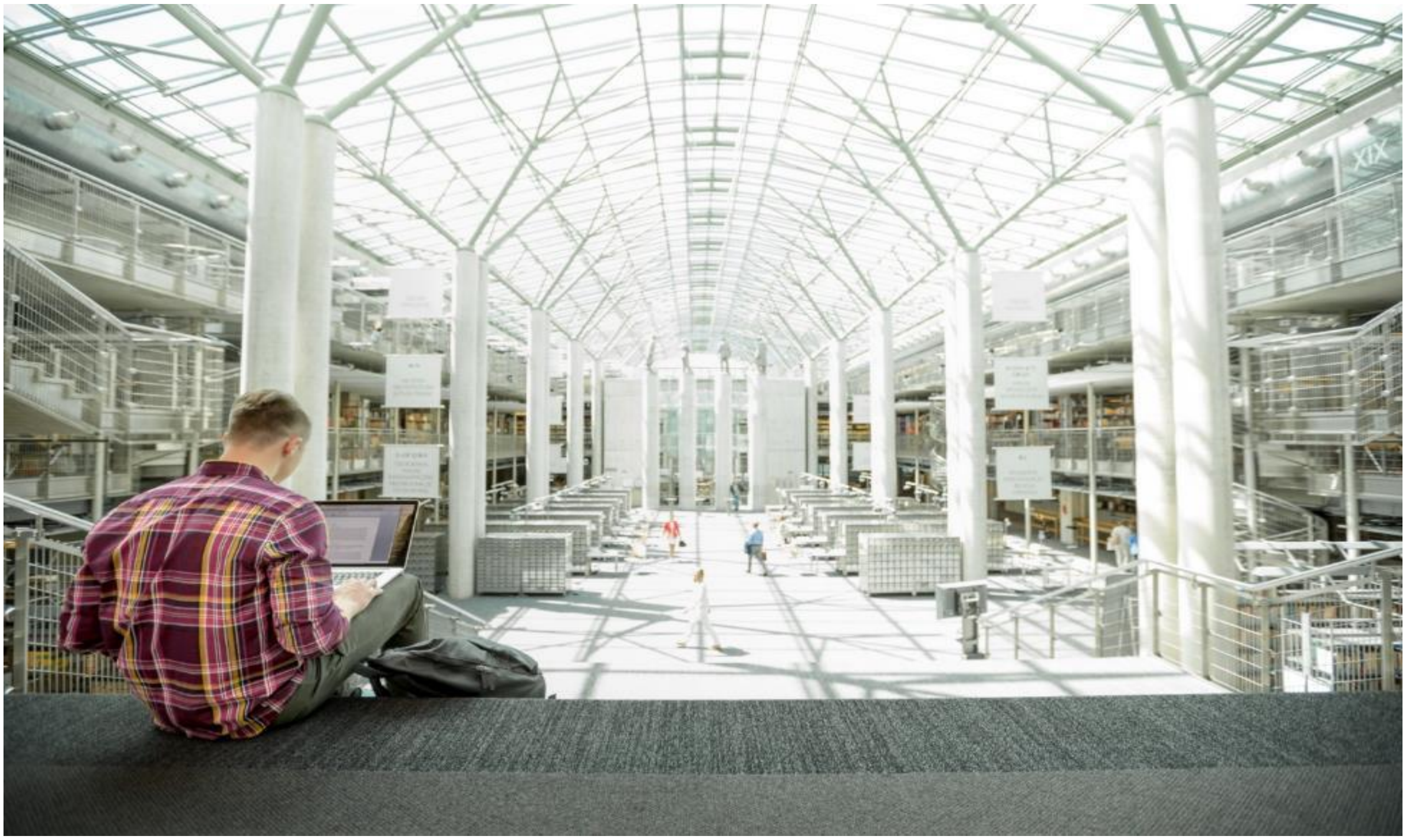

FlashStack for SAP HANA TDI

Deployment Guide for FlashStack for SAP HANA TDI

Published: November 2020

In partnership with:

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Executive Summary

Cisco® Validated Designs (CVDs) consists of systems and solutions that are designed, tested, and documented to facilitate and improve customer deployments. These designs incorporate a wide range of technologies and products into a portfolio of solutions that have been developed to address the business needs of customers and to guide them from design to deployment.

This document discusses the deployment requirements and procedures to install and operate SAP HANA Tailored Data Center Integration (TDI) deployments on FlashStack, a converged infrastructure jointly developed by Cisco and Pure Storage. The predesigned FlashStack solution serves as foundation for a variety of workloads and enables efficient architectural designs based on customer requirements.

FlashStack for SAP HANA is a validated approach to deploy Cisco and Pure Storage technologies in an appliance like infrastructure. The reference architecture builds on the Cisco® Unified Computing System™ (Cisco UCS®) platform based on 2nd Generation Intel Xeon Scalable Processors optionally with DDR4 memory modules only or in a mixed memory configuration of DDR4 modules and Intel® Optane™ DC Persistent Memory Modules (DC PMM). The Cisco UCS Servers connect through Cisco switching products to the Pure Storage® FlashArray//X.

This document details the required configuration steps for SAP HANA TDI deployments whether in SAP HANA Scale-Up or Scale-Out configuration running on either Red Hat Enterprise Linux for SAP Solutions or SUSE Linux Enterprise Server for SAP Applications.

Solution Overview

Introduction

Industry trends indicate a vast data center transformation toward shared infrastructure, multi-tenant workload and cloud computing. Business agility requires application agility, so IT teams must provision applications quickly and resources must scale up (and out) as needed.

Cisco and Pure Storage jointly developed FlashStack, which uses best-in-class storage, server, and network components to serve as the foundation for a variety of workloads, enabling efficient architectural designs that can be quickly and confidently deployed. FlashStack converged infrastructure provides the advantage of having the compute, storage, and network stack integrated with the programmability of Cisco UCS and the on-demand growth and expandability of Evergreen storage from Pure Storage. Users experience appliance-level simplicity with cloud-like efficiencies and economics while maintaining their SAP HANA TDI-based re-deployment/re-use options as their landscape evolves.

SAP HANA is SAP SE’s implementation of in-memory database technology. The SAP HANA database combines transactional and analytical SAP workloads and hereby takes advantage of the low-cost main memory (RAM), data-processing capabilities of multicore processors, and faster data access. Cisco UCS servers equipped with the second-generation Intel® Xeon® Scalable processors support mixed Intel® Optane™ DC PM and DDR4 memory configurations which not only significantly increases the maximum supported memory size but the SAP HANA startup time as well.

The Pure Storage FlashArray//X provides out-of-the-box file sharing capabilities without compromise, thus enabling distributed SAP HANA Scale-Out deployments. It enables organizations to consolidate their SAP landscape and run SAP application servers as well as multiple SAP HANA databases hosted on the same infrastructure.

Audience

The target audience for this document includes, but is not limited to field consultants, professional services, IT managers, partner engineers, and customers who want to take advantage of an infrastructure built to deliver IT efficiency and enable IT innovation.

Purpose of this Document

This deployment guide provides step by step configuration and implementation guidelines for the FlashStack data center solution for SAP HANA TDI and show case the scalability, manageability, and simplicity of the FlashStack converged infrastructure solution when deploying SAP HANA mission critical applications.

What’s New in this Release?

The previous FlashStack reference architecture has been updated with the up-to-date Cisco and Pure Storage hardware and software components:

- Support for the Cisco UCS 4.1(1) unified software release.
- Cisco UCS B-Series M5 Blade Servers with the second-generation Intel® Xeon® Scalable processors and Cisco 1400 Series Virtual Interface Cards (VICs). Holds true for UCSM managed Cisco UCS C220, C240 and C480 M5 Rack Servers as well.
- Validation with Intel® Optane™ Data Center persistent memory modules (DC PMM)

- Cisco UCS 6454 Fabric Interconnects and Cisco UCS 2408 Fabric Extender
- Validation with Nexus® 9300-FX Switches
- Pure Storage FlashArray//X R3 with DirectFlash Modules
- Cisco Intersight Management and Monitoring

Software versions used in this validation reflect the current version at the time of the publication. Review and implement the Cisco suggested release mentioned on the corresponding Cisco UCS Hardware and Software compatibility list at the time of actual implementation.

Solution Summary

The FlashStack platform, is a flexible and highly modular converged infrastructure solution. It delivers pre-validated storage, networking, and server technologies and scales easily as requirements and demand change. FlashStack is a defined set of hardware and software that serves as an integrated foundation for both virtualized and non-virtualized workloads. Cisco and Pure Storage carefully validated and verified the FlashStack 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 portfolio includes, but is not limited to, the following items:

- Best practice architectural design
- Implementation and deployment guidelines
- SAP application sizing recommendations

All components are connected and configured according to best practices of both Cisco and Pure Storage and provide the ideal platform to run a variety of enterprise workloads with confidence. FlashStack can scale up for greater performance and capacity (adding compute, network, or storage resources individually as required), or it can scale out for environments that require multiple consistent deployments.

The validated reference architecture follows the FlashStack for SAP HANA TDI design guide and leverages the Pure Storage FlashArray//X, Cisco Nexus 9300 series and Cisco MDS 9100 series as switching elements as well as Cisco 6400 Series Fabric Interconnects for system management. Each of the Cisco or Pure Storage component families shown offer platform and resource options to scale the infrastructure up or down, while supporting the same features and functionality that are required under the configuration and connectivity best practices of FlashStack.

Validation tests confirm the functionality and resilience of the whole solution.

Technology Overview

Solution Architecture

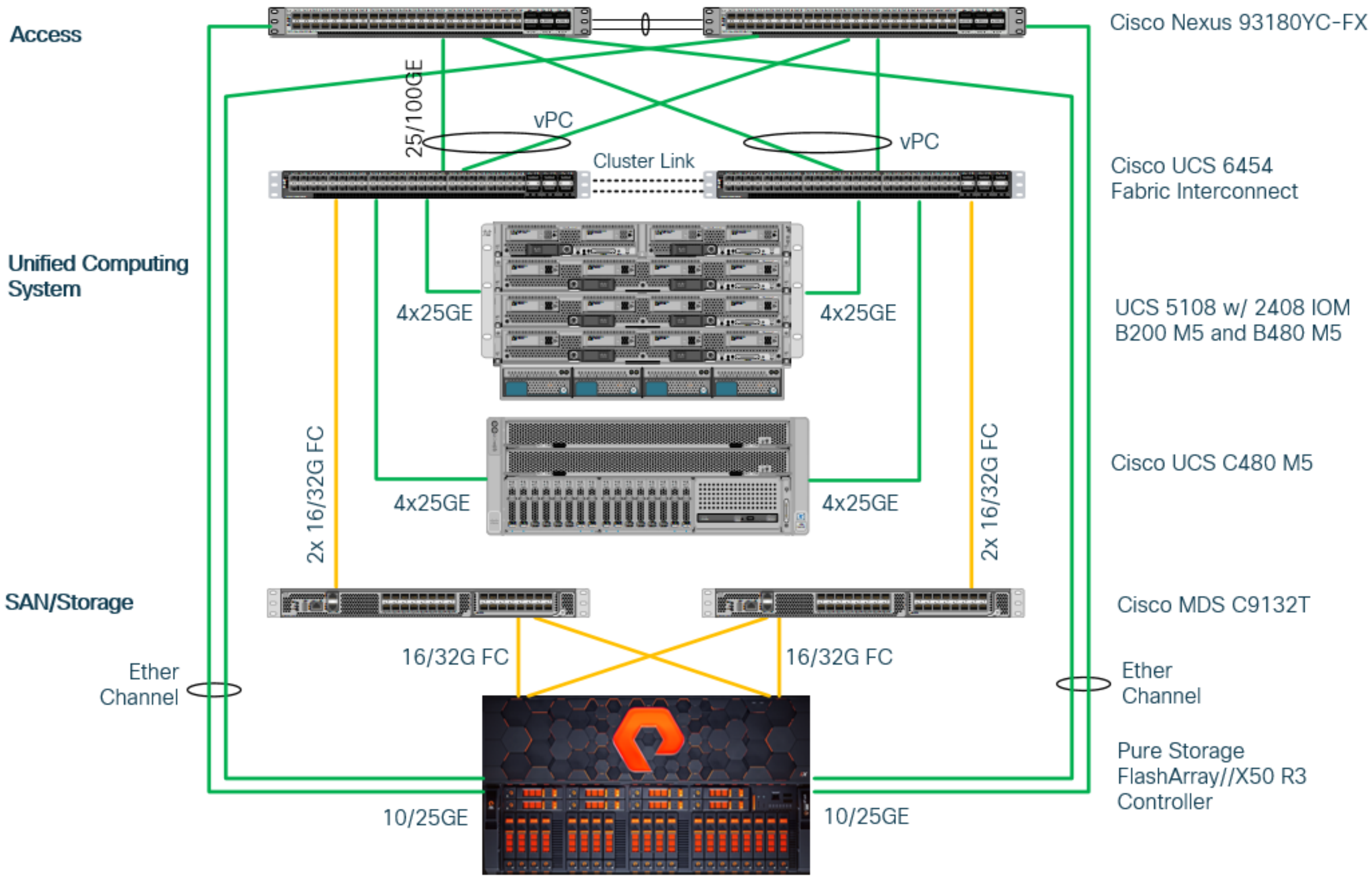
FlashStack for SAP HANA TDI provides an end-to-end architecture that demonstrates support for multiple SAP HANA workloads including high availability and secure multi-tenancy. The architecture builds around the Cisco UCS compute and Pure Storage FlashArray//X connected by Cisco MDS Multilayer SAN Switches and is further enabled by Cisco Nexus Switches.

These components form a powerful and scalable design, built on the best practices of Cisco and Pure Storage to create an ideal platform for running a variety of enterprise application workloads. Figure 1 illustrates the topology of the FlashStack solution for SAP HANA TDI.

The Cisco Nexus Switches handle the Ethernet traffic and uplink to the customer network. The chassis with Cisco UCS 2408 FEX leverages 25GE connections to the Fabric Interconnects. The validated design uses 25GE connections from the Fabric Interconnect (FI) to the Cisco Nexus switches and 16 Gb Fibre Channel connections towards the MDS switches and the FlashArray//X.

The FlashStack environment scales easily when requirements and demand change. It is recommended to add additional 4 connections between the Fabric Interconnects and the Cisco Nexus switches and to define a dedicated port channel to handle the SAP HANA backup network traffic explicitly.

Figure 1. High- level Physical Topology of the Validated FlashStack Solution



Requirements

The information in the deployment guide follows a complete configuration of a customer environment. The installation steps outlined below require various configuration variables which are customer environment and naming convention specific, like host names, IP addresses, VLAN schemes or appropriate MAC addresses. Appendix 1: Configuration Variables, lists the configuration variables used throughout this deployment guide. When completed with the customer-specific site variables it can be used as a reference during the deployment.

The following non-FlashStack system configuration needs to be in place before you start:

- Internal and external DNS records
- Firewall & Proxy configuration
- Active Directory Domain (required for an SAP HANA Scale-Out scenario only)

Physical Topology

The lab infrastructure uses a management pod which includes a pair of Cisco Nexus 9000 Switches in standalone mode for out-of-band management network and a pair of Cisco UCS C220 M5 Rack Servers running VMware ESXi. The hypervisor runs a vCenter Server Appliance and VMware hosts provide the Active Domain Service (ADS), Domain Name Service (DNS) and the Network Time Protocol (NTP) Service. Installation and configuration of the management pod and its VMWare hosts are not further detailed in this document but remain pre-requisite to finish the FlashStack installation successfully.

The management pod hosts the Cisco Intersight Virtual Assist Appliance which helps to connect the Pure Storage FlashArray//X to Cisco Intersight.

Cisco UCS Manager

FlashStack configuration with Cisco UCS 6454 Fabric Interconnects, Intel Cascade Lake processors and Intel Optane DC PM modules require Cisco UCS Manager release 4.0(4) or later. Cisco UCS Manager provides unified, embedded management of all Cisco software and hardware components.

The Cisco suggested release based on software quality, stability and longevity is release 4.1(1c). Beginning with Cisco UCS Manager Release 4.1(1), the KVM Console GUI is available as an HTML5-based application only and Java is no longer required to manage and install the environment.

Infrastructure Requirements

SAP defines hardware and software requirements to run SAP HANA TDI systems. This Cisco Validated Design uses guidelines provided by SAP and best practices provided by Cisco and Pure Storage.

CPU

SAP HANA 2.0 (TDI) supports servers equipped with Intel Xeon processor E7-8880v3, E7-8890v3, E7-8880v4, E7-8890v4 and all Skylake CPU’s > 8 cores. In addition, the Intel Xeon processor E5-26xx v4 is supported for SAP HANA Scale up deployments.

Memory

Appropriate SAP HANA memory sizing must be performed before considering an Intel Optane DC PM based configuration. More detailed information on the configuration and management is available in the whitepaper Cisco UCS for SAP HANA with Intel Optane DC PMM.

SAP HANA supports the following DDR4 only memory configurations:

- Homogenous symmetric assembly of dual in-line memory modules (DIMMs) for example, DIMM size or speed should not be mixed
- Maximum use of all available memory channels
- SAP HANA 2.0 memory per socket ratio is up to 768 GB for SAP NetWeaver Business Warehouse (BW) and DataMart
- SAP HANA 2.0 memory per socket ratio is up to 1536 GB for SAP Business Suite on SAP HANA (SoH) on two or four-socket servers.

Mixed DC PM/DDR4 memory module configurations are supported with SAP HANA 2.0 SPS03 rev 35 and higher:

- Same size of all installed DDR4 memory modules
- Same size of all installed DC PM memory modules

- Homogenous symmetric assembly of all memory modules for example, each memory channel consists of DC PM and DDR4 memory modules.
- Maximum use of all available memory channel.

CPU and Memory Dependencies

SAP HANA supports a specific set of CPU and memory combinations only. Table 1 lists the certified Cisco UCS servers for SAP HANA with supported Memory and CPU configuration for different use cases. Mixed memory configurations with DRAM and DC PM modules are available with different memory ratios between (1:1) to (4:1). Table 2 lists the maximum possible memory configuration using Intel Optane DC PMM.

Table 1. Supported DRAM Memory Configuration for FlashStack for SAP HANA TDI

Cisco UCS Server	Intel Xeon CPU Socket	Supported Memory	Scale-Up / Suite on HANA	Scale-Out
Cisco UCS B200 M5 Cisco UCS C220 M5 Cisco UCS C240 M5	2	BW: 128 GB to 1.5 TB SoH: 128 GB to 3 TB	Supported	Not supported
Cisco UCS B480 M5 Cisco UCS C480 M5	4	BW: 256 GB to 3 TB for BW SoH: 256 GB to 6 TB for SoH	Supported	Supported (BW only)

Table 2. Maximum DRAM/DC PM Memory Configuration for FlashStack for SAP HANA TDI

Cisco UCS Server	Intel Xeon CPU Socket	Max. (4:1) Supported Memory	Cisco UCS Server	Intel Xeon CPU Socket
Cisco UCS B200 M5 Cisco UCS C220 M5 Cisco UCS C240 M5	2	BW: 1.5 TB DRAM + 6 TB DC PMM = 7.5 TB SoH: 3 TB DRAM + 12 TB DC PMM = 15 TB	Supported	Not supported
Cisco UCS B480 M5 Cisco UCS C480 M5	4	BW: 3 TB DRAM + 12 TB DC PMM = 15 TB SoH: 6 TB DRAM + 24 TB DC PMM = 30 TB	Supported	Supported (BW only)

Network

SAP HANA data center deployments can range from databases running on single hosts (Scale Up), distributed systems (Scale Out) to complex Scale Out systems with multiple hosts located at a primary site having one or more secondary sites to operate SAP HANA with full fault tolerance and disaster recovery.

The different components of the SAP HANA platform communicate via different network channels. To apply the appropriate security and performance measures it is recommended to:

- Separate network communication into logical network zones.
- Enable redundancy for the internal and storage networks, but important too for high availability requirements.
- Separate the Backup network from other HANA related network communication and to configure an additional, exclusive port channel for the Backup network traffic.

Make sure to use the named VLANs to isolate traffic to the external LAN, including broadcast traffic.

Table 3. SAP HANA Network Requirements

Client Zone				
Application Server Network	SAP Application Server to database communication	All	Application Server Network	SAP Application Server to database communication
Client Network	User / Client Application to database communication	All	Client Network	User / Client Application to database communication
Data Source Network	Data import and external data integration	Optional	Data Source Network	Data import and external data integration
Internal Zone				
Inter-Node Network	Node to node communication	Scale-Out	Inter-Node Network	Node to node communication
System Replication Network	SAP HANA System Replication	SAP HANA System Replication and Disaster Tolerance	System Replication Network	SAP HANA System Replication
Storage Zone				
NFS Shared Network	Shared SAP HANA binaries	Scale-Out	NFS Shared Network	Shared SAP HANA binaries
Backup Network	Data Backup	Optional	Backup Network	Data Backup
Storage Network	Node to Storage communication	All	Storage Network	Node to Storage communication
Infrastructure Related				
Administration Network	Infrastructure and SAP HANA administration	Optional	Administration Network	Infrastructure and SAP HANA administration

Boot Network	Boot the Operating Systems via PXE/NFS or iSCSI	Optional	Boot Network	Boot the Operating Systems via PXE/NFS or iSCSI

The SAP HANA TDI network requirement whitepaper (http://scn.sap.com/docs/DOC-63221) describes more detailed network requirements and recommendations.

Storage

FlashStack provides consolidated access to both SAN storage and Network Attached Storage (NAS) over unified fabric. For SAP HANA Scale Out scenarios the Pure Storage FlashArray//X provides out of the box NFS capabilities to share SAP HANA binaries and maps the Fibre Channel storage LUNs to the SAP HANA server hosts with a point-to-point connection. The SAP HANA Storage Connector (see SAP Note 190823 - SAP HANA Storage Connector API) manages the remapping of the SAP HANA data and log volumes in the event of a failover to the standby host.

The recommended file system sizes (Table 4) for SAP HANA worker nodes depend on the total amount of physical server memory and the given SAP HANA scenario.

Table 4. File System Size Requirements

Mount Point	Scale-Up	Scale-Out
/ (incl. swap)	62 GB	
/usr/sap	50 GB	
/hana/shared	1 x RAM or 1 TB (whichever is less)	1 x RAM of a single worker node for each 4 nodes
/hana/data/<SID>	1 x RAM	
/hana/log/<SID>	If the server memory is <= 512 GB then ½ x RAM If the server memory is > 512 GB then 512 GB	

All relevant information about storage requirements is documented in this white paper: https://www.sap.com/documents/2015/03/74cdb554-5a7c-0010-82c7-eda71af511fa.html.

Operating System

The operating systems to operate SAP HANA compatible with Intel Optane DC PM are:

- SUSE Linux Enterprise Server for SAP Applications 12 SP4 or later and 15 or later
- Red Hat Enterprise Linux for SAP Solutions 7.6 or later and 8.0 or later

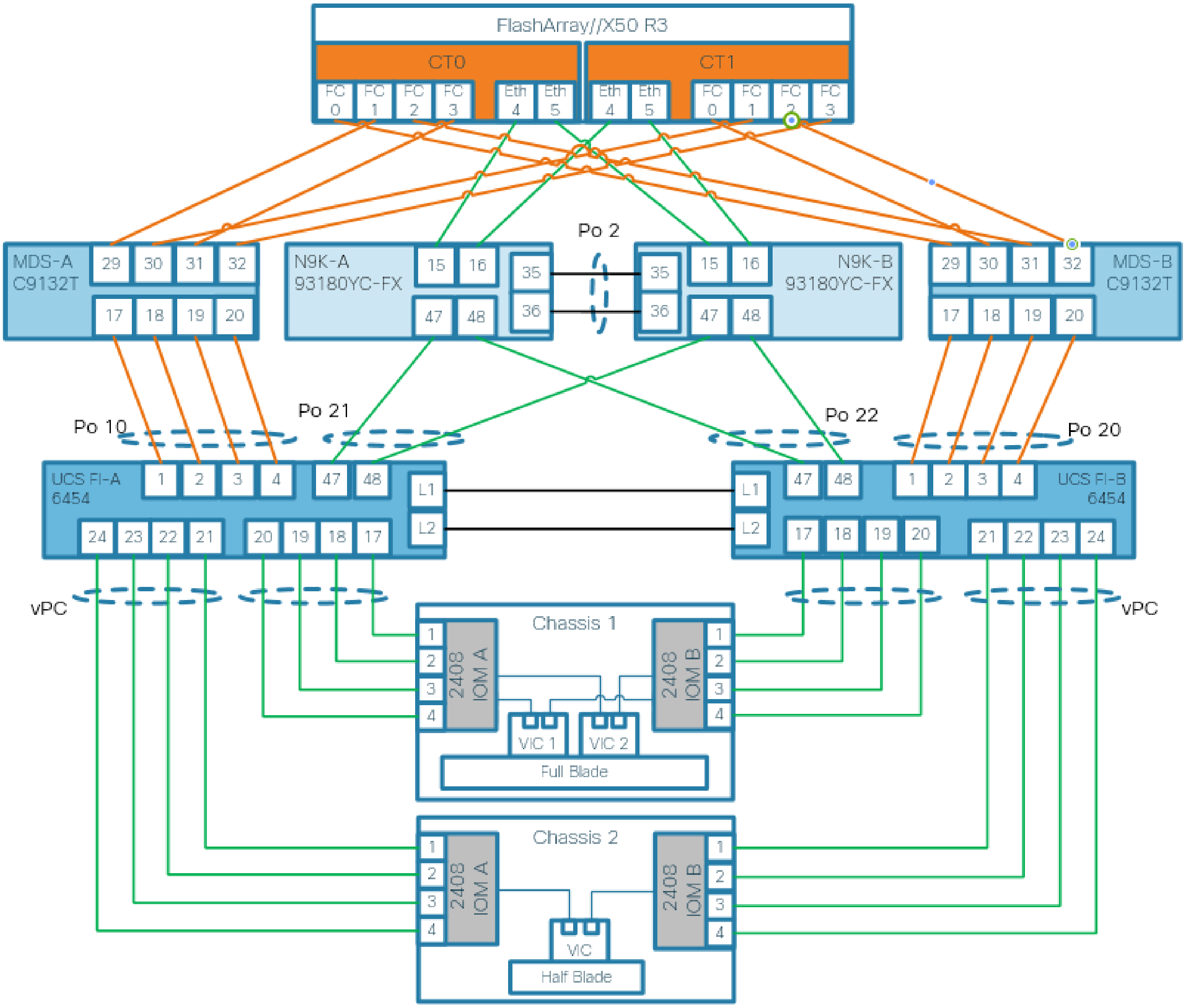
Review SAP note 2235581 - SAP HANA: Supported Operating Systems to evaluate compatibility information between Linux operating system release and SAP HANA platform releases.

Physical Cabling

This section describes the requirements to enable the network connectivity between the Cisco Nexus 93180YC-FX switches and the Cisco UCS Fabric Interconnects that manage the chassis with the Cisco UCS M5 B-Series servers, as well as the FlashArray//X file share access required for SAP HANA Scale-Out scenarios.

Figure 2 shows the cabling topology for IP network configuration of FlashStack for SAP HANA.

Figure 2. **FlashStack Network Device Cabling Topology**



The following tables include both, local and remote device port locations for easier reference. The tables capture the out-of-band management port connectivity into a pre-existing management infrastructure too.

Table 5. Cisco Nexus-A 93180YC-FX Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
Nexus 93180YC-FX-A	Eth 1/47	25GbE	Cisco UCS FI-A	Eth 1/47
	Eth 1/48	25GbE	Cisco UCS FI-B	Eth 1/47
	Eth 1/53	40GbE	Cisco N9K-Mgmt-A	Eth 1/49
	Eth 1/54	40GbE	Cisco N9K-Mgmt-B	Eth 1/49
	Eth 1/15	10/25GbE	Pure Storage FlashArray//X CT0	Eth 4
	Eth 1/16	10/25GbE	Pure Storage FlashArray//X CT1	Eth 4
	Eth 1/35	10GbE	Cisco N9K-B (peer-link)	Eth 1/35
	Eth 1/36	10GbE	Cisco N9K-B (peer-link)	Eth 1/36
	MGMT	1GbE	Customer’s Management Switch	Eth 1/23

Table 6. Cisco Nexus-B 93180YC-FX Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
Nexus 93180YC-FX-B	Eth 1/47	25GbE	Cisco UCS FI-A	Eth 1/48
	Eth 1/48	25GbE	Cisco UCS FI-B	Eth 1/48
	Eth 1/9	40GbE	Cisco N9K-Mgmt-A	Eth 1/50
	Eth 1/11	40GbE	Cisco N9K-Mgmt-B	Eth 1/50
	Eth 1/15	10/25GbE	Pure Storage FlashArray//X CT0	Eth 5
	Eth 1/16	10/25GbE	Pure Storage FlashArray//X CT1	Eth 5
	Eth 1/35	10GbE	Cisco N9K-B (peer-link)	Eth 1/35
	Eth 1/36	10GbE	Cisco N9K-B (peer-link)	Eth 1/36
	MGMT	1GbE	Customer’s Management Switch	Any

Use Twinax cables for the iSCSI port ethernet connectivity from the FlashArray//X to the Nx93180YC-FX to provide the HANA shared filesystem access.

Table 7. Cisco UCS Fabric Interconnect A Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
Cisco 6454 Fabric Inter-	fc 1/1	FC uplink	Cisco MDS-A 9148T	fc 1/17

Local Device	Local Port	Connection	Remote Device	Remote Port
connect A	fc 1/2	FC uplink		fc 1/18
	fc 1/3	FC uplink		fc 1/19
	fc 1/4	FC uplink		fc 1/20
	Eth 1/17	25GbE	Cisco UCS 5108 - IOM-A 2408	1/1
	Eth 1/18	25GbE		1/2
	Eth 1/19	25GbE		1/3
	Eth 1/20	25GbE		1/4
	Eth 1/47	25GbE	Cisco Nexus 93180YC-FX-A	Eth 1/47
	Eth 1/48	25GbE	Cisco Nexus 93180YC-FX-B	Eth 1/47
	L1	GbE	Cisco UCS FI-B	L1
	L2	GbE	Cisco UCS FI-B	L2
	MGMT	1GbE	Customer's Management Switch	Any

Table 8. Cisco UCS Fabric Interconnect B Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
Cisco Fabric Interconnect B	fc 1/1	FC uplink	Cisco MDS-B 9148T	fc 1/17
	fc 1/2	FC uplink		fc 1/18
	fc 1/3	FC uplink		fc 1/19
	fc 1/4	FC uplink		fc 1/20
	Eth 1/17	40GbE	Cisco UCS 5108 - IOM-B 2408	2/1
	Eth 1/18	40GbE		2/2
	Eth 1/19	10GbE		2/3
	Eth 1/20	10GbE		2/4
	Eth 1/47	25GbE	Cisco Nexus 93180YC-FX-A	Eth 1/48
	Eth 1/48	25GbE	Cisco Nexus 93180YC-FX-B	Eth 1/48
	L1	GbE	Cisco UCS FI-A	L1
	L2	GbE	Cisco UCS FI-A	L2
	MGMT	1GbE	Customer's Management Switch	Any

Table 9. Cisco MDS-A 9148T Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
MDS-A 9148T	fc 1/17	32GbE	Cisco UCS FI-A	fc 1/1
	fc 1/18	32GbE		fc 1/2
	fc 1/19	32GbE		fc 1/3
	fc 1/20	32GbE		fc 1/4
	fc 1/29	16/32GbE	Pure Storage FlashArray//X CT0	CT0.FC0
	fc 1/30	16/32GbE	Pure Storage FlashArray//X CT1	CT1.FC0
	fc 1/31	16/32GbE	Pure Storage FlashArray//X CT0	CT0.FC2
	fc 1/32	16/32GbE	Pure Storage FlashArray//X CT1	CT1.FC2
	MGMT	1GbE	Customer’s Management Switch	Any

Table 10. Cisco MDS-B 9148T Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
MDS-B 9148T	fc 1/17	32GbE	Cisco UCS FI-A	fc 1/1
	fc 1/18	32GbE		fc 1/2
	fc 1/19	32GbE		fc 1/3
	fc 1/20	32GbE		fc 1/4
	fc 1/29	16/32GbE	Pure Storage FlashArray//X CT0	CT0.FC0
	fc 1/30	16/32GbE	Pure Storage FlashArray//X CT1	CT1.FC0
	fc 1/31	16/32GbE	Pure Storage FlashArray//X CT0	CT0.FC2
	fc 1/32	16/32GbE	Pure Storage FlashArray//X CT1	CT1.FC2
	MGMT	1GbE	Customer’s Management Switch	Any

Table 11. Pure Storage FlashArray//X 50 R3 Device Cabling

Local Device	Local Port	Connection	Remote Device	Remote Port
FlashArray//X 50 R3	CT0.FC0	16/32GbE	Cisco MDS-A 9148T	fc 1/29
	CT1.FC0	16/32GbE		fc 1/30
	CT0.FC2	16/32GbE		fc 1/31

Local Device	Local Port	Connection	Remote Device	Remote Port
	CT1.FC2	16/32GbE		fc 1/32
	CT0.FC1	16/32GbE	Cisco MDS-B 9148T	fc 1/29
	CT1.FC1	16/32GbE		fc 1/30
	CT0.FC3	16/32GbE		fc 1/31
	CT1.FC3	16/32GbE		fc 1/32
	CT0 eth4	10/25GbE	Nexus 93180YC-FX-A	Eth 1/15
	CT0 eth5	10/25GbE	Nexus 93180YC-FX-B	Eth 1/15
	CT1 eth4	10/25GbE	Nexus 93180YC-FX-A	Eth 1/16
	CT1 eth5	10/25GbE	Nexus 93180YC-FX-B	Eth 1/16

Solution components and Software Revisions

The following tables list the components and software revisions validated for the FlashStack for SAP HANA TDI deployment.

Table 12. Inventory and Bill of Material of the Validation Setup

Vendor	Name	Version/Model	Description	Quantity
Cisco	Cisco Nexus 93180YC Switch	N9K-C93180YC-FX	Cisco Nexus 9300 Series Switches	2
Cisco	Cisco MDS 9148T 32GB Multilayer Switch	DS-C9148T-K9	Cisco MDS 9100 Series Multilayer Fabric Switches	2
Cisco	Cisco UCS 6454 Fabric Interconnect	UCS-FI-6454	Cisco 6400 Series Fabric Interconnects	2
Cisco	Cisco UCS Fabric Extender	UCS-IOM-2408	Cisco UCS 2408 I/O Module (8x 25GB External, 32x 10GB Internal)	4
Cisco	Cisco UCS B480 M5 blade servers	UCSB-B480-M5	Cisco UCS B-Series Blade Servers	4
Cisco	Cisco UCS VIC 1440 mLom	UCSB-MLOM-40G-04	Cisco UCS VIC 1400 PCIE adapters for blade servers	4
Cisco	Cisco UCS VIC 1480	UCSB-VIC-M84-4P	Cisco UCS VIC 1400 PCIE adapters for blade servers	4
Pure Storage	FlashArray//X	FlashArray//X50 R3	Pure Storage FlashArray//X	1

Table 13. Hardware and Software Component Versions of the Validated Setup

Vendor	Product	Version
Cisco	Cisco UCSM	4.1(1c)
Cisco	Cisco UCS 6454	7.0(3)N2(4.11b)
Cisco	Cisco UCS B-Series M5 Servers	4.1(1c)
Cisco	Cisco Nexus 93180YC Switches	9.2(1)
Cisco	Cisco MDS 9148T 32GB	8.3(1)
Pure Storage	Purity//FA	5.3.8
SUSE	SUSE Linux Enterprise Server for SAP Applications	15 SP1
RHEL	Red Hat Enterprise Linux for SAP Solutions	8.1

Considerations

This FlashStack design guide aims for SAP HANA TDI installations. Nevertheless, the same FlashStack architecture can handle other application workloads in parallel.

Although this is the base design, each of the components whether switching, compute or storage scale easily to support specific business requirements. Additional servers or even blade chassis increase compute capacity without introducing additional network components.

Performance

The solution is designed to meet SAP HANA TDI performance requirements defined by SAP SE. All data traffic between SAP HANA nodes is handled by the UCS Fabric Interconnect. Each HANA Server is equipped with a minimum of 4 x 10GbE capable Cisco Virtual Interface Card, the storage network provides dedicated bandwidth between SAP HANA servers and the FlashArray//X. For HANA node-to-node network, 10 GB dedicated network bandwidth is provided with non-blocking mode.

All FlashStack components are capable to operate end-to-end with 32GB Fibre channel and meet the SAP HANA TDI performance requirements already with 16GB Fibre channel connectivity.

Cisco Hardware Configuration

Some hardware components like the Cisco UCS Fabric Interconnects or Cisco UCS B-Series blade servers are configured similarly. This document details steps for provisioning multiple Cisco UCS hosts which are identified sequentially, like:

```
HANA-Server0{1 | 2}.
```

Angle brackets (<>) indicate a character string that the user needs to enter like a variable pertinent to the customer environment or a password.

All physical hardware needs to be racked according to their specific hardware installation guides. This deployment guides assumes the cabling is complete and based on the physical cabling detailed in the Technology Overview chapter. All hardware is powered off prior of starting the initial configuration.

Cisco Nexus 9000 Series Switch Network Configuration

This section provides a detailed procedure to configure the Cisco Nexus 9000 Switches part of the FlashStack environment. The configuration steps are based on above cabling plan. If systems are connected on different ports, configure the switches accordingly following the guidelines described in this section.

Ensure the physical hardware installation and cabling is complete before you continue. First create a local management connection through a console terminal to perform the initial configuration and to configure a switch IP address. Second configure the required features and virtual local area networks (VLANs) according to the device cabling documentation.

Connect to the serial or console port of the Nexus switch. The NX-OS setup will automatically start and attempt to enter power on auto provisioning after initial boot.

Cisco Nexus Initial Configuration

To perform the initial Cisco Nexus switch configuration, follow these steps. Keep all settings on default if not listed otherwise.

1. Connect to the Nexus A console port and press the spacebar:

- Would you like to enter the basic configuration dialog (yes/no): yes
- Enter the switch name : <var_nexus_A_hostname>
- Continue with Out-of-band (mgmt0) management configuration? (yes/no) [y]:
- Mgmt0 IPv4 address : <var_nexus_A_mgmt0_ip>
- Out of Band Mgmt0 IPv4 netmask : <var_oob_vlan_net>
- Configure the default gateway? (yes/no) [y]:
- IPv4 address of the default gateway : <var_oob_vlan_gw>
- Number of rsa key bits <1024-2048> [2048]: 1024
- Configure the ntp server? (yes/no) [n]: y

- NTP server IPv4 address : <var_global_ntp_server_ip>

2. The configuration wizard lists a configuration summary at the end. Review the summary and save it.

3. Connect to the Nexus B console port and press the spacebar:

- Would you like to enter the basic configuration dialog (yes/no): yes
- Enter the switch name : <var_nexus_B_hostname>
- Continue with Out-of-band (mgmt0) management configuration? (yes/no) [y]:
- Mgmt0 IPv4 address : <var_nexus_B_mgmt0_ip>
- Out of Band Mgmt0 IPv4 netmask : <var_oob_vlan_net>
- Configure the default gateway? (yes/no) [y]:
- IPv4 address of the default gateway : <var_oob_vlan_gw>
- Number of rsa key bits <1024-2048> [2048]: 1024
- Configure the ntp server? (yes/no) [n]: y
- NTP server IPv4 address : <var_global_ntp_server_ip>

4. The configuration wizard lists a configuration summary at the end. Review the summary and save it.

Enable Cisco Nexus 9000 Series Switch Features and Spanning-Tree

To enable the required features and set the default spanning tree behavior on both Nexus switches, run the following commands:

1. Run the following:

```
N9K-A|B# config terminal
```

2. Enable features:

```
N9K-A|B(config)# feature udld
N9K-A|B(config)# feature lacp
N9K-A|B(config)# feature vpc
N9K-A|B(config)# feature interface-vlan
N9K-A|B(config)# feature lldp
```

3. Set Spanning-Tree:

```
N9K-A|B(config)# spanning-tree port type network default
N9K-A|B(config)# spanning-tree port type edge bpduguard default
N9K-A|B(config)# spanning-tree port type edge bpdufilter default
```

4. Persist the configuration:

```
N9K-A|B(config)# copy run start
```

Create VLANs for SAP HANA Traffic

Separate network traffic using multiple VLANs for SAP Hana traffic. In Nexus configuration mode create VLANs depending on customer and HANA scenario requirements:

5. Use multiple VLANs for network traffic separation. Run the following commands in the Nexus configuration mode to create the VLANs:

```
N9K-A|B(config)# vlan <var_oob_vlan_id>
N9K-A|B(config-vlan)# name HANA-Node-Mgmt
N9K-A|B(config-vlan)# exit
```

6. Create additional VLANs using the same command syntax as shown above:

```
vlan <var_client_vlan_id> name HANA-Client
vlan <var_AppServer_vlan_id> name HANA-AppServer
vlan <var_datasource_vlan_id> name HANA-DataSource
vlan <var_backup_vlan_id> name HANA-Node-Backup>
```

7. Other SAP HANA scenarios like Scale-Out or SAP HANA System Replication can require additional VLANs:

```
vlan <var_nfs-shared_vlan_id> name HANA-NFSshared
vlan <var_internal_vlan_id> name HANA-Internode
vlan <var_replication_vlan_id> name HANA-System-Replication
```

Define the same VLAN ID for HANA-NFSshared and the management services network, that provides the Active Directory Services and DNS within the SAP landscape.

Virtual Port-Channel Domain Configuration

To configure the virtual port channel domain, follow these steps:

1. Run the following commands in the Nexus configuration mode to create the vPCs:

```
N9K-A(config)# vpc domain <var_nexus_vpc_domain_id>
```

2. Define a lower priority value to promote this Nexus as primary vPC peer:

```
N9K-A(config-vpc-domain)# role priority 10
```

3. Use the management interfaces on the supervisors to establish a keepalive link:

```
N9K-A(config-vpc-domain)# peer-keepalive destination <var_nexus_B_mgmt0_ip>
source <var_nexus_A_mgmt0_ip>
```

4. Enable the following features for this vPC domain:

```
N9K-A(config-vpc-domain)# peer-switch
N9K-A(config-vpc-domain)# delay restore 150
N9K-A(config-vpc-domain)# peer-gateway
N9K-A(config-vpc-domain)# auto-recovery
```

5. Complete the vPC configuration on the other Nexus switch:

```
N9K-B(config)# vpc domain <var_nexus_vpc_domain_id>
```

6. Define a higher priority value than on the other Nexus switch to promote this Nexus as secondary vPC peer:

```
N9K-B(config-vpc-domain)# role priority 20
```

7. Use the management interfaces on the supervisors to establish a keepalive link:

```
N9K-B(config-vpc-domain)# peer-keepalive destination <var_nexus_A_mgmt0_ip>
source <var_nexus_B_mgmt0_ip>
```

8. Enable the following features for this vPC domain:

```
N9K-B(config-vpc-domain)# peer-switch
N9K-B(config-vpc-domain)# delay restore 150
N9K-B(config-vpc-domain)# peer-gateway
N9K-B(config-vpc-domain)# auto-recovery
```

Network Interface Configuration for the vPC Peer Links

To configure the network interface for the vPC peer links, follow these steps:

1. Define a port description for the vPC peer interface:

```
N9K-A(config)# interface eth1/35
N9K-A(config)# description vPC peer <var_nexus_B_hostname>:1/35
N9K-A(config)# interface eth1/36
N9K-A(config)# description vPC peer <var_nexus_B_hostname>:1/36
```

2. Define a port description for the vPC peer links on the secondary Nexus:

```
N9K-B(config)# interface eth1/35
N9K-B(config)# description vPC peer <var_nexus_A_hostname>:1/35
N9K-B(config)# interface eth1/36
N9K-B(config)# description vPC peer <var_nexus_A_hostname>:1/36
```

Perform the following configuration steps on both Nexus switches.

3. Apply a port channel to both vPC peer links and bring the interfaces up:

```
N9K-A|B (config)# interface eth1/35-36
N9K-A|B (config-if-range)# channel-group 2 mode active
N9K-A|B (config-if-range)# no shutdown
```

4. Define a description for the port channel connecting to the other Nexus:

```
N9K-A|B (config)# interface Po2
N9K-A|B (config-if)# vPC peer-link
```

5. Make the port channel a switchport and configure a trunk to allow the HANA VLANs:

```
N9K-A|B (config-if)# switchport
N9K-A|B (config-if)# switchport mode trunk
N9K-A|B (config-if)# switchport trunk allowed vlan <var_oob_vlan_id>,
<var_client_vlan_id>, <var_appserver_vlan_id>, <var_datasource_vlan_id>,
<var_backup_vlan_id>, <var_nfs-shared_vlan_id>, <var_internal_vlan_id>,
<var_replication_vlan_id>
```

6. Make the port channel the vPC peer link and bring it up:

```
N9K-A|B(config-if)# spanning-tree port type network
N9K-A|B(config-if)# vpc peer-link
N9K-A|B(config-if)# no shutdown
```

Configure vPC with the Cisco UCS Fabric Interconnects

To configure vPC with the Cisco UCS FIs, follow these steps:

1. The different SAP HANA network zones will use the vPC for the admin, client, and internal network traffic. Verify the neighbors with the following command:

```
N9K-A|B# show cdp neighbors
```

2. Define a port description for the interfaces connecting to the fabric interconnect:

```
N9K-A(config)# interface eth1/47
N9K-A(config-if)# description <var_ucs_clustername>-A:1/47
N9K-A(config)# interface eth1/48
N9K-A(config-if)# description <var_ucs_clustername>-B:1/47
N9K-B(config)# interface eth1/47
N9K-B(config-if)# description <var_ucs_clustername>-A:1/48
N9K-B(config)# interface eth1/48
N9K-B(config-if)# description <var_ucs_clustername>-B:1/48
```

3. Apply the interfaces to a port channel and bring them up:

```
N9K-A|B(config)# interface eth1/47
N9K-A|B(config-if)# channel-group 21 mode active
N9K-A|B(config-if)# no shutdown
N9K-A|B(config)# interface eth1/48
N9K-A|B(config-if)# channel-group 22 mode active
N9K-A|B(config-if)# no shutdown
```

4. Define a port channel description for port channel 21 and configure it:

```
N9K-A|B(config)# interface Po21
N9K-A|B(config-if)# description <var_ucs_clustername>-A
```

5. Make the port channel a switchport and configure a trunk to allow the HANA VLANs:

```
N9K-A|B(config-if)# switchport
N9K-A|B(config-if)# switchport mode trunk
N9K-A|B(config-if)# switchport trunk allowed vlan <var_oob_vlan_id>,
<var_client_vlan_id>, <var_appserver_vlan_id>, <var_datasource_vlan_id>,
<var_internal_vlan_id>, <var_replication_vlan_id>
```

6. Associate interface spanning tree edge ports:

```
N9K-A|B(config-if)# spanning-tree port type edge trunk
```

7. Set MTU to support jumbo frames:

```
N9K-A|B(config-if)# mtu 9216
```

8. Make this a vPC port channel and bring it up:

```
N9K-A|B(config-if)# vpc 21
N9K-A|B(config-if)# no shutdown
```

9. Define a port channel description for port channel 22 and configure it:

```
N9K-A|B(config)# interface Po22
N9K-A|B(config-if)# description <var_ucs_clustername>-B
```

10. Make the port channel a switchport and configure a trunk to allow the HANA VLANs:

```
N9K-A|B(config-if)# switchport
N9K-A|B(config-if)# switchport mode trunk
N9K-A|B(config-if)# switchport trunk allowed vlan <var_oob_vlan_id>,
<var_client_vlan_id>, <var_appserver_vlan_id>, <var_datasource_vlan_id>,
<var_internal_vlan_id>, <var_replication_vlan_id>
```

11. Associate interface spanning tree edge ports:

```
N9K-A|B(config-if)# spanning-tree port type edge trunk
```

12. Set MTU to support jumbo frames:

```
N9K-A|B(config-if)# mtu 9216
```

13. Make this a vPC port channel and bring it up:

```
N9K-A|B(config-if)# vpc 22
N9K-A|B(config-if)# no shutdown
```

(Optional) Configure additional vPCs for exclusive usage by the storage zone network, SAP HANA node backup network, or the NFS network if this is used for backup purposes.

