details	Policy Details Add policy details	only for LICS	Domains					
		Uplink Trunking ©		Jonana					
		Add VSAN			G Export 1	l items found	50 v per page 10 1 of	r1 চাচা	
			VSAN ID	Name	VSAN Sco	ope		FCoE VL	AN ID
			151	VSAN-FI-A	Uplink				251
								1 of 1 🖸	

- Step 5. Click Create to create this VSAN policy for FI-A.
- **Step 6.** Configure VSAN policy for FI-B:
 - a. To configure the VSAN Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the Policy select "VSAN."
 - b. In the VSAN Policy Create section, for the Organization select "ORA21" and for the Policy name select "VLAN-FI-B." Click Next.
 - c. In the Policy Details section, to configure the individual VSAN, select "Add VSAN." Provide a name, VSAN ID, FCoE VLAN ID and VSAN Scope for the VSAN on FI-B side as shown below:

Add VSAN			
Name * VSAN-FI-B			<u>(</u>)
VSAN Scope 💿			
◯ Storage & Uplink ◎ (◯ Storage ©	Uplini	()
VSAN ID * 152) ()
			1 - 4093
FCoE VLAN ID * 252) ()
	Cancel		Add

Step 7. Click Add to add this VSAN to the policy.

General	Policy Details Add policy details								
o Policy Details	This policy is applicable only for UCS Domains								
	● Uplink Trunking ©								
	Add VSAN								
			🕒 Export 1 items found	50 v per page 📧 🤇 1 of 1 🗩 🔅					
	C VS	AN ID Name	VSAN Scope	FCoE VLAN ID					
		152 VSAN-FI-B	Uplink	252					
	1 8			C C 1 of 1 5 3					

Step 8. Click Create to create this VSAN policy for FI-B.

Procedure 4. Configure Port Policy

- Step 1. To configure the Port Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the policy, select "Port."
- **Step 2.** In the Port Policy Create section, for the Organization, select "ORA21", for the policy name select "ORA-FI-A-Port-Policy" and for the Switch Model select "UCS-FI-6536." Click Next.

Policies > Port	
Create	
 General Unified Port 	General Add a name, description and tag for the policy.
3 Breakout Options	Organization * ORA21
	Name * ORA-FI-A-Port-Policy
	UCS-FI-6536
	Set Tags
	Description // // // // // // // // // // // // //

Note: We did not configure the Fibre Channel Ports for this solution. In the Unified Port section, leave it as default and click Next.

- **Note:** We did not configure the Breakout options for this solution. Leave it as default and click Next.
- **Step 3.** In the Unified Port section, move the slider to right side as shown below. This changes Port 35 and Port 36 to FC port.



Step 4. In the Breakout Options section, go to Fibre Channel tab and select Port 35 and 36 and click Configure. Set Port 35 and 36 to "4x32G" and click Next.

	General Unified Port Breakout Options Port Roles	Breakou Configure bre Ethe	akout ports on FC or Ethernet. met Fibre Channel nfigure		H 166 V9 PA	Pit 70 70 70 70 70 70 70 70 70
			Port Port 36 Port 35	Type FC FC	Speed 32G 32G	Breakout Ports Port 36/1, Port 36/2, Port 36 Port 35/1, Port 35/2, Port 35

Step 5. In the Port Role section, select port 1 to 16 and click Configure.

Policies > Port										
Create										
General	Port Roles Configure port	roles to define t	the traffic type ca	arried through a u	unified port conne	ection.				
Breakout Options	Port F	Roles Port C	Channels Pi	n Groups						
Port Roles	Col	nfigure Sele Port	ected Port 1, ts 14, Por	Port 2, Port 3, Port - t 15, Port 16	4, Port 5, Port 6, Por	t 7, Port 8, Port 9, P	ort 10, Port 11, Port	12, Port 13	, Port CI St	ear lection
									Unconfig	ured
									🕒 Export	
		Name	Туре	Role	Connected	Device Num	Port Channel	Mode	Auto	Negoti
		port 1	Ethernet	Unconfigured						
		port 2	Ethernet	Unconfigured						
		port 3	Ethernet	Unconfigured						
		port 4	Ethernet	Unconfigured			57			

Step 6. In the Configure section, for Role select Server and keep the Auto Negotiation ON.



Step 7. Click SAVE to add this configuration for port roles.

Step 8. Go to the Port Channels tab and select Port 27 to 30 and click Create Port Channel between FI-A and both Cisco Nexus Switches. In the Create Port Channel section, for Role select Ethernet Uplinks Port Channel, and for the Port Channel ID select 51 and select Auto for the Admin Speed.

Policies > Port Create	
	Create Port Channel
	Configuration
	The combined maximum number of Ethernet Uplink, FCoE Uplink, and Appliance port channels permitted is 12 and the maximum number of FC port channels permitted is 4.
	Role
	Port Channel ID * Admin Speed 51 C Auto < o
	1 - 256 Ethernet Network Group ©
	Select Policy
	Flow Control
	Link Aggregation
	Select Policy
	Link Control Select Policy

Step 9. Click SAVE to add this configuration for uplink port roles.

		Dant Dalas							
\bigcirc	General	Port Roles			10 A				
\odot	Unified Port	Port Roles	Port Channels	Pin Groups	i unified port conni	ection.			
\odot	Breakout Options								
4	Port Roles	Create Port C	hannel						
)		14 UA TU UA TU 152 000000 000000 000000 000000000000000	114 VII 114 VII 114 V	Yai Dia Yai Dia Yai Di 1940 - China Angela 1940 - China Angela 194		
								Ethernet Unlink Port Channel	
								ethemet opinik i ort ondinier	
						1 items found	50 🗸 per page 🛽	বর <u>1</u> of 1 স সি	•
		D ID		Ro	le		: Ports		
				51 Et	hernet Uplink Port	Channel	Port 27, Port	28, Port 29, Port 30	
								⊠ <u> </u>	
		Cancel						Back	Save

Step 10. Go to the Port Channels tab and now select Port 35/1 to 35/4 and 36/1 to 36/4. Click Create Port Channel between FI-A and Cisco MDS A Switch. In the Create Port Channel section, for Role select FC Uplink Port Channel, and for the Port Channel ID select 41 and enter 151 as VSAN ID.

The combined is 12 and the r	d maximum number of Etherne maximum number of FC port c	et Uplink, FCoE Uplink, and hannels permitted is 4.	d Appliance port chan	nels permitted
Role				
FC Uplink Port Channel				
Port Channel ID *	Admin Co.o.	ad	VSAN ID *	
Fort Channel ID	Admin Spec	eu	voratio	
41	© 32Gbps 1 - 256	✓ ()	151	0 1 - 409
41 Select Member Ports	© 32Gbps 1 - 256	v ()	151	0 - 1 - 409
41 Select Member Ports	© 32Gbps 1 - 256	∽ ⊙	151	0 d 1 - 409
41 Select Member Ports	© 32Gbps 1 - 256	⊷ ⊙	151	0 1 - 409
41 Select Member Ports	© 32Gbps 1 - 256	⊷ ⊙ are available for port chan	151	<u>)</u> 1 - 409

Step 11. Click SAVE to add this configuration for storage uplink port roles.

Step 12. Verify both the port channel as shown below:

Por	t Roles						
Config	ure port roles t	to define the traffic typ	pe carried throu	gh a unified port con	nection.		
	Port Roles	Port Channels	Pin Groups				
	Create Por	t Channel					
		Y2 34 Y1 34 Y1 34 Y1 34 Y1			194. V39 214. V22 234 2411144	V 24 25A	Yas Yas <thyas< th=""> <thyas< th=""> <thyas< th=""></thyas<></thyas<></thyas<>
					Ethern	net Uplin	nk Port Channel 🛛 🌑 FC Uplink Port Channel
					2 items found	50	✓ per page K < 1 of 1 >> ∅
			ID	Role		\$	Ports
			51	Ethernet Uplink Por	t Channel		Port 27, Port 28, Port 29, Port 30
			41	FC Uplink Port Cha	nnel		Port 35/1, Port 35/2, Port 35/3, Port 35/
							K < <u>1</u> of 1 ∋ ∋

Step 13. Click SAVE to complete this configuration for all the server ports and uplink port roles.

Note: We configured the FI-B ports and created a Port Policy for FI-B, "ORA-FI-B-Port-Policy."

Note: In the FI-B port policy, we also configured unified ports as well as breakout options for 4x32G on port 35 and 36 for FC Traffic.

Note: As configured for FI-A, we configured the port policy for FI-B. For FI-B, configured port 1 to 16 for server ports, port 27 to 30 as the ethernet uplink port-channel ports and 35/1-35/4 to 36/1-36/4 ports as FC uplink Port channel ports.

Note: For FI-B, we configured Port-Channel ID as 52 for Ethernet Uplink Port Channel and Port-Channel ID as 42 for FC Uplink Port Channel as shown below:

Port Configu	t Roles	S les to define the traffic ty	vpe carried throu	gh a unified port co	nnection.			
	Port Rol	es Port Channels	Pin Groups					
	Create	Port Channel						
	lare				4 144 TH 114 TH 114	7 14 114		
	1.555 C						52 52 52 54 54 54 54 55 52 52 52 52 52 52 52 52 52 52 52 52	
					Ethern	net Uplir	nk Port Channel 🛛 🌑 FC Uplink Port Channel	Ľ
					2 items found	50	✓ per page < ✓ 1 of 1 >> >>	3
			ID	Role		\$	Ports	
			52	Ethernet Uplink P	ort Channel		Port 27, Port 28, Port 29, Port 30	
			42	FC Uplink Port Ch	annel		Port 35/1, Port 35/2, Port 35/3, Port 3	5/
							⊠ < _1_ of 1 ≥	

This completes the Port Policy for FI-A and FI-B for Cisco UCS Domain profile.

Procedure 5. Configure NTP Policy

- **Step 1.** To configure the NTP Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the policy select "NTP."
- **Step 2.** In the NTP Policy Create section, for the Organization select "ORA21" and for the policy name select "NTP-Policy." Click Next.
- **Step 3.** In the Policy Details section, select the option to enable the NTP Server and enter your NTP Server details as shown below.

Policies > NTP Create	
 General Policy Details 	Policy Details Add policy details
	Enable NTP © NTP Servers * • • • • • Timezone America/Los_Angeles

Step 4. Click Create.

Procedure 6. Configure Network Connectivity Policy

- Step 1. To configure to Network Connectivity Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the policy select "Network Connectivity."
- **Step 2.** In the Network Connectivity Policy Create section, for the Organization select "ORA21" and for the policy name select "Network-Connectivity-Policy." Click Next.
- **Step 3.** In the Policy Details section, enter the IPv4 DNS Server information according to your environment details as shown below:



Step 4. Click Create.

Procedure 7. Configure System QoS Policy

- Step 1. To configure the System QoS Policy for the Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the policy select "System QoS."
- **Step 2.** In the System QoS Policy Create section, for the Organization select "ORA21" and for the policy name select "ORA-QoS." Click Next.
- Step 3. In the Policy Details section under Configure Priorities, select Best Effort and set the MTU size to 9216.



Step 4. Click Create.

Procedure 8. Configure Switch Control Policy

- **Step 1.** To configure the Switch Control Policy for the UCS Domain profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Domain" and for the policy select "Switch Control."
- **Step 2.** In the Switch Control Policy Create section, for the Organization select "ORA21" and for the policy name select "ORA-Switch-Control." Click Next.
- **Step 3.** In the Policy Details section, for the Switching Mode for Ethernet as well as FC, select and keep "End Host" Mode.

Bulleton and Andrea Anna and			
	Policy Details		
General	Add policy details		
2 Policy Details	• This policy is applicable only for UCS Domains	β.	
	Switching Mode		
	Ethernet O	FC 0	
	End Host O Switch	End Host Switch	
	VLAN Port Count		
	Enable VLAN Port Count Optimization \circ		
	MAC Address Table Aging Time		
	Default Custom		
	This ontion sats the default MAC address ani	na time to 14500 seconds for the End Host mode	
	Unidirectional Link Detection (UDLD) Global Settings	
	Message Interval 15 © ○		
	Recovery Action ©		
	Vone C Reset		
<	Cancel		Back Create

Step 4. Click Create to create this policy.

Configure Cisco UCS Domain Profile

With Cisco Intersight, a domain profile configures a fabric interconnect pair through reusable policies, allows for configuration of the ports and port channels, and configures the VLANs and VSANs in the network. It defines the characteristics of and configures ports on fabric interconnects. You can create a domain profile and associate it with a fabric interconnect domain. The domain-related policies can be attached to the profile either at the time of creation or later. One UCS Domain profile can be assigned to one fabric interconnect domain. For more information, go to: https://intersight.com/help/saas/features/fabric_interconnects/configure#domain_profile

Some of the characteristics of the Cisco UCS domain profile in the FlashStack environment are:

- A single domain profile (ORA-Domain) is created for the pair of Cisco UCS fabric interconnects.
- Unique port policies are defined for the two fabric interconnects.
- The VLAN configuration policy is common to the fabric interconnect pair because both fabric interconnects are configured for the same set of VLANs.
- The VSAN configuration policy is different to each of the fabric interconnects because both fabric interconnects are configured to carry separate storage traffic through separate VSANs.

• The Network Time Protocol (NTP), network connectivity, and system Quality-of-Service (QoS) policies are common to the fabric interconnect pair.

Procedure 1. Create a domain profile

Step 1. To create a domain profile, go to Infrastructure Service > Configure > Profiles > then go to the UCS Domain Profiles tab and click Create UCS Domain Profile.

≡	ا 🖧 المنان المراجع المنان المراجع المنان المراجع المنان المراجع المراجع المراجع المراجع المراجع المراجع المراجع	frastructure Service 🗸	
:¢:	Overview	<profiles< pre=""> Create UCS Domain</profiles<>	Profile
© •	Operate ✓ Configure ∧	1 General	General Add a name, description and tag for the UCS domain profile.
l	Profiles	2 UCS Domain Assignment	Organization * ORA21 ~
	Policies	3 VLAN & VSAN Configuration	Name *
	Pools	4 Ports Configuration 5 UCS Domain Configuration	ORA-Domain O
Ne	Command Palette ×	6 Summary	Set Tags
Navi to H	gate Intersight with ೫+K or go elp > Command Palette		Description
			<= 1024

- **Step 2.** For the domain profile name, enter "ORA-Domain" and for the Organization select what was previously configured. Click Next.
- **Step 3.** In the UCS Domain Assignment menu, for the Domain Name select "ORA21C-FI" which was added previously into this domain and click Next.

.¢.	Overview	 ← Profiles Create UCS Domain Profile
	Operate ^	
	Servers	⊘ _{General} UCS Domain Assignment
	Chassis	Choose to assign a Fabric Interconnect pair to the profile now or later.
	Fabric Interconnects	UCS Domain Assignment Assign Now Assign Later
	HyperFlex Clusters	(3) VLAN & VSAN Configuration
	Integrated Systems	Ports Configuration Choose to assign a Fabric Interconnect pair now or later. If you choose Assign Now, select a pair that you want to assign and click Next. If you choose Assign Later, click Next to proceed to policy selection.
ତ୍	Analyze ^	5 UCS Domain Configuration Show Assigned
	Explorer New	6 Summary
۵,	Configure ^	Q, _Add Filter 1 items found10 ∨ per page K < of 1 > > <
	Profiles	Domain N : Fabric Interconnect A Fabric Interconnect B
	Templates	FS-ORA-FI UCS-FI-6536 FD026080P UCS-FI-6536 FD026080P
	Policies	Selected 1 of 1 Show Selected Unselect All
	Pools	

Step 4. In the VLAN & VSAN Configuration screen, for the VLAN Configuration for both FIs, select VLAN-FI. For the VSAN configuration for FI-A, select VSAN-FI-A and for FI-B select VSAN-FI-B that were configured in the previous section. Click Next.

\oslash	General	VLAN & VSAN Configuration	
\oslash	UCS Domain Assignment	Create or select a policy for the fabric interconnect pair.	
3	VLAN & VSAN Configuration	Fabric Interconnect A 2 of 2 Policies Configured	
4	Ports Configuration	VLAN Configuration	× 🇷 👁 VLAN-FI 🗐
5	UCS Domain Configuration	VSAN Configuration	× 🧷 👁 VSAN-FI-A 🗐
6	Summary		
		Fabric Interconnect B 2 of 2 Policies Configured	
		VLAN Configuration	× 🖉 👁 VLAN-FI 🗐
		VSAN Configuration	× 🧷 💿 VSAN-FI-B 🗐

Step 5. In the Port Configuration section, for the Port Configuration Policy for FI-A select ORA-FI-A-PortPolicy. For the port configuration policy for FI-B select ORA-FI-B-PortPolicy.



Step 6. In the UCS Domain Configuration section, select the policy for NTP, Network Connectivity, System QoS and Switch Control as shown below:

Create UCS Domain	Profile	
General UCS Domain Assignment VLAN & VSAN Configuration	UCS Domain Configuration Select the compute and management policies to be associate Show Attached Policies (4)	d with the fabric interconnect.
 Ports Configuration UCS Domain Configuration 	Management 2 of 4 Policies Configured NTP Syslog	× © // NTP-Policy 🗐
(6) Summary	Network Connectivity SNMP	× © / Network-Connectivity-Policy 🗐
	^ Network 2 of 2 Policies Configured	
	System QoS *	× @ // ORA-QoS 🗐
	Switch Control	× 💿 🧷 ORA-Switch-Control 🗐

Step 7. In the Summary window, review the policies and click Deploy to create Domain Profile.

After the Cisco UCS domain profile has been successfully created and deployed, the policies including the port policies are pushed to the Cisco UCS fabric interconnects. The Cisco UCS domain profile can easily be cloned to install additional Cisco UCS systems. When cloning the Cisco UCS domain profile, the new Cisco UCS domains utilize the existing policies for the consistent deployment of additional Cisco UCS systems at scale.

The Cisco UCS X9508 Chassis and Cisco UCS X210c M7 Compute Nodes are automatically discovered when the ports are successfully configured using the domain profile as shown below:

≡	ះរ៉េះដូ: Intersight រ	📽 Infrastructure Service 🗸		Q Search	С
.ġ.	Overview	← Chassis FS-ORA-FI-1 @Healthy			
0	Operate ^	General Inventory Connections	UCS Chassis Profile Topology Metrics		
П	Servers	Details	Properties		
L	Fabric Interconnects	C Healthy	Cisco UCSX-9508	Front Rear	
	HyperFlex Clusters Integrated Systems	Name FS-ORA-FI-1 User Label			
ତ୍	Analyze 🗸 🗸	- Serial FOX2509P01Z			
د	Configure ^ Profiles	Model UCSX-9508			
	Templates	Revision O			
	Policies	Part Number 68-6847-03			
	Pools	Management Mode Intersight			
		UCS Domain FS-ORA-FI	Locator LED O Off	Health Overlay 💽	
		Chassis Profile ORA-Chassis-1	States Conn Input Power Health Conne	ection Details	

← Chassis										
FS-ORA-FI-1	Healthy]								
General Inventory Co	onnections	UCS Chassis P	rofile	Topology	Metri	ics				
Intelligent Fabric Modules X-Fabric Modules	Serve	ers								
Thermal			A shall Pills and				G Evenent	A itoms found	<u> </u>	
Power	Г	··· ◇ · 、 (○ Name	Add Filter	Health	¢	User Label	Export	4 items found Slot Id	ل ا \$	Model
		U FS-ORA-	FI-1-1	Healthy					1	UCSX-210C-M7
	-	U U FS-ORA-	FI-1-3	Healthy					3	UCSX-210C-M7
		U U FS-ORA-	FI-1-5	Healthy					5	UCSX-210C-M7
		U U FS-ORA-	FI-1-7	Healthy					7	UCSX-210C-M7
😑 ululu Intersight 🛛 😪	Infrastructure Ser							Search		6 5

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:¢:	Overview	S	iervers					
	Operate		× All Servers ⊚ +				G. Furnant	
	Servers		Add Pilter					
	Chassis		Health	Power	HCL Status	Bundle Version	Firmware Vers	ion
	Fabric Interconnects		8 • Critical 1 • Healthy 7	(⁰ On 8	② Incomplete 8	8 • 5.2(2.240053) 8	8 • 5.2(2.24	40053) 8
	HyperFlex Clusters							
	Integrated Systems		Name	‡ Health	C Model C	UCS Domain 💲 CPU C 🛈	C C	Firmware
	Integrated Systems		Name	: Health © Healthy	C Model C UCSX-210C-M7	UCS Domain : CPU C FS-ORA-FI	* Memory C * 153.6 512.0	Firmware 3
ତ୍	Integrated Systems Analyze		Name •	: Health © Healthy © Healthy	Model : UCSX-210C-M7 UCSX-210C-M7	UCS Domain : CPU C () FS-ORA-FI FS-ORA-FI	Comparison Memory C C 153.6 512.0 153.6 512.0	Firmware : 5.2(2.240053) 5.2(2.240053)
୍	Integrated Systems Analyze Configure		Name ○ FS-ORA-FI-1-1 ○ FS-ORA-FI-1-3 ○ FS-ORA-FI-1-5	: Health C Healthy C Healthy C Healthy C Healthy	Model : UCSX-210C-M7 UCSX-210C-M7 UCSX-210C_M7 UCSX-210C_M7	UCS Domain : CPU C O FS-ORA-FI . . . FS-ORA-FI . . .	Memory C 1 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0	Firmware Comparison 5.2(2.240053) 5.2(2.240053) 5.2(2.240053) 5.2(2.240053)
୍	Integrated Systems Analyze Configure		Name ○ FS-ORA-FI-1-1 ○ FS-ORA-FI-1-3 ○ FS-ORA-FI-1-3 ○ FS-ORA-FI-1-5 ○ FS-ORA-FI-1-7	: Health Healthy Healthy Healthy Healthy Healthy	Model : UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7	UCS Domain : CPU C O FS-ORA-FI FS-ORA-FI FS-ORA-FI FS-ORA-FI	C Memory C C 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0	Firmware : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) :
୍	Integrated Systems Analyze Configure Profiles		Name © FS-ORA-FI-1-1 © FS-ORA-FI-1-3 © FS-ORA-FI-1-5 © FS-ORA-FI-1-7 © FS-ORA-FI-2-1	: Health C Healthy C Healthy C Healthy C Healthy C Healthy C Healthy	Model : UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7	UCS Domain CPU C FS-ORA-FI FS-ORA-FI FS-ORA-FI FS-ORA-FI FS-ORA-FI FS-ORA-FI FS-ORA-FI	Memory C : 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0	Firmware : 5.2(2.240053) 5.2(2.240053) 5.2(2.240053) 5.2(2.240053) 5.2(2.240053)
୍	Integrated Systems Analyze Configure Profiles Templates		Name © FS-ORA-FI-1-1 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-5 © FS-ORA-FI-1-7 © FS-ORA-FI-2-1 © FS-ORA-FI-2-3	: Health	Model : UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7	UCS Domain : CPU C O FS-ORA-FI . . .	t Memory C t 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0	Firmware : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) : 5.2(2.240053) :
୍	Integrated Systems Analyze Configure Profiles Templates Policies		Name ○ FS-ORA-FI-1-1 ○ FS-ORA-FI-1-3 ○ FS-ORA-FI-1-3 ○ FS-ORA-FI-1-3 ○ FS-ORA-FI-1-5 ○ FS-ORA-FI-1-5 ○ FS-ORA-FI-2-1 ○ FS-ORA-FI-2-3 ○ FS-ORA-FI-2-5	: Health Healthy Healthy Healthy Healthy Healthy Healthy CHealthy Critical CHealthy	Model : UCSX-210C-M7 :	UCS Domain CPU C FS-ORA-FI -	t Memory C t 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0	Firmware State 5.2(2.240053) State
୍	Integrated Systems Analyze Configure Profiles Templates Policies		Name © FS-ORA-FI-1-1 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-1-3 © FS-ORA-FI-2-1 © FS-ORA-FI-2-3 © FS-ORA-FI-2-5 © FS-ORA-FI-2-7	: Health	Model : UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7 UCSX-210C-M7	UCS Domain : CPU C O FS-ORA-FI . . . FS-ORA-FI . . .	t Memory C t 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0 153.6 512.0	Firmware Signal 5.2(2.240053) Signal

Step 8. After discovering the servers successfully, upgrade all server firmware through IMM to the supported release. To do this, check the box for All Servers and then click the ellipses and from the drop-down list, select Upgrade Firmware.
und <u>10 ~</u>
und <u>10 ~</u>
ion
0053) 8
Firmware
5.2(2.240053)
5.2(2.240053) 5.2(2.240053)
5.2(2.240053)
5.2(2.240053) 5.2(2.240053)
5.2(2.240053)
4

Step 9. In the Upgrade Firmware section, select all servers and click Next. In the Version section, for the supported firmware version release select "5.2(2.240053)" and click Next, then click Upgrade to upgrade the firmware on all servers simultaneously.

✓ Servers Upgrade Firmware							
General Version	Vers Select a Select	sion a firmware version Firmware Bund	to upgrade the s le	servers to.			Advanced Mode 💽
Summary	I	The selected firm storage controlle	ware bundle wil rs. Use Advance	l be download d Mode to exc	ed from intersight.com. A clude upgrade of drives a	All the server components will be upgraded along ind storage controllers.	with drives and
	٩ (Add Filter	<u>.</u>	Size :	Release Date	8 items found 10 v per page « < (1_of1 > ≫ © ≏ Ø
	۲	5.2(2.240053)		763.24 MiB	Jun 4, 2024 10:48 PM	Cisco Intersight Server Bundle	• /
	0	5.2(1.240010)	Ġ	756.32 MiB	Feb 15, 2024 9:52 AM	Cisco Intersight Server Bundle	Ø
	0	5.2(0.230127)		711.04 MiB	Jan 24, 2024 10:12 AM	Cisco Intersight Server Bundle	
	0	5.2(0.230092)		710.42 MiB	Nov 15, 2023 12:04 PM	Cisco Intersight Server Bundle	
	0	5.2(0.230041)		703.72 MiB	Aug 15, 2023 11:40 PM	Cisco Intersight Server Bundle	

After the successful firmware upgrade, you can create a server profile template and a server profile for IMM configuration.

Configure Policies for Server Profile

A server profile enables resource management by simplifying policy alignment and server configuration. The server profile wizard groups the server policies into the following categories to provide a quick summary view of the policies that are attached to a profile:

- Compute Configuration: BIOS, Boot Order, and Virtual Media policies.
- Management Configuration: Certificate Management, IMC Access, IPMI (Intelligent Platform Management Interface) Over LAN, Local User, Serial Over LAN, SNMP (Simple Network Management Protocol), Syslog and Virtual KVM (Keyboard, Video, and Mouse).
- Storage Configuration: SD Card, Storage.
- Network Configuration: LAN connectivity and SAN connectivity policies.

Some of the characteristics of the server profile template for FlashStack are as follows:

- BIOS policy is created to specify various server parameters in accordance with FlashStack best practices.
- Boot order policy defines virtual media (KVM mapper DVD) and SAN boot through Pure Storage.
- IMC access policy defines the management IP address pool for KVM access.
- LAN connectivity policy is used to create two virtual network interface cards (vNICs) One vNIC for Server Node Management and Public Network Traffic, second vNIC for Private Server-to-Server Network (Cache Fusion) Traffic Interface for Oracle RAC.
- SAN connectivity policy is used to create total 10 vHBA (2 vHBA for FC SAN Boot and 8 vHBA for NVMe FC Database traffic) per server to boot through FC SAN as well as run NVMe FC traffics on the same server node.

Procedure 1. Configure UUID Pool

- **Step 1.** To create UUID Pool for a Cisco UCS, go to > Infrastructure Service > Configure > Pools > and click Create Pool. Select option UUID.
- **Step 2.** In the UUID Pool Create section, for the Organization, select ORA21 and for the Policy name ORA-UUID. Click Next.
- Step 3. Select Prefix, UUID block and size according to your environment and click Create.

Create UUID		
 Ceneral Pool Details 	Pool Details Collection of UUID suffix Blocks. Configuration Prefix * 0000135-1350-0000 © UUID Blocks	
	From 0000-135135000000 O	Size 256

Procedure 2. Configure BIOS Policy

Note: For more information, see "Performance Tuning Best Practices Guide for Cisco UCS M7 Platforms"

- Note: For this specific database solution, we created a BIOS policy and used all "Platform Default" values.
- **Step 1.** To create BIOS Policy, go to > Infrastructure Service > Configure > Policies > and select Platform type as UCS Server and select on BIOS and click on start.
- **Step 2.** In the BIOS create general menu, for the Organization, select ORA21 and for the Policy name ORA-BIOS. Click Next
- **Step 3.** Click Create to create the platform default BIOS policy.

Procedure 3. Create MAC Pool

- **Step 1.** To configure a MAC Pool for a Cisco UCS Domain profile, go to > Infrastructure Service > Configure > Pools > and click Create Pool. Select option MAC to create MAC Pool.
- Step 2. In the MAC Pool Create section, for the Organization, select ORA21 and for the Policy name ORA-MAC-A. Click Next.

≡	ا گی المعادی المرابع	nfrastructure Service 🗸	Q Search	
:¢:	Overview	Pools > MAC Pool Edit		
(Č)	Operate ^ Servers	1 General	General Pool represents a collection of MAC addresses that can be allocated to VNICs of a server profile.	
	Chassis Fabric Interconnects	2 Pool Details		
	HyperFlex Clusters		Name * ORA-MAC-A	
, e	Integrated Systems Configure ^			
	Profiles Templates		Set Tags	
	Policies		Description ///	
	Pools			

Step 3. Enter the MAC Blocks from and Size of the pool according to your environment and click Create.

Pools > MAC Pool Create		
 General Pool Details 	Pool Details Collection of MAC Blocks. MAC Blocks	
	From 00:25:B5:A3:50:00	Size 512

Note: For this solution, we configured two MAC Pools. ORA-MAC-A for vNICs MAC Address VLAN 135 (public network traffic) on all servers through FI-A Side. ORA-MAC-B for vNICs MAC Address of VLAN 10 (private network traffic) on all servers through FI-B Side.

- Step 4. Create a second MAC Pool to provide MAC addresses to all vNICs running on VLAN 10.
- **Step 5.** Go to > Infrastructure Service > Configure > Pools > and click Create Pool. Select option MAC to create MAC Pool.
- **Step 6.** In the MAC Pool Create section, for the Organization, select ORA21 and for the Policy name "ORA-MAC-B." Click Next.
- **Step 7.** Enter the MAC Blocks from and Size of the pool according to your environment and click Create.

⊘ 2	General Pool Details	Pool Details Collection of MAC Blocks. MAC Blocks	
		From ③ 00:25:B5:B3:50:00	Size ③ 512

Procedure 4. Create WWNN and WWPN Pools

Step 1. To create WWNN Pool, go to > Infrastructure Service > Configure > Pools > and click Create Pool. Select option WWNN.

Cr	eate			
	♀ Search			
() IP	◯ MAC		
(Resource	• WWNN	

- **Step 2.** In the WWNN Pool Create section, for the Organization select ORA21 and name it "WWNN-Pool." Click Next.
- **Step 3.** Add WWNN Block and Size of the pool according to your environment and click Create.
- **Step 4.** Click Create to create this policy.

 General Pool Details 	Pool Details Block of WWNN Identifiers. WWNN Blocks	
	From ① 20:00:00:25:B5:13:50:00	Size ① 512

- **Step 5.** Create WWPN Pool, go to > Infrastructure Service > Configure > Pools > and click Create Pool. Select option WWPN.
- **Step 6.** In the WWPN Pool Create section, for the Organization select ORA21 and name it "WWPN-Pool." Click Next.
- **Step 7.** Add WWPN Block and Size of the pool according to your environment and click Create.
- Step 8. Click Create to create this policy.

 General Pool Details 	Pool Details Block of WWPN Identifiers. WWPN Blocks	
	From (1) 20:00:00:25:B5:AB:30:00	Size () 1024

Procedure 5. Configure Ethernet Network Control Policy

- Step 1. To configure the Ethernet Network Control Policy for the UCS server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- Step 2. For the platform type select UCS Server and for the policy select Ethernet Network Control.
- **Step 3.** In the Switch Control Policy Create section, for the Organization select ORA21 and for the policy name enter "ORA-Eth-Network-Control." Click Next.
- **Step 4.** In the Policy Details section, keep the parameter as shown below:

	Deliev Details
General	Add policy details
2 Policy Details	This policy is applicable only for UCS Servers (FI-Attached)
	Enable CDP 0
	MAC Register Mode ©
	Only Native VLAN All Host VLANs
	Action on Uplink Fail 💿
	Eink Down Warning
	Important! If the Action on Uplink is set to Warning, the switch will not fail over if uplink connectivity is lost.
	MAC Security
	Forge ©
	Allow O Deny
	LLDP
	Enable Transmit ©

Step 5. Click Create to create this policy.

Procedure 6. Configure Ethernet Network Group Policy

Note: We configured two Ethernet Network Groups to allow two different VLAN traffic for this solution.

- **Step 1.** To configure the Ethernet Network Group Policy for the UCS server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Ethernet Network Group.
- **Step 3.** In the Switch Control Policy Create section, for the Organization select ORA21 and for the policy name enter "Eth-Network-135." Click Next.
- **Step 4.** In the Policy Details section, for the Allowed VLANs and Native VLAN enter 135 as shown below:

Create Ethernet Network Group					
General	Policy Details Add policy details				
	VLAN Settings				
	Native VLAN 135	Ĵ © 1 - 4093			
	Enable QinQ Tunneling 💿				
	Allowed VLANs 135	0			

Step 5. Click Create to create this policy for VLAN 135.

Step 6. Create "Eth-Network-10" and add VLAN 10 for the Allowed VLANs and Native VLAN.

Note: For this solution, we used these two Ethernet Network Group policies and applied them on different vNICs to carry individual both the VLAN traffic.

Procedure 7. Configure Ethernet Adapter Policy

- **Step 1.** To configure the Ethernet Adapter Policy for the UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Ethernet Adapter.

≡	cisco Intersight	🎝 📽 Infrastructure Service $ \checkmark $			Q Search	Ø
:@:	Overview	← Policies Create				
$(\widetilde{\boldsymbol{0}})$	Operate Servers	^ Filters				
	Chassis Fabric Interconnects HyperFlex Clusters Integrated Systems	Platform Type All UCS Server UCS Domain	Adapter Configuration BIOS Boot Order Cartificate Management	Ethernet QoS FC Zone Fibre Channel Adapter	iSCSI Static Target LAN Connectivity LDAP	SD Card Serial Over LAN SMTP
ه.	Configure Profiles Templates Policies	UCS Chassis UCS Chassis HyperFlex Cluster Kubernetes Cluster	Certaincate management Device Connector Ethernet Adapter Ethernet Network Ethernet Network Ethernet Network	Fibre Channel QoS IMC Access IPMI Over LAN	Network Connectivity NTP Persistent Memory Power	SSH Storage Syslog
	Pools		Ethernet Network Group	iscsi Boot	SAN Connectivity	Virtual Media

- **Step 3.** In the Ethernet Adapter Configuration section, for the Organization select ORA21 and for the policy name enter ORA-Linux-Adapter.
- **Step 4.** Select the Default Ethernet Adapter Configuration option and select Linux from the popup menu. Click Next.

Policies > Ethernet Adapter	
Create	
General Deline Details	General Add a name, description and tag for the policy.
2 Policy Details	Organization * ORA21 ~
	Name * ORA-Linux-Adapter
	Set Tags
	Description ///. <= 1024
	Ethernet Adapter Default Configuration
	Selected Default Linux $ \times \odot $

- **Step 5.** In the Ethernet Adapter Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-Linux-Adapter." Select the Default Ethernet Adapter Configuration option and select Linux from the popup menu. Click Next.
- **Step 6.** In the Policy Details section, for the recommended performance on the ethernet adapter, keep the "In-terrupt Settings" parameter.

General	Policy Details	
	Add policy details	
2 Policy Details		All Platforms
	Enable Virtual Extensible LAN 💿	
	Enable Network Virtualization using Generic Routing Encapsulation \odot	
	Enable Accelerated Receive Flow Steering	
	Enable Precision Time Protocol 💿	
	Enable Advanced Filter 💿	
	Enable Interrupt Scaling ©	
	● Enable GENEVE Offload ◎	
	RoCE Settings	
	Enable RDMA over Converged Ethernet	





Step 7. Click Create to create this policy.

Procedure 8. Create Ethernet QoS Policy

- **Step 1.** To configure the Ethernet QoS Policy for the UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Ethernet QoS.
- **Step 3.** In the Create Ethernet QoS Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-Eth-QoS-1500" click Next.
- Step 4. Enter QoS Settings as shown below to configure 1500 MTU for management vNIC.

Ceneral Policy Details	Policy Details Add policy details		🏹 All Platforms 🛛 UCS Server (Standalone)	UCS Server (FI-Attached)
	QoS Settings			
	MTU, Bytes 1500	0 0	Rate Limit, Mbps 0	<u> </u>
	Burst 10240	<u> </u>	Priority Best-effort	
	● Enable Trust Host CoS ©			

Step 5. Click Create to create this policy for vNICO.

- **Step 6.** Create another QoS policy for second vNIC running oracle private network and interconnect traffic.
- **Step 7.** In the Create Ethernet QoS Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-Eth-QoS-9000." Click Next.
- **Step 8.** Enter QoS Settings as shown below to configure 9000 MTU for oracle database private interconnect vNIC traffic.

General Policy Details	Policy Details Add policy details		All Platforms UCS Server (Standalone)	UCS Server (FI-Attached)
	QoS Settings			
	MTU, Bytes		Rate Limit, Mbps	
	9000	0		Ĵ 0
	Durat		Deioritu	
	10240	0	Best-effort	
	● Enable Trust Host CoS ©			

Step 9. Click Create to create this policy for vNIC1.

Procedure 9. Configure LAN Connectivity Policy

Two vNICs were configured per server as shown in Table 9.

Table 9. Configured VNICs

Name	Switch ID	PCI-Order	MAC Pool	Fail-Over
vNICO	FI – A	0	ORA-MAC-A	Enabled
vNIC1	FI – B	1	ORA-MAC-B	Enabled

Step 1. Go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select "UCS Server" and for the policy select "LAN Connectivity."

Step 2. In the LAN Connectivity Policy Create section, for the Organization select ORA21, for the policy name enter "ORA-LAN-Policy" and for the Target Platform select UCS Server (FI-Attached). Click Next.