Configure Pure Storage FlashArray//X Connectivity

Purity//FAs run platform-based WFS configuration and enables NFS filesystem provisioning. It uses iSCSI ports on the array controllers for southbound connectivity to consumer nodes via the Nexus switches. The iSCSI ports work as uplink ports for the controller hosted Windows 2016 Server VMs configured as failover cluster. The iSCSI ports on the array side do not support LACP; they are configured as access ports with spanning-tree type edge.

To configure the ports that connect to Pure Storage FlashArray//X's iSCSI ports to provide IP connectivity to the NFS share for the SAP HANA Scale Out scenario, follow these steps:

1. Define a port description for the interface connecting to the iSCSI port eth 2 on array controller CT0.

```
N9K-A(config)# interface eth1/15
N9K-A(config-if)# description FlashArray-CT0-iscsi-eth2
```

2. Configure the access port and assign the NFS network VLAN ID.

```
N9K-A(config-if)# switchport access vlan <var_nfs-shared_vlan_id>
N9K-A(config-if)# spanning-tree port type edge
N9K-A(config-if)# no shutdown
```

3. Define a port description for the interface connecting to the iSCSI port eth 2 on array controller CT1.

```
N9K-A(config)# interface eth1/16
N9K-A(config-if)# description FlashArray-CT1-iscsi-eth2
```

4. Configure the access port and assign the NFS network VLAN ID.

```
N9K-A(config-if)# switchport access vlan <var_nfs-shared_vlan_id>
N9K-A(config-if)# spanning-tree port type edge
N9K-A(config-if)# no shutdown
```

5. Optionally, connect eth1/17 and eth1/18 to FlashArray interface eth 4 (PCI Port 2).

Perform the same configuration as above for N9K-B replacing the iSCSI port with eth 3, optionally eth 5.

6. Persist the configuration on both Nexus devices.

```
N9K-A|B# copy run start
```

Cisco MDS 9148T Switch Configuration

This section provides the configure procedure for the Cisco MDS 9100 Switches part of the FlashStack SAN environment. Figure 1. illustrates the connected MDS Switches to Fabric Interconnects and Pure Storage FlashArray//X and Table 9 and Table 10 provide the port information required for the configuration.

If systems are connected on different ports, configure the switches accordingly following the guidelines described in this section. Ensure the physical hardware installation and cabling is complete before you continue. First create a local management connection through a console terminal to perform the initial configuration and to configure a switch IP address. Second configure the required features and VLANs according to the device cabling documentation.

Cisco UCS needs to be configured for the FC ports connected to the Cisco UCS Fabric Interconnects to come up.

Cisco MDS Initial Configuration

To perform the initial Cisco MDS switch configuration, follow these steps. Keep all settings on default if not listed otherwise.

1. Connect to the MDS A console port and press the spacebar:

   - Enter the password for " admin" : <var_mgmt_passwd>
   - Confirm the password for " admin" : <var_mgmt_passwd>
   - Would you like to enter the basic configuration dialog (yes/no): yes
   - Configure read-only SNMP community string (yes/no) [n]: yes
   - SNMP community string :
   - Enter the switch name : <var_mds-A_hostname>
   - Mgmt0 IPv4 address : <var_mds-A_mgmt0_ip>
   - Out of Band Mgmt0 IPv4 netmask : <var_oob_vlan_net>

- IPv4 address of the default gateway : <var_oob_vlan_gw>
- Number of rsa key bits <768-2048> [1024]: 2048
- Configure the ntp server? (yes/no) [n]: y
- NTP server IPv4 address : <var_global_ntp_server_ip>
- Configure default switchport interface state (shut/noshut) [shut]: noshut
- Configure default switchport trunk mode (on/off/auto) [on]: auto
- Configure default switchport port mode F (yes/no) [n]: y

   a. The configuration wizard lists a configuration summary at the end. Review the summary and save it.

2. Connect to the MDS B console port and press the spacebar:

- Enter the password for " admin" : <var_mgmt_passwd>
- Confirm the password for " admin" : <var_mgmt_passwd>
- Would you like to enter the basic configuration dialog (yes/no): yes
- Configure read-only SNMP community string (yes/no) [n]: yes
- SNMP community string :
- Enter the switch name : <var_mds-B_hostname>
- Mgmt0 IPv4 address : <var_mds-B_mgmt0_ip>
- Out of Band Mgmt0 IPv4 netmask : <var_oob_vlan_net>
- IPv4 address of the default gateway : <var_oob_vlan_gw>
- Number of rsa key bits <768-2048> [1024]: 2048
- Configure the ntp server? (yes/no) [n]: y
- NTP server IPv4 address : <var_global_ntp_server_ip>
- Configure default switchport interface state (shut/noshut) [shut]: noshut
- Configure default switchport trunk mode (on/off/auto) [on]: auto
- Configure default switchport port mode F (yes/no) [n]: y

3. The configuration wizard lists a configuration summary at the end. Review the summary and save it.

Configure the Management Port and Enable Essential Features

To configure the management port and enable feature, follow these steps:

1. Enter the configuration mode and configure both MDS switches:

```
MDS-A|B# config terminal
```

2. Configure the management port:

```
MDS-A|B(config)# interface mgmt 0
```

```
MDS-A|B(config-if)# switchport speed 1000
MDS-A|B(config-if)# no shutdown
```

3. Enable features:

```
MDS-A|B(config)# feature fport-channel-trunk
MDS-A|B(config)# feature npiv
```

Create Port Channels and VSANs

To configure the fibre channel ports, follow these steps:

1. Create a Port Channel that will uplink to the Cisco UCS Fabric Interconnect on both 9148T MDS switches:

```
MDS-A(config)# interface port-channel <var_fc-pc_A_id>
MDS-B(config)# interface port-channel <var_fs-pc-B_id>
```

2. Create the VSAN to connect the Cisco UCS Fabric Interconnect and the Pure Storage FlashArray//X. Assign this VSAN to the interface which connects to the Pure Storage FlashArray//X, as well as the interfaces and the port channels connected to the Cisco Fabric Interconnect:

```
MDS-A(config)# vsan database
MDS-A(config-vsan-db)# vsan <var_san_A_id>
MDS-A(config-vsan-db)# vsan <var_san_A_id> int port-channel <var_fc-pc_A_id>
MDS-A(config-vsan-db)# vsan <var_san_A_id> int fc 1/29
MDS-A(config-vsan-db)# vsan <var_san_A_id> int fc 1/30
MDS-A(config-vsan-db)# vsan <var_san_A_id> int fc 1/31
MDS-A(config-vsan-db)# vsan <var_san_A_id> int fc 1/32
MDS-A(config-vsan-db)# interface fc 1/29-32
MDS-A(config-if)# no shut
```

3. Repeat the command on the Cisco 9148T MDS-B switch and use the fabric B appropriate VSAN ID:

```
MDS-B(config)# vsan database
MDS-B(config-vsan-db)# vsan <var_san_B_id>
MDS-B(config-vsan-db)# vsan <var_san_B_id> int port-channel <var_fc-pc_B_id>
MDS-B(config-vsan-db)# vsan <var_san_B_id> int fc 1/29
MDS-B(config-vsan-db)# vsan <var_san_B_id> int fc 1/30
MDS-B(config-vsan-db)# vsan <var_san_B_id> int fc 1/31
MDS-B(config-vsan-db)# vsan <var_san_B_id> int fc 1/32
MDS-B(config-vsan-db)# interface fc 1/29-32
MDS-B(config-if)# no shut
```

4. Configure the port channel and add the interfaces connecting to the Cisco Fabric Interconnect:

```
MDS-A(config)# interface port-channel <var_fc-pc-_A_id>
MDS-A(config-if)# channel mode active
MDS-A(config-if)# switchport mode F
MDS-A(config-if)# switchport trunk mode off
MDS-A(config-if)# switchport trunk allowed vsan <var_san_A_id>
MDS-A(config-if)# int fc1/17-20
MDS-A(config-if)# port-license acquire
MDS-A(config-if)# channel-group <var_fc-pc_A_id> force
MDS-A(config-if)# no shut
```

5. Repeat the commands on the Cisco 9148T MDS-B switch and use the fabric appropriate port channel:

```
MDS-B(config)# interface port-channel <var_fc-pc-_B_id>
MDS-B(config-if)# channel mode active
MDS-B(config-if)# switchport mode F
MDS-B(config-if)# switchport trunk mode off
MDS-B(config-if)# switchport trunk allowed vsan <var_san_B_id>
MDS-B(config-if)# int fc1/17-20
MDS-B(config-if)# port-license acquire
MDS-B(config-if)# channel-group <var_fc-pc_B_id> force
MDS-B(config-if)# no shut
```

Persist the Configuration

To persist the configuration, follow this step:

1. Save the configuration changes on both MDS switches:

```
MDS-A|B# copy run start
```

Cisco UCS Configuration Overview

It is beyond the scope of this document to explain the Cisco UCS infrastructure installation and connectivity. If you require additional information on specific configuration steps or options you might have review the Cisco UCS Manager Installation and Upgrade Guides.

High-Level Steps to Configure Cisco Unified Computing System

From a high-level perspective, the following steps are required to configure the Cisco UCS infrastructure and service profile templates:

1. Initial Fabric Interconnect configuration for a cluster setup.

2. Configure Fabric Interconnects for Chassis and Blade discovery.

3. Configure LAN and SAN in Cisco UCS Manager.

4. Configure UUDI, IP, MAC, WWNN and WWPN pools.

5. Configure vNIC and vHBA templates.

6. Configure ethernet uplink port-channels.

7. Create Service Profile templates.

Cisco Fabric Interconnect Initial Configuration

The first time you access a fabric interconnect in a Cisco UCS instance, a setup wizard prompts you for the following information required to configure the system.

To configure the initial Cisco Fabric Interconnect, follow these steps:

1. Perform the initial Cisco FI configuration. Keep all settings on default if not listed otherwise.

2. Connect to the FI-A console port and press space:

- Enter the setup mode; setup newly or restore from backup.(setup/restore)? setup
- You have chosen to setup a new fabric interconnect? Continue? (y/n): y
- Enter the password for " admin" : <var_password>
- Enter the same password for " admin" : <var_password>
- Is this fabric interconnect part of a cluster (select 'no' for standalone)? (yes/no) [n]: y
- Which switch fabric (A|B): A
- Enter the system name: <var_ucs_clustername>
- Physical switch Mgmt0 IPv4 address: <var_ucsa_mgmt_ip>
- Physical switch Mgmt0 IPv4 netmask: <var_oob_vlan_net>
- IPv4 address of the default gateway: <var_oob_vlan_gw>
- Cluster IPv4 address: <var_ucs_cluster_ip>
- Configure DNS Server IPv4 address? (yes/no) [no]: y
- DNS IPv4 address: <var_nameserver_ip>
- Configure the default domain name? y
- Default domain name: <var_dns_domain_name>

3. The configuration wizard lists a configuration summary at the end. Review the summary and save it.

4. Connect to the FI-B console port and press the spacebar:

```
Enter the configuration method: console
Installer had detected the presence of a peer Fabric interconnect. This Fabric
interconnect will be added to the cluster. Do you want to continue {y|n} y
Enter the admin password for the peer fabric interconnect: <var_password>
Physical switch Mgmt0 IPv4 address: <var_ucsb_mgmt_ip>
Apply and save the configuration (select ‘no’ if you want to re-enter)? (yes/no):
y
```

5. Wait for the login prompt to make sure that the configuration has been saved.

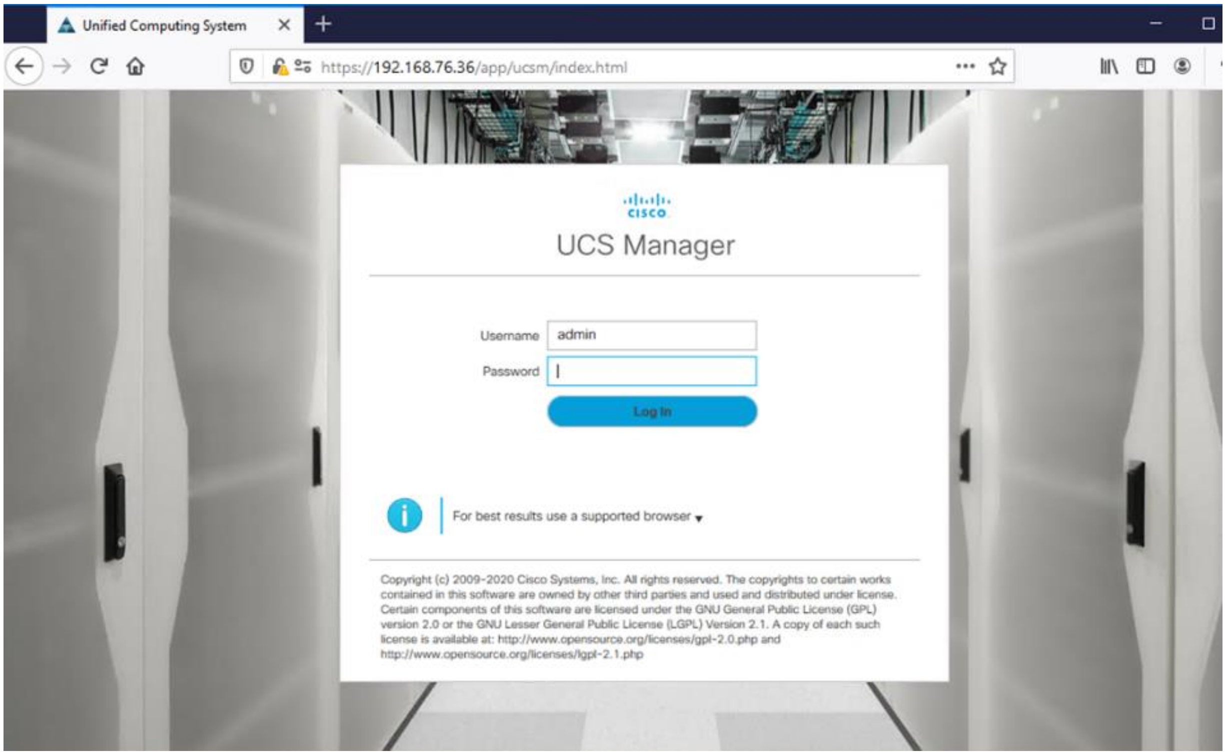
Cisco UCS Manager

With the Fabric Interconnects configured continue the configuration from the web frontend of the Cisco UCS Manager. To access the frontend, follow these steps:

1. Open a web browser and navigate to the FI cluster address https://<var_ucs_cluster_ip>

2. Click Launch UCS Manager (accept the security certificate warning if prompted)

3. Enter the username “admin” and the Cisco UCS admin password <var_password> before you click Log In.



https://192.168.76.36/app/ucsm/index.html

Username admin

Password

For best results use a supported browser ▾

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Chassis Discovery Policy

To modify the discovery policy to enable discovery of the Cisco UCS B-Series chassis and the Cisco UCS C-Series server connectivity, follow these steps:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane and select Equipment in the list on the left.

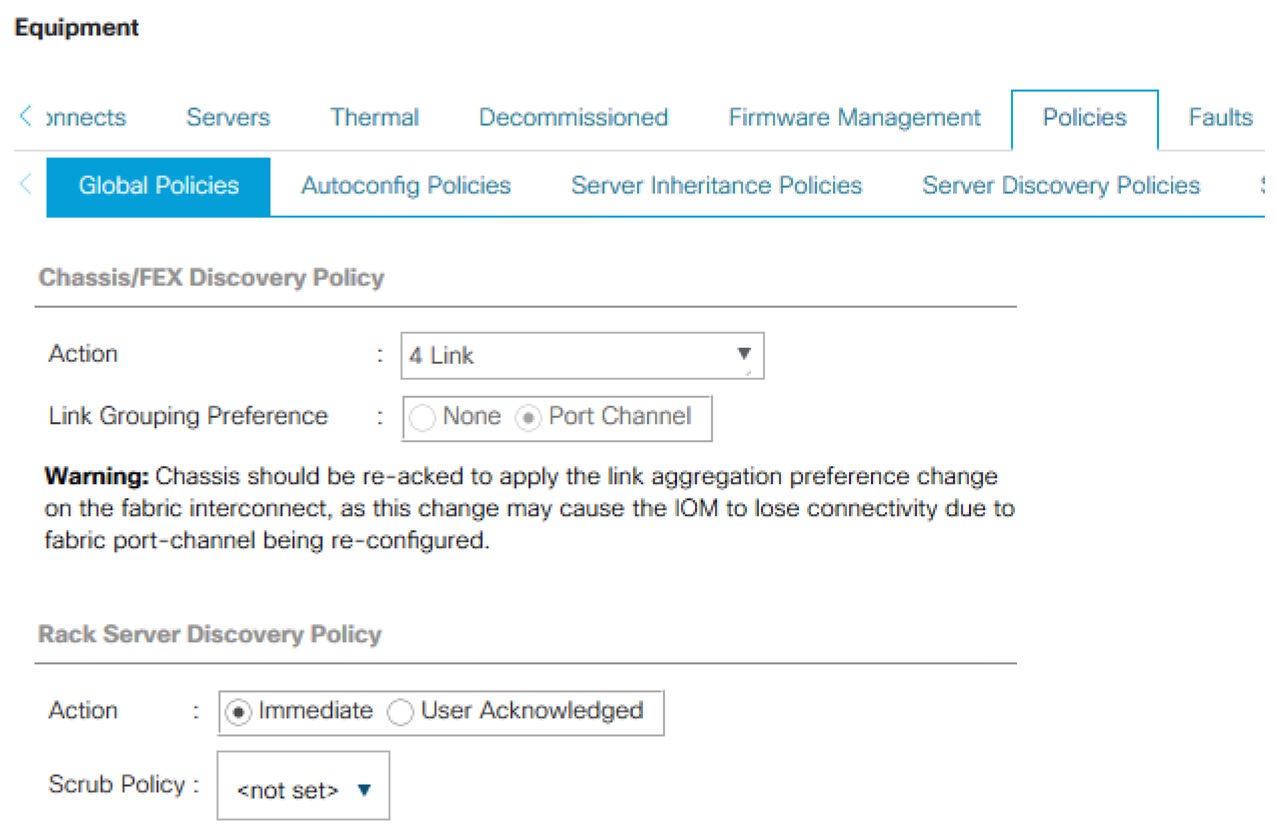
2. In the right pane, click the Policies tab.

3. Under Global Policies, set the Chassis/FEX Discovery Policy to match the number of uplink ports that are cabled between the chassis or fabric extenders (FEXes) and the fabric interconnects. Keep the port channel default for Link Grouping Preference.

4. Under Rack Server Discovery Policy change the action to Immediate.

5. Click Save Changes.

6. Click OK.



Chassis/FEX Discovery Policy

Action : 4 Link ▼

Link Grouping Preference : ○ None ● Port Channel

Warning: Chassis should be re-acked to apply the link aggregation preference change on the fabric interconnect, as this change may cause the IOM to lose connectivity due to fabric port-channel being re-configured.

Rack Server Discovery Policy

Action : ● Immediate ○ User Acknowledged

Scrub Policy : <not set> ▼

Configure Server Ports

To enable server and uplink ports, follow these steps on both Fabric Interconnects:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

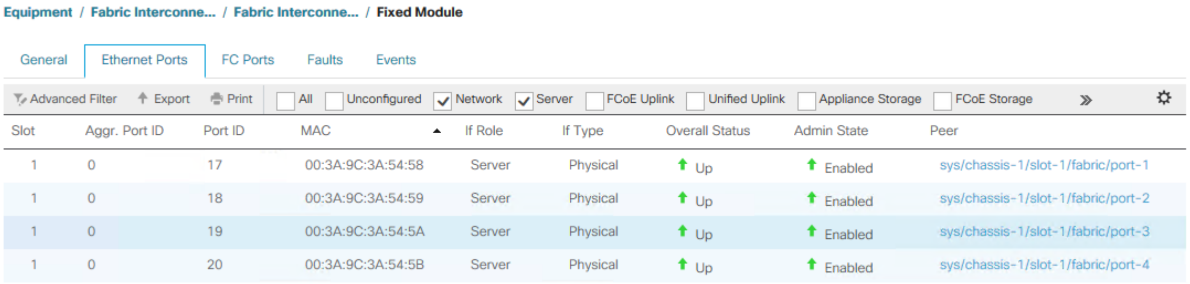
2. Select Equipment > Fabric Interconnects > Fabric Interconnect A|B (primary | subordinate) > Fixed Module.

3. Go to the Ethernet Ports tabulator.

4. Select the ports that are connected to the chassis and / or to the Cisco C-Series Server (two per FI), right-click them, and select Configure as Server Port.

5. Click Yes to confirm server ports and click OK.

6. Verify that the ports connected to the chassis and / or to the Cisco C-Series Server are now configured as server ports.



Equipment / Fabric Interconne... / Fabric Interconne... / Fixed Module

General | Ethernet Ports | FC Ports | Faults | Events

Advanced Filter | Export | Print | □ All □ Unconfigured ☑ Network ☑ Server □ FCoE Uplink □ Unified Uplink □ Appliance Storage □ FCoE Storage

Slot	Aggr. Port ID	Port ID	MAC	If Role	If Type	Overall Status	Admin State	Peer
1	0	17	00:3A:9C:3A:54:58	Server	Physical	↑ Up	↑ Enabled	sys/chassis-1/slot-1/fabric/port-1
1	0	18	00:3A:9C:3A:54:59	Server	Physical	↑ Up	↑ Enabled	sys/chassis-1/slot-1/fabric/port-2
1	0	19	00:3A:9C:3A:54:5A	Server	Physical	↑ Up	↑ Enabled	sys/chassis-1/slot-1/fabric/port-3
1	0	20	00:3A:9C:3A:54:5B	Server	Physical	↑ Up	↑ Enabled	sys/chassis-1/slot-1/fabric/port-4

Configure Ethernet Uplink Ports

To configure the ethernet uplink ports, follow these steps on both Fabric Interconnects:

Select ports in the range 49-54 for 40/100GE Uplink Port connectivity.

1. Configure the ports connected to the N9Ks Ethernet Uplink Ports. The port range 17-48 provides 10/25GE uplink connectivity.

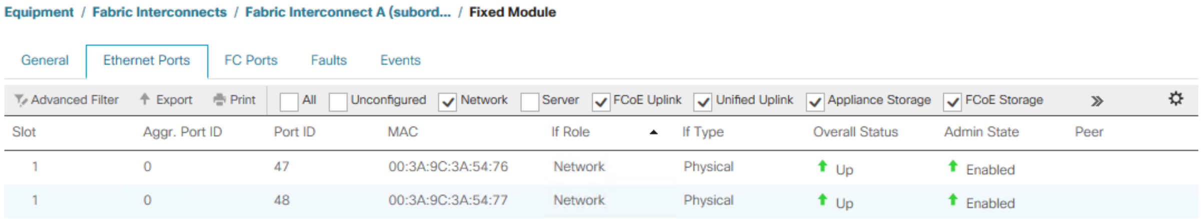
2. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

3. Select Equipment > Fabric Interconnects > Fabric Interconnect A|B (primary | subordinate) > Fixed Module.

4. Go to the Ethernet Ports tabulator.

5. Select ports that are connected to the Cisco Nexus switches, right-click them, and select Configure as Uplink Port.

6. Click Yes to confirm uplink ports and click OK.



Equipment / Fabric Interconnects / Fabric Interconnect A (subord... / Fixed Module

General | Ethernet Ports | FC Ports | Faults | Events

Advanced Filter | Export | Print | □ All □ Unconfigured ☑ Network □ Server ☑ FCoE Uplink ☑ Unified Uplink ☑ Appliance Storage ☑ FCoE Storage

Slot	Aggr. Port ID	Port ID	MAC	If Role	If Type	Overall Status	Admin State	Peer
1	0	47	00:3A:9C:3A:54:76	Network	Physical	↑ Up	↑ Enabled	
1	0	48	00:3A:9C:3A:54:77	Network	Physical	↑ Up	↑ Enabled	

Configure FC SAN Connectivity

Enable FlashStack for volume provisioning used by the FlashStack UCS hosts to boot from Fibre Channel LUNs and used as application data volumes.

Configure Unified Ports

The Configure Unified Ports wizard allows you to change the port mode from Ethernet to Fibre Channel. Create the first set of ports from the left, for example ports 1-4 of the fixed module for Fibre Channel. Each of the other ports can be an Ethernet Uplink Port to the Nexus switches.

While configuring the Fixed Module Ports, the slider bar movement enables sets of ports from the left of the module as FC ports. The remainder is available for Ethernet Uplinks. This step used 4 ports for uplink to MDS, it is sufficient to configure first set of 8 ports as FC ports.

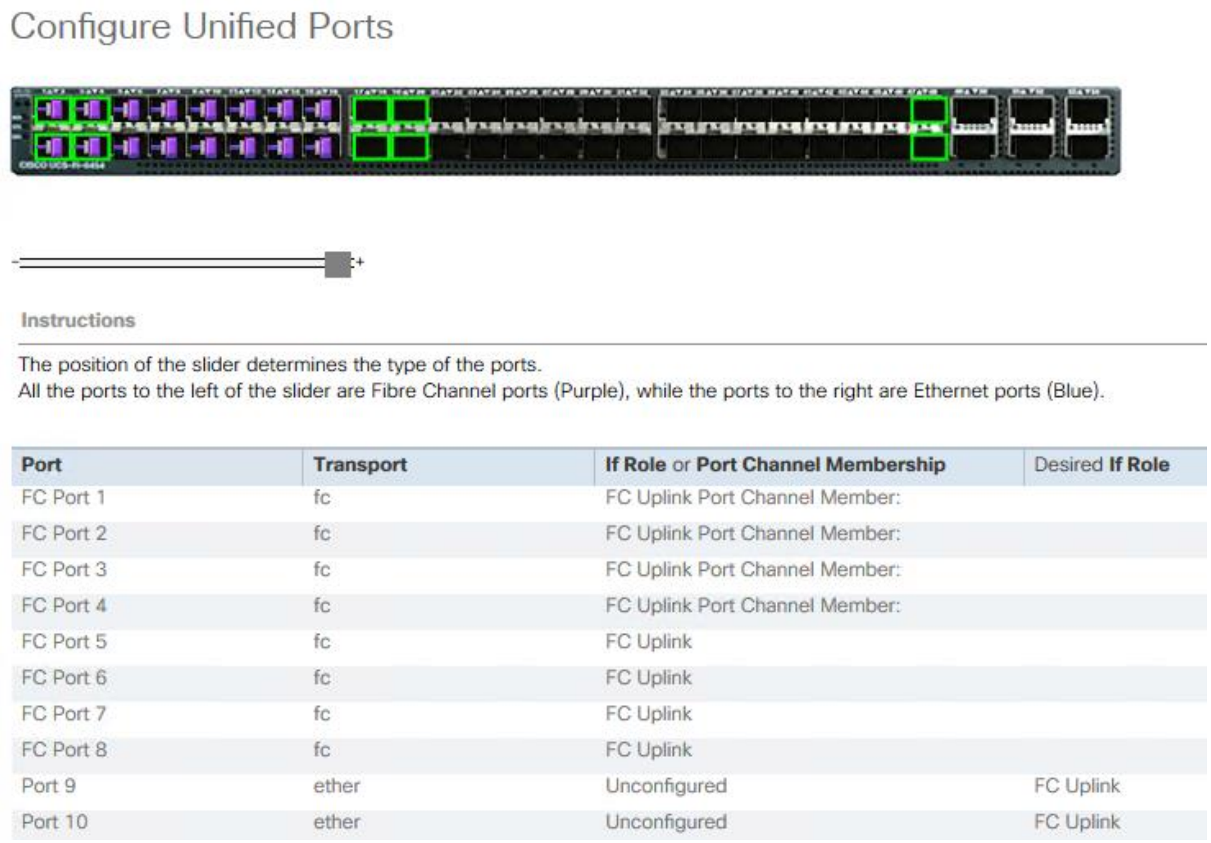
Follow these steps on both Fabric Interconnects:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

2. Select Equipment > Fabric Interconnects > Fabric Interconnect A|B (primary | subordinate)

3. In the right pane General tab scroll to Actions and select Configure Unified Ports. Confirm the warning,

4. Move the slider bar to right to enable the first set of 8 ports for FC Uplink Role. Click OK.



Configure Unified Ports

Instructions

The position of the slider determines the type of the ports.
All the ports to the left of the slider are Fibre Channel ports (Purple), while the ports to the right are Ethernet ports (Blue).

Port	Transport	If Role or Port Channel Membership	Desired If Role
FC Port 1	fc	FC Uplink Port Channel Member:	
FC Port 2	fc	FC Uplink Port Channel Member:	
FC Port 3	fc	FC Uplink Port Channel Member:	
FC Port 4	fc	FC Uplink Port Channel Member:	
FC Port 5	fc	FC Uplink	
FC Port 6	fc	FC Uplink	
FC Port 7	fc	FC Uplink	
FC Port 8	fc	FC Uplink	
Port 9	ether	Unconfigured	FC Uplink
Port 10	ether	Unconfigured	FC Uplink

A change to the fixed module requires a reboot of the Fabric Interconnects. To reboot the FIs, follow these steps:

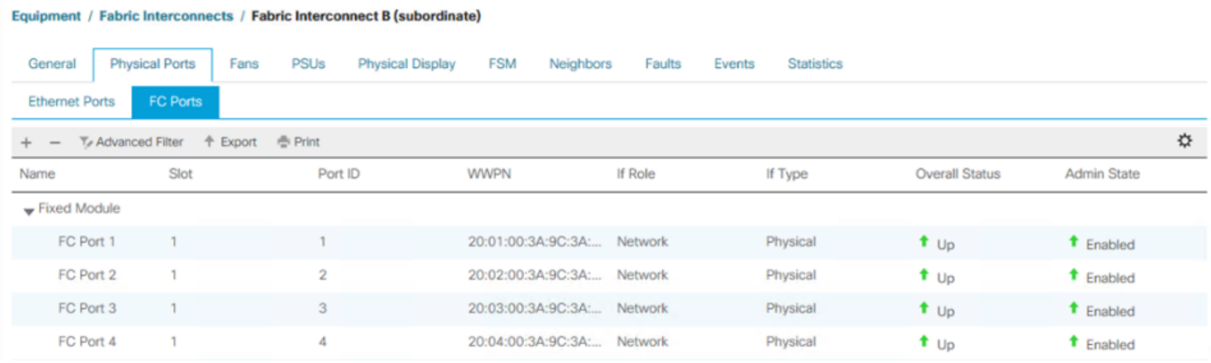
1. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

2. Select Equipment > Fabric Interconnects > Fabric Interconnect A|B (primary | subordinate)

3. Expand the FC ports.

4. Select the ports connected to the Cisco MDS switch, right-click them and select Enable

5. Click Yes to confirm to enable the ports and click OK.



Name	Slot	Port ID	WWPN	If Role	If Type	Overall Status	Admin State
Fixed Module							
FC Port 1	1	1	20:01:00:3A:9C:3A:...	Network	Physical	↑ Up	↑ Enabled
FC Port 2	1	2	20:02:00:3A:9C:3A:...	Network	Physical	↑ Up	↑ Enabled
FC Port 3	1	3	20:03:00:3A:9C:3A:...	Network	Physical	↑ Up	↑ Enabled
FC Port 4	1	4	20:04:00:3A:9C:3A:...	Network	Physical	↑ Up	↑ Enabled

SAN Configuration

VSAN is a security mechanism for storage which can be compared to VLANs for the networks.

The storage connectivity is achieved through northbound Cisco MDS Fabric Switches. It is important to note that physical northbound storage connectivity does not support vPCs like LAN connectivity does and it is required to connect FI-A via MDS-A and FI-B via MDS-B towards the FlashArray//X. Fabric Interconnects do not cross connect with MDS switches.

Port channel configuration to combine multiple storage FC uplink ports to provide physical link redundancy is possible.

To configure VSAN, follow these steps:

1. In Cisco UCS Manager, click the SAN tab in the navigation pane.

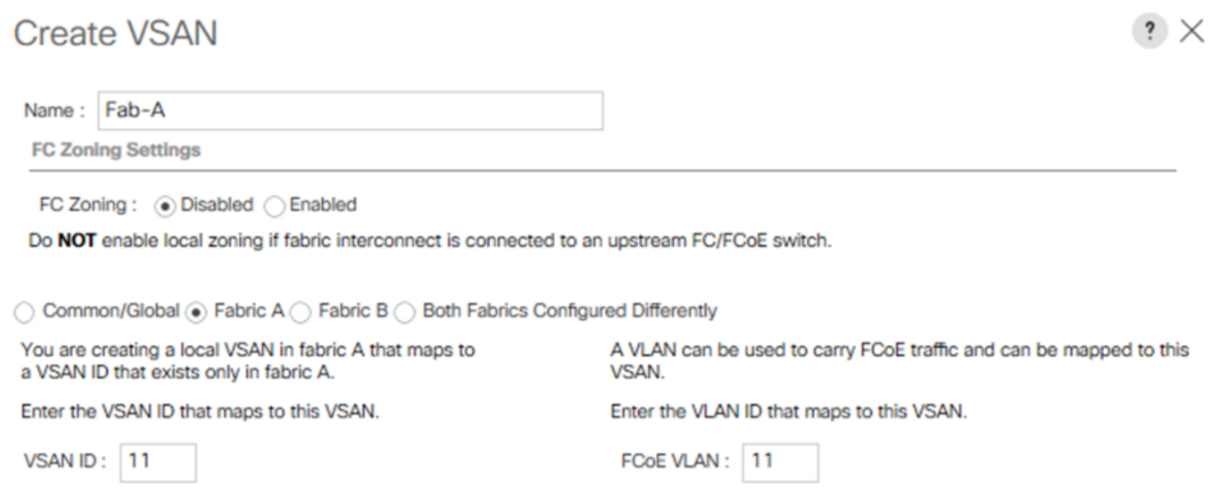
2. Select SAN > SAN Cloud > VSANs.

3. Right-click VSANs and select Create VSAN.

4. Enter Fab-A as the name of the VSAN to be used for Fabric-A.

5. Retain 'Disabled' for FC Zoning option and select Fabric A. Enter VSAN ID <var_san_A_id> which maps to the VSAN on MDS-A. Use the same value for FCOE VLAN ID.

6. Click OK and then click OK again.



Name : Fab-A

FC Zoning Settings

FC Zoning : ● Disabled ○ Enabled

Do **NOT** enable local zoning if fabric interconnect is connected to an upstream FC/FCoE switch.

○ Common/Global ● Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating a local VSAN in fabric A that maps to a VSAN ID that exists only in fabric A.

Enter the VSAN ID that maps to this VSAN.

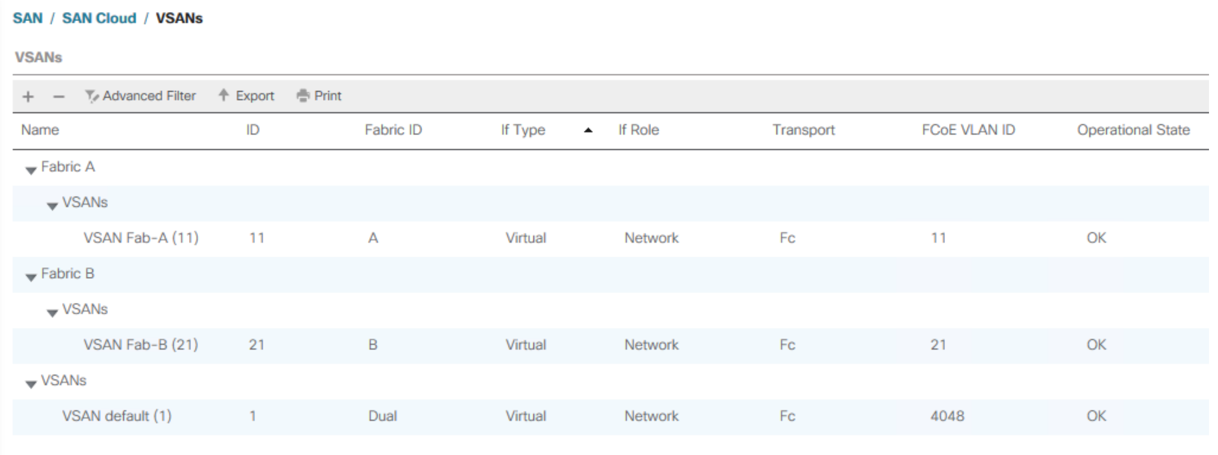
VSAN ID : 11

A VLAN can be used to carry FCoE traffic and can be mapped to this VSAN.

Enter the VLAN ID that maps to this VSAN.

FCoE VLAN : 11

7. Repeat steps 1 – 6 to create VSAN Fab-B and use VSAN ID <var_san_B_id> which maps to the VSAN on MDS-B.



Name	ID	Fabric ID	If Type	If Role	Transport	FCoE VLAN ID	Operational State
Fabric A							
VSANs							
VSAN Fab-A (11)	11	A	Virtual	Network	Fc	11	OK
Fabric B							
VSANs							
VSAN Fab-B (21)	21	B	Virtual	Network	Fc	21	OK
VSANs							
VSAN default (1)	1	Dual	Virtual	Network	Fc	4048	OK

Create FC Port Channels

Configure the FC uplinks from the Fabric Interconnects towards the Cisco MDS fabric switches. A port channel bundles the interfaces into a group to provide increased bandwidth and redundancy and load balance the VSAN traffic. The port channel pair has corresponding F-port-channel-trunks defined on the MDS switches to allow the fabric logins from N Port Virtualization (NPV) enabled Fabric Interconnects. This provides non-disruptive re-dundancy should individual member links fail.

To configure the necessary port channels out of the Cisco UCS environment, follow these steps:

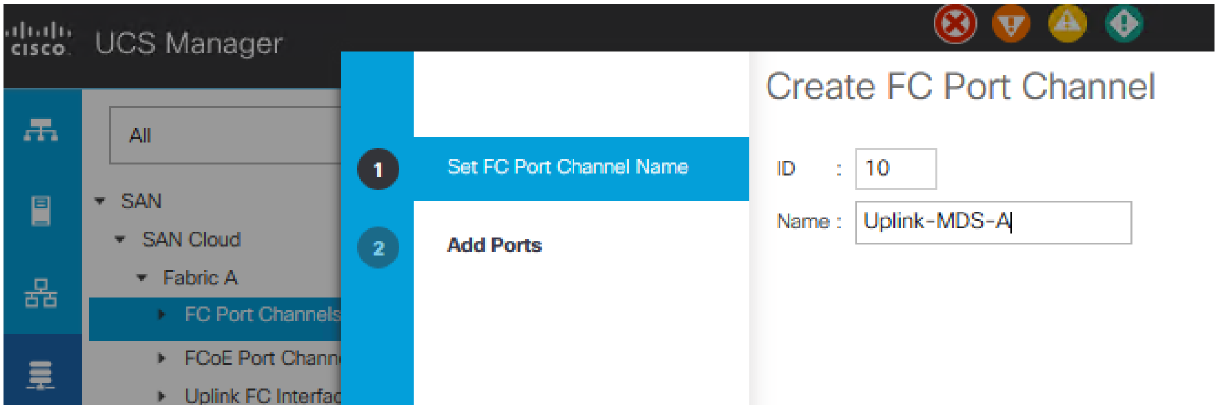
1. In Cisco UCS Manager, click the SAN tab in the navigation pane.

2. Under SAN > SAN Cloud, expand the Fabric A tree.

3. Right-click FC Port Channels.

4. Select Create FC Port Channel.

5. Enter the unique ID 10 and FC port channel name Uplink-MDS-A. Click Next.



Create FC Port Channel

ID : 10

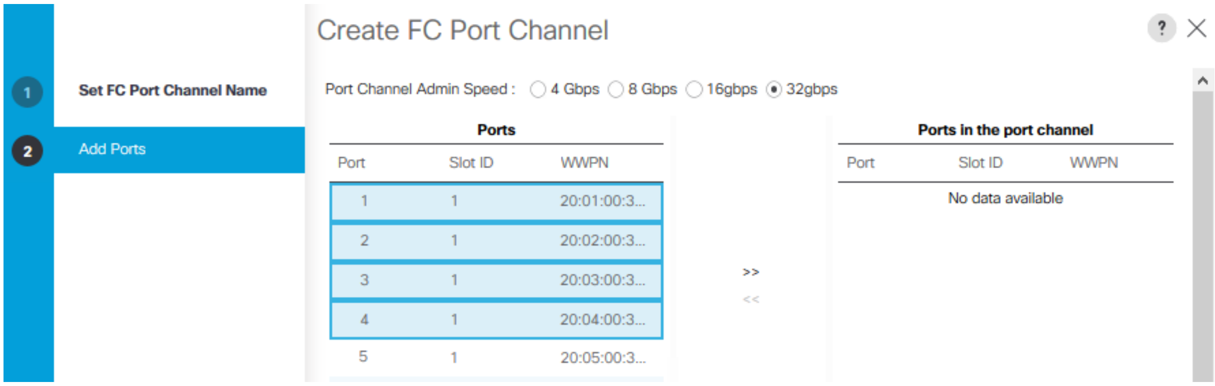
Name : Uplink-MDS-A

6. Set Port Channel Admin Speed to 16gbps. Select the following ports to be added to the port channel:

- Slot ID 1 and port 1
- Slot ID 1 and port 2
- Slot ID 1 and port 3
- Slot ID 1 and port 4

The selected port channel admin speed and ports is based on Uplink Port connectivity and device cabling in this lab setup and might deviate in your data center configuration.

7. Click the >> symbol to add the ports to the FC port channel.



Create FC Port Channel

Port Channel Admin Speed : ○ 4 Gbps ○ 8 Gbps ○ 16gbps ● 32gbps

Ports

Port	Slot ID	WWPN
1	1	20:01:00:3...
2	1	20:02:00:3...
3	1	20:03:00:3...
4	1	20:04:00:3...
5	1	20:05:00:3...

Ports in the port channel

Port	Slot ID	WWPN

No data available

8. To create the port channel, click Finish.

9. Click OK

10. Under SAN > SAN Cloud, expand the Fabric B tree.

11. Right-click FC Port Channels.

12. Select Create FC Port Channel.

13. Enter the unique ID 20 and FC port channel name Uplink-MDS-B. Click Next.

14. Set Port Channel Admin Speed to 16gbps. Select the following ports to be added to the port channel:

    - Slot ID 1 and port 1
    - Slot ID 1 and port 2
    - Slot ID 1 and port 3
    - Slot ID 1 and port 4

The selected port channel admin speed and ports is based on Uplink Port connectivity and device cabling in this lab setup and might deviate in your data center configuration.

15. Click the >> symbol to add the ports to the FC port channel

16. To create the port channel, click Finish.

17. Click OK.

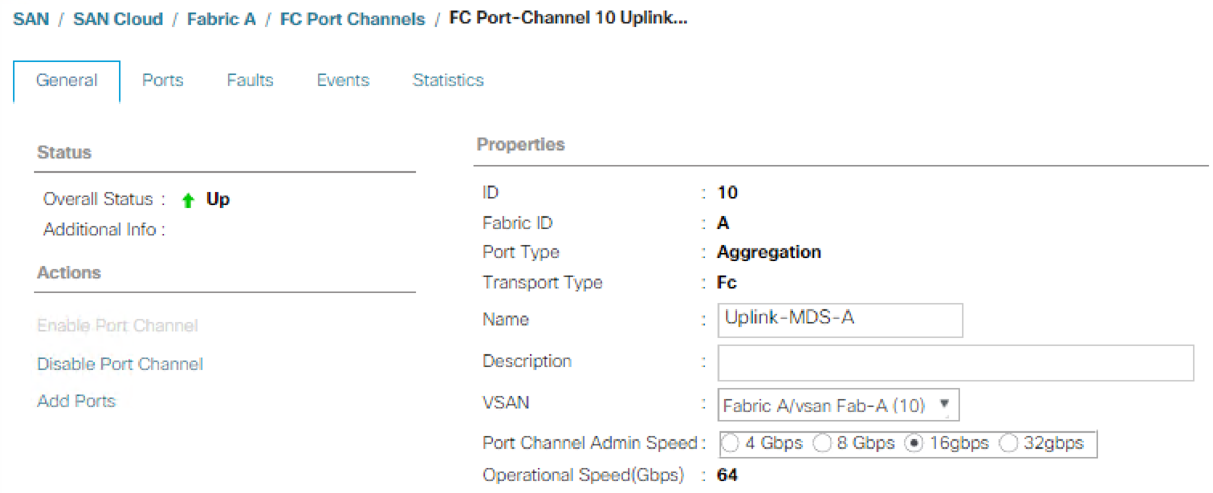
Assign Respective Fabric FC Channels to the VSANs

To assign the fc port channels to respective fabric VSAN just created, follow these steps:

1. In Cisco UCS Manager, click the SAN tab > SAN Cloud > Fabric A > FC Port Channels.

2. Select FC Port-Channel 10 Uplink-MDS-A

3. On the right pane, change the VSAN information from default (1) to Fab-A VSAN 10 created for Fabric-A.



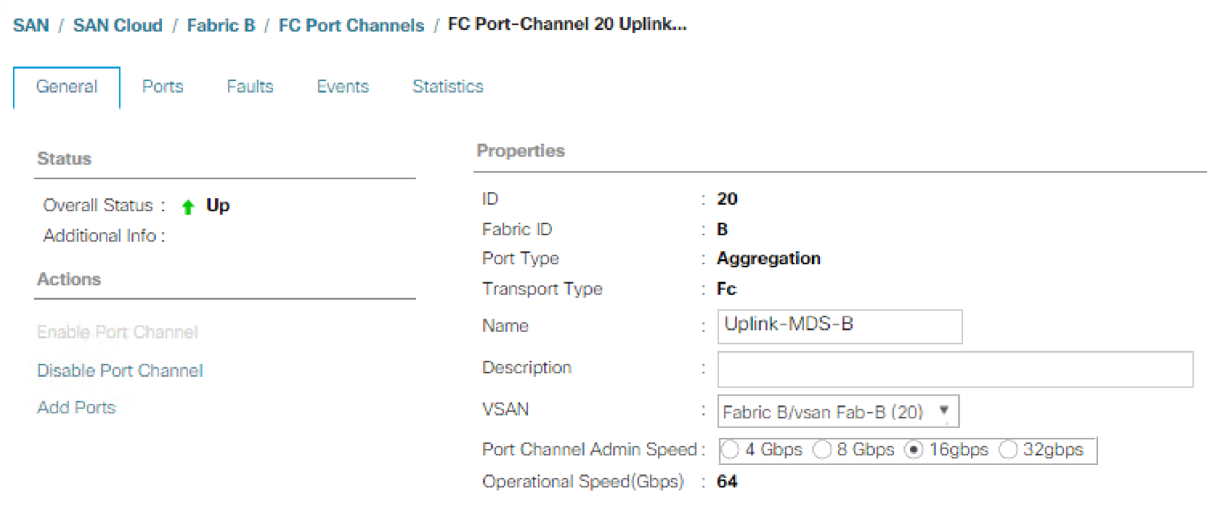
Overall Status : Up
Additional Info :

ID : 10
Fabric ID : A
Port Type : Aggregation
Transport Type : Fc
Name : Uplink-MDS-A
Description :
VSAN : Fabric A/vsan Fab-A (10)
Port Channel Admin Speed : ○ 4 Gbps ○ 8 Gbps ● 16gbps ○ 32gbps
Operational Speed(Gbps) : 64

4. Click the SAN tab > SAN Cloud > Fabric B > FC Port Channels.

5. Select FC Port-Channel 20 Uplink-MDS-B.

6. On the right pane, change the VSAN information from default (1) to Fab-B VSAN 20 created for Fabric-B.



Status

Overall Status : Up
Additional Info :

Properties

ID : 20
Fabric ID : B
Port Type : Aggregation
Transport Type : Fc
Name : Uplink-MDS-B
Description :
VSAN : Fabric B/vsan Fab-B (20)
Port Channel Admin Speed : ○ 4 Gbps ○ 8 Gbps ● 16gbps ○ 32gbps
Operational Speed(Gbps) : 64

Create LAN Uplink Port Channels

Configure the LAN uplinks from the Fabric Interconnects towards the northbound Nexus Switches. A port channel bundles the interfaces into a group to provide increased bandwidth and redundancy and load balance the SAP network zone traffic across these physical interfaces.

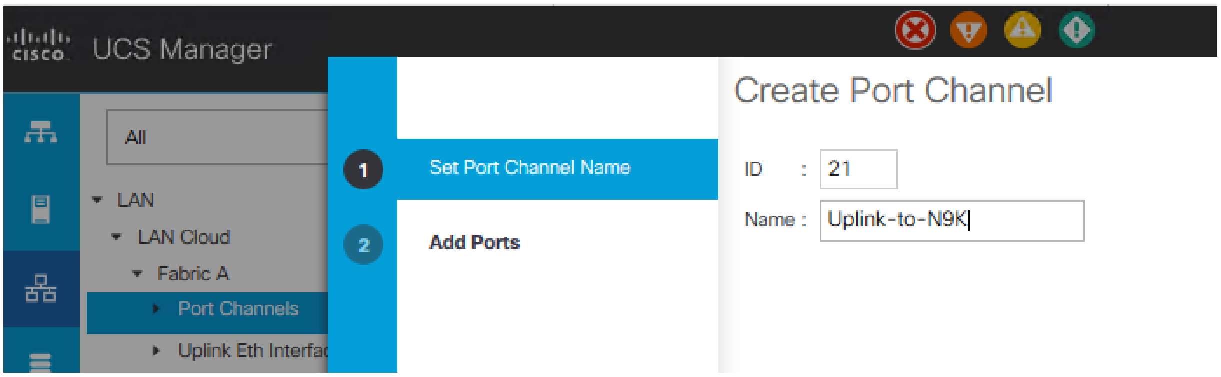
For example, create port channel 21 on FI-A and port channel 22 on FI-B. This port channel pairs have corresponding vPCs defined on N9Ks to ensure seamless redundancy and failover for the north-south network traffic in the rare case of an IOM or VIC port failure situation.

In this example configuration we use two pairs of 2 x 25GE ports for the connectivity between the FI and Nexus switch to handle the network traffic of all network zones except the internal node to node traffic. While this is sufficient for most of the use cases it is possible to extend the configuration and add additional port channel pairs if required to separate network intensive traffic like backup for example.

The ports selection is based on Uplink Port connectivity and device cabling in this lab setup and might deviate in your data center configuration.

To configure the necessary port channels from FI-A and FI-B to the uplink Cisco Nexus switches follow these steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane
2. Under LAN > LAN Cloud, expand the Fabric A tree.
3. Right-click Port Channels.
4. Select Create Port Channel.
5. Enter the unique ID 21 and port channel name Uplink-to-N9K, then click Next.



Create Port Channel

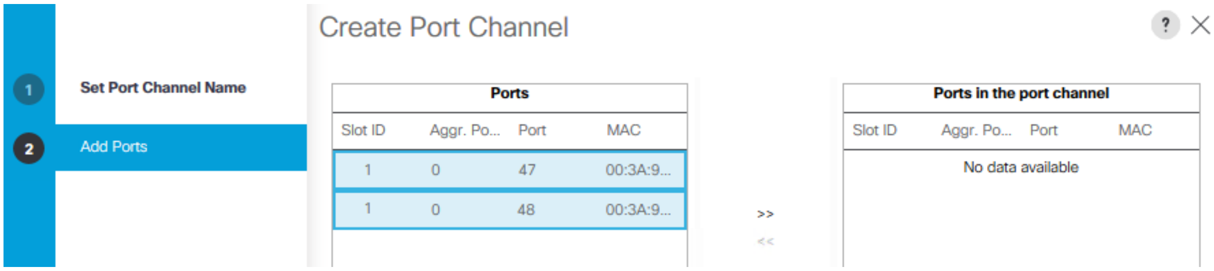
ID : 21

Name : Uplink-to-N9K

6. Select the following ports and add them to the port channel:

   - Slot ID 1 and port 47
   - Slot ID 2 and port 48

7. Click the >> symbol to add the ports to the port channel.



Create Port Channel

Ports

Slot ID	Aggr. Po...	Port	MAC
1	0	47	00:3A:9...
1	0	48	00:3A:9...

Ports in the port channel

Slot ID	Aggr. Po...	Port	MAC
No data available			

8. Click Finish to create the port-channel.

9. Click Ok.

10. Under LAN > LAN Cloud, expand the Fabric B tree.

11. Right-click Port Channels.

12. Select Create Port Channel.

13. Enter the unique ID 22 and port channel name Uplink-to-N9K, then click Next.

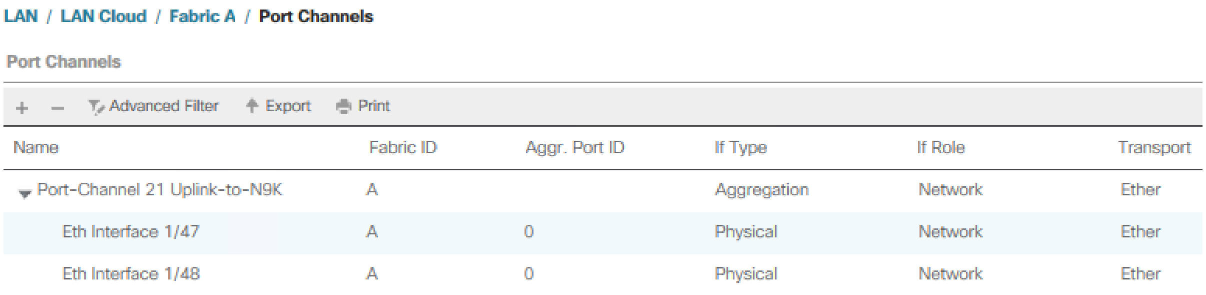
14. Select the following ports and add them to the port channel:

   - Slot ID 1 and port 47
   - Slot ID 2 and port 48

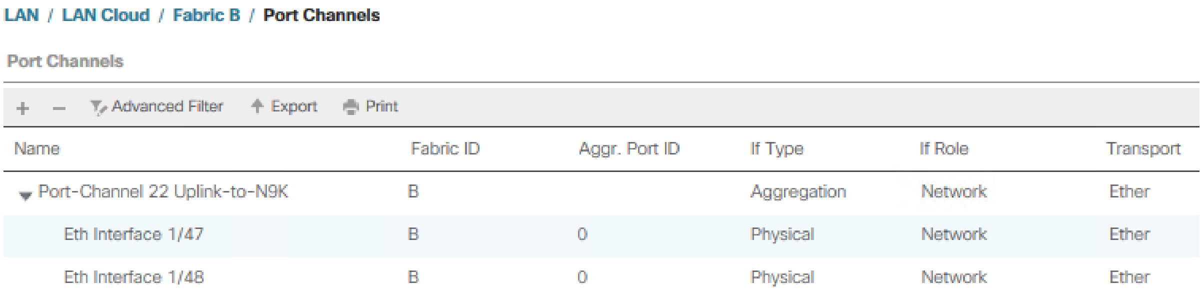
15. Click the >> symbol to add the ports to the port channel

16. To create the port channel, click Finish.

17. Click OK.


LAN / LAN Cloud / Fabric A / Port Channels
Port Channels
+ − Advanced Filter Export Print

Name	Fabric ID	Aggr. Port ID	If Type	If Role	Transport
Port-Channel 21 Uplink-to-N9K	A		Aggregation	Network	Ether
Eth Interface 1/47	A	0	Physical	Network	Ether
Eth Interface 1/48	A	0	Physical	Network	Ether


LAN / LAN Cloud / Fabric B / Port Channels
Port Channels
+ − Advanced Filter Export Print

Name	Fabric ID	Aggr. Port ID	If Type	If Role	Transport
Port-Channel 22 Uplink-to-N9K	B		Aggregation	Network	Ether
Eth Interface 1/47	B	0	Physical	Network	Ether
Eth Interface 1/48	B	0	Physical	Network	Ether

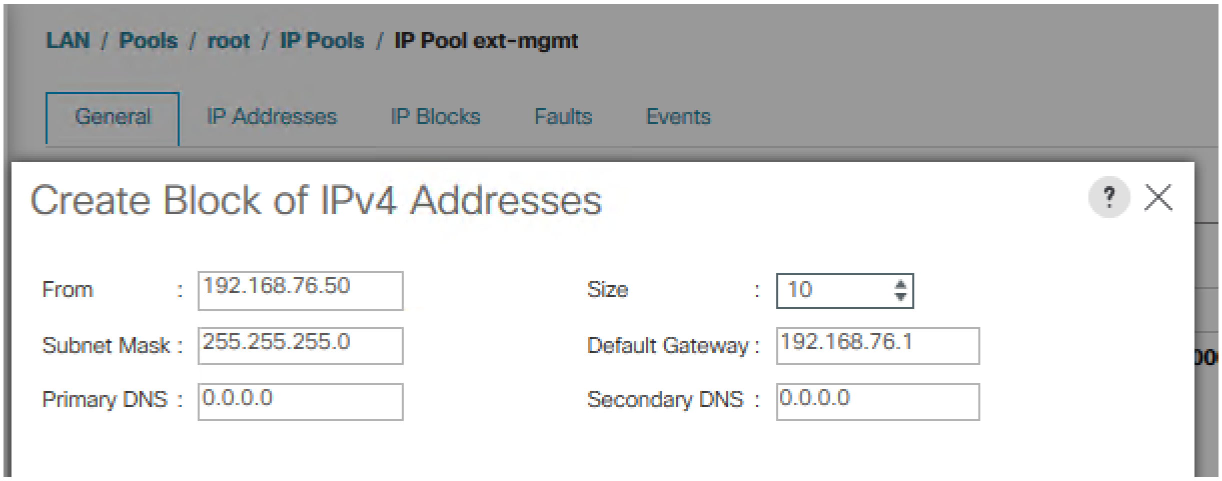
A second uplink port channel set can be configured and exclusively used for backup network traffic.

Add Block of IP Addresses for KVM Access

To create a block of IP addresses for server Keyboard, Video, Mouse (KVM) access in the Cisco UCS environment, follow these steps:

This block of IP addresses should be in the same subnet as the management IP addresses for the Cisco UCS Manager.

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select Pools > root > IP Pools > IP Pool ext-mgmt.
3. In the Actions pane, select Create Block of IPv4 Addresses.
4. Enter the starting IP address of the block and the number of IP addresses required, and the subnet and gateway information.



Create Block of IPv4 Addresses

From : 192.168.76.50
Size : 10
Subnet Mask : 255.255.255.0
Default Gateway : 192.168.76.1
Primary DNS : 0.0.0.0
Secondary DNS : 0.0.0.0

5. Click OK to create the IP block.

6. Click OK in the confirmation notification.

Power Policy

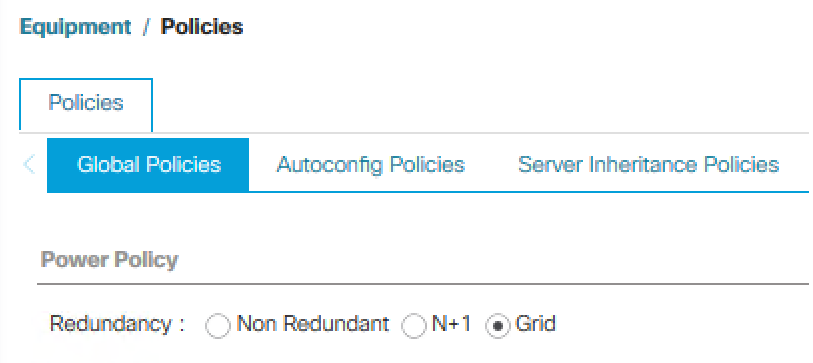
To run Cisco UCS with two independent power distribution units, the redundancy must be configured as Grid. Follow these steps:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

2. Select Equipment > Policies.

3. Select Global Policies in the work pane.

4. Set the Power Policy Redundancy to Grid.



Power Policy

Redundancy : ○ Non Redundant ○ N+1 ● Grid

5. Click Save Changes.

6. Click OK.

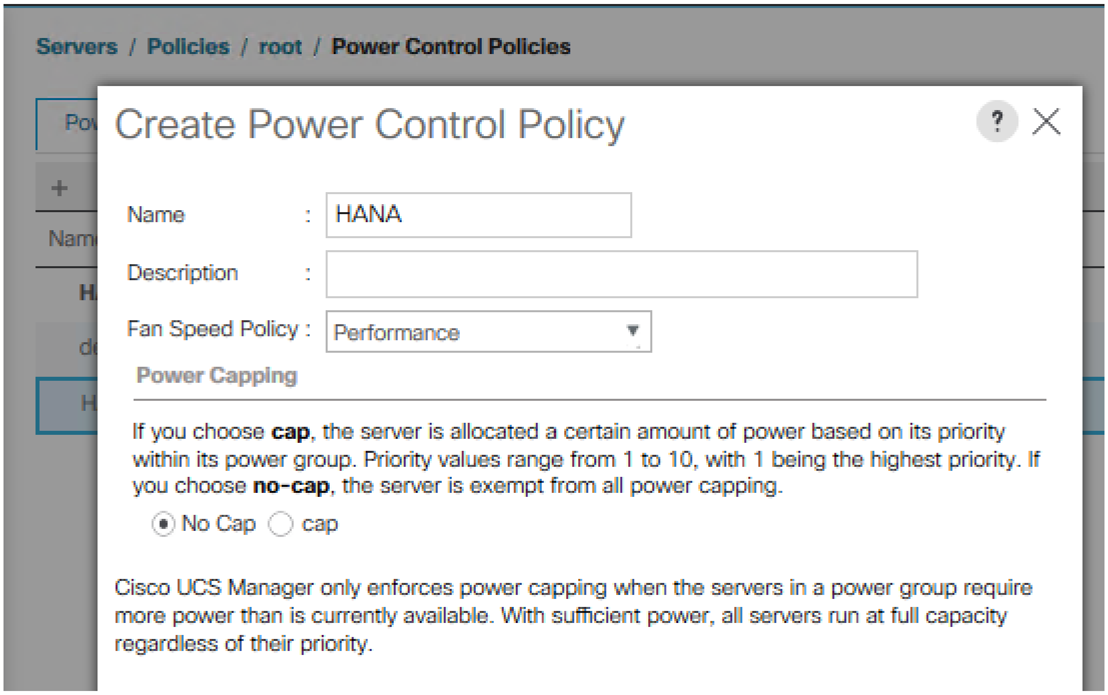
Power Control Policy

The Power Capping feature in Cisco UCS is designed to save power in the data center. This feature conflicts with the high-performance behavior of SAP HANA. Choose the “No Cap” option for the power control policy to not restrict the power supply for the SAP HANA server nodes.

A power control policy is recommended to ensure sufficient power supply for high-performance and critical workload applications like SAP HANA.

To create a power control policy for the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > root > Power Control Policies.
3. Right-click Power Control Policies and select Create Power Control Policy.
4. Enter HANA as the Power Control Policy name.
5. (Optional) Provide a description.
6. Set Fan Speed Policy to Performance from the drop-down list.
7. Enable the Power Capping radio button No Cap.



Servers / Policies / root / Power Control Policies

Create Power Control Policy

Name : HANA

Description :

Fan Speed Policy : Performance

Power Capping

If you choose **cap**, the server is allocated a certain amount of power based on its priority within its power group. Priority values range from 1 to 10, with 1 being the highest priority. If you choose **no-cap**, the server is exempt from all power capping.

● No Cap ○ cap

Cisco UCS Manager only enforces power capping when the servers in a power group require more power than is currently available. With sufficient power, all servers run at full capacity regardless of their priority.

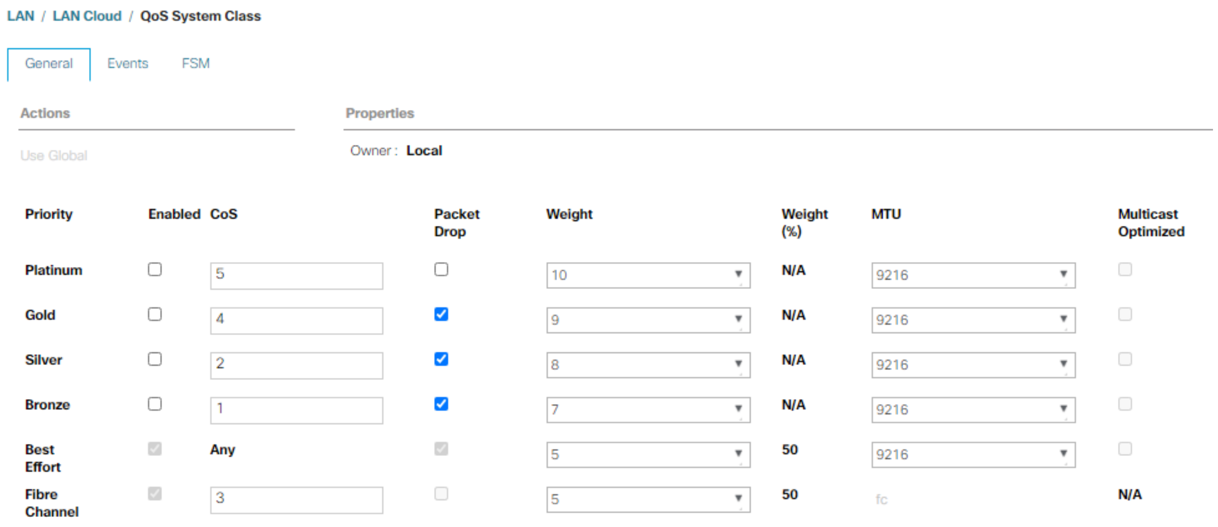
8. Click OK to create the power control policy.
9. Click OK.

Set Jumbo Frames in Cisco UCS Fabric

The core network requirements for SAP HANA are covered by Cisco UCS defaults. The Service Profile is configured to distribute the traffic across Fabric Interconnect A and B.

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

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > LAN Cloud > QoS System Class.
3. In the right pane, click the General tab.
4. On the MTU Column, enter 9216 in the box.
5. Click Save Changes in the bottom of the window.
6. Click OK.



LAN / LAN Cloud / QoS System Class

Owner : Local

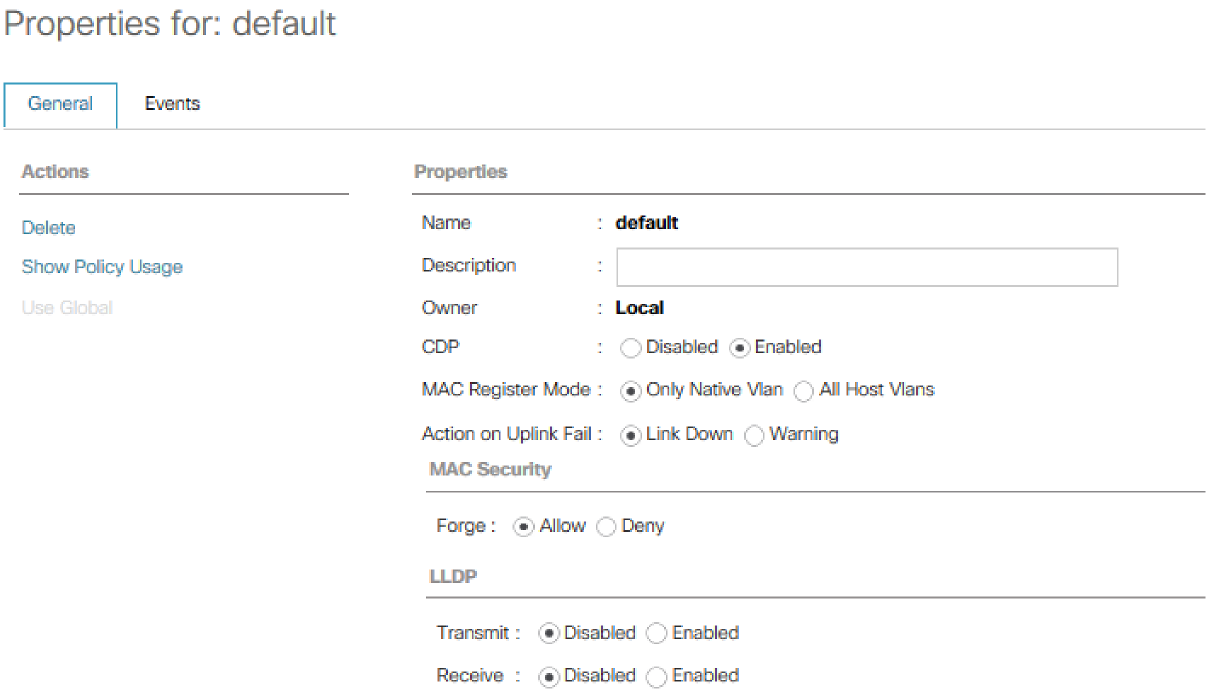
Priority	Enabled	CoS	Packet Drop	Weight	Weight (%)	MTU	Multicast Optimized
Platinum	☐	5	☐	10	N/A	9216	☐
Gold	☐	4	☑	9	N/A	9216	☐
Silver	☐	2	☑	8	N/A	9216	☐
Bronze	☐	1	☑	7	N/A	9216	☐
Best Effort	☑	Any	☑	5	50	9216	☐
Fibre Channel	☑	3	☐	5	50	fc	N/A

Enable CDP in the Default Network Control Policy

To enable the Cisco Discovery Protocol (CDP) to learn the MAC address of the End Point and to update the default Network Control Policy, follow these steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > Policies > root > Network Control Policies.
3. Double-click Default in the work pane.
4. Select the Enabled button for CDP.
5. Click Save Changes in the bottom of the window.

6. Click OK.



Properties for: default

Name : **default**

Description :

Owner : **Local**

CDP : ○ Disabled ● Enabled

MAC Register Mode : ● Only Native Vlan ○ All Host Vlans

Action on Uplink Fail : ● Link Down ○ Warning

MAC Security

Forge : ● Allow ○ Deny

LLDP

Transmit : ● Disabled ○ Enabled

Receive : ● Disabled ○ Enabled

Acknowledge Cisco UCS Chassis and Rack-Mount Servers

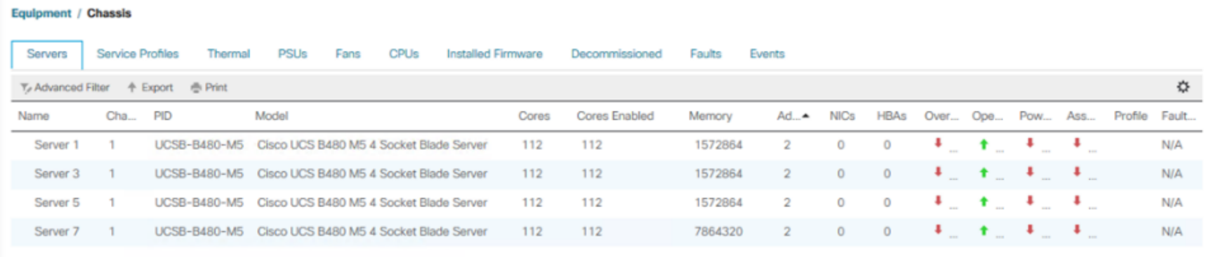
To acknowledge all Cisco UCS chassis and/or Rack Mount Servers, follow these steps:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

2. Expand Chassis and select each chassis that is listed. Right-click each chassis and select Acknowledge Chassis.

3. Expand Rack-Mounts to the list the discovered servers. The servers automatically go into “Discovery” phase.

4. Ensure the Discovery completes successfully and there are no major or critical faults reported for any of the servers.



Name	Cha...	PID	Model	Cores	Cores Enabled	Memory	Ad... ▲	NICs	HBAs	Over...	Ope...	Pow...	Ass...	Profile	Fault...
Server 1	1	UCSB-B480-M5	Cisco UCS B480 M5 4 Socket Blade Server	112	112	1572864	2	0	0	⬇ ...	⬆ ...	⬇ ...	⬇ ...		N/A
Server 3	1	UCSB-B480-M5	Cisco UCS B480 M5 4 Socket Blade Server	112	112	1572864	2	0	0	⬇ ...	⬆ ...	⬇ ...	⬇ ...		N/A
Server 5	1	UCSB-B480-M5	Cisco UCS B480 M5 4 Socket Blade Server	112	112	1572864	2	0	0	⬇ ...	⬆ ...	⬇ ...	⬇ ...		N/A
Server 7	1	UCSB-B480-M5	Cisco UCS B480 M5 4 Socket Blade Server	112	112	7864320	2	0	0	⬇ ...	⬆ ...	⬇ ...	⬇ ...		N/A

Firmware Update

Obtain the Cisco UCSM Release software bundles and transfer the Cisco UCS infrastructure software bundle, the related Cisco UCS B-Series and C-Series software bundle as well as the Capability Catalog file towards the Cisco Fabric Interconnect.

To update the firmware to the Cisco recommended release, review the Cisco UCS Manager Firmware Management Guide (https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/ucs-manager/GUI-User-Guides/Firmware-Mgmt/4-1/b_UCSM_GUI_Firmware_Management_Guide_4-1/b_UCSM_GUI_Firmware_Management_Guide_4-1_chapter_011.html).

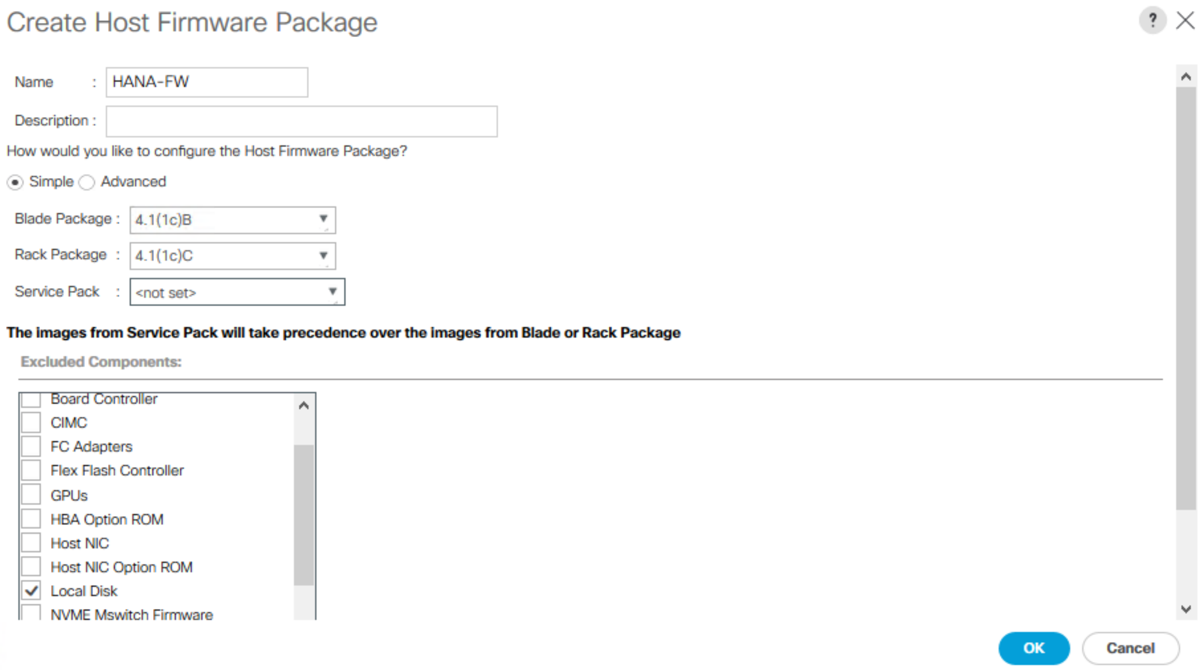
At the time of this validation the recommended firmware package release is 4.1(1c).

Create Host Firmware Package

Firmware management policies allow the administrator to select the corresponding packages for a given server configuration. These policies often include packages for adapter, BIOS, board controller, FC adapters, host bus adapter (HBA) option ROM, and storage controller properties.

To create a firmware management policy for a given server configuration in the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > root > Firmware Packages.
3. Right-click Host Firmware Packages and select Create Host Firmware Package.
4. Enter HANA-FW as the name of the host firmware package.
5. Leave Simple selected.
6. Select the version 4.1(1c) for both the Blade and Rack Packages.
7. Click OK to create the host firmware package.
8. Click OK.



Create Host Firmware Package

Name : HANA-FW

Description :

How would you like to configure the Host Firmware Package?

● Simple ○ Advanced

Blade Package : 4.1(1c)B

Rack Package : 4.1(1c)C

Service Pack : <not set>

The images from Service Pack will take precedence over the images from Blade or Rack Package

Excluded Components:

- □ Board Controller
- □ CIMC
- □ FC Adapters
- □ Flex Flash Controller
- □ GPUs
- □ HBA Option ROM
- □ Host NIC
- □ Host NIC Option ROM
- ☑ Local Disk
- □ NVME Mswitch Firmware

Update Default Maintenance Policy

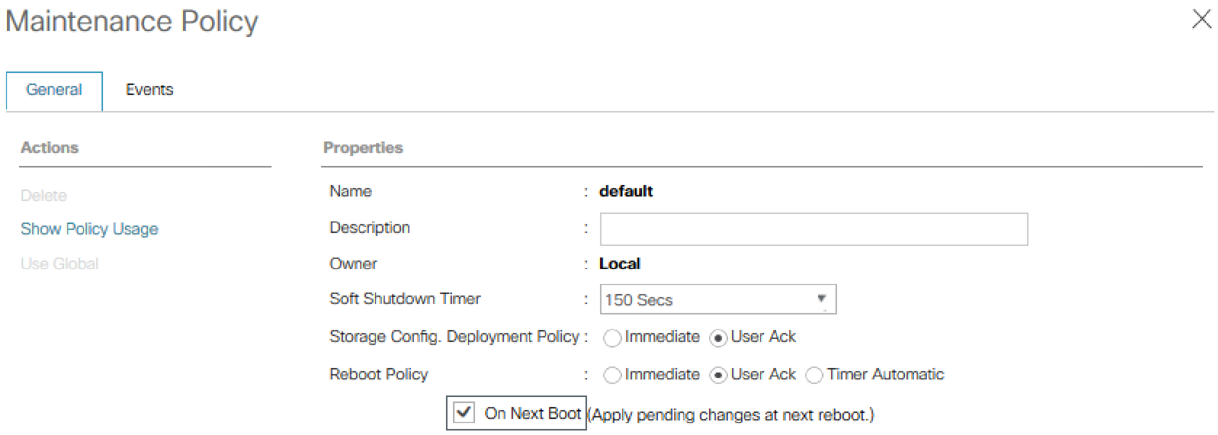
To update the default Maintenance Policy with the Reboot Policy “User Ack” for SAP HANA servers, follow these steps. This policy will wait for the administrator to acknowledge the server reboot for the configuration changes to take effect.

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.

2. Select Policies > root.

3. Select Maintenance Policies > default.

4. Change the Reboot Policy to User Ack.



Maintenance Policy

Name : **default**

Description :

Owner : **Local**

Soft Shutdown Timer : 150 Secs

Storage Config. Deployment Policy : ○ Immediate ● User Ack

Reboot Policy : ○ Immediate ● User Ack ○ Timer Automatic

☑ On Next Boot (Apply pending changes at next reboot.)

5. Click Save Changes.

6. Click OK to accept the change

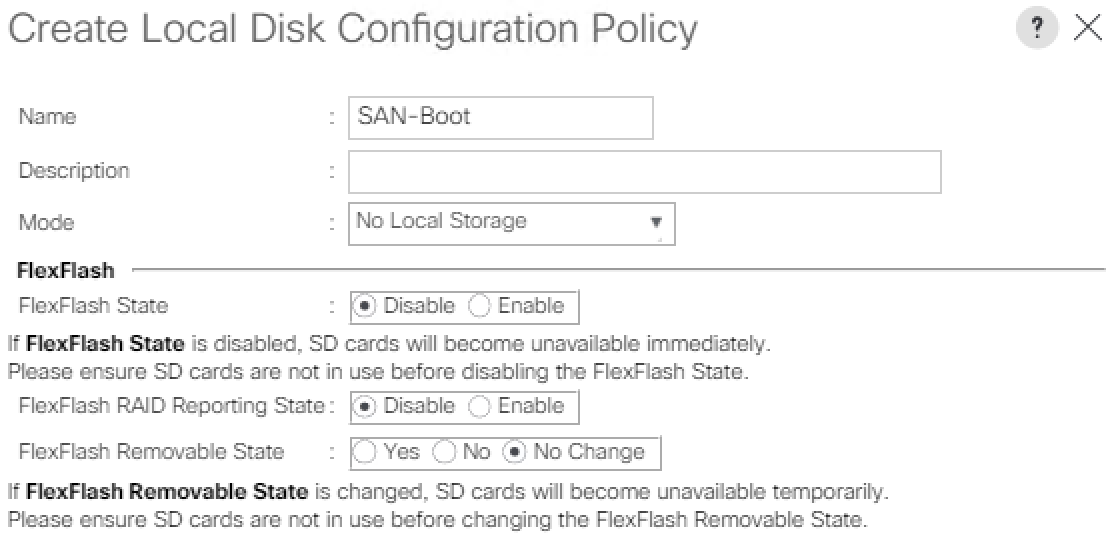
Create Local Disk Configuration Policy

All nodes are set to boot from SAN for this Cisco Validated Design as part of the Service Profile template. The benefits of booting from SAN are numerous; disaster recovery, lower cooling, and power requirements for each server since local drives are not required, as well as better performance, to name just a few.

A local disk configuration is required only if the servers in the environment do have local disks.

To configure local disk policy, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > root > Local Disk Config Policies
3. Right-click Local Disk Config Policies and select create local disk configuration policy
4. Provide SAN-Boot as policy name
5. Change the mode drop down box to No Local Storage
6. Keep the other defaults and confirm with OK.



Create Local Disk Configuration Policy

Name : SAN-Boot

Description :

Mode : No Local Storage

FlexFlash

FlexFlash State : ● Disable ○ Enable

If **FlexFlash State** is disabled, SD cards will become unavailable immediately.
Please ensure SD cards are not in use before disabling the FlexFlash State.

FlexFlash RAID Reporting State : ● Disable ○ Enable

FlexFlash Removable State : ○ Yes ○ No ● No Change

If **FlexFlash Removable State** is changed, SD cards will become unavailable temporarily.
Please ensure SD cards are not in use before changing the FlexFlash Removable State.

LAN Configuration

Within Cisco UCS, all the network types for an SAP HANA system are manifested by defined VLANs. Network design guideline from SAP recommends seven SAP HANA related networks and two infrastructure related networks.

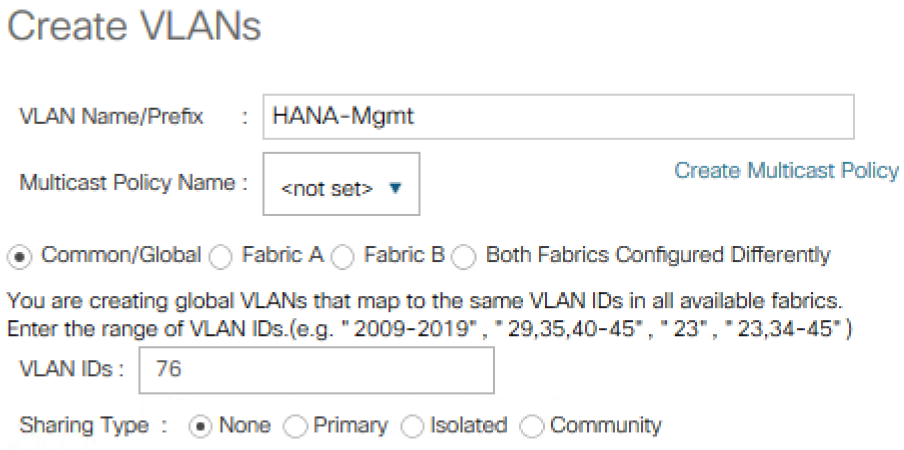
The total number of VLANs depends on the SAP HANA installation scenario and might differ in a customer environment. If there is no SAP HANA System Replication configured the replication network is needless. The same applies for the internal host communication network when there is no Scale Out scenario required.

The VLAN IDs can be changed if required to match the VLAN IDs in the customer's network – for example, ID 221 for backup should match the configured VLAN ID at the customer uplink network switches.

Create VLANs

To configure the necessary VLANs for the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > LAN Cloud > VLANs.
3. Right-click VLANs and select Create VLANs.
4. Enter HANA-Mgmt as VLAN name of the HANA Management network.
5. Keep the Common/Global option selected for the scope of the VLAN.
6. Enter <var_oob_vlan_id> as the ID of the HANA Node to Node network.
7. Keep the Sharing Type as None.
8. Click OK and confirm with OK.



Create VLANs

VLAN Name/Prefix : HANA-Mgmt

Multicast Policy Name : <not set>

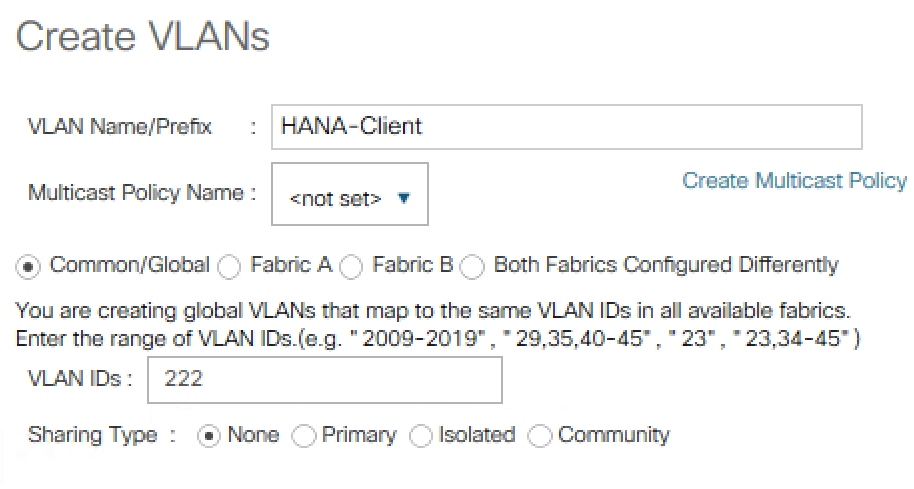
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 76

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

9. Repeat steps 1-8 to create all required VLANs.
10. Create VLAN HANA-Client using <var_client_vlan_id>



Create VLANs

VLAN Name/Prefix : HANA-Client

Multicast Policy Name : <not set>

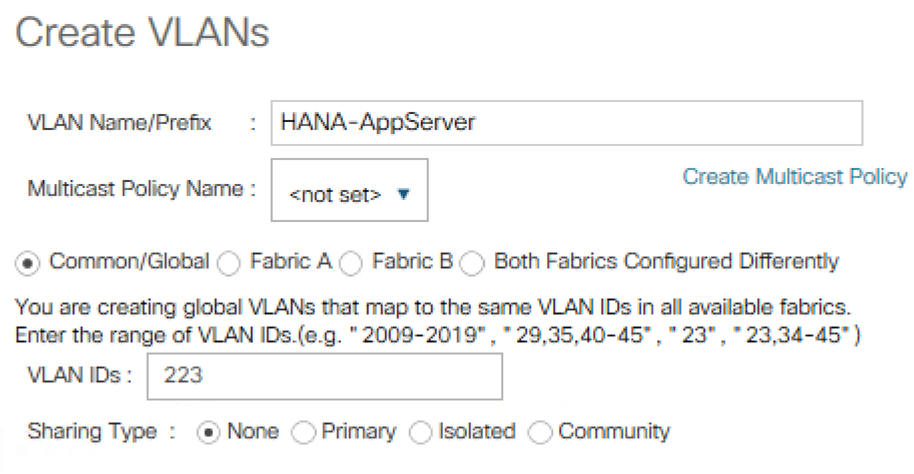
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 222

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

11. Create VLAN HANA-AppServer using <var_appserver_vlan_id>



Create VLANs

VLAN Name/Prefix : HANA-AppServer

Multicast Policy Name : <not set>

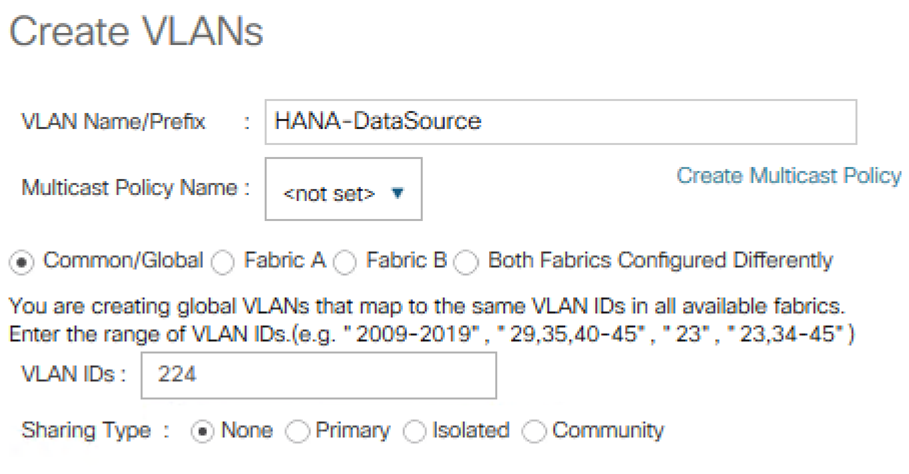
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 223

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

12. Create VLAN HANA-DataSource using <var_datasource_vlan_id>



Create VLANs

VLAN Name/Prefix : HANA-DataSource

Multicast Policy Name : <not set>

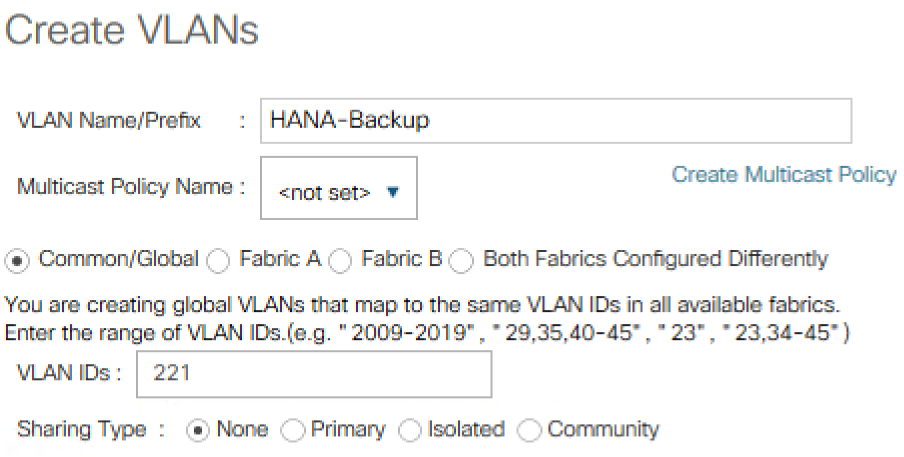
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 224

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

13. Create VLAN HANA-Backup using <var_backup_vlan_id>



Create VLANs

VLAN Name/Prefix : HANA-Backup

Multicast Policy Name : <not set> ▼

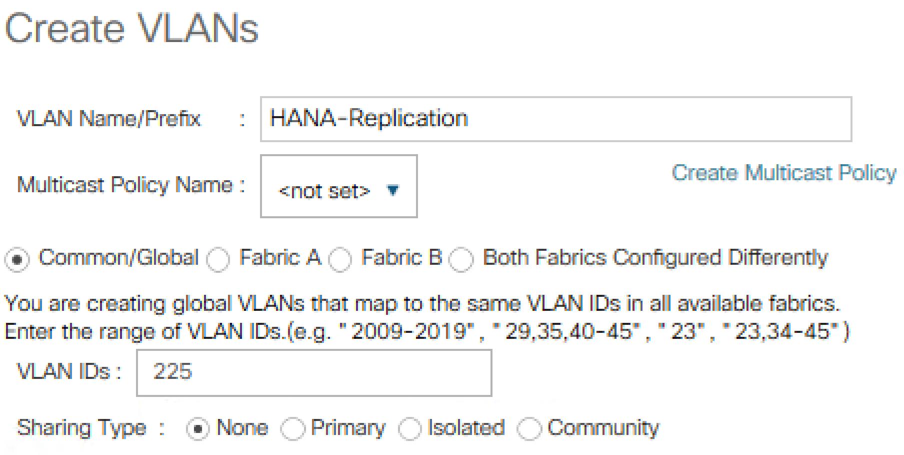
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 221

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

14. Create VLAN HANA-Replication using <var_replication_vlan_id>



Create VLANs

VLAN Name/Prefix : HANA-Replication

Multicast Policy Name : <not set> ▼

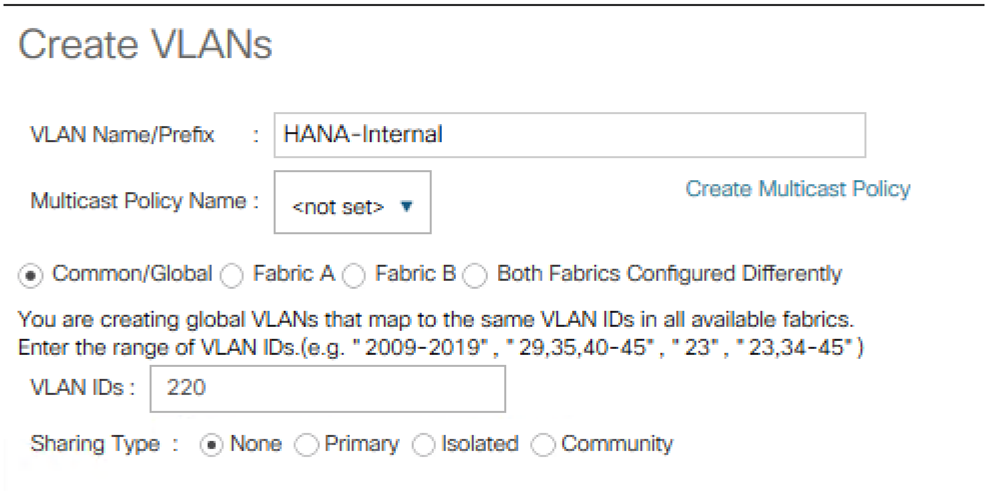
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 225