≡	cisco Intersight	C Sea	arch
:¢:	Overview	Policies > LAN Connectivity Create	
	Operate		
	Servers	General General	
	Chassis Fabric Interconnects	Add a name, description and tag for the policy. Organization * ORA21	
	HyperFlex Clusters	Name *	
	Integrated Systems	ORA-LAN-Policy	
.0	Configure Profiles	Target Platform ◎ ○ UCS Server (Standalone) UCS Server (FI-Attached)	
	Templates	Set Tags	
	Policies		
	Pools	Description	

- **Step 3.** In the Policy Details section, click Add vNIC. In the Add vNIC section, for the first vNIC enter vNIC0. In the Edit vNIC section, for the vNIC name enter "vNIC0" and for the MAC Pool select ORA-MAC-A.
- **Step 4.** In the Placement option, select Simple and for the Switch ID select A as shown below:

Edit	AN-Policy
Edit vNIC	
	General
	Name * vNIC0 Pin Group Name ©
l	MAC
	Pool Static
	MAC Pool * 0
	Selected Pool ORA-MAC-A × 💿 🧷
	Placement
	Simple Advanced
	When Simple Placement is selected, the Slot ID and PCI Link are automatically determined by the system. vNICs are deployed on the first VIC. The Slot ID determines the first VIC. Slot ID numbering begins with MLOM, and thereafter it keeps incrementing by 1, starting from 1.
	Switch ID *
	A v 0

Step 5. For Failover select Enable for this vNIC configuration. This enables the vNIC to failover to another FI.

Failover				
Enabled 🕕				
Ethernet Network Group * (
Selected Policy Eth-Networ	k-135 © 🖉 Edi	it Selection 🛍		
Ethernet Network Control*	<u>(</u>)			
Selected Policy ORA-Eth-N	etwork-Control ©	🔗 Edit Selection	匬	
Ethernet QoS * 🛈				
Selected Policy ORA-Eth-Q	oS-1500 © Ø I	Edit Selection 🖻		
Ethernet Adapter * 🛈				
Selected Policy ORA-Linux-	Adapter 💿 🔗 🛙	Edit Selection 🖻		
iSCSI Boot 🛈				
Select Policy				
Connection				
Disabled	usNIC	VMQ	SR-IOV)

- **Step 6.** For the Ethernet Network Group Policy, select Eth-Network-135. For the Ethernet Network Control Policy select ORA-Eth-Network-Control. For Ethernet QoS, select ORA-Eth-QoS-1500, and for the Ethernet Adapter, select ORA-Linux-Adapter. Click Add to add vNIC0 to this policy.
- Step 7. Add a second vNIC. For the name enter "vNIC1" and for the MAC Pool select ORA-MAC-B.
- **Step 8.** In the Placement option, select Simple and for the Switch ID select B as shown below:

General	
Name * vNIC1	© Pin Group Name ✓ ⊙
MAC	
Pool Static	
MAC Pool * ⊙ Selected Pool ORA-MAC-B × ⊚ ∥	
Placement	
Simple Advanced	
When Simple Placement is selected, the Slot vNICs are deployed on the first VIC. The Slo MLOM, and thereafter it keeps incrementing	t ID and PCI Link are automatically determined by the system. ID determines the first VIC. Slot ID numbering begins with g by 1, starting from 1.
Switch ID * B	∨ ©

- Step 9. For Failover select Enable for this vNIC configuration. This enables the vNIC to failover to another FI.
- **Step 10.** For the Ethernet Network Group Policy, select Eth-Network-10. For the Ethernet Network Control Policy, select ORA-Eth-Network-Control. For the Ethernet QoS, select ORA-Eth-QoS-9000, and for the Ethernet Adapter, select ORA-Linux-Adapter. Click Add to add vNIC0 to this policy.

Failover
Enabled O
Ethernet Network Group Policy * ©
Selected Policy Eth-Network-10 × 💿 🧷
Ethernet Network Control Policy * © Selected Policy ORA-Eth-Network-Control × © 🖉
Ethernet QoS * O
Selected Policy ORA-Eth-QoS-9000 × 👁 🧷
Ethernet Adapter * ☉ Selected Policy ORA-Linux-Adapter × ⊚ Ø
iSCSI Boot ☉
Select Policy 🗐
Connection
Disabled usNIC VMQ

Step 11. Click Add to add vNIC1 into this policy.

Step 12. After adding these two vNICs, review and make sure the Switch ID, PCI Order, Failover Enabled, and MAC Pool are as shown below:

General	IQN									
2 Policy Details		None Po	ol	<u> </u>	Static					
	6	This option ensures the IQN	l name is n	ot associa	ited with the poli					
	vNIC	Configuration								
		Manual vNICs Placement		Au						
	i	For manual placement optic	in you nee	d to speci	fy placement for	each vNIC. Lear	n more at Help C			
6	Ac								Graphic vNICs Ed	ditor
		🧷 📋 📔 🔍 Add Filte			⊖ Ex	port 2 items	found 50 v	per page 🔣 🔇	1_ of 1 🕞 🕅	
		Name ‡	Slot ID	• •	Switch :	PCI Or 💲	Failover :	Pin Gro 💲	MAC P 2	Ş
		VNICO	Auto		A		Enabled			
		vNIC1	Auto		В		Enabled			
	Ø	/ 0							E of 1	N N

Step 13. Click Create to create this policy.

Procedure 10. Create Fibre Channel Network Policy

- **Step 1.** To configure the Fibre Channel Network Policy for the UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Fibre Channel Network.

Note: For this solution, we configured two Fibre Channel network policy as "ORA-FC-Network-151" and "ORA-FC-Network-152" to carry two VSAN traffic 151 and 152 on each of the Fabric Interconnect.

- **Step 3.** In the Create Fibre Channel Network Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-FC-Network-151." Click Next.
- Step 4. For the VSAN ID enter 151 as shown below:

 General Policy Details 	Policy Details Add policy details		V
	Fibre Channel Network		
	VSAN ID 151) © 1 - 4094	

- Step 5. Click Create to create this policy for VSAN 151.
- **Step 6.** Create another Fibre Channel Network Policy for the UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 7.** For the platform type select UCS Server and for the policy select Fibre Channel Network.
- **Step 8.** In the Create Fibre Channel Network Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-FC-Network-152." Click Next.
- Step 9. For the VSAN ID enter 152 as shown below:

 General Policy Details 	Policy Details Add policy details	
	Fibre Channel Network	
	VSAN ID 152	 1 - 4094

Step 10. Click Create to create this policy for VSAN 152.

Procedure 11. Create Fibre Chanel QoS Policy

- **Step 1.** To configure the Fibre Channel QoS Policy for the UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Fibre Channel QoS.

- **Step 3.** In the Create Fibre Channel QoS Configuration section, for the Organization select ORA21 and for the policy name enter ORA-FC-QoS click Next.
- Step 4. Enter QoS Settings as shown below to configure QoS for Fibre Channel for vHBA0:

General Policy Details	Policy Details Add policy details		V All Platforms UCS Server (Standalone)	UCS Server (FI-Attached)
	Fibre Channel QoS			
	Rate Limit, Mbps 0	0 100000	Maximum Data Field Size, Bytes 2112	
	Burst 10240	© ⊙	Priority FC	

Step 5. Click Create to create this policy for Fibre Channel QoS.

Procedure 12. Create Fibre Channel Adapter Policy

Two vHBA (HBA0 and HBA1) were configured for Boot from SAN and eight vHBAs (HBA2 to HBA9) were configured to carry the NVMe/FC network traffic for the databases. We have created two different Fibre Channel Adapter Policy for both FC and NVMe/FC as explained below.

- **Step 1.** To configure the Fibre Channel Adapter Policy for the UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Fibre Channel Adapter.
- **Step 3.** In the Create Fibre Channel Adapter Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-FC-Adapter-Linux". For the Fibre Channel Adapter Default Configuration, select Linux and click Next.

Policies > Fibre Channel Adapter	
Create	
1 General	General
	Add a name, description and tag for the policy.
2 Policy Details	
	Organization *
	ORA21 ~
	Name *
	ORA-FC-Adapter-Linux
	Set Tags
	Description
	<= 1024
	Fibre Channel Adapter Default
	Configuration
	Selected Default
	Configuration Linux × ©

Note: For this solution, we used the default linux adapter settings to configure the FC HBA's while we used FCNVMeInitiator configuration for NVMe/FC HBA's.

General Policy Details	Policy Details Add policy details		V All Platforms UCS Server (Standalone)	UCS Server (FI-Attached)
	Error Recovery			
	Port Down Timeout, ms 10000	0 - 240000	Link Down Timeout, ms 30000	<mark>₿ ©</mark> 0 - 240000
	I/O Retry Timeout, Seconds 5	<mark>0</mark>	Port Down IO Retry, ms 8	<mark>0 ∞</mark> 0 - 255
	Error Detection Error Detection Timeout 2000) o 1000 - 100000		
	Resource Allocation Timeout	() ()		
General	Flogi			
2 Policy Details	Flogi Retries 8	○ ○ >= ○	Flogi Timeout, ms 4000	⊜ ⊘ 1000 - 255000
	Plogi			
	Plogi Retries 8	<mark>€</mark> ⊙ 0 - 255	Plogi Timeout, ms 4000	0 o 1000 - 255000
	Interrupt			
	MSix			
	512	C O 1 - 1024		

\odot	General	I/O Throttle Count 512	<u>(</u>) o		
2	Policy Details				
-		LUN			
		Maximum LUNs Per Target		LUN Queue Depth	
		1024	0 0	20	0 0
		Receive			
		Receive Ring Size			
		64	() o		
		Transmit			
		Transmit			
		Transmit Ring Size			
		64			
		SCSI I/O			
_					
		SCSI I/O Queues		SCSI I/O Ring Size	
			<u>)</u> o	512	Î 0

- **Step 4.** Click Create to create this policy for vHBA for FC HBA's.
- **Step 5.** Now similarly, to configure another Fibre Channel Adapter Policy for the NVMe/FC HBA's, go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select UCS Server and for the policy select Fibre Channel Adapter.
- **Step 6.** In the Create Fibre Channel Adapter Configuration section, for the Organization select ORA21 and for the policy name enter "ORA-NVMe-Adapter-Linux." For the Fibre Channel Adapter Default Configuration, select "FCNVMeInitiator" and click Next.
- **Note:** We kept all the parameter to default settings and set "SCSI I/O Queues" to 16 as shown below:

General	I/O Throttle Count ① 512	<u>^</u>	
2 Policy Details			
	LUN		
	Maximum LUNs Per Target 🕕		LUN Queue Depth 🛞
	1024		20
		1 - 4096	1 - 254
	Receive		
	Receive Ring Size 🚯		
	64	÷	
		>= 64	
	Transmit		
	Transmit Ring Size 🛈		
	64	<u> </u>	
		>= 64	
	SCSI I/O		
	SCSI I/O Queues ①		SCSI I/O Ring Size 🛈
	16	 	64
		1 - 245	64 - 512

Step 7. Click on Create to create this policy for vHBA for NVMe HBA's.

Procedure 13. Configure SAN Connectivity Policy

As mentioned previously, two vHBA (HBA0 and HBA1) were configured for Boot from SAN on two VSANs. HBA0 was configured to carry the FC Network Traffic on VSAN 151 and boot from SAN through the MDS-A Switch while HBA1 was configured to carry the FC Network Traffic on VSAN 152 and boot from SAN through the MDS-B Switch.

A total of eight vHBAs were configured to carry the NVMe/FC network traffic for the database on two VSANs. Four vHBAs (HBA2, HBA4, HBA6 and HBA8) were configured to carry the NVMe/FC network traffic on VSAN 151 for Oracle RAC database storage traffic through MDS-A Switch. Four vHBA (HBA3, HBA5, HBA7 and HBA9) were configured to carry the NVMe/FC network traffic on VSAN 152 for Oracle RAC database storage traffic through the MDS-B Switch.

For each Server node, a total of 10 vHBAs were configured as listed in <u>Table 10</u>.

Name	vHBA Туре	Switch ID	PCI-Order	Fibre Channel Network	Fibre Channel Adapter	Fibre Channel QoS
HBA0	fc-initiator	FI – A	2	ORA-FC-Network-151	ORA-FC-Adapter-Linux	ORA-FC-QoS
HBA1	fc-initiator	FI – B	3	ORA-FC-Network-152	ORA-FC-Adapter-Linux	ORA-FC-QoS
HBA2	fc-nvme-initiator	FI – A	4	ORA-FC-Network-151	ORA-NVMe-Adapter-Linux	ORA-FC-QoS

Table 10. Configured vHBAs

Name	vHBA Туре	Switch ID	PCI-Order	Fibre Channel Network	Fibre Channel Adapter	Fibre Channel QoS
HBA3	fc-nvme-initiator	FI – B	5	ORA-FC-Network-152	ORA-NVMe-Adapter-Linux	ORA-FC-QoS
HBA4	fc-nvme-initiator	FI – A	6	ORA-FC-Network-151	ORA-NVMe-Adapter-Linux	ORA-FC-QoS
HBA5	fc-nvme-initiator	FI – B	7	ORA-FC-Network-152	ORA-NVMe-Adapter-Linux	ORA-FC-QoS
HBA6	fc-nvme-initiator	FI – A	8	ORA-FC-Network-151	ORA-NVMe-Adapter-Linux	ORA-FC-QoS
HBA7	fc-nvme-initiator	FI – B	9	ORA-FC-Network-152	ORA-NVMe-Adapter-Linux	ORA-FC-QoS
HBA8	fc-nvme-initiator	FI – A	10	ORA-FC-Network-151	ORA-NVMe-Adapter-Linux	ORA-FC-QoS
HBA9	fc-nvme-initiator	FI – B	11	ORA-FC-Network-152	ORA-NVMe-Adapter-Linux	ORA-FC-QoS

Step 1. Go to > Infrastructure Service > Configure > Polices > and click Create Policy. For the platform type select UCS Server and for the policy select SAN Connectivity.

Step 2. In the SAN Connectivity Policy Create section, for the Organization select ORA21, for the policy name enter ORA-SAN-Policy and for the Target Platform select UCS Server (FI-Attached). Click Next.

Policies > SAN Connectivity	
Create	
1 General	General Add a name, description and tag for the policy.
2 Policy Details	Organization * ORA21 ~
	Name * ORA-SAN-Policy
	Target Platform © O UCS Server (Standalone) O UCS Server (FI-Attached)
	Set Tags
	Description ///

- **Step 3.** In the Policy Details section, select WWNN Pool and then select WWNN-Pool that you previously created. Click Add vHBA.
- Step 4. In the Add vHBA section, for the Name enter "HBA0" and for the vHBA Type enter "fc-initiator."
- **Step 5.** For the WWPN Pool, select the WWPN-Pool that you previously created, as shown below:

Policies > SAN Connectivity			
Create			
Add vHBA			
	General		
	Name * HBA0	vHBA Type fc-initiator	
	Pin Group Name		
	WWPN		
	Pool Static		
	WWPN Pool * ⊙ Selected Pool WWPN-Pool × ∞ Ø		
	Placement		
	Simple Advanced		

- **Step 6.** For the Placement, keep the option Simple and for the Switch ID select A and for the PCI Order select 2.
- **Step 7.** For the Fibre Channel Network select ORA-FC-Network-151.
- **Step 8.** For the Fibre Channel QoS select ORA-FC-QoS.
- **Step 9.** For the Fibre Channel Adapter select ORA-FC-Adapter-Linux.

Placement
Simple Advanced
When Simple Placement is selected, the Slot ID and PCI Link are automatically determined by the system. vHBAs are deployed on the first VIC. The Slot ID determines the first VIC. Slot ID numbering begins with MLOM, and thereafter it keeps incrementing by 1, starting from 1.
Switch ID *
A <u>v o</u>
PCI Order
2
Persistent LUN Bindings
Persistent LUN Bindings 💿
Fibre Channel Network *
Selected Policy ORA-FC-Network-151 × 👁 🖉
Fibre Channel QoS * 💿
Selected Policy ORA-FC-QoS × 💿 🧷
Fibre Channel Adapter * O
Selected Policy ORA-FC-Adapter-Linux × 👁 🖉

Step 10. Click Add to add this first HBA0.

Step 11. Click Add vHBA to add a second HBA.

Step 12. In the Add vHBA section, for the Name enter "HBA1" and for the vHBA Type select fc-initiator.

Step 13. For the WWPN Pool select WWPN-Pool that was previously create, as shown below:

Create	
Add vHBA	
	General
	Name * HBA1 © VHBA Type fc-initiator ~ 0
	Pin Group Name 🗸 💿
	WWPN
	Pool Static
	WWPN Pool ★ ⊙ Selected Pool WWPN-Pool × ∞ Ø

Step 14. For the Placement, keep the option Simple and for Switch ID select B and for the PCI Order select 3.

Step 15. For the Fibre Channel Network select ORA-FC-Network-152.

Step 16. For the Fibre Channel QoS select ORA-FC-QoS.

Step 17. For the Fibre Channel Adapter select ORA-FC-Adapter-Linux.

Switch ID * B v o	
PCI Order 3 ©	
Persistent LUN Bindings	
Persistent LUN Bindings ©	
Fibre Channel Network * 0	
Selected Policy ORA-FC-Network-152 $ $ $ imes$ $ $ \odot $ $ $ otive{ORA-FC-Network-152}$	
Fibre Channel QoS * ☉	
Selected Policy ORA-FC-QoS \mid $ imes$ \mid \otimes \mid $ ot\!\!/$	
Fibre Channel Adapter * 0	
Selected Policy ORA-FC-Adapter-Linux $ $ $ imes$ $ $ $@$ $ $ $ ot\! /$	
FC Zone © Select Policy(s) 🗐	

Step 18. Click Add to add this second HBA1.

Note: For this solution, we added another eight HBA for NVME/FC.

Step 19. Click Add vHBA.

Step 20. In the Add vHBA section, for the Name enter "HBA2" and for the vHBA Type select fc-nvme-initiator.

Step 21. For the WWPN Pool select WWPN-Pool, which was previously created, as shown below:

General	
Name * HBA2 O	vHBA Type fc-nvme-initiator v O
Pin Group Name v o	
WWPN	
Pool Static	
WWPN Pool * ◎ Selected Pool WWPN-Pool × ◎ Ø	
Placement	
Simple Advanced	

- Step 22. For the Placement, keep the option Simple and for the Switch ID select A and for the PCI Order select 4.
- Step 23. For the Fibre Channel Network select ORA-FC-Network-151.
- Step 24. For the Fibre Channel QoS select ORA-FC-QoS.
- Step 25. For the Fibre Channel Adapter select ORA-NVMe-Adapter-Linux.
- Step 26. Click Add to add this HBA2.
- **Note:** For this solution, we added another seven HBA for NVME/FC.
- Step 27. Click Add vHBA and select the appropriate vHBA Type, WWPN Pool, Simple Placement, Switch ID, PCI Order, Fibre Channel Network, Fibre Channel QoS, and Fibre Channel Adapter for all rest of the HBAs listed in <u>Table 10</u>.
- **Step 28.** After adding the ten vHBAs, review and make sure the Switch ID, PCI Order, and HBA Type are as shown below:

General Policy Details	WWNN Pool * © Selected Pool WWNN-Pool × © /							
	Ad	d vHBA	you need to specify pl	acement for each vHB	A. Learn more at Help 10 items found	Center 50 ∨ per page ເK [Graphic vHBAs Ed	itor
		Name ‡	Slot ID 🗘	Switch ID	PCI Order 🗘	Pin Group 🗘	WWPN Pool 🗘	Ş
		HBA0	Auto	A	2	-	WWPN-Pool	
		HBA1	Auto	В				••••
		HBA2	Auto	A	4			
		НВАЗ	Auto	В				
		HBA4	Auto	A	6			•••
		HBA5	Auto	В				••••
		HBA6	Auto	A	8			••••
		HBA7	Auto	В				••••
		HBA8	Auto	A	10			
		HBA9	Auto	В	11	-	WWPN-Pool	

Step 29. Click Create to create this policy.

Procedure 14. Configure Boot Order Policy

All Oracle server nodes are set to boot from SAN for this Cisco Validated Design, as part of the Service Profile. The benefits of booting from SAN are numerous; disaster recovery, lower cooling, and power requirements for each server since a local drive is not required, and better performance, and so on. We strongly recommend using "Boot from SAN" to realize the full benefits of Cisco UCS stateless computing features, such as service profile mobility.

Note: For this solution, we used SAN Boot and configured the SAN Boot order policy as detailed in this procedure.

To create SAN Boot Order Policy, you need to enter the WWPN of Pure Storage Target ports. The screenshot below shows both the Pure Storage Controller FC Ports and related WWPN:

0	PURESTORAGE"	• Health								<u>A</u> 8	Q Search
۹	Dashboard	Hardware	Alerts	Connections	Network						
۲		Host Conne	ections ~								1-10 of 3
$\overline{\heartsuit}$		Array Conne	ections								
		Array		Pa	ths		Replication	Address			
Q							No array	paths found.			
		Array Ports	^								
		FC Port	Name			Speed	Failover	FC Port	Name		Speed
Ð	Health	CT0.FC32	52:4	A:93:7A:7E:04:85:8	0	32 Gb/s		CT1.FC32	12:4A:93:7A:7E:04:85:90		32 Gb/s
*	Settings	CT0.FC33	52:4	A:93:7A:7E:04:85:8	1	32 Gb/s		CT1.FC33	52:4A:93:7A:7E:04:85:91		32 Gb/s
		CT0.FC4	100 52:4	A:93:7A:7E:04:85:0	4	32 Gb/s		CT1.FC4	🕎 52:4A:93:7A:7E:04:85:14		32 Gb/s
Help		CT0.FC5	100 52:4	A:93:7A:7E:04:85:0	5	32 Gb/s		CT1.FC5	152:4A:93:7A:7E:04:85:15		32 Gb/s
End L		CT0.FC6	52:4	A:93:7A:7E:04:85:0	6	32 Gb/s	-	CT1.FC6	w 52:4A:93:7A:7E:04:85:16		32 Gb/s
Log C		CT0.FC7	52:4	A:93:7A:7E:04:85:0	7	32 Gb/s		CT1.FC7	52:4A:93:7A:7E:04:85:17		32 Gb/s

- **Step 1.** To configure Boot Order Policy for UCS Server profile, go to > Infrastructure Service > Configure > Polices > and click Create Policy.
- **Step 2.** For the platform type select UCS Server and for the policy select Boot Order.
- **Step 3.** In the Boot Order Policy Create section, for the Organization select ORA21 and for the name of the Policy select SAN-Boot. Click Next.
- **Step 4.** In the Policy Details section, click Add Boot Device and select Virtual Media for the first boot order. Name the device "KVM-DVD" and for the Sub-type select KVM MAPPED DVD as shown below:

\oslash	General	Policy Details				
2	Policy Details	Add policy details				
			All Platforms	UCS Server (Standalone)	UCS Server	(FI-Attached)
		Configured Boot Mode 🛛				
		Unified Extensible Firmware Interface (UEFI) Clegacy				
		Enable Secure Boot ©				
		Add Boot Device ~				
		— Virtual Media (KVM-DVD)		Ena	bled 🛛 🔟	~ ~
		Device Name * KVM-DVD				
			Sub-Type KVM MAPPED DVD			

- **Step 5.** Add the second boot order: Click Add Boot Device and for the second boot order for HBA0, select SAN Boot as the primary path through the Pure Storage Controller port CT0-FC04.
- **Step 6.** Enter the Device Name, Interface Name, and Target WWPN according to storage target.

─ SAN Boot (PureFAXL170-ORA21c-CT0-FC04) ⊘	Enabled 🗍 🔨 🗸
Device Name* () PureFAXL170-ORA21c-CT0-FC04	LUN ③ 1 0 - 255
Slot (i)	Interface Name* () HBA0
Target WWPN* () 52:4A:93:7A:7E:04:85:04	
Bootloader Name () Bootloader Name	Bootloader Description () Bootloader Description
Bootloader Path () Bootloader Path	

Note: We added a third boot order and the appropriate target for HBA0 as the secondary path through Pure Storage Controller port CT1-FC04 as shown in the screenshot below.

Step 7. Enter the Device Name, Interface Name, and Target WWPN according to storage target.

— SAN Boot (PureFAXL170-ORA21c-CT1-FC04) ⊘	Enabled 🛛 💼 🔨 🗸
Device Name * () PureFAXL170-ORA21c-CT1-FC04	LUN ① 1 0 - 255
Slot ① Slot	Interface Name* ③ HBA0
Target WWPN * ③ 52:4A:93:7A:7E:04:85:14	
Bootloader Name () Bootloader Name	Bootloader Description ③ Bootloader Description
Bootloader Path () Bootloader Path	

Note: We added a fourth boot order for now HBA1 as the primary path through Pure Storage Controller port CT0-FC05.

Step 8. Enter the Device Name, Interface Name and Target WWPN according to storage target.

SAN Boot (PureFAXL170-ORA21c-CT0-FC05) ⊘	Enabled 🗎 🔨 🗸
Device Name* () PureFAXL170-ORA21c-CT0-FC05	LUN ③ 1 0 - 255
Slot ①	Interface Name * 🛈
Slot	HBA1
Target WWPN* ①	
52:4A:93:7A:7E:04:85:05	
Bootloader Name 🚯	Bootloader Description 🚯
Bootloader Name	Bootloader Description
Bootloader Path 🛈	
Bootloader Path	

Note: We added a fifth boot order for HBA1 as the secondary path through Pure Storage Controller port CT1-FC05.

Step 9. Enter the Device Name, Interface Name and Target WWPN according to storage target.

SAN Boot (PureFAXL170-ORA21c-CT1-FC05) ⊘	Enabled 🛅 🔨 🗸
Device Name* () PureFAXL170-ORA21c-CT1-FC05	LUN ③ 1 ^ 0 - 255
Slot ①	Interface Name* 🛈
Slot	HBA1
Target WWPN * 🚯	
52:4A:93:7A:7E:04:85:15	
Bootloader Name 🚯	Bootloader Description ①
Bootloader Name	Bootloader Description
Bootloader Path () Bootloader Path	

- **Step 10.** By configuring both FC Boot HBAs (HBA0 and HBA1) with the Primary and Secondary path, you have configured high availability for SAN boot, as well as a fourth path for the OS Boot LUNs.
- **Step 11.** Review the Policy details and verify that all four SAN boot paths are configured to provide high availability as shown below:
| General | Policy Details
Add policy details | |
|------------------|--|--|
| 2 Policy Details | | All Platforms UCS Server (Standalone) UCS Server (FI-Attached) |
| | Configured Boot Mode ○ | |
| | Enable Secure Boot ① Add Boot Device ~ | |
| | + Virtual Media (KVM-DVD) ③ | C Enabled 🛛 💼 🔿 🗸 |
| | + SAN Boot (PureFAXL170-ORA21c-CT0-FC04) ⊘ | Enabled 🛛 🖬 🔨 🗸 |
| | + SAN Boot (PureFAXL170-ORA21c-CT1-FC04) ⊙ | Enabled 🗎 🛧 🗸 |
| | + SAN Boot (PureFAXL170-ORA21c-CT0-FC05) | Enabled 🗎 🔨 🗸 |
| | + SAN Boot (PureFAXL170-ORA21c-CT1-FC05) © | Enabled 🛛 💼 🔦 🗸 |

Step 12. Click Create to create this SAN boot order policy.

Procedure 15. Configure and Deploy Server Profiles

The Cisco Intersight server profile allows server configurations to be deployed directly on the compute nodes based on polices defined in the profile. After a server profile has been successfully created, server profiles can be attached with the Cisco UCS X210c M7 Compute Nodes.

Note: For this solution, we configured eight server profiles; ORARAC1 to ORARAC8. We assigned the server profile ORARAC1 to Chassis 1 Server 3, server profile ORARAC2 to Chassis 1 Server 3, server profile ORARAC3 to Chassis 1 Server 5 and server profile ORARAC4 to Chassis 1 Server 7. We assigned the server profile ORARAC5 to Chassis 2 Server 1, server profile ORARAC6 to Chassis 2 Server 3, server profile ORARAC7 to Chassis 2 Server 5 and server profile ORARAC8 to Chassis 2 Server 7.

Note: All eight x210c M7 servers will be used to create Oracle RAC database nodes later in the database creation section.

Note: For this solution, we configured one server profile "ORARAC1" and attached all policies for the server profile which were configured in the previous section. We cloned the first server profile and created seven more server profiles; "ORARAC2", "ORARAC3", "ORARAC4", "ORARAC5", "ORARAC6", "ORARAC7" and "ORARAC8". Alternatively, you can create a server profile template with all server profile policies and the derive server profile from the standard template.

Step 1. To create a server profile, go to > Infrastructure Service > Configure > Profile > and then select the tab for UCS Server Profile. Click Create UCS Server Profile.

≡	الندان Intersight	÷ 1	nfrastructure Service 🗸			Q Search		⊘	£] 🚺	Q (୭
:Ø:	Overview		Profiles								
ତ୍	Analyze		HyperFlex Cluster Profiles UCS Chassis Pro	files UCS Domain Profiles UCS	Server Profiles						
	Operate							E.			
	Servers							<u> </u>	Create UC	S Server F	Profile
	Chassis		All UCS Server Prof +			🕞 Export	13 items found	14 ∨ per	page R R	1 of 1	
	Fabric Interconnects										
	HyperFlex Clusters		Status	Inconsistency Reason	Target Platform						
	Integrated Systems	_	Inconsistent 1 Not Assigned 9 OK 3	1 • Pending Changes 1	FI-Attached 13						
,e	Configure	4									
	Profiles		Name ‡ Status	Target Platform	CCS Server Template	Server		Last U	Jpdate		ş

Step 2. In Create Server Profile, for the Organization select ORA21 and for the Name for the Server Profile enter "ORARAC1." For the Target Platform type select UCS Server (FI-Attached).

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:Ø:	Overview	<pre>← Profiles</pre> Create UCS Server P	rofile
(Q)	Operate ^		
	Servers	General	General
	Chassis	2 Server Assignment	Enter a name, description, tag and select a platform for the server profile.
	Fabric Interconnects	3 Compute Configuration	Organization * ORA21 v
	HyperFlex Clusters	4 Management Configuration	
	Integrated Systems	5 Storage Configuration	Name * ORARAC1
O,	Analyze ^		
	Explorer New	6 Network Configuration	Target Platform 💿
C	Configure	7 Summary	UCS Server (Standalone) UCS Server (FI-Attached)
Т	Profiles		
	Templates		Set Tags
	Policies		
	Pools		Description

Step 3. In the Server Assignment menu, select Chassis 1 Server 1 to assign this server profile and click Next.

Step 4. In the Compute Configuration menu, select UUID Pool and select the ORA-UUID option that you previously created. For the BIOS select ORA-BIOS and for the Boot Order select SAN-Boot that you previously created. Click Next.

\oslash	General	Compute Configuration	
\oslash	Server Assignment	Create or select existing Compute policies that you want to associate with this profile.	
3	Compute Configuration		
4	Management Configuration	Pool Static	
5	Storage Configuration	UUID Pool Selected Pool ORA-UUID × © //	
6	Network Configuration	BIOS	⊘ ORA-BIOS
7	Summary	Boot Order	SAN-Boot 📋
		Firmware	
		Power	
		Thermal	
		Virtual Media	

Step 5. In the Management Configuration menu, for the IMC Access select ORA-IMC-Access to configure the Server KVM access and then click Next.

0	General	Management Configuration Create or select existing Management policies that you want to associate with this profile.	
⊘ ○	Server Assignment	Certificate Management	
⊘ ●	Compute Configuration	IMC Access	♥ ORA-IMC-Access
4	Management Configuration		
5	Storage Configuration	Local User 	
6	Network Configuration	SNMP	
7	Summary	Syslog	
		Virtual KVM	

- **Note:** We didn't configure any local storage or any storage policies for this solution.
- Step 6. Click Next to go to Network configuration.
- **Step 7.** For the Network Configuration section, for the LAN connectivity select ORA-LAN-Policy and for the SAN connectivity select ORA-SAN-Policy that you previously created.

General	Network Configuration
Server Assignment	Create or select existing Network Configuration policies that you want to associate with this profile.
Ompute Configuration	LAN Connectivity ORA-LAN-Policy
Management Configuration	SAN Connectivity ORA-SAN-Policy
Storage Configuration	Auto Placement Configuration for VNICs & VHBAS
B Network Configuration	Graphical representation of vNICs & vHBAs placement is only applicable for Auto Configuration mode.
7 Summary	
	No vNICs & vHBAs Placement Available
	Assign server and attach LAN/SAN connectivity policies to view representation

Note: By assigning these LAN and SAN connectivity in the server profile, the server profile will create and configure two vNIC and ten vHBA on the server for management, private interconnect, and storage network traffic.

Step 8. Click Next and review the summary for the server profile and click Deploy to assign this server profile to the first server.

Note: After this server profile "ORARAC1" deploys successfully on chassis 1 server 1, you can clone this server profile to create another seven identical server profile for the rest of the seven remaining server nodes.

Step 9. To clone and create another server profile, go to Infrastructure Service > Configure > Profiles > UCS Server Profiles and Select server Profile ORARAC1 and click the radio button "---" and select option Clone as shown below:

≡	ះរះរះ Intersig	iht 🕽	🗣 Infrastructure Service $ imes $			Q Search	C	ତ ସୀ ଦି(oo 🗴 💿 🛛 🗴
:¢:	Overview		Profiles						
()	Operate		HyperFlex Cluster Profiles	UCS Chassis Profiles UCS Do	omain Profiles UCS Server Pro	files			
ତ୍	Analyze							Cre	Deploy Activate
,e	Configure		* All UCS Server Prof ©	+					Unassign Server
Ι	Profiles			Add Filter		[] Export 1	6 items found	14 v per page	Edit
	Templates		Status	Inconsistency Reason	Target Platform				Delete
	Policies		 Not Assigned 8 OK 8 	No data available	FI-Attached 16				Set User Label
	Pools								Create a Template
			Name	‡ Status ‡	Target Platform 2 UCS	Server Template Ser	ver	Last Update	Server Actions >
			ORARAC1	0 OK	UCS Server (FI-Attached)	FS	ORA-FI-1-1	a minute ago	

Step 10. From the Clone configuration menu, select Chassis 1 Server 3 and click Next. For the Server Profile Clone Name enter "ORARAC2" and for the Organization select ORA21 to create a second server profile for the second Cisco UCS x210c M7 server on chassis 1 server 3.

Note: We created seven more server profile clones; ORARAC2 to ORARAC8 and assigned these cloned server profiles to all the remaining seven servers.

The following screenshot shows the server profiles with the Cisco UCS domain and assigned servers from both chassis:

≡	cisco Intersight	နီး Infrastructure Service 🗸		Q Search	C
:Ø:	Overview	Profiles			
	Operate 🗸 🗸	HyperFlex Cluster Profiles UCS Chassis Pr	ofiles UCS Domain Profiles	Server Profiles	
୍	Analyze 🗸 🗸				
e	Configure	★ All UCS Server Prof ◎ +			
	Profiles	··· / Ø III 🔍 Add Filter			xport 16 items found
	Templates	Status Inconsiste	ncy Reason Target Platform	1	
	Policies	OK 8 Not Assigned 8 No data ava	FI-Attached 16		
	Pools				
		Name : Status	Target Platform	2 UCS Server Template	Server
		ORARAC1	UCS Server (FI-Attached	0	FS-ORA-FI-1-1
		ORARAC2	UCS Server (FI-Attached	1)	FS-ORA-FI-1-3
			UCS Server (FI-Attached	1)	FS-ORA-FI-1-5
		ORARAC4	UCS Server (FI-Attached	()	FS-ORA-FI-1-7
		ORARAC5	UCS Server (FI-Attached	1)	FS-ORA-FI-2-1
		ORARAC6	UCS Server (FI-Attached	1)	FS-ORA-FI-2-3
		ORARAC7	UCS Server (FI-Attached	1)	FS-ORA-FI-2-5
		ORARAC8	UCS Server (FI-Attached	1)	FS-ORA-FI-2-7

After the successful deployment of the server profile, the Cisco UCS X210c M7 Compute Nodes are configured with the parameters defined in the server profile. This completed Cisco UCS X-Series and Intersight Managed Mode (IMM) configuration can boot each server node from SAN LUN.

Cisco MDS Switch Configuration

This section provides a detailed procedure for configuring the Cisco MDS 9132T Switches.

IMPORTANT! Follow these steps precisely because failure to do so could result in an improper configuration.



The Cisco MDS Switches are connected to the Fabric Interconnects and the Pure Storage FlashArray//XL170 System as shown below:



For this solution, eight ports (ports 1 to 8) of the MDS Switch A were connected to the Fabric Interconnect A (ports 1/35/1-4 and 1/36/1-4). The port-channel (PC 41) was configured on these ports between MDS-A to FI-A. Eight ports (ports 1 to 8) of the MDS Switch B were connected to the Fabric Interconnect B (ports 1/35/1-4 and ports 1/36/1-4). Another port-channel (PC 42) was created and on these ports were MDS-B to FI-B. All of the ports carry 32 Gb/s FC Traffic. Table 11 lists the port connectivity of Cisco MDS Switches to the Fabric Interconnects.

vPC Description	vPC ID	Fabric Interconnects Ports	Cisco MDS Switch Ports	Allowed VSANs
Port Channel between MDS-A and	41	FI-A Port 1/35/1	MDS-A-1/1	151
FI-A		FI-A Port 1/35/2	MDS-A-1/2	
		FI-A Port 1/35/3	MDS-A-1/3	
		FI-A Port 1/35/4	MDS-A-1/4	
		FI-A Port 1/36/1	MDS-A-1/5	
		FI-A Port 1/36/2	MDS-A-1/6	
		FI-A Port 1/36/3	MDS-A-1/7	
		FI-A Port 1/36/4	MDS-A-1/8	
Port Channel	42	FI-B Port 1/35/1	MDS-B-1/1	152

Table 11. Cisco MDS Switch Port connectivity to Fabric Interconnect

vPC Description	vPC ID	Fabric Interconnects Ports	Cisco MDS Switch Ports	Allowed VSANs
between MDS-B and FI-B		FI-B Port 1/35/2	MDS-B-1/2	
		FI-B Port 1/35/3	MDS-B-1/3	
		FI-B Port 1/35/4	MDS-B-1/4	
		FI-B Port 1/36/1	MDS-B-1/5	
		FI-B Port 1/36/2	MDS-B-1/6	
		FI-B Port 1/36/3	MDS-B-1/7	
		FI-B Port 1/36/4	MDS-B-1/8	

For this solution, MDS Switch A and MDS Switch B both were connected to both the Pure Storage Controllers for high availability in case of MDS or Pure storage controller failures. Six ports (ports 17 to 22) from the MDS Switch A were connected to both the Pure Storage FA//XL170 controllers CT0 and CT1. Six ports (ports 17 to 22) from the MDS Switch B were also connected to both the Pure Storage FA//XL170 controllers CT0 and CT1. All ports carry 32 Gb/s FC Traffic. <u>Table 12</u> lists the port connectivity of Cisco MDS Switches to both the Pure Storage FA//XL170 CT0 and CT1.

MDS Switch	MDS Switch Port	Pure Storage FA//XL170 Controller	Pure Storage Controller Ports	Descriptions
MDS Switch A	FC Port 1/17	Storage FA//XL170 CT0	CT0.FC4	PureFAXL170-ORA21c-CT0.FC4
	FC Port 1/18	Storage FA//XL170 CT1	CT1.FC4	PureFAXL170-ORA21c-CT1.FC4
	FC Port 1/19	Storage FA//XL170 CT0	CT0.FC6	PureFAXL170-ORA21c-CT0.FC6
	FC Port 1/20	Storage FA//XL170 CT1	CT1.FC6	PureFAXL170-ORA21c-CT1.FC6
	FC Port 1/21	Storage FA//XL170 CT0	CT0.FC32	PureFAXL170-ORA21c-CT0.FC32
	FC Port 1/22	Storage FA//XL170 CT1	CT1.FC32	PureFAXL170-ORA21c-CT1.FC32
MDS Switch B	FC Port 1/17	Storage FA//XL170	CT0.FC5	PureFAXL170-ORA21c-CT0.FC5

Table 12. Cico MDS Switches port connectivity to the Pure Storage FA//XL170 Controller

MDS Switch	MDS Switch Port	Pure Storage FA//XL170 Controller	Pure Storage Controller Ports	Descriptions
		СТО		
	FC Port 1/18	Storage FA//XL170 CT1	CT1.FC5	PureFAXL170-ORA21c-CT1.FC5
	FC Port 1/19	Storage FA//XL170 CT0	CT0.FC7	PureFAXL170-ORA21c-CT0.FC7
	FC Port 1/20	Storage FA//XL170 CT1	CT1.FC7	PureFAXL170-ORA21c-CT1.FC7
	FC Port 1/21	Storage FA//XL170 CT0	CT0.FC33	PureFAXL170-ORA21c-CT0.FC33
	FC Port 1/22	Storage FA//XL170 CT1	CT1.FC33	PureFAXL170-ORA21c-CT1.FC33

The following procedures describe how to configure the Cisco MDS switches for use in a base FlashStack environment. These procedures assume you're using Cisco MDS 9332T FC switches.

Cisco Feature on Cisco MDS Switches

Procedure 1. Configure Features

Step 1. Login as admin user into MDS Switch A and MDS Switch B and run the following commands:

```
config terminal
feature npiv
feature fport-channel-trunk
copy running-config startup-config
```

Procedure 2. Configure VSANs and Ports

- Step 1. Login as Admin User into MDS Switch A.
- **Step 2.** Create VSAN 151 for Storage network traffic and configure the ports by running the following commands:

```
config terminal
vsan database
vsan 151
vsan 151 name "VSAN-FI-A"
vsan 151 interface fc 1/1-24
interface port-channel 41
switchport trunk allowed vsan 151
```

```
switchport description Port-Channel-FI-A-MDS-A
  switchport rate-mode dedicated
  switchport trunk mode off
  no shut
interface fc1/1
  switchport description FS-ORA-FI-A-1/35/1
  switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/2
  switchport description FS-ORA-FI-A-1/35/2
 switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/3
  switchport description FS-ORA-FI-A-1/35/3
 switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/4
  switchport description FS-ORA-FI-A-1/35/4
  switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/5
  switchport description FS-ORA-FI-A-1/36/1
 switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/6
  switchport description FS-ORA-FI-A-1/36/2
  switchport trunk mode off
 port-license acquire
  channel-group 41 force
```

```
no shutdown
interface fc1/7
  switchport description FS-ORA-FI-A-1/36/3
  switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/8
  switchport description FS-ORA-FI-A-1/36/4
  switchport trunk mode off
 port-license acquire
 channel-group 41 force
 no shutdown
interface fc1/17
  switchport trunk allowed vsan 151
 switchport description PureFAXL170-ORA21c-CT0.FC4
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/18
  switchport trunk allowed vsan 151
 switchport description PureFAXL170-ORA21c-CT1.FC4
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/19
  switchport trunk allowed vsan 151
 switchport description PureFAXL170-ORA21c-CT0.FC6
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/20
  switchport trunk allowed vsan 151
  switchport description PureFAXL170-ORA21c-CT1.FC6
  switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/21
```

```
switchport trunk allowed vsan 151
  switchport description PureFAXL170-ORA21c-CT0.FC32
  switchport trunk mode off
  port-license acquire
  no shutdown
interface fc1/22
  switchport trunk allowed vsan 151
  switchport description PureFAXL170-ORA21c-CT1.FC32
  switchport trunk mode off
  port-license acquire
  no shutdown
vsan database
 vsan 151 interface port-channel 41
 vsan 151 interface fc1/17
 vsan 151 interface fc1/18
 vsan 151 interface fc1/19
 vsan 151 interface fc1/20
 vsan 151 interface fc1/21
```

vsan 151 interface fc1/22

copy running-config startup-config

- Step 3. Login as Admin User into MDS Switch B
- **Step 4.** Create VSAN 152 for Storage network traffic and configure the ports by running the following commands:

```
config terminal
vsan database
vsan 152
vsan 152 name "VSAN-FI-B"
vsan 152 interface fc 1/1-24
interface port-channel 42
switchport trunk allowed vsan 152
switchport description Port-Channel-FI-B-MDS-B
switchport rate-mode dedicated
switchport trunk mode off
no shut
```

```
interface fc1/1
  switchport description FS-ORA-FI-B-1/35/1
  switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/2
  switchport description FS-ORA-FI-B-1/35/2
 switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/3
  switchport description FS-ORA-FI-B-1/35/3
 switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/4
  switchport description FS-ORA-FI-B-1/35/4
 switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/5
  switchport description FS-ORA-FI-B-1/36/1
 switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/6
  switchport description FS-ORA-FI-B-1/36/2
  switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/7
  switchport description FS-ORA-FI-B-1/36/3
  switchport trunk mode off
```

```
port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/8
  switchport description FS-ORA-FI-B-1/36/4
  switchport trunk mode off
 port-license acquire
 channel-group 42 force
 no shutdown
interface fc1/17
  switchport trunk allowed vsan 152
 switchport description PureFAXL170-ORA21c-CT0.FC5
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/18
  switchport trunk allowed vsan 152
 switchport description PureFAXL170-ORA21c-CT1.FC5
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/19
  switchport trunk allowed vsan 152
  switchport description PureFAXL170-ORA21c-CT0.FC7
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/20
  switchport trunk allowed vsan 152
 switchport description PureFAXL170-ORA21c-CT1.FC7
 switchport trunk mode off
 port-license acquire
 no shutdown
interface fc1/21
  switchport trunk allowed vsan 152
  switchport description PureFAXL170-ORA21c-CT0.FC33
  switchport trunk mode off
 port-license acquire
```

```
no shutdown
interface fc1/22
  switchport trunk allowed vsan 152
  switchport description PureFAXL170-ORA21c-CT1.FC33
  switchport trunk mode off
  port-license acquire
  no shutdown
vsan database
  vsan 152 interface port-channel 42
 vsan 152 interface fc1/17
 vsan 152 interface fc1/18
 vsan 152 interface fc1/19
 vsan 152 interface fc1/20
 vsan 152 interface fc1/21
 vsan 152 interface fc1/22
copy running-config startup-config
```

Procedure 3. Create and configure Fibre Channel Zoning for FC Boot

This procedure sets up the Fibre Channel connections between the Cisco MDS 9132T switches, the Cisco UCS Fabric Interconnects, and the Pure Storage systems. Before you configure the zoning details, decide how many paths are needed for each LUN and extract the WWPN numbers for each of the HBAs from each server.

For this solution, 10 vHBAs were configured on each server node. Two vHBA (HBA0 and HBA1) were created to carry the FC Network Traffic and Boot from SAN through MDS-A and MDS-B Switches. Another eight vHBAs (HBA2 to HBA9) were configured for the NVMe/FC Network Traffic (Oracle RAC Storage Traffic) through MDS-A and MDS-B Switch.

Step 1. Log in to Cisco Intersight and go to Infrastructure service > Operate > Servers > and click server 1 (server profile as ORARAC1).

≡	۰۱۱۰۰۱۱۰۰ Intersight	ີ່ 😽 Infrastructure Service 🗸			Qs	Search
:@:	Overview	Servers				
	Operate ^	<u>+ All Servers ⊙</u> +				
	Servers	···· <> 🔍 Add Filter				🖸 Expor
	Chassis	Health	Power	HCL Status	Bundle Version	Firi
	Fabric Interconnects	8 • Critical 1 • Healthy 7	(¹) On 8	② Incomplete 8	8 • 5.2(2.240053)	8
	HyperFlex Clusters					
	Integrated Systems	Name	‡ Health	≎ Model ≎	Server Profile	S Domain 💲
		🗍 🖒 FS-ORA-FI-1-1	Healthy	UCSX-210C-M7	ORARAC1 ⊘ FS-	ORA-FI
Ø	Analyze V	🗍 🖒 FS-ORA-FI-1-3	Healthy	UCSX-210C-M7	ORARAC2 Ø FS-	ORA-FI

Step 2. Go to the UCS Server Profile tab and select connectivity > vNICs/vHBAs to get the details of all of the HBAs and their respective WWPN ID as shown below:

		← Servers					
:©:	Overview	FS-ORA-FI-1-1 CHealthy					
0	Operate ^	General Inventory UCS Server Profile	HCL Topology	Metrics Connectivity			
l	Servers	Details C	onfiguration				
	Chassis Fabric Interconnects	Status © OK	neral Identifie	rs VNICs / VHBAs			
	HyperFlex Clusters	Name ORARAC1	v vNICs				
	Integrated Systems	User Label	∧ vHBAs				
			🔍 🛛 Add Filter		🖸 Export	10 items found 10 ~	per page < < 🚺 o
ତ୍	Analyze 🗸 🗸	Target Platform	Name :	WWPN ID	WWPN Pools 🗘	Switch ID	\$ Slot ID \$
e.	Configure ^	UCS Server (FI-Attached)	HBA0	20:00:00:25:85:AB:30:00	WWPN-Pool	A	MLOM
	Profiles	Template Name	HBA1	20:00:00:25:B5:AB:30:01	WWPN-Pool	В	MLOM
			HBA2	20:00:00:25:B5:AB:30:02			MLOM
	Templates	Last Update 35 minutes ago	НВАЗ	20:00:00:25:B5:AB:30:03			MLOM
	Policies		HBA4	20:00:00:25:B5:AB:30:04			MLOM
	Pools	Description -	HBA5	20:00:00:25:B5:AB:30:05			MLOM
			HBA6	20:00:00:25:B5:AB:30:06			MLOM
		ORA21	HBA7	20:00:00:25:B5:AB:30:07			MLOM
		Server Assignment	HBA8	20:00:00:25:B5:AB:30:08			MLOM
		Assigned Server	HBA9	20:00:00:25:B5:AB:30:09			MLOM
		FS-ORA-FI-1-1					× ×

Note: For this solution, HBA0 (through FI-A) and HBA1 (Through FI-B) were configured for FC SAN Boot and one dedicated FC boot zone was created across both MDS switches.

Note: Four HBAs through FI-A (HBA2, HBA4, HBA6 and HBA8) and four HBAs through FI-B (HBA3, HBA5, HBA7 and HBA9) were configured for the NVMe FC database traffic and a dedicated NVMe FC zone was created across both MDS switches.

Step 3. Login into the Pure Storage controller and extract the WWPN of FC ports and verify that the port information is correct. This information can be found in the Pure Storage GUI under Health > Connections > Array Ports.

Note: For this solution, we used all the twelve FC ports from Pure Storage controllers. Four ports (two ports from each controller) were configured to carry "scsi-fc" services while remaining eight ports (four ports from each controller) were configured to carry "nvme-fc" services as shown in below green and red colors respectively.

0	PURESTORAGE" •	Health								A 8	Q Search
۹	Dashboard	Hardware	Alerts C	onnections	Network						
۲	Storage	Host Conne	ctions ~								1-10 of
Ø	Protection	Array Conne	ections								
-		Array		Pat	hs		Replication A	ddress			
Q	Analysis Performance	No array paths found.									
	Capacity Replication	Array Ports	^								
_		FC Port	Name			Speed	Failover	FC Port	Name		Speed
Ð	Health	CT0.FC32	i 52:4A:93	:7A:7E:04:85:80)	32 Gb/s	VMe/FC Ports	CT1.FC32	52:4A:93:7A:7E:04:85:90		32 Gb/s
*	Settings	CT0.FC33	🕎 52:4A:93	:7A:7E:04:85:81		32 Gb/s		CT1.FC33	52:4A:93:7A:7E:04:85:91		32 Gb/s
		CT0.FC4	😇 52:4A:93	1:7A:7E:04:85:04	1	32 Gb/s	EC Porte	CT1.FC4	52:4A:93:7A:7E:04:85:14		32 Gb/s
Help		CT0.FC5	😇 52:4A:93	:7A:7E:04:85:05	5	32 Gb/s	rerons	CT1.FC5	52:4A:93:7A:7E:04:85:15		32 Gb/s
End U	Jser Agreement	CT0.FC6	52:4A:93	1:7A:7E:04:85:06	ò	32 Gb/s	VMe/FC Ports	CT1.FC6	52:4A:93:7A:7E:04:85:16		32 Gb/s
Log C	Dut	CT0.FC7	52:4A:93	:7A:7E:04:85:07	,	32 Gb/s		CT1.FC7	52:4A:93:7A:7E:04:85:17		32 Gb/s

For this solution, device aliases were created for zoning on MDS Switch A and Switch B as detailed below:

- **Step 4.** To configure device aliases and zones for FC and NVMe/FC Network data paths on MDS switch A, complete the following steps
- Step 5. Login as admin user and run the following commands into MDS Switch A:

```
config terminal
```

```
device-alias database
```

```
device-alias name ORARAC-1-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:00
device-alias name ORARAC-2-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:0a
device-alias name ORARAC-3-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:14
device-alias name ORARAC-4-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:28
device-alias name ORARAC-6-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:28
```

device-alias name ORARAC-7-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:3c device-alias name ORARAC-8-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:46

device-alias name ORARAC1-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:02 device-alias name ORARAC1-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:04 device-alias name ORARAC1-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:06 device-alias name ORARAC1-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:08

device-alias name ORARAC2-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:0c device-alias name ORARAC2-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:0e device-alias name ORARAC2-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:10 device-alias name ORARAC2-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:12

device-alias name ORARAC3-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:16 device-alias name ORARAC3-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:18 device-alias name ORARAC3-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:1a device-alias name ORARAC3-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:1c

device-alias name ORARAC4-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:20 device-alias name ORARAC4-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:22 device-alias name ORARAC4-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:24 device-alias name ORARAC4-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:26

device-alias name ORARAC5-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:2a device-alias name ORARAC5-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:2c device-alias name ORARAC5-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:2e device-alias name ORARAC5-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:30

device-alias name ORARAC6-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:34 device-alias name ORARAC6-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:36 device-alias name ORARAC6-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:38 device-alias name ORARAC6-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:38

device-alias name ORARAC7-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:3e device-alias name ORARAC7-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:40 device-alias name ORARAC7-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:42 device-alias name ORARAC7-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:44

device-alias name ORARAC8-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:48

device-alias name ORARAC8-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:4a device-alias name ORARAC8-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:4c device-alias name ORARAC8-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:4e

device-alias name PureFAXL170-ORA21c-CT0-FC04 pwwn 52:4a:93:7a:7e:04:85:04 device-alias name PureFAXL170-ORA21c-CT0-FC06 pwwn 52:4a:93:7a:7e:04:85:06 device-alias name PureFAXL170-ORA21c-CT0-FC32 pwwn 52:4a:93:7a:7e:04:85:80 device-alias name PureFAXL170-ORA21c-CT1-FC04 pwwn 52:4a:93:7a:7e:04:85:14 device-alias name PureFAXL170-ORA21c-CT1-FC06 pwwn 52:4a:93:7a:7e:04:85:16 device-alias name PureFAXL170-ORA21c-CT1-FC02 pwwn 52:4a:93:7a:7e:04:85:16

device-alias commit

copy run start

Step 6. Login as admin user and run the following commands into MDS Switch B: config terminal

device-alias database

```
device-alias name ORARAC-1-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:01
device-alias name ORARAC-2-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:15
device-alias name ORARAC-4-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:1f
device-alias name ORARAC-4-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:29
device-alias name ORARAC-5-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:33
device-alias name ORARAC-6-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:33
device-alias name ORARAC-7-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:34
device-alias name ORARAC-8-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:30
device-alias name ORARAC-8-FC-HBA1 pwwn 20:00:00:25:b5:ab:30:30
device-alias name ORARAC1-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:03
device-alias name ORARAC1-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:07
device-alias name ORARAC1-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:07
device-alias name ORARAC1-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:07
device-alias name ORARAC2-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:01
```

device-alias name ORARAC3-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:17

device-alias name ORARAC2-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:13

device-alias name ORARAC3-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:19
device-alias name ORARAC3-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:1b
device-alias name ORARAC3-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:1d

device-alias name ORARAC4-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:21
device-alias name ORARAC4-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:23
device-alias name ORARAC4-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:25
device-alias name ORARAC4-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:27

device-alias name ORARAC5-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:2b device-alias name ORARAC5-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:2d device-alias name ORARAC5-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:2f device-alias name ORARAC5-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:31

device-alias name ORARAC6-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:35 device-alias name ORARAC6-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:37 device-alias name ORARAC6-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:39 device-alias name ORARAC6-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:3b

device-alias name ORARAC7-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:3f device-alias name ORARAC7-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:41 device-alias name ORARAC7-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:43 device-alias name ORARAC7-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:45

device-alias name ORARAC8-NVMe-HBA3 pwwn 20:00:00:25:b5:ab:30:49 device-alias name ORARAC8-NVMe-HBA5 pwwn 20:00:00:25:b5:ab:30:4b device-alias name ORARAC8-NVMe-HBA7 pwwn 20:00:00:25:b5:ab:30:4d device-alias name ORARAC8-NVMe-HBA9 pwwn 20:00:00:25:b5:ab:30:4f

```
device-alias name PureFAXL170-ORA21c-CT0-FC05 pwwn 52:4a:93:7a:7e:04:85:05
device-alias name PureFAXL170-ORA21c-CT0-FC07 pwwn 52:4a:93:7a:7e:04:85:07
device-alias name PureFAXL170-ORA21c-CT0-FC33 pwwn 52:4a:93:7a:7e:04:85:81
device-alias name PureFAXL170-ORA21c-CT1-FC05 pwwn 52:4a:93:7a:7e:04:85:15
device-alias name PureFAXL170-ORA21c-CT1-FC07 pwwn 52:4a:93:7a:7e:04:85:17
device-alias name PureFAXL170-ORA21c-CT1-FC03 pwwn 52:4a:93:7a:7e:04:85:17
```

device-alias commit

copy run start

For each of the traffic type (FC and NVMe/FC), you will create its individual zoning (FC Zoning for Boot and NVMe/FC Zoning for NVMe/FC network traffic) as explained in the following procedure.

Procedure 4. Create Zoning for FC SAN Boot on each node

```
Step 1. Login as admin user and run the following commands into MDS Switch A to create a zone: config terminal
```

zone name ORARAC-1-Boot-A vsan 151 member device-alias ORARAC-1-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target member device-alias PureFAXL170-ORA21c-CT1-FC04 target

zone name ORARAC-2-Boot-A vsan 151 member device-alias ORARAC-2-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target member device-alias PureFAXL170-ORA21c-CT1-FC04 target

zone name ORARAC-3-Boot-A vsan 151 member device-alias ORARAC-3-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target member device-alias PureFAXL170-ORA21c-CT1-FC04 target

zone name ORARAC-4-Boot-A vsan 151 member device-alias ORARAC-4-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target member device-alias PureFAXL170-ORA21c-CT1-FC04 target

zone name ORARAC-5-Boot-A vsan 151 member device-alias ORARAC-5-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target member device-alias PureFAXL170-ORA21c-CT1-FC04 target

zone name ORARAC-6-Boot-A vsan 151 member device-alias ORARAC-6-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target member device-alias PureFAXL170-ORA21c-CT1-FC04 target

zone name ORARAC-7-Boot-A vsan 151 member device-alias ORARAC-7-FC-HBA0 init member device-alias PureFAXL170-ORA21c-CT0-FC04 target

```
member device-alias PureFAXL170-ORA21c-CT1-FC04 target
zone name ORARAC-8-Boot-A vsan 151
member device-alias ORARAC-8-FC-HBA0 init
member device-alias PureFAXL170-ORA21c-CT0-FC04 target
member device-alias PureFAXL170-ORA21c-CT1-FC04 target
Step 2. Create zoneset and add all zone members:
config terminal
zoneset name ORARAC-A vsan 151
member ORARAC-1-Boot-A
member ORARAC-2-Boot-A
```

```
member ORARAC-3-Boot-A
member ORARAC-4-Boot-A
member ORARAC-5-Boot-A
member ORARAC-6-Boot-A
```

```
member ORARAC-8-Boot-A
```

Step 3. Activate the zoneset and save the configuration:

zoneset activate name ORARAC-A vsan 151 copy run start

Step 4. Login as admin user and run the following commands into MDS Switch B to create a zone: config terminal

zone name ORARAC-1-Boot-B vsan 152 member device-alias ORARAC-1-FC-HBA1 init member device-alias PureFAXL170-ORA21c-CT0-FC05 target member device-alias PureFAXL170-ORA21c-CT1-FC05 target

```
zone name ORARAC-2-Boot-B vsan 152
member device-alias ORARAC-2-FC-HBA1 init
member device-alias PureFAXL170-ORA21c-CT0-FC05 target
member device-alias PureFAXL170-ORA21c-CT1-FC05 target
```

```
zone name ORARAC-3-Boot-B vsan 152
member device-alias ORARAC-3-FC-HBA1 init
member device-alias PureFAXL170-ORA21c-CT0-FC05 target
member device-alias PureFAXL170-ORA21c-CT1-FC05 target
```

zone name ORARAC-4-Boot-B vsan 152

copy run start

```
Procedure 5. Create and Configure Zoning for NVMe FC on both Cisco MDS Switches
```

```
member device-alias ORARAC-8-FC-HBA1 init
        member device-alias PureFAXL170-ORA21c-CT0-FC05 target
        member device-alias PureFAXL170-ORA21c-CT1-FC05 target
Step 5. Create zoneset and add all zone members:
        config terminal
        zoneset name ORARAC-B vsan 152
            member ORARAC-1-Boot-B
            member ORARAC-2-Boot-B
            member ORARAC-3-Boot-B
            member ORARAC-4-Boot-B
            member ORARAC-5-Boot-B
            member ORARAC-6-Boot-B
            member ORARAC-7-Boot-B
            member ORARAC-8-Boot-B
Step 6. Activate the zoneset and save the configuration:
        zoneset activate name ORARAC-B vsan 152
```

zone name ORARAC-7-Boot-B vsan 152

zone name ORARAC-8-Boot-B vsan 152

```
member device-alias ORARAC-7-FC-HBA1 init
member device-alias PureFAXL170-ORA21c-CT0-FC05 target
member device-alias PureFAXL170-ORA21c-CT1-FC05 target
```

```
zone name ORARAC-6-Boot-B vsan 152
member device-alias ORARAC-6-FC-HBA1 init
member device-alias PureFAXL170-ORA21c-CT0-FC05 target
member device-alias PureFAXL170-ORA21c-CT1-FC05 target
```

```
zone name ORARAC-5-Boot-B vsan 152
member device-alias ORARAC-5-FC-HBA1 init
member device-alias PureFAXL170-ORA21c-CT0-FC05 target
member device-alias PureFAXL170-ORA21c-CT1-FC05 target
```

member device-alias ORARAC-4-FC-HBA1 init
member device-alias PureFAXL170-ORA21c-CT0-FC05 target
member device-alias PureFAXL170-ORA21c-CT1-FC05 target

Step 1. Login as admin user and run the following commands on the MDS Switch A to create a zone: config terminal

zone name ORARAC-1-NVMe-A1 vsan 151
member device-alias ORARAC1-NVMe-HBA2 init
member device-alias ORARAC1-NVMe-HBA4 init
member device-alias ORARAC1-NVMe-HBA6 init
member device-alias ORARAC1-NVMe-HBA8 init
member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
member device-alias PureFAXL170-ORA21c-CT1-FC32 target

```
zone name ORARAC-2-NVMe-A1 vsan 151
member device-alias ORARAC2-NVMe-HBA2 init
member device-alias ORARAC2-NVMe-HBA4 init
member device-alias ORARAC2-NVMe-HBA6 init
member device-alias ORARAC2-NVMe-HBA8 init
member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT1-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
member device-alias PureFAXL170-ORA21c-CT1-FC32 target
```

```
zone name ORARAC-3-NVMe-A1 vsan 151
member device-alias ORARAC3-NVMe-HBA2 init
member device-alias ORARAC3-NVMe-HBA4 init
member device-alias ORARAC3-NVMe-HBA6 init
member device-alias ORARAC3-NVMe-HBA8 init
member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT1-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
```

zone name ORARAC-4-NVMe-A1 vsan 151 member device-alias ORARAC4-NVMe-HBA2 init member device-alias ORARAC4-NVMe-HBA4 init member device-alias ORARAC4-NVMe-HBA6 init member device-alias ORARAC4-NVMe-HBA8 init member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT1-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
member device-alias PureFAXL170-ORA21c-CT1-FC32 target

zone name ORARAC-5-NVMe-A1 vsan 151 member device-alias ORARAC5-NVMe-HBA2 init member device-alias ORARAC5-NVMe-HBA4 init member device-alias ORARAC5-NVMe-HBA6 init member device-alias ORARAC5-NVMe-HBA8 init member device-alias PureFAXL170-ORA21c-CT0-FC06 target member device-alias PureFAXL170-ORA21c-CT1-FC06 target member device-alias PureFAXL170-ORA21c-CT0-FC32 target

zone name ORARAC-6-NVMe-A1 vsan 151
member device-alias ORARAC6-NVMe-HBA2 init
member device-alias ORARAC6-NVMe-HBA4 init
member device-alias ORARAC6-NVMe-HBA8 init
member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT1-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
member device-alias PureFAXL170-ORA21c-CT1-FC32 target

zone name ORARAC-7-NVMe-A1 vsan 151
member device-alias ORARAC7-NVMe-HBA2 init
member device-alias ORARAC7-NVMe-HBA4 init
member device-alias ORARAC7-NVMe-HBA6 init
member device-alias ORARAC7-NVMe-HBA8 init
member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
member device-alias PureFAXL170-ORA21c-CT1-FC32 target

zone name ORARAC-8-NVMe-A1 vsan 151 member device-alias ORARAC8-NVMe-HBA2 init member device-alias ORARAC8-NVMe-HBA4 init member device-alias ORARAC8-NVMe-HBA6 init

```
member device-alias ORARAC8-NVMe-HBA8 init
member device-alias PureFAXL170-ORA21c-CT0-FC06 target
member device-alias PureFAXL170-ORA21c-CT1-FC06 target
member device-alias PureFAXL170-ORA21c-CT0-FC32 target
```

Step 2. Create a zoneset and add all zone members:

```
config terminal
```

```
zoneset name ORARAC-A vsan 151
```

```
member ORARAC-1-NVMe-A1
```

```
member ORARAC-2-NVMe-A1
```

```
member ORARAC-3-NVMe-A1
```

```
member ORARAC-4-NVMe-A1
```

```
member ORARAC-5-NVMe-A1
```

```
Member Orarac-J-NVMe-A
```

```
member ORARAC-6-NVMe-A1
```

```
member ORARAC-7-NVMe-A1
```

```
member ORARAC-8-NVMe-A1
```

Step 3. Activate the zoneset and save the configuration:

```
zoneset activate name ORARAC-A vsan 151
copy run start
```

Step 4. Login as admin user and run the following commands on the MDS Switch B to create a zone: config terminal

```
zone name ORARAC-1-NVMe-B1 vsan 152

member device-alias ORARAC1-NVMe-HBA3 init

member device-alias ORARAC1-NVMe-HBA5 init

member device-alias ORARAC1-NVMe-HBA7 init

member device-alias ORARAC1-NVMe-HBA9 init

member device-alias PureFAXL170-ORA21c-CT0-FC07 target

member device-alias PureFAXL170-ORA21c-CT1-FC03 target

member device-alias PureFAXL170-ORA21c-CT1-FC33 target
```

```
zone name ORARAC-2-NVMe-B1 vsan 152
member device-alias ORARAC2-NVMe-HBA3 init
member device-alias ORARAC2-NVMe-HBA5 init
member device-alias ORARAC2-NVMe-HBA7 init
member device-alias ORARAC2-NVMe-HBA9 init
member device-alias PureFAXL170-ORA21c-CT0-FC07 target
member device-alias PureFAXL170-ORA21c-CT1-FC07 target
```

member device-alias PureFAXL170-ORA21c-CT0-FC33 target
member device-alias PureFAXL170-ORA21c-CT1-FC33 target

zone name ORARAC-3-NVMe-B1 vsan 152 member device-alias ORARAC3-NVMe-HBA3 init member device-alias ORARAC3-NVMe-HBA5 init member device-alias ORARAC3-NVMe-HBA7 init member device-alias ORARAC3-NVMe-HBA9 init member device-alias PureFAXL170-ORA21c-CT0-FC07 target member device-alias PureFAXL170-ORA21c-CT1-FC07 target member device-alias PureFAXL170-ORA21c-CT0-FC33 target member device-alias PureFAXL170-ORA21c-CT1-FC33 target

```
zone name ORARAC-4-NVMe-B1 vsan 152
member device-alias ORARAC4-NVMe-HBA3 init
member device-alias ORARAC4-NVMe-HBA5 init
member device-alias ORARAC4-NVMe-HBA7 init
member device-alias ORARAC4-NVMe-HBA9 init
member device-alias PureFAXL170-ORA21c-CT0-FC07 target
member device-alias PureFAXL170-ORA21c-CT1-FC07 target
member device-alias PureFAXL170-ORA21c-CT0-FC33 target
```

```
zone name ORARAC-5-NVMe-B1 vsan 152
member device-alias ORARAC5-NVMe-HBA3 init
member device-alias ORARAC5-NVMe-HBA5 init
member device-alias ORARAC5-NVMe-HBA7 init
member device-alias ORARAC5-NVMe-HBA9 init
member device-alias PureFAXL170-ORA21c-CT0-FC07 target
member device-alias PureFAXL170-ORA21c-CT1-FC07 target
member device-alias PureFAXL170-ORA21c-CT0-FC33 target
```

zone name ORARAC-6-NVMe-B1 vsan 152 member device-alias ORARAC6-NVMe-HBA3 init member device-alias ORARAC6-NVMe-HBA5 init member device-alias ORARAC6-NVMe-HBA7 init member device-alias ORARAC6-NVMe-HBA9 init member device-alias PureFAXL170-ORA21c-CT0-FC07 target

```
member device-alias PureFAXL170-ORA21c-CT1-FC07 target
        member device-alias PureFAXL170-ORA21c-CT0-FC33 target
        member device-alias PureFAXL170-ORA21c-CT1-FC33 target
        zone name ORARAC-7-NVMe-B1 vsan 152
        member device-alias ORARAC7-NVMe-HBA3 init
        member device-alias ORARAC7-NVMe-HBA5 init
        member device-alias ORARAC7-NVMe-HBA7 init
        member device-alias ORARAC7-NVMe-HBA9 init
        member device-alias PureFAXL170-ORA21c-CT0-FC07 target
        member device-alias PureFAXL170-ORA21c-CT1-FC07 target
        member device-alias PureFAXL170-ORA21c-CT0-FC33 target
        member device-alias PureFAXL170-ORA21c-CT1-FC33 target
        zone name ORARAC-8-NVMe-B1 vsan 152
        member device-alias ORARAC8-NVMe-HBA3 init
        member device-alias ORARAC8-NVMe-HBA5 init
        member device-alias ORARAC8-NVMe-HBA7 init
        member device-alias ORARAC8-NVMe-HBA9 init
        member device-alias PureFAXL170-ORA21c-CT0-FC07 target
        member device-alias PureFAXL170-ORA21c-CT1-FC07 target
        member device-alias PureFAXL170-ORA21c-CT0-FC33 target
        member device-alias PureFAXL170-ORA21c-CT1-FC33 target
Step 5. Create a zoneset and add all zone members:
        config terminal
        zoneset name ORARAC-B vsan 152
            member ORARAC-1-NVMe-B1
            member ORARAC-2-NVMe-B1
            member ORARAC-3-NVMe-B1
            member ORARAC-4-NVMe-B1
            member ORARAC-5-NVMe-B1
            member ORARAC-6-NVMe-B1
            member ORARAC-7-NVMe-B1
            member ORARAC-8-NVMe-B1
Step 6. Activate the zoneset and save the configuration:
        zoneset activate name ORARAC-B vsan 152
        copy run start
```

Procedure 6. Verify FC ports on MDS Switch A and MDS Switch B

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Step 1. Login as admin user into MDS Switch A and verify all "flogi" by running "show flogi database vsan 151" as shown below:

FS-ORA-MDS-A# show flogi database vsan 151

_____ VSAN FCID PORT NAME INTERFACE NODE NAME _____ fc1/17 151 0xd40081 52:4a:93:7a:7e:04:85:04 52:4a:93:7a:7e:04:85:04 [PureFAXL170-ORA21c-CT0-FC04] fc1/18 151 0xd40041 52:4a:93:7a:7e:04:85:14 52:4a:93:7a:7e:04:85:14 [PureFAXL170-ORA21c-CT1-FC04] fc1/19 151 0xd40042 52:4a:93:7a:7e:04:85:06 52:4a:93:7a:7e:04:85:06 [PureFAXL170-ORA21c-CT0-FC06] fc1/20 0xd40022 52:4a:93:7a:7e:04:85:16 52:4a:93:7a:7e:04:85:16 151 [PureFAXL170-ORA21c-CT1-FC06] 0xd40061 52:4a:93:7a:7e:04:85:80 52:4a:93:7a:7e:04:85:80 fc1/21 151 [PureFAXL170-ORA21c-CT0-FC32] fc1/22 151 0xd40021 52:4a:93:7a:7e:04:85:90 52:4a:93:7a:7e:04:85:90 [PureFAXL170-ORA21c-CT1-FC32] 0xd40000 24:29:00:08:31:07:e2:00 20:97:00:08:31:07:e2:01 port-channel41 151 0xd40001 20:00:00:25:b5:ab:30:00 20:00:00:25:b5:13:50:00 port-channel41 1.51 [ORARAC-1-FC-HBA0] 0xd40002 20:00:00:25:b5:ab:30:02 20:00:00:25:b5:13:50:00 port-channel41 151 [ORARAC1-NVMe-HBA2] 151 0xd40003 20:00:00:25:b5:ab:30:04 20:00:00:25:b5:13:50:00 port-channel41 [ORARAC1-NVMe-HBA4] 0xd40004 20:00:00:25:b5:ab:30:06 20:00:00:25:b5:13:50:00 port-channel41 151 [ORARAC1-NVMe-HBA6] port-channel41 151 0xd40005 20:00:00:25:b5:ab:30:08 20:00:00:25:b5:13:50:00 [ORARAC1-NVMe-HBA8] port-channel41 151 0xd40006 20:00:00:25:b5:ab:30:1e 20:00:00:25:b5:13:50:03 [ORARAC-4-FC-HBA0] 0xd40007 20:00:00:25:b5:ab:30:0a 20:00:00:25:b5:13:50:01 port-channel41 151 [ORARAC-2-FC-HBA0] 0xd40008 20:00:00:25:b5:ab:30:14 20:00:00:25:b5:13:50:02 port-channel41 151 [ORARAC-3-FC-HBA0] 151 0xd40009 20:00:00:25:b5:ab:30:0c 20:00:00:25:b5:13:50:01 port-channel41 [ORARAC2-NVMe-HBA2] port-channel41 151 0xd4000a 20:00:00:25:b5:ab:30:0e 20:00:00:25:b5:13:50:01

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			[ORARAC2-NVMe-HBA4]	
port-channel41	151	0xd4000b	20:00:00:25:b5:ab:30:10	20:00:00:25:b5:13:50:01
			[ORARAC2-NVMe-HBA6]	
port-channel41	151	0xd4000c	20:00:00:25:b5:ab:30:12	20:00:00:25:b5:13:50:01
			[ORARAC2-NVMe-HBA8]	
port-channel41	151	0xd4000d	20:00:00:25:b5:ab:30:16	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA2]	
port-channel41	151	0xd4000e	20:00:00:25:b5:ab:30:18	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA4]	
port-channel41	151	0xd4000f	20:00:00:25:b5:ab:30:1a	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA6]	
port-channel41	151	0xd40010	20:00:00:25:b5:ab:30:1c	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA8]	
port-channel41	151	0xd40011	20:00:00:25:b5:ab:30:20	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA2]	
port-channel41	151	0xd40012	20:00:00:25:b5:ab:30:22	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA4]	
port-channel41	151	0xd40013	20:00:00:25:b5:ab:30:24	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA6]	
port-channel41	151	0xd40014	20:00:00:25:b5:ab:30:26	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA8]	
port-channel41	151	0xd40015	20:00:00:25:b5:ab:30:28	20:00:00:25:b5:13:50:04
			[ORARAC-5-FC-HBA0]	
port-channel41	151	0xd40016	20:00:00:25:b5:ab:30:32	20:00:00:25:b5:13:50:05
			[ORARAC-6-FC-HBA0]	
port-channel41	151	0xd40017	20:00:00:25:b5:ab:30:46	20:00:00:25:b5:13:50:07
			[ORARAC-8-FC-HBA0]	
port-channel41	151	0xd40018	20:00:00:25:b5:ab:30:3c	20:00:00:25:b5:13:50:06
			[ORARAC-7-FC-HBA0]	
port-channel41	151	0xd40019	20:00:00:25:b5:ab:30:2a	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA2]	
port-channel41	151	0xd4001a	20:00:00:25:b5:ab:30:2c	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA4]	
port-channel41	151	0xd4001b	20:00:00:25:b5:ab:30:2e	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA6]	
port-channel41	151	0xd4001c	20:00:00:25:b5:ab:30:30	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA8]	
port-channel41	151	0xd4001d	20:00:00:25:b5:ab:30:34	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA2]	

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port-channel41	151	0xd4001e	20:00:00:25:b5:ab:30:36	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA4]	
port-channel41	151	0xd4001f	20:00:00:25:b5:ab:30:38	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA6]	
port-channel41	151	0xd400a0	20:00:00:25:b5:ab:30:3a	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA8]	
port-channel41	151	0xd400a1	20:00:00:25:b5:ab:30:3e	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA2]	
port-channel41	151	0xd400a2	20:00:00:25:b5:ab:30:40	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA4]	
port-channel41	151	0xd400a3	20:00:00:25:b5:ab:30:42	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA6]	
port-channel41	151	0xd400a4	20:00:00:25:b5:ab:30:44	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA8]	
port-channel41	151	0xd400a5	20:00:00:25:b5:ab:30:48	20:00:00:25:b5:13:50:07
			[ORARAC8-NVMe-HBA2]	
port-channel41	151	0xd400a6	20:00:00:25:b5:ab:30:4a	20:00:00:25:b5:13:50:07
			[ORARAC8-NVMe-HBA4]	
port-channel41	151	0xd400a7	20:00:00:25:b5:ab:30:4c	20:00:00:25:b5:13:50:07
			[ORARAC8-NVMe-HBA6]	
port-channel41	151	0xd400a8	20:00:00:25:b5:ab:30:4e	20:00:00:25:b5:13:50:07
			[ORARAC8-NVMe-HBA8]	

Total number of flogi = 47.