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

15. Create VLAN HANA-Internal Node to Node traffic using <var_internal_vlan_id>



Create VLANs

VLAN Name/Prefix : HANA-Internal

Multicast Policy Name : <not set> ▼

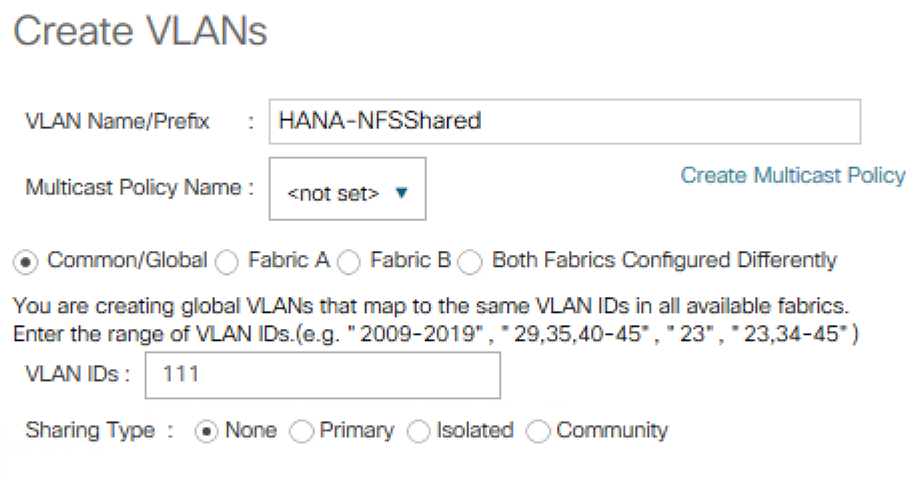
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 220

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

16. Create VLAN HANA-NFSshared for /hana/shared NFS network.



Create VLANs

VLAN Name/Prefix : HANA-NFSShared

Multicast Policy Name : <not set> ▼

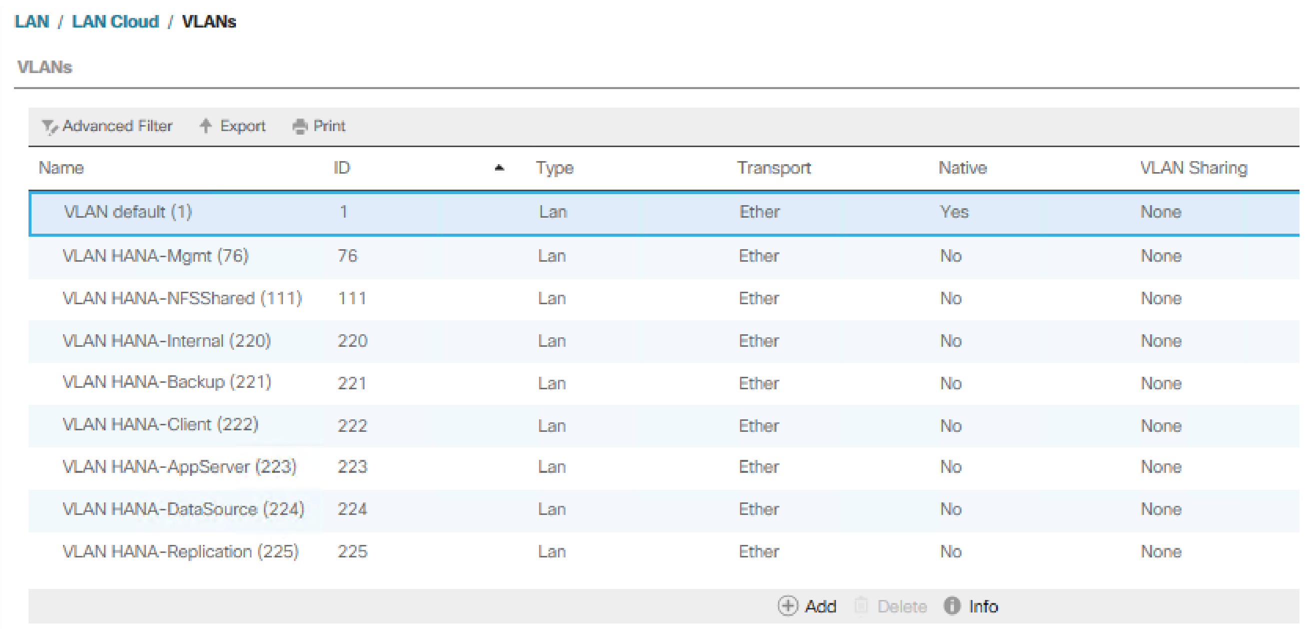
● Common/Global ○ Fabric A ○ Fabric B ○ Both Fabrics Configured Differently

You are creating global VLANs that map to the same VLAN IDs in all available fabrics.
Enter the range of VLAN IDs.(e.g. " 2009-2019" , " 29,35,40-45" , " 23" , " 23,34-45")

VLAN IDs : 111

Sharing Type : ● None ○ Primary ○ Isolated ○ Community

The summary of all previous created VLANs is shown below:



LAN / LAN Cloud / VLANs

VLANs

Name	ID	Type	Transport	Native	VLAN Sharing
VLAN default (1)	1	Lan	Ether	Yes	None
VLAN HANA-Mgmt (76)	76	Lan	Ether	No	None
VLAN HANA-NFSShared (111)	111	Lan	Ether	No	None
VLAN HANA-Internal (220)	220	Lan	Ether	No	None
VLAN HANA-Backup (221)	221	Lan	Ether	No	None
VLAN HANA-Client (222)	222	Lan	Ether	No	None
VLAN HANA-AppServer (223)	223	Lan	Ether	No	None
VLAN HANA-DataSource (224)	224	Lan	Ether	No	None
VLAN HANA-Replication (225)	225	Lan	Ether	No	None

Create VLAN Groups

Create VLAN Groups to simplify the management and bandwidth allocation to a dedicated uplink on the Fabric Interconnect. SAP groups recommended SAP HANA networks into zones which translates to VLAN Groups in the Cisco UCS configuration:

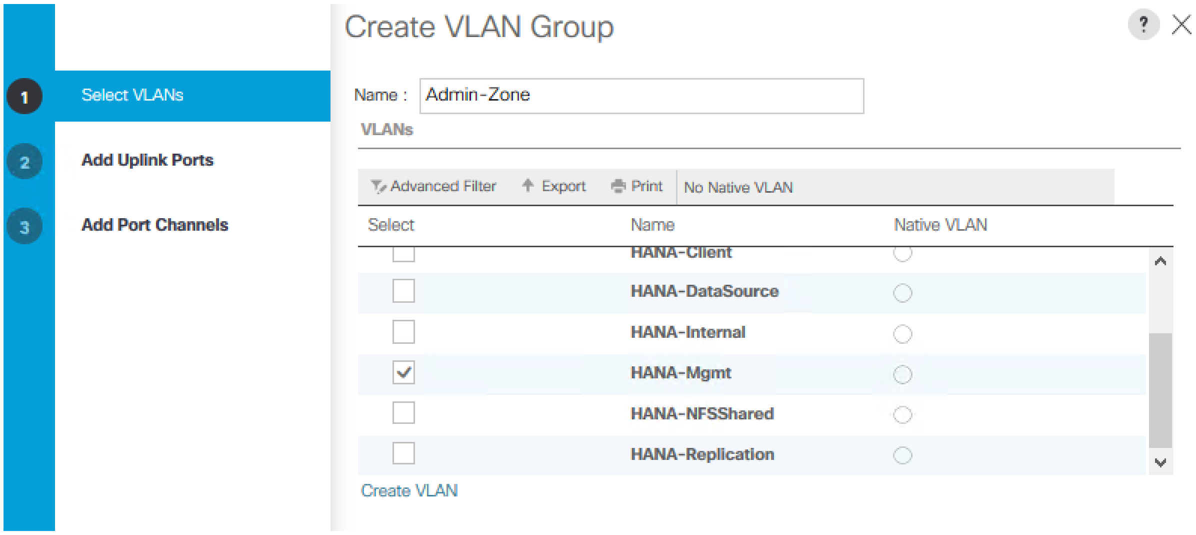
- Client Zone – including AppServer, Client and DataSource networks
- Internal Zone – including Inter-node and System Replication networks
- Storage Zone – including Backup and IP storage networks

- (optional) Admin zone – including Management or Linux cluster network if any

For this deployment guide we create four VLAN Groups. Depending on customer requirements and SAP HANA scenario the number of VLAN Groups might differ in a customer environment.

To configure the recommended VLAN Groups for the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > LAN Cloud > VLAN Groups.
3. Right-click VLAN Groups and select Create VLAN Groups.
4. Enter Admin-Zone as the name of the VLAN Group used for Infrastructure network.
5. Select VLAN HANA-Mgmt.



Create VLAN Group

1 Select VLANs

2 Add Uplink Ports

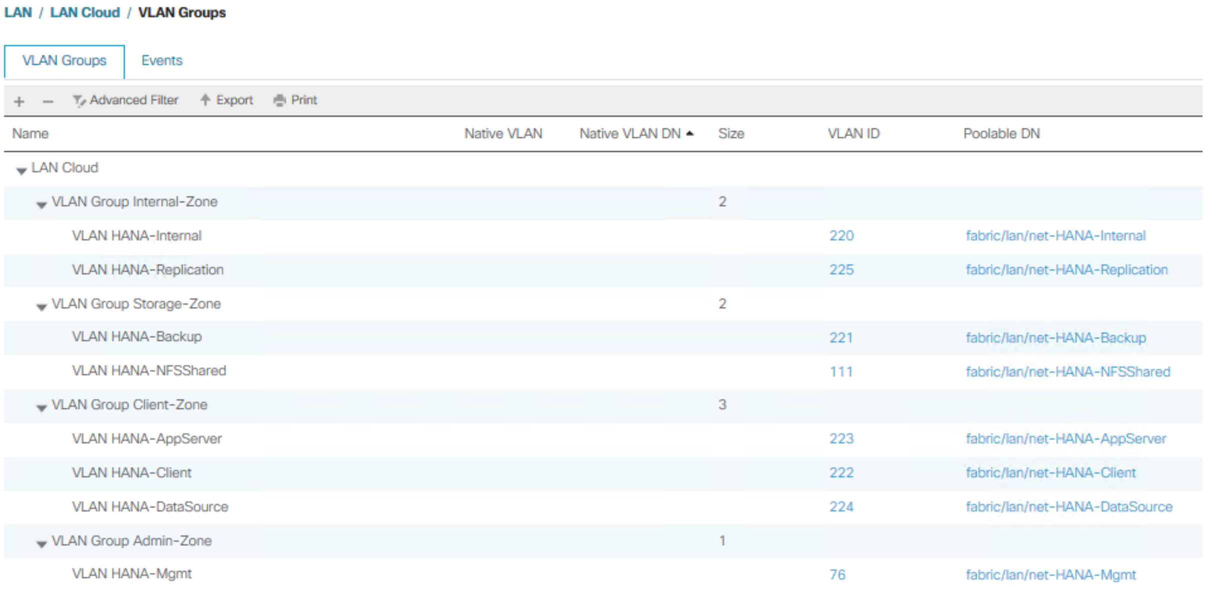
3 Add Port Channels

Name : Admin-Zone

VLANs

Select	Name	Native VLAN
□	HANA-Client	○
□	HANA-DataSource	○
□	HANA-Internal	○
☑	HANA-Mgmt	○
□	HANA-NFSShared	○
□	HANA-Replication	○

6. Click Next.
7. Click Next on Add Uplink Ports.
8. Select the uplink network port channels previously created and add them.
9. Click Finish.
10. Repeat steps 1-9 to create VLAN Group Client-Zone and add VLANs HANA-AppServer, HANA-Client and HANA-DataSource.
11. Repeat steps 1-9 to create VLAN Group Internal-Zone and add VLANs HANA-Internal and HANA-Replication
12. Repeat steps 1-9 to create VLAN Group Storage-Zone and add VLANs HANA-Backup and HANA-NFSShared



LAN / LAN Cloud / VLAN Groups
VLAN Groups
Events
+ − Advanced Filter Export Print

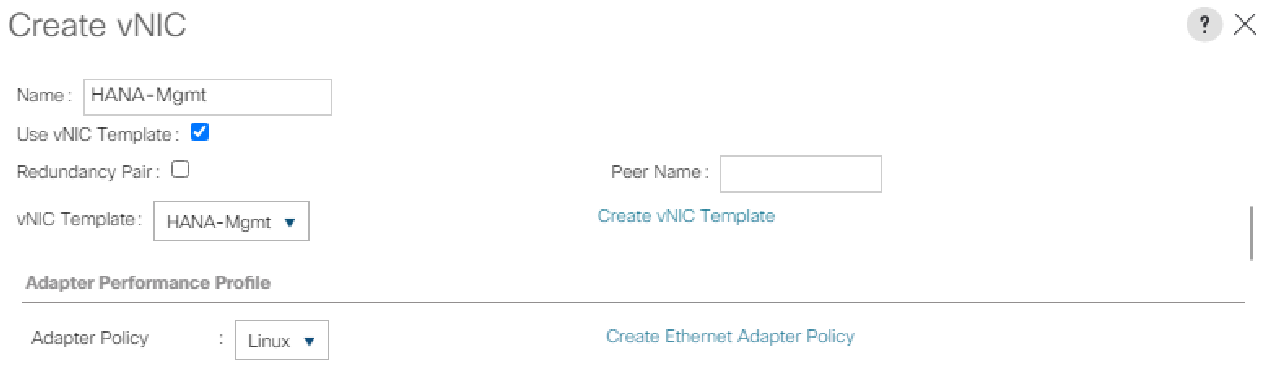
Name	Native VLAN	Native VLAN DN ▲	Size	VLAN ID	Poolable DN
LAN Cloud					
VLAN Group Internal-Zone			2		
VLAN HANA-Internal				220	fabric/lan/net-HANA-Internal
VLAN HANA-Replication				225	fabric/lan/net-HANA-Replication
VLAN Group Storage-Zone			2		
VLAN HANA-Backup				221	fabric/lan/net-HANA-Backup
VLAN HANA-NFSShared				111	fabric/lan/net-HANA-NFSShared
VLAN Group Client-Zone			3		
VLAN HANA-AppServer				223	fabric/lan/net-HANA-AppServer
VLAN HANA-Client				222	fabric/lan/net-HANA-Client
VLAN HANA-DataSource				224	fabric/lan/net-HANA-DataSource
VLAN Group Admin-Zone			1		
VLAN HANA-Mgmt				76	fabric/lan/net-HANA-Mgmt

Create LAN Connectivity Policy

A LAN Connectivity Policy in the target organization (HANA) forces the device ordering through Consistent Device Naming (CDN). The policy avoids manual reordering of ethernet devices during the Linux installation. An alternative configuration is to specify the vNIC and vHBA placement manually in the process of creating the service profile template.

To create the LAN connectivity policy, follow these steps:

1. In the Navigation pane, click LAN.
2. Select LAN > Policies > root > Sub-Organizations > HANA > LAN Connectivity Policies.
3. Right-click LAN Connectivity Policies and select Create LAN Connectivity Policy.
4. Use LAN-HANA as policy name.
5. (Optional) provide a policy description.
6. Click the Add button to add a vNIC.
7. In the Create vNIC dialog box, use HANA-Mgmt as vNIC name.
8. Check mark the use vNIC Template box.
9. In the vNIC Template drop-down menu, select HANA-Mgmt.
10. Set the Adapter Policy to Linux.



Create vNIC

Name : HANA-Mgmt

Use vNIC Template : ☑

Redundancy Pair : □

Peer Name :

vNIC Template : HANA-Mgmt ▾

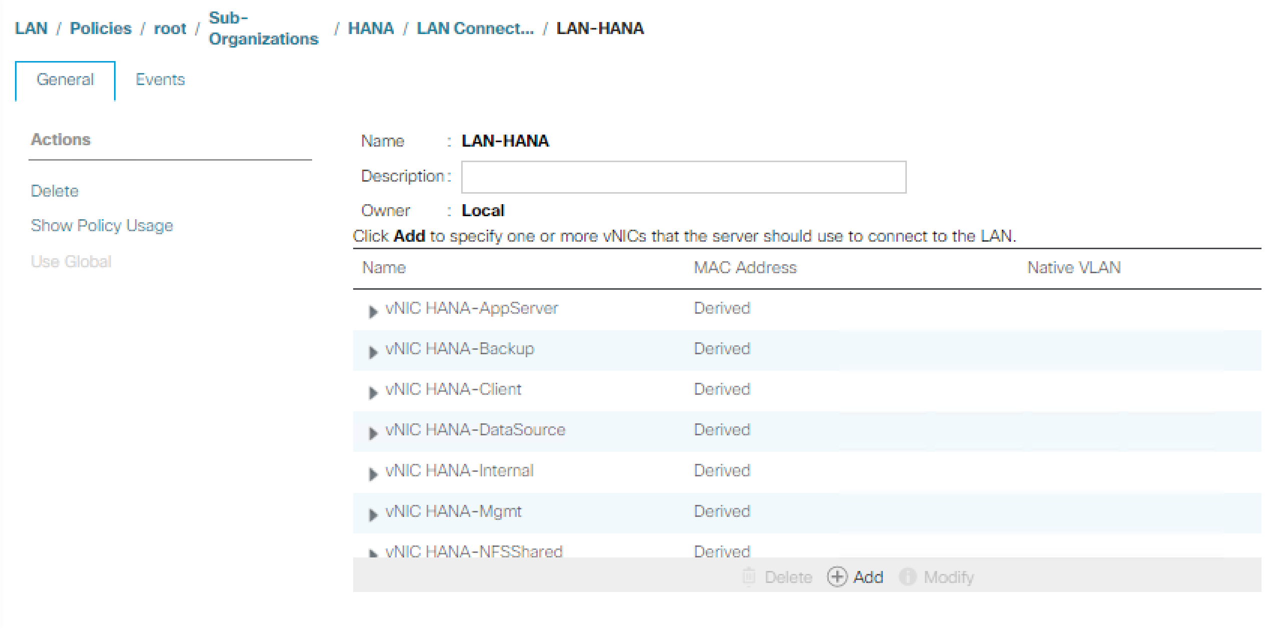
Adapter Performance Profile

Adapter Policy : Linux ▾

11. Click OK to add this vNIC to the policy.

12. Click Add to add all other vNIC.

13. Click OK to create the LAN Connectivity Policy and click OK again.



LAN / Policies / root / Sub-Organizations / HANA / LAN Connect... / LAN-HANA
General
Events
Actions
Delete
Show Policy Usage
Use Global

Name : LAN-HANA

Description :

Owner : Local

Click **Add** to specify one or more vNICs that the server should use to connect to the LAN.

Name	MAC Address	Native VLAN
▸ vNIC HANA-AppServer	Derived	
▸ vNIC HANA-Backup	Derived	
▸ vNIC HANA-Client	Derived	
▸ vNIC HANA-DataSource	Derived	
▸ vNIC HANA-Internal	Derived	
▸ vNIC HANA-Mgmt	Derived	
▸ vNIC HANA-NFSShared	Derived	

Multi-Tenancy Environment

Multi-tenancy allows to divide up the large physical infrastructure of an instance into logical entities known as organizations. As a result, you can achieve a logical isolation between organizations without providing a dedicated physical infrastructure for each organization.

Assign unique resources to each tenant through the related organization, in the multi-tenant environment these resources can include different policies, pools, and quality of service definitions. In a multi-tenant environment, all organizations are hierarchical. The top-level organization is always root. The policies and pools created in root are system-wide and are available to all organizations in the system. However, any policies and pools created in other organizations are only available to organizations that are above it in the same hierarchy.

For secure multi-tenancy within the Cisco UCS domain create an organization for the SAP HANA deployment.

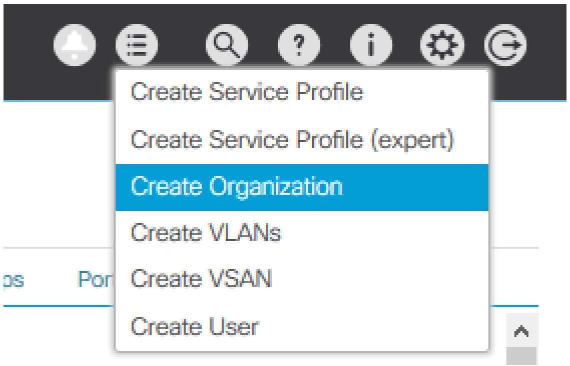
Create New Organization

To create a new organization, follow these steps:

1. In Cisco UCS Manager, click Quick Actions.
2. From the drop-down list select Create Organization.
3. Enter the Name as HANA.

Optionally use a different naming convention to divide SAP production, test, sandbox, training, and development environments

4. (Optional) Enter the Description as Org for HANA.
5. Click OK to create the Organization.



Create UUID Suffix Pool

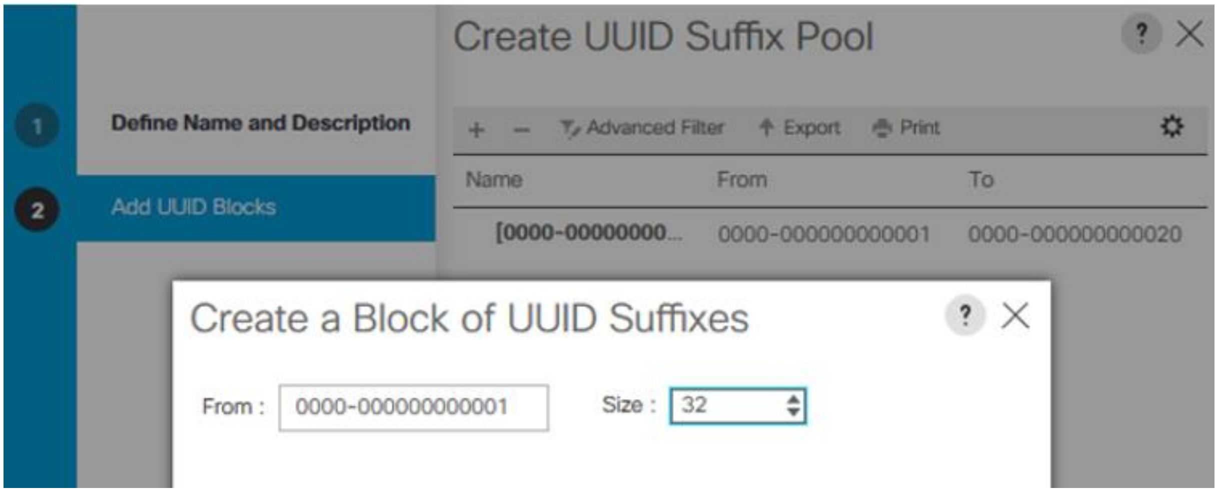
To configure the universal unique identifier (UUID) suffix pool for the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Pools > root > Sub-Organization > HANA > UUUID Suffix Pools
3. Right-click UUID Suffix Pools and select Create UUID Suffix Pool.
4. Enter UUID-Pool as name of the UUID suffix pool.
5. (Optional) Enter a description for the UUID suffix pool.
6. Keep the Prefix as the Derived option.
7. Select Sequential for Assignment Order
8. Click Next.

9. Click Add to add a block of UUIDs.

10. Keep the ‘From’ field at the default setting.

11. Specify the UUID block size sufficient to support the available blade or server resources.



12. Click OK.

13. Click Finish and then click OK.

Create Server BIOS Policy

To achieve the best performance, the SAP HANA environment needs to configure the Server BIOS accurately. To create a server BIOS policy for the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.

2. Select Policies > root > Sub-Organization > HANA > BIOS Policies.

3. Right-click BIOS Policies and select Create BIOS Policy.

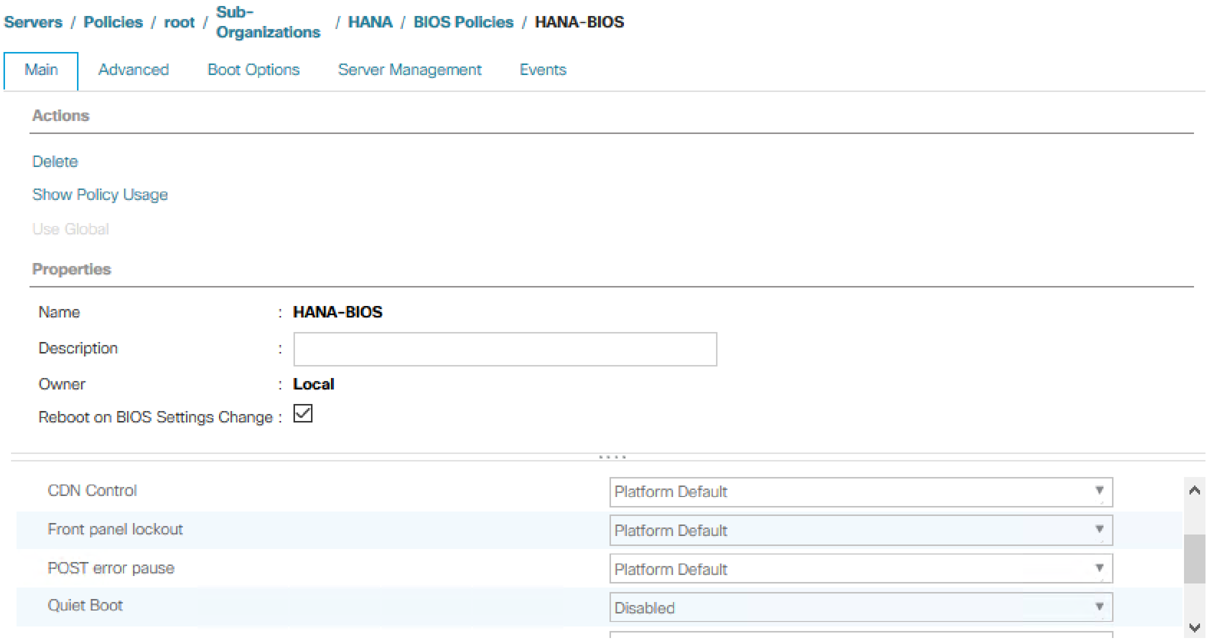
4. Enter HANA-BIOS as BIOS policy name.

5. Select Reboot on BIOS Settings Change.

6. Click OK and confirm the new BIOS Policy with OK.

7. Select the HANA-BIOS policy in the navigation pane.

8. On the Main sub tab, change the Quiet Boot setting from Platform Default to Disabled.



Name : HANA-BIOS

Description :

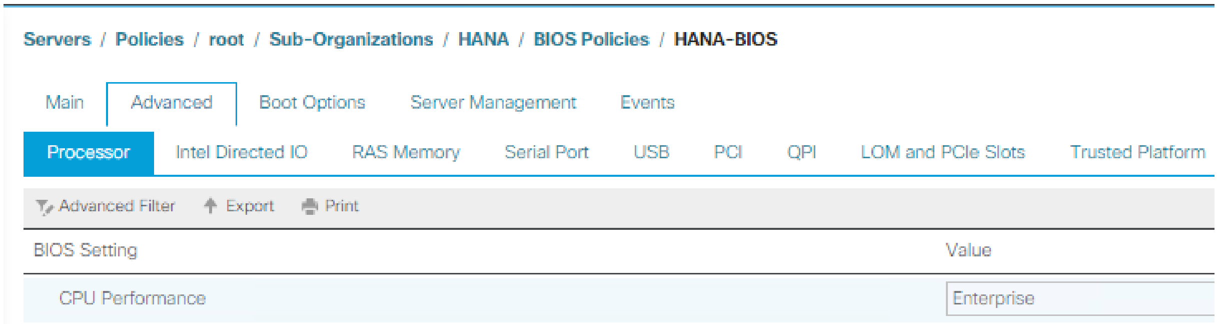
Owner : Local

Reboot on BIOS Settings Change : ☑

CDN Control	Platform Default
Front panel lockout	Platform Default
POST error pause	Platform Default
Quiet Boot	Disabled

9. Change to the Advanced sub tab.

10. In the processor sub-tab, change CPU Performance from Platform Default to Enterprise.



BIOS Setting	Value
CPU Performance	Enterprise

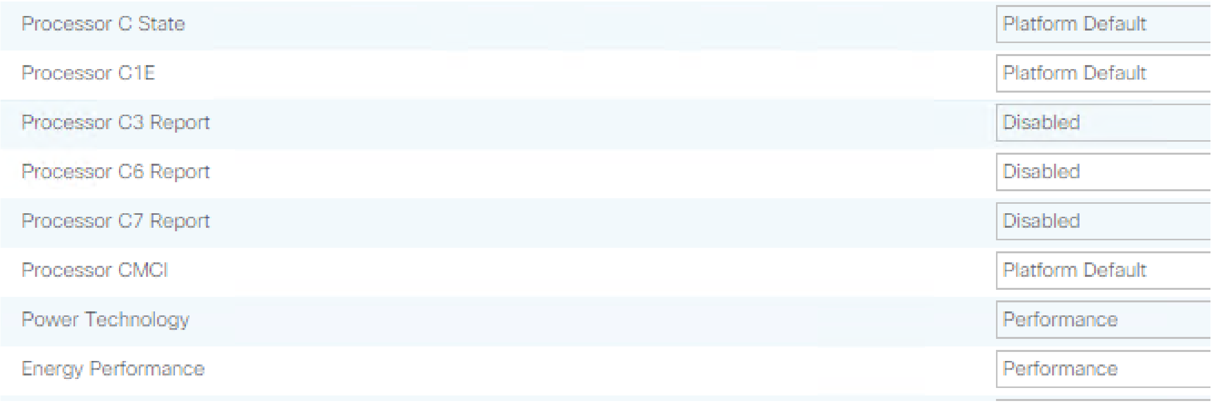
11. Keep processor C State on platform default

12. Keep Processor C1E on Platform Default

13. Change Processor C3, C6 and C7 Report to disabled.

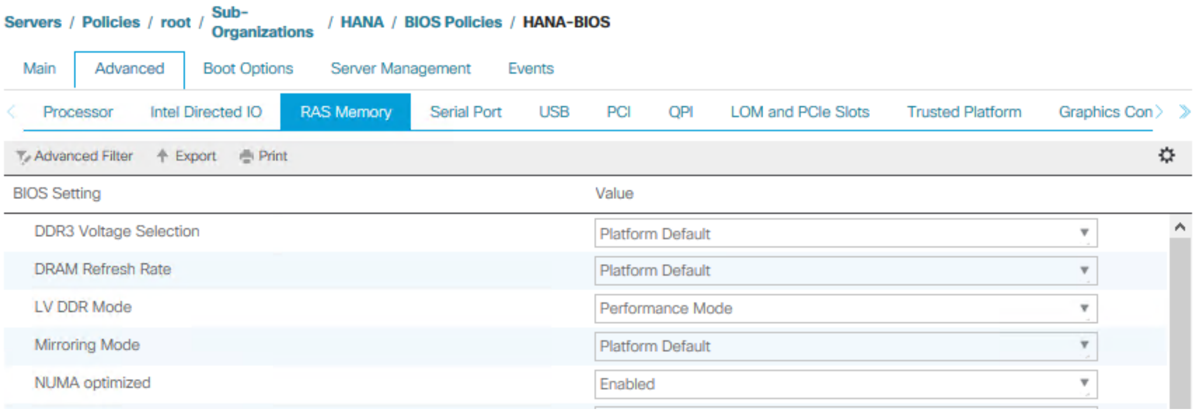
14. Change Power Technology from Platform Default to Performance.

15. Change Energy Performance from Platform Default to Performance.



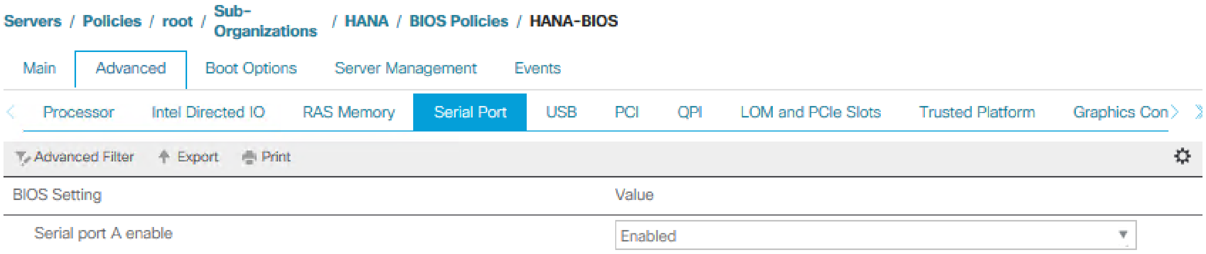
Processor C State	Platform Default
Processor C1E	Platform Default
Processor C3 Report	Disabled
Processor C6 Report	Disabled
Processor C7 Report	Disabled
Processor CMCI	Platform Default
Power Technology	Performance
Energy Performance	Performance

16. In the RAS Memory tab change the LV DDR Mode to performance mode and enable NUMA. Keep the memory RAS configuration on platform default.



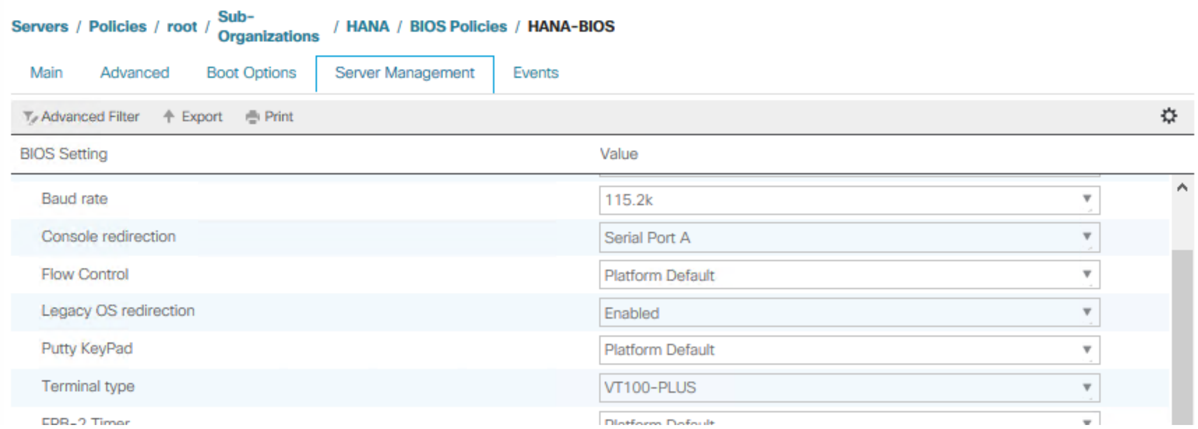
BIOS Setting	Value
DDR3 Voltage Selection	Platform Default
DRAM Refresh Rate	Platform Default
LV DDR Mode	Performance Mode
Mirroring Mode	Platform Default
NUMA optimized	Enabled

17. Enable Serial Port A in the Serial Port tab.



BIOS Setting	Value
Serial port A enable	Enabled

18. In the Server Management tab, configure the Console Redirection to serial-port-a with the BAUD Rate 115200 and enable the feature Lega-cy OS redirect. This is used for Serial Console Access over LAN to all SAP HANA servers.



Servers / Policies / root / Sub-Organizations / HANA / BIOS Policies / **HANA-BIOS**

BIOS Setting	Value
Baud rate	115.2k
Console redirection	Serial Port A
Flow Control	Platform Default
Legacy OS redirection	Enabled
Putty KeyPad	Platform Default
Terminal type	VT100-PLUS
FRB-2 Timer	Platform Default

19. Click Save Changes to update the BIOS Policy.

20. Click OK.

Create Boot Policy for SAN Boot

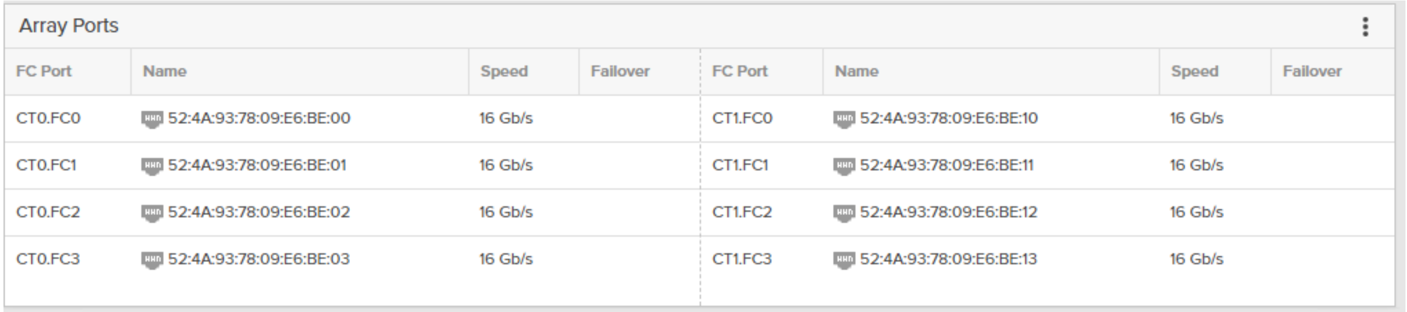
Use “Boot from SAN” to realize full benefits of Cisco UCS stateless computing features such as service profile mobility such as service profile mobility.

The Pure Storage FlashArray//X controller ports are cross connected with the MDS switches to provide alternate paths to the LUNs, in addition to the built-in redundancy and path management features of the FlashArray//X itself.

The Cisco MDS-A switch connects to FlashArray//X controller 0 and SAN port CT0.FC1 and to FlashArray//X Controller 1 and SAN port CT1.FC1 as well as the SAN ports CT0.FC3 and CT1.FC3. The Cisco MDS-B switch connects to both controllers and ports FC0 and FC2 accordingly.

Determine the WWPN information of these storage array target ports from the Purity//FA GUI.

Figure 3. Pure Storage FlashArray//X - FC Target Ports



Array Ports

FC Port	Name	Speed	Failover	FC Port	Name	Speed	Failover
CT0.FC0	52:4A:93:78:09:E6:BE:00	16 Gb/s		CT1.FC0	52:4A:93:78:09:E6:BE:10	16 Gb/s	
CT0.FC1	52:4A:93:78:09:E6:BE:01	16 Gb/s		CT1.FC1	52:4A:93:78:09:E6:BE:11	16 Gb/s	
CT0.FC2	52:4A:93:78:09:E6:BE:02	16 Gb/s		CT1.FC2	52:4A:93:78:09:E6:BE:12	16 Gb/s	
CT0.FC3	52:4A:93:78:09:E6:BE:03	16 Gb/s		CT1.FC3	52:4A:93:78:09:E6:BE:13	16 Gb/s	

The SAN Boot policy requires a primary (vhba-a) and secondary (vhba-b) path, both with a primary and secondary boot target each. For the primary path configure SAN port CT0.FC1 as primary target and SAN port CT1.FC1 as secondary target. For the secondary path configure SAN port CT1.FC0 as primary target and SAN port CT0.FC1 as secondary target.

To create a SAN boot policy for the HANA organization, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Servers > Policies > root > Sub-Organizations > HANA > Boot Policies.
3. Right-click and select Create Boot Policy.
4. Enter HANA-SANboot as boot policy name.
5. Checkmark Enforce vNIC/vHBA/iSCSI Name
6. Select the Boot Mode radio button UEFI.
7. Ensure there is no checkmark for Boot Security.
8. Expand the Local Devices menu and select Add CD/DVD.
9. Expand the vHBAs menu and select Add SAN Boot.
10. Select type Primary.
11. Enter vhba-a in the vHBA field and click OK.
12. Select Add SAN Boot Target.
13. Change Boot Target LUN to 1.

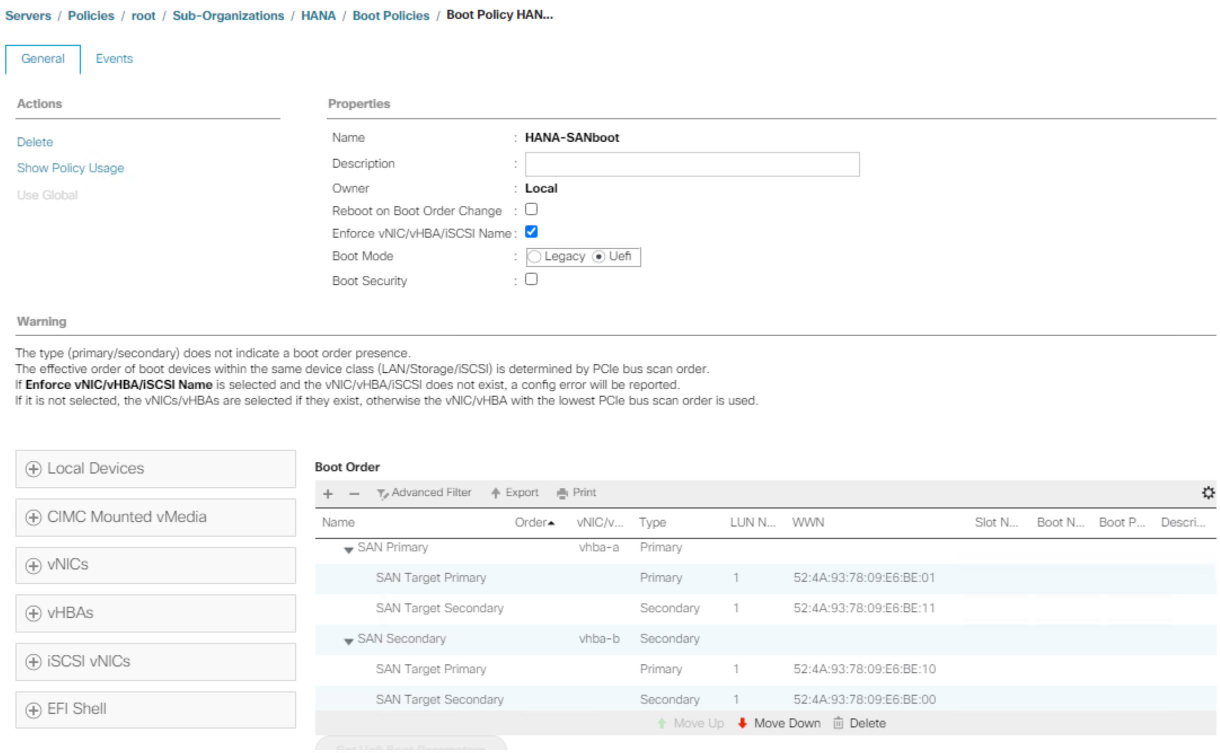
Pure Storage FlashArray//X reserves LUN ID 0 for internal purpose.

14. Enter the WWPN of SAN port CT0.FC1.
15. Select Type Primary and click OK.
16. Add a secondary SAN Boot target to the same vhba-a. Select Add SAN Boot Target
17. Change Boot Target LUN to 1.
18. Enter the WWPN of SAN port CT1.FC0 and click OK.
19. Add the secondary SAN boot target. Select Add SAN Boot.
20. Enter vhba-b in the vHBA field and click OK.
21. Select Add SAN Boot Target
22. Change Boot Target LUN to 1.
23. Enter the WWPN of SAN port CT1.FC0.
24. Select Type Primary and click OK.

25. Add a secondary SAN Boot target to the same vhba-b. Select Add SAN Boot Target

26. Change Boot Target LUN to 1

27. Enter the WWPN of SAN port CT0.FC1 and click OK.



Properties

Name	HANA-SANboot
Description	
Owner	Local
Reboot on Boot Order Change	□
Enforce vNIC/vHBA/iSCSI Name	☑
Boot Mode	○ Legacy ● Uefi
Boot Security	□

Warning

The type (primary/secondary) does not indicate a boot order presence.
The effective order of boot devices within the same device class (LAN/Storage/iSCSI) is determined by PCIe bus scan order.
If **Enforce vNIC/vHBA/iSCSI Name** is selected and the vNIC/vHBA/iSCSI does not exist, a config error will be reported.
If it is not selected, the vNICs/vHBAs are selected if they exist, otherwise the vNIC/vHBA with the lowest PCIe bus scan order is used.

Boot Order

Name	Order	vNIC/v...	Type	LUN N...	WWN	Slot N...	Boot N...	Boot P...	Descri...
SAN Primary		vhba-a	Primary						
SAN Target Primary			Primary	1	52:4A:93:78:09:E6:BE:01				
SAN Target Secondary			Secondary	1	52:4A:93:78:09:E6:BE:11				
SAN Secondary		vhba-b	Secondary						
SAN Target Primary			Primary	1	52:4A:93:78:09:E6:BE:10				
SAN Target Secondary			Secondary	1	52:4A:93:78:09:E6:BE:00				

28. Click OK and confirm with OK.

Create an IPMI/Redfish Access Profile

In the SAP HANA Scale-Out scenario, IPMI enables the HANA internal high availability functionality. To create an IPMI/Redfish access profile, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.

2. Select Servers > Policies > root > Sub-Organizations > HANA > IPMI/Redfish Access Profiles.

3. Right-click IPMI/Redfish Access Profile and select Create IPMI/Redfish Access Profile.

4. Provide the profile name HANA-IPMI

5. (Optional) Add a description

6. Keep IPMI/Redfish Over LAN enabled.

7. Click add to add an IPMI/Redfish user

8. Provide a username <var_ipmi_username>

9. Provide an IPMI password: <var_ipmi_password> and confirm the password.

10. Change the role to Admin and click OK.

Create Serial over LAN Policy

The Serial over LAN policy is required to enable SSH console access to all SAP HANA servers from the management network. This is useful if the server hangs or in the event of a Linux kernel crash when a dump file is required.

To create a Serial over LAN policy, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.

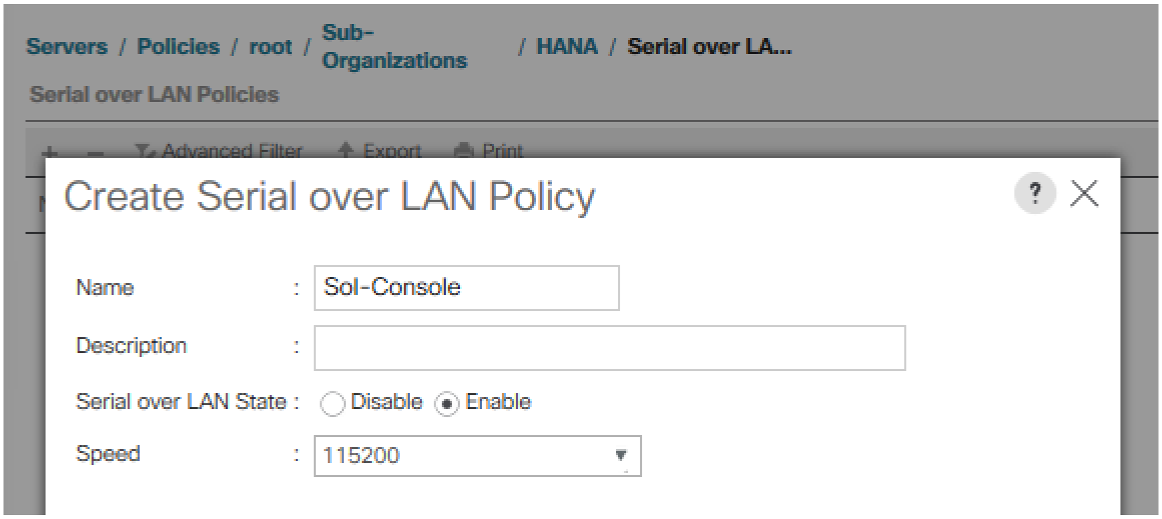
2. Select Policies > root > Sub-Organization > HANA > Serial over LAN Policies.

3. Right-click Serial over LAN Policies and select Create Serial over LAN Policy.

4. Enter SoL-Console as the Policy name.

5. Enable Serial over LAN.

6. Change the Speed to 115200.


Servers / Policies / root / Sub-Organizations / HANA / Serial over LA...
Serial over LAN Policies
+ − Advanced Filter Export Print
?

Create Serial over LAN Policy

Name : Sol-Console

Description :

Serial over LAN State : ○ Disable ● Enable

Speed : 115200

7. Click OK.

Create MAC Address Pools

To configure the necessary MAC address pool in the Cisco UCS environment for each Fabric Interconnect, follow these steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.

2. Select Pools > root > Sub-Organization > HANA > MAC Pools.

3. Right-click and select Create MAC Pool to create the MAC address pool.

4. Enter FI-A as the name of the MAC pool.

5. (Optional) Enter a description for the MAC pool.