Step 2. Login as admin user into MDS Switch B and verify all "flogi" by running "show flogi database vsan 152" as shown below:

FS-ORA-MDS-B# show flogi database vsan 152

INTERFACE	VSAN	FCID	PORT NAME	NODE NAME
fc1/17	152	0xc70042	52:4a:93:7a:7e:04:85:05	52:4a:93:7a:7e:04:85:05
			[PureFAXL170-ORA21c-CT0-	-FC05]
fc1/18	152	0xc70022	52:4a:93:7a:7e:04:85:15	52:4a:93:7a:7e:04:85:15
			[PureFAXL170-ORA21c-CT1-	-FC05]
fc1/19	152	0xc700a0	52:4a:93:7a:7e:04:85:07	52:4a:93:7a:7e:04:85:07
			[PureFAXL170-ORA21c-CT0-	-FC07]
fc1/20	152	0xc70062	52:4a:93:7a:7e:04:85:17	52:4a:93:7a:7e:04:85:17
			[PureFAXL170-ORA21c-CT1-	-FC07]
fc1/21	152	0xc70001	52:4a:93:7a:7e:04:85:81	52:4a:93:7a:7e:04:85:81

fc1/22	152	0xc70061	52:4a:93:7a:7e:04:85:91	52:4a:93:7a:7e:04:85:91
			[PureFAXL170-ORA21c-CT1-	-FC33]
port-channel42	152	0xc70080	24:2a:00:08:31:0f:4d:64	20:98:00:08:31:0f:4d:65
port-channel42	152	0xc70081	20:00:00:25:b5:ab:30:01	20:00:00:25:b5:13:50:00
			[ORARAC-1-FC-HBA1]	
port-channel42	152	0xc70082	20:00:00:25:b5:ab:30:03	20:00:00:25:b5:13:50:00
			[ORARAC1-NVMe-HBA3]	
port-channel42	152	0xc70083	20:00:00:25:b5:ab:30:05	20:00:00:25:b5:13:50:00
			[ORARAC1-NVMe-HBA5]	
port-channel42	152	0xc70084	20:00:00:25:b5:ab:30:07	20:00:00:25:b5:13:50:00
			[ORARAC1-NVMe-HBA7]	
port-channel42	152	0xc70085	20:00:00:25:b5:ab:30:09	20:00:00:25:b5:13:50:00
			[ORARAC1-NVMe-HBA9]	
port-channel42	152	0xc70086	20:00:00:25:b5:ab:30:1f	20:00:00:25:b5:13:50:03
			[ORARAC-4-FC-HBA1]	
port-channel42	152	0xc70087	20:00:00:25:b5:ab:30:0b	20:00:00:25:b5:13:50:01
			[ORARAC-2-FC-HBA1]	
port-channel42	152	0xc70088	20:00:00:25:b5:ab:30:15	20:00:00:25:b5:13:50:02
			[ORARAC-3-FC-HBA1]	
port-channel42	152	0xc70089	20:00:00:25:b5:ab:30:0d	20:00:00:25:b5:13:50:01
			[ORARAC2-NVMe-HBA3]	
port-channel42	152	0xc7008a	20:00:00:25:b5:ab:30:0f	20:00:00:25:b5:13:50:01
			[ORARAC2-NVMe-HBA5]	
port-channel42	152	0xc7008b	20:00:00:25:b5:ab:30:11	20:00:00:25:b5:13:50:01
			[ORARAC2-NVMe-HBA7]	
port-channel42	152	0xc7008c	20:00:00:25:b5:ab:30:13	20:00:00:25:b5:13:50:01
			[ORARAC2-NVMe-HBA9]	
port-channel42	152	0xc7008d	20:00:00:25:b5:ab:30:17	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA3]	
port-channel42	152	0xc7008e	20:00:00:25:b5:ab:30:19	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA5]	
port-channel42	152	0xc7008f	20:00:00:25:b5:ab:30:1b	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA7]	
port-channel42	152	0xc70090	20:00:00:25:b5:ab:30:1d	20:00:00:25:b5:13:50:02
			[ORARAC3-NVMe-HBA9]	
port-channel42	152	0xc70091	20:00:00:25:b5:ab:30:21	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA3]	
port-channel42	152	0xc70092	20:00:00:25:b5:ab:30:23	20:00:00:25:b5:13:50:03

[PureFAXL170-ORA21c-CT0-FC33]

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			[ORARAC4-NVMe-HBA5]	
port-channel42	152	0xc70093	20:00:00:25:b5:ab:30:25	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA7]	
port-channel42	152	0xc70094	20:00:00:25:b5:ab:30:27	20:00:00:25:b5:13:50:03
			[ORARAC4-NVMe-HBA9]	
port-channel42	152	0xc70095	20:00:00:25:b5:ab:30:29	20:00:00:25:b5:13:50:04
			[ORARAC-5-FC-HBA1]	
port-channel42	152	0xc70096	20:00:00:25:b5:ab:30:33	20:00:00:25:b5:13:50:05
			[ORARAC-6-FC-HBA1]	
port-channel42	152	0xc70097	20:00:00:25:b5:ab:30:47	20:00:00:25:b5:13:50:07
			[ORARAC-8-FC-HBA1]	
port-channel42	152	0xc70098	20:00:00:25:b5:ab:30:3d	20:00:00:25:b5:13:50:06
			[ORARAC-7-FC-HBA1]	
port-channel42	152	0xc70099	20:00:00:25:b5:ab:30:2b	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA3]	
port-channel42	152	0xc7009a	20:00:00:25:b5:ab:30:2d	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA5]	
port-channel42	152	0xc7009b	20:00:00:25:b5:ab:30:2f	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA7]	
port-channel42	152	0xc7009c	20:00:00:25:b5:ab:30:31	20:00:00:25:b5:13:50:04
			[ORARAC5-NVMe-HBA9]	
port-channel42	152	0xc7009d	20:00:00:25:b5:ab:30:35	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA3]	
port-channel42	152	0xc7009e	20:00:00:25:b5:ab:30:37	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA5]	
port-channel42	152	0xc7009f	20:00:00:25:b5:ab:30:39	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA7]	
port-channel42	152	0xc700c0	20:00:00:25:b5:ab:30:3b	20:00:00:25:b5:13:50:05
			[ORARAC6-NVMe-HBA9]	
port-channel42	152	0xc700c1	20:00:00:25:b5:ab:30:3f	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA3]	
port-channel42	152	0xc700c2	20:00:00:25:b5:ab:30:41	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA5]	
port-channel42	152	0xc700c3	20:00:00:25:b5:ab:30:43	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA7]	
port-channel42	152	0xc700c4	20:00:00:25:b5:ab:30:45	20:00:00:25:b5:13:50:06
			[ORARAC7-NVMe-HBA9]	
port-channel42	152	0xc700c5	20:00:00:25:b5:ab:30:49	20:00:00:25:b5:13:50:07
			[ORARAC8-NVMe-HBA3]	

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port-channel42	152	0xc700c6	20:00:00:25:b5:ab:30:4b	20:00:00:25:b5:13:50:07			
			[ORARAC8-NVMe-HBA5]				
port-channel42	152	0xc700c7	20:00:00:25:b5:ab:30:4d	20:00:00:25:b5:13:50:07			
			[ORARAC8-NVMe-HBA7]				
port-channel42	152	0xc700c8	20:00:00:25:b5:ab:30:4f	20:00:00:25:b5:13:50:07			
			[ORARAC8-NVMe-HBA9]				
Total number of flogi = 47.							

Pure Storage FlashArray//XL170 Configuration

This section details the high-level steps to configure the Pure Storage for this solution.



Pure Storage Connectivity

It is beyond the scope of this document to explain the detailed information about the Pure storage installation. For detailed information, see:

<u>https://www.purestorage.com/content/dam/pdf/en/datasheets/ds-flasharray-xl.pdf</u> and for information about the install upgrade, see:

https://support.purestorage.com/bundle/m_flasharrayx/page/FlashArray/FlashArray_Hardware/94_FlashArray_ay_X/topics/concept/c_flasharrayx_install_and_upgrade_guides.html

Note: Currently, the initial deployment of a FlashArray[™] requires a person to be physically present in the Data Center. This is inconvenient for some customers; particularly those that deploy many FlashArrays. To address this concern, Pure Storage[®] introduced a new DHCP boot feature, in which the management ports ct0.eth0 & ct1.eth0 on the FlashArray request IP addresses from a DHCP server when the array is first powered on. A REST API endpoint is also added on ct1.eth0, so that after the FlashArray powers on for the first time, users can connect to it remotely via the REST API and initialize the array. This process can be performed remotely and eliminates the need for a direct connection to the FlashArray via the console port for the initial setup.

Note: Both management interfaces must be configured on both controllers and both arrays with enabled and active links. The management interfaces are as follows:

- FlashArray//XR4 ct0.eth4, ct0.eth5, ct1.eth4, ct1.eth5
- All other FlashArray Models ct0.eth0, ct0.eth1, ct1.eth0

Note: When the FlashArray first powers up in DHCP mode, no authentication is required to connect to the FlashArray via the REST API endpoint. Users can connect to the endpoint via the IP address assigned by the DHCP server. During the initialization process, the DHCP assigned IP addresses are replaced with static IP addresses. When the initialization process is complete, the FlashArray returns to its normal operating mode, the DHCP feature is disabled, and the FlashArray no longer allows remote REST API connections without authentication. Please contact Pure Storage support for setting up initial setup and configuration of the Storage array according to your environment.

As explained earlier in the MDS switch configuration section, both the MDS switches were connected with both the Pure Storage Controllers CT0 and CT1 and also zoning were configured on MDS switches to carry FC and NVMe/FC connectivity. Please refer to table 12 for more details on Pure storage connectivity in the earlier MDS configuration section.

For this solution, we used all the twelve FC ports from Pure Storage controllers. Four ports (two ports from each controller) were configured to carry "scsi-fc" services while remaining eight ports (four ports from each controller) were configured to carry "nvme-fc" services as shown in below green and red colors respectively.

As shown in the image below, both Pure Storage controller nodes, ports FC4 and FC5 were configured with "scsi-fc" services to carry FC network traffic. Also, from both storage controller nodes, ports FC6, FC7, FC32 and FC33 were configured with "nvme-fc" services to carry NVMe/FC database network traffic.

0	PURESTORAGE" (Health									Q Search
۹	Dashboard	Hardware	Alerts Connection	ons Network							
۲	Storage	Host Connect	tions ~								1-10 of
$\overline{\heartsuit}$	Protection	Array Connec	tions								
		Array		Paths		Replication A	ddress				
۹	Analysis Performance	Analysis Performance			No array paths found.						
	Capacity Replication	Array Ports ~									
_		FC Port	Name		Speed	Failover	FC Port	Name			Speed
Ð	Health	CT0.FC32	w 52:4A:93:7A:7E:04:	85:80	32 Gb/s		CT1.FC32	w 52:4A:93:7A:7E:04:85:90			32 Gb/s
4	Settings	CT0.FC33	52:4A:93:7A:7E:04:	85:81	32 Gb/s	/Me/FC Ports	CT1.FC33	52:4A:93:7A:7E:04:85:91			32 Gb/s
		CT0.FC4	52:4A:93:7A:7E:04:	85:04	32 Gb/s		CT1.FC4	52:4A:93:7A:7E:04:85:14			32 Gb/s
Help		CT0.FC5	52:4A:93:7A:7E:04:	85:05	32 Gb/s	FC Ports	CT1.FC5	52:4A:93:7A:7E:04:85:15			32 Gb/s
End U	lser Agreement	CT0.FC6	52:4A:93:7A:7E:04:	85:06	32 Gb/s		CT1.FC6	52:4A:93:7A:7E:04:85:16			32 Gb/s
Log C	Jut	CT0.FC7	52:4A:93:7A:7E:04:	85:07	32 Gb/s	Werc Ports	CT1.FC7	52:4A:93:7A:7E:04:85:17			32 Gb/s

The overview of the network configuration and respective services are shown as below:

pureuser@	PureFAXL1	70-ORA21c> purenetwork fc	list	
Name	Enabled	WWN	Speed	Services
CT0.FC4	True	52:4A:93:7A:7E:04:85:04	32.00 Gb/s	scsi-fc
CT0.FC5	True	52:4A:93:7A:7E:04:85:05	32.00 Gb/s	scsi-fc
CT0.FC6	True	52:4A:93:7A:7E:04:85:06	32.00 Gb/s	nvme-fc
CT0.FC7	True	52:4A:93:7A:7E:04:85:07	32.00 Gb/s	nvme-fc
CT0.FC32	True	52:4A:93:7A:7E:04:85:80	32.00 Gb/s	nvme-fc
CT0.FC33	True	52:4A:93:7A:7E:04:85:81	32.00 Gb/s	nvme-fc
CT1.FC4	True	52:4A:93:7A:7E:04:85:14	32.00 Gb/s	scsi-fc
CT1.FC5	True	52:4A:93:7A:7E:04:85:15	32.00 Gb/s	scsi-fc
CT1.FC6	True	52:4A:93:7A:7E:04:85:16	32.00 Gb/s	nvme-fc
CT1.FC7	True	52:4A:93:7A:7E:04:85:17	32.00 Gb/s	nvme-fc
CT1.FC32	True	52:4A:93:7A:7E:04:85:90	32.00 Gb/s	nvme-fc
CT1.FC33	True	52:4A:93:7A:7E:04:85:91	32.00 Gb/s	nvme-fc

Configure Host and attach LUN for SAN Boot

Note: Configure separate hosts to carry both FC and NVMe/FC network traffic in Pure Storage FlashArray GUI. You will use the eight FC hosts with each hosts having two WWNs for SAN Boot.

Procedure 1. Configure the Pure Storage Host

- **Step 1.** Login into the Pure Storage array.
- **Step 2.** To create a Host into Pure Storage GUI, go to Storage > Hosts > Hosts and under Hosts option in the right frame, click the + sign to create FC host as shown below:
| | PURESTORAGE" « | Storage | | |
|------|-------------------------|-----------------------------|-------------------|---|
| | | | Create Multiple H | osts |
| | Dashboard | Array Hosts Volumes | Name | FC-ORARAC# |
| | Storago | 🛞 > Hosts | | |
| Ŷ | Storage | Size Virtual Data Reduction | Personality | None - |
| | Protection | 93.00 T 🕧 62.21 T 2.3 to 1 | | ✓ Add to protection group after hosts are created |
| | | Hosts ~ | Start Number | 1 |
| | Analysis | | | |
| | Performance
Capacity | Host Groups ~ | Count | 8 |
| | Replication | | | |
| | | | Number of Digits | 2 |
| | Health | | | |
| | | | | |
| | Settings | | Create Single | Cancel Create |
| | | | | |
| | | | | |
| | Jser Agreement | | | |
| | s | | | |
| Log(| Dut | | | |

- **Step 3.** After creating all eight FC hosts for SAN boot, create 8 volumes and assign this each volume to individual host for FC SAN boot.
- **Step 4.** Go to Storage > Volumes > Volumes > and click "+" on the right menu to create volumes as shown below:

0	PURESTORAGE" •	Storage	() X Q Search	
۹	Dashboard	Array Hosts Volumes	Pods File Systems Policies	
۲	Storage	🤔 > Volumes		
Ĩ	Protection	SizeVirtualData Reduction93.00 T ()62.21 T2.4 to 1	Unique Snapshots Total 26.40 T 530.91 G 26.92 T	
ů,	Analysis	Volumes ~	Space QoS Details 1-10 of 90 + Destroyed (0) Create	:
	Performance Capacity Replication	Volume Groups v	Create Snapshots Spac Move	
4	Health		Destroyed (0) v Destroy Show Protocol Endpoints	
	riealui		Download CSV	
*	Settings			

Note: We created one dedicated volume for each of the FC Hosts and installed RHEL OS on it.

Note: More volumes will be created and their respective NVMe/FC hosts in the database creation section.

Eight FC hosts were configured for FC SAN Boot with each host having two WWNs. After creating all eight FC hosts, eight volumes were created and each volume were mapped to an individual FC Hosts where the OS will be installed, as shown below:

\mathbf{O}	PURESTORAGE" (Storage		A (
۹	Dashboard	Array Hosts Volumes Pods File Systems Policies			
B	Storage	🚯 > Hosts			
~	Storage	Size Virtual Data Reduction Unique Snapshots Total			
$\overline{\mathbf{O}}$	Protection	93.00 T 🚺 62.21 T 2.3 to 1 26.37 T 531.57 G 27.45 T			
		Hosts A			Gene
	Analysis Performance Capacity	Name A Host Group FC-ORARAC	Interface	# Volumes F	Preferred .
	Replication	r= FC-ORARAC1	FC	1	
æ	Health	Ima FC-ORARAC2	FC	1	
Ŭ		ors FC-ORARAC3	FC	1	
*		Dem FC-ORARAC4	FC	1	
		om FC-ORARAC5	FC	1	
Help End L	Jser Aareement	om FC-ORARAC6	FC	1	
Term: Log (Dem FC-ORARAC7	FC	1	
		Inter FC-ORARAC8	FC	1	

Also, the same eight Hosts were configured to carry NVMe/FC database storage traffic with host's respective NQNs. Also, one host group was configured and all the NVMe hosts were added into that group so that we can share database volumes across all hosts.

\mathbf{O}	PURESTORAGE" •	Storage			Δ	
۵	Dashboard	Array Hosts Volumes Pods File Systems Policies				
ß	Storage	() > Hosts				
	otorage	Size Virtual Data Reduction Unique Snapshots Total				
Ø	Protection	93.001 0 02.211 2.3 (01 20.371 531.576 27.451				
G	Analysis	Hosts ^				Gene
9	Performance	Name A	Host Group	Interface	# Volumes	Preferred .
	Capacity	NVMe-ORARAC				
	Replication	ण्या NVMe-ORARAC1	ORARAC	NVMe-oF	58	
æ	Health	ma NVMe-ORARAC2	ORARAC	NVMe-oF	58	
		INVMe-ORARAC3	ORARAC	NVMe-oF	58	
		In NVMe-ORARAC4	ORARAC	NVMe-oF	58	
		In NVMe-ORARACS	ORARAC	NVMe-oF	58	
	lsor Agroomont	w NVMe-ORARAC6	ORARAC	NVMe-oF	58	
	s	International NVMe-ORARAC7	ORARAC	NVMe-oF	58	
		Internet NVMe-ORARAC8	ORARAC	NVMe-oF	58	

-				
pureuser@Pure	FAXL170-ORA21c> purehost	list		
Name	WWN	IQN	NQN	Host Group
FC-ORARAC1	20:00:00:25:B5:AB:30:00	-	-	-
	20:00:00:25:B5:AB:30:01			
FC-ORARAC2	20:00:00:25:B5:AB:30:0A			
	20:00:00:25:B5:AB:30:0B			
FC-ORARAC3	20:00:00:25:B5:AB:30:14			
	20:00:00:25:B5:AB:30:15			
FC-ORARAC4	20:00:00:25:B5:AB:30:1E			
	20:00:00:25:B5:AB:30:1F			
FC-ORARAC5	20:00:00:25:B5:AB:30:28			
	20:00:00:25:B5:AB:30:29			
FC-ORARAC6	20:00:00:25:B5:AB:30:32			
	20:00:00:25:B5:AB:30:33			
FC-ORARAC7	20:00:00:25:B5:AB:30:3C			
	20:00:00:25:B5:AB:30:3D			
FC-ORARAC8	20:00:00:25:B5:AB:30:46			
	20:00:00:25:B5:AB:30:47			
NVMe-ORARAC1			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000000	ORARAC
NVMe-ORARAC2			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000001	ORARAC
NVMe-ORARAC3			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000002	ORARAC
NVMe-ORARAC4			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000003	ORARAC
NVMe-ORARAC5			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000004	ORARAC
NVMe-ORARAC6			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000005	ORARAC
NVMe-ORARAC7			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000006	ORARAC
NVMe-ORARAC8			nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000007	ORARAC

Below is the screenshot of all the FC and NVMe/FC hosts configured for this solution as:

After configuring FC and NVMe/FC hosts, we are now ready to install OS through SAN boot as described in the next section.

Operating System and Database Deployment

This chapter contains the following:

- <u>Configure the Operating System</u>
- ENIC and FNIC Drivers for Linux OS
- NVME CLI
- Device-mapper Multipathing
- Public and Private Network Interfaces
- <u>Configure OS Prerequisites for Oracle Software</u>
- <u>Configure Additional OS Prerequisites</u>
- <u>Configure Volumes for OCR and Voting Disk</u>
- Oracle Database 21c GRID Infrastructure Deployment
- Oracle Database Grid Infrastructure Software
- Overview of Oracle Flex ASM
- Oracle Database Installation
- Oracle Database Multitenant Architecture

Note: Detailed steps to install the OS are not explained in this document, but the following section describes the high-level steps for an OS install.

The design goal of this reference architecture is to represent a real-world environment as closely as possible.

As explained in the previous section, the service profile was created using Cisco Intersight to rapidly deploy all stateless servers to deploy an eight node Oracle RAC. The SAN boot LUNs for these servers were hosted on the Pure Storage system to provision the OS. The zoning was performed on the Cisco MDS Switches to enable the initiators to discover the targets during the boot process.

Each server node has a dedicated single LUN to install the operating system. For this solution, the Red Hat Enterprise Linux Server 8.9 (4.18.0-513.5.1.el8_9.x86_64) was installed on these LUNs and the NVMe/FC connectivity was configured, all prerequisite packages were configured to install the Oracle Database 21c Grid Infrastructure, and the Oracle Database 21c software was used to create an eight node Oracle Multitenant RAC 21c database for this solution.

The following screenshot shows the high-level steps to configure the Linux Hosts and deploy the Oracle RAC Database solution:



Install OS (Red Hat Linux) & Configure NVMe/FC

- Install OS & Configure Network Interfaces
- > Install Supported ENIC & FNIC Linux Drivers for Cisco VIC
- > Configure and setup device-mapper multipath for basic failover
- Configure Storage Volumes and NVMe Subsystems

Oracle Grid Infrastructure & Database Deployment

- > Configure Pre-requisites and additional OS requirements
- > Install Oracle 21c Grid Infrastructure
- Install Oracle 21c Database
- Create Multiple Container RAC Databases for stress tests

Hardware Calibration & Database Stress Tests

- FIO Tests (IOPS & Bandwidth Scale)
- SLOB Calibration Tests (Container with 1 Pluggable) (IOPS Scale)
- One OLTP Database (Container with 1 Pluggable) running SwingBench SOE Stress Tests (IOPS Scale)
- Two OLTP Database (Container with 2 Pluggable) running SwingBench SOE Stress Tests (IOPS Scale)
- One DSS Database (Container with 1 Pluggable) running SwingBench SH Stress Tests (Bandwidth Scale)
- Multiple Databases (OLTP + DSS) running SwingBench SOE & SH Stress Tests (IOPS & Bandwidth Scale)

This section describes the high-level steps to configure the Oracle Linux Hosts and deploy the Oracle RAC Database solution.

Configure the Operating System

Note: The detailed installation process is not explained in this document, but the following procedure describes the high-level steps for the OS installation.

Procedure 1. Configure OS

Step 1. Download the Red Hat Enterprise Linux 8.9 OS image and save the IOS file to local disk.

Step 2. Launch the vKVM console on your server by going to Cisco Intersight > Infrastructure Service > Operate > Servers > click Chassis 1 Server 1 > from the Actions drop-down list select Launch vKVM.

≡	intersight		lnfrastruc	cture Service 🗸						Q Search		С	0	f] 🕕	Q 💶 🛆	0	<u>م</u>
:@:	Overview		Serv	/ers													
Ő.	Operate	^	<u>* /</u>	All Servers 🐵 +	я					e	Export 8 items fo	und	[10 ~]	per pa	ge 《 < [1] o		
ľ	Servers Chassis Fabric Interconnects			Health	Power © On 8		HCL Status	Bundle Ver	rsion		Firmware Vers	ion		Mode	Hs		
	HyperFlex Clusters			8 Healthy 7				••••	.2(2.240	0053) 8	8 • 5.2(2.24	0053) 8		(*	• UCSX 210C-M7		
	Integrated Systems			Name	: Hea	th :	: Model :	Server Profile	:	UCS Domain	: CPU C 0	: M	emory C	: 512.0	Firmware :	U. 🖗	
୍	Analyze			© FS-ORA-FI-1-3		C Healthy	UCSX-210C-M7	ORARAC2	© ⊘	FS-ORA-FI	153	3.6		512.0 512 Po	ower	>	
	A) () FS-ORA-FI-1-5		O Healthy	UCSX-210C-M7	ORARAC3			153	3.6		512 Sy	rstem		
	Configure			SFS-ORA-FI-1-7		Healthy	UCSX-210C-M7	ORARAC4			15:	3.6		512 Pr	ofile		
				😃 FS-ORA-FI-2-1		C Healthy	UCSX-210C-M7	ORARAC5			153	3.6		512 VN	/ware		
				O FS-ORA-FI-2-3		0 Critical	UCSX-210C-M7	ORARAC6			153	3.6		512 In:	stall Operating Syst	em	
				😃 FS-ORA-FI-2-5		C Healthy	UCSX-210C-M7	ORARAC7			153	3.6		512 Up	ograde Firmware		4
				© FS-ORA-FI-2-7		Healthy	UCSX-210C-M7	ORARAC8			153	3.6		512 La	unch vKVM		
				 Selected 1 of 8 	Show Selected	Unselect A											
														St	art Alarm Suppress	ion	
														Se	et License Tier		
														co	pliect Tech Support	Bundle	

- Step 3. Click Accept security and open KVM. Click Virtual Media > vKVM-Mapped vDVD. Click Browse and map the Oracle Linux ISO image, click Open and then click Map Drive. After mapping the iso file, click Power > Power Cycle System to reboot the server.
- **Step 4.** When the Server boots, it will detect the boot order and start booting from the Virtual mapped DVD as previously configured.
- **Step 5.** When the Server starts booting, it will detect the Pure Storage active FC paths. If you see those following storage targets in the KVM console while the server is rebooting along with the target WWPNs, it confirms the setup and zoning is done correctly and boot from SAN will be successful.



- **Step 6.** During the server boot order, it detects the virtual media connected as RHEL OS ISO DVD media and it will launch the RHEL OS installer.
- Step 7. Select language and for the Installation destination assign the local virtual drive. Apply the hostname and click Configure Network to configure any or all the network interfaces. Alternatively, you can configure only the "Public Network" in this step. You can configure additional interfaces as part of post OS install steps.

Note: For an additional RPM package, we recommend selecting the "Customize Now" option and the relevant packages according to your environment.

- **Step 8.** After the OS installation finishes, reboot the server, and complete the appropriate registration steps.
- Step 9. Repeat steps 1 4 on all server nodes and install RHEL 8.9 to create an eight node Linux system.
- Step 10. Optionally, you can choose to synchronize the time with ntp server. Alternatively, you can choose to use the Oracle RAC cluster synchronization daemon (OCSSD). Both NTP and OCSSD are mutually exclusive and OCSSD will be setup during GRID install if NTP is not configured.

ENIC and FNIC Drivers for Linux OS

For this solution, the following ENIC and FNIC versions were installed:

- ENIC: version: 4.6.0.0-977.3
- FNIC: version: 2.0.0.96-324.0

Procedure 1. Install the ENIC and FNIC drivers

- Step 1. Download the supported UCS Linux Drivers from this link: https://software.cisco.com/download/home/286327804
- **Step 2.** Mount the driver ISO to the Linux host KVM and install the relevant supported ENIC and FNIC drivers for the Linux OS. To configure the drivers, run the following commands:
 - Check the current ENIC & FNIC version:

```
[root@orarac1 ~]# cat /sys/module/enic/version
[root@orarac1 ~]# cat /sys/module/fnic/version
[root@orarac1 ~]# rpm -qa | grep enic
[root@orarac1 ~]# rpm -qa | grep fnic
```

• Install the supported ENIC & FNIC driver from RPM:

[root@orarac1 software]# rpm -ivh kmod-enic-4.6.0.0-977.3.rhel8u9_4.18.0_513.5.1.x86_64
[root@orarac1 software]# rpm -ivh kmod-fnic-2.0.0.96-324.0.rhel8u9.x86 64

• Reboot the server and verify that the new driver is running as shown below:

```
[root@orarac1 ~]# rpm -qa | grep enic
kmod-enic-4.6.0.0-977.3.rhel8u9 4.18.0 513.5.1.x86 64
[root@orarac1 ~]# rpm -qa | grep fnic
kmod-fnic-2.0.0.96-324.0.rhel8u9.x86 64
[root@orarac1 ~] # modinfo enic | grep version
version:
         4.6.0.0-977.3
rhelversion:
              8.9
srcversion: 4248075B65C84CA281FE03E
vermagic:
              4.18.0-513.5.1.el8 9.x86 64 SMP mod unload modversions
[root@orarac1 ~] # modinfo fnic | grep version
version:
         2.0.0.96-324.0
rhelversion:
              8.9
srcversion:
             0EA398F96B3E8444AF73198
vermagic:
              4.18.0-513.5.1.el8 9.x86 64 SMP mod unload modversions
[root@orarac1 ~]# cat /sys/module/enic/version
4.6.0.0-977.3
[root@orarac1 ~]# cat /sys/module/fnic/version
2.0.0.96-324.0
```

```
[root@orarac1 ~]# lsmod | grep fnic
fnic 290816 8
nvme_fc 53248 3713 fnic
scsi_transport_fc 81920 1 fnic
[root@orarac1 ~]#
```

Step 3. Repeat steps 1 and 2 to configure the Cisco VIC linux drivers on all eight nodes.

Note: You should use a matching ENIC and FNIC pair.

Note: Check the Cisco UCS supported driver release for more information about the supported kernel version, here:

https://www.cisco.com/c/en/us/support/docs/servers-unified-computing/ucs-manager/116349-technoteproduct-00.html

NVME CLI

The NVME hosts and targets are distinguished through their NQN. The FNIC NVME host reads its host nqn from the file /etc/nvme/hostnqn. With a successful installation of the nvme-cli package, the hostnqn file will be created automatically for some OS versions, such as RHEL.

Note: If the /etc/nvme/hostnqn file is not present after name-cli installed, then create the file manually.

Procedure 1. Install the NVME CLI

Step 1. Run the following commands to Install nvme-cli and get HostNQN information from the host:

```
[root@orarac1 ~]# rpm -q nvme-cli
nvme-cli-1.16-9.el8.x86_64
[root@orarac1 ~]# cat /etc/nvme/hostnqn
nqn.2014-08.org.nvmexpress:uuid:35010000-5013-0000-0000-135135000000
```

Device-mapper Multipathing

For this solution, the DM-Multipath was configured for the FC Boot LUNs as well as NVMe/FC database workload. For more information, go to the following links:

- <u>https://support.purestorage.com/bundle/m_linux/page/Production/Solutions/Oracle/Oracle_on_FlashArra_v/library/common_content/c_recommended_dmmultipath_settings.html</u>
- <u>https://support.purestorage.com/bundle/m_flasharrayx/page/FlashArray/FlashArray_Hardware/94_FlashArray_FlashArray_Hardware/94_FlashArray_Ktopics/concept/c_enabling_nvmefc.html</u>

Note: For DM-Multipath Configuration and best practice, refer to Pure Storage Support article: <u>https://support.purestorage.com/bundle/m_linux/page/Solutions/Oracle/Oracle_on_FlashArray/library/com_mon_content/c_recommended_dmmultipath_settings.html</u> **Note:** We made sure the multipathing packages were installed and enabled for an automatic restart across reboots.

Procedure 1. Configure device-mapper multipathing

```
Step 1. Enable and initialize the multipath configuration file:
        [root@orarac1 ~] # mpathconf --enable
        [root@orarac1 ~]# mpathconf
        multipath is enabled
        find multipaths is no
        user friendly names is disabled
        default property blacklist is disabled
        enable foreign is not set (all foreign multipath devices will be shown)
        dm multipath module is loaded
        multipathd is running
        [root@orarac1 ~] # systemctl status multipathd.service
        • multipathd.service - Device-Mapper Multipath Device Controller
           Loaded: loaded (/usr/lib/systemd/system/multipathd.service; enabled; vendor preset:
    enabled)
           Active: active (running) since Mon 2024-06-17 12:09:07 PDT; 1 weeks 0 days ago
          Process: 3655 ExecStartPre=/sbin/multipath -A (code=exited, status=0/SUCCESS)
          Process: 3653 ExecStartPre=/sbin/modprobe -a scsi dh alua scsi dh emc scsi dh rdac
    dm-multipath (code=exited, status=0/SUCCESS)
         Main PID: 3657 (multipathd)
           Status: "up"
            Tasks: 7
           Memory: 133.7M
           CGroup: /system.slice/multipathd.service
                    └─3657 /sbin/multipathd -d -s
Step 2. Edit the "/etc/multipath.conf" file:
```

```
[root@orarac1 ~]# cat /etc/multipath.conf
defaults {
        polling_interval 10
}
devices {
     device {
        vendor "NVME"
```

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```
product
                                     "Pure Storage FlashArray"
                                     "queue-length 0"
        path selector
        path grouping policy
                                     group by prio
        prio
                                     ana
                                     immediate
        failback
        fast io fail tmo
                                     10
        user friendly names
                                     no
        no path retry
                                     0
        features
                                     0
        dev loss tmo
                                     60
    }
    device {
                                  "PURE"
        vendor
        product
                                  "FlashArray"
        path selector
                                  "service-time 0"
        hardware handler
                                  "1 alua"
        path_grouping_policy
                                 group_by_prio
        prio
                                  alua
                                  immediate
        failback
        path checker
                                  tur
        fast io fail tmo
                                  10
        user friendly names
                                 no
        no path retry
                                  0
        features
                                  0
        dev loss tmo
                                  600
    }
multipaths {
        multipath {
                wwid
                              3624a93704a5561942d7640ea00011436
                alias
                              ORARAC1-RHEL-OS
        }
```

```
Note: To ensure the best performance with the Pure Storage FlashArray, please use this guide for the
configuration and implementation of Linux hosts in your environment:
```

https://support.purestorage.com/bundle/m troubleshooting for vmware solutions/page/Solutions/VMwar e Platform Guide/Troubleshooting for VMware Solutions/VMware-Related KB Articles/library/common content/c introduction 46.html. These recommendations apply to the versions of Linux that Pure storage have certified.

}

}

Note: Regarding path selectors as listed above, Pure Storage recommends using queue-length 0 with NVMe and service-time 0 with SCSI, which improve performance in situations where paths have differing latencies by biasing I/Os towards paths that are servicing I/O more quickly.

Note: To ensure the best performance with the Pure Storage FlashArray for Oracle deployment, please use this guide:

https://support.purestorage.com/bundle/m_oracle/page/Solutions/Oracle/Oracle_on_FlashArray/topics/co_ncept/c_oracle_database_recommended_settings_for_flasharray.html

Step 3. Run "multipath -II" command to view all the LUN id and enter that wwid information accordingly on each node:

[root@orarac1 ~] # multipath -ll

ORARAC1-RHEL-OS (3624a93704a5561942d7640ea00011436) dm-5 PURE,FlashArray

size=500G features='0' hwhandler='1 alua' wp=rw

+-	policy='service	e-time 0'	prio=50 s	status=ac	ctive	
-	3:0:1:1	sdh	8:112	active	ready	running
-	3:0:0:1	sdg	8:96	active	ready	running
-	4:0:0:1	sdi	8:128	active	ready	running
` —	4:0:1:1	sdj	8:144	active	ready	running

Public and Private Network Interfaces

If you have not configured network settings during OS installation, then configure it now. Each node must have at least two network interface cards (NICs), or network adapters. One adapter is for the public network interface and another adapter is for the private network interface (RAC interconnect).

Procedure 1. Configure Management Public and Private Network Interfaces

Step 1. Login as a root user into each Linux node and go to "/etc/sysconfig/network-scripts/"

Step 2. Configure the Public network and Private network IP addresses according to your environments.

Note: Configure the Private and Public network with the appropriate IP addresses on all eight Linux Oracle RAC nodes.

Configure OS Prerequisites for Oracle Software

To successfully install the Oracle RAC Database 21c software, configure the operating system prerequisites on all eight Linux nodes.

Note: Follow the steps according to your environment and requirements. For more information, see the Install and Upgrade Guide for Linux for Oracle Database 21c: <u>https://docs.oracle.com/en/database/oracle/oracle-database/21/cwlin/index.html</u> and <u>https://docs.oracle.com/en/database/oracle/oracle-database/21/ladbi/index.html</u>

Procedure 1. Configure the OS prerequisites

- Step 1. To configure the operating system prerequisites using RPM for Oracle 21c software on Linux node, install the "oracle-database-preinstall-21c (oracle-database-preinstall-21c-1.0-1.el8.x86_64.rpm)" rpm package on all eight nodes. You can also download the required packages from: https://public-vum.oracle.com/oracle-linux-8.html
- Step 2. If you plan to use the "oracle-database-preinstall-21c" rpm package to perform all your prerequisites setup automatically, then login as root user and issue the following command on all each of the RAC nodes:

[root@orarac1 ~]# yum install oracle-database-preinstall-21c-1.0-1.el8.x86 64.rpm

Note: If you have not used the oracle-database-preinstall-21c package, then you will have to manually perform the prerequisites tasks on all the nodes.

Configure Additional OS Prerequisites

After configuring the automatic or manual prerequisites steps, you have a few additional steps to complete the prerequisites to install the Oracle database software on all eight Linux nodes.

Procedure 1. Disable SELinux

Since most organizations might already be running hardware-based firewalls to protect their corporate networks, you need to disabled Security Enhanced Linux (SELinux) and the firewalls at the server level for this reference architecture.

Step 1. Set the secure Linux to permissive by editing the "/etc/selinux/config" file, making sure the SELINUX flag is set as follows:

SELINUX=permissive

Procedure 2. Disable Firewall

Step 1. Check the status of the firewall by running following commands. (The status displays as active (running) or inactive (dead)). If the firewall is active / running, run this command to stop it:

systemctl status firewalld.service

systemctl stop firewalld.service

Step 2. To completely disable the firewalld service so it does not reload when you restart the host machine, run the following command:

systemctl disable firewalld.service

Procedure 3. Create Grid User

Step 1. Run this command to create a grid user:

useradd -u 54322 -g oinstall -G dba grid

Procedure 4. Set the User Passwords

Step 1. Run these commands to change the password for Oracle and Grid Users:

passwd oracle passwd grid

Procedure 5. Configure UDEV Rules for IO Policy

You need to configure the UDEV rules to assign the IO Policy in all Oracle RAC nodes to access the Pure Storage subsystems. To review the best practices for applying queue settings with UDEV rules, go to: https://support.purestorage.com/bundle/m_linux/page/Solutions/Oracle/Oracle_on_FlashArray/library/common_content/c_applying_queue_settings_with_udev.html

Step 1. Assign IO Policy by creating a new file named "99-pure-storage.rules" with the following entries on all the nodes:

[root@orarac1 ~]# cat /etc/udev/rules.d/99-pure-storage.rules

Recommended settings for Pure Storage FlashArray.

Use none scheduler for high-performance solid-state storage for SCSI devices

ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{queue/scheduler}="none"

ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block", ENV{DM_NAME}=="3624a937*", ATTR{queue/scheduler}="none"

Reduce CPU overhead due to entropy collection

```
ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{queue/add random}="0"
```

```
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block", ENV{DM_NAME}=="3624a937*", ATTR{queue/add_random}="0"
```

Spread CPU load by redirecting completions to originating CPU

```
ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{queue/rq affinity}="2"
```

```
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block", ENV{DM_NAME}=="3624a937*", ATTR{queue/rq affinity}="2"
```

Set the HBA timeout to 60 seconds
ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE",
ATTR{device/timeout}="60"

Procedure 6. Configure "/etc/hosts"

- Step 1. Login as a root user into the Linux node and edit the "/etc/hosts" file.
- **Step 2.** Provide the details for Public IP Address, Private IP Address, SCAN IP Address, and Virtual IP Address for all the nodes. Configure these settings in each Oracle RAC Nodes as shown below:

[root@orarac1 ~]# cat /etc/hosts
127.0.0.1 localhost localhost.localdomain localhost4 localhost4.localdomain4
::1 localhost localhost.localdomain localhost6 localhost6.localdomain6

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```
### Public IP
10.29.135.71
                 oraracl
                               orarac1.ciscoucs.com
10.29.135.72
                  orarac2
                               orarac2.ciscoucs.com
10.29.135.73
                  orarac3
                               orarac3.ciscoucs.com
10.29.135.74
                 orarac4
                               orarac4.ciscoucs.com
10.29.135.75
                 orarac5
                               orarac5.ciscoucs.com
10.29.135.76
                 orarac6
                               orarac6.ciscoucs.com
10.29.135.77
                 orarac7
                               orarac7.ciscoucs.com
10.29.135.78
                               orarac8.ciscoucs.com
                  orarac8
### Virtual IP
10.29.135.79
                 oraracl-vip oraracl-vip.ciscoucs.com
10.29.135.80
                  orarac2-vip orarac2-vip.ciscoucs.com
10.29.135.81
                  orarac3-vip orarac3-vip.ciscoucs.com
10.29.135.82
                  orarac4-vip orarac4-vip.ciscoucs.com
10.29.135.83
                  orarac5-vip orarac5-vip.ciscoucs.com
10.29.135.84
                  orarac6-vip orarac6-vip.ciscoucs.com
10.29.135.85
                  orarac7-vip orarac7-vip.ciscoucs.com
10.29.135.86
                  orarac8-vip orarac8-vip.ciscoucs.com
### Private IP
10.10.10.71 oraracl-priv oraracl-priv.ciscoucs.com
10.10.10.72 orarac2-priv orarac2-priv.ciscoucs.com
10.10.10.73 orarac3-priv orarac3-priv.ciscoucs.com
10.10.10.74 orarac4-priv orarac4-priv.ciscoucs.com
10.10.10.75 orarac5-priv orarac5-priv.ciscoucs.com
10.10.10.76 orarac6-priv orarac6-priv.ciscoucs.com
10.10.10.77 orarac7-priv orarac7-priv.ciscoucs.com
10.10.10.78 orarac8-priv orarac8-priv.ciscoucs.com
### SCAN IP
10.29.135.87
                  orarac-scan orarac-scan.ciscoucs.com
10.29.135.88
                  orarac-scan orarac-scan.ciscoucs.com
10.29.135.89
                  orarac-scan orarac-scan.ciscoucs.com
```

- Step 3. You must configure the following addresses manually in your corporate setup:
 - A Public and Private IP Address for each Linux node
 - A Virtual IP address for each Linux node
 - · Three single client access name (SCAN) address for the oracle database cluster

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Note: These steps were performed on all eight Linux nodes. These steps complete the prerequisites for the Oracle Database 21c installation at OS level on the Oracle RAC Nodes.

Configure Volumes for OCR and Voting Disk

You will use the "OCRVOTE" file system on the storage array to store the OCR (Oracle Cluster Registry) files, Voting Disk files, and other Clusterware files. We have created two volumes and shared both these two volumes across all eight nodes so that database nodes can access these files.

Procedure 1. Configure the Pure Storage Host Group and Volumes for OCR and Voting Disk

Step 1. Login into the Pure Storage array.

Step 2. Go to Storage > Volumes > Volumes > and click "+" on the right menu to create volumes as shown below:

0	PURESTORAGE" •	Storage	Q Search
۹	Dashboard	Array Hosts Volumes	Pods File Systems Policies
P	Storage	🤔 > Volumes	
✓	Protection	SizeVirtualData Reduction93.00 T62.21 T2.4 to 1	Unique Snapshots Total 26.40 T 530.91 G 26.92 T
Č.	Analysis	Volumes ~	Space QoS Details 1-10 of 90 < > +
	Performance		Destroyed (0) V Create
	Capacity Replication	Volume Groups ~	Create Snapshots Spac Move
			Destroyed (0) V Destroy
$\mathbf{\bullet}$	Health		Show Protocol Endpoints
*	Settings		Download CSV

Note: We created two volumes for configuring these files as "ocrvote1" and "ocrvote2."

Step 3. To create Host a Host into Pure Storage GUI, go to Storage > Hosts > Hosts and under Hosts option in the right frame, click the + sign to create NVMe hosts.

	Storage	Create Multiple H	losts	1	
Dashboard	Array Hosts Volumes	Name	NVMe-ORARAC#		
🕐 Storage	Size Virtual Data Reduction	Personality	None -	_	
Protection	93.00 T 🚺 62.21 T 2.3 to 1		Add to protection group after hosts are created		
Q Analysis	Hosts A	Start Number	1	e	# Volumes
Capacity Replication	v= FC-ORARAC1	Count	8		1
🛞 Health	- FC-ORARAC2	Number of Digits	2		1
Settings	IN FC-ORARAC3	Create Single	Cancel Create		1
	e FC-ORARAC5		FC		1
Help End User Agreement	HE FC-ORARAC6		FC		1
Terms Log Out	FC-ORARAC7		FC		1

- **Step 4.** For this solution, eight NVMe Hosts were configured to carry NVMe/FC database storage traffic with host's respective NQNs. Also, one host group was configured and all the NVMe hosts were added into that group so that we can share database volumes across all hosts
- **Step 5.** Go to Storage > Hosts > Host Groups > and click "+" on the right menu to create host group as shown below:

0	PURESTORAGE" (Storage					Q Search
۹	Dashboard	Array Hosts	Volumes	Pods	File Syste	ems Policies	
۲	Storage	🧭 > Hosts					
ŵ	Protection	Size Virtual 93.00 T (1) 62.21 T	Data Reduction 2.3 to 1	Unique 26.40 T	Snapshots 530.91 G	Total 27.51 T	
Ģ	Analysis	Hosts ~				General Space	e 1-10 of 32 < > + :
~	Performance Capacity	Host Groups 🗸					1-2 of 2 +
	Replication						Create Delete
€	Health						Show Remote Host Groups
*	Settings						Download CSV

Note: For this solution, we created one host group as "ORARAC" and added al eight hosts (orarac1 to orarac8) into this group.

Ç	PURESTORAGE" 4	Storage	
۸	Dashboard	Array Hosts Volumes Pods File Systems Policies	
۲	Storage	() > Hosts > B ORARAC	
Ì	Protection	Size Virtual Data Reduction Unique Snapshots Total 66.85 T 54.13 T 2.5 to 1 21.25 T 0.00 21.25 T	
٩	Analysis Performance Capacity	Member Hosts A	Interface
	Replication	Dem NVMe-ORARAC1	NVMe-oF
✤	Health		NVMe-oF
*	Settings	DE NVMe-ORARAC4	NVMe-oF
		De NVMe-ORARAC5	NVMe-oF
Help End U	Jser Agreement	P= NVMe-ORARAC6	NVMe-oF
Terms		P= NVMe-ORARAC7	NVMe-oF
Log O		Dem NVMe-ORARAC8	NVMe-oF

- **Step 6.** Into this "ORARAC" host group, connect two volumes "ocrvote1" and "ocrvote2" to share these two volumes across all eight nodes.
- Note: You will create more volumes for storing database files later in the database creation.
- Step 7. When the OS level prerequisites and file systems are configured, you are ready to install the Oracle Grid Infrastructure as grid user. Download the Oracle Database 21c (21.3.0.0.0) for Linux x86-64 and the Oracle Database 21c Grid Infrastructure (21.3.0.0.0) for Linux x86-64 software from Oracle Software site. Copy these software binaries to Oracle RAC Node 1 and unzip all files into appropriate directories.

Note: These steps complete the prerequisites for the Oracle Database 21c Installation at OS level on the Oracle RAC Nodes.

Oracle Database 21c GRID Infrastructure Deployment

This section describes the high-level steps for the Oracle Database 21c RAC installation. This document provides a partial summary of details that might be relevant.

Note: 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 more information, click this link for the Oracle Database 21c install and upgrade guide: https://docs.oracle.com/en/database/oracle/oracle/oracle/oracle/oracle/0racl

For this solution, two volumes of 50G each in size were created and shared across all eight Linux nodes for storing OCR and Voting Disk files for all RAC databases. Oracle 21c Release 21.3 Grid Infrastructure (GI) was installed on the first node as a grid user. The installation also configured and added the remaining three nodes as a part of the GI setup. We also configured Oracle Automatic Storage Management (ASM) in Flex mode.

Complete the following procedures to install the Oracle Grid Infrastructure software for the Oracle Standalone Cluster.

Procedure 1. Create Directory Structure

Step 1. Download and copy the Oracle Grid Infrastructure image files to the first local node only. During installation, the software is copied and installed on all other nodes in the cluster.

Step 2. Create the directory structure according to your environment and run the following commands:

For example:

```
mkdir -p /u01/app/grid
mkdir -p /u01/app/21.3.0/grid
mkdir -p /u01/app/oraInventory
mkdir -p /u01/app/oracle/product/21.3.0/dbhome_1
chown -R grid:oinstall /u01/app/grid
chown -R grid:oinstall /u01/app/21.3.0/grid
chown -R grid:oinstall /u01/app/oraInventory
chown -R oracle:oinstall /u01/app/oracle
```

Step 3. As the grid user, download the Oracle Grid Infrastructure image files and extract the files into the Grid home:

```
cd /u01/app/21.3.0/grid
unzip -q <download_location>/LINUX.X64_213000_grid_home.zip
```

Procedure 2. Configure UDEV Rules for ASM Disk Access

- Step 1. Configure the UDEV rules to have read/write privileges on the storage volumes for grid user. This includes the device details and corresponding "uuid" of the storage volumes:
- **Step 2.** Assign Owner & Permission on NVMe targets by creating a new file named "99-oracleasm.rules" with the following entries on all the nodes

```
[root@orarac1 ~]# cat /etc/udev/rules.d/99-oracleasm.rules
#All volumes which starts with ocrvote* #
ENV{DM_NAME}=="ocrvote*", OWNER:="grid", GROUP:="oinstall", MODE:="660"
#All volumes which starts with dg_oradata_* #
ENV{DM_NAME}=="*data*", OWNER:="oracle", GROUP:="oinstall", MODE:="660"
#All volumes which starts with dg_oraredo_* #
ENV{DM_NAME}=="*log*", OWNER:="oracle", GROUP:="oinstall", MODE:="660"
```

HugePages

HugePages is a method to have a 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.

Advantage of HugePages:

- HugePages are not swappable so there is no page-in/page-out mechanism overhead.
- HugePages uses fewer pages to cover the physical address space, so the size of "bookkeeping" (mapping from the virtual to the physical address) decreases, so it requires fewer entries in the TLB and so TLB hit ratio improves.
- HugePages reduces page table overhead. Also, HugePages eliminates 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 two abstract
 memory operations. Since there are fewer pages to work on, the possible bottleneck on page table access
 is avoided.

Note: For this configuration, HugePages were used for all the OLTP and DSS workloads. Refer to the Oracle guidelines to configure HugePages:

https://docs.oracle.com/en/database/oracle/oracle-database/21/ladbi/disabling-transparent-hugepages.ht ml

Procedure 1. Run Cluster Verification Utility

This procedure verifies that all the prerequisites are met to install the Oracle Grid Infrastructure software. Oracle Grid Infrastructure ships with the Cluster Verification Utility (CVU) that can run to validate the pre and post installation configurations.

Step 1. Login as Grid User in Oracle RAC Node 1 and go to the directory where the Oracle Grid software binaries are located. Run the script named "runcluvfy.sh" as follows:

```
./runcluvfy.sh stage -pre crsinst -n
orarac1,orarac2,orarac3,orarac4,orarac5,orarac6,orarac7,orarac8 -verbose
```

After the configuration, you are ready to install the Oracle Grid Infrastructure and Oracle Database 21c software.

Note: For this solution, Oracle home binaries were installed on the boot LUN of the nodes. The OCR, Data, and Redo Log files reside in the volumes configured on Pure Storage array

Oracle Database Grid Infrastructure Software

Note: It is not within the scope of this document to include the specifics of an Oracle RAC installation. However, a partial summary of details is provided that might be relevant. Please refer to the Oracle installation documentation for specific installation instructions for your environment.

Procedure 1. Install and configure the Oracle Database Grid Infrastructure software

Step 1. Go to the Grid home where the Oracle 21c Grid Infrastructure software binaries are located and launch the installer as the "grid" user.

Step 2. Start the Oracle Grid Infrastructure installer by running the following command:

./gridSetup.sh

Step 3. Select the option Configure Oracle Grid Infrastructure for a New Cluster then click Next.

🛓 Oracle Grid Infrastructure 21c Inst	aller - Step 1 of 9@orarac1	- 🗆 ×
Select Configuration Opti	••• 21 ^c	ORACLE Grid Infrastructure
Configuration Option Cluster Configuration Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product Finish	Select an option to configure the software. The wizard will register the home inventory and then perform the selected configuration. Configure Oracle Grid Infrastructure for a New <u>C</u> luster Configure Oracle Grid Infrastructure for a Standalone Server (Oracle <u>Resta</u> <u>Upgrade Oracle Grid Infrastructure</u> Set Up Software <u>O</u> nly	in the central
Help	< Back Next >	Install Cancel

- **Step 4.** For the Cluster Configuration select Configure an Oracle Standalone Cluster then clicks Next.
- Step 5. In next window, enter the Cluster Name and SCAN Name fields. Enter the names for your cluster and cluster scan that are unique throughout your entire enterprise network. You can also select to Configure GNS if you have configured your domain name server (DNS) to send to the GNS virtual IP address name resolution requests.
- **Step 6.** In the Cluster node information window, click Add to add all eight nodes, Public Hostname and Virtual Host-name as shown below:

* (j)	📓 Oracle Grid Infrastructure 21c Installer - Step 4 of 17@orarac1 – 🗆 🗙						
Clu	Cluster Node Information 21 ORACLE Grid Infrastructure						
Ť	Configuration Option Cluster Configuration	Provide the list of nodes to be managed by and Virtual Hostname.	Oracle Grid Infrastructure with their Public Hostname				
÷	Grid Plug and Play	oraracl	orarac1-vip				
	Cluster Node Information	orarac2	orarac2-vip				
Ť	Natural Interference	orarac3	orarac3-vip				
Ť	Network Interface Usage	orarac4	orarac4-vip				
Ŕ	Storage Option	orarac5	orarac5-vip				
点	GIMR Option	oraraco orarac7	orarac7-vip				
	GIMR Storage Option	orarac8	orarac8-vip				
	Create ASM Disk Group ASM Password Operating System Groups						
\ \	Installation Location						
*	Root script execution	SSH <u>c</u> onnectivity	uster Configuration File				
- ¢	Prerequisite Checks	OS Username: grid	OS Password:				
0	Summary						
	Ipetall Product	Reuse private and public keys existing in	n the user home				
J	Finish		Test Setup				
	Help		< Back Next > Install Cancel				

- **Step 7.** You will see all nodes listed in the table of cluster nodes. Click the SSH Connectivity. Enter the operating system username and password for the Oracle software owner (grid). Click Setup.
- **Step 8.** A message window appears, indicating that it might take several minutes to configure SSH connectivity between the nodes. After some time, another message window appears indicating that password-less SSH connectivity has been established between the cluster nodes. Click OK to continue.
- **Step 9.** In the Network Interface Usage screen, select the usage type for each network interface for Public and Private Network Traffic and click Next.

🛓 Oracle Grid Infrastructure 21c Inst	taller - Step 5 of 17@orarac1		_	o x			
Specify Network Interfac	e Usage			Structure			
Configuration Option	Private interfaces are used l	oy Oracle Grid Infrastructure fo	r internode traffic.				
Grid Plug and Play	Interface Name	Subnet	Use for				
Chuster Nede Jefermation	eno5	10.29.135.0	Public				
	eno6	10.10.10.0	ASM & Private				
Network Interface Usage							
Storage Option							
GIMR Option							
GIMR Storage Option	Note: While configuring an Oracle Member Cluster for Databases using the Grid Naming Service						
Create ASM Disk Group	can be designated as 'Public	".	protocor (price) assigned add	1100000			
ASM Password							
Operating System Groups							
Installation Location							
Root script execution							
Prerequisite Checks							
y Summary							
V Install Product							
5 Finish							
Help	•	< <u>B</u> ack	Next > Install	Cancel			

- **Step 10.** In the storage option, select the option Use Oracle Flex ASM for storage then click Next. For this solution, the Do Not Use a GIMR database option was selected.
- **Step 11.** In the Create ASM Disk Group window, select the "ocrvote1" & "ocrvote2" volumes which are configured into Pure Storage to store OCR and Voting disk files. Enter the name of disk group "OCRVOTE" and select appropriate external redundancy options as shown below:

🔮 Oracle Grid Infrastructure 21c Inst	-		×		
Create ASM Disk Group		2		nfrastru	€ cture
Configuration Option Cluster Configuration Grid Plug and Play Cluster Node Information Network Interface Usage	OCR and Voting disk data will be stored in the following ASI characteristics of this Disk group. Disk group name Ocrvote Redundancy Flex High Normal Allocation Unit Size MB	M Disk grou	up. Select disks	and	
GIMR Option		Show C	andidate/Provis	ioned Dist	<s <b="">-</s>
Create ASM Disk Group	Disk Path		Size (in MB)	Statu	5
ASM Paseword	/dev/mapper/ocrvote1 /dev/mapper/ocrvote2		51200	Candidate	
Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product Finish	Disk Discovery Path:'/dev/mapper/*' Change Discovery Path Configure Oracle ASM Eilter Driver Select this option to configure ASM Filter Driver(AFD) to sim disk devices by Oracle ASM.	ıplify config	uration and ma	nagement	t of
Help		<u>N</u> ext	>	Car	ncel

- **Note:** For this solution, we did not configure Oracle ASM Filter Driver.
- **Step 12.** Select the password for the Oracle ASM account, then click Next:
- Step 13. For this solution, "Do not use Intelligent Platform Management Interface (IPMI)" was selected. Click Next.
- Step 14. You can configure to have this instance of the Oracle Grid Infrastructure and Oracle Automatic Storage Management to be managed by Enterprise Manager Cloud Control. For this solution, this option was not selected. You can choose to set it up according to your requirements.
- Step 15. Select the appropriate operating system group names for Oracle ASM according to your environments.
- **Step 16.** Specify the Oracle base and inventory directory to use for the Oracle Grid Infrastructure installation and then click Next. The Oracle base directory must be different from the Oracle home directory. Click Next and select the Inventory Directory according to your setup.
- **Step 17.** Click Automatically run configuration scripts to run scripts automatically and enter the relevant root user credentials. Click Next.
- Step 18. Wait while the prerequisite checks complete.
- Step 19. If you have any issues, click the "Fix & Check Again." If any of the checks have a status of Failed and are not fixable, then you must manually correct these issues. After you have fixed the issue, you can click Check Again to have the installer check the requirement and update the status. Repeat as needed until all the checks have a status of Succeeded. Click Next.
- **Step 20.** Review the contents of the Summary window and then click Install. The installer displays a progress indicator enabling you to monitor the installation process.

Step 17 of 19@orarac1



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Step 21. Wait for the grid installer configuration assistants to complete.



Step 22. When the configuration completes successfully, click Close to finish, and exit the grid installer.

Step 23. When the GRID installation is successful, login to each of the nodes and perform the minimum health checks to make sure that the Cluster state is healthy. After your Oracle Grid Infrastructure installation is complete, you can install Oracle Database on a cluster.

Overview of Oracle Flex ASM

Oracle ASM is Oracle's recommended storage management solution that provides an alternative to conventional volume managers, file systems, and raw devices. Oracle ASM is a volume manager and a file system for Oracle Database files that reduces the administrative overhead for managing database storage by consolidating data storage into a small number of disk groups. The smaller number of disk groups consolidates the storage for multiple databases and provides for improved I/O performance.

Oracle Flex ASM enables an Oracle ASM instance to run on a separate physical server from the database servers. With this deployment, larger clusters of Oracle ASM instances can support more database clients while reducing the Oracle ASM footprint for the overall system.



When using Oracle Flex ASM, Oracle ASM clients are configured with direct access to storage. With Oracle Flex ASM, you can consolidate all the storage requirements into a single set of disk groups. All these disk groups are mounted by and managed by a small set of Oracle ASM instances running in a single cluster. You can specify the number of Oracle ASM instances with a cardinality setting. The default is three instances.

The following screenshot shows few more commands to check the cluster and FLEX ASM details:

[grid@orarac1 ~]\$ crsctl check cluster CRS-4537: Cluster Ready Services is online CRS-4529: Cluster Synchronization Services is online CRS-4533: Event Manager is online [grid@orarac1 ~]\$ [grid@orarac1 ~]\$ clear [grid@orarac1 ~]\$ [grid@orarac1 ~]\$ crsctl check cluster CRS-4537: Cluster Ready Services is online CRS-4529: Cluster Synchronization Services is online CRS-4533: Event Manager is online [grid@orarac1 ~]\$ srvctl status asm -detail ASM is running on orarac1,orarac2,orarac3 ASM is enabled. ASM instance +ASM3 is running on node orarac3 Number of connected clients: 1 Client names: orarac3: OCR:orarac-cluster ASM instance +ASM1 is running on node orarac1 Number of connected clients: 1 Client names: orarac1: OCR:orarac-cluster ASM instance +ASM2 is running on node orarac2 Number of connected clients: 1 Client names: orarac2: OCR:orarac-cluster [grid@orarac1 ~]\$ srvctl config asm -detail ASM home: <CRS home> Password file: +ocrvote/orapwASM Backup of Password file: +ocrvote/orapwASM backup ASM listener: LISTENER ASM is enabled. ASM is individually enabled on nodes: ASM is individually disabled on nodes: ASM instance count: 3 Cluster ASM listener: ASMNET1LSNR ASM [grid@orarac1 ~]\$ asmcmd ASMCMD> showclustermode ASM cluster : Flex mode enabled - Direct Storage Access ASMCMD> showclusterstate Normal

Oracle Database Installation

After successfully installing the Oracle GRID, it's recommended to only install the Oracle Database 21c software. You can create databases using DBCA or database creation scripts at later stage.

Note: It is not within the scope of this document to include the specifics of an Oracle RAC database installation. However, a partial summary of details is provided that might be relevant. Please refer to the Oracle database installation documentation for specific installation instructions for your environment here: <u>https://docs.oracle.com/en/database/oracle/oracle-database/21/ladbi/index.html</u>

Procedure 1. Install Oracle database software

Complete the following steps as an "oracle" user.

Step 1. Start the "./runInstaller" command from the Oracle Database 21c installation media where the Oracle database software is located.

 \times

- **Step 2.** For Configuration Option, select the option Set Up Software Only.
- Step 3. Select the option "Oracle Real Application Clusters database installation" and click Next.

🛃 Oracle Database 21c Installer - Step 2 of 9@orarac1



Step 4. Select all eight nodes in the cluster where the installer should install Oracle RAC. For this setup, install the software on all eight nodes as shown below:

🔬 Oracle Database 21c Installer - Step 3 of 10@orarac1 -						×	(
Se	lect List of Nodes					21 ^C ORACLE Database	Ξ	
Ť	Configuration Option	Se RA	lect n C or C	odes (in addition to the local node) in Dracle RAC One.	the cluster where t	he installer should install Oracle		
- 4	Database Installation Options				Node name			
- (e)	Nodes Selection	V	1	oraracl				
	Install Type		2	orarac2				
T			3	orarac3				
Ŷ	Typical Installation		4	orarac4				
	Root script execution		5	oraracs				
	Prerequisite Checks	H	7	orarac7				
Ť			8	orarac8				
9	Summary							
- ¢	Install Product							
	Finish							
~								
		SSH <u>c</u> onnectivity						
			S Llas	reares arada		[]		
		⊻	5 056		OS Pass <u>w</u> ord.			
			Reus	se private and public <u>k</u> eys existing in [.]	the user home			
						<u>T</u> est Setu <u>p</u>		
4	1000000							
•	49993						_	
	Help				< Back	Next > Install Cancel	٦	

Step 5. Click "SSH Connectivity..." and enter the password for the "oracle" user. Click Setup to configure passwordless SSH connectivity and click Test to test it when it is complete. When the test is complete, click Next.

🛃 Oracle Database 21c Installer - Ste	ep 3 of 10@orarac1	- 🗆 X
Select List of Nodes		21° ORACLE Database
Configuration Option Database Installation Options Nodes Selection Install Type Typical Installation Root script execution Prerequisite Check Summary Install Product Finish	Select nodes (in addition to the local node) in the r RAC or Oracle RAC One. 1 orarac1 2 orarac2 3 orarac3 4 orarac4 5 orarac5 Database 21c Installer@orarac1 Successfully established passwordless SSH co the selected nodes.	cluster where the installer should install Oracle
	QS Username: oracle □ Reuse private and public keys existing in the u	OS Password:

- Step 6. Select the Database Edition Options according to your environments and then click Next.
- **Step 7.** Enter the appropriate Oracle Base, then click Next.
- Step 8. Select the desired operating system groups and then click Next.
- **Step 9.** Select the option Automatically run configuration script from the option Root script execution menu and click Next.
- **Step 10.** Wait for the prerequisite check to complete. If there are any problems, click "Fix & Check Again" or try to fix those by checking and manually installing required packages. Click Next.
- Step 11. Verify the Oracle Database summary information and then click Install.



Step 12. Wait for the installation of Oracle Database finish successfully, then click Close to exit of the installer.

실 Oracle Database 21c Installer - Step	- 0	×	
Install Product			CLE
Configuration Option Database Installation Options Nodes Selection Database Edition	Progress Saving Cluster Inventory	93%	
Operating System Groups Root script execution Prerequisite Checks Summary Install Product Finish	 Configure Local Node Prepare Link binaries Setup Copy Files to Remote Nodes Configure Remote Nodes Configure Remote Nodes Prepare Setup Setup Setup Cracle Base Setup Read-Only Oracle Home Execute Root Scripts 	Succee Succee Succee Succee Succee Succee Succee Succee Succee Succee Succee Succee Succee	ided ided ided ided ided ided ided ided
	21 ^c ORACLE Database	Details Revert All Revert Betry	Skip
Help		< Back Next > Install	Cancel

These steps complete the installation of the Oracle 21c Grid Infrastructure and Oracle 21c Database software.

Oracle Database Multitenant Architecture

The multitenant architecture enables an Oracle database to function as a multitenant container database (CDB). A CDB includes zero, one, or many customer-created pluggable databases (PDBs). A PDB is a portable collection of schemas, schema objects, and non-schema objects that appears to an Oracle Net client as a non-CDB. All Oracle databases before Oracle Database 12c were non-CDBs.

A container is logical collection of data or metadata within the multitenant architecture. The following figure represents possible containers in a CDB:



The multitenant architecture solves several problems posed by the traditional non-CDB architecture. Large enterprises may use hundreds or thousands of databases. Often these databases run on different platforms on multiple physical servers. Because of improvements in hardware technology, especially the increase in the number of CPUs, servers can handle heavier workloads than before. A database may use only a fraction of the server hardware capacity. This approach wastes both hardware and human resources. Database consolidation is the process of consolidating data from multiple databases into one database on one computer. The Oracle Multitenant option enables you to consolidate data and code without altering existing schemas or applications.

For more information on Oracle Database Multitenant Architecture, go to:

https://docs.oracle.com/en/database/oracle/oracle-database/21/cncpt/CDBs-and-PDBs.html#GUID-5C339A6 0-2163-4ECE-B7A9-4D67D3D894FB

In this solution, multiple Container Databases were configured and validated system performance as explained in the next scalability test section.

Now you are ready to run synthetic IO tests against this infrastructure setup. "fio" was used as primary tools for IOPS tests.

Scalability Test and Results

This chapter contains the following:

- Hardware Calibration Test using FIO
- IOPS Tests on a Single x210c M7 Server
- Bandwidth Tests
- Database Creation with DBCA
- SLOB Test
- <u>SwingBench Test</u>
- One OLTP Database Performance
- Multiple (Two) OLTP Databases Performance
- One DSS Database Performance

Note: Before creating databases for workload tests, it is extremely important to validate that this is indeed a balanced configuration that can deliver expected performance. In this solution, node and user scalability will be tested and validated on all eight node Oracle RAC Databases with various database benchmarking tools.

Hardware Calibration Test using FIO

FIO is short for Flexible IO, a versatile IO workload generator. FIO is a tool that will spawn number of threads or processes doing a particular type of I/O action as specified by the user. For this solution, FIO is used to measure the performance of a Pure Storage FlashArray over a given period.

For the FIO Tests, we have created 8 volumes of 1 TB in size and were shared across all the eight nodes for read/write IO operations.

We run various FIO tests for measuring IOPS, Latency and Throughput performance of this solution by changing block size parameter into the FIO test. For each FIO test, we also changed read/write ratio as 0/100 % read/write, 50/50 % read/write, 70/30 % read/write, 90/10 % read/write and 100/0 % read/write to scale the performance of the storage system. We also ran each of the tests for at least 6 hours to help ensure that this configuration can sustain this type of load for longer period of time.

IOPS Tests on Single x210c M7 Server

This type of FIO IOPS tests with 8k block size represents OLTP type of workloads. For this single server node IOPS scale, we used FIO with random read/write tests, changed read/write ratio and captured all the output as shown in the chart below:



For the single server node, we observed average 921k IOPS for 100/0 % read/write test with the read latency under 1 millisecond. Similarly, for the 90/10 % read/write test, we achieved around 706k IOPS and for the 70/30 % read/write test, we achieved around 655k IOPS with the read and write latency under 0.8 millisecond. For the 50/50 % read/write test, we achieved around 609k IOPS and for the 0/100 % read/write test, we achieved around 592k IOPS with the write and read latency under 1 millisecond.

Bandwidth Tests

The bandwidth tests are carried out with sequential 512k IO Size and represents the DSS database type workloads. The chart below shows results for the various sequential read/write FIO test for the 512k block size. We ran bandwidth test on single x210c M7 server and captured the results as shown below:


For the 100/0 % read/write test, we achieved around 177 Gbps throughput with the read latency around 2.5 millisecond. Similarly, for the 90/10 % read/write test, we achieved around 149 Gbps throughput with the read and write latency under 2.5 milliseconds. For the 70/30 % read/write bandwidth test, we achieved around 126 Gbps throughput with the read latency around 2.3 milliseconds while the write latency around 3.8 milliseconds. For the 50/50 % read/write test, we achieved around 98 Gbps throughput with the read and write latency under 4 milliseconds And lastly, for the 0/100 % read/write test, we achieved around 62 Gbps throughput with the write latency around 5 milliseconds.

We did not see any performance dips or degradation over the period of run time. It is also important to note that this is not a benchmarking exercise, and these are practical and out of box test numbers that can be easily reproduced by anyone. At this time, we are ready to create OLTP database(s) and continue with database tests.

Database Creation with DBCA

We used Oracle Database Configuration Assistant (DBCA) to create multiple OLTP and DSS databases for SLOB and SwingBench test calibration. For SLOB Tests, we configured one container database as "SLOBCDB" and under this container, we create one pluggable database as "SLOBPDB." For SwingBench SOE (OLTP type) workload tests, we configured two container databases as "SOECDB" and "ENGCDB". Under these two container ers, we created one pluggable database on each container as "SOEPDB" and "ENGPDB" to demonstrate the system scalability running multiple OLTP container and pluggable databases for various SOE workloads. For SwingBench SH (DSS type) workload tests, we configured one container database as "SHCDB" and under this container, we created one pluggable database as "SHPDB." Alternatively, you can use Database creation scripts to create the databases as well.

For each RAC database, we created a total number of 10 volumes. We connected all these volumes across eight nodes through single host group ORARAC as explained earlier. All database files were also spread evenly across the storage system so that each storage node served data for the databases. <u>Table 13</u> lists the storage layout of all the volume configuration for all the databases. For each database, we created two disk groups to store the "data" and "log" files for storing the database files. We used 8 volumes to create Oracle ASM "Data" disk group and 2 volumes to create Oracle ASM "log" disk group for each database.

<u>Table 13</u> lists the database volume configuration for this solution where we deployed all three databases to validate SLOB and SwingBench workloads.

Database Name	Volumes	Size (GB)	Notes
OCRVOTE	ocrvote1	50	OCR & Voting Disk
	ocrvote2	50	
SLOBCDB	slobdata01	800	SLOB Database Data Files
(Container SLOBCDB with	slobdata02	800	
Database as SLOBPDB)	slobdata03	800	
	slobdata04	800	
	slobdata05	800	
	slobdata06	800	
	slobdata07	800	
	slobdata08	800	
	sloblog01	100	SLOB Database Redo Log Files
	sloblog02	100	
SOECDB	soedata01	1500	SOECDB Database Data Files
(Container SOECDB with One	soedata02	1500	
Pluggable Database as SOEPDB)	soedata03	1500	
	soedata04	1500	
	soedata05	1500	

 Table 13. Database volume configuration

Database Name	Volumes	Size (GB)	Notes				
	soedata06	1500					
	soedata07	1500					
	soedata08	1500					
	soelog01	100	SOECDB Database Redo Log Files				
	soelog02	100					
ENGCDB	engdata01	1200	ENGCDB Database Data Files				
(Container ENGCDB with	engdata02	1200					
One Pluggable Database as	engdata03	1200					
PDB)	engdata04	1200					
	engdata05	1200					
	engdata06	1200					
	engdata07	1200					
	engdata08	1200					
	englog01	100	ENGCDB Database Redo Log Files				
	englog02	100					
SHCDB	shdata01	2000	SH Database Data Files				
(Container SHCDB with One	shdata02	2000					
Pluggable Database as SHPDB)	shdata03	2000					
	shdata04	2000					
	shdata05	2000					
	shdata06	2000					
	shdata07	2000					

Database Name	Volumes	Size (GB)	Notes
	shdata08	2000	
	shlog01	100	SH Database Redo Log Files
	shlog02	100	

We used the widely adopted SLOB and Swingbench database performance test tools to test and validate throughput, IOPS, and latency for various test scenarios as explained in the following section.

SLOB Test

The Silly Little Oracle Benchmark (SLOB) is a toolkit for generating and testing I/O through an Oracle database. SLOB is very effective in testing the I/O subsystem with genuine Oracle SGA-buffered physical I/O. SLOB supports testing physical random single-block reads (db file sequential read) and random single block writes (DBWR flushing capability). SLOB issues single block reads for the read workload that are generally 8K (as the database block size was 8K).

For testing the SLOB workload, we have created one container database as SLOBCDB. For SLOB database, we have created total 10 volumes. On these 10 volumes, we have created two disk groups to store the "data" and "log" files for the SLOB database. First disk-group "SLOBDATA" was created with 8 volumes (800 GB each) while second disk-group "SLOBLOG" was created with 2 volumes (100 GB each).

Those ASM disk groups provided the storage required to create the tablespaces for the SLOB Database. We loaded SLOB schema on "DATASLOB" disk-group of up to 3 TB in size.

We used SLOB2 to generate our OLTP workload. Each database server applied the workload to Oracle database, log, and temp files. The following tests were performed and various metrics like IOPS and latency were captured along with Oracle AWR reports for each test scenario.

User Scalability Test

SLOB2 was configured to run against all the eight Oracle RAC nodes and the concurrent users were equally spread across all the nodes. We tested the environment by increasing the number of Oracle users in database from a minimum of 128 users up to a maximum of 512 users across all the nodes. At each load point, we verified that the storage system and the server nodes could maintain steady-state behavior without any issues. We also made sure that there were no bottlenecks across servers or networking systems.

The User Scalability test was performed with 128, 256, 384 and 512 users on 8 Oracle RAC nodes by varying read/write ratio as follows:

- 100% read (0% update)
- 90% read (10% update)
- 70% read (30% update)
- 50% read (50% update)

<u>Table 14</u> lists the total number of IOPS (both read and write) available for user scalability test when run with 128, 256, 384 and 512 Users on the SLOB database.

Users	Read/Write % (100-0)	Read/Write % (90-10)	Read/Write % (70-30)	Read/Write % (50-50)
128	535,042	521,999	525,198	521,066
256	752,431	728,685	772,983	766,689
384	969,034	905,226	857,039	859,248
512	1,092,035	965,048	881,120	856,003

Table 14. Total number of IOPS

The following graphs demonstrate the total number of IOPS while running SLOB workload for various concurrent users for each test scenario.