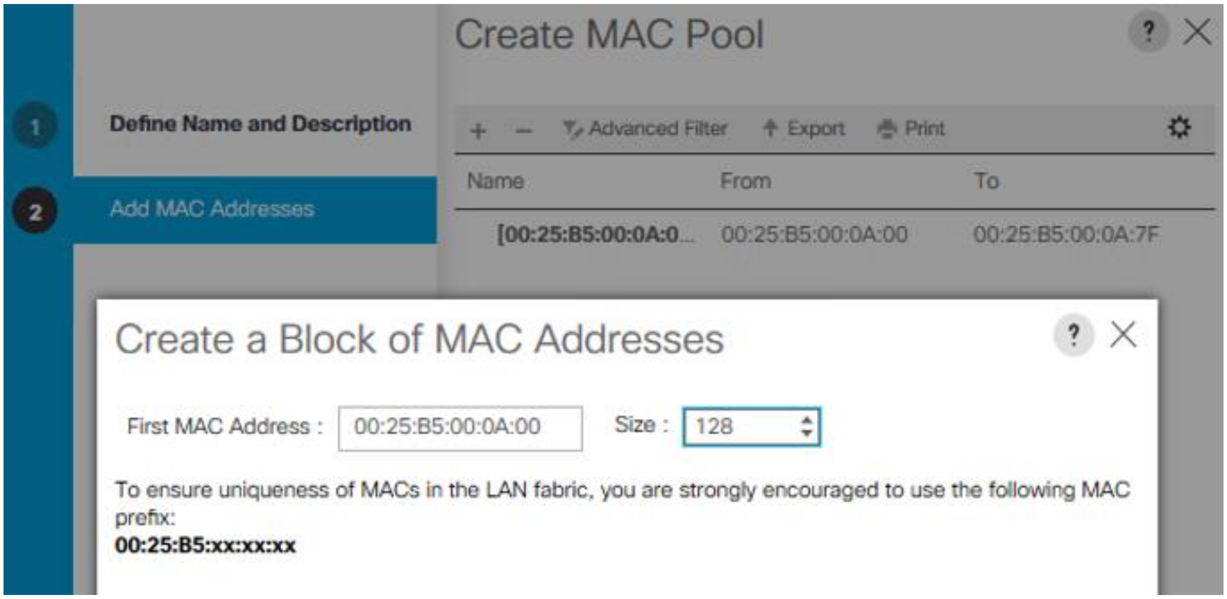
6. Choose Assignment Order Sequential.

7. Click Next.

8. Click Add.

9. Specify a starting MAC address.

10. Specify a size for the MAC address pool that is sufficient to support the available blade or server resources.



Name	From	To
[00:25:B5:00:0A:0...	00:25:B5:00:0A:00	00:25:B5:00:0A:7F

Create a Block of MAC Addresses

First MAC Address : 00:25:B5:00:0A:00 Size : 128

To ensure uniqueness of MACs in the LAN fabric, you are strongly encouraged to use the following MAC prefix:
00:25:B5:xx:xx:xx

11. Click OK.

12. Click Finish.

13. In the confirmation notification, click OK.

14. Right-click MAC Pools under the HANA organization.

15. Select Create MAC Pool to create the MAC address pool.

16. Enter FI-B as the name of the MAC pool.

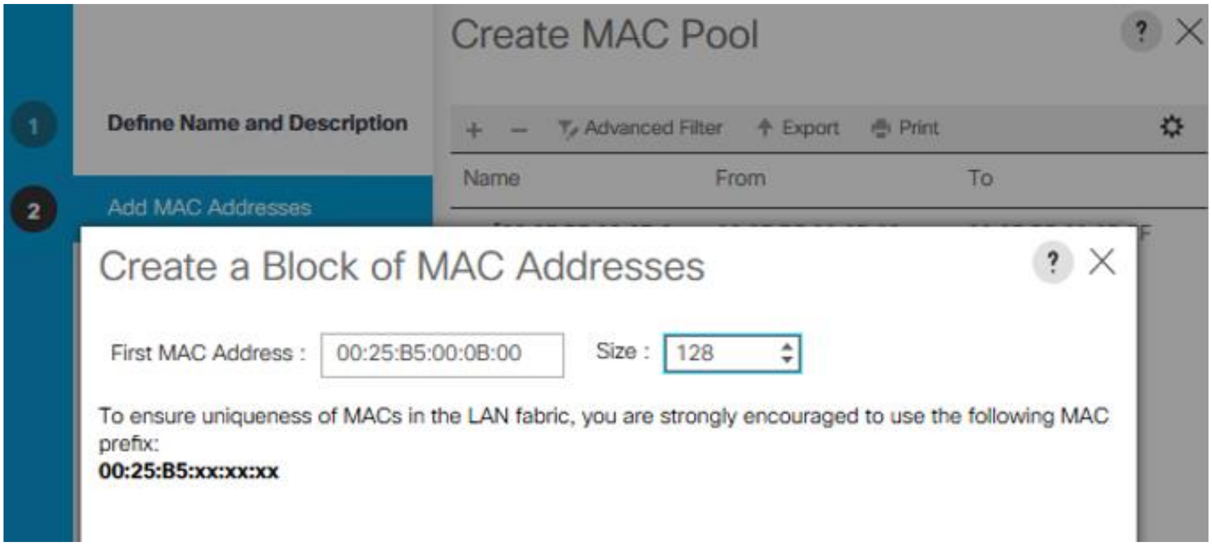
17. (Optional) Enter a description for the MAC pool. Select ‘Sequential’ for Assignment order.

18. Click Next.

19. Click Add.

20. Specify a starting MAC address.

21. Specify a size for the MAC address pool that is sufficient to support the available blade or server resources.


Create MAC Pool
1 Define Name and Description
2 Add MAC Addresses
+ − Advanced Filter Export Print
Name From To

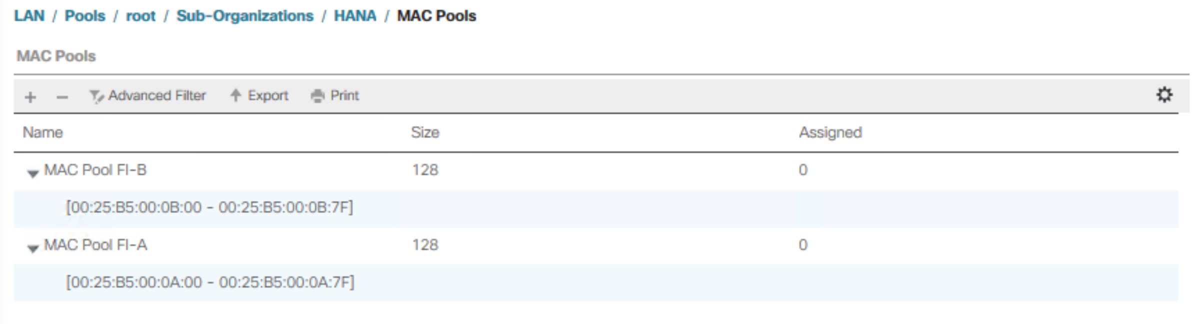
Create a Block of MAC Addresses

First MAC Address : 00:25:B5:00:0B:00 Size : 128

To ensure uniqueness of MACs in the LAN fabric, you are strongly encouraged to use the following MAC prefix:
00:25:B5:xx:xx:xx

22. Click OK.

23. Click Finish and then click OK.


LAN / Pools / root / Sub-Organizations / HANA / MAC Pools
MAC Pools
+ − Advanced Filter Export Print

Name	Size	Assigned
MAC Pool FI-B	128	0
[00:25:B5:00:0B:00 - 00:25:B5:00:0B:7F]		
MAC Pool FI-A	128	0
[00:25:B5:00:0A:00 - 00:25:B5:00:0A:7F]		

Create vNIC Template

Each VLAN is mapped to a vNIC template to specify the characteristic of a specific network. The vNIC template configuration settings include MTU size, Failover capabilities and MAC-Address pools.

To create vNIC templates for the Cisco UCS environment, follow these steps:

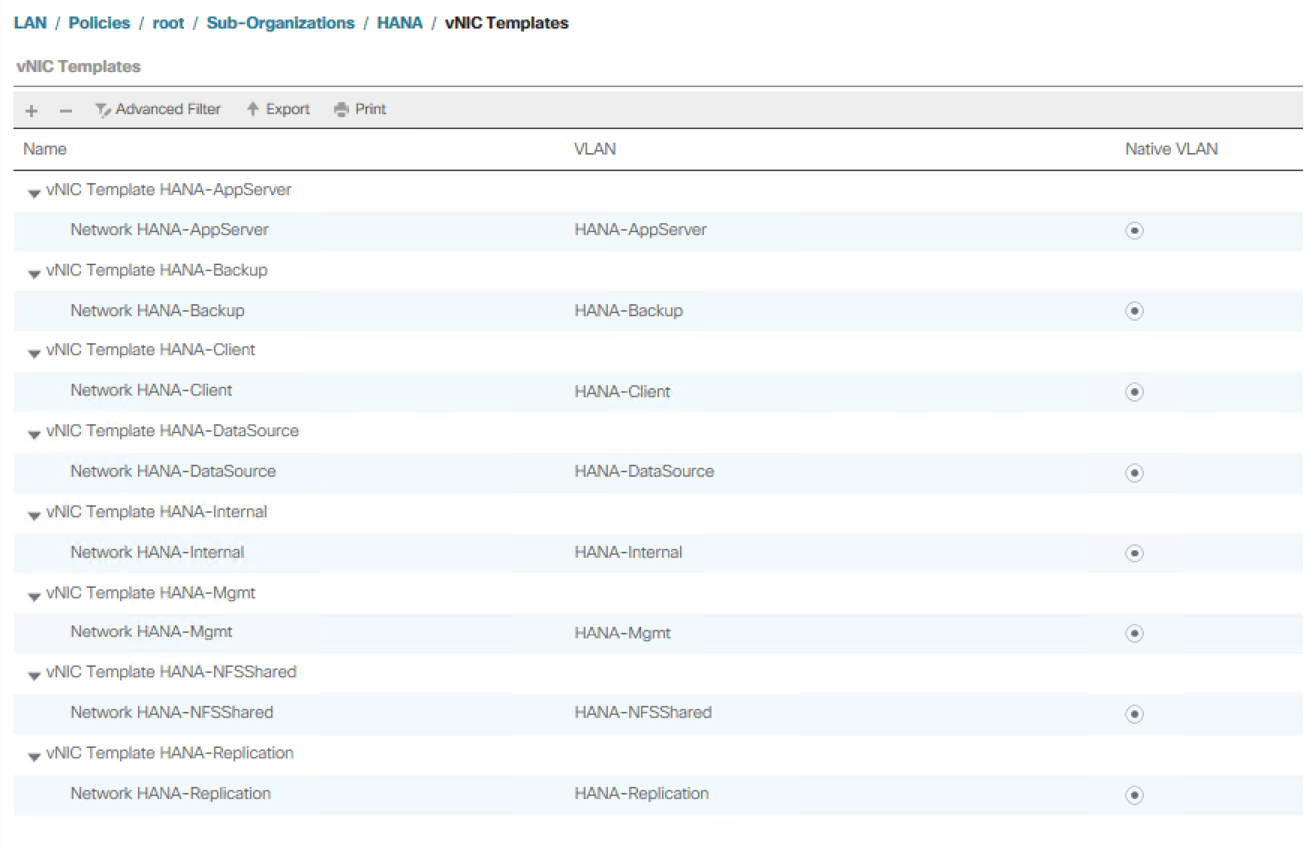
1. In Cisco UCS Manager, click the LAN tab in the navigation pane.

2. Select Policies > root > Sub-Organization > HANA > vNIC Templates.

3. Right-click vNIC Templates and select Create vNIC Template.
4. Enter HANA-Internal as the vNIC template name.
5. (Optional) Provide a vNIC Template description
6. Keep Fabric A selected (alter to Fabric B for the next vNIC Template)
7. Check the Enable Failover checkbox.
8. Under Target, ensure the VM checkbox is unchecked.
9. Select Template Type Updating Template.
10. Select the HANA-Internal VLAN.
11. Enable the native VLAN radio button for the VLAN HANA-Internal.
12. Change the MTU to the maximum value 9000.
13. Select the MAC Pool list for FI-A (Select FI-B for the next vNIC Template)
14. Select Default from the drop-down list of Network Control Policy.
15. Keep all other settings default
16. Click OK to create the vNIC template.
17. Confirm the new vNIC template with OK.

For optimal performance a MTU size of 9000 is recommended for all vNICs. For the management vNIC the MTU size of 1500 or 9000 is optional.

18. Continue to create a vNIC template for each VLAN altering the FI-A and FI-B assignments.



LAN / Policies / root / Sub-Organizations / HANA / **vNIC Templates**

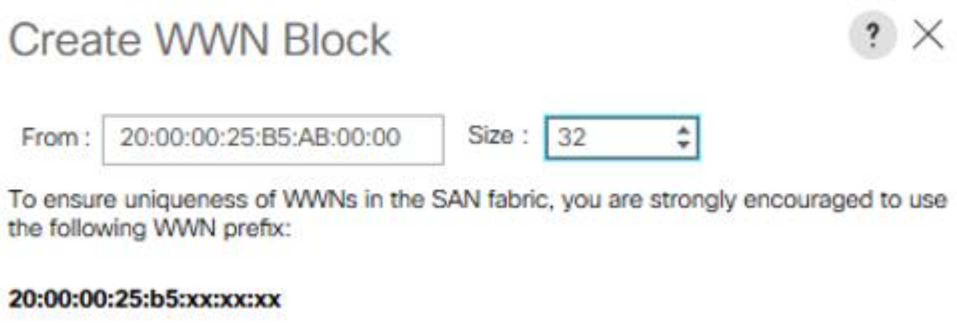
vNIC Templates

Name	VLAN	Native VLAN
vNIC Template HANA-AppServer		
Network HANA-AppServer	HANA-AppServer	◉
vNIC Template HANA-Backup		
Network HANA-Backup	HANA-Backup	◉
vNIC Template HANA-Client		
Network HANA-Client	HANA-Client	◉
vNIC Template HANA-DataSource		
Network HANA-DataSource	HANA-DataSource	◉
vNIC Template HANA-Internal		
Network HANA-Internal	HANA-Internal	◉
vNIC Template HANA-Mgmt		
Network HANA-Mgmt	HANA-Mgmt	◉
vNIC Template HANA-NFSShared		
Network HANA-NFSShared	HANA-NFSShared	◉
vNIC Template HANA-Replication		
Network HANA-Replication	HANA-Replication	◉

Create WWNN Pool

To configure the WWNN pool for the HANA organization in the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the SAN tab in the navigation pane.
2. Select Pools > root > Sub-Organization > HANA > WWNN Pools.
3. Right-click WWNN Pools and select Create WWNN Pool.
4. Enter HANA-Nodes as the name of the WWNN pool.
5. (Optional) Enter a description for the WWNN pool.
6. Choose Assignment Order Sequential.
7. Click Next.
8. Click Add.
9. Specify a starting WWNN address.
10. Specify a size for the WWNN pool that is sufficient to support the available blade or server resources.



Create WWN Block

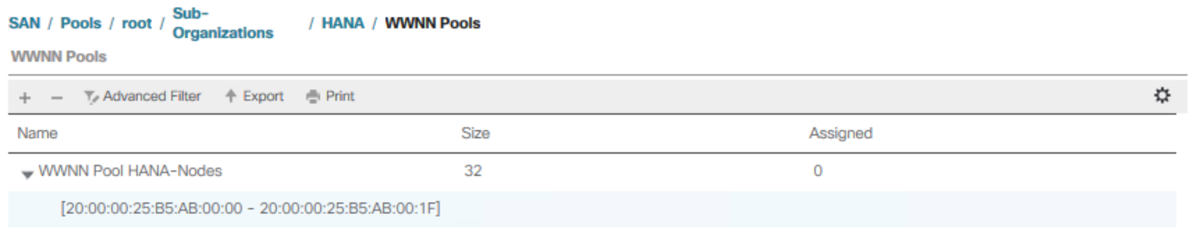
From : 20:00:00:25:B5:AB:00:00 Size : 32

To ensure uniqueness of WWNs in the SAN fabric, you are strongly encouraged to use the following WWN prefix:

20:00:00:25:b5:xx:xx:xx

11. Click OK.

12. Click Finish and confirm with OK.



SAN / Pools / root / Sub-Organizations / HANA / **WWNN Pools**

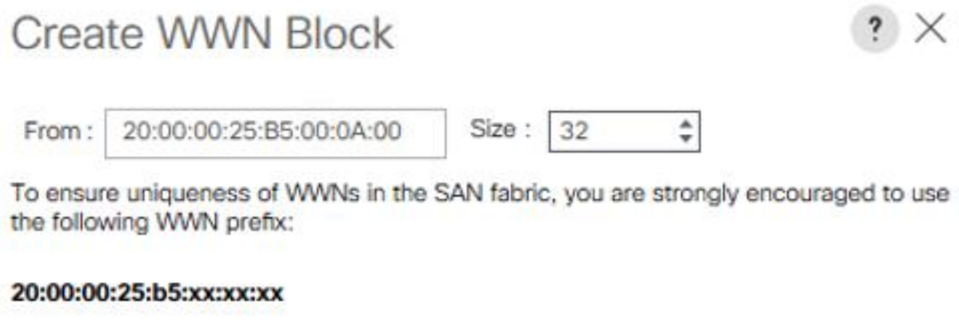
WWNN Pools

Name	Size	Assigned
WWNN Pool HANA-Nodes	32	0
[20:00:00:25:B5:AB:00:00 - 20:00:00:25:B5:AB:00:1F]		

Create WWPN Pool

To configure each Fabric Interconnect with the WWPN pool in the Cisco UCS environment, follow these steps:

1. In Cisco UCS Manager, click the SAN tab in the navigation pane.
2. Select Pools > root > Sub-Organization > HANA > WWPN Pools.
3. Right-click WWPN Pools and select Create WWPN Pool.
4. Enter FI-A as WWPN pool name.
5. (Optional) Enter a description for the WWPN pool.
6. Choose Assignment Order Sequential.
7. Click Next.
8. Click Add.
9. Specify a starting WWN address.
10. Specify a size for the WWPN address pool that is sufficient to support the available blade or server resources.



Create WWN Block

From : 20:00:00:25:B5:00:0A:00

Size : 32

To ensure uniqueness of WWNs in the SAN fabric, you are strongly encouraged to use the following WWN prefix:

20:00:00:25:b5:xx:xx:xx

11. Click OK.

12. Click Finish and OK to confirm the confirmation notification.

13. Right-click WWPN Pools under the HANA organization again.

14. Select Create WWPN Pool to create another WWNN address pool.

15. Enter FI-B as the name of the WWPN pool.

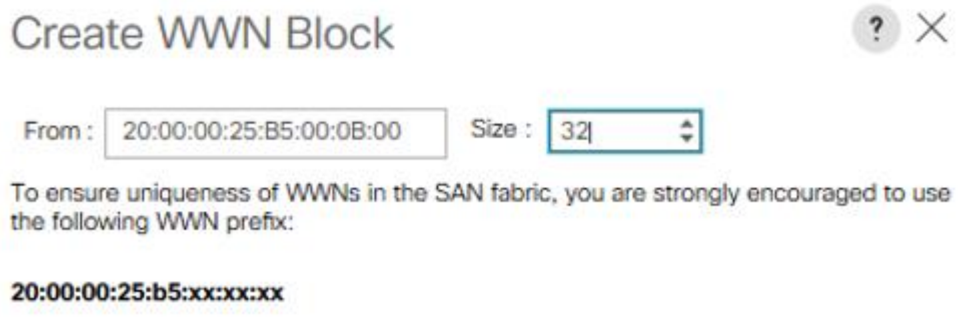
16. (Optional) Enter a description for the WWPN pool. Select ‘Sequential’ for Assignment order.

17. Click Next.

18. Click Add.

19. Specify a starting WWPN address.

20. Specify a size for the WWPN address pool that is sufficient to support the available blade or server resources.



Create WWN Block

From : 20:00:00:25:B5:00:0B:00

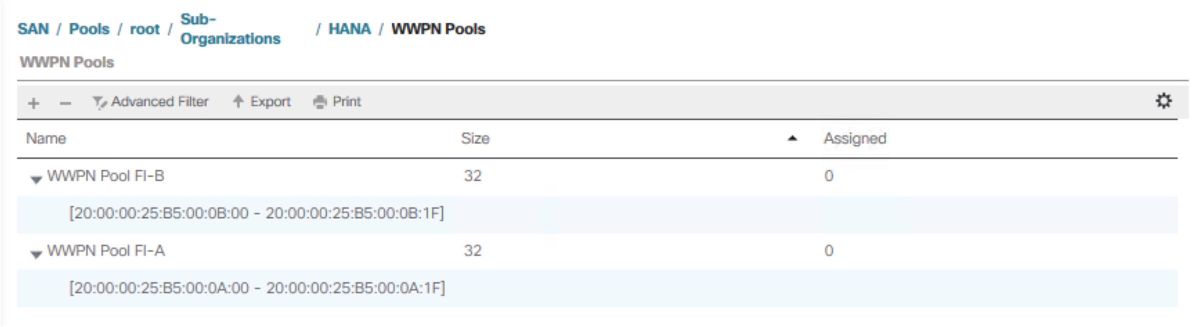
Size : 32

To ensure uniqueness of WWNs in the SAN fabric, you are strongly encouraged to use the following WWN prefix:

20:00:00:25:b5:xx:xx:xx

21. Click OK.

22. Click Finish and then click OK.



SAN / Pools / root / Sub-Organizations / HANA / WWPN Pools

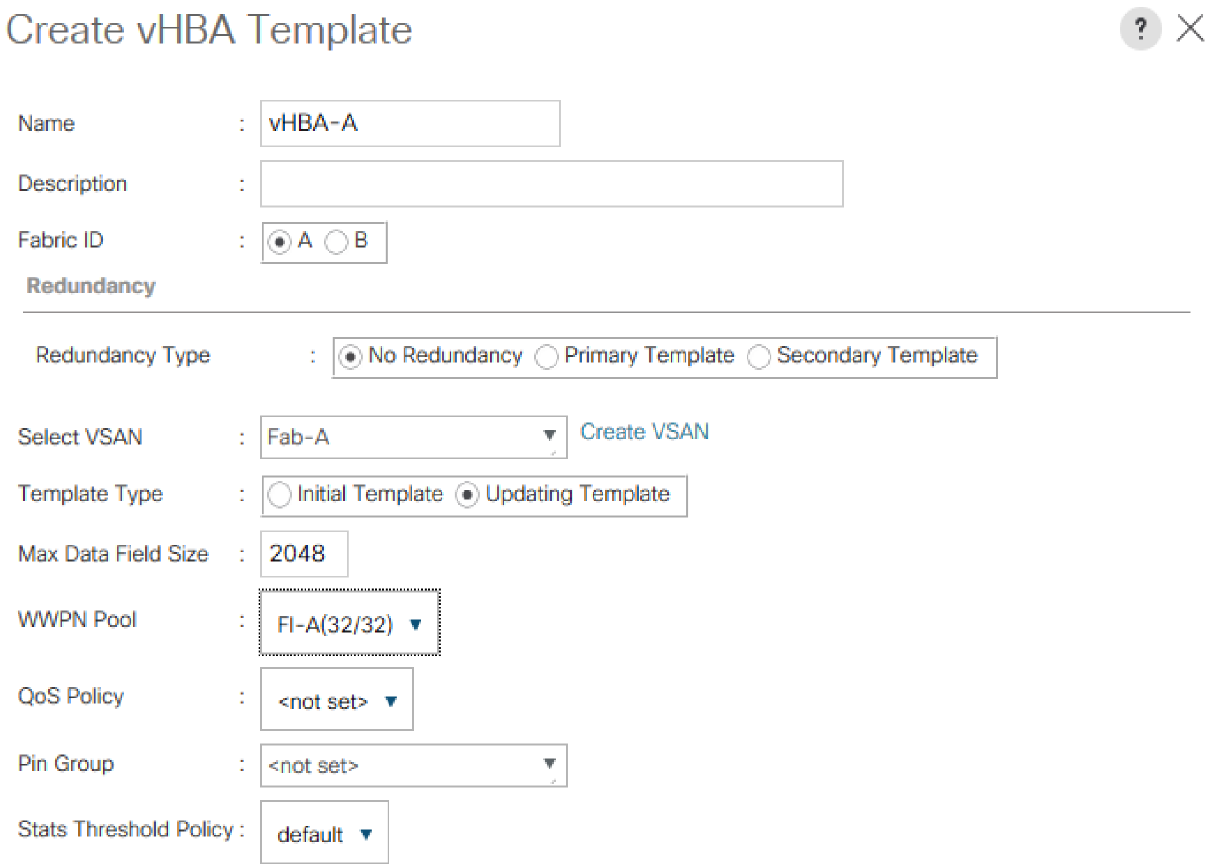
WWPN Pools

Name	Size	Assigned
WWPN Pool FI-B	32	0
[20:00:00:25:B5:00:0B:00 - 20:00:00:25:B5:00:0B:1F]		
WWPN Pool FI-A	32	0
[20:00:00:25:B5:00:0A:00 - 20:00:00:25:B5:00:0A:1F]		

Create vHBA Template

To create one dedicated vHBA template for each Fabric Interconnect, follow these steps:

1. In Cisco UCS Manager, click the SAN tab in the navigation pane.
2. Select SAN > Policies > root > Sub-Organizations > HANA > vHBA Templates.
3. Right-click vHBA Templates and select Create vHBA Template.
4. Choose vHBA-A as template name.
5. (Optional) Provide a description.
6. Select Fabric ID A
7. Select VSAN Fab-A and Template Type Updating template.
8. Select WWPN Pool FI-A.
9. Click OK and then click OK again.



Create vHBA Template

Name : vHBA-A

Description :

Fabric ID : ● A ○ B

Redundancy

Redundancy Type : ● No Redundancy ○ Primary Template ○ Secondary Template

Select VSAN : Fab-A ▼ Create VSAN

Template Type : ○ Initial Template ● Updating Template

Max Data Field Size : 2048

WWPN Pool : FI-A(32/32) ▼

QoS Policy : <not set> ▼

Pin Group : <not set> ▼

Stats Threshold Policy : default ▼

10. Right-click vHBA Templates and select Create vHBA Template.

11. Choose vHBA-B as template name.

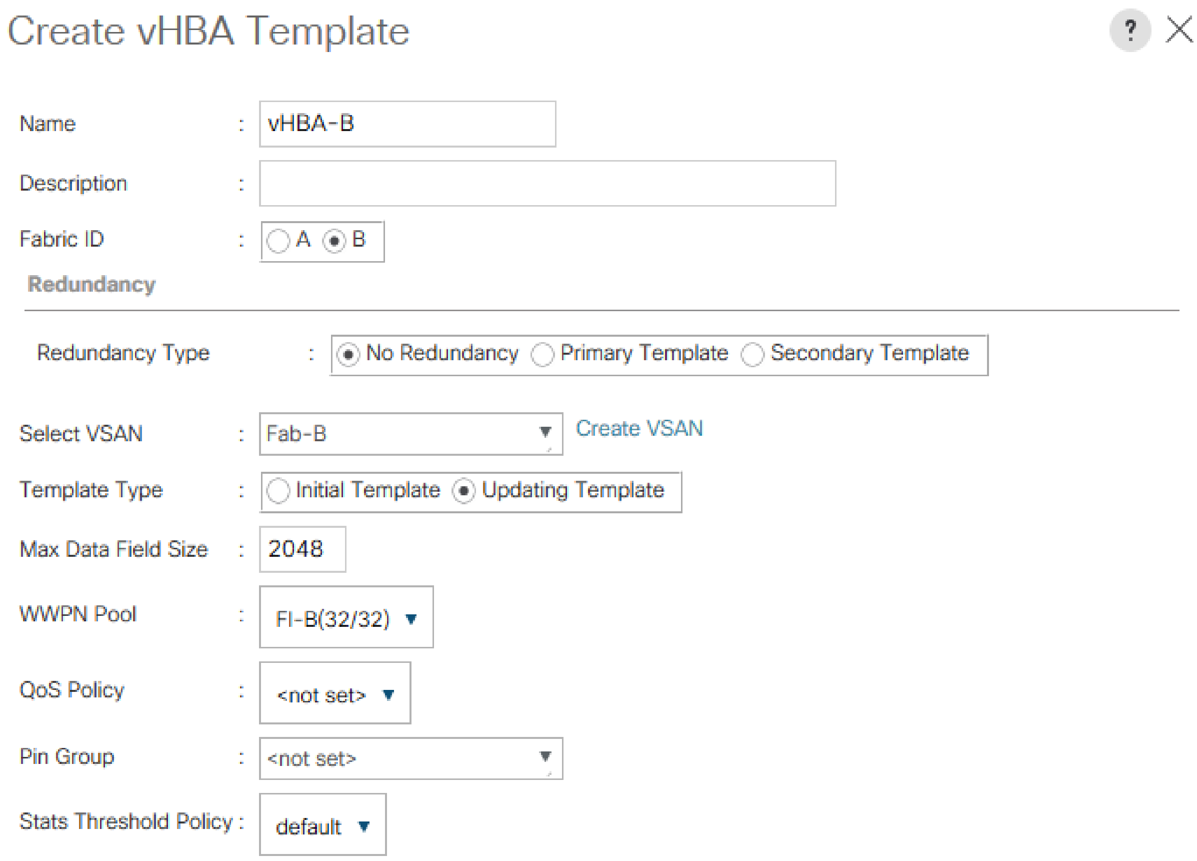
12. (Optional) Provide a description.

13. Select Fabric ID B

14. Select VSAN Fab-B and Template Type Updating template.

15. Select WWPN Pool FI-B.

16. Click OK and then click OK again.



Create vHBA Template

Name	:	vHBA-B
Description	:	
Fabric ID	:	○ A ● B

Redundancy

Redundancy Type	:	● No Redundancy ○ Primary Template ○ Secondary Template

Select VSAN	:	Fab-B ▼ Create VSAN
Template Type	:	○ Initial Template ● Updating Template
Max Data Field Size	:	2048
WWPN Pool	:	FI-B(32/32) ▼
QoS Policy	:	<not set> ▼
Pin Group	:	<not set> ▼
Stats Threshold Policy	:	default ▼

Create SAN Connectivity Policy

After establishing the physical connectivity, configure the zoning for the servers and the SAN:

- Storage connection policies: This configures the storage connectivity considering the WWPN Target numbers. Since Zoning is handled by the MDS switches and the FIs aren't direct attached to the Storage, a storage connection policy is not required.
- SAN connectivity policies: This configures vHBAs for the servers which will provide WWPN Initiator numbers for the servers. This server-side configuration is necessary to prepare the server connection towards the storage.

To configure the storage connection policy, follow these steps:

1. In Cisco UCS Manager, click the SAN tab in the navigation pane.
2. Select SAN > Policies > root > Sub-Organizations > HANA > SAN Connectivity Policies.
3. Right-click SAN Connectivity Policies and select Create SAN Connectivity Policy.
4. Enter the SAP Connectivity policy name HANA-SAN.
5. (Optional) Add a description.

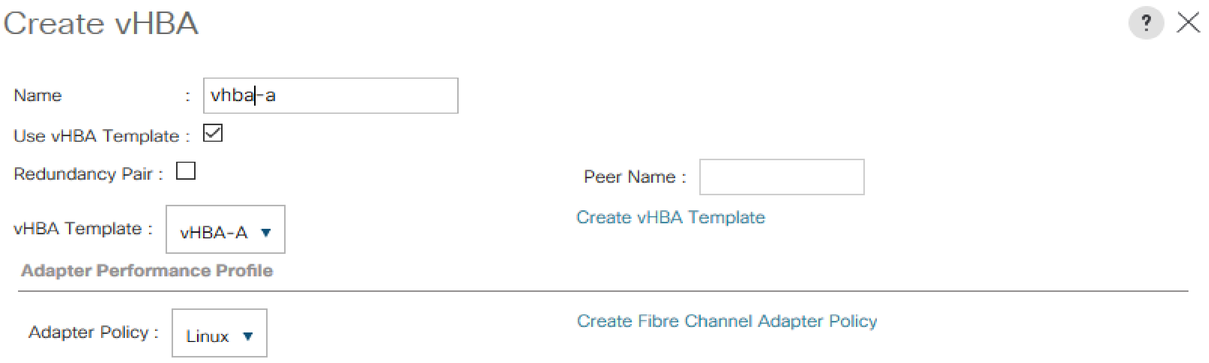
6. Select HANA-Nodes from the WWNN Assignment drop-down list.

7. Click Add to add the vHBAs from the vHBA templates previously created.

8. In the Create vHBA window, provide a name as vhba-a.

9. Checkmark the “Use vHBA Template” option.

10. Select vHBA-A from the vHBA Template drop-down list and Linux from the Adapter Policy drop-down list.



Create vHBA

Name : vhba-a

Use vHBA Template : ☑

Redundancy Pair : □

Peer Name :

vHBA Template : vHBA-A ▾

Adapter Performance Profile

Adapter Policy : Linux ▾

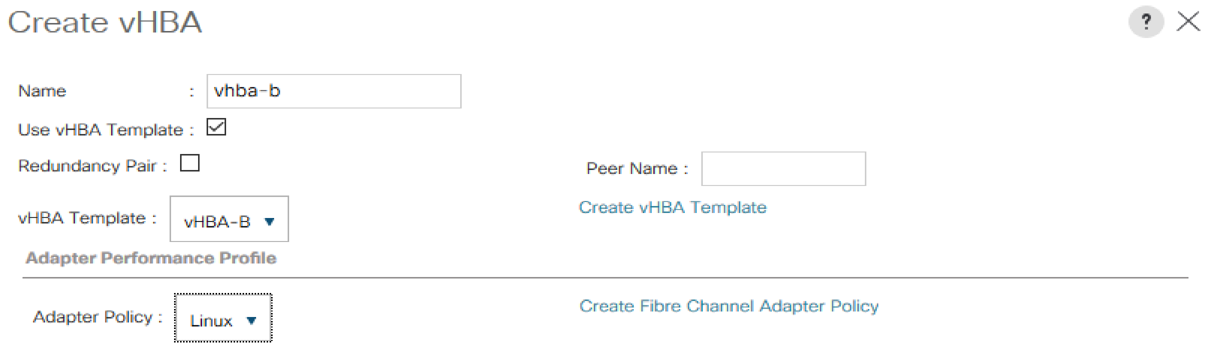
11. Click OK

12. Click Add in the Create SAN Connectivity Policy window to add another vHBA

13. In the Create vHBA window, provide name as vhba-b.

14. Checkmark the “Use vHBA Template” option.

15. Select vHBA-B from the vHBA Template drop-down list and Linux from the Adapter Policy drop-down list.



Create vHBA

Name : vhba-b

Use vHBA Template : ☑

Redundancy Pair : □

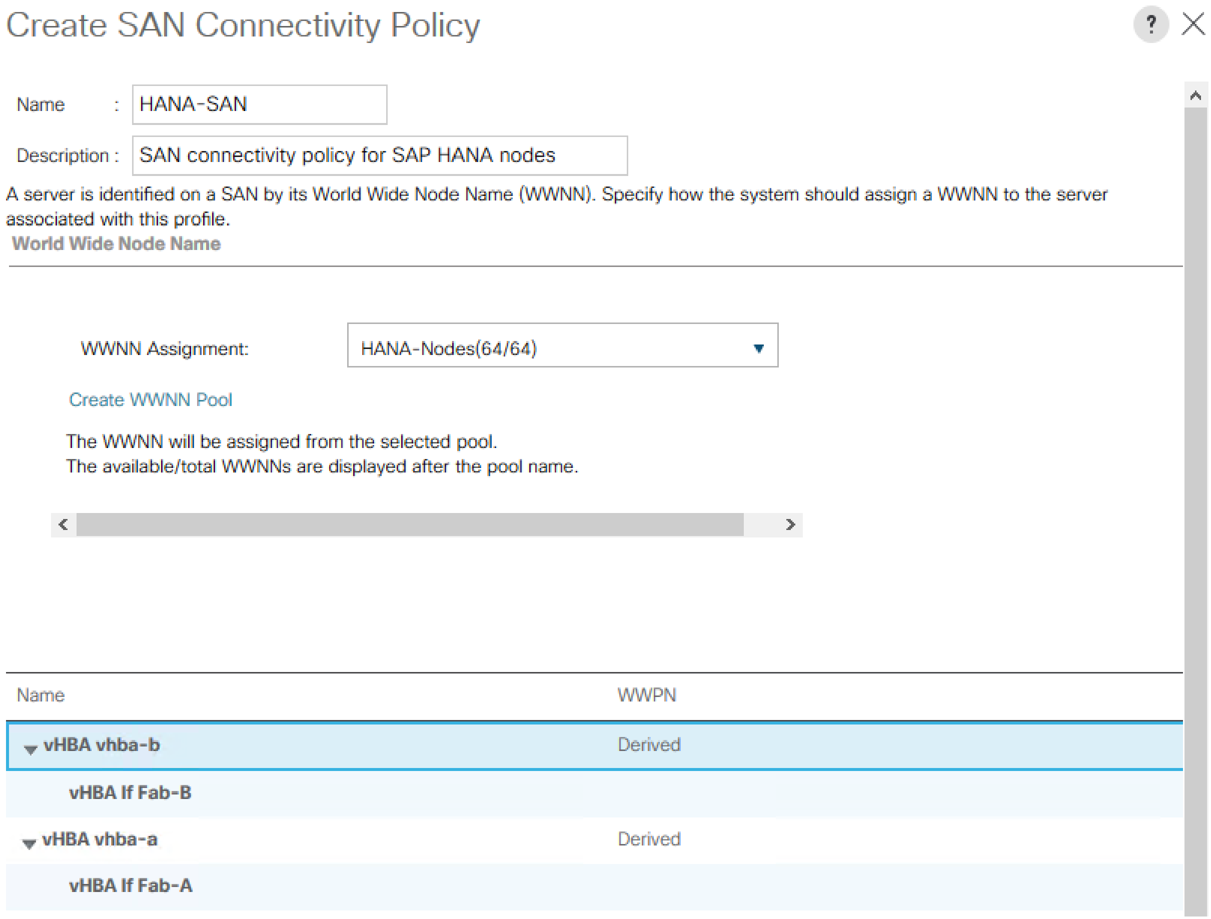
Peer Name :

vHBA Template : vHBA-B ▾

Adapter Performance Profile

Adapter Policy : Linux ▾

16. Click OK.



Create SAN Connectivity Policy

Name : HANA-SAN

Description : SAN connectivity policy for SAP HANA nodes

A server is identified on a SAN by its World Wide Node Name (WWNN). Specify how the system should assign a WWNN to the server associated with this profile.

World Wide Node Name

WWNN Assignment: HANA-Nodes(64/64)

The WWNN will be assigned from the selected pool.
The available/total WWNNs are displayed after the pool name.

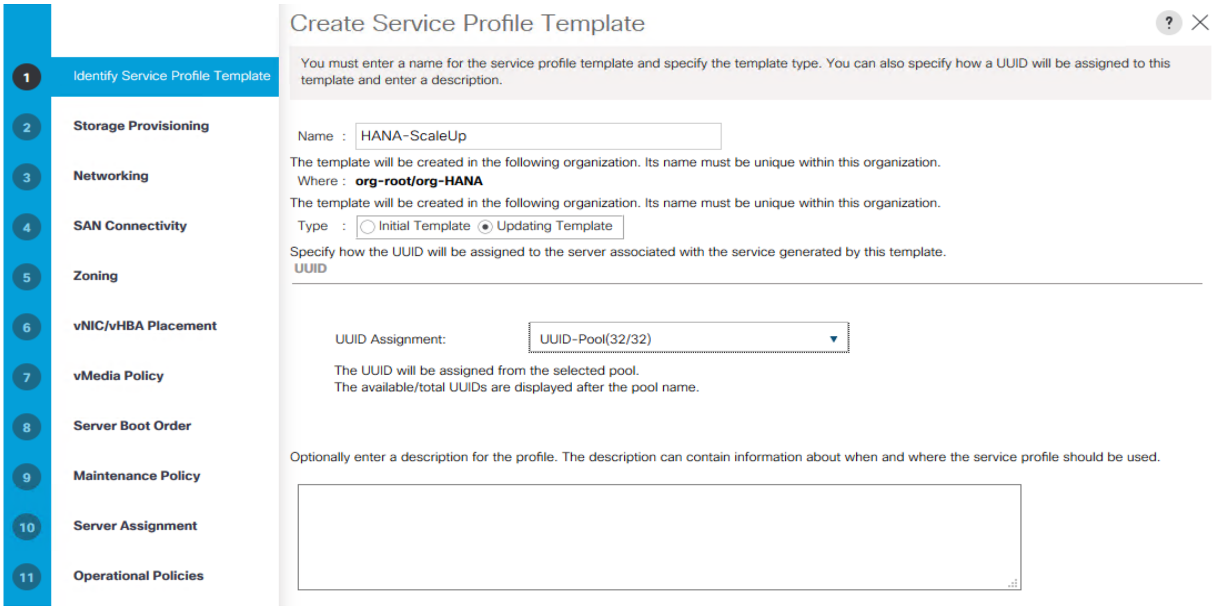
Name	WWPN
vHBA vhba-b	Derived
vHBA If Fab-B	
vHBA vhba-a	Derived
vHBA If Fab-A	

17. Click OK and then click with OK again.

Create SAP HANA Service Profile Template

To create SAP HANA Service Profile template, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Service Profile Templates > root > Sub-Organization > HANA.
3. Right-click HANA and select Create Service Profile Template.
4. In the Create Service Profile Template wizard enter a service profile template name.
5. Select the radio button Updating Template.
6. Change the UUID assignment and select the UUID pool from the drop-down list.
7. (Optional) Add a description.



Create Service Profile Template

You must enter a name for the service profile template and specify the template type. You can also specify how a UUID will be assigned to this template and enter a description.

Name : HANA-ScaleUp

The template will be created in the following organization. Its name must be unique within this organization.

Where : **org-root/org-HANA**

The template will be created in the following organization. Its name must be unique within this organization.

Type : ○ Initial Template ● Updating Template

Specify how the UUID will be assigned to the server associated with the service generated by this template.

UUID

UUID Assignment: UUID-Pool(32/32)

The UUID will be assigned from the selected pool.
The available/total UUIDs are displayed after the pool name.

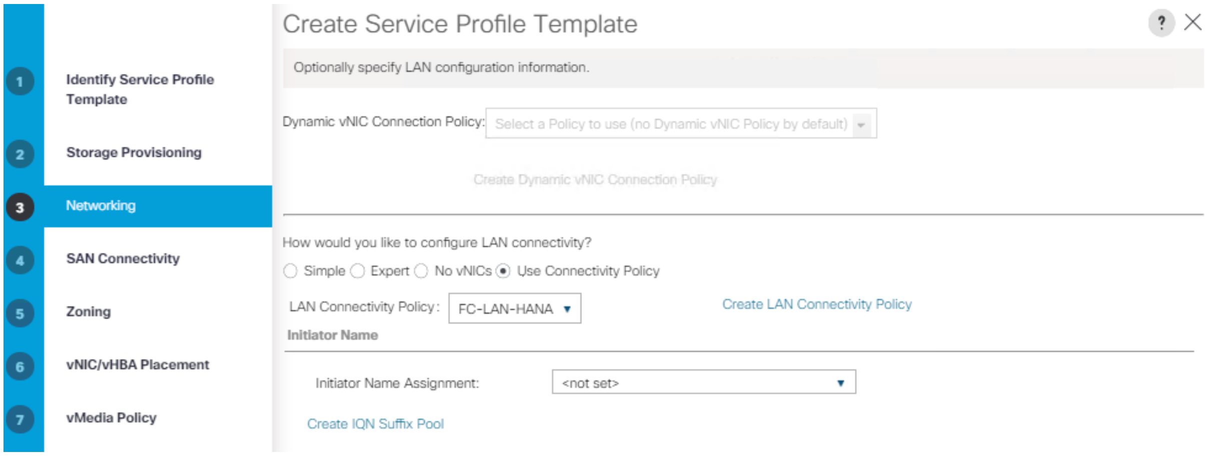
Optionally enter a description for the profile. The description can contain information about when and where the service profile should be used.

8. Click Next.

9. Skip Storage Provisioning and click Next.

10. Select the Use Connectivity Policy radio button on the question how to configure the LAN connectivity.

11. Select FC-LAN-HANA from the LAN Connectivity Policy drop-down list and click Next.



Create Service Profile Template

Optionally specify LAN configuration information.

Dynamic vNIC Connection Policy: Select a Policy to use (no Dynamic vNIC Policy by default)

How would you like to configure LAN connectivity?

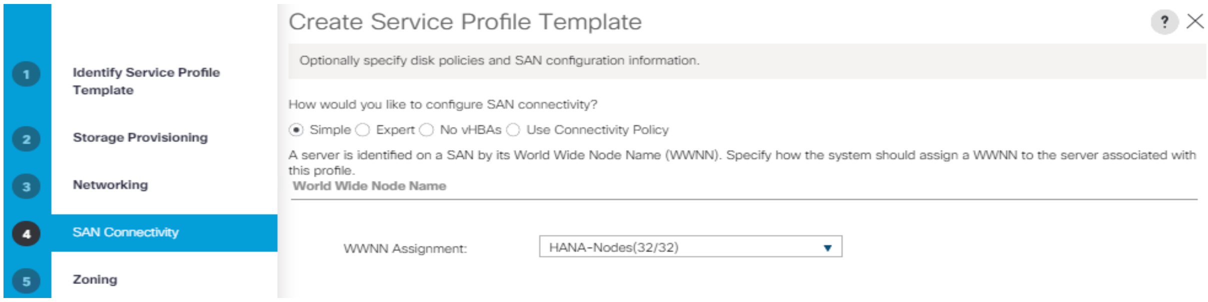
○ Simple ○ Expert ○ No vNICs ● Use Connectivity Policy

LAN Connectivity Policy : FC-LAN-HANA

Initiator Name

Initiator Name Assignment: <not set>

12. Select HANA-Nodes from the WWNN Assignment drop-down list.



Create Service Profile Template

Optionally specify disk policies and SAN configuration information.

How would you like to configure SAN connectivity?

● Simple ○ Expert ○ No vHBAs ○ Use Connectivity Policy

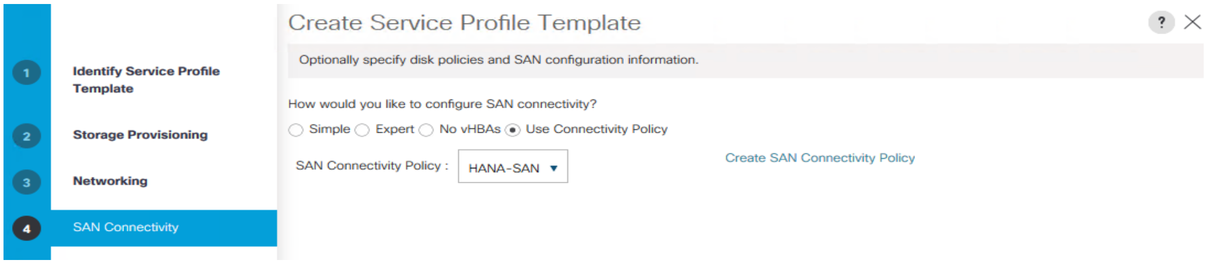
A server is identified on a SAN by its World Wide Node Name (WWNN). Specify how the system should assign a WWNN to the server associated with this profile.

World Wide Node Name

WWNN Assignment: HANA-Nodes(32/32)

13. Enable the radio button Use Connectivity Policy on the top.

14. Select HANA-SAN from the SAN Connectivity Policy drop-down list.


1 Identify Service Profile Template
2 Storage Provisioning
3 Networking
4 SAN Connectivity
?
Create SAN Connectivity Policy

Create Service Profile Template

Optionally specify disk policies and SAN configuration information.