The graph below shows the linear scalability with increased users and similar IOPS from 128 users to 512 users with 100% Read/Write, 90% Read/Write, 70% Read/Write and 50% Read/Write.



Due to variations in workload randomness, we conducted multiple runs to ensure consistency in behavior and test results. The AWR screenshot below was captured from one of the test run scenarios for 100% Read with 512 users running SLOB workload for 4 hours across all eight nodes.

Database Summary												
bacabase Sullillary												
	Databas	se			Snapst	ot Ids	Number of	Instances	Number of	Hosts	Report To	tal (minutes)
Id Name Uni	ique Name Role	Edition	RAC CDB	Block	Size Begin	End	In Report	Total	In Report	Total	DB time	Elapsed time
2435367805 SLOBCDB slo Database Instances Includ -> Listed in order of ins	obcdb PRIMARY ded In Report stance number, I#	EE	YES YES		8192 115	120	8	8	8	8	23,019.14	240.28
										Ava Activ	•	
I# Instance Host	Startup	Begin Snap Time	End Snap	Time	Release	Elapsed	Time(min) DB	time(min)	Up Time(hrs)	Session	Platform	
1 slobcdb1 orarac1 2 slobcdb2 orarac2 3 slobcdb3 orarac3 4 slobcdb4 orarac3 5 slobcdb5 orarac5 6 slobcdb6 orarac6 7 slobcdb6 orarac6 8 slobcdb8 orarac8	14-Mar-24 23:01 14-Mar-24 23:01 14-Mar-24 23:01 14-Mar-24 23:01 14-Mar-24 23:01 14-Mar-24 23:01 14-Mar-24 23:01 14-Mar-24 23:01	15-Mar-24 23:12 15-Mar-24 23:12 15-Mar-24 23:12 15-Mar-24 23:12 15-Mar-24 23:12 15-Mar-24 23:12 15-Mar-24 23:12	16-Mar-2 16-Mar-2 16-Mar-2 16-Mar-2 16-Mar-2 16-Mar-2 16-Mar-2 16-Mar-2 16-Mar-2	4 03:12 4 03:12 4 03:12 4 03:12 4 03:12 4 03:12 4 03:12 4 03:12 4 03:12	21.0.0.0.0 21.0.0.0.0 21.0.0.0.0 21.0.0.0.0 21.0.0.0.0 21.0.0.0.0 21.0.0.0.0 21.0.0.0.0 21.0.0.0.0		240.23 240.23 240.23 240.23 240.23 240.23 240.23 240.23 240.23	15,377.77 15,377.14 15,377.08 15,376.92 15,377.91 15,377.63 15,377.67 15,377.01	28.19 28.19 28.19 28.19 28.19 28.19 28.19 28.19 28.19 28.19	64.0 64.0 64.0 64.0 64.0 64.0 64.0 64.0	Linux x86 Linux x86 Linux x86 Linux x86 Linux x86 Linux x86 Linux x86 Linux x86	5 64-bi 5 64-bi 5 64-bi 5 64-bi 5 64-bi 5 64-bi 5 64-bi 5 64-bi
Open Pluggable Databases	at Begin Snap: 3	, End Snap: 3										

The following screenshot shows a section from the Oracle AWR report that highlights Physical Reads/Sec and Physical Writes/Sec for each instance while running SLOB workload for the same above 100% read tests with 512 users running the workload. It highlights that IO load is distributed across all the cluster nodes performing workload operations.

System	Statistics - P	er Second	DB/Inst: SL	_OBCDB/slobcdb	1 Snaps: 115	120				
I#	Logical Reads/s	Physical Reads/s	Physical Writes/s	Redo Size (k)/s	Block Changes/s	User Calls/s	Execs/s	Parses/s	Logons/s	Txns/s
1	164,493.85	149,030.0	1.5	4.1	11.5	43.2	2,708.9	4.1	10.40	0.1
2	164,216.05	149,032.4	1.9	4.2	11.3	42.8	2,550.8	4.6	10.34	0.1
3	164,186.77	148,966.7	1.8	8.6	43.5	43.0	2,555.8	20.8	10.39	0.1
4	164,142.35	149,000.3	1.4	4.0	9.7	42.8	2,533.6	4.0	10.36	0.1
5	164,426.44	149,034.8	1.2	3.9	9.3	42.6	2,670.3	3.8	10.30	0.1
6	164,151.75	148,967.6	1.6	4.0	9.8	42.4	2,539.7	4.0	10.25	0.1
7	164,185.13	148,976.8	1.4	4.0	10.4	42.2	2,548.6	4.9	10.21	0.1
8	164,153.44	149,014.5	1.3	3.4	8.9	42.0	2,539.5	4.4	10.16	0.1
Sum	1,313,955.78	1,192,023.1	12.2	36.0	114.4	341.0	20,647.2	50.6	82.42	0.7
Avg	164,244.47	149,002.9	1.5	4.5	14.3	42.6	2,580.9	6.3	10.30	0.1
Std	136.42	29.3	0.2	1.7	11.8	0.4	68.2	5.9	0.09	0.0

We also run one of the above SLOB test for sustained 24 hours with 512 Users with 70% Read (30% Update) SLOB workload and captured the results. The AWR screenshot below was captured from this sustained 24 hours test with 512 users running SLOB workload across all eight nodes.

Database Summary								
	Databa	se		Snapsh	ot Ids	Number of Instances	Number of Hosts	Report Total (minutes)
Id Name	Unique Name Role	Edition	n RAC CDB Block	Size Begin	End	In Report Total	In Report Total	DB time Elapsed time
2435367805 SLOBCD Database Instances -> Listed in order	slobcdb PRIMAR) Included In Report of instance number, If	EE	YES YES	8192 161	185	8 8	8 8	737,584.91 1,440.37
I# Instance Hos	Startup	Begin Snap Time	End Snap Time	Release	Elapsed T	ime(min) DB time(min)	Avg Act Up Time(hrs) Sess	tive ions Platform
1 slobcdb1 ora 2 slobcdb2 ora 3 slobcdb3 ora 4 slobcdb4 ora 5 slobcdb5 ora 6 slobcdb6 ora	rac1 17-Mar-24 14:33 rac2 17-Mar-24 14:33 rac3 17-Mar-24 14:33 rac4 17-Mar-24 14:33 rac5 17-Mar-24 14:33 rac6 17-Mar-24 14:33	17-Mar-24 14:34 17-Mar-24 14:34 17-Mar-24 14:34 17-Mar-24 14:34 17-Mar-24 14:34 17-Mar-24 14:34	18-Mar-24 14:34 18-Mar-24 14:34 18-Mar-24 14:34 18-Mar-24 14:34 18-Mar-24 14:34 18-Mar-24 14:34	4 21.0.0.0.0 4 21.0.0.0.0 4 21.0.0.0.0 4 21.0.0.0.0 4 21.0.0.0.0 4 21.0.0.0.0 4 21.0.0.0.0		1,440.33 92,198.65 1,440.33 92,198.06 1,440.33 92,198.06 1,440.35 92,198.42 1,440.35 92,197.63 1,440.35 92,197.63	24.05 6, 24.05 6, 24.05 6, 24.05 6, 24.05 6, 24.05 6, 24.05 6,	1.01 Linux x86 64-bi 4.01 Linux x86 64-bi
8 slobcdb8 ora 0pen Pluggable Dat	ac7 17-mar-24 14:31 ac8 17-Mar-24 14:31 abases at Begin Snap: 3	. 17-Mar-24 14:34 . 17-Mar-24 14:34 . End Snap: 3	18-Mar-24 14:34 18-Mar-24 14:34	4 21.0.0.0.0		1,440.33 92,196.37 1,440.33 92,197.55	24.05 64 24.05 64	4.01 Linux x86 64-bi 4.01 Linux x86 64-bi

The following screenshot shows a section from the Oracle AWR report that highlights Physical Reads/Sec and Physical Writes/Sec for each instance while running SLOB workload for sustained 24 hours. It highlights that IO load is distributed across all the cluster nodes performing workload operations.

Syste	m Statistics - Per	Second	DB/Inst: S	DB/Inst: SLOBCDB/slobcdb1 Snaps: 161-185						
I#	Logical Reads/s	Physical Reads/s	Physical Writes/s	Redo Size (k)/s	Block Changes/s	User Calls/s	Execs/s	Parses/s	Logons/s	Txns/s
1	93,417.04	81,881.2	26,586.0	22,239.5	53,468.2	43.3	1,438.7	3.9	10.49	408.7
2	93,440.90	81,912.0	26,605.1	22,256.9	53,512.0	43.3	1,407.4	4.0	10.47	409.0
3	93,514.01	81,935.5	26,605.8	22,265.6	53,545.0	43.2	1,425.0	20.8	10.44	409.1
4	93,415.21	81,863.7	26,585.8	22,244.6	53,472.1	43.3	1,413.1	4.0	10.42	408.7
5	93,439.72	81,836.7	26,581.6	22,240.7	53,462.6	42.9	1,449.9	4.1	10.38	408.6
6	93,581.81	81,936.0	26,611.9	22,264.5	53,522.4	42.8	1,466.7	4.3	10.34	409.1
7	93,526.04	81,964.0	26,622.2	22,274.0	53,542.6	42.7	1,423.0	4.3	10.32	409.3
8	93,495.85	81,969.7	26,614.6	22,266.4	53,524.5	42.6	1,410.8	4.1	10.29	409.1
Sum	747,830.58	655,298.8	212,812.8	178,052.2	428,049.5	343.9	11,434.6	49.5	83.14	3,271.6
Avg	93,478.82	81,912.3	26,601.6	22,256.5	53,506.2	43.0	1,429.3	6.2	10.39	409.0
Std	59.99	48.0	15.2	13.3	33.7	0.3	20.9	5.9	0.07	0.2

The following screenshot shows "IO Profile" which was captured from the same 70% Read (30% update) Test scenario while running SLOB test with 512 users which shows 863k IOPS (655k Reads and 208k Writes) for this sustained 24 Hours test.

IO Profile (Global)	0 Profile (Global) DB/Inst: SLOBCDB/slobcdb1			
Statistic	Read+Write/s	Reads/s	Writes/s	
Total Requests	863,612.24	655,400.87	208,211.37	
Database Requests	856,647.59	655,247.21	201,400.38	
Optimized Requests	0.00	0.00	0.00	
Redo Requests	2,967.88	N/A	2,967.88	
Total (MB)	7,057.25	5,213.25	1,844.00	
Database (MB)	6,781.98	5,119.42	1,662.56	
Optimized Total (MB)	0.00	0.00	0.00	
Redo (MB)	173.88	N/A	173.88	
Database (blocks)	868,093.44	655,285.12	212,808.32	
Via Buffer Cache (blocks)	868,082.87	655,278.66	212,804.21	
Direct (blocks)	10.75	6.65	4.10	

The following screenshot shows "Top Timed Events" and "Wait Time" during this 24-Hour SLOB test while running workload with 512 users.

Тор	Timed Events	DB/Inst: SLOBCDB/slo	cdbl Snaps: 161-	185								
-> I	nstance '*'	- cluster wide summary										
->		Waits, %Timeouts, Wait Time Total(s)	: Cluster-wide t	otal for 1	the wait event							
->		'Wait Time Avg' : Cl	luster-wide average	e computed	i <mark>as</mark> (Wait Time Total / Ev	ent Waits	.)					
->	'*' Summary 'Avg Wait Time ' : Per-instance 'Wait Time Avg ' used to compute the following statistics											
->	'*' [Avg/Min/Max/Std Dev] : average/minimum/maximum/standard deviation of per-instance 'Wait Time Avg'											
->		Cnt	: count of insta	nces with	wait times for the event							
		Wait	Event		Wait Time			Summarv	Avg Wait Ti	me		
I#	Class	Event	Waits %	Timeouts	Total(s) Avg Wait %	DB time	Avg	Min	Max	Std Dev	Cnt	
*	User I/O	db file sequential read	5.654935E+10	0.0	4.3315019E+07 765.97us	97.88	765.97us	764.90us	766.69us	576.70ns	8	
		DB CPU	N/A	N/A	1,100,549.33	2,49					8	
	Other	GV\$: slave acquisition retry wait time	651,383	100.0	664,595.37 1020.28m	1.50	1020.28ms	1019.84ms	1020.60ms	236.84us	8	
	System I/C) db file parallel write	2.256983E+09	Θ.Θ	432,015.77 191.41us	0.98	191.42us	189.79us	192.58us	1.05us	8	
	System I/C) log file parallel write	513,778,417	Θ.Θ	395,137.34 769.08us	0.89	769.14us	751.69us	783.42us	11.48us	8	
	System I/C) db file async I/O submit	226, 342, 727	0.0	150,954.32 666.93us	0.34	666.92us	660.10us	671.69us	3.65us	8	
	Cluster	gc cr grant 2-way	1.218704E+09	0.0	101,534.11 83.31us	0.23	83.35us	82.14us	85.08us	1.01us	8	
	Cluster	gc current grant 2-way	296,481,530	0.0	31,475.30 106.16us	0.07	106.43us	100.89us	113.03us	3.80us	8	
	Other	LGWR worker group ordering	20,754,480	0.0	22,909.38 1.10ms	0.05	1.10ms	1.08ms	1.13ms	17.45us	8	
	Other	LGWR any worker group	22,092,081	0.0	20,207.75 914.71us	0.05	914.92us	904.72us	921.11us	5.91us	8	

The following screenshot was captured from Pure Storage GUI during this 24 Hour SLOB test while running workload.



The following graph illustrates the latency exhibited by the Pure Storage FA//XL170 across different workloads (100% Read/Write, 90% Read/Write, 70% Read/Write and 50% Read/Write). All the workloads experienced less than 1 millisecond latency and it varies based on the workloads. As expected, the 50% read (50% update) test exhibited higher latencies as the user counts increases.



SwingBench Test

SwingBench is a simple to use, free, Java-based tool to generate various types of database workloads and perform stress testing using different benchmarks in Oracle database environments. SwingBench can be used to demonstrate and test technologies such as Real Application Clusters, Online table rebuilds, Standby databases, online backup, and recovery, and so on. In this solution, we used SwingBench tool for running various type of workload and check the overall performance of this reference architecture.

SwingBench provides four separate benchmarks, namely, Order Entry, Sales History, Calling Circle, and Stress Test. For the tests described in this solution, SwingBench Order Entry (SOE) benchmark was used for representing OLTP type of workload and the Sales History (SH) benchmark was used for representing DSS type of workload.

The Order Entry benchmark is based on SOE schema and is TPC-C like 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 like TPC-H. The workload is query (read) centric and is designed to test the performance of queries against large tables.

The first step after the databases creation is calibration; about the number of concurrent users, nodes, throughput, IOPS and latency for database optimization. For this solution, we ran the SwingBench workloads on various combination of databases and captured the system performance as follows:

Typically encountered in the real-world deployments, we tested a combination of scalability and stress related scenarios that ran across all the 8-node Oracle RAC cluster, as follows:

- OLTP database user scalability workload representing small and random transactions.
- DSS database workload representing larger transactions.
- Mixed databases (OLTP and DSS) workloads running simultaneously.

For this SwingBench workload tests, we created three Container Database as SOECDB, ENGCDB and SHCDB. We configured the first container database as "SOECDB" and created one pluggable database as "SOEPDB" and second container database "ENGCDB" with one pluggable database as "ENGPDB" to run the SwingBench SOE workload representing OLTP type of workload characteristics. We configured the container databases "SHCDB" and created one pluggable database as "SHCDB" and created one pluggable database as "SHCDB" workload characteristics. We configured the container databases "SHCDB" and created one pluggable database as "SHCDB" to run the SwingBench SH workload representing DSS type of workload characteristics.

For this solution, we deployed and validated multiple container databases as well as pluggable databases and run various SwingBench SOE and SH workloads to demonstrate the multitenancy capability, performance, and sustainability for this reference architecture.

For the OLTP databases, we created and configured SOE schema of 3.5 TB for the SOEPDB Database and 3 TB for the ENGPDB Database. For the DSS database, we created and configured SH schema of 4 TB for the SHPDB Database:

- One OLTP Database Performance
- Multiple (Two) OLTP Databases Performance
- One DSS Database Performance
- Multiple OLTP & DSS Databases Performance

One OLTP Database Performance

For one OLTP database workload featuring Order Entry schema, we created one container database SOECDB and one pluggable database SOEPDB as explained earlier. We used 64 GB size of SGA for this database and, we ensured that the HugePages were in use. We ran the SwingBench SOE workload with varying the total number of users on this database from 200 Users to 800 Users. Each user scale iteration test was run for at least 3 hours and for each test scenario, we captured the Oracle AWR reports to check the overall system performance below:

User Scalability

<u>Table 15</u> lists the Transaction Per Minutes (TPM), IOPS, Latency and System Utilization for the SOECDB Database while running the workload from 200 users to 800 users across all the eight RAC nodes.

Number	Transactions		Storage IOPS		Latency (milliogeopte)	CPU	
or Users	Per Seconds (TPS)	Per Minutes (TPM)	Reads/Sec	Writes/Sec	Total IOPS	(miniseconas)	(%)
200	20,329	1,219,710	189,668	59,055	248,724	0.40	12.1
400	27,918	1,675,098	260,764	79,971	340,736	0.48	15.8

Tabla 15	Lleor S	calo '	Tost	on	Ono		Databasa
Table 15.	User 3	cale	iest	on	Une	ULIP	Database

Number	Transaction	S	Storage IOPS			Latency (milliogeopte)	CPU
600	33,854	2,031,234	340,950	98,233	439,183	0.57	21.3
800	39,613	2,376,780	406,529	120,775	527,304	0.69	26.7

The following chart shows the IOPS and Latency for the SOECDB Database while running the SwingBench Order Entry workload tests from 200 users to 800 users across all eight RAC nodes.



The chart below shows the Transaction Per Minutes (TPM) and System Utilization for the SOECDB Database while running the same SwingBench Order Entry workload tests from 200 users to 800 users:



The AWR screenshot below was captured from one of the above test scenarios with 800 users running SwingBench Order Entry workload for sustained 24 hours across all eight RAC nodes:

Database Summar	y ~												
		Databa	ise			Snapsho	ot Ids	Number of	Instances	Number of	Hosts	Report Tota	l (minutes)
Id Nam	e Unic	que Name Role	Editi	on RAC CDB	Block Size	Begin	End	In Report	Total	In Report	Total	DB time E	lapsed time
1666996520 SOE Database Instan -> Listed in or	CDB soec ices Include ider of inst	db PRIMARY ed In Report tance number, I#	EE	YES YES	8192	342	366	8	8	8	8	566,828.31	1,440.25
I# Instance	Host	Startup	Begin Snap Time	e End Snap	Time Relea	ase	Elapsed T	ime(min) DB	time(min)	Up Time(hrs)	Avg Acti Sessio	ve ns Platform	
1 soecdb1 2 soecdb2 3 soecdb3 4 soecdb4 5 soecdb5 6 soecdb6 7 soecdb7 8 soecdb8	orarac1 orarac2 orarac3 orarac4 orarac5 orarac6 orarac7 orarac8	10-Apr-24 14:55 10-Apr-24 14:55 10-Apr-24 14:55 10-Apr-24 14:55 10-Apr-24 14:55 10-Apr-24 14:55 10-Apr-24 14:55 10-Apr-24 14:55	13-Apr-24 15:4 13-Apr-24 15:4 13-Apr-24 15:4 13-Apr-24 15:4 13-Apr-24 15:4 13-Apr-24 15:4 13-Apr-24 15:4 13-Apr-24 15:4	2 14-Apr-24 2 14-Apr-24 2 14-Apr-24 2 14-Apr-24 2 14-Apr-24 2 14-Apr-24 2 14-Apr-24 2 14-Apr-24 2 14-Apr-24	4 15:42 21.0 4 15:42 21.0	.0.0.0 .0.0.0 .0.0.0 .0.0.0 .0.0.0 .0.0.0 .0.0.0 .0.0.0 .0.0.0		1,440.15 1,440.17 1,440.17 1,440.17 1,440.17 1,440.15 1,440.15 1,440.15	69,571.25 71,520.58 72,033.69 70,629.84 70,658.88 70,646.05 71,131.32 70,636.70	96.78 96.78 96.78 96.78 96.78 96.78 96.78 96.78 96.78	48. 49. 50. 49. 49. 49. 49. 49.	31 Linux x86 66 Linux x86 02 Linux x86 04 Linux x86 05 Linux x86 05 Linux x86 39 Linux x86 05 Linux x86	64-bi 64-bi 64-bi 64-bi 64-bi 64-bi 64-bi 64-bi
Open Pluggable	Databases a	at Begin Snap: 3	, End Snap: 3						,				

The following screenshot captured from the Oracle AWR report highlights the Physical Reads/Sec, Physical Writes/Sec and Transactions per Seconds for the Container SOECDB Database for the same above test. We captured about 528k IOPS (412k Reads/s and 116k Writes/s) with the 38k TPS (Transactions Per Seconds) while running this 24-hour sustained SwingBench Order Entry workload on one OLTP database with 800 users.

Syste	n Statistics - Per	r Second	DB/Inst:	SOECDB/soecdb	01 Snaps: 342	-366				
I#	Logical Reads/s	Physical Reads/s	Physical Writes/s	Redo Size (k)/s	Block Changes/s	User Calls/s	Execs/s	Parses/s	Logons/s	Txns/s
1	1,013,583.95	48,580.4	13,917.2	13,261.0	78,787.4	21,135.2	80,106.6	7,723.5	0.67	4,618.7
2	1,080,533.56	54,013.3	14,696.1	13,840.2	82,434.1	22,089.3	83,711.6	8,071.6	0.67	4,826.4
3	996,194.68	52,567.9	15,188.2	14,333.3	85,341.0	22,871.8	86,681.3	8,357.8	0.67	4,998.4
4	1,066,366.10	51,231.5	14,808.1	13,987.4	83,230.2	22,290.1	84,473.8	8,145.0	0.67	4,871.2
5	1,147,468.12	50,244.7	14,284.1	13,707.0	81,263.4	21,854.9	82,834.2	7,986.3	0.67	4,776.4
6	1,097,500.31	50,669.8	14,603.8	13,832.0	82,255.5	22,041.6	83,532.1	8,054.4	0.67	4,817.3
7	1,276,983.25	53,586.4	14,372.9	13,408.5	79,793.4	21,354.5	80,967.6	7,807.2	0.67	4,665.7
8	1,007,551.49	50,988.2	14,729.0	13,919.7	82,823.7	22,186.7	84,079.3	8,107.5	0.67	4,848.7
Sum	8,686,181.48	411,882.2	116,599.5	110,289.1	655,928.6	175,824.2	666,386.6	64,253.2	5.36	38,422.9
Avg	1,085,772.68	51,485.3	14,574.9	13,786.1	81,991.1	21,978.0	83,298.3	8,031.7	0.67	4,802.9
Std	92,785.00	1,809.9	383.2	335.4	2,047.3	543.9	2,052.8	198.0	0.00	119.0

The following screenshot captured from the Oracle AWR report shows the SOECDB database "IO Profile" for the "Reads/s" and "Writes/s" requests for the entire 24-hour of the test. The Total Requests (Read and Write Per Second) were around "552k" with Total (MB) "Read+Write" Per Second was around "4316" MB/s for the SOECDB database while running the SwingBench Order Entry workload test on one OLTP database.

IO Profile (Global)	DB/Inst:	SOECDB/soecdb1	Snaps: 342-366
Statistic	Read+Write/s	Reads/s	Writes/s
Total Requests	552,808.24	407,363.61	145,444.64
Database Requests	509,901.26	407,234.47	102,666.79
Optimized Requests	0.00	0.00	0.00
Redo Requests	23,936.71	N/A	23,936.71
Total (MB)	4,316.48	3,283.95	1,032.54
Database (MB)	4,128.50	3,217.62	910.87
Optimized Total (MB)	0.00	0.00	0.00
Redo (MB)	107.70	N/A	107.70
Database (blocks)	528,447.49	411,855.52	116,591.97
Via Buffer Cache (blocks)	523,794.18	407,215.13	116,579.05
Direct (blocks)	4,653.27	4,640.35	12.92

The following screenshot captured from the Oracle AWR report shows the "Top Timed Events" and average wait time for the SOECDB database for the entire duration of the 24-hour test running with 800 users.

Top T -> In -> -> -> ->	imed Events stance '*' '*' '*' '*' '*'	DB/Inst: SOECDE - cluster wide summary Waits, %Timeouts, Wait Time Total(s) 'Wait Time Avg' Summary 'Avg Wait Time ' [Avg/Min/Max/Std Dev] Cnt	<pre>B/soecdbl Snaps: 342-366 : Cluster-wide total : Cluster-wide average co : Per-instance 'Wait Tim : average/minimum/ma : count of instances</pre>	for npute Avg cimum with	the wait event d as (Wait Time Total / ' used to compute the f /standard deviation of p wait times for the even	Event Waits ollowing st er-instance t	;) atistics : 'Wait Time /	Avg '			
		Wait	Event		Wait Time			Summary A	Avg Wait Tir	ie	
I#	Class	Event	Waits %Time	outs	Total(s) Avg Wait	%DB time	Avg	Min	Max	Std Dev	Cnt
*	User I/0 Cluster Commit Cluster Cluster Cluster Cluster User I/0 Svetem I/0	db file sequential read DB CPU gc cr grant 2-way log file sync gc current block 3-way gc current grant 2-way gc cr block 3-way gc cr block 2-way db file parallel read log file parallel read	2.821722E+10 N/A 1.523692E+10 3.314268E+09 7.664151E+09 9.342035E+09 4.339339E+09 6.193674E+09 3.095676E+09 4.3995676E+09	0.0 N/A 0.0 0.0 0.0 0.0 0.0 0.0	1.4172606E+07 502.27us 8,442,043.37 2,598,062.64 170.51us 2,505,732.12 756.04us 1,928,758.97 251.66us 1,494,311.17 159.96us 1,111,474.72 256.14us 938,627.14 151.55us 851,807.37 275.16us 851,807.37 275.16us	41.67 24.82 7.64 7.37 5.67 4.39 3.27 2.76 2.50	502.31us 170.55us 756.00us 251.59us 160.00us 256.05us 151.74us 275.17us	500.58us 162.45us 744.37us 243.27us 157.47us 247.48us 142.69us 274.67us	507.52us 172.56us 761.83us 255.81us 170.89us 260.51us 160.03us 276.88us	2.21us 3.40us 6.11us 3.79us 4.43us 3.93us 5.21us 712.13ns 712.13ns	000000000000000000000000000000000000000

The following screenshot shows the Pure Storage array dashboard when one OLTP database was running the workload for the sustained 24-hour SwingBench SOE workload with 800 users. The screenshot shows the average IOPS "550k" with the average throughput of "4200 MB/s" with the average storage latency around "1.7 millisecond."



The storage cluster utilization during the above test was average around 45% which was an indication that storage hasn't reached the threshold and could take more load by adding multiple databases.

Also, for the entire 24-hour test, we observed the system performance (IOPS and Throughput) was consistent throughout and we did not observe any dips in performance while running one OLTP database stress test.

Multiple (Two) OLTP Databases Performance

For running multiple OLTP database workload, we have created two container database SOECDB and ENGCDB. For each container database, one pluggable database was configured as SOEPDB and ENGPDB as explained earlier. We ran the SwingBench SOE workload on both the databases at the same time with varying the total number of users on both the databases from 200 Users to 1000 Users. Each user scale iteration test was run for at least 3 hours and for each test scenario, we captured the Oracle AWR reports to check the overall system performance. <u>Table 16</u> lists the IOPS and System Utilization for each of the pluggable databases while running the workload from total of 200 users to 1000 users across all the eight RAC nodes.

Users	IOPS for SOECDB	IOSP for ENGCDB	Total IOPS	System Utilization (%)
200	168,946	153,727	322,673	19.7
400	231,312	211,475	442,786	24.6
600	281,617	258,175	539,792	29.1
800	306,521	279,627	586,149	33.4
1000	345,470	307,845	653,315	36.8

The following chart shows the IOPS and System Utilization for both the container databases while running the SwingBench SOE workload on them at the same time. We observed both databases were linearly scaling the IOPS after increasing and scaling more users. We observed average 653k IOPS with overall system utilization around 37% when scaling maximum number of users on multiple OLTP database workload test. After increasing users beyond certain level, we observed more GC cluster events and overall similar IOPS around 650k.



<u>Table 17</u> lists the Transactions per Seconds (TPS) and Transactions per Minutes (TPM) for each of the pluggable databases while running the workload from total of 200 users to 1000 users across all the eight RAC nodes.

Users	TPS for SOECDB	TPS for ENGCDB	Total TPS	Total TPM
200	12,622	12,396	25,018	1,501,080
400	17,288	17,098	34,386	2,063,178
600	21,063	20,880	41,943	2,516,580
800	22,902	22,654	45,555	2,733,318
1000	25,904	24,914	50,818	3,049,086



The following chart shows the Transactions per Seconds (TPS) for the same tests (above) on CDBDB Database for running the workload on both pluggable databases.



The following screenshot showcases the test start time for the first SOECDB database with 500 users running SwingBench Order Entry workload for sustained 24 hours across all eight nodes as:

Datab 1666 Datab -> Li	Id N 10 N 5996520 S 50ase Inst isted in	ary ~~~ ame Un: OECDB so ances Inclu order of in:	l ique Name Ro ecdb Pf ded In Repo stance numbo	Database ole RIMARY rt er, I#		Edition	RAC CDE	3 Block	Size 8192	Snapsl Begin 566	hot Ids End 590	Number of In Report	Instances Total 8	Number In Report	r of Ho t To B	sts P tal 8 62	DB time	tal (minut Elapsed t 1,440
1 2 3 4 5 6 7 8 0pen	soecdb1 soecdb2 soecdb3 soecdb4 soecdb5 soecdb6 soecdb7 soecdb8 Pluggab1	orarac1 orarac2 orarac3 orarac4 orarac5 orarac6 orarac7 orarac8 e Databases	26-Apr-24 26-Apr-24 26-Apr-24 26-Apr-24 26-Apr-24 26-Apr-24 26-Apr-24 26-Apr-24 26-Apr-24 at Begin Su	22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17 22:17	27-Apr-24 27-Apr-24 27-Apr-24 27-Apr-24 27-Apr-24 27-Apr-24 27-Apr-24 27-Apr-24 End Snap	00:32 00:32 00:32 00:32 00:32 00:32 00:32 00:32 00:32 : 3	28-Apr-2 28-Apr-2 28-Apr-2 28-Apr-2 28-Apr-2 28-Apr-2 28-Apr-2 28-Apr-2	24 00:3 24 00:3 24 00:3 24 00:3 24 00:3 24 00:3 24 00:3 24 00:3	3 21.0.0 3 21.0.0 3 21.0.0 3 21.0.0 3 21.0.0 3 21.0.0 3 21.0.0 3 21.0.0 3 21.0.0).0.0).0.0).0.0).0.0).0.0).0.0).0.0).0.0		1,440.93 1,440.93 1,440.93 1,440.93 1,440.93 1,440.95 1,440.93 1,440.92 1,440.93	77,862.21 77,488.03 77,472.90 77,934.62 77,955.49 77,422.76 78,028.77 77,474.43	20 20 20 20 20 20 20 20 20 20 20	6.26 6.26 6.26 6.26 6.26 6.26 6.26 5.26 5	54.04 53.78 53.77 54.09 54.10 53.73 54.15 53.77	Linux x8 Linux x8 Linux x8 Linux x8 Linux x8 Linux x8 Linux x8 Linux x8	6 64-bi 6 64-bi 6 64-bi 6 64-bi 6 64-bi 6 64-bi 6 64-bi 6 64-bi

The following screenshot showcases the test start time for the second ENGCDB database with 500 users running SwingBench Order Entry workload for sustained 24 hours across all eight nodes at the same time as:

Database Summary	
Database	napshot Ids Number of Instances Number of Hosts Report Total (minutes
Id Name Unique Name Role Edition RAC CDB Block Size	egin End In Report Total In Report Total DB time Elapsed tim
2518202654 ENGCDB engcdb PRIMARY EE YES YES 8192 Database Instances Included In Report -> Listed in order of instance number, I#	361 385 8 8 8 8 567,260.68 1,440.9
I# Instance Host Startup Begin Snap Time End Snap Time Release	Avy Active Elapsed Time(min) DB time(min) Up Time(hrs) Sessions Platform
1 engcdb1 orarac1 26-Apr-24 22:18 27-Apr-24 00:32 28-Apr-24 00:33 21.0.0.0.0 2 engcdb2 orarac2 26-Apr-24 22:18 27-Apr-24 00:32 28-Apr-24 00:33 21.0.0.0.0 0 3 engcdb2 orarac2 26-Apr-24 22:18 27-Apr-24 00:32 28-Apr-24 00:33 21.0.0.0.0 0 4 engcdb4 orarac4 26-Apr-24 22:18 27-Apr-24 00:32 28-Apr-24 00:33 21.0.0.0.0 0 4 engcdb4 orarac4 26-Apr-24 22:18 27-Apr-24 00:32 28-Apr-24 00:33 21.0.0.0.0 0 0 6 0 6 0 21.0.0.0.0 0 0 21.0.0.0.0 0 0 21.0.0.0.0 0 0 21.0.0.0.0 0 26-Apr-24 22:18 27-Apr-24 00:32 28-Apr-24 00:33 21.0.0.0.0 0 0 32 21.0.0.0.0 0 32	1,440.97 71,406.47 26.25 49.55 Linux x86 64-bi 1,440.95 70,688.63 26.25 49.06 Linux x86 64-bi 1,440.95 70,688.66 26.25 49.06 Linux x86 64-bi 1,440.95 70,688.66 26.25 49.06 Linux x86 64-bi 1,440.95 70,696.75 26.25 48.37 Linux x86 64-bi 1,440.95 70,696.75 26.25 49.06 Linux x86 64-bi 1,440.95 70,717.94 26.25 49.08 Linux x86 64-bi 1,440.95 71,281.58 26.25 49.08 Linux x86 64-bi 1,440.95 72,087.33 26.25 50.03 Linux x86 64-bi

The following screenshot was captured from the Oracle AWR report, shows the "Physical Reads/Sec", "Physical Writes/Sec" and "Transactions per Seconds" for the first Container Database SOECDB while running 500 users SOE workload for sustained 24-hour test. We captured about 312k IOPS (237k Reads/s and 75k Writes/s) with the 24k TPS (1,440,960 TPM) while running this workload test on two OLTP databases at the same time during this entire 24 hours sustained test.

Syster	n Statistics - Per	Second	DB/Inst:	SOECDB/soecdb	o1 Snaps: 566	6-590				
I#	Logical Reads/s	Physical Reads/s	Physical Writes/s	Redo Size (k)/s	Block Changes/s	User Calls/s	Execs/s	Parses/s	Logons/s	Txns/s
1 2 3 4 5 6 7 8	725,743.05 810,068.86 879,336.88 818,098.58 885,919.32 783,996.17 810,401.99 849,192.66	28,160.3 30,255.9 29,421.5 29,483.3 31,850.4 28,518.2 30,430.0 29,637.1	8,678.3 9,420.8 9,526.5 9,573.8 9,392.6 9,518.9 9,780.7 9,351.4	8,715.8 9,341.8 9,312.1 9,528.9 9,401.6 9,534.1 9,623.3 9,382.3	54,162.2 58,130.4 57,968.5 59,316.8 58,513.5 59,359.5 59,359.5 59,923.7 58,361.3	14,580.9 15,656.6 15,609.0 15,976.1 15,759.6 15,987.4 16,139.4 15,720.3	55,441.8 59,529.3 59,358.9 60,753.5 59,926.6 60,784.6 61,368.8 59,770.5	5,294.5 5,684.1 5,668.9 5,773.7 5,722.8 5,804.4 5,860.2 5,707.4	0.70 0.69 0.69 0.69 0.70 0.69 0.69 0.69 0.70	2,791.7 2,998.0 2,988.3 3,058.9 3,017.9 3,061.4 3,090.2 3,009.9
Sum Avg Std	6,562,757.51 820,344.69 52,225.47	237,756.7 29,719.6 1,156.3	75,243.0 9,405.4 322.7	74,840.0 9,355.0 279.8	465,735.9 58,217.0 1,774.7	125,429.3 15,678.7 480.3	476,933.9 59,616.7 1,826.4	45,516.0 5,689.5 172.1	5.54 0.69 0.00	24,016.3 3,002.0 92.0

The following screenshot was captured from the second Container Database ENGCDB while running another 500 users on this second OLTP databases at the same time for sustained 24-hour test. We captured about 294k IOPS (225k Reads/s and 70k Writes/s) with the 21k TPS (1,307,700 TPM) while running the workload test on two databases at the same time during this 24 hour sustained test.

System	n Statistics - Per	Second	DB/Inst:	ENGCDB/engcdb	1 Snaps: 361	Snaps: 361-385				
I#	Logical Reads/s	Physical Reads/s	Physical Writes/s	Redo Size (k)/s	Block Changes/s	User Calls/s	Execs/s	Parses/s	Logons/s	Txns/s
1 2 3 4 5 6 7 8	610,682.67 664,987.66 682,988.57 688,307.23 735,730.8 857,941.22 680,314.49 663,155.39	28,061.2 27,647.4 28,874.0 27,770.4 27,406.6 27,181.8 29,734.6 28,476.3	8,272.3 8,765.9 8,480.7 8,513.2 8,809.5 8,611.7 8,789.2 9,018.0	8,226.0 8,709.4 8,423.8 8,449.6 8,588.7 8,568.6 8,742.5 8,967.5	49,925.2 52,893.9 51,082.6 51,236.7 52,174.2 51,953.9 53,028.5 54,435.0	12,454.4 13,196.2 12,750.0 12,785.2 13,021.3 12,964.0 13,239.0 13,590.8	49,571.1 52,515.6 50,739.5 50,889.7 51,818.1 51,589.9 52,684.0 54,083.6	4,526.3 4,791.9 4,629.7 4,644.1 4,728.5 4,707.5 4,807.2 4,935.4	0.85 0.85 0.84 0.84 0.85 0.85 0.85 0.85 0.84 0.84	2,610.0 2,765.7 2,672.1 2,679.3 2,728.6 2,717.3 2,774.5 2,848.3
Sum Avg Std	5,584,107.84 698,013.48 73,256.05	225,152.3 28,144.0 848.2	69,260.6 8,657.6 234.4	68,676.3 8,584.5 226.8	416,730.0 52,091.3 1,387.8	104,001.0 13,000.1 349.0	413,891.5 51,736.4 1,385.7	37,770.6 4,721.3 125.8	6.77 0.85 0.00	21,795.8 2,724.5 73.2

The following screenshot shows the SOECDB database "IO Profile" for the "Reads/s" and "Writes/s" requests for this multiple OLTP test running workload together for sustained 24-hour test. The Total Requests (Read and Write Per Second) were around "318k" with Total (MB) "Read+Write" Per Second was around "2572" MB/s for the first SOECDB database during this 24-hour test.

IO Profile (Global)	DB/Inst:	SOECDB/soecdb1	Snaps: 566-590
Statistic	Read+Write/s	Reads/s	Writes/s
Total Requests	318,123.05	232,337.57	85,785.48
Database Requests	296,842.37	232,225.91	64,616.46
Optimized Requests	0.00	0.00	0.00
Redo Requests	11,251.69	N/A	11,251.69
Total (MB)	2,572.70	1,904.10	668.60
Database (MB)	2,445.29	1,857.46	587.83
Optimized Total (MB)	0.00	0.00	0.00
Redo (MB)	73.09	N/A	73.09
Database (blocks)	312,997.43	237,754.96	75,242.47
Via Buffer Cache (blocks)	307,446.54	232,216.86	75,229.68
Direct (blocks)	5,550.93	5,538.13	12.79

The following screenshot shows the ENGCDB database "IO Profile" for the "Reads/s" and "Writes/s" requests for this multiple OLTP test running workload together for sustained 24-hour test. The Total Requests (Read and Write Per Second) were around "300k" with Total (MB) "Read+Write" Per Second was around "2418" MB/s for the second ENGCDB database while running this workload for 24-hour.

IO Profile (Global)	DB/Inst:	ENGCDB/engcdb1	Snaps: 361-385
Statistic	Read+Write/s	Reads/s	Writes/s
Total Requests Database Requests	300,951.46 280,827.97	220,964.40 220,859.16	79,987.06 59,968.81
Optimized Requests Redo Requests	0.00 11.032.67	0.00 N/A	0.00 11.032.67
Total (MB)	2,418.02	1,802.67	615.36
Optimized Total (MB)	2,300.08	1,758.99 0.00	0.00
Redo (MB) Database (blocks)	67.07 294.410.62	N/A 225.150.60	67.07 69.260.02
Via Buffer Cache (blocks) Direct (blocks)	290,126.64 4,284.02	220,881.29 4,269.35	69,245.35 14.67

The following screenshot, "OS Statistics by Instance" while running the workload test for 24-hour on two OLTP databases at the same time. As shown below, the workload was equally spread across all the databases clusters while the average CPU utilization was around 35 % overall.

0S S -> L -> E	tatistic isted in nd value	s By In order s are d	stance of ins iplaye	tance num d only if	DB, ber, I# differe	/Inst: SC ent from	ECDB/so	ecdb1 alues	Snaps:	566-590					
		CPU		Lo	ad			% CPU				Time (s)		Memory	End Values
I#	#CPUs	#Core	#Sckt	Begin	End	% Busy	% Usr	% Sys	% WIO	% Idl	Busy	Idle	Total	MB	#CPU #Cor #Sck Memory (M)
1 2 3	128 128 128	64 64 64	2 2 2	101.2 86.5 87.9	91.8 85.4 81.6	36.4 28.3 27.5	25.1 20.1 19.4	7.4 5.3 5.2	21.4 25.5 25.7	63.6 71.7 72.5	3,961,137.1 3,082,962.5 2,997,067.1	6,932,947.9 7,829,047.9 7,917,152.6	10,894,085.0 10,912,010.4 10,914,219.7	515,140.6 515,140.6 515,139.3	
4 5 6 7	128 128 128	64 64 64	2 2 2	87.3 87.1 82.5	85.4 82.3 80.7	30.3 30.5 28.0	21.6 21.8 20.0	5.6 5.6 5.1	24.8 24.6 24.9	69.7 69.5 72.0	3,306,828.4 3,333,392.4 3,055,782.8	7,604,960.6 7,581,843.7 7,864,220.9	10,911,789.0 10,915,236.0 10,920,003.7	515,140.6 515,140.6 450,628.7	
8	128	64 64	2	84.4	84.0	29.5	19.3	5.1	25.6	72.8	2,969,284.9	7,944,814.2	10,914,099.1	515,140.0	
Sum											25,929,203.1	61,365,903.8	87,295,106.9		

The following screenshot captured from the Oracle AWR report shows the "Top Timed Events" and average wait time for the first SOECDB database for the entire duration of the 24-hour workload test.

												_
Top 1	imed Events	DB/Inst: SOECDB	/soecdbl Snaps: 566-5	90								
-> Ir	stance '*'	 cluster wide summary 										
->		Waits, %Timeouts, Wait Time Total(s)	: Cluster-wide to	tal for t	he wait event							
- 5	1.8.1	'Wait Time Avg'	· Cluster-wide average	computer	as (Wait Time	Total / E	vent Waits	3				
-	1 * 1	Summary Ava Wait Time !	· Par-instance Wait	Time Ave	used to compu	to the fe	llowing st	atistics				
	1.81	Summary Avg walt Time	. rei-instance wait	/maniference	useu to compu	te the To	ctowing st	allotto	lum l			
->	1.4.1	[Avg/min/max/std Dev]	: average/minimum	/maximum/	standard deviat	ion or pe	r-instance	wait lime /	avg.			
->	141	Cnt	: count of instan	ces with	wait times for	the event						
		Wait	Event		Wai	t Time			Summary /	Avg Wait Tim	ne	
I#	Class	Event	Waits %T	imeouts	Total(s)	Avg Wait S	‱DB time	Avg	Min	Max	Std Dev	Cnt
*	User I/O	db file sequential read	1.741295E+10	0.0	1.5901031E+07	913.17us	42.63	913.42us	900.39us	.96ms	18.90us	8
		DB CPU	N/A	N/A	7,134,351,92		19.13					8
	Commit	log file sync	2.061055E+09	0.0	6,088,932,57	2.95ms	16.32	2.95ms	2.69ms	3.19ms	187,94us	8
	System T/(dh file parallel write	1 751028E+09	0.0	1 976 969 23	1 13ms	5 30	1 13ms	1 07ms	1 17ms	42 7905	8
	Cluster	as or arant 2-way	7 996211E+00	0 0	1 450 757 54	192 06116	2 90	194 21.05	172 76115	105 000	9 41.05	0
	Cluster	ge er grant black 2 unu	5 1042705+00	0.0	1,400,707.04	103.90us	3.05	227 12	220 62.	242.04	4.05	0
	Cluster	gc current block 3-way	5.1942/92+09	0.0	1,230,901.03	230.96us	3.30	237.12us	230.0305	243.0405	4.9505	0
	Cluster	gc current grant 2-way	6.040165E+09	0.0	1,115,555.59	184.69us	2.99	184.90us	178.58us	199.67us	6.93us	8
	Cluster	gc cr block busy	108,875,532	0.0	892,799.75	8.20ms	2.39	8.19ms	7.08ms	9.76ms	1.07ms	8
	Cluster	gc cr block 3-way	3.233596E+09	0.0	777,899.34	240.57us	2.09	240.36us	235.35us	245.00us	4.15us	8
	System I/0) log file parallel write	1.946172E+09	Θ.Θ	749.207.38	384.96us	2.01	385.13us	370.71us	398.03us	10.24us	8

The following screenshot captured from the Oracle AWR report shows the "Top Timed Events" and average wait time for the second ENGCDB database for the entire duration of the 24-hour sustained workload test.

Тор	Timed Events	DB/Inst: ENGCDB/e	engcdbl Snaps: 361	-385								
-> I	nstance '*'	 cluster wide summary 										
->	1*1	Waits, %Timeouts, Wait Time Total(s)	: Cluster-wide	total for :	the wait event							
->	1*1	'Wait Time Avg' :	Cluster-wide avera	ige compute	d <mark>as</mark> (Wait Time	Total /	Event Wait	5)				
->		Summary 'Avg Wait Time ' :	Per-instance 'Wai	t Time Avg	' used to comp	ute the f	ollowing s	tatistics				
->		[Avg/Min/Max/Std Dev]	: average/minim	um/maximum,	standard devia	tion of p	er-instanc	e 'Wait Time	Ava'			
->		Cnt	: count of inst	ances with	wait times for	the even	t		2			
		Wait	Even	t	Wa	it Time			Summary	Avg Wait Ti	me	
I#	Class	Event	Waits	%Timeouts	Total(s)	Avg Wait	%DB time	Avg	Min	Max	Std Dev	Cnt
*	User I/O	db file sequential read	1.676326E+10	0.0	1.5065772E+07	898.74us	44.26	899.16us	885.62us	947.36us	20.26us	8
		DB CPU	N/A	N/A	6,392,254.62		18.78					8
	Commit	log file sync	1.871619E+09	0.0	5,365,067.43	2.87ms	15.76	2.87ms	2.64ms	3.13ms	185.44us	8
	System I/C) db file parallel write	1.643327E+09	0.0	1,900,735.66	1.16ms	5.58	1.16ms	1.10ms	1.22ms	45.47us	8
	Cluster	gc cr grant 2-way	7.945959E+09	0.0	1,366,480.27	171.97us	4.01	172.15us	160.86us	176.81us	4.74us	8
	Cluster	gc current block 3-way	5.078796E+09	Θ.Θ	1,246,443.05	245.42us	3.66	245.47us	238.90us	254.45us	4.94us	8
	Cluster	gc current grant 2-way	5.514754E+09	0.0	907.432.76	164.55us	2.67	164.59us	160.55us	180.66us	6.73us	8
	Cluster	gc cr block busy	78,084,021	Θ.Θ	785,625,38	10.06ms	2.31	10.05ms	7.95ms	12.60ms	1.73ms	8
	User I/O	db file parallel read	1.378192E+09	0.0	735.332.68	533.55us	2.16	533.80us	526.83us	565.43us	12.91us	8
	Cluster	gc cr block 3-way	2.902745E+09	Θ.Θ	732,464.97	252.34us	2.15	252.11us	245.85us	256.96us	3.98us	8

The following screenshot shows the Pure Storage FlashArray dashboard when multiple OLTP database was running the workload at the same time. The screenshot shows the average IOPS "680k" with the average throughput of "5300 MB/s" with the average latency around "3 millisecond".



For the entire duration of the 24-hour test, we observed the system performance (IOPS, Latency and Throughput) was consistent throughout and we did not observe any dips in performance while running multiple OLTP database stress test.

One DSS Database Performance

DSS database workloads are generally sequential in nature, read intensive and exercise large IO size. DSS database workload runs a small number of users that typically exercise extremely complex queries that run for hours. For running oracle database multitenancy architecture, we configured one container database as SHCDB and into that container, we created one pluggable database as SHPDB as explained earlier.

Note: We configured 4 TB of SHPDB pluggable database by loading Swingbench "SH" schema into Datafile Tablespace.

The following screenshot shows the database summary for the "SHCDB" database running for 24-hour duration. The container database "SHCDB" was also running with one pluggable databases "SHPDB" and the pluggable database was running the Swingbench SH workload for the entire 24-hour duration of the test across all eight RAC nodes.

WORKLOAD REPOS	ITORY REPOR	T (RAC)													
Database Summa	iry														
		Databa	se					Snapsh	ot Ids	Number of	Instances	Number of	Hosts	Report To	otal (minute
Id Na	me Uni	que Name Role	Edi	ition	RAC CD	3 Block	Size	Begin	End	In Report	Total	In Report	Total	DB time	e Elapsed t:
3241305692 SH Database Insta -> Listed in o	ICDB show Inces Include Inder of ins	db PRIMARY ed In Report tance number, I#	EE		YES YE	5	8192	27	63	8	8	8	8	23,861.44	1,444
I# Instance	Host	Startup	Begin Snap 1	Time E	nd Sna	o Time	Release		Elapsed	Time(min) D	B time(min)	Up Time(hrs)	Avg Activ Session	ve is Platfori	n
<pre>1 shcdb1 2 shcdb2 3 shcdb3 4 shcdb4 5 shcdb5 6 shcdb5 7 shcdb7 8 shcdb8 Open Pluggable</pre>	orarac1 orarac2 orarac3 orarac4 orarac5 orarac6 orarac7 orarac8 Databases	23-Apr-24 15:09 23-Apr-24 15:09 23-Apr-24 15:09 23-Apr-24 15:09 23-Apr-24 15:09 23-Apr-24 15:09 23-Apr-24 15:09 23-Apr-24 15:09 at Begin Snap: 3	23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18 23-Apr-24 18	B:11 2 B:11 2 B:11 2 B:11 2 B:11 2 B:11 2 B:11 2 B:11 2 B:11 2 B:11 2	24-Apr- 24-Apr- 24-Apr- 24-Apr- 24-Apr- 24-Apr- 24-Apr-	24 18:1 24 18:1 24 18:1 24 18:1 24 18:1 24 18:1 24 18:1 24 18:1 24 18:1	5 21.0.0.0 5 21.0.0.0 5 21.0.0.0 5 21.0.0.0 5 21.0.0.0 5 21.0.0.0 5 21.0.0.0 5 21.0.0.0 5 21.0.0.0	.0 .0 .0 .0 .0 .0		1,444.70 1,444.68 1,444.68 1,444.68 1,444.68 1,444.68 1,444.68 1,444.68 1,444.70	3,506.57 2,899.84 2,959.72 2,898.62 2,898.81 2,899.05 2,899.93 2,898.90	27.11 27.11 27.11 27.11 27.11 27.11 27.11 27.11 27.11	2.4 2.0 2.0 2.0 2.0 2.0 2.0 2.0	3 Linux x8 11 Linux x8 15 Linux x8 11 Linux x8 11 Linux x8 11 Linux x8 11 Linux x8 11 Linux x8	86 64-bi 86 64-bi 86 64-bi 86 64-bi 86 64-bi 86 64-bi 86 64-bi 86 64-bi

The following screenshot captured from Oracle AWR report shows the SHCDB database "IO Profile" for the "Reads/s" and "Writes/s" requests for the entire duration of the test. As the screenshots shows, the Total MB (Read and Write Per Second) were around "21,238 MB/s" (20,673 MB/s Reads/s & 565 MB/s Writes/s) for the SHPDB database while running this workload.

IO Profile (Global)	DB/I	nst: SHCDB/shcdb1	Snaps: 27-63
Statistic	Read+Write/s	Reads/s	Writes/s
Total Requests Database Requests	25,364.16 25,279.51	22,666.61 22,595.29	2,697.55 2,684.21
Optimized Requests Redo Requests	0.00 4.68	0.00 N/A	0.00 4.68
Total (MB) Database (MB)	21,238.89 21,237.62	20,673.87 20,672.76	565.02 564.86
Optimized Total (MB) Bedo (MB)	0.00	0.00 N/A	0.00
Database (blocks) Via Buffer Cache (blocks)	2,718,415.41	2,646,113.61 13,858,19	72,301.80
Direct (blocks)	2,704,319.04	2,632,255.42	72,063.62

The following screenshot shows "Top Timed Events" for this container database SHCDB for the entire duration of the test while running SwingBench SH workload for 24-hours.

Top Ti	imed Events		DB/Inst: SHCDB/shcdb	51 Snaps:	27-63								
-> Ins	stance '*'	- cluster wide summary											
->		Waits, %Timeouts, Wait Ti	ime Total(s) : Cl	luster-wide	total for t	he wait event							
->		'Wait Time Avg'	: Cluster	r-wide aver	age computed	as (Wait Time To	tal / Eve	ent Waits)					
->		Summary 'Avg Wait Time '	: Per-in	nstance 'Wa	it Time Avq	' used to compute	the fol	lowing sta	tistics				
->		[Avg/Min/Max/Std Dev]	: a	verage/mini	mum/maximum/	standard deviatio	n of per-	instance	'Wait Time	Ava'			
->		Cnt	: 00	ount of ins	tances with	wait times for th	e event						
		Wait		Eve	nt	Wait	Time			Summary A	lvg Wait Ti	me	
Τ#	Class	Event		Waite	%Timeouts	Total(s) Av	n Wait %)R time	Ava	Min	May	Std Dev	Cnt
10	6 (433	Lvent		Walts	of Line ou co		g marc of	VD CIIIIC			FIGA	500 000	enc
*		DB CPU		N/A	N/A	1,019,924.27		71.24					8
	User I/O	direct path read temp	4	16,523,433	0.0	232,773.86 55	8.85us	16.26	559.00us	540.18us	600.50us	21.07us	8
	User I/O	direct path read	1.	786443E+09	0.0	106,581.36 5	9.66us	7.44	59.66us	54.29us	82.57us	9.48us	8
	User I/O	direct path write temp	2	238,377,952	0.0	22,736.88 9	5.38us	1.59	95.35us	82.80us	102.12us	6.43us	8
	User I/O	db file scattered read		9,513,923	0.0	22,661.36	2.38ms	1.58	2.37ms	2.15ms	2.51ms	114.31us	8
	Cluster	ac cr multi block arant		13.797.381	0.0	9,796,23 71	0.01us	0.68	711.47us	658.82us	827.51us	55.58us	8
	User I/O	local write wait		20.061.116	0.0	7,409,34 36	9.34us	0.52	369.28us	363.99us	374.29us	3.71us	8
	System I/) db file parallel write		20,379,060	0.0	6,330,64 31	0.64us	0.44	310.60us	306.81us	316.02us	3.88us	8
	Other	gcs enter server mode		276	0.0	3,972,45 1	4.39 s	0.28	15.38 s	9069.19ms	28.04 s	5693.22ms	8
	System I/) control file sequential	read	6,098,213	0.0	3,916.31 64	2.21us	0.27	643.17us	608.71us	744.32us	43.51us	8

The following screenshot captured through Pure Storage FlashArray dashboard shows the performance of the storage system while running Swingbench SH workload on single DSS database. The screenshot shows the average throughput of "20,800 MB/s (20.8 GB/s)" while running the SwingBench SH workload on one DSS database.



In this one DSS database use-case, we observed the DSS database performance was consistent throughout the test, and we did not observe any dips in performance for entire period of 24-hour test.

Resiliency and Failure Tests

This chapter contains the following:

- Test 1 Cisco UCS-X Chassis IFM Links Failure
- Test 2 FI Failure
- Test 3 Cisco Nexus Switch Failure
- Test 4 Cisco MDS Switch Failure
- Test 5 Storage Controller Links Failure
- <u>Test 6 Oracle RAC Server Node Failure</u>

The goal of these tests was to ensure that the reference architecture withstands commonly occurring failures due to either unexpected crashes, hardware failures or human errors. We conducted many hardware (disconnect power), software (process kills) and OS specific failures that simulate the real world scenarios under stress conditions. In the destructive testing, we will also demonstrate the unique failover capabilities of Cisco UCS components used in this solution. Table 18 lists the test cases.

Test Scenario	Tests Performed
Test 1: UCS-X Chassis IFM Link/Links Failure	Run the system on full Database workload. Disconnect one or two links from any of the Chassis 1 IFM or Chassis 2 IFM by pulling it out and reconnect it after 10-15 minutes. Capture the impact on overall database performance.
Test 2: One of the FI Failure	Run the system on full Database workload. Power Off one of the Fabric Interconnects and check the network traffic on the other Fabric Interconnect and capture the impact on overall database performance.
Test 3: One of the Nexus Switch Failure	Run the system on full Database workload. Power Off one of the Cisco Nexus switches and check the network and storage traffic on the other Nexus switch. Capture the impact on overall database performance.
Test 4: One of the MDS Switch Failure	Run the system on full Database workload. Power Off one of the Cisco MDS switches and check the network and storage traffic on the other MDS switch. Capture the impact on overall database performance.
Test 5: Storage Controller Links Failure	Run the system on full Database workload. Disconnect one link from each of the Pure Storage Controllers by pulling it out and reconnect it after 10-15 minutes. Capture the impact on overall database

Table 18. Hardware Failover Tests

Test Scenario	Tests Performed
	performance.
Test 6: RAC Server Node Failure	Run the system on full Database workload. Power Off one of the Linux Hosts and check the impact on database performance.

The architecture below illustrates various failure scenario which can be occurred due to either unexpected crashes or hardware failures. The failure scenario 1 represents the Chassis IFM links failures while the scenario 2 represents the entire IFM module failure. Scenario 3 represents one of the Cisco UCS FI failures and similarly, scenario 4 and 5 represents one of the Cisco Nexus and MDS Switch failures. Scenario 6 represents the Pure Storage Controllers link failures and Scenario 7 represents one of the Server Node Failures.





As previously explained, we configured to carry Oracle Public Network traffic on "VLAN 135" through FI – A and Oracle Private Interconnect Network traffic on "VLAN 10" through FI – B under normal operating conditions before the failover tests. We configured FC & NVMe/FC Storage Network Traffic access from both the Fabric Interconnects to MDS Switches on VSAN 151 and VSAN 152.

The screenshots below show a complete infrastructure details of MAC address and VLAN information for Cisco UCS FI – A and FI – B Switches before failover test. Log into FI – A and type "connect nxos" then type "show mac address-table" to see all the VLAN connection on the switch:

FS	-ORA-FI-	A(nx-os)# show ma	c address	-table	grep 135		
*	135	242a.04b0.9e29	dynamic	0	F	F	Eth2/1/33
*	135	242a.04b0.9e59	dynamic	0	F	F	Eth1/1/33
*	135	242a.04b0.9eb9	dynamic	0	F	F	Eth1/1/33
*	135	5451.ded5.81e1	dynamic	0	F	F	Eth1/1/33
*	135	5451.ded5.83f1	dynamic	0	F	F	Eth2/1/33
*	135	5451.ded5.87c1	dynamic	0	F	F	Eth1/1/33
*	135	5cb1.2e4a.8289	dynamic	0	F	F	Eth2/1/33
*	135	806a.00fa.1401	dynamic	0	F	F	Eth1/1/33
*	135	90eb.50cc.4581	dynamic	0	F	F	Eth2/1/33
*	135	d0dc.2c5f.9d99	dynamic	0	F	F	Eth2/1/33
*	135	0025.b5a3.5000	static		F	F	Veth800
*	135	0025.b5a3.5001	static	()	F	F	Veth814
*	135	0025.b5a3.5002	static	()	F	F	Veth828
*	135	0025.b5a3.5003	static	-	F	F	Veth842
*	135	0025.b5a3.5004	static		F	F	Veth856
*	135	0025.b5a3.5005	static	2—2	F	F	Veth870
*	135	0025.b5a3.5006	static		F	F	Veth884
*	135	0025.b5a3.5007	static	-	F	F	Veth898

Similarly, log into FI – B and type "connect nxos" then type "show mac address-table" to see all the VLAN connection on the switch as follows:

FS-	-ORA-	FI-B(nx-os)# show ma	c addres	s-table	grep 10		
*	10	0025.b5b3.5000	static		F	F	Veth802
*	10	0025.b5b3.5001	static	—	F	F	Veth816
*	10	0025.b5b3.5002	static	-	F	F	Veth830
*	10	0025.b5b3.5003	static	0. 1:	F	F	Veth844
*	10	0025.b5b3.5004	static		F	F	Veth858
*	10	0025.b5b3.5005	static	-	F	F	Veth872
*	10	0025.b5b3.5006	static		F	F	Veth886
*	10	0025.b5b3.5007	static	-	F	F	Veth900

Test 1 - Cisco UCS-X Chassis IFM Links Failure

We conducted the chassis IFM Links failure test on Cisco UCS Chassis 1 by disconnecting one of the server port link cables from the bottom chassis 1 as shown below:



Unplug two server port cables from Chassis 1 and check all the VLAN and Storage traffic information on both Cisco UCS FIs, Database and Pure Storage. We noticed no disruption in any of the network and storage traffic and the database kept running under normal working conditions even after multiple IFM links failed from Chassis because of the Cisco UCS Port-Channel Feature.

We also conducted the IFM module test and removed the entire IFM module from one of the chassis as shown below:



The screenshot below shows the database workload performance from the storage array when the chassis IFM module links failed:



We noticed that IFM failure caused a momentary impact on the overall performance on OLTP as well as throughput of the DSS database for a few seconds but noticed that we did not see any interruption in any Private Server to Server Oracle RAC Interconnect Network, Management Public Network and Storage network traffic on IO Service Requests to the storage. We observed the database workload kept running under normal conditions throughout duration of IFM failure.

Test 2 - One FI Failure

We conducted a hardware failure test on FI-A by disconnecting the power cable to the fabric interconnect switch.

The figure below illustrates how during FI-A switch failure, the respective nodes (orarac1 to orarac4) on chassis 1 and nodes (orarac5 to orarac8) on chassis 2 will re-route the VLAN (135 - Management Network) traffic through the healthy Fabric Interconnect Switch FI-B. However, storage traffic VSANs from FI - A switch were not able to failover to FI - B because of those storage interfaces traffic is not capable of failing over to another switch.



Log into FI – B and type "connect nxos" then type "show mac address-table" to see all VLAN connection on FI – B. In the screenshot below, we noticed when the FI-A failed, all the MAC addresses of the redundant vNICs kept their VLANs network traffic going through FI-B. We observed that MAC addresses of public network vNICs (each server having 1 vNIC for VLAN 135) were failed over to other FI and database network traffic kept running under normal conditions even after failure of one of the FI.

FS-ORA-FI-B(nx-os)# show mac address-table													
Legend:													
* – primary entry, G – Gateway MAC, (R) – Routed MAC, O – Overlay MAC													
age – seconds since last seen,+ – primary entry using vPC Peer-Link,													
	(T) – True, (F) – False, C – ControlPlane MAC, ~ – vsan												
	VLAN	MAC Address	Туре	age	Secure	NTFY	/ Ports						
	·····	-+	+	+	+	+	+						
*	10	0025.b5b3.5000	static	(1 	F	F	Veth802						
*	10	0025.b5b3.5001	static	17 <u>-</u>	F	F	Veth816						
*	10	0025.b5b3.5002	static	-	F	F	Veth830						
*	10	0025.b5b3.5003	static	-	F	F	Veth844						
*	10	0025.b5b3.5004	static	-	F	F	Veth858						
*	10	0025.b5b3.5005	static			F	Veth872						
*	10	0025.b5b3.5006	static	-	F	F	Veth886						
*	10	0025.b5b3.5007	static	3 .	F	F	Veth900						
*	135	04bd.97f1.da01	dynamic	0	F	F	Eth1/1/33						
*	135	242a.04b0.9e59	dynamic	0	F	F	Eth1/1/33						
*	135	246c.8419.9cc1	dynamic	0	F	F	Eth2/1/33						
*	135	0025.b5a3.5000	static	-	F	F	Veth801						
*	135	0025.b5a3.5001	static	-	F	F	Veth815						
*	135	0025.b5a3.5002	static	—	F	F	Veth829						
*	135	0025.b5a3.5003	static	_	,	F	Veth843						
*	135	0025.b5a3.5004	static	s — :	Ē	F	Veth857						
*	135	0025.b5a3.5005	static		P	F	Veth871						
*	135	0025.b5a3.5006	static		F	F	Veth885						
*	135	0025.b5a3.5007	static	3 — 3		F	Veth899						

However, Storage Network Traffic for VSAN 151 were not able to fail-over to another FI Switch and thus we lost half of the storage traffic connectivity from the Oracle RAC Databases to Storage Array. The screenshot below shows the Pure Storage FlashArray performance of the mixed workloads on all the databases while one of the FI failed.



We also monitored and captured databases and its performance during this FI failure test through database alert log files and AWR reports. When we disconnected the power from FI – A, it caused a momentary impact on performance on the overall total IOPS, latency on OLTP as well as throughput on the DSS database for a few seconds but noticed that we did not see any interruption in any Private Server to Server Oracle RAC Interconnect Network, Management Public Network and Storage network traffic on IO Service Requests to the storage. We observed the database workload kept running under normal conditions throughout duration of FI failure.

We noticed this behavior because each server node can failover vNICs from one fabric interconnect switch to another fabric interconnect switch but there is no vHBA storage traffic failover from one fabric interconnect switch to another fabric interconnect switch. Therefore, in case of any one fabric interconnect failure, we would lose half of the number of vHBAs or storage paths and consequently we observe momentary databases performance impact for few seconds on the overall system as shown in the graph (above).

After plugging back power cable to FI-A Switch, the respective nodes (orarac1 to orarac4) on chassis 1 and nodes (orarac5 to orarac8) on chassis 2 will route back the MAC addresses and its VLAN public network and storage network traffic to FI-A. After FI – A arrives in normal operating state, all the nodes to storage connectivity, the operating system level multipath configuration will bring back all the path back to active and database performance will resume to peak performance.

Test 3 - Cisco Nexus Switch Failure

We conducted a hardware failure test on Cisco Nexus Switch-A by disconnecting the power cable to the Cisco Nexus Switch and checking the public, private and storage network traffic on Cisco Nexus Switch-B and the overall system as shown below:



The screenshot below shows the vpc summary on Cisco Nexus Switch B while Cisco Nexus A was down.

ICC ODA NOV D# show was brief											
Legond:											
(*) = local vPC is down forwarding via vPC poor-link											
		i, iorwaruriig via	vrc p	eer-ttiik							
vPC domain id	: 1										
Peer status	: pee	er link is down									
vPC keep-alive status	: Sus	uspended (Destination IP not reachable)									
Configuration consistency status	: su	cess									
Per-vlan consistency status : success											
Type-2 consistency status	: suc	: success									
vPC role	: pr	: primary									
Number of vPCs configured	: 2	2									
Peer Gateway	abled										
Dual-active excluded VLANs : -											
Graceful Consistency Check	: Ena	abled									
Auto-recovery status	: Ena	abled, timer is of	f.(ti	meout = 240s)							
Delay-restore status	: Tir	ner is off.(timeou	t = 3	0s)							
Delay-restore SVI status	: Tir	ner is off.(timeou	t = 1	0s)							
Operational Layer3 Peer-router	: Dis	sabled									
Virtual-peerlink mode	: Dis	sabled									
vPC Peer-link status											
· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·									
id Port Status Active vlans	Active vlans										
 1 Po1 down -		he balada hake alaka kaka kaka ka									
vPC status											
Id Port Status Consis	stency	Reason 		Active vlans 							
51 Po51 up succes	ss	Type checks were bypassed for the vPC Type checks were bypassed for the vPC		1,10,135							
52 Po52 up succes	ŝS			1,10,135							
Please check "show vpc consistency-parameters vpc <vpc-num>" for the consistency reason of down vpc and for type-2 consistency reasons for any vpc.</vpc-num>											

When we disconnected the power from Cisco Nexus-A Switch, it caused no impact on database performance of the overall total IOPS, latency on OLTP as well as throughput of the DSS database and noticed no interruption in the overall Private Server to Server Oracle RAC Interconnect Network, Management Public Network, and storage network traffic on I/O Service Requests to the storage.

Such as FI failure tests, we observed no impact overall on all three databases performance and all the VLAN network traffic were going through other active Cisco Nexus switch B and databases workload kept running under normal conditions throughout the duration of Nexus failure. After plugging back the power cable back into Cisco Nexus-A Switch, Nexus Switch returns to normal operating state and database performance continue peak performance.

Test 4 - Cisco MDS Switch Failure

We conducted a hardware failure test on Cisco MDS Switch-A by disconnecting the power cable to the MDS Switch and checking the public, private and storage network traffic on Cisco MDS Switch-B and the overall system as shown below:


Like FI failure tests, we observed some impact on all three databases performance as we lost half of the VSAN (VSAN-A 151) traffic. While VSAN-A (151) stays locally into the switch and only carry storage traffic through the MDS switch A, VSAN-A doesn't failover to MDS Switch B therefore we reduced server to storage connectivity into half during MDS Switch A failure. However, failure in MDS Switch did not cause any disruption to Private and Public Network Traffic.

We also recorded performance of the databases from the storage dashboard where we observed momentary impact on performance on overall IOPS, latency on OLTP as well as throughput on DSS database for few seconds.

After plugging back power cable to MDS Switch A, the operating system level multipath configuration will bring back all the path back to active and database performance will resume to peak performance.

Test 5 - Storage Controller Links Failure

We performed storage controller link failure test by disconnecting two of the FC 32G links from the Pure Storage FlashArray from one of the storage controllers as shown below:



Like FI and MDS failure tests, storage link failure did not cause any disruption to Private, Public and Storage Network Traffic. After plugging back FC links to storage controller, MDS Switch and Storage array links comes back online, and the operating system level multipath configuration will bring back all the path back to active and database performance will resume to peak performance.

Test 6 - Oracle RAC Server Node Failure

In this test, we started the SwingBench workload test run on all eight RAC nodes, and then during run, we powered down one node from the RAC cluster to check the overall system performance. We didn't observe any performance impact on overall database IOPS, latency and throughput after losing one node from the system.



We completed an additional failure scenario and validated that there is no single point of failure in this reference design.

Summary

FlashStack is a converged infrastructure solution jointly developed by Cisco and Pure Storage. It combines computing, networking, and storage components into a pre-validated, integrated architecture designed to simplify data center operations and improve efficiency.

Key features of FlashStack include:

- All-flash storage: FlashStack utilizes Pure Storage's all-flash arrays, providing high performance with consistent sub-millisecond latency.
- Al-based management: FlashStack uses artificial intelligence for infrastructure management, improving business outcomes and simplifying operations.
- Flexible consumption models: It offers as-a-service consumption options, allowing organizations to align costs with usage.
- Validated designs: FlashStack provides pre-validated designs for popular workloads, reducing deployment risks and simplifying implementation.
- Cloud integration: The solution supports hybrid cloud environments, offering cloud-like agility and pay-as-you-use pricing.

FlashStack is an ideal platform for the architecture of mission critical database workloads such as Oracle RAC. The combination of Cisco UCS, Pure Storage and Oracle Real Application Cluster Database architecture can accelerate your IT transformation by enabling faster deployments, greater flexibility of choice, efficiency, high availability, and lower risk. The FlashStack Datacenter solution is a validated approach for deploying Cisco and Pure Storage System technologies and products to build shared private and public cloud infrastructure.