How would you like to configure SAN connectivity?

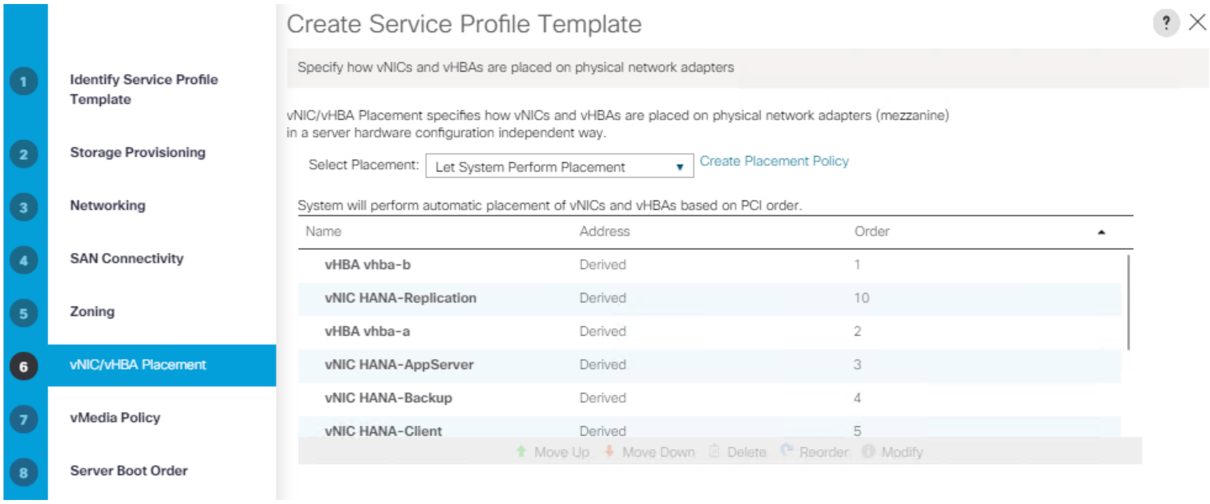
○ Simple ○ Expert ○ No vHBAs ● Use Connectivity Policy

SAN Connectivity Policy : HANA-SAN

15. Click Next.

16. Skip Zoning and click Next.

17. Keep Let System Perform Placement in the drop-down list.



Create Service Profile Template

Specify how vNICs and vHBAs are placed on physical network adapters

vNIC/vHBA Placement specifies how vNICs and vHBAs are placed on physical network adapters (mezzanine) in a server hardware configuration independent way.

Select Placement: Let System Perform Placement

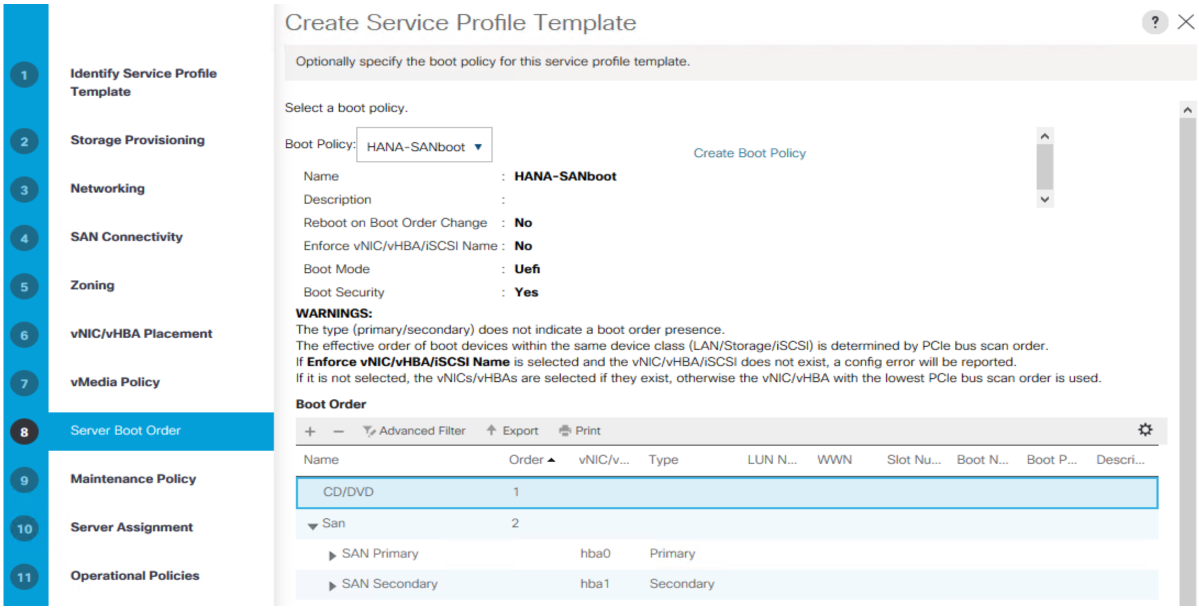
System will perform automatic placement of vNICs and vHBAs based on PCI order.

Name	Address	Order
vHBA vhba-b	Derived	1
vNIC HANA-Replication	Derived	10
vHBA vhba-a	Derived	2
vNIC HANA-AppServer	Derived	3
vNIC HANA-Backup	Derived	4
vNIC HANA-Client	Derived	5

18. Click Next.

19. Skip vMedia Policy and click Next.

20. Select HANA-SANboot from the Boot Policy drop-down list.



Create Service Profile Template

Optionally specify the boot policy for this service profile template.

Select a boot policy.

Boot Policy: HANA-SANboot ▾

Name	:	**HANA-SANboot**
Description	:	
Reboot on Boot Order Change	:	**No**
Enforce vNIC/vHBA/iSCSI Name	:	**No**
Boot Mode	:	**Uefi**
Boot Security	:	**Yes**

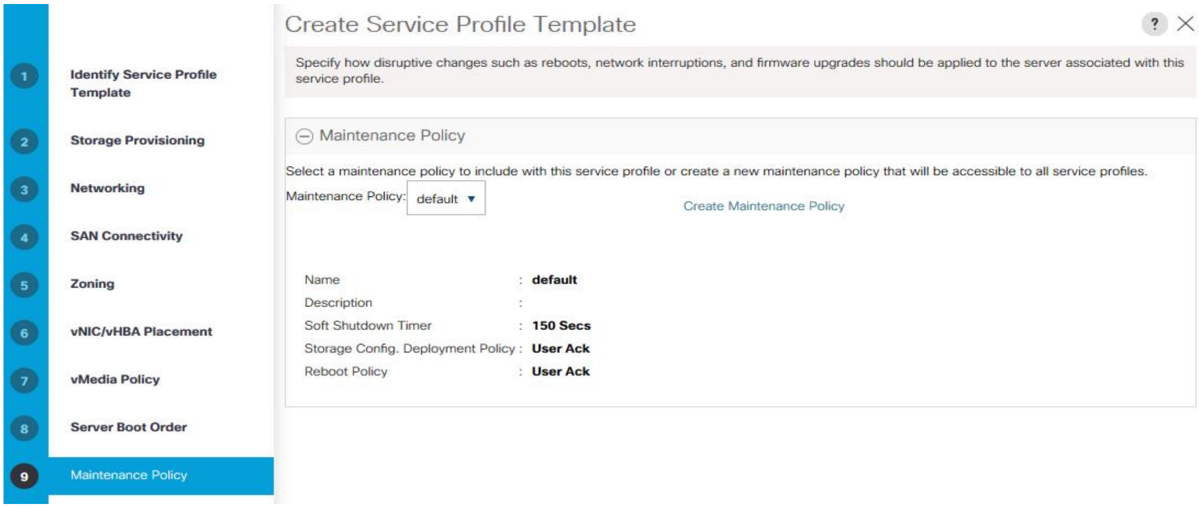
WARNINGS:
The type (primary/secondary) does not indicate a boot order presence.
The effective order of boot devices within the same device class (LAN/Storage/iSCSI) is determined by PCIe bus scan order.
If **Enforce vNIC/vHBA/iSCSI Name** is selected and the vNIC/vHBA/iSCSI does not exist, a config error will be reported.
If it is not selected, the vNICs/vHBAs are selected if they exist, otherwise the vNIC/vHBA with the lowest PCIe bus scan order is used.

Boot Order

Name	Order ▲	vNIC/v...	Type	LUN N...	WWN	Slot Nu...	Boot N...	Boot P...	Descri...
CD/DVD	1								
▾ San	2								
▸ SAN Primary		hba0	Primary						
▸ SAN Secondary		hba1	Secondary						

21. Click Next.

22. Select default from the Maintenance Policy drop-down list and click Next.



Create Service Profile Template

Specify how disruptive changes such as reboots, network interruptions, and firmware upgrades should be applied to the server associated with this service profile.

⊖ Maintenance Policy

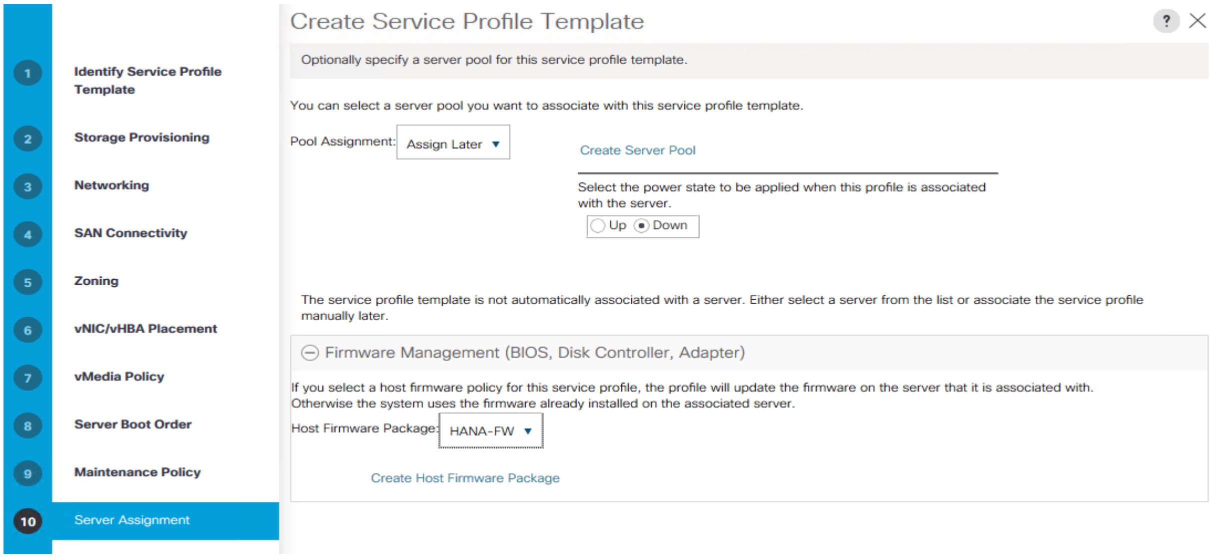
Select a maintenance policy to include with this service profile or create a new maintenance policy that will be accessible to all service profiles.

Maintenance Policy: default ▾

Name	:	**default**
Description	:	
Soft Shutdown Timer	:	**150 Secs**
Storage Config. Deployment Policy	:	**User Ack**
Reboot Policy	:	**User Ack**

23. Enable the Power State Down radio button.

24. Expand Firmware Management and select HANA-FW from the Host Firmware Package drop-down list.



Create Service Profile Template

Optionally specify a server pool for this service profile template.

You can select a server pool you want to associate with this service profile template.

Pool Assignment: Assign Later ▾

Select the power state to be applied when this profile is associated with the server.

○ Up ● Down

The service profile template is not automatically associated with a server. Either select a server from the list or associate the service profile manually later.

⊖ Firmware Management (BIOS, Disk Controller, Adapter)

If you select a host firmware policy for this service profile, the profile will update the firmware on the server that it is associated with. Otherwise the system uses the firmware already installed on the associated server.

Host Firmware Package: HANA-FW ▾

25. Click Next.

26. In BIOS Configuration select HANA-BIOS from the BIOS Policy drop-down list.

27. Select the HANA-IPMI profile from the IPMI/Redfish Access Profile drop-down list.

28. Select Sol-Console from the SoL Configuration Profile drop-down list.

29. In Management IP Address select ext-mgmt from the Management IP Address Policy drop-down list in the Out-band IPv4 tab.

30. In Power Control Policy Configuration select HANA from the Power Control Policy drop-down list.

31. In the Scrub Policy select default from the Scrub Policy drop-down list.

32. In KVM Management Policy select default from the KVM Management Policy drop-down list.

33. In Graphics Card Policy select default from the Graphics Card Policy drop-down list.

34. Click Finish to create the service profile template and then click OK.

Create Service Profile from the Template

To create service profiles using the service profile template, follow these steps:

1. In Cisco UCSM, click the Servers tab in the navigation pane.

2. Select Servers > Service Profile Templates > root > Sub-Organization > HANA.

3. Right-click HANA and select Create Service Profiles from Template.

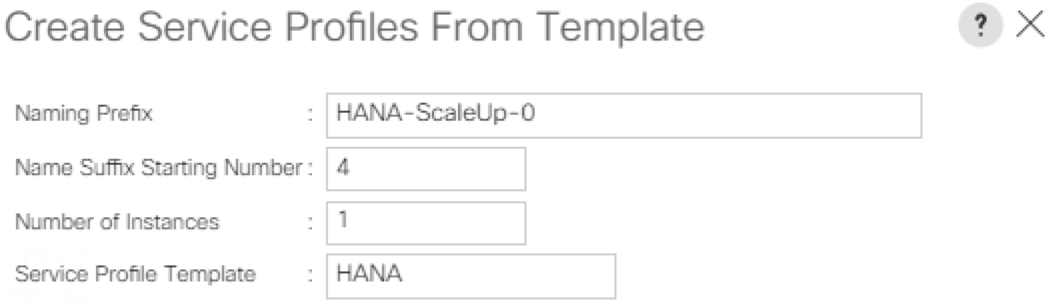
4. Enter HANA-Server0 as the service profile prefix.

5. Enter 4 as Name Suffix Starting Number.

6. Enter 1 as the Number of Instances

7. Select the HANA Service Profile Template from the drop-down list.

8. Click OK to create the Service Profile from the Template.



Create Service Profiles From Template

Naming Prefix : HANA-ScaleUp-0

Name Suffix Starting Number : 4

Number of Instances : 1

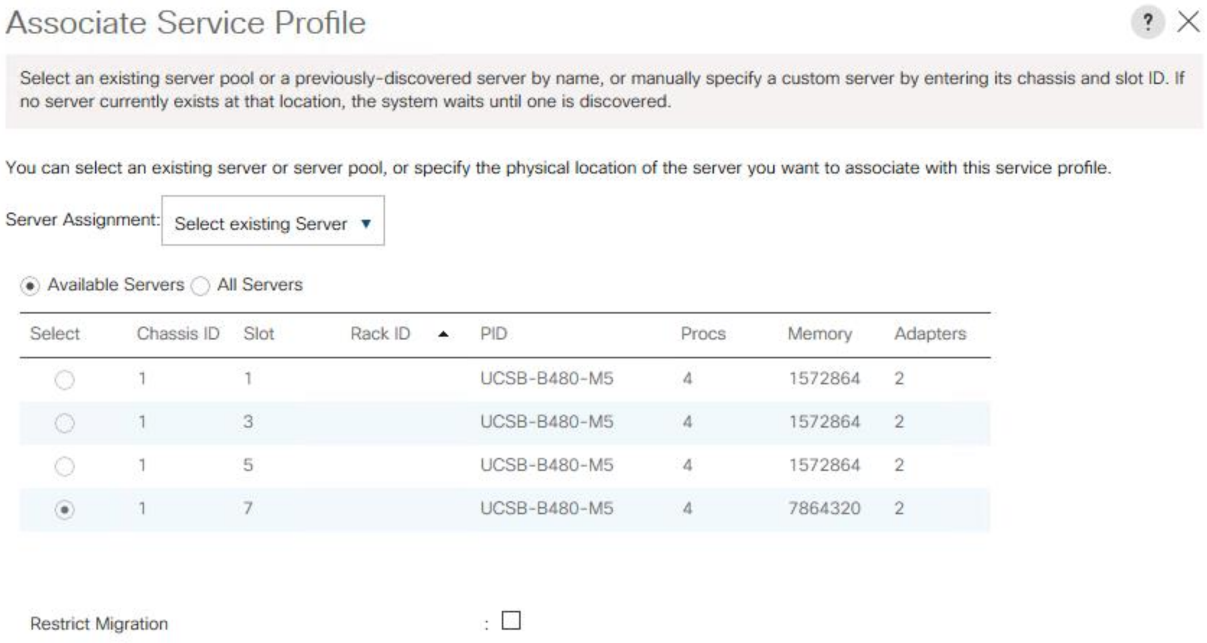
Service Profile Template : HANA

9. Select Servers > Service Profiles > root > Sub-Organizations > HANA > HANA-Server04.

10. Right-click HANA-Server04 and select Change Service Profile Association.

11. Choose Select existing Server from the Server Assignment drop-down list.

12. Enable the radio button Available Servers and select the server to assign.



Associate Service Profile

Select an existing server pool or a previously-discovered server by name, or manually specify a custom server by entering its chassis and slot ID. If no server currently exists at that location, the system waits until one is discovered.

You can select an existing server or server pool, or specify the physical location of the server you want to associate with this service profile.

Server Assignment: Select existing Server ▼

● Available Servers ○ All Servers

Select	Chassis ID	Slot	Rack ID ▲	PID	Procs	Memory	Adapters
○	1	1		UCSB-B480-M5	4	1572864	2
○	1	3		UCSB-B480-M5	4	1572864	2
○	1	5		UCSB-B480-M5	4	1572864	2
●	1	7		UCSB-B480-M5	4	7864320	2

Restrict Migration : □

13. Click OK, confirm the warning by clicking Yes and then click OK.

Cisco MDS Smart Zoning

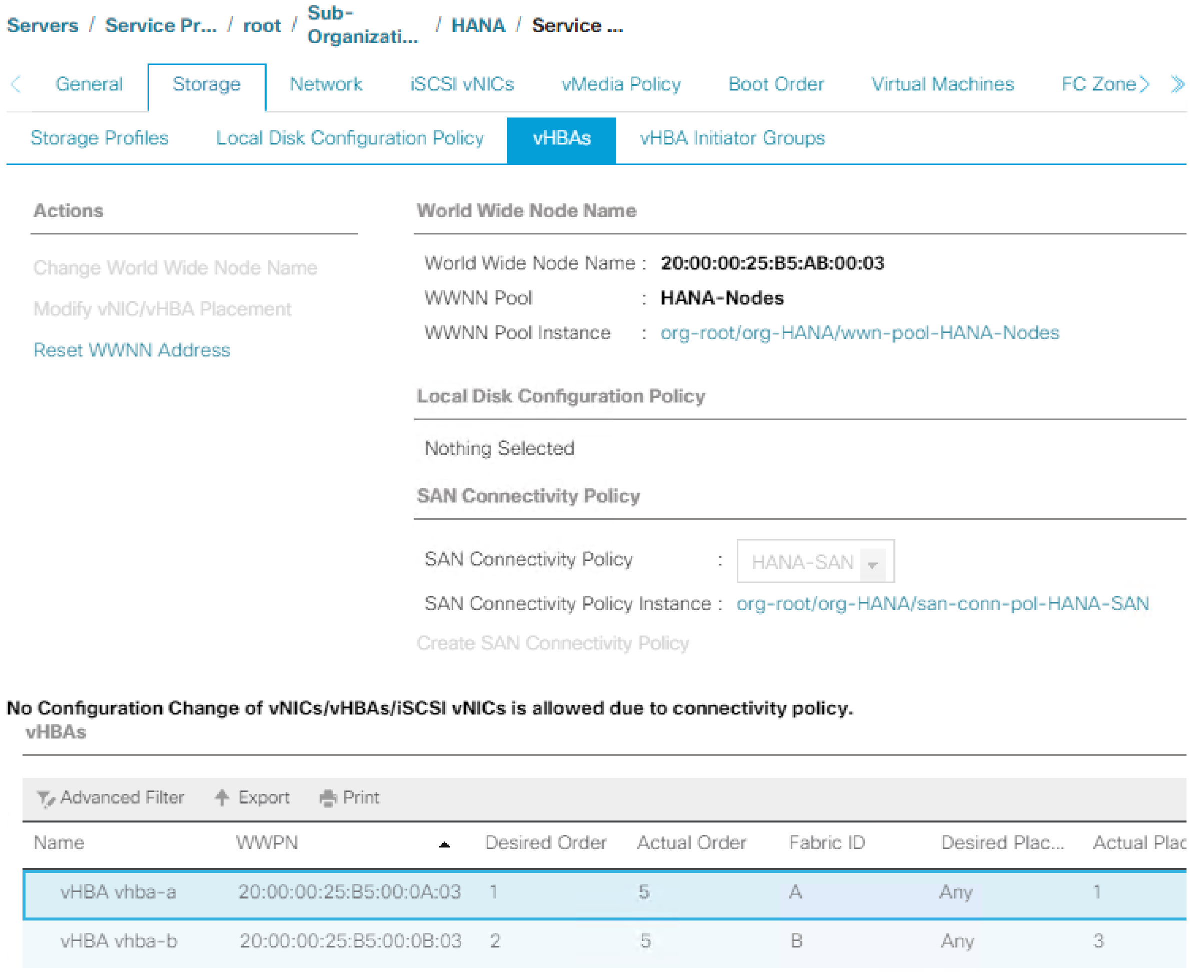
The traditional zoning method allows each device in a zone to communicate with every other device in the zone. Smart zoning allows the configuration of initiator-target pairs using fewer hardware resources than previously required. The device type information of each device in a smart zone is automatically populated from the Fibre Channel Name Server (FCNS) database.

To collect the WWPN information from UCSM and to enable the Pure Storage Administration UI to prepare the zoning configuration of the MDS switch, follow these steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.

2. Select Servers > Service Profiles > root > Sub-Organization > HANA > HANA-Server04

3. In the working pane, click the storage tab and the vHBAs sub tab to receive the WWPN of the HBA's.



Servers / Service Pr... / root / Sub-Organizati... / HANA / Service ...
General
Storage
Network
iSCSI vNICs
vMedia Policy
Boot Order
Virtual Machines
FC Zone
Storage Profiles
Local Disk Configuration Policy
vHBAs
vHBA Initiator Groups
Actions
Change World Wide Node Name
Modify vNIC/vHBA Placement
Reset WWNN Address
Create SAN Connectivity Policy
Advanced Filter
Export
Print

World Wide Node Name

World Wide Node Name : **20:00:00:25:B5:AB:00:03**
WWNN Pool : **HANA-Nodes**
WWNN Pool Instance : org-root/org-HANA/wwn-pool-HANA-Nodes

Local Disk Configuration Policy

Nothing Selected

SAN Connectivity Policy

SAN Connectivity Policy : HANA-SAN
SAN Connectivity Policy Instance : org-root/org-HANA/san-conn-pol-HANA-SAN

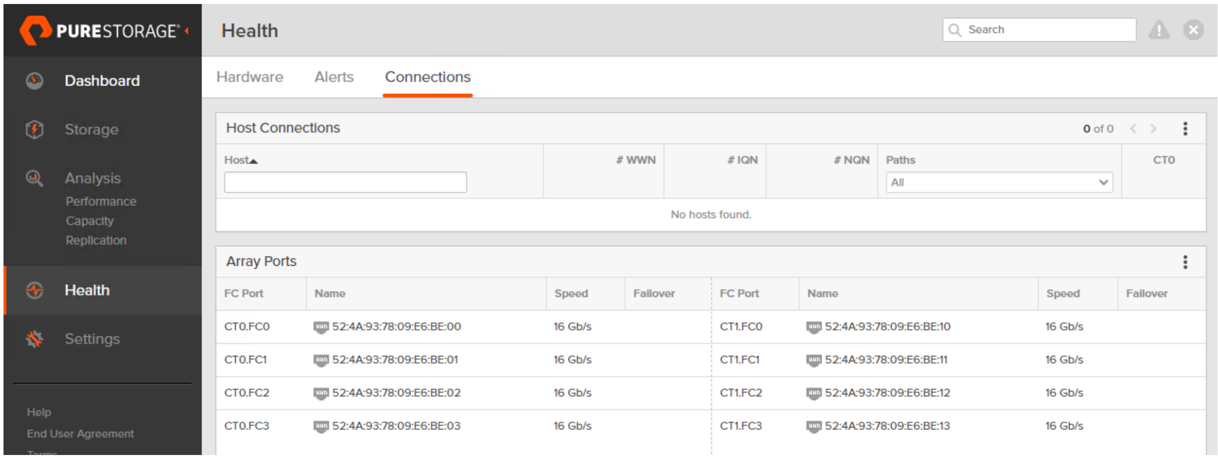
No Configuration Change of vNICs/vHBAs/iSCSI vNICs is allowed due to connectivity policy.

vHBAs

Name	WWPN	Desired Order	Actual Order	Fabric ID	Desired Plac...	Actual Plac
vHBA vhba-a	20:00:00:25:B5:00:0A:03	1	5	A	Any	1
vHBA vhba-b	20:00:00:25:B5:00:0B:03	2	5	B	Any	3

4. Note down the WWPN of all configured servers from the service profiles.

5. Connect to the Pure Storage Administration UI to collect the WWPN of the FC ports connected to the Cisco MDS switches. Each of the two FlashArray//X controller CT0 and CT1 connects with 4 FC ports to the Cisco MDS switches.



Host Connections — 0 of 0

Host▲	# WWN	# IQN	# NQN	Paths	CT0
No hosts found.				All	

Array Ports

FC Port	Name	Speed	Failover	FC Port	Name	Speed	Failover
CT0.FC0	52:4A:93:78:09:E6:BE:00	16 Gb/s		CT1.FC0	52:4A:93:78:09:E6:BE:10	16 Gb/s	
CT0.FC1	52:4A:93:78:09:E6:BE:01	16 Gb/s		CT1.FC1	52:4A:93:78:09:E6:BE:11	16 Gb/s	
CT0.FC2	52:4A:93:78:09:E6:BE:02	16 Gb/s		CT1.FC2	52:4A:93:78:09:E6:BE:12	16 Gb/s	
CT0.FC3	52:4A:93:78:09:E6:BE:03	16 Gb/s		CT1.FC3	52:4A:93:78:09:E6:BE:13	16 Gb/s	

Create Device Aliases for the Fiber Channel Zoning

To configure device aliases and zones for the primary boot paths, follow these steps:

1. SSH to MDS-A and run the following commands:

```
MDS-A # conf t
MDS-A(config)# device-alias database
MDS-A(config-device-alias-db)#
   device-alias name HANA-node01-hba-a pwwn 20:00:00:25:b5:00:0A:03
   device-alias name HANA-node02-hba-a pwwn 20:00:00:25:b5:00:0A:02
   device-alias name HANA-node03-hba-a pwwn 20:00:00:25:b5:00:0A:01
   device-alias name HANA-node04-hba-a pwwn 20:00:00:25:b5:00:0A:00
   device-alias name Pure-CT0.FC1 pwwn 52:4A:93:78:09:E6:BE:01
   device-alias name Pure-CT1.FC1 pwwn 52:4A:93:78:09:E6:BE:11
   device-alias name Pure-CT0.FC3 pwwn 52:4A:93:78:09:E6:BE:03
   device-alias name Pure-CT1.FC3 pwwn 52:4A:93:78:09:E6:BE:13
MDS-A(config-device-alias-db)# exit
MDS-A(config)# device-alias commit
```

2. SSH login to MDS-B and run the following commands:

```
MDS-B # conf t
MDS-B(config)# device-alias database
MDS-B(config-device-alias-db)#
   device-alias name HANA-node01-hba-b pwwn 20:00:00:25:b5:00:0B:03
   device-alias name HANA-node02-hba-b pwwn 20:00:00:25:b5:00:0B:02
   device-alias name HANA-node03-hba-b pwwn 20:00:00:25:b5:00:0B:01
   device-alias name HANA-node04-hba-b pwwn 20:00:00:25:b5:00:0B:00
   device-alias name Pure-CT0.FC0 pwwn 52:4A:93:78:09:E6:BE:00
   device-alias name Pure-CT0.FC2 pwwn 52:4A:93:78:09:E6:BE:02
   device-alias name Pure-CT1.FC0 pwwn 52:4A:93:78:09:E6:BE:10
   device-alias name Pure-CT1.FC2 pwwn 52:4A:93:78:09:E6:BE:12
MDS-B(config-device-alias-db)# exit
MDS-B # device-alias commit
```

Create Zoning

This section details how to configure zones on both MDS switches for each service profile.

To enable SAP HANA failover capabilities, add all SAP HANA nodes as member of the same zone.

To SSH login to MDS-A. This example creates two zones, one for a Scale-Out and another for a Scale-Up deployment, run the following commands:

1. Create zones:

```
MDS-A(config)# zone name HANA-ScaleOut-a vsan 10
MDS-A(config-zone)# member device-alias Pure-CT0.FC1
MDS-A(config-zone)# member device-alias Pure-CT1.FC1
MDS-A(config-zone)# member device-alias Pure-CT0.FC3
MDS-A(config-zone)# member device-alias Pure-CT1.FC3
MDS-A(config-zone)# member device-alias HANA-node01-hba-a
MDS-A(config-zone)# member device-alias HANA-node02-hba-a
MDS-A(config-zone)# member device-alias HANA-node03-hba-a
MDS-A(config-zone)# exit
MDS-A(config)# zone name HANA-node04-a vsan 10
MDS-A(config-zone)# member device-alias Pure-CT0.FC1
MDS-A(config-zone)# member device-alias Pure-CT1.FC1
MDS-A(config-zone)# member device-alias Pure-CT0.FC3
MDS-A(config-zone)# member device-alias Pure-CT1.FC3
MDS-A(config-zone)# member device-alias HANA-node04-hba-a
MDS-A(config-zone)# exit
```

2. Create zone set and add members:

```
MDS-A(config)# zoneset name HANA-Nodes-A vsan 10
MDS-A(config-zoneset)# member HANA-ScaleOut-a
MDS-A(config-zoneset)# member HANA-node04-a
MDS-A(config-zoneset)# exit
```

3. Activate the zone set:

```
MDS-A(config)# zoneset activate name HANA-Nodes-A vsan 10
MDS-A(config)# exit
```

4. Persist the configuration:

```
MDS-A # copy run start
```

To SSH login to MDS-B and run the following commands:

1. Create zones:

```
MDS-B(config)# zone name HANA-ScaleOut-b vsan 20
MDS-B(config-zone)# member device-alias Pure-CT0.FC0
MDS-B(config-zone)# member device-alias Pure-CT1.FC0
MDS-B(config-zone)# member device-alias Pure-CT0.FC2
MDS-B(config-zone)# member device-alias Pure-CT1.FC2
MDS-B(config-zone)# member device-alias HANA-node01-hba-b
MDS-B(config-zone)# member device-alias HANA-node02-hba-b
```

```
MDS-B(config-zone)# member device-alias HANA-node03-hba-b
MDS-B(config-zone)# exit
MDS-B(config)# zone name HANA-node04-b vsan 20
MDS-B(config-zone)# member device-alias Pure-CT0.FC0
MDS-B(config-zone)# member device-alias Pure-CT1.FC0
MDS-B(config-zone)# member device-alias Pure-CT0.FC2
MDS-B(config-zone)# member device-alias Pure-CT1.FC2
MDS-B(config-zone)# member device-alias HANA-node04-hba-b
MDS-B(config-zone)# exit
```

2. Create zone set and add members:

```
MDS-B(config)# zoneset name HANA-Nodes-B vsan 20
MDS-B(config-zoneset)# member HANA-ScaleOut-b
MDS-B(config-zoneset)# member HANA-node04-b
MDS-B(config-zoneset)# exit
```

3. Activate the zone set:

```
MDS-B(config)# zoneset activate name HANA-Nodes-B vsan 20
MDS-B(config)# exit
```

4. Persist the configuration:

```
MDS-B # copy run start
```

Verify Fiber Channel Connectivity

To verify the fibre channel connectivity, follow these steps:

1. Power-On the Cisco UCS Servers for the first time to verify the WWPN ports connect properly.

2. In Cisco UCS Manager, click the Equipment tab in the navigation pane.

3. Select Equipment > Chassis > Servers > Server 1

4. In the General work pane select the action KVM console

5. Follow the onscreen notifications and open the console to confirm the boot progress.

6. In the General work pane select the action Boot Server.

7. Confirm the popup windows with OK.

8. On both MDS switches verify the connectivity:

```
MDS-[A] # show flogi database
--------------------------------------------------------------------------------
INTERFACE        VSAN    FCID           PORT NAME               NODE NAME
--------------------------------------------------------------------------------
fc1/29           10    0x880060  52:4a:93:78:09:e6:be:01 52:4a:93:78:09:e6:be:01
                           [Pure-CT0.FC1]
fc1/30           10    0x880020  52:4a:93:78:09:e6:be:11 52:4a:93:78:09:e6:be:11
                           [Pure-CT1.FC1]
fc1/31           10    0x880040  52:4a:93:78:09:e6:be:03 52:4a:93:78:09:e6:be:03
```

```
                           [Pure-CT0.FC3]
fc1/32           10    0x880000  52:4a:93:78:09:e6:be:13 52:4a:93:78:09:e6:be:13
                           [Pure-CT1.FC3]
port-channel10   10    0x880080  24:0a:00:3a:9c:3a:54:40 20:0a:00:3a:9c:3a:54:41
port-channel10   10    0x880081  20:00:00:25:b5:00:0a:03 20:00:00:25:b5:ab:00:03
                           [HANA-node01-hba-a]
port-channel10   10    0x880082  20:00:00:25:b5:00:0a:00 20:00:00:25:b5:ab:00:00
                           [HANA-node04-hba-a]
port-channel10   10    0x880083  20:00:00:25:b5:00:0a:02 20:00:00:25:b5:ab:00:02
                           [HANA-node02-hba-a]
port-channel10   10    0x880084  20:00:00:25:b5:00:0a:01 20:00:00:25:b5:ab:00:01
                           [HANA-node03-hba-a]

Total number of flogi = 9.

MDS-A # show zoneset active
zoneset name HANA-Nodes-A vsan 10
  zone name HANA-ScaleOut-a vsan 10
  * fcid 0x880060 [pwwn 52:4a:93:78:09:e6:be:01] [Pure-CT0.FC1]
  * fcid 0x880040 [pwwn 52:4a:93:78:09:e6:be:03] [Pure-CT0.FC3]
  * fcid 0x880020 [pwwn 52:4a:93:78:09:e6:be:11] [Pure-CT1.FC1]
  * fcid 0x880000 [pwwn 52:4a:93:78:09:e6:be:13] [Pure-CT1.FC3]
  * fcid 0x880081 [pwwn 20:00:00:25:b5:00:0a:03] [HANA-node01-hba-a]
  * fcid 0x880083 [pwwn 20:00:00:25:b5:00:0a:02] [HANA-node02-hba-a]
  * fcid 0x880084 [pwwn 20:00:00:25:b5:00:0a:01] [HANA-node03-hba-a]
```

Pure Storage FlashArray//X Configuration

Host Configuration

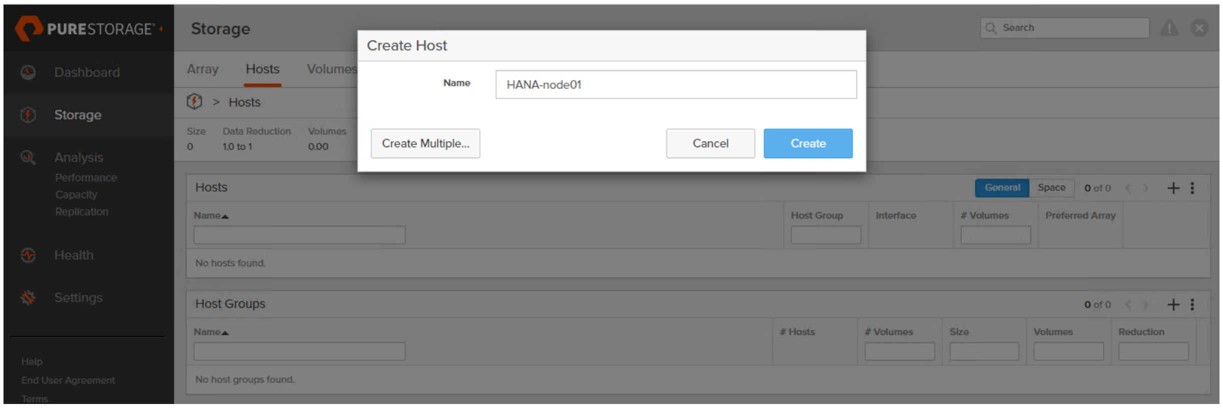
To set up a host, follow these steps in the Purity//FA GUI:

All hosts need to be powered on to make use of the host auto discovery feature of the FlashArray//X. Alternatively it is possible to add the host WWN manually.

1. Login to the Purity//FA dashboard at http://<var_purecluster_ip>

2. Select Storage in the navigation pane.

3. Select Hosts in the work pane. To create a host, click the + sign on the right.

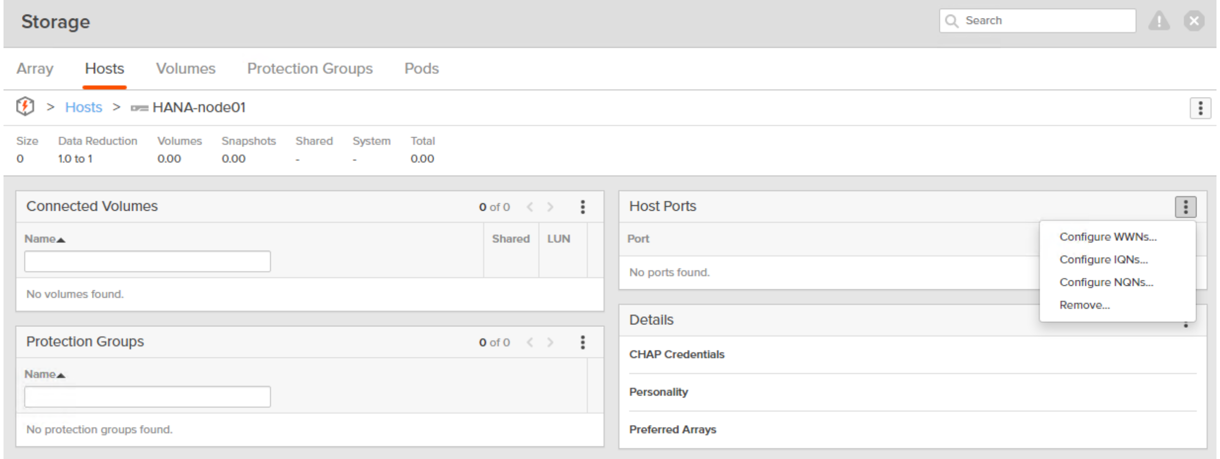


Name: HANA-node01

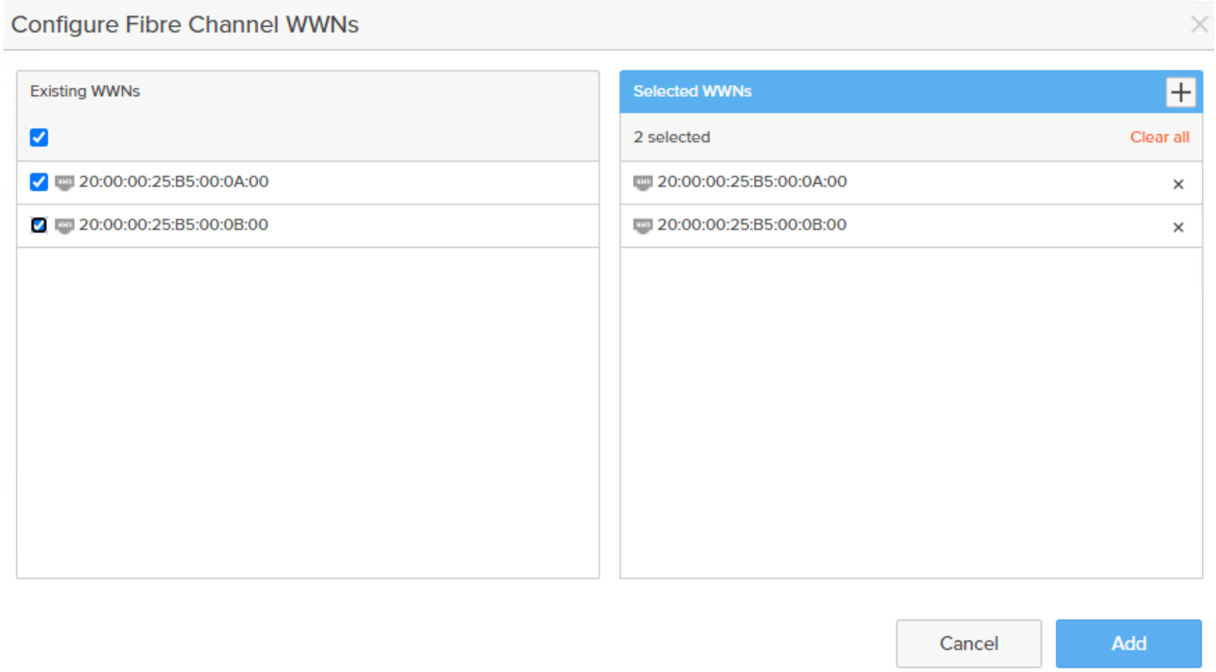
4. Enter the host name and click Create.

5. Update the host with the connectivity information and provide the Fibre Channel WWNs. Select the HANA-node01 host in the hosts work pane.

6. In the Host Ports pane click the settings button and select “Configure WWNs.”



7. Select the vhba-a and vhba-b PWWNs from the listed WWNs.



Configure Fibre Channel WWNs

Existing WWNs

☑

☑ 20:00:00:25:B5:00:0A:00

☑ 20:00:00:25:B5:00:0B:00

Selected WWNs

2 selected

20:00:00:25:B5:00:0A:00

20:00:00:25:B5:00:0B:00

8. Click Add.

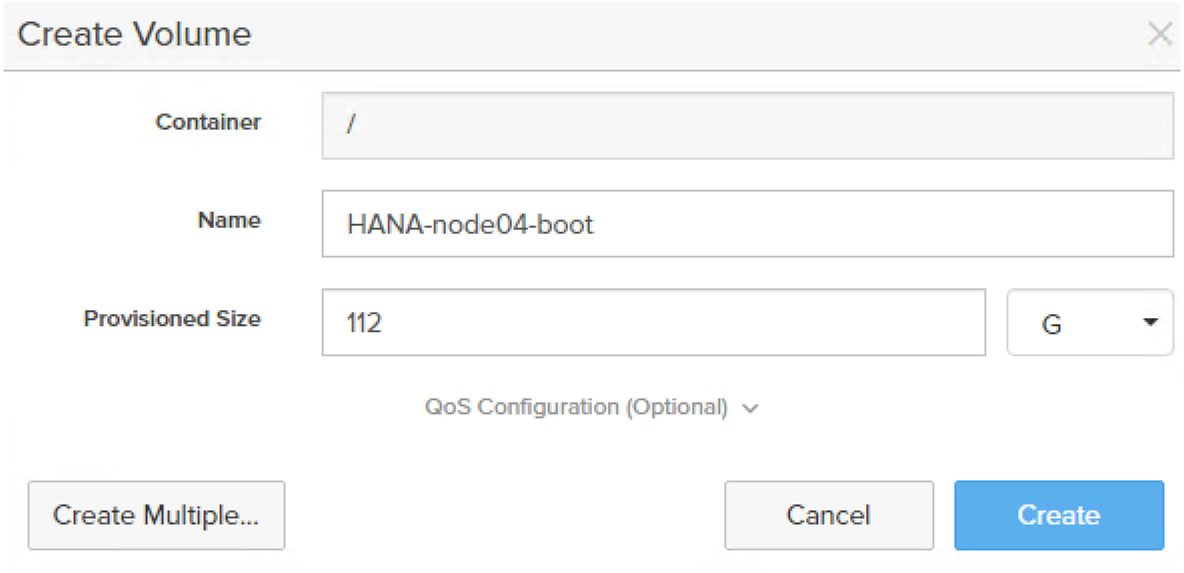
Configure SAN Boot Volume

To configure a single SAN boot volume that will become the master template for additional boot volume clones, follow these steps:

1. Select the Storage - Volumes tab in the navigation pane.

2. In the Volumes work pane click the + sign to create a new volume.

3. Provide a volume name and choose the appropriate volume size.



Create Volume

Container: /

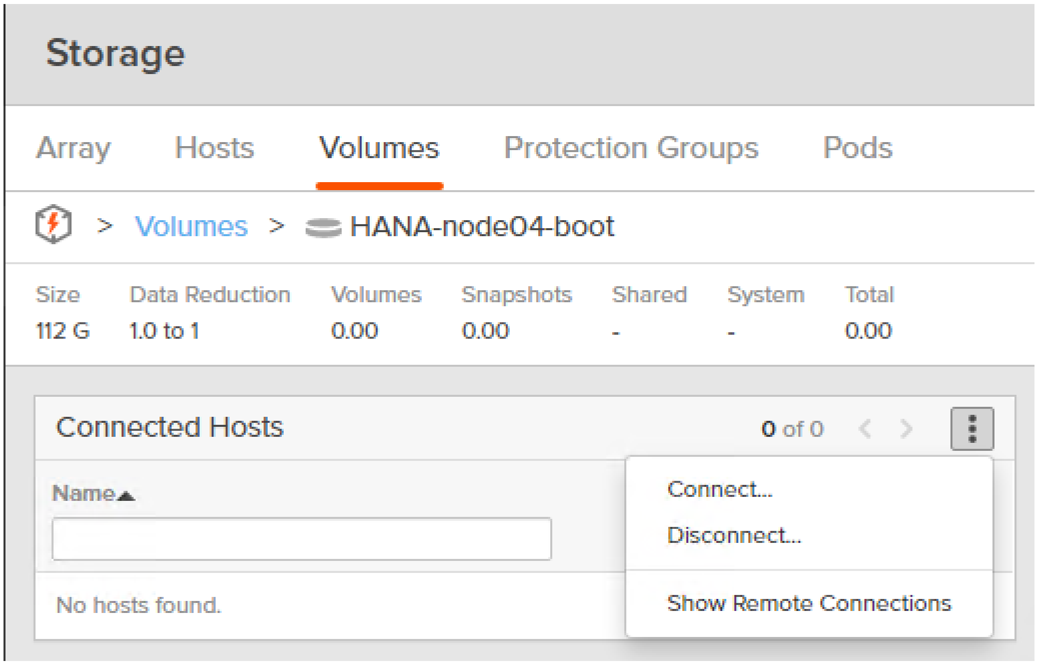
Name: HANA-node04-boot

Provisioned Size: 112 G

4. Click Create.

5. Select the new volume in the volumes work pane.

6. In the Connected Hosts work pane click Connect to connect the new volume.



Storage

> Volumes > HANA-node04-boot

Size	Data Reduction	Volumes	Snapshots	Shared	System	Total
112 G	1.0 to 1	0.00	0.00	-	-	0.00

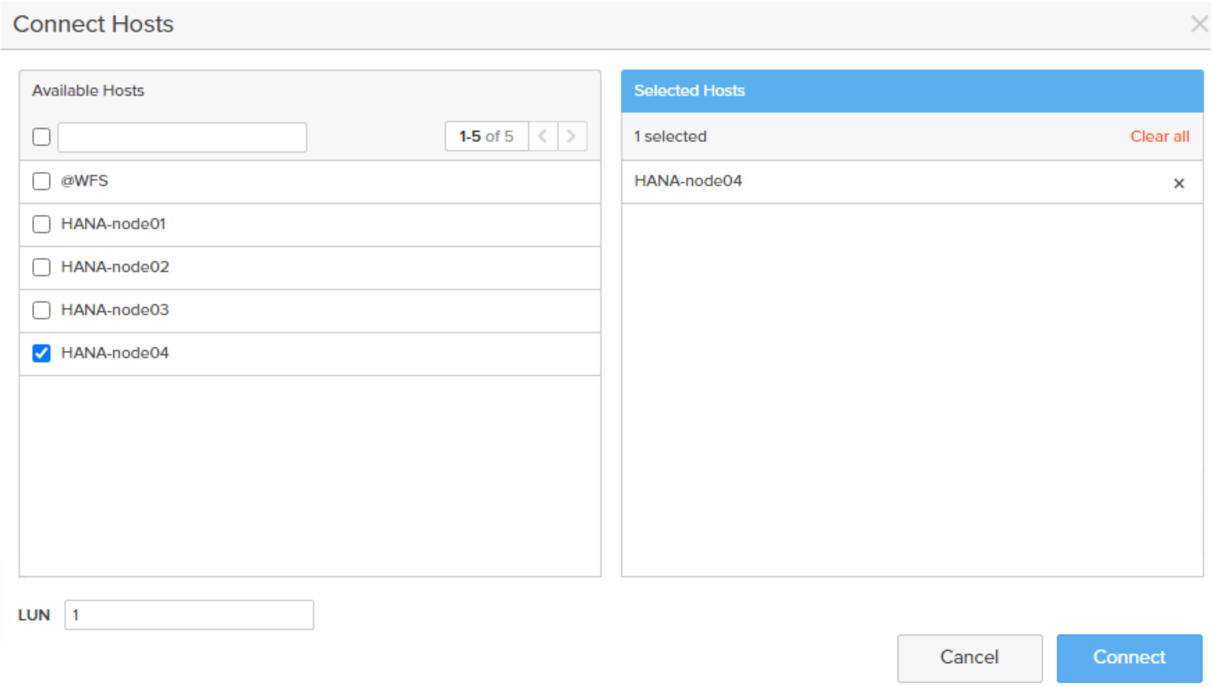
Connected Hosts 0 of 0

Name▲

No hosts found.

7. Change the LUN ID to 1 for the boot LUN.

8. Checkmark the new volume and click Connect.



☐ @WFS
☐ HANA-node01
☐ HANA-node02
☐ HANA-node03
☑ HANA-node04

HANA-node04 ×

LUN 1

9. Repeat steps 1-8 to create and connect new boot volumes for each new SAP HANA worker node in the FlashStack environment.

SAP HANA Data and Log Volumes

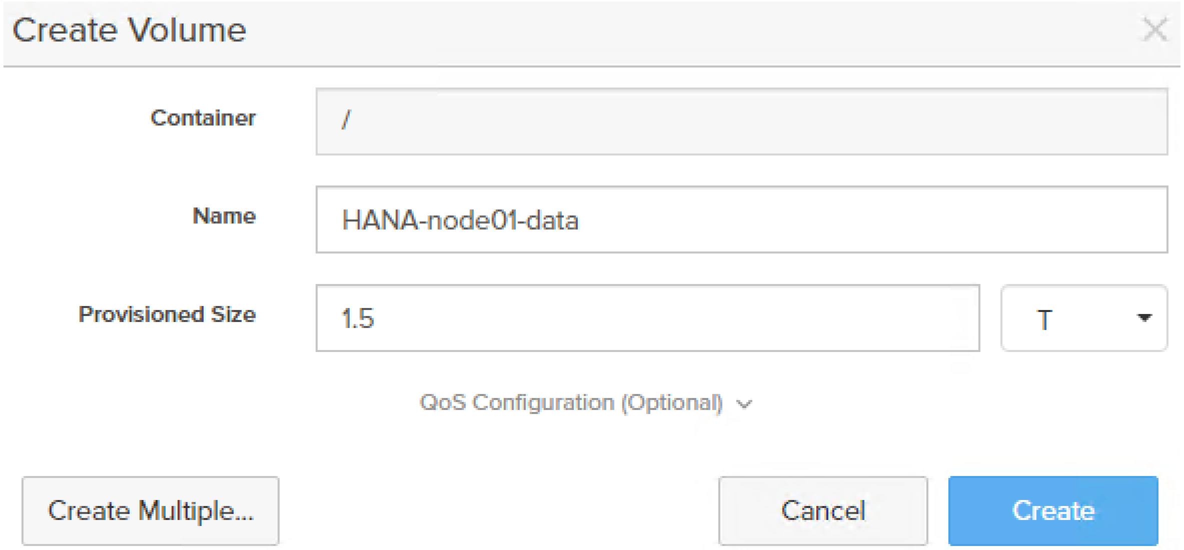
Create the SAP HANA data and log volumes for each SAP HANA worker node and connect them to the appropriate host. Follow the sizing recommendations provided in section Pure Storage FlashArray//X Configuration.

The sizing recommendations deviate for SAP HANA Scale-Up and Scale-Out scenarios and so the host group configuration described below. To enable the SAP HANA failover capabilities and to add the shared volume to a host group which is shared with all hosts to ensure it receives the same LUN ID regardless of which host mounts the data or log volume, follow these steps:

1. In the navigation pane select Storage and Volumes in the work pane.

2. In the Volumes pane click the + sign to create an SAP HANA data volume.

3. Provide an SAP HANA data volume name and choose the appropriate volume size.



Create Volume

Container: /

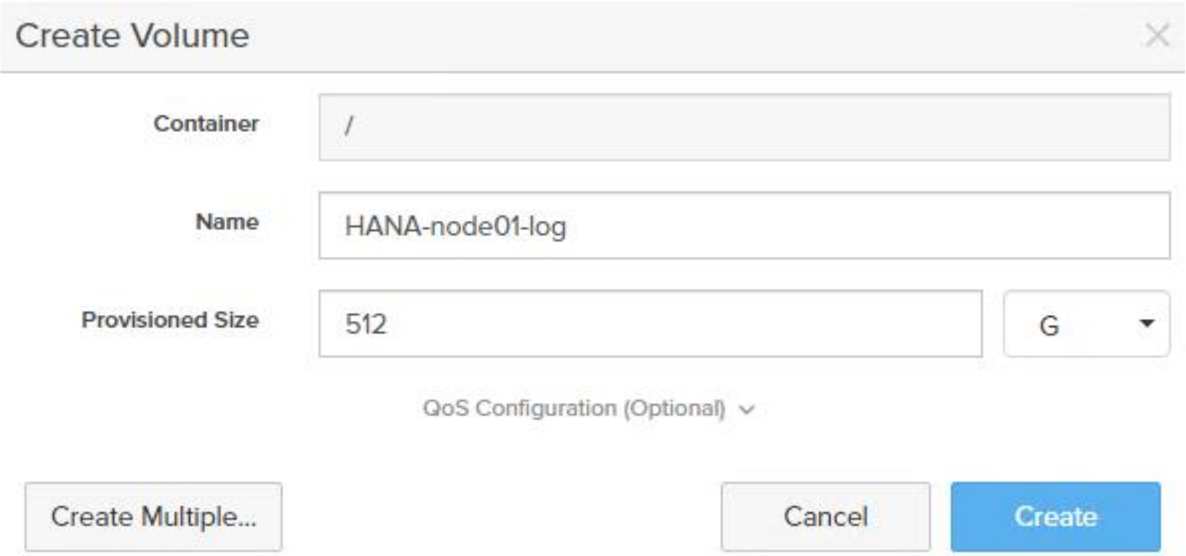
Name: HANA-node01-data

Provisioned Size: 1.5 T

4. Select Create.

5. In the Volumes work pane click the + sign to create an SAP HANA log volume.

6. Provide an SAP HANA log volume name and choose the appropriate volume size.



Create Volume

Container: /

Name: HANA-node01-log

Provisioned Size: 512 G

7. Select Create.

8. In the Volumes pane select the HANA-node01-data volume link.

9. In the connected Hosts pane select Connect from the menu bar.

10. In the Connect Host dialog, select the host and keep the LUN ID on automatic.

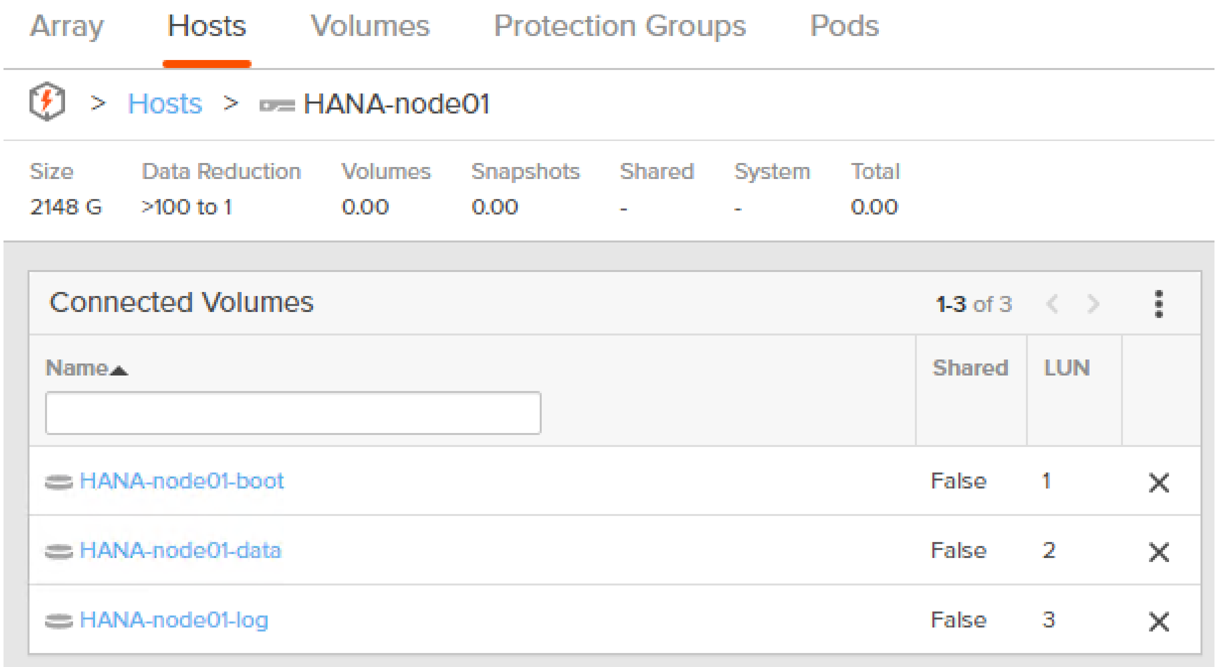
11. Select Connect.

12. In the Volumes pane select the HANA-node01-log volume link.

13. In the connected Hosts pane select Connect from the menu bar.

14. In the Connect Host dialog, select the host and keep the LUN ID on automatic.

15. Select Connect.



Size	Data Reduction	Volumes	Snapshots	Shared	System	Total
2148 G	>100 to 1	0.00	0.00	-	-	0.00

Connected Volumes 1-3 of 3

Name▲	Shared	LUN	
HANA-node01-boot	False	1	×
HANA-node01-data	False	2	×
HANA-node01-log	False	3	×

SAP HANA Shared Volume

In addition to the SAP HANA data and log volumes, the SAP HANA installation requires an SAP HANA shared volume as well. The configuration itself depends on the SAP HANA scenario.

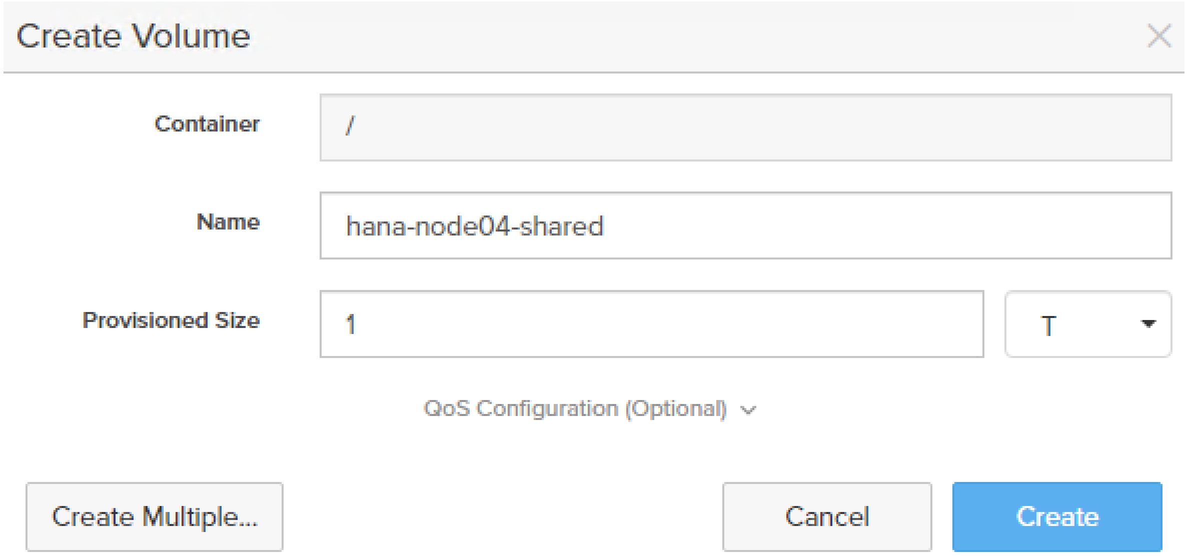
SAP HANA Scale-Up

The SAP HANA Scale-Up deployment requires a locally mounted SAP HANA shared volume. Recommended volume size is 1TB. To configure the SAP HANA Scale-Up, follow these steps:

1. In the navigation pane select Storage and Volumes in the work pane.

2. In the Volumes work pane click the + sign to create an SAP HANA shared volume.

3. Provide an SAP HANA shared volume name and choose 1 TB volume size.


Create Volume

Container: /

Name: hana-node04-shared

Provisioned Size: 1 T

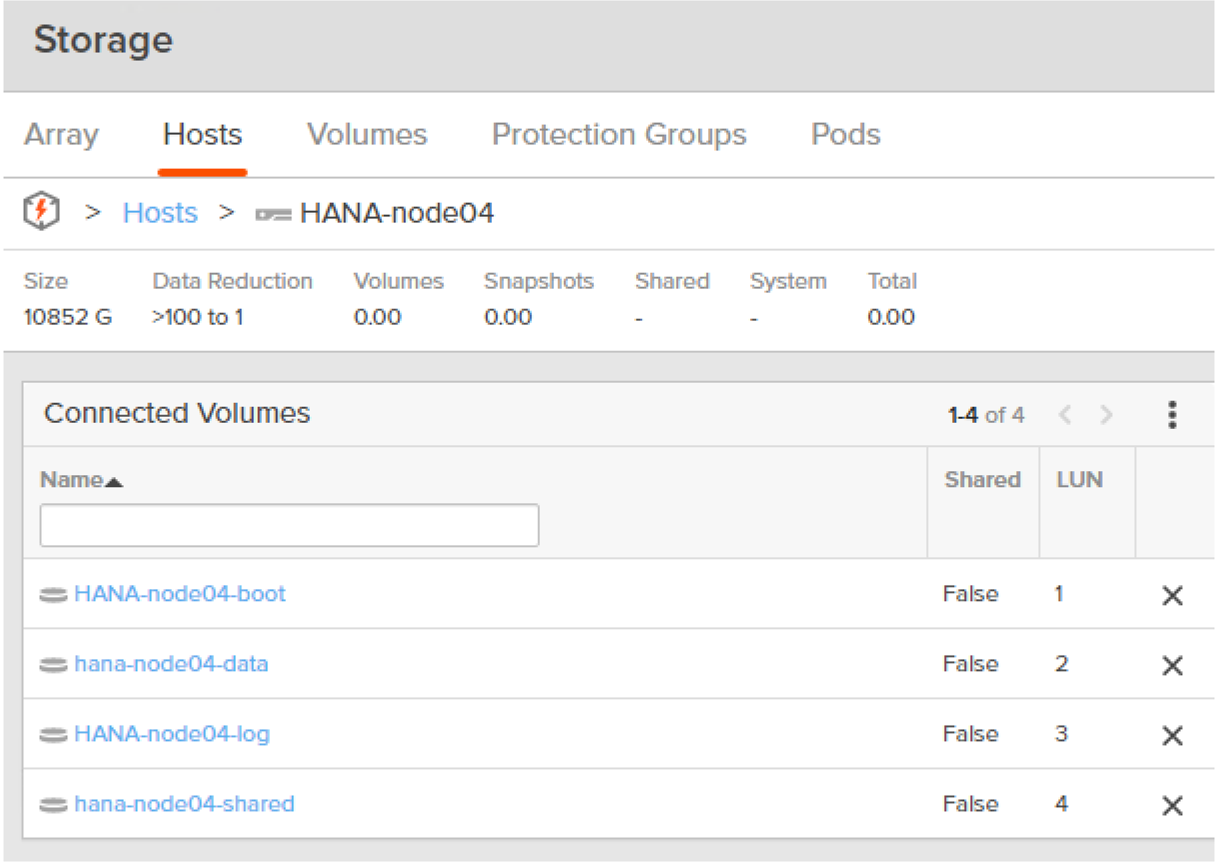
4. Click Create.

5. In the Volumes pane select the HANA-node04-shared volume link.

6. In the connected Hosts pane select Connect from the menu bar.

7. In the Connect Host dialog, select the host and keep the LUN ID on automatic.

8. Select Connect.



Size	Data Reduction	Volumes	Snapshots	Shared	System	Total
10852 G	>100 to 1	0.00	0.00	-	-	0.00

Connected Volumes 1-4 of 4

Name▲	Shared	LUN	
HANA-node04-boot	False	1	✕
hana-node04-data	False	2	✕
HANA-node04-log	False	3	✕
hana-node04-shared	False	4	✕

SAP HANA Scale-Out

Other than for SAP HANA Scale-Up the SAP HANA shared volume needs to be accessible from all nodes through NFS at the same time. This requires additional configuration effort compared to the Scale Up deployments.

Starting from Pure's Purity//FA 4.10.9, each controller can host a VM instance of Microsoft Windows Server 2016 which form a Windows Failover Cluster (WFS). File Servers within this cluster serve as NFS shares.

Each WFS VM resides on its own boot volume. For Windows clustering purposes, a default quorum witness volume is available to both WFS VMs. In addition, a default data volume hosts file services data. Subsequent data volumes can be created if additional capacity is required. Data volumes are exported to both WFS VMs to ensure persistent data across a WFS VM failover.

More information about the best practices for WFS on the Purity RUN platform is available in the Pure Technical Services documentation.

WFS requirements for the FlashArray//X:

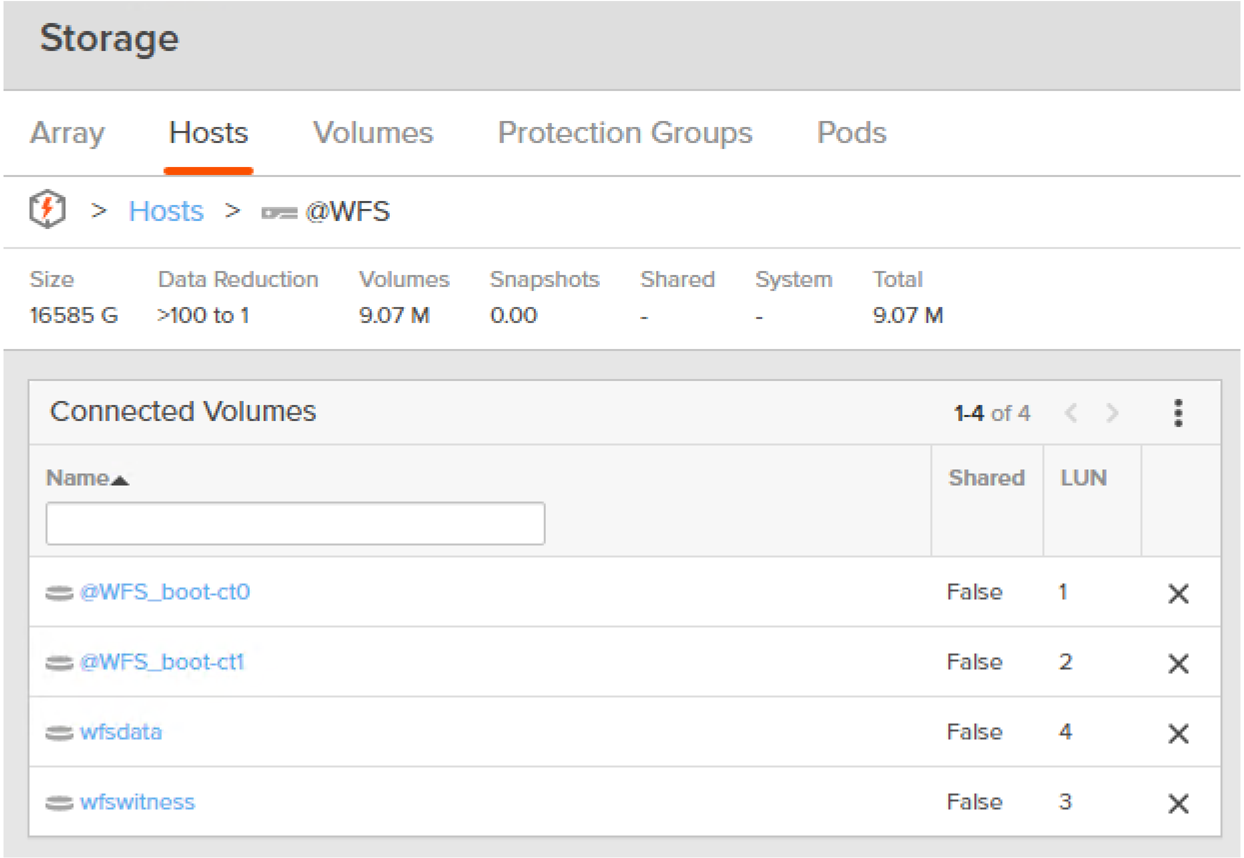
- **FlashArray Support:** Two 10G iSCSI services ports on each controller for cluster and file services client traffic
- **Domain Controller:** Microsoft Failover Cluster requires a domain controller; therefore, a working domain controller must exist to run WFS.

- **Domain Administrator Privileges:** Customers must have appropriately elevated Domain Administrator privileges to perform many of the required setup steps like the following:
  - Configuring WFS VM IP addresses
  - Creating Microsoft Failover Clusters
  - Creating File Servers
- **DNS Server:** There must be a functional DNS server in the environment to run file services with WFS. The two WFS VMs, Failover Cluster, and File Servers will be given a default hostname as shown in Table A. Customers have the option of using the given default hostnames or to specify their own hostnames.
- **IP Addresses:** A minimum of six IP addresses are required to run WFS.

Pure Support performs the WFS cluster setup and configuration based on the provided user account and IP information.

To configure the SAP HANA Scale-Out, follow these steps:

1. Verify the WFS storage configuration from the navigation pane Storage and Hosts work pane by selecting the @WFS host link.

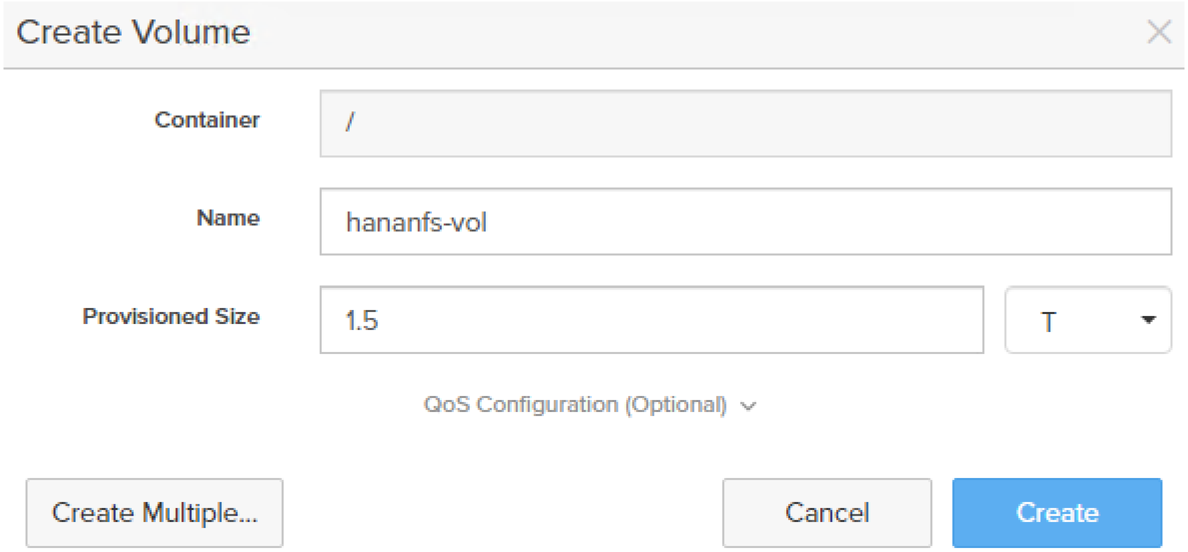


Size	Data Reduction	Volumes	Snapshots	Shared	System	Total
16585 G	>100 to 1	9.07 M	0.00	-	-	9.07 M

Connected Volumes 1-4 of 4

Name▲	Shared	LUN
@WFS_boot-ct0	False	1
@WFS_boot-ct1	False	2
wfsdata	False	4
wfswitness	False	3

2. Like adding new volumes to an external host connected to the FlashArray//X, use the same steps to add a new volume and connect it to the WFS host. Create a new volume with a size of 1.5TB.



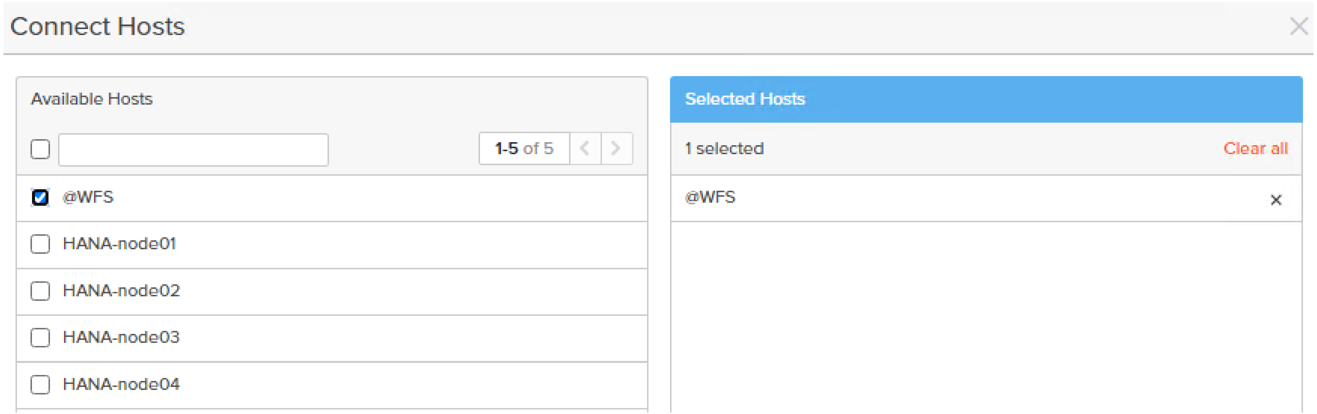
Create Volume

Container: /

Name: hananfs-vol

Provisioned Size: 1.5 T

3. Connect the Volume to the @WFS host.



Connect Hosts

Available Hosts

1-5 of 5

☑ @WFS

□ HANA-node01

□ HANA-node02

□ HANA-node03

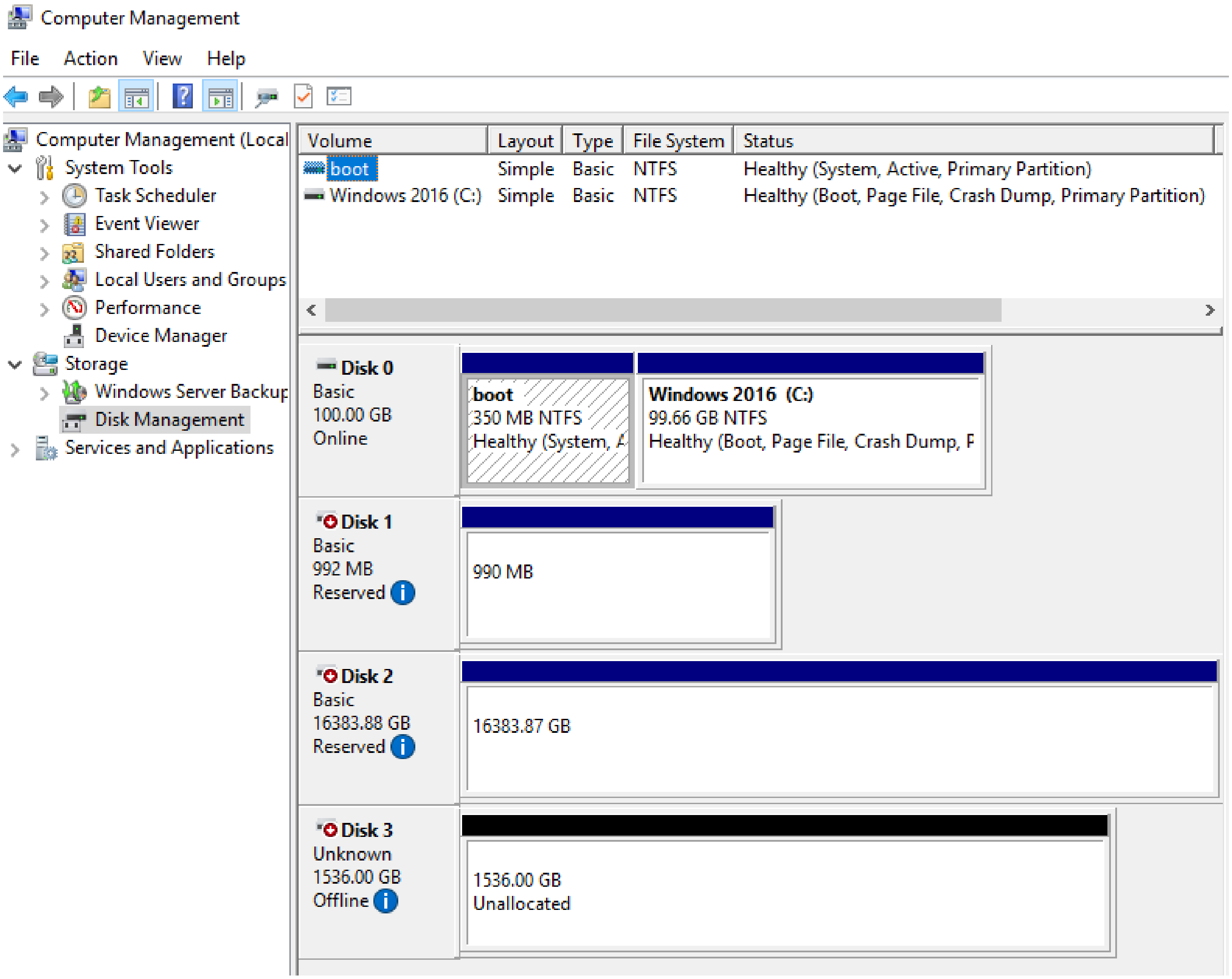
□ HANA-node04

Selected Hosts

1 selected

@WFS

4. Use a VNC viewer to connect to one side of the WFS cluster. Start Computer Management > Disk Management and rescan the disks from the menu selection.



Volume	Layout	Type	File System	Status
boot	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)
Windows 2016 (C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)

Disk 0
Basic
100.00 GB
Online

boot
350 MB NTFS
Healthy (System, A

Windows 2016 (C:)
99.66 GB NTFS
Healthy (Boot, Page File, Crash Dump, F

Disk 1
Basic
992 MB
Reserved

990 MB

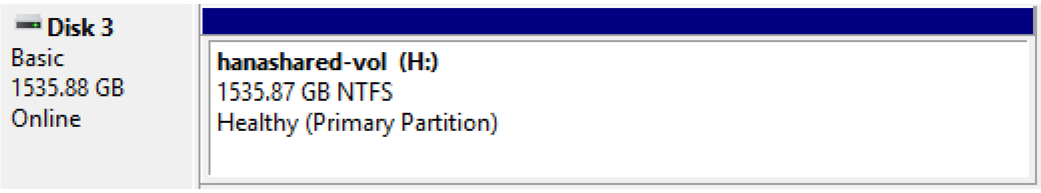
Disk 2
Basic
16383.88 GB
Reserved

16383.87 GB

Disk 3
Unknown
1536.00 GB
Offline

1536.00 GB
Unallocated

In this lab configuration disk 3 with 1536GB space shows up as new disk. Using the Disk Management menu change the disk from offline to online, initialize the disk and create an NTFS file system for the complete volume. Ensure both WFS VMs can see the disk. In the validation setup, a 1.5TB drive appears as disk 3 in both VMs.

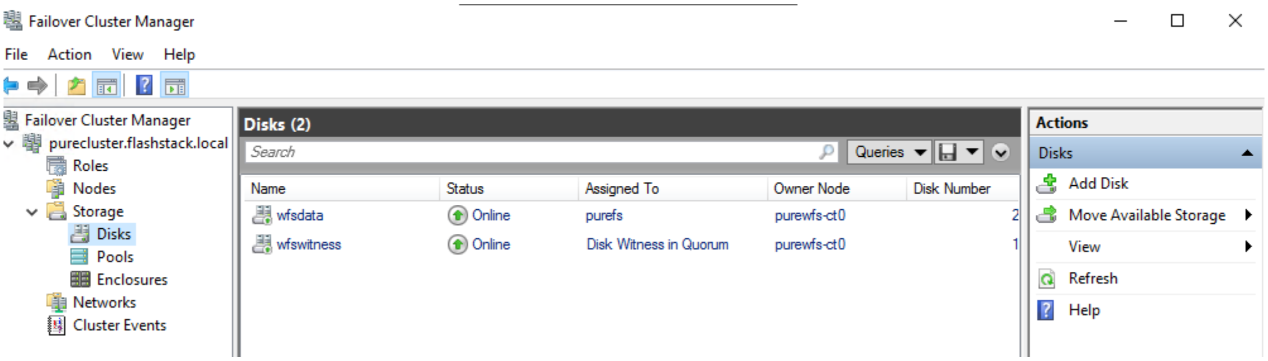


Disk 3
Basic
1535.88 GB
Online

hanashared-vol (H:)
1535.87 GB NTFS
Healthy (Primary Partition)

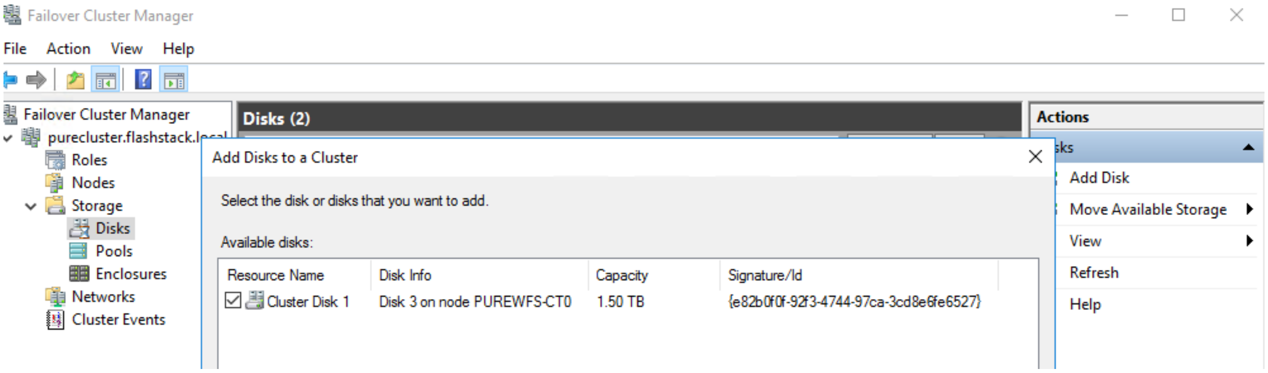
To configure a new file server role on the WFS VM, follow these steps:

1. In the Failover Cluster Manager, expand the cluster tree, highlight Disks, and select Add Disk.



Name	Status	Assigned To	Owner Node	Disk Number
wfsdata	Online	purefs	purewfs-ct0	2
wfswitness	Online	Disk Witness in Quorum	purewfs-ct0	1

2. Select the newly created volume and click OK. The new volume appears on the list of available disks.



Select the disk or disks that you want to add.

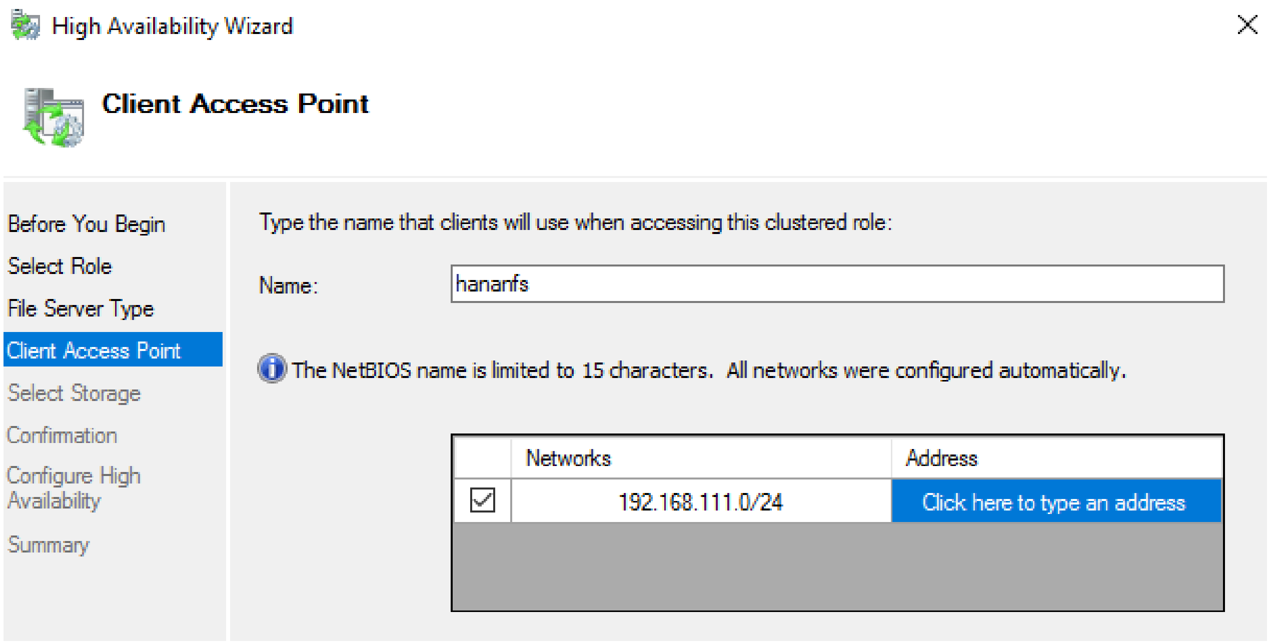
Available disks:

Resource Name	Disk Info	Capacity	Signature/Id
☑ Cluster Disk 1	Disk 3 on node PUREWFS-CT0	1.50 TB	{e82b0f0f-92f3-4744-97ca-3cd8e6fe6527}

3. In the Failover Cluster Manager select the cluster tree, highlight Roles, and right-click Configure Role. In the select role dialog, select the option File Server, click Next.

4. Select the default “File Server for general use” option as File Server Type; click Next.

5. In the Client Access Point tab, provide the Share name hananfs and ensure the right IP network is selected. Specify the IP address and click Next.



High Availability Wizard

Client Access Point

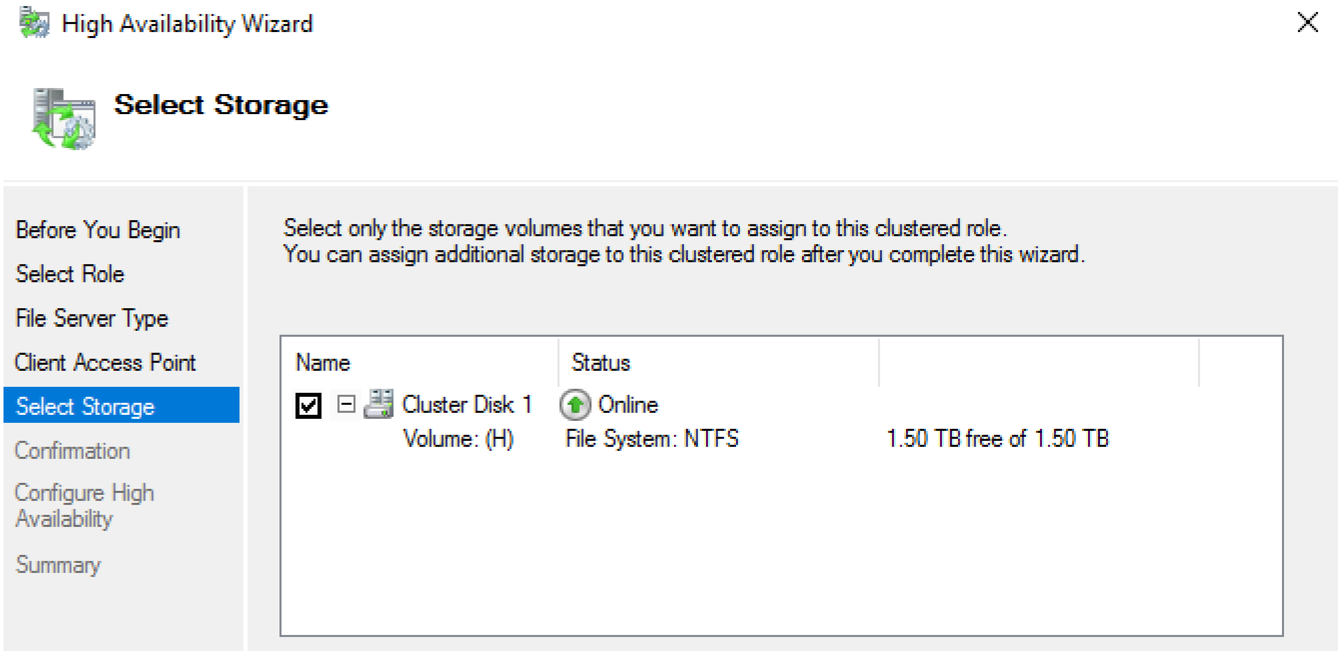
Type the name that clients will use when accessing this clustered role:

Name: hananfs

The NetBIOS name is limited to 15 characters. All networks were configured automatically.

	Networks	Address
☑	192.168.111.0/24	Click here to type an address

6. In the Select Storage dialog screen, select the available Cluster Disk and click Next.



High Availability Wizard

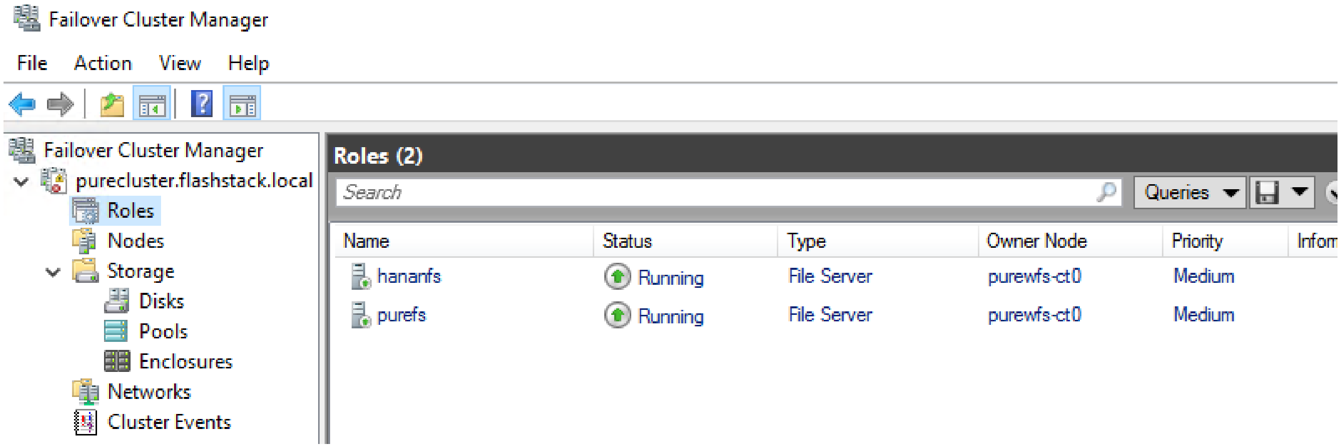
Select Storage

Select only the storage volumes that you want to assign to this clustered role.
You can assign additional storage to this clustered role after you complete this wizard.

Name	Status	
☑ ⊟ Cluster Disk 1	Online	
Volume: (H)	File System: NTFS	1.50 TB free of 1.50 TB

7. Click Next in the following dialog screens and the click Finish in the Summary dialog screen.

The SAP HANA File Server role configuration is done ready to support NFS shares.



Name	Status	Type	Owner Node	Priority	Infor
hananfs	Running	File Server	purewfs-ct0	Medium	
purefs	Running	File Server	purewfs-ct0	Medium	

Configure the HANA NFS Share

SAP HANA installations require additional configuration steps for the NFS share exported from a Microsoft Windows Server to function correctly. Correct permissions regarding a group identifier (GID) and user identifier(UID) need to be in place which link two active directory users with full access to the windows share.

LDAP authentication capabilities in Red Hat Enterprise Linux or SUSE Enterprise Linux are not required.

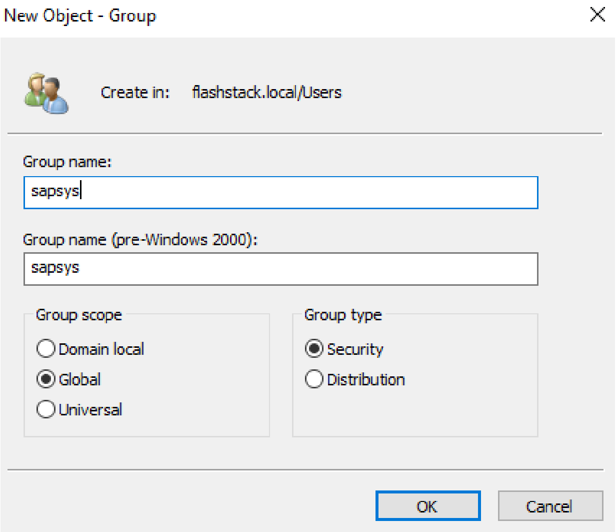
Create a group in Active Directory

During the SAP software installation, the user group sapsys will be created typically with the default GID of 79. While it is possible to change the GID to a different number it is key to have the GID information available prior of the SAP softer installation.