If you're interested in understanding the FlashStack design and deployment details, including the configuration of various elements of design and associated best practices, refer to Cisco Validated Designs for FlashStack, here:

https://www.cisco.com/c/en/us/solutions/design-zone/data-center-design-guides/data-center-design-guides/ -all.html#FlashStack

https://support.purestorage.com/bundle/m_flashstack_reference_architectures/page/FlashStack/FlashStack_Re_ference_Architectures/topics/concept/c_50th_celebration_of_flashstack_cisco_validated_designs.html

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Acknowledgements

For their support and contribution to the design, validation, and creation of this Cisco Validated Design, the authors would like to thank:

- Tushar Patel, Distinguished Technical Marketing Engineer, Cisco Systems, Inc.
- Vijay Kulari, Solution Architecture, Pure Storage Systems

Appendix

This appendix contains the following:

- <u>Compute</u>
- <u>Network</u>
- <u>Storage</u>
- Interoperability Matrix
- <u>Cisco MDS Switch Configuration</u>
- <u>Cisco Nexus Switch Configuration</u>
- Multipath Configuration "/etc/multipath.conf"
- <u>Configure "/etc/udev/rules.d/99-pure-storage.rules"</u>
- <u>Configure "/etc/udev/rules.d/99-oracleasm.rules"</u>
- Configure "sysctl.conf"
- <u>Configure "oracle-database-preinstall-21c.conf"</u>

Compute

Cisco Intersight: https://www.intersight.com

Cisco Intersight Managed Mode:

https://www.cisco.com/c/en/us/td/docs/unified_computing/Intersight/b_Intersight_Managed_Mode_Configurati on_Guide.html

Cisco Unified Computing System: http://www.cisco.com/en/US/products/ps10265/index.html

Cisco UCS 6536 Fabric Interconnects:

https://www.cisco.com/c/en/us/products/collateral/servers-unified-computing/ucs6536-fabric-interconnect-ds .html

Network

Cisco Nexus 9000 Series Switches: http://www.cisco.com/c/en/us/products/switches/nexus-9000-series-switches/index.html

Cisco MDS 9132T Switches: <u>https://www.cisco.com/c/en/us/products/collateral/storage-networking/mds-9100-series-multilayer-fabric-sw</u> <u>itches/datasheet-c78-739613.html</u>

Storage

Pure Storage: https://www.purestorage.com/products/unified-block-file-storage.html

Interoperability Matrix

Cisco UCS Hardware Compatibility Matrix: https://ucshcltool.cloudapps.cisco.com/public/_____

Cisco MDS Switch Configuration

FS-ORA-MDS-A# show running-config

!Command: show running-config !No configuration change since last restart !Time: Sat June 13 10:45:28 2024

version 9.3(2)

power redundancy-mode redundant

system default switchport trunk mode auto

system default switchport mode F

feature fport-channel-trunk

```
role name default-role
```

description This is a system defined role and applies to all users.

rule 5 permit show feature environment

rule 4 permit show feature hardware

rule 3 permit show feature module

rule 2 permit show feature snmp

rule 1 permit show feature system

```
ip domain-lookup
```

ntp server 72.163.32.44

vsan database

vsan 151 name "VSAN-FI-A"

no device-alias mode enhanced

device-alias database

device-alias name ORARAC-1-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:00

device-alias name ORARAC-2-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:0a device-alias name ORARAC-3-FC-HBA0 pwwn 20:00:25:b5:ab:30:14 device-alias name ORARAC-4-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:1e device-alias name ORARAC-5-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:28 device-alias name ORARAC-6-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:32 device-alias name ORARAC-7-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:3c device-alias name ORARAC-8-FC-HBA0 pwwn 20:00:00:25:b5:ab:30:46 device-alias name ORARAC1-NVMe-HBA2 pwwn 20:00:25:b5:ab:30:02 device-alias name ORARAC1-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:04 device-alias name ORARAC1-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:06 device-alias name ORARAC1-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:08 device-alias name ORARAC2-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:0c device-alias name ORARAC2-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:0e device-alias name ORARAC2-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:10 device-alias name ORARAC2-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:12 device-alias name ORARAC3-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:16 device-alias name ORARAC3-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:18 device-alias name ORARAC3-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:1a device-alias name ORARAC3-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:1c device-alias name ORARAC4-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:20 device-alias name ORARAC4-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:22 device-alias name ORARAC4-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:24 device-alias name ORARAC4-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:26 device-alias name ORARAC5-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:2a device-alias name ORARAC5-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:2c device-alias name ORARAC5-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:2e device-alias name ORARAC5-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:30 device-alias name ORARAC6-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:34 device-alias name ORARAC6-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:36

device-alias name ORARAC6-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:38 device-alias name ORARAC6-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:3a device-alias name ORARAC7-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:3e device-alias name ORARAC7-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:40 device-alias name ORARAC7-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:42 device-alias name ORARAC7-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:44 device-alias name ORARAC8-NVMe-HBA2 pwwn 20:00:00:25:b5:ab:30:48 device-alias name ORARAC8-NVMe-HBA4 pwwn 20:00:00:25:b5:ab:30:4a device-alias name ORARAC8-NVMe-HBA6 pwwn 20:00:00:25:b5:ab:30:4c device-alias name ORARAC8-NVMe-HBA8 pwwn 20:00:00:25:b5:ab:30:4e device-alias name PureFAXL170-ORA21c-CT0-FC04 pwwn 52:4a:93:7a:7e:04:85:04 device-alias name PureFAXL170-ORA21c-CT0-FC06 pwwn 52:4a:93:7a:7e:04:85:06 device-alias name PureFAXL170-ORA21c-CT0-FC32 pwwn 52:4a:93:7a:7e:04:85:80 device-alias name PureFAXL170-ORA21c-CT1-FC04 pwwn 52:4a:93:7a:7e:04:85:14 device-alias name PureFAXL170-ORA21c-CT1-FC06 pwwn 52:4a:93:7a:7e:04:85:16 device-alias name PureFAXL170-ORA21c-CT1-FC32 pwwn 52:4a:93:7a:7e:04:85:90

device-alias commit

system default zone distribute full zone smart-zoning enable vsan 151 zoneset distribute full vsan 151 !Active Zone Database Section for vsan 151

zone name ORARAC-1-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:00 init
! [ORARAC-1-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]

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```
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-2-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:0a init
! [ORARAC-2-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-3-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:14 init
! [ORARAC-3-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-4-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:1e init
! [ORARAC-4-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-5-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:28 init
```

! [ORARAC-5-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

zone name ORARAC-6-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:32 init
! [ORARAC-6-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

zone name ORARAC-7-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:3c init
! [ORARAC-7-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

```
zone name ORARAC-8-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:46 init
! [ORARAC-8-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-1-NVMe-A1 vsan 151
   member pwwn 20:00:00:25:b5:ab:30:02 init
   !
             [ORARAC1-NVMe-HBA2]
   member pwwn 20:00:00:25:b5:ab:30:04 init
             [ORARAC1-NVMe-HBA4]
   !
   member pwwn 20:00:00:25:b5:ab:30:06 init
             [ORARAC1-NVMe-HBA6]
   !
   member pwwn 20:00:00:25:b5:ab:30:08 init
   !
             [ORARAC1-NVMe-HBA8]
   member pwwn 52:4a:93:7a:7e:04:85:06 target
             [PureFAXL170-ORA21c-CT0-FC06]
   !
   member pwwn 52:4a:93:7a:7e:04:85:16 target
             [PureFAXL170-ORA21c-CT1-FC06]
   !
   member pwwn 52:4a:93:7a:7e:04:85:80 target
   ! [PureFAXL170-ORA21c-CT0-FC32]
   member pwwn 52:4a:93:7a:7e:04:85:90 target
   ! [PureFAXL170-ORA21c-CT1-FC32]
```

```
zone name ORARAC-2-NVMe-A1 vsan 151
member pwwn 20:00:00:25:b5:ab:30:0c init
! [ORARAC2-NVMe-HBA2]
member pwwn 20:00:00:25:b5:ab:30:0e init
! [ORARAC2-NVMe-HBA4]
member pwwn 20:00:00:25:b5:ab:30:10 init
! [ORARAC2-NVMe-HBA6]
member pwwn 20:00:00:25:b5:ab:30:12 init
! [ORARAC2-NVMe-HBA8]
member pwwn 52:4a:93:7a:7e:04:85:06 target
```

! [PureFAXL170-ORA21c-CT0-FC06] member pwwn 52:4a:93:7a:7e:04:85:16 target ! [PureFAXL170-ORA21c-CT1-FC06] member pwwn 52:4a:93:7a:7e:04:85:80 target ! [PureFAXL170-ORA21c-CT0-FC32] member pwwn 52:4a:93:7a:7e:04:85:90 target ! [PureFAXL170-ORA21c-CT1-FC32]

zone name ORARAC-3-NVMe-A1 vsan 151 member pwwn 20:00:00:25:b5:ab:30:16 init ! [ORARAC3-NVMe-HBA2] member pwwn 20:00:00:25:b5:ab:30:18 init ! [ORARAC3-NVMe-HBA4] member pwwn 20:00:00:25:b5:ab:30:1a init ! [ORARAC3-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:1c init ! [ORARAC3-NVMe-HBA8] member pwwn 52:4a:93:7a:7e:04:85:06 target ! [PureFAXL170-ORA21c-CT0-FC06] member pwwn 52:4a:93:7a:7e:04:85:16 target ! [PureFAXL170-ORA21c-CT1-FC06] member pwwn 52:4a:93:7a:7e:04:85:80 target 1 [PureFAXL170-ORA21c-CT0-FC32] member pwwn 52:4a:93:7a:7e:04:85:90 target ! [PureFAXL170-ORA21c-CT1-FC32]

zone name ORARAC-4-NVMe-A1 vsan 151
member pwwn 20:00:00:25:b5:ab:30:20 init
! [ORARAC4-NVMe-HBA2]

member pwwn 20:00:00:25:b5:ab:30:22 init ! [ORARAC4-NVMe-HBA4] member pwwn 20:00:00:25:b5:ab:30:24 init ! [ORARAC4-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:26 init ! [ORARAC4-NVMe-HBA8] member pwwn 52:4a:93:7a:7e:04:85:06 target ! [PureFAXL170-ORA21c-CT0-FC06] member pwwn 52:4a:93:7a:7e:04:85:16 target ! [PureFAXL170-ORA21c-CT1-FC06] member pwwn 52:4a:93:7a:7e:04:85:80 target [PureFAXL170-ORA21c-CT0-FC32] ! member pwwn 52:4a:93:7a:7e:04:85:90 target ! [PureFAXL170-ORA21c-CT1-FC32]

zone name ORARAC-5-NVMe-A1 vsan 151 member pwwn 20:00:00:25:b5:ab:30:2a init ! [ORARAC5-NVMe-HBA2] member pwwn 20:00:00:25:b5:ab:30:2c init ! [ORARAC5-NVMe-HBA4] member pwwn 20:00:00:25:b5:ab:30:2e init ! [ORARAC5-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:30 init [ORARAC5-NVMe-HBA8] 1 member pwwn 52:4a:93:7a:7e:04:85:06 target [PureFAXL170-ORA21c-CT0-FC06] 1 member pwwn 52:4a:93:7a:7e:04:85:16 target ! [PureFAXL170-ORA21c-CT1-FC06] member pwwn 52:4a:93:7a:7e:04:85:80 target

```
! [PureFAXL170-ORA21c-CT0-FC32]
member pwwn 52:4a:93:7a:7e:04:85:90 target
! [PureFAXL170-ORA21c-CT1-FC32]
```

```
zone name ORARAC-6-NVMe-A1 vsan 151
   member pwwn 20:00:00:25:b5:ab:30:34 init
   ! [ORARAC6-NVMe-HBA2]
   member pwwn 20:00:00:25:b5:ab:30:36 init
   ! [ORARAC6-NVMe-HBA4]
   member pwwn 20:00:00:25:b5:ab:30:38 init
   ! [ORARAC6-NVMe-HBA6]
   member pwwn 20:00:00:25:b5:ab:30:3a init
   !
             [ORARAC6-NVMe-HBA8]
   member pwwn 52:4a:93:7a:7e:04:85:06 target
   ! [PureFAXL170-ORA21c-CT0-FC06]
   member pwwn 52:4a:93:7a:7e:04:85:16 target
   ! [PureFAXL170-ORA21c-CT1-FC06]
   member pwwn 52:4a:93:7a:7e:04:85:80 target
   ! [PureFAXL170-ORA21c-CT0-FC32]
   member pwwn 52:4a:93:7a:7e:04:85:90 target
   ! [PureFAXL170-ORA21c-CT1-FC32]
```

```
zone name ORARAC-7-NVMe-A1 vsan 151
member pwwn 20:00:00:25:b5:ab:30:3e init
! [ORARAC7-NVMe-HBA2]
member pwwn 20:00:00:25:b5:ab:30:40 init
! [ORARAC7-NVMe-HBA4]
member pwwn 20:00:00:25:b5:ab:30:42 init
! [ORARAC7-NVMe-HBA6]
```

 member pwwn 20:00:25:b5:ab:30:44 init

 !
 [ORARAC7-NVMe-HBA8]

 member pwwn 52:4a:93:7a:7e:04:85:06 target

 !
 [PureFAXL170-ORA21c-CT0-FC06]

 member pwwn 52:4a:93:7a:7e:04:85:16 target

 !
 [PureFAXL170-ORA21c-CT1-FC06]

 member pwwn 52:4a:93:7a:7e:04:85:80 target

 !
 [PureFAXL170-ORA21c-CT1-FC06]

 member pwwn 52:4a:93:7a:7e:04:85:80 target

 !
 [PureFAXL170-ORA21c-CT0-FC32]

 member pwwn 52:4a:93:7a:7e:04:85:90 target

 !
 [PureFAXL170-ORA21c-CT1-FC32]

zone name ORARAC-8-NVMe-A1 vsan 151 member pwwn 20:00:00:25:b5:ab:30:48 init ! [ORARAC8-NVMe-HBA2] member pwwn 20:00:00:25:b5:ab:30:4a init ! [ORARAC8-NVMe-HBA4] member pwwn 20:00:00:25:b5:ab:30:4c init ! [ORARAC8-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:4e init ! [ORARAC8-NVMe-HBA8] member pwwn 52:4a:93:7a:7e:04:85:06 target ! [PureFAXL170-ORA21c-CT0-FC06] member pwwn 52:4a:93:7a:7e:04:85:16 target [PureFAXL170-ORA21c-CT1-FC06] 1 member pwwn 52:4a:93:7a:7e:04:85:80 target ! [PureFAXL170-ORA21c-CT0-FC32] member pwwn 52:4a:93:7a:7e:04:85:90 target ! [PureFAXL170-ORA21c-CT1-FC32]

zoneset name ORARAC-A vsan 151

member ORARAC-1-Boot-A

member ORARAC-2-Boot-A

member ORARAC-3-Boot-A

member ORARAC-4-Boot-A

member ORARAC-1-NVMe-A1

member ORARAC-2-NVMe-A1

member ORARAC-3-NVMe-A1

member ORARAC-4-NVMe-A1

member ORARAC-5-Boot-A

member ORARAC-6-Boot-A

member ORARAC-7-Boot-A

member ORARAC-8-Boot-A

member ORARAC-5-NVMe-A1

member ORARAC-6-NVMe-A1

member ORARAC-7-NVMe-A1

member ORARAC-8-NVMe-A1

zoneset activate name ORARAC-A vsan 151 do clear zone database vsan 151 !Full Zone Database Section for vsan 151

```
zone name ORARAC-1-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:00 init
! [ORARAC-1-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-2-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:0a init
! [ORARAC-2-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

```
zone name ORARAC-3-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:14 init
! [ORARAC-3-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

zone name ORARAC-4-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:1e init
! [ORARAC-4-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

zone name ORARAC-1-NVMe-A1 vsan 151
member pwwn 20:00:00:25:b5:ab:30:02 init
! [ORARAC1-NVMe-HBA2]
member pwwn 20:00:00:25:b5:ab:30:04 init

 !
 [ORARAC1-NVMe-HBA4]

 member
 pwwn
 20:00:00:25:b5:ab:30:06 init

 !
 [ORARAC1-NVMe-HBA6]

 member
 pwwn
 20:00:00:25:b5:ab:30:08 init

 !
 [ORARAC1-NVMe-HBA8]

 member
 pwwn
 52:4a:93:7a:7e:04:85:06 target

 !
 [PureFAXL170-ORA21c-CT0-FC06]

 member
 pwwn
 52:4a:93:7a:7e:04:85:16 target

 !
 [PureFAXL170-ORA21c-CT1-FC06]

 member
 pwwn
 52:4a:93:7a:7e:04:85:80 target

 !
 [PureFAXL170-ORA21c-CT0-FC32]

 member
 pwm
 52:4a:93:7a:7e:04:85:90 target

 !
 [PureFAXL170-ORA21c-CT1-FC32]

zone name ORARAC-2-NVMe-A1 vsan 151 member pwwn 20:00:00:25:b5:ab:30:0c init ! [ORARAC2-NVMe-HBA2] member pwwn 20:00:00:25:b5:ab:30:0e init ! [ORARAC2-NVMe-HBA4] member pwwn 20:00:00:25:b5:ab:30:10 init ! [ORARAC2-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:12 init ! [ORARAC2-NVMe-HBA8] member pwwn 52:4a:93:7a:7e:04:85:06 target ! [PureFAXL170-ORA21c-CT0-FC06] member pwwn 52:4a:93:7a:7e:04:85:16 target ! [PureFAXL170-ORA21c-CT1-FC06] member pwwn 52:4a:93:7a:7e:04:85:80 target ! [PureFAXL170-ORA21c-CT0-FC32]

```
member pwwn 52:4a:93:7a:7e:04:85:90 target
   ! [PureFAXL170-ORA21c-CT1-FC32]
zone name ORARAC-3-NVMe-A1 vsan 151
   member pwwn 20:00:00:25:b5:ab:30:16 init
             [ORARAC3-NVMe-HBA2]
   !
   member pwwn 20:00:00:25:b5:ab:30:18 init
   ! [ORARAC3-NVMe-HBA4]
   member pwwn 20:00:00:25:b5:ab:30:1a init
   ! [ORARAC3-NVMe-HBA6]
   member pwwn 20:00:00:25:b5:ab:30:1c init
             [ORARAC3-NVMe-HBA8]
   !
   member pwwn 52:4a:93:7a:7e:04:85:06 target
             [PureFAXL170-ORA21c-CT0-FC06]
   !
   member pwwn 52:4a:93:7a:7e:04:85:16 target
   ! [PureFAXL170-ORA21c-CT1-FC06]
   member pwwn 52:4a:93:7a:7e:04:85:80 target
   ! [PureFAXL170-ORA21c-CT0-FC32]
   member pwwn 52:4a:93:7a:7e:04:85:90 target
   ! [PureFAXL170-ORA21c-CT1-FC32]
```

```
zone name ORARAC-4-NVMe-A1 vsan 151
member pwwn 20:00:00:25:b5:ab:30:20 init
! [ORARAC4-NVMe-HBA2]
member pwwn 20:00:00:25:b5:ab:30:22 init
! [ORARAC4-NVMe-HBA4]
member pwwn 20:00:00:25:b5:ab:30:24 init
! [ORARAC4-NVMe-HBA6]
member pwwn 20:00:00:25:b5:ab:30:26 init
```

 !
 [ORARAC4-NVMe-HBA8]

 member pwwn
 52:4a:93:7a:7e:04:85:06 target

 !
 [PureFAXL170-ORA21c-CT0-FC06]

 member pwwn
 52:4a:93:7a:7e:04:85:16 target

 !
 [PureFAXL170-ORA21c-CT1-FC06]

 member pwwn
 52:4a:93:7a:7e:04:85:80 target

 !
 [PureFAXL170-ORA21c-CT0-FC32]

 member pwwn
 52:4a:93:7a:7e:04:85:90 target

 !
 [PureFAXL170-ORA21c-CT1-FC32]

```
zone name ORARAC-5-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:28 init
! [ORARAC-5-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]
```

zone name ORARAC-6-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:32 init
! [ORARAC-6-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

zone name ORARAC-7-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:3c init
! [ORARAC-7-FC-HBA0]

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member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

zone name ORARAC-8-Boot-A vsan 151
member pwwn 20:00:00:25:b5:ab:30:46 init
! [ORARAC-8-FC-HBA0]
member pwwn 52:4a:93:7a:7e:04:85:04 target
! [PureFAXL170-ORA21c-CT0-FC04]
member pwwn 52:4a:93:7a:7e:04:85:14 target
! [PureFAXL170-ORA21c-CT1-FC04]

zone name ORARAC-5-NVMe-A1 vsan 151 member pwwn 20:00:00:25:b5:ab:30:2a init ! [ORARAC5-NVMe-HBA2] member pwwn 20:00:00:25:b5:ab:30:2c init ! [ORARAC5-NVMe-HBA4] member pwwn 20:00:00:25:b5:ab:30:2e init ! [ORARAC5-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:30 init ! [ORARAC5-NVMe-HBA8] member pwwn 52:4a:93:7a:7e:04:85:06 target [PureFAXL170-ORA21c-CT0-FC06] 1 member pwwn 52:4a:93:7a:7e:04:85:16 target [PureFAXL170-ORA21c-CT1-FC06] 1 member pwwn 52:4a:93:7a:7e:04:85:80 target ! [PureFAXL170-ORA21c-CT0-FC32] member pwwn 52:4a:93:7a:7e:04:85:90 target

```
! [PureFAXL170-ORA21c-CT1-FC32]
```

```
zone name ORARAC-6-NVMe-A1 vsan 151
   member pwwn 20:00:00:25:b5:ab:30:34 init
            [ORARAC6-NVMe-HBA2]
   !
   member pwwn 20:00:00:25:b5:ab:30:36 init
   ! [ORARAC6-NVMe-HBA4]
   member pwwn 20:00:00:25:b5:ab:30:38 init
   ! [ORARAC6-NVMe-HBA6]
   member pwwn 20:00:00:25:b5:ab:30:3a init
   ! [ORARAC6-NVMe-HBA8]
   member pwwn 52:4a:93:7a:7e:04:85:06 target
   !
             [PureFAXL170-ORA21c-CT0-FC06]
   member pwwn 52:4a:93:7a:7e:04:85:16 target
   ! [PureFAXL170-ORA21c-CT1-FC06]
   member pwwn 52:4a:93:7a:7e:04:85:80 target
   ! [PureFAXL170-ORA21c-CT0-FC32]
   member pwwn 52:4a:93:7a:7e:04:85:90 target
   ! [PureFAXL170-ORA21c-CT1-FC32]
```

```
zone name ORARAC-7-NVMe-A1 vsan 151
   member pwwn 20:00:00:25:b5:ab:30:3e init
   !
             [ORARAC7-NVMe-HBA2]
   member pwwn 20:00:00:25:b5:ab:30:40 init
   !
             [ORARAC7-NVMe-HBA4]
   member pwwn 20:00:00:25:b5:ab:30:42 init
   ! [ORARAC7-NVMe-HBA6]
   member pwwn 20:00:00:25:b5:ab:30:44 init
   ! [ORARAC7-NVMe-HBA8]
```

member pwwn 52:4a:93:7a:7e:04:85:06 target
! [PureFAXL170-ORA21c-CT0-FC06]
member pwwn 52:4a:93:7a:7e:04:85:16 target
! [PureFAXL170-ORA21c-CT1-FC06]
member pwwn 52:4a:93:7a:7e:04:85:80 target
! [PureFAXL170-ORA21c-CT0-FC32]
member pwwn 52:4a:93:7a:7e:04:85:90 target
! [PureFAXL170-ORA21c-CT1-FC32]

zone name ORARAC-8-NVMe-A1 vsan 151 member pwwn 20:00:00:25:b5:ab:30:48 init ! [ORARAC8-NVMe-HBA2] member pwwn 20:00:00:25:b5:ab:30:4a init [ORARAC8-NVMe-HBA4] ! member pwwn 20:00:00:25:b5:ab:30:4c init ! [ORARAC8-NVMe-HBA6] member pwwn 20:00:00:25:b5:ab:30:4e init ! [ORARAC8-NVMe-HBA8] member pwwn 52:4a:93:7a:7e:04:85:06 target ! [PureFAXL170-ORA21c-CT0-FC06] member pwwn 52:4a:93:7a:7e:04:85:16 target ! [PureFAXL170-ORA21c-CT1-FC06] member pwwn 52:4a:93:7a:7e:04:85:80 target [PureFAXL170-ORA21c-CT0-FC32] 1 member pwwn 52:4a:93:7a:7e:04:85:90 target ! [PureFAXL170-ORA21c-CT1-FC32]

interface mgmt0

ip address 10.29.135.57 255.255.255.0

interface port-channel41

switchport trunk allowed vsan 151 switchport description Port-Channel-FI-A-MDS-A switchport rate-mode dedicated switchport trunk mode off

vsan database

vsan 151 interface port-channel41

vsan 151 interface fc1/9

- vsan 151 interface fc1/10
- vsan 151 interface fc1/11
- vsan 151 interface fc1/12
- vsan 151 interface fc1/13
- vsan 151 interface fc1/14
- vsan 151 interface fc1/15
- vsan 151 interface fc1/16
- vsan 151 interface fc1/17
- vsan 151 interface fc1/18
- vsan 151 interface fc1/19
- vsan 151 interface fc1/20
- vsan 151 interface fc1/21
- vsan 151 interface fc1/22
- vsan 151 interface fc1/23
- vsan 151 interface fc1/24
- switchname FS-ORA-MDS-A
- cli alias name autozone source sys/autozone.py
- line console
- line vty

boot kickstart bootflash:/m9100-s6ek9-kickstart-mz.9.3.2.bin
boot system bootflash:/m9100-s6ek9-mz.9.3.2.bin

interface fc1/1

switchport description ORA21C-FI-A-1/35/1
switchport trunk mode off
port-license acquire
channel-group 41 force

no shutdown

interface fc1/2

switchport description ORA21C-FI-A-1/35/2
switchport trunk mode off
port-license acquire
channel-group 41 force
no shutdown

interface fc1/3

switchport description ORA21C-FI-A-1/35/3
switchport trunk mode off

port-license acquire

channel-group 41 force

no shutdown

interface fc1/4

switchport description ORA21C-FI-A-1/35/4
switchport trunk mode off
port-license acquire
channel-group 41 force

no shutdown

interface fc1/5

switchport description ORA21C-FI-A-1/35/5
switchport trunk mode off
port-license acquire
channel-group 41 force

no shutdown

interface fc1/6

switchport description ORA21C-FI-A-1/35/6
switchport trunk mode off
port-license acquire
channel-group 41 force
no shutdown

interface fc1/7

switchport description ORA21C-FI-A-1/35/7
switchport trunk mode off
port-license acquire
channel-group 41 force
no shutdown

interface fc1/8

switchport description ORA21C-FI-A-1/35/8
switchport trunk mode off
port-license acquire
channel-group 41 force
no shutdown

interface fc1/17

switchport trunk allowed vsan 151
switchport description PureFAXL170-ORA21c-CT0.FC4
switchport trunk mode off
port-license acquire
no shutdown

interface fc1/18

switchport trunk allowed vsan 151

switchport description PureFAXL170-ORA21c-CT1.FC4

switchport trunk mode off

port-license acquire

no shutdown

interface fc1/19

switchport trunk allowed vsan 151
switchport description PureFAXL170-ORA21c-CT0.FC6
switchport trunk mode off
port-license acquire
no shutdown

interface fc1/20

switchport trunk allowed vsan 151
switchport description PureFAXL170-ORA21c-CT1.FC6
switchport trunk mode off
port-license acquire
no shutdown

interface fc1/21
switchport trunk allowed vsan 151
switchport description PureFAXL170-ORA21c-CT0.FC32
switchport trunk mode off
port-license acquire
no shutdown
interface fc1/22

switchport trunk allowed vsan 151
switchport description PureFAXL170-ORA21c-CT1.FC32
switchport trunk mode off
port-license acquire
no shutdown

ip default-gateway 10.29.135.1

Cisco Nexus Switch Configuration

FS-ORA-N9K-A# show running-config

!Command: show running-config !No configuration change since last restart !Time: Sat Jul 13 01:01:08 2024

version 9.3(7) Bios:version 05.45
switchname FS-ORA-N9K-A
policy-map type network-qos jumbo
class type network-qos class-default

mtu 9216

vdc FS-ORA-N9K-A id 1
limit-resource vlan minimum 16 maximum 4094
limit-resource vrf minimum 2 maximum 4096
limit-resource port-channel minimum 0 maximum 511
limit-resource u4route-mem minimum 248 maximum 248
limit-resource u6route-mem minimum 96 maximum 96
limit-resource m4route-mem minimum 58 maximum 58
limit-resource m6route-mem minimum 8 maximum 8

cfs eth distribute

feature interface-vlan

feature hsrp

feature lacp

feature vpc

feature lldp

ip domain-lookup

system default switchport

system qos

service-policy type network-qos jumbo

ntp server 72.163.32.44 use-vrf default

vlan 1,10,135

vlan 10

name Oracle RAC Private Traffic

vlan 135

```
name Oracle_RAC_Public_Traffic
```

spanning-tree port type edge bpduguard default

```
spanning-tree port type network default
vrf context management
  ip route 0.0.0.0/0 10.29.135.1
port-channel load-balance src-dst 14port
vpc domain 1
  peer-keepalive destination 10.29.135.56 source 10.29.135.55
  auto-recovery
```

interface Vlan1

```
interface port-channel1
```

description vPC peer-link switchport mode trunk switchport trunk allowed vlan 1,10,135 spanning-tree port type network

vpc peer-link

interface port-channel51

description connect to FS-ORA-FI-A switchport mode trunk

switchport trunk allowed vlan 1,10,135

spanning-tree port type edge trunk

mtu 9216

vpc 51

interface port-channel52
description connect to FS-ORA-FI-B
switchport mode trunk

switchport trunk allowed vlan 1,10,135 spanning-tree port type edge trunk mtu 9216 vpc 52

interface Ethernet1/1

description Peer link connected to FS-ORA-N9K-B-Eth-1/1

switchport mode trunk

switchport trunk allowed vlan 1,10,135

channel-group 1 mode active

interface Ethernet1/2

description Peer link connected to FS-ORA-N9K-B-Eth-1/2 switchport mode trunk

switchport trunk allowed vlan 1,10,135

channel-group 1 mode active

interface Ethernet1/3

description Peer link connected to FS-ORA-N9K-B-Eth-1/3

switchport mode trunk

switchport trunk allowed vlan 1,10,135

channel-group 1 mode active

interface Ethernet1/4

description Peer link connected to FS-ORA-N9K-B-Eth-1/4
switchport mode trunk
switchport trunk allowed vlan 1,10,135
channel-group 1 mode active

```
interface Ethernet1/9
description Fabric-Interconnect-A-27
switchport mode trunk
switchport trunk allowed vlan 1,10,135
spanning-tree port type edge trunk
mtu 9216
channel-group 51 mode active
```

interface Ethernet1/10

description Fabric-Interconnect-A-28 switchport mode trunk switchport trunk allowed vlan 1,10,135 spanning-tree port type edge trunk mtu 9216 channel-group 51 mode active

interface Ethernet1/11

description Fabric-Interconnect-B-27
switchport mode trunk
switchport trunk allowed vlan 1,10,135
spanning-tree port type edge trunk
mtu 9216
channel-group 52 mode active

```
interface Ethernet1/12
  description Fabric-Interconnect-B-28
  switchport mode trunk
  switchport trunk allowed vlan 1,10,135
  spanning-tree port type edge trunk
```

```
mtu 9216
```

channel-group 52 mode active

interface Ethernet1/29

description To-Management-Uplink-Switch

switchport access vlan 135

speed 1000

interface mgmt0

vrf member management

ip address 10.29.135.55/24

icam monitor scale

line console

line vty

boot nxos bootflash:/nxos.9.3.7.bin

no system default switchport shutdown

Multipath Configuration "/etc/multipath.conf"

```
[root@oraracl ~]# cat /etc/multipath.conf
defaults {
    polling_interval 10
}
devices {
    device {
        vendor "NVME"
        product "Pure Storage FlashArray"
        path_selector "queue-length 0"
        path_grouping_policy group_by_prio
```

prio	ana
failback	immediate
fast_io_fail_tmo	10
user_friendly_names	no
no_path_retry	0
features	0
dev_loss_tmo	60

```
}
```

```
device {
```

	vendor	"PURE"
	product	"FlashArray"
	path_selector	"service-time 0"
	hardware_handler	"1 alua"
	path_grouping_policy	group_by_prio
	prio	alua
	failback	immediate
	path_checker	tur
	fast_io_fail_tmo	10
	user_friendly_names	no
	no_path_retry	0
	features	0
	dev_loss_tmo	600
}		
}		
multipaths {		
	multipath {	
	wwid 3	524a93704a5561942d7640ea00011436

alias ORARAC1-RHEL-OS

}
multipath {				
	wwid	eui.004a5561942d764024a937ea00011f4e		
	alias	ocrvotel		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00011f4f		
	alias	ocrvote2		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00011f50		
	alias	slobdata01		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00011f51		
	alias	slobdata02		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00011f52		
	alias	slobdata03		
}				
multipath {				
	wwid	eui.004a5561942d764024a937ea00011f53		
	alias	slobdata04		
}				
multipath {				
	wwid	eui.004a5561942d764024a937ea00011f54		
	alias	slobdata05		
}				
multipath {				

```
wwid eui.004a5561942d764024a937ea00011f55
      alias
                 slobdata06
}
multipath {
      wwid
                 eui.004a5561942d764024a937ea00011f56
      alias
               slobdata07
}
multipath {
      wwid eui.004a5561942d764024a937ea00011f57
     alias slobdata08
}
multipath {
                 eui.004a5561942d764024a937ea00011f58
      wwid
      alias
                 sloblog01
}
multipath {
      wwid eui.004a5561942d764024a937ea00011f59
      alias sloblog02
}
multipath {
              eui.004a5561942d764024a937ea00011fca
      wwid
      alias
                 soedata01
}
multipath {
      wwid
                 eui.004a5561942d764024a937ea00011fcb
               soedata02
      alias
}
multipath {
      wwid eui.004a5561942d764024a937ea00011fcc
```

```
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```

	alias	soedata03			
}					
multip	oath {				
	wwid	eui.004a5561942d764024a937ea00011fcd			
	alias	soedata04			
}					
multip	multipath {				
	wwid	eui.004a5561942d764024a937ea00011fce			
	alias	soedata05			
}					
multip	multipath {				
	wwid	eui.004a5561942d764024a937ea00011fcf			
	alias	soedata06			
}					
multipath {					
	wwid	eui.004a5561942d764024a937ea00011fd0			
	alias	soedata07			
}					
multip	oath {				
	wwid	eui.004a5561942d764024a937ea00011fd1			
	alias	soedata08			
}					
multip	multipath {				
	wwid	eui.004a5561942d764024a937ea00011fd2			
	alias	soelog01			
}					
multipath {					
	wwid	eui.004a5561942d764024a937ea00011fd3			
	alias	soelog02			

```
}
```

```
multipath {
      wwid
                 eui.004a5561942d764024a937ea0001206e
       alias
                  engdata01
}
multipath {
              eui.004a5561942d764024a937ea0001206f
      wwid
      alias engdata02
}
multipath {
      wwid
               eui.004a5561942d764024a937ea00012070
      alias
                  engdata03
}
multipath {
      wwid
                 eui.004a5561942d764024a937ea00012071
      alias
                 engdata04
}
multipath {
      wwid eui.004a5561942d764024a937ea00012072
      alias engdata05
}
multipath {
      wwid
                 eui.004a5561942d764024a937ea00012073
      alias
                  engdata06
}
multipath {
               eui.004a5561942d764024a937ea00012074
      wwid
      alias engdata07
}
```

multipath {				
	wwid	eui.004a5561942d764024a937ea00012075		
	alias	engdata08		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00012076		
	alias	englog01		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00012077		
	alias	englog02		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00011fd4		
	alias	shdata01		
}				
multipa	ath {			
	wwid	eui.004a5561942d764024a937ea00011fd5		
	alias	shdata02		
}				
multipath {				
	wwid	eui.004a5561942d764024a937ea00011fd6		
	alias	shdata03		
}				
multipath {				
	wwid	eui.004a5561942d764024a937ea00011fd7		
	alias	shdata04		
}				
multipath {				

```
wwid eui.004a5561942d764024a937ea00011fd8
      alias
                 shdata05
}
multipath {
      wwid
                 eui.004a5561942d764024a937ea00011fd9
      alias
                shdata06
}
multipath {
      wwid eui.004a5561942d764024a937ea00011fda
     alias shdata07
}
multipath {
                 eui.004a5561942d764024a937ea00011fdb
      wwid
      alias
                 shdata08
}
multipath {
      wwid eui.004a5561942d764024a937ea00011fdc
      alias shlog01
}
multipath {
              eui.004a5561942d764024a937ea00011fdd
      wwid
      alias
                 shlog02
}
multipath {
      wwid
                 eui.004a5561942d764024a937ea00011ece
      alias
               fiovol51
}
multipath {
      wwid eui.004a5561942d764024a937ea00011ecf
```

		alias	fiovol52		
	}				
	multipa	th {			
		wwid	eui.004a5561942d764024a937ea00011ed0		
		alias	fiovol53		
	}				
	multipa	th {			
		wwid	eui.004a5561942d764024a937ea00011ed1		
		alias	fiovol54		
	}				
	multipa	th {			
		wwid	eui.004a5561942d764024a937ea00011ed2		
		alias	fiovol55		
	}				
	multipath {				
		wwid	eui.004a5561942d764024a937ea00011ed3		
		alias	fiovol56		
	}				
	multipath {				
		wwid	eui.004a5561942d764024a937ea00011ed4		
		alias	fiovol57		
	}				
	multipath {				
		wwid	eui.004a5561942d764024a937ea00011ed5		
		alias	fiovol58		
	}				
multipath {					
		wwid	eui.004a5561942d764024a937ea00011ed6		
		alias	fiovol61		

```
}
```

```
multipath {
      wwid
                eui.004a5561942d764024a937ea00011ed7
                fiovol62
      alias
}
multipath {
      wwid eui.004a5561942d764024a937ea00011ed8
      alias fiovol63
}
multipath {
     wwid eui.004a5561942d764024a937ea00011ed9
     alias
                fiovol64
}
multipath {
      wwid
                eui.004a5561942d764024a937ea00011eda
      alias
               fiovol65
}
multipath {
      wwid eui.004a5561942d764024a937ea00011edb
     alias fiovol66
}
multipath {
                eui.004a5561942d764024a937ea00011edc
      wwid
      alias
                fiovol67
}
multipath {
      wwid eui.004a5561942d764024a937ea00011edd
     alias fiovol68
}
```

}

[root@orarac1 ~]#

Configure "/etc/udev/rules.d/99-pure-storage.rules"

[root@orarac1 ~]# cat /etc/udev/rules.d/99-pure-storage.rules

Recommended settings for Pure Storage FlashArray.

Use none scheduler for high-performance solid-state storage for SCSI devices

ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{queue/scheduler}="none"

ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block", ENV{DM_NAME}=="3624a937*", ATTR{queue/scheduler}="none"

Reduce CPU overhead due to entropy collection

ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{queue/add random}="0"

ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block", ENV{DM_NAME}=="3624a937*", ATTR{queue/add random}="0"

Spread CPU load by redirecting completions to originating CPU

ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{queue/rq_affinity}="2"

```
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block", ENV{DM_NAME}=="3624a937*", ATTR{queue/rq affinity}="2"
```

Set the HBA timeout to 60 seconds

ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block", ENV{ID_VENDOR}=="PURE", ATTR{device/timeout}="60"

Configure "/etc/udev/rules.d/99-oracleasm.rules"

[root@orarac1 ~]# cat /etc/udev/rules.d/99-oracleasm.rules
#All volumes which starts with ocrvote* #
ENV{DM_NAME}=="ocrvote*", OWNER:="grid", GROUP:="oinstall", MODE:="660"

#All volumes which starts with dg_oradata_* #

```
ENV{DM NAME}=="*data*", OWNER:="oracle", GROUP:="oinstall", MODE:="660"
```

```
#All volumes which starts with dg_oraredo_* #
ENV{DM NAME}=="*log*", OWNER:="oracle", GROUP:="oinstall", MODE:="660"
```

Configure "sysctl.conf"

```
[root@orarac1 ~]# cat /etc/sysctl.conf
vm.nr hugepages=120000
```

```
# oracle-database-preinstall-21c setting for fs.file-max is 6815744
fs.file-max = 6815744
```

oracle-database-preinstall-21c setting for kernel.sem is '250 32000 100 128'
kernel.sem = 250 32000 100 128

oracle-database-preinstall-21c setting for kernel.shmmni is 4096
kernel.shmmni = 4096

```
# oracle-database-preinstall-21c setting for kernel.shmall is 1073741824 on x86_64
kernel.shmall = 1073741824
```

oracle-database-preinstall-21c setting for kernel.shmmax is 4398046511104 on x86_64
kernel.shmmax = 4398046511104

```
# oracle-database-preinstall-21c setting for kernel.panic_on_oops is 1 per Orabug 19212317
kernel.panic_on_oops = 1
```

oracle-database-preinstall-21c setting for net.core.rmem_default is 262144
net.core.rmem default = 262144

```
# oracle-database-preinstall-21c setting for net.core.rmem_max is 4194304
net.core.rmem max = 4194304
```

```
# oracle-database-preinstall-21c setting for net.core.wmem_default is 262144
net.core.wmem default = 262144
```

```
# oracle-database-preinstall-21c setting for net.core.wmem_max is 1048576
net.core.wmem max = 1048576
```

```
# oracle-database-preinstall-21c setting for net.ipv4.conf.all.rp_filter is 2
net.ipv4.conf.all.rp filter = 2
```

oracle-database-preinstall-21c setting for net.ipv4.conf.default.rp_filter is 2
net.ipv4.conf.default.rp filter = 2

```
# oracle-database-preinstall-21c setting for fs.aio-max-nr is 1048576
fs.aio-max-nr = 1048576
```

oracle-database-preinstall-21c setting for net.ipv4.ip_local_port_range is 9000 65500
net.ipv4.ip local port range = 9000 65500

Configure "oracle-database-preinstall-21c.conf"

[root@orarac1 ~]# cat /etc/security/limits.d/oracle-database-preinstall-21c.conf

oracle-database-preinstall-21c setting for nofile soft limit is 1024
oracle soft nofile 1024

oracle-database-preinstall-21c setting for nofile hard limit is 65536
oracle hard nofile 65536

oracle-database-preinstall-21c setting for nproc soft limit is 16384
refer orabug15971421 for more info.
oracle soft nproc 16384

oracle-database-preinstall-21c setting for nproc hard limit is 16384
oracle hard nproc 16384

oracle-database-preinstall-21c setting for stack soft limit is 10240KB
oracle soft stack 10240

oracle-database-preinstall-21c setting for stack hard limit is 32768KB
oracle hard stack 32768

oracle-database-preinstall-21c setting for memlock hard limit is maximum of 128GB on x86_64 or 3GB on x86 OR 90 % of RAM

oracle hard memlock 474753608

oracle-database-preinstall-21c setting for memlock soft limit is maximum of 128GB on x86_64 or 3GB on x86 OR 90% of RAM

oracle soft memlock 474753608

oracle-database-preinstall-21c setting for data soft limit is 'unlimited'
oracle soft data unlimited

oracle-database-preinstall-21c setting for data hard limit is 'unlimited'
oracle hard data unlimited

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