To create a group in Active Directory, follow these steps:

1. Open the Active Directory Users and Computers management console.

2. Right-click Users in the Domain tree and select New and then Group.



Create in: flashstack.local/Users

Group name: sapsys

Group name (pre-Windows 2000): sapsys

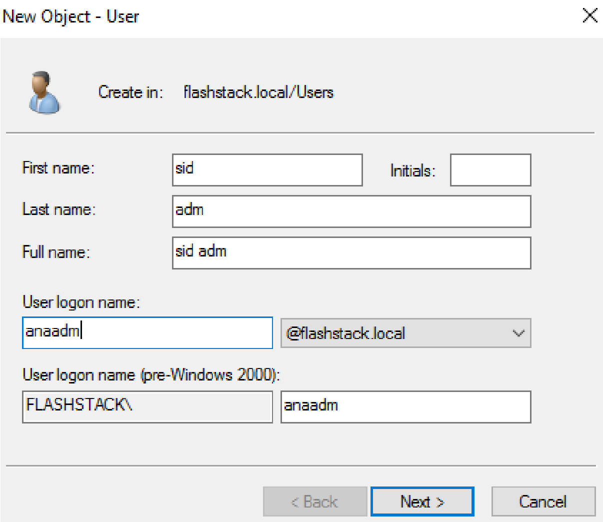
Group scope: ○ Domain local ● Global ○ Universal

Group type: ● Security ○ Distribution

3. Create a <sid>adm user which fits name and GID wise to the SAP instance being installed.

4. Right-click on Users in the Domain tree and select New and then User.

5. Provide the username and logon name. In the validation setup the SAP SID is ANA; hence anaadm in this example.


New Object - User

Create in: flashstack.local/Users

First name: sid

Initials:

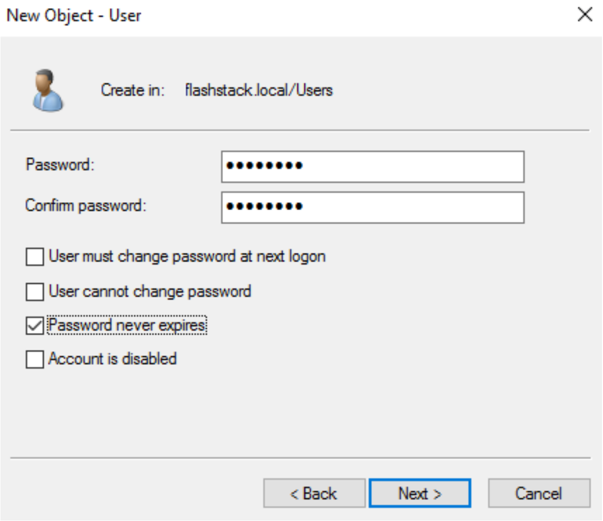
Last name: adm

Full name: sid adm

User logon name: anaadm @flashstack.local

User logon name (pre-Windows 2000): FLASHSTACK\ anaadm

6. Provide a user password and set the password to never expire.


New Object - User

Create in: flashstack.local/Users

Password: ••••••••

Confirm password: ••••••••

☐ User must change password at next logon

☐ User cannot change password

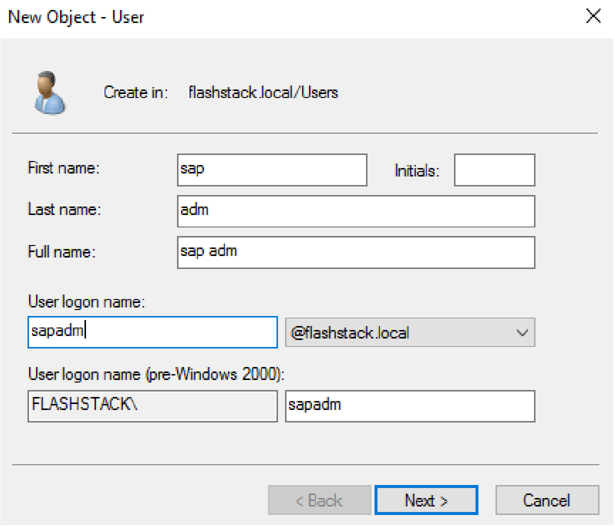
☑ Password never expires

☐ Account is disabled

Do not add the <sid>adm user to the sapsys group. This will be done automatically during the share creation process later.

7. Right-click on Users in the Domain tree and select New and then Group.

8. Provide the username and logon name.



New Object - User

Create in: flashstack.local/Users

First name: sap

Initials:

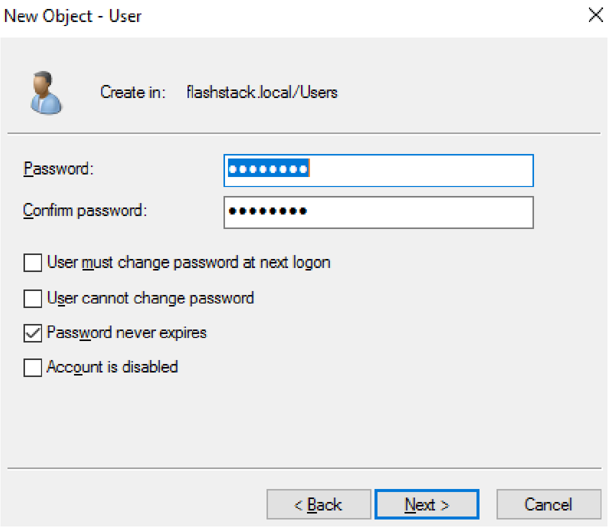
Last name: adm

Full name: sap adm

User logon name: sapadm @flashstack.local

User logon name (pre-Windows 2000): FLASHSTACK\ sapadm

9. Provide a user password and set the password to never expire.



New Object - User

Create in: flashstack.local/Users

Password: ••••••••

Confirm password: ••••••••

□ User must change password at next logon

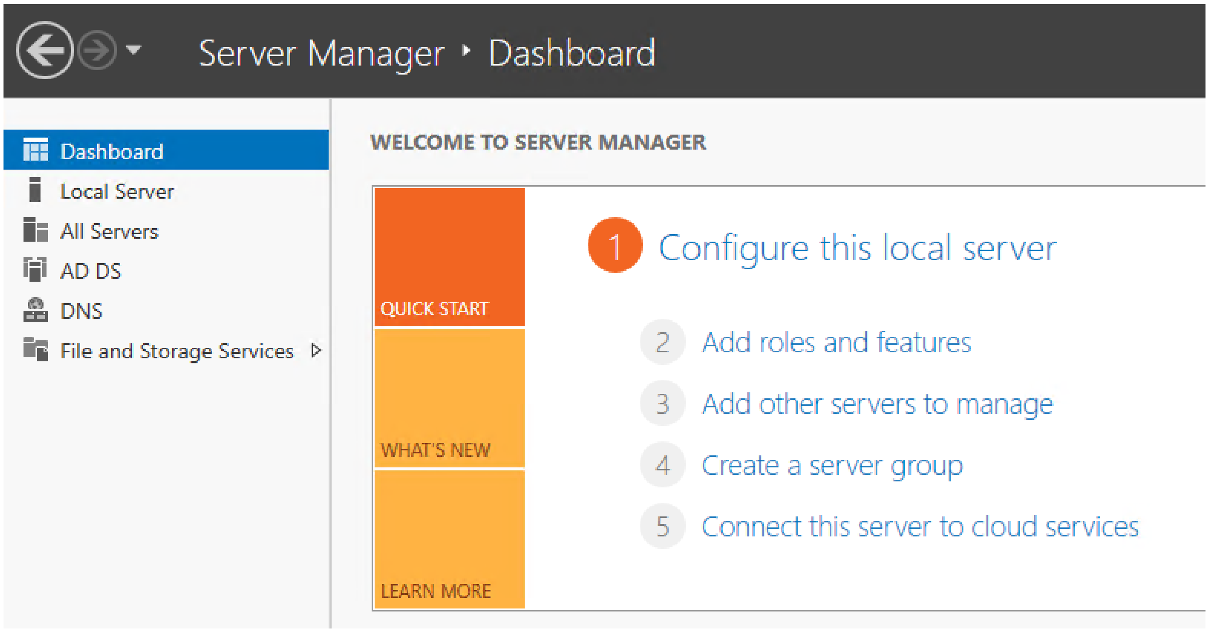
□ User cannot change password

☑ Password never expires

□ Account is disabled

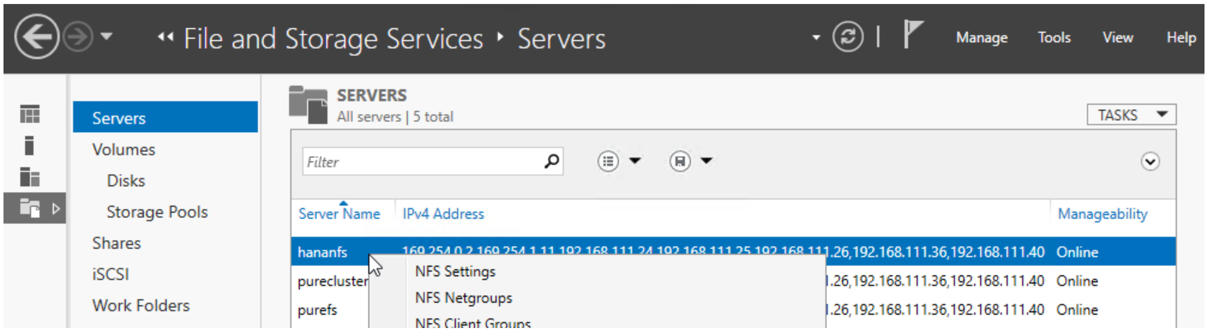
To connect to the Windows File Services VM, follow these steps:

1. Open the Server Manager.


Server Manager ‣ Dashboard
Dashboard
Local Server
All Servers
AD DS
DNS
File and Storage Services
WELCOME TO SERVER MANAGER
QUICK START
WHAT'S NEW
LEARN MORE
1 Configure this local server
2 Add roles and features
3 Add other servers to manage
4 Create a server group
5 Connect this server to cloud services

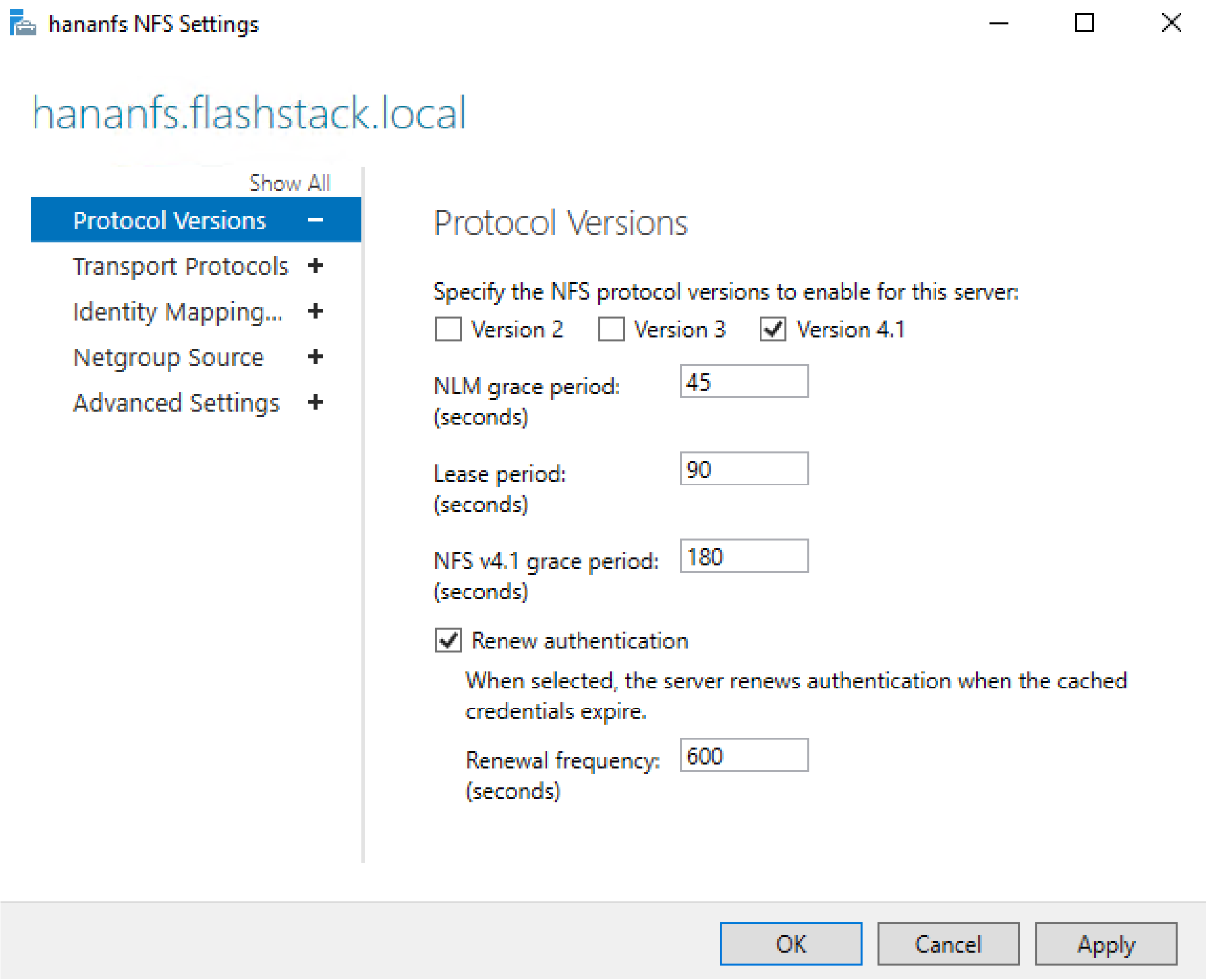
2. Navigate to the File and Storage Services.

3. Select the hananfs File Server and right-click to select NFS Settings from the menu.



Server Name	IPv4 Address	Manageability
hananfs	169.254.0.2,169.254.1.11,192.168.111.24,192.168.111.25,192.168.111.26,192.168.111.36,192.168.111.40	Online
purecluster	.26,192.168.111.36,192.168.111.40	Online
purefs	.26,192.168.111.36,192.168.111.40	Online

4. In the dialog screen set the relevant protocol versions (version 3 and 4.1 are recommended). Set the lease period to 90 seconds and the NFS v4.1 grace period to 180 seconds.



hananfs NFS Settings

hananfs.flashstack.local

Protocol Versions

Specify the NFS protocol versions to enable for this server:

□ Version 2 □ Version 3 ☑ Version 4.1

NLM grace period: (seconds) 45

Lease period: (seconds) 90

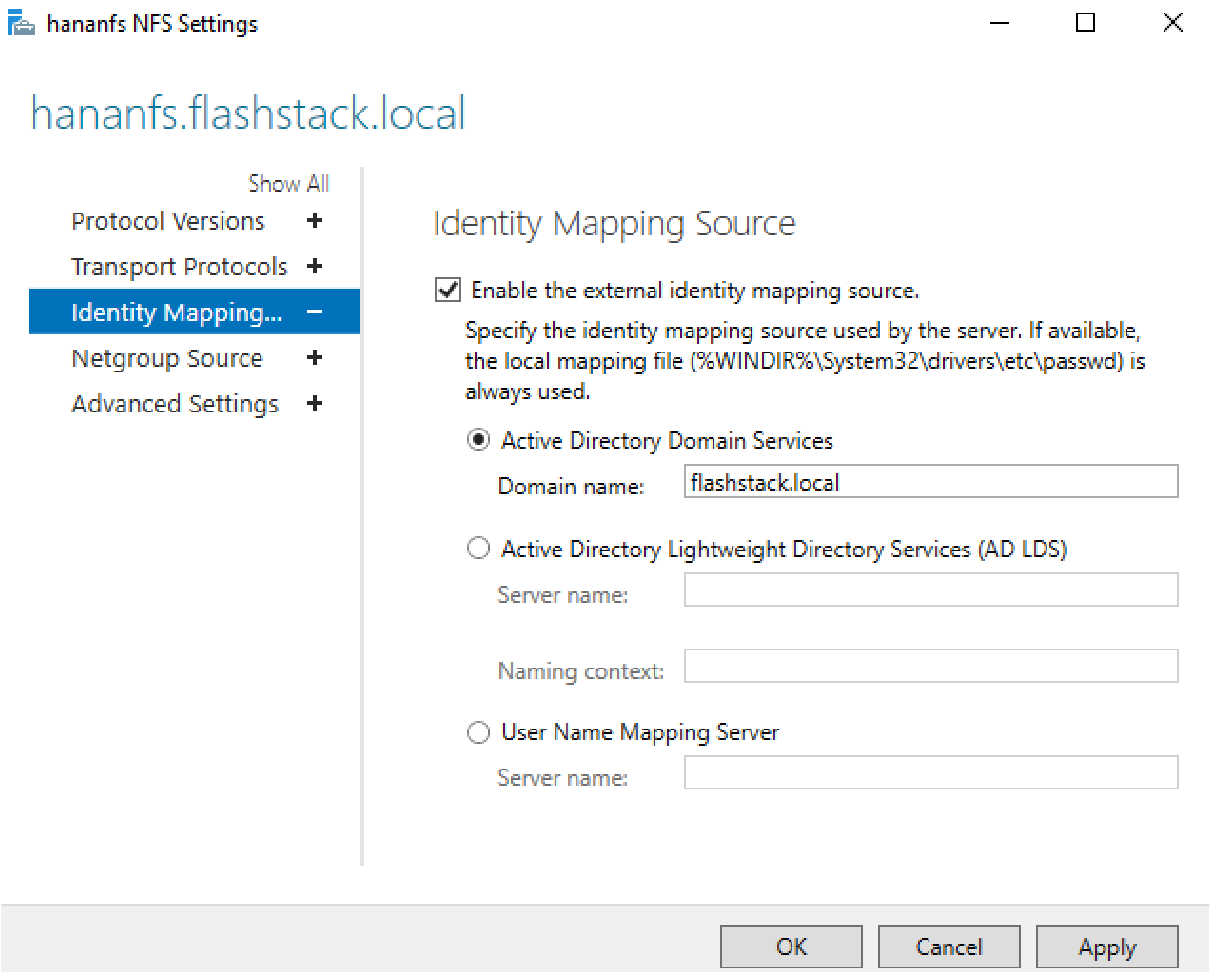
NFS v4.1 grace period: (seconds) 180

☑ Renew authentication

When selected, the server renews authentication when the cached credentials expire.

Renewal frequency: (seconds) 600

5. Change to Identity Mapping and set the identity mapping source which is the Active Directory Domain Service. Click OK.



hananfs NFS Settings

hananfs.flashstack.local

Identity Mapping Source

☑ Enable the external identity mapping source.

Specify the identity mapping source used by the server. If available, the local mapping file (%WINDIR%\System32\drivers\etc\passwd) is always used.

● Active Directory Domain Services

Domain name: flashstack.local

○ Active Directory Lightweight Directory Services (AD LDS)

Server name:

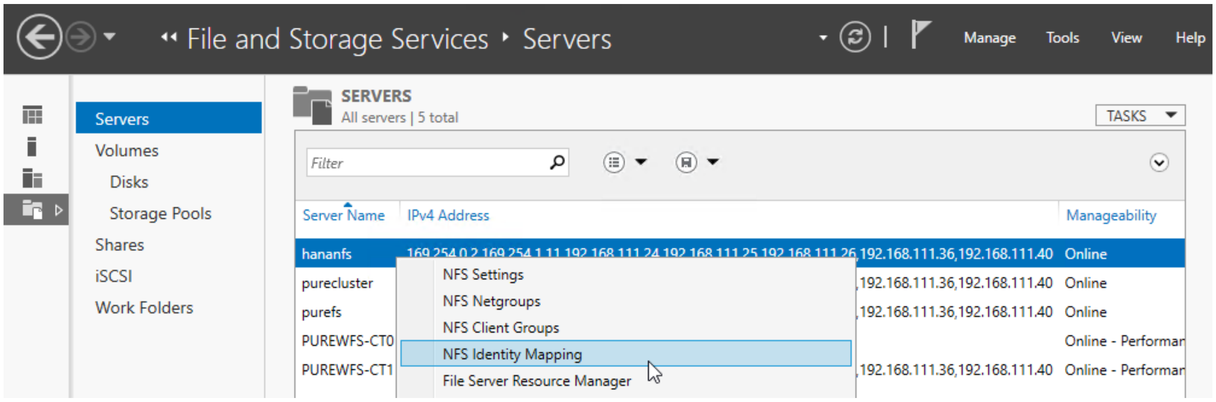
Naming context:

○ User Name Mapping Server

Server name:

6. Return to File and Storage Services.

7. Select the hananfs File Server and right-click to select NFS Identity Mapping from the menu.



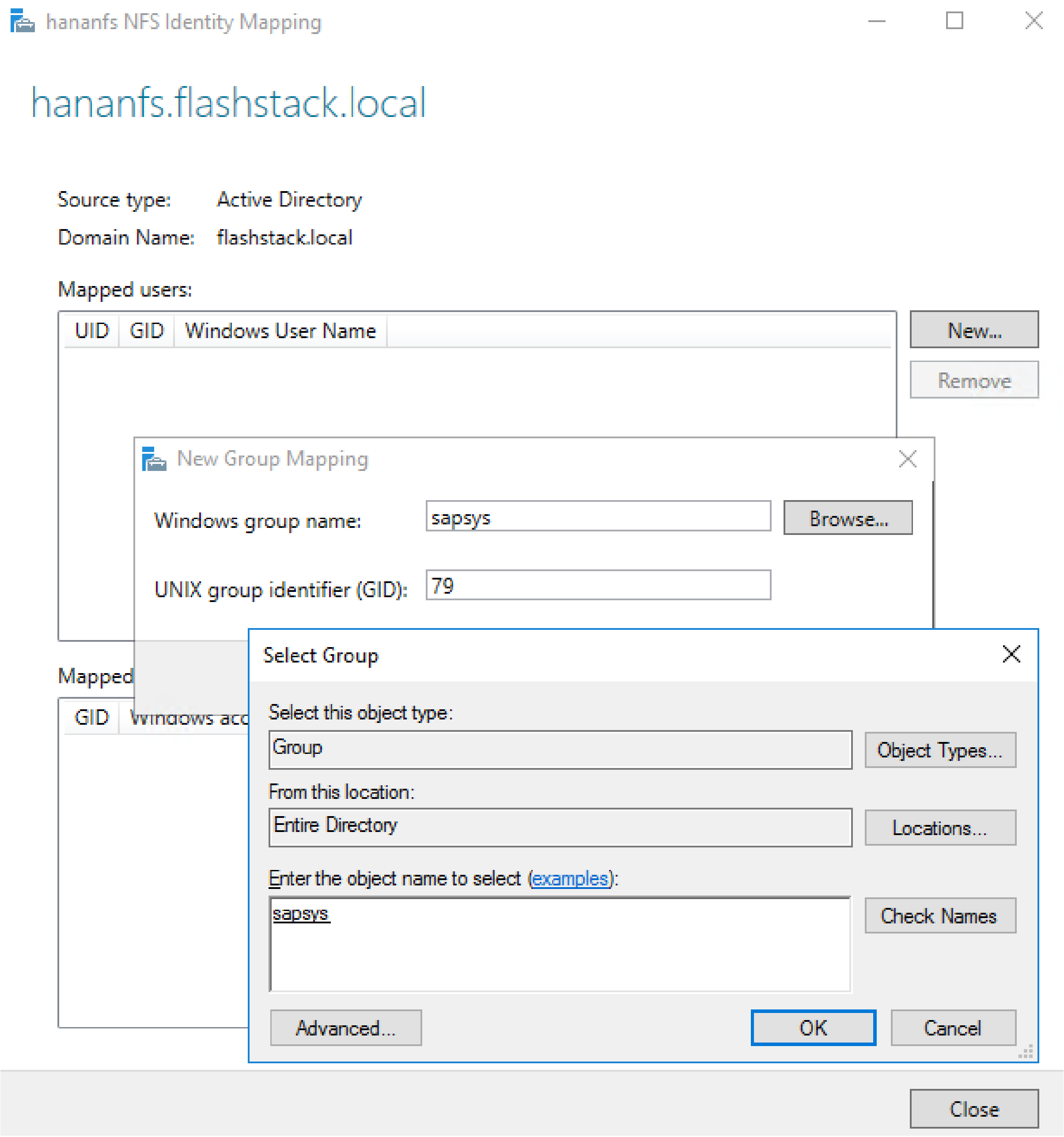
SERVERS
All servers | 5 total

Server Name	IPv4 Address	Manageability
hananfs	169.254.0.2,169.254.1.11,192.168.111.24,192.168.111.25,192.168.111.26,192.168.111.36,192.168.111.40	Online
purecluster	,192.168.111.36,192.168.111.40	Online
purefs	,192.168.111.36,192.168.111.40	Online
PUREWFS-CT0		Online - Performar
PUREWFS-CT1	,192.168.111.36,192.168.111.40	Online - Performar

8. In the NFS Identity dialog screen, select New in the mapped groups work pane.

9. Provide the sapsys group with the same GID expected to be used for the SAP HANA installation.

10. Browse the domain for the sapsys group and confirm the dialogs to add the group.



hananfs NFS Identity Mapping

hananfs.flashstack.local

Source type: Active Directory

Domain Name: flashstack.local

Mapped users:

UID	GID	Windows User Name

New Group Mapping

Windows group name: sapsys

UNIX group identifier (GID): 79

Select Group

Select this object type: Group

From this location: Entire Directory

Enter the object name to select (examples): sapsys

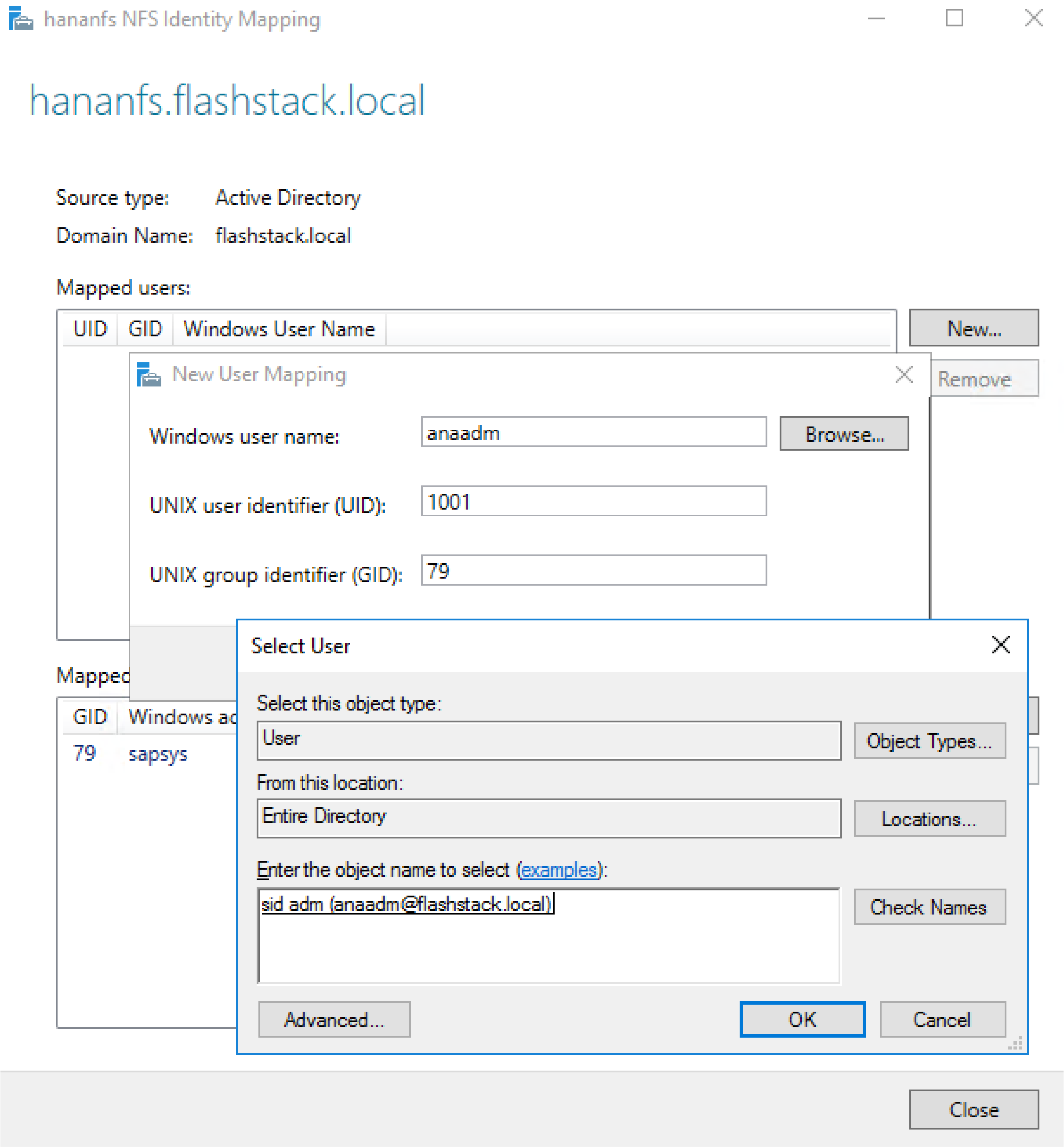
Mapped

GID	Windows acc

11. In the NFS Identity dialog screen, select New in the mapped users work pane.

12. Provide the <sid>adm user with the same UID expected to be used for the SAP HANA installation.

13. Browse the domain for the <sid>adm user and confirm the dialogs to add the user.



hananfs NFS Identity Mapping

hananfs.flashstack.local

Source type: Active Directory

Domain Name: flashstack.local

Mapped users:

UID	GID	Windows User Name

New User Mapping

Windows user name: anaadm

UNIX user identifier (UID): 1001

UNIX group identifier (GID): 79

Select User

Select this object type: User

From this location: Entire Directory

Enter the object name to select (examples): sid adm (anaadm@flashstack.local)

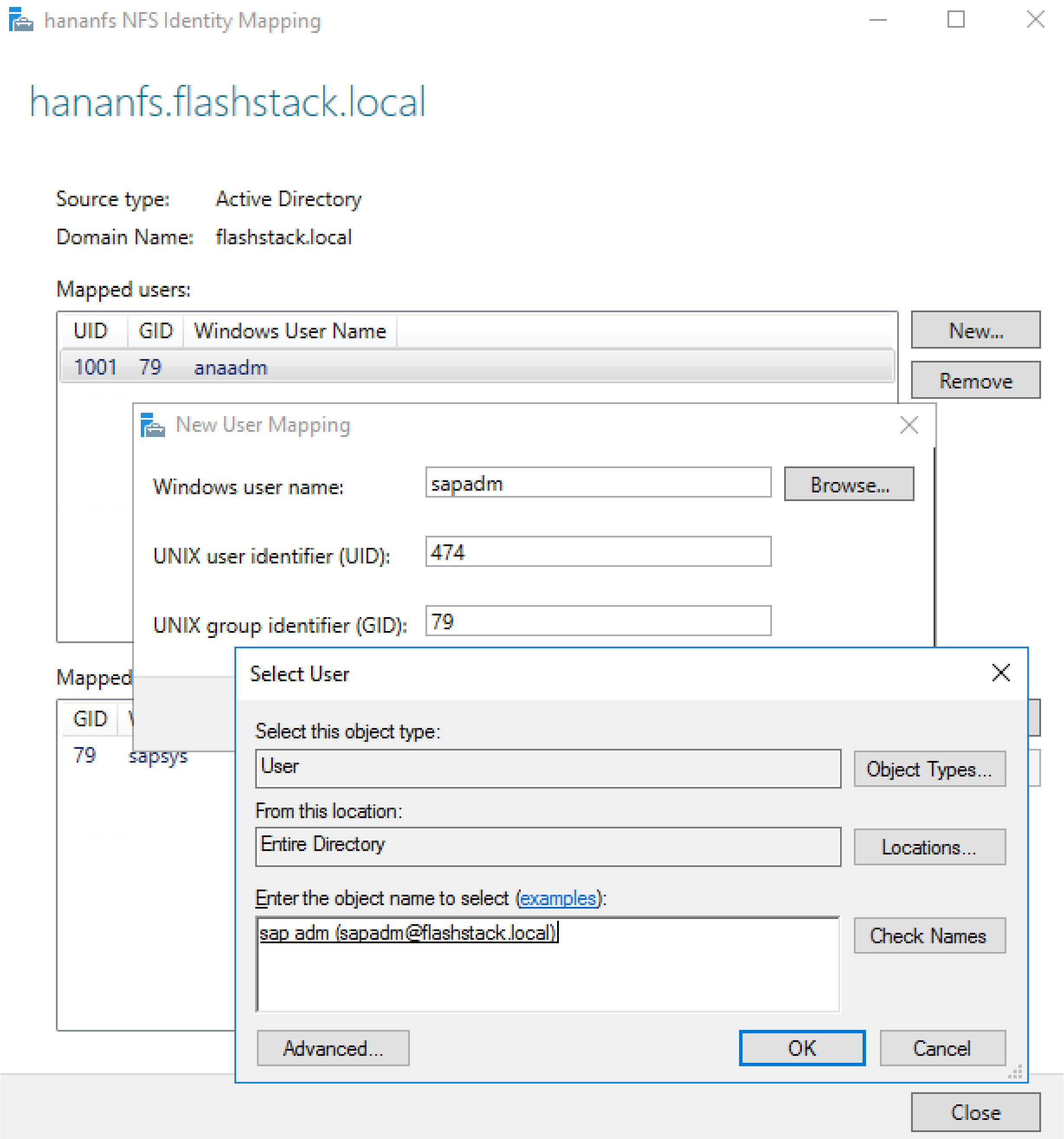
Mapped

GID	Windows ac
79	sapsys

14. In the NFS Identity dialog screen, select New in the mapped users work pane.

15. Provide the sapadm user with the same UID expected to be used for the SAP HANA installation.

16. Browse the domain for the sapadm user and confirm the dialogs to add the user.



hananfs NFS Identity Mapping

hananfs.flashstack.local

Source type: Active Directory

Domain Name: flashstack.local

Mapped users:

UID	GID	Windows User Name
1001	79	anaadm

New User Mapping

Windows user name: sapadm

UNIX user identifier (UID): 474

UNIX group identifier (GID): 79

Mapped

GID	W
79	sapsys

Select User

Select this object type: User

From this location: Entire Directory

Enter the object name to select (examples): sap adm (sapadm@flashstack.local)

17. Confirm and close the dialog screen.

The NFS service in Windows File Services can map credentials in the domain to an NFS GID and UID.

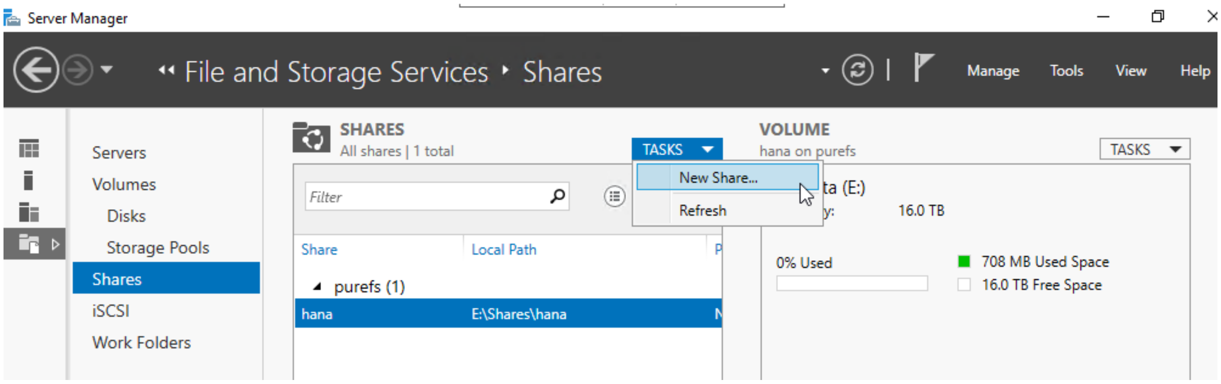
Set up NFS Share and Configure Permissions

A single volume and drive should be presented for the NFS share. The use of drive letters is recommended but mount points are possible too.

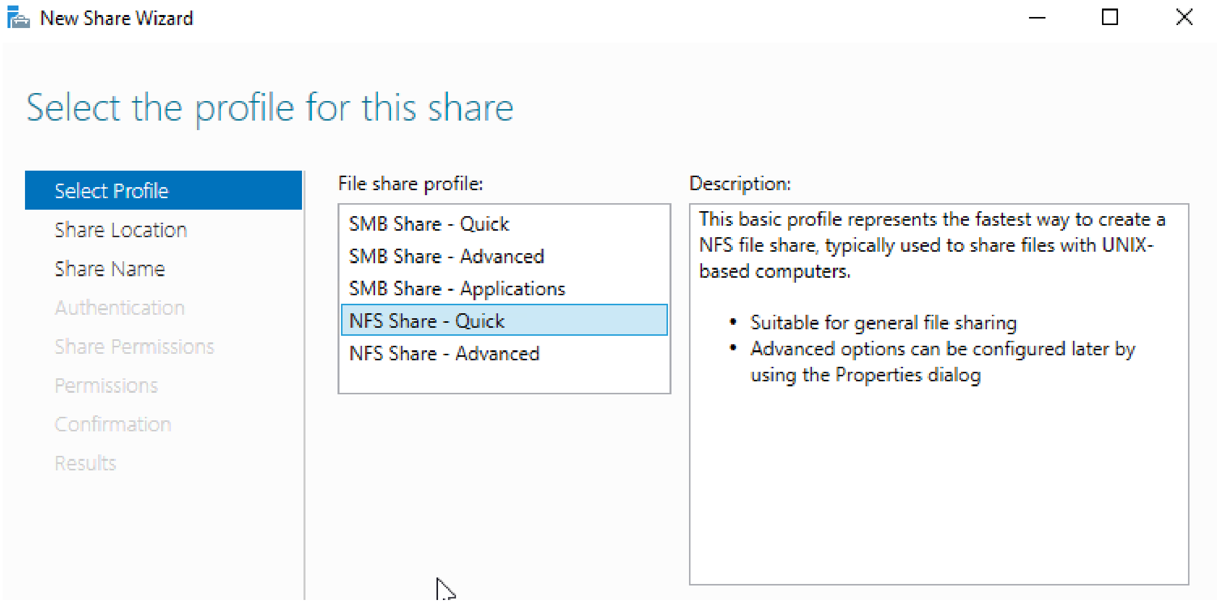
To connect to the Windows File Services VM, follow these steps:

1. In Server Manager, navigate to Files and Storage Service and the sub menu Shares.

2. Click TASKS and select New Share.



3. Select NFS Share – Quick and click Next.



Select the profile for this share

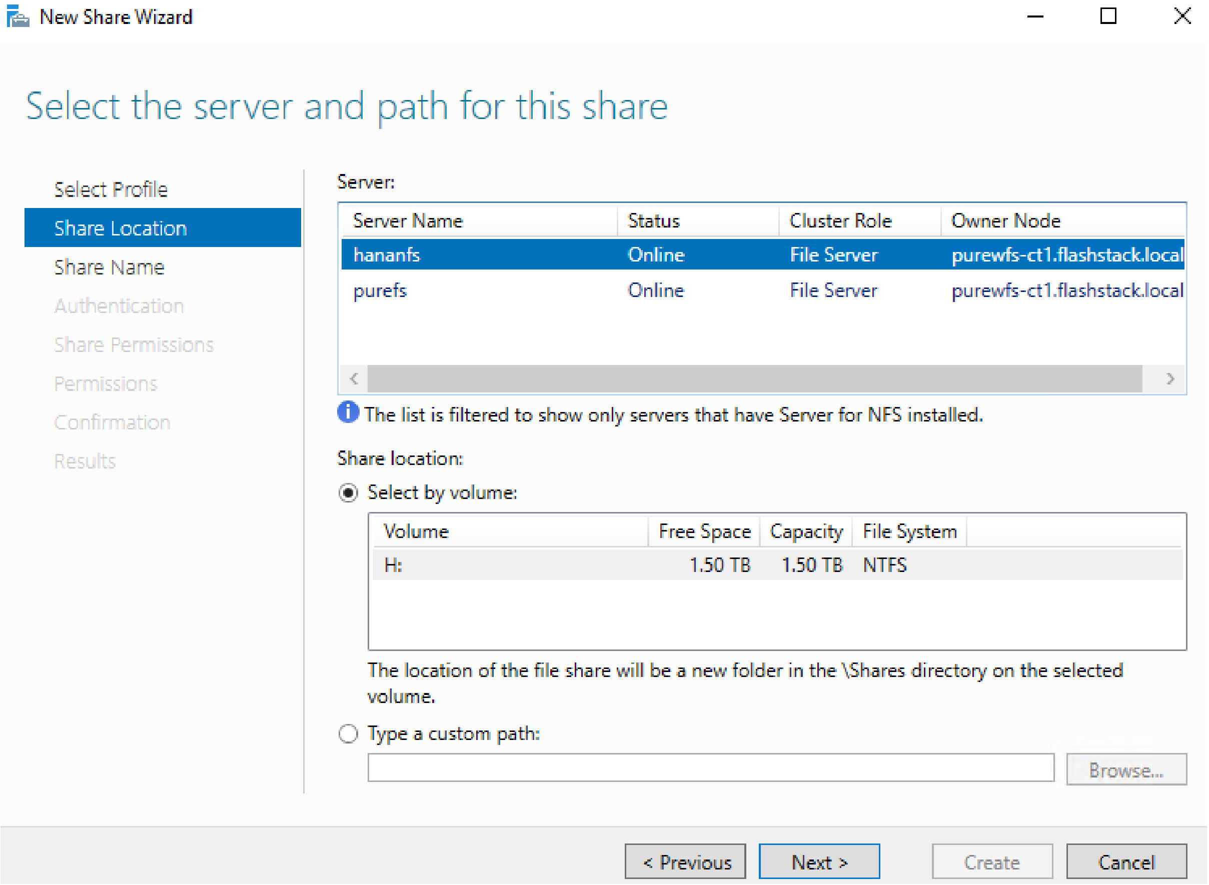
File share profile: NFS Share - Quick

Description:

This basic profile represents the fastest way to create a NFS file share, typically used to share files with UNIX-based computers.

- Suitable for general file sharing
- Advanced options can be configured later by using the Properties dialog

4. Select the hananfs server name and its volume. Click Next.



Select the server and path for this share

Server:

Server Name	Status	Cluster Role	Owner Node
hananfs	Online	File Server	purewfs-ct1.flashstack.local
purefs	Online	File Server	purewfs-ct1.flashstack.local

The list is filtered to show only servers that have Server for NFS installed.

Share location:

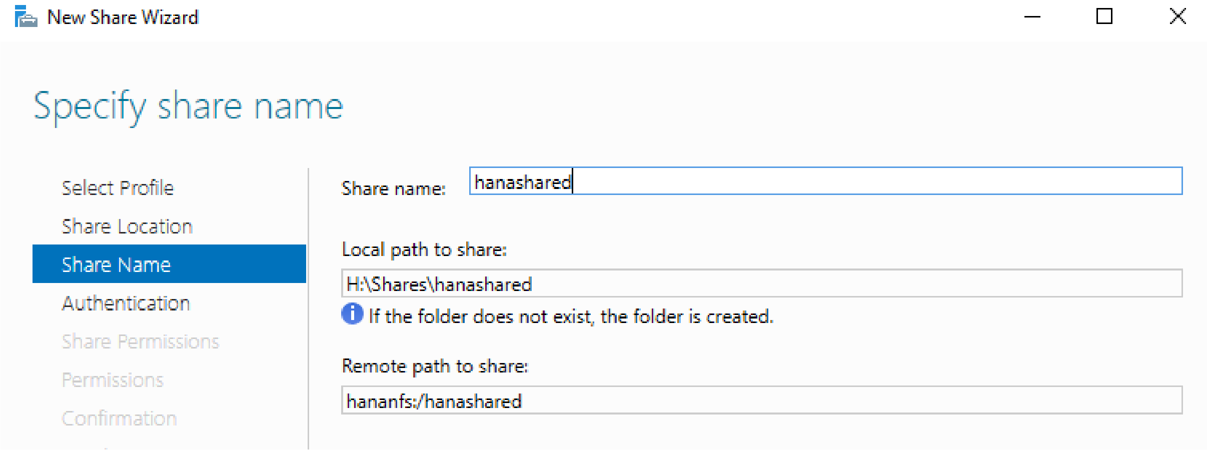
● Select by volume:

Volume	Free Space	Capacity	File System
H:	1.50 TB	1.50 TB	NTFS

The location of the file share will be a new folder in the \Shares directory on the selected volume.

○ Type a custom path:

5. Provide a share name and click Next.



Specify share name

Share name: hanashared

Local path to share:

H:\Shares\hanashared

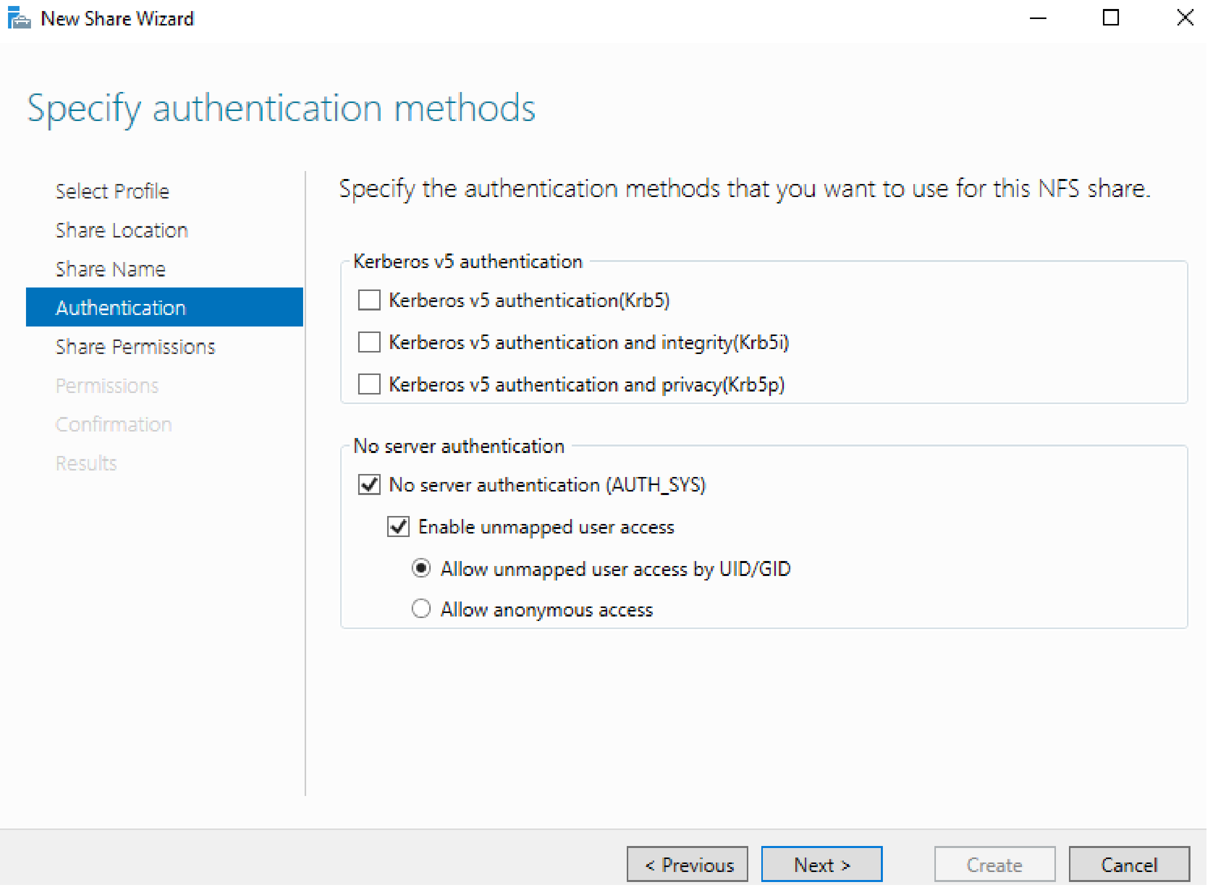
If the folder does not exist, the folder is created.

Remote path to share:

hananfs:/hanashared

6. Select the Authentication method: No server authentication (AUTH_SYS).

7. Select Enable unmapped user access and Allow unmapped user access by UID/GID.



New Share Wizard

Specify authentication methods

Specify the authentication methods that you want to use for this NFS share.

Kerberos v5 authentication

□ Kerberos v5 authentication(Krb5)

□ Kerberos v5 authentication and integrity(Krb5i)

□ Kerberos v5 authentication and privacy(Krb5p)

No server authentication

☑ No server authentication (AUTH_SYS)

☑ Enable unmapped user access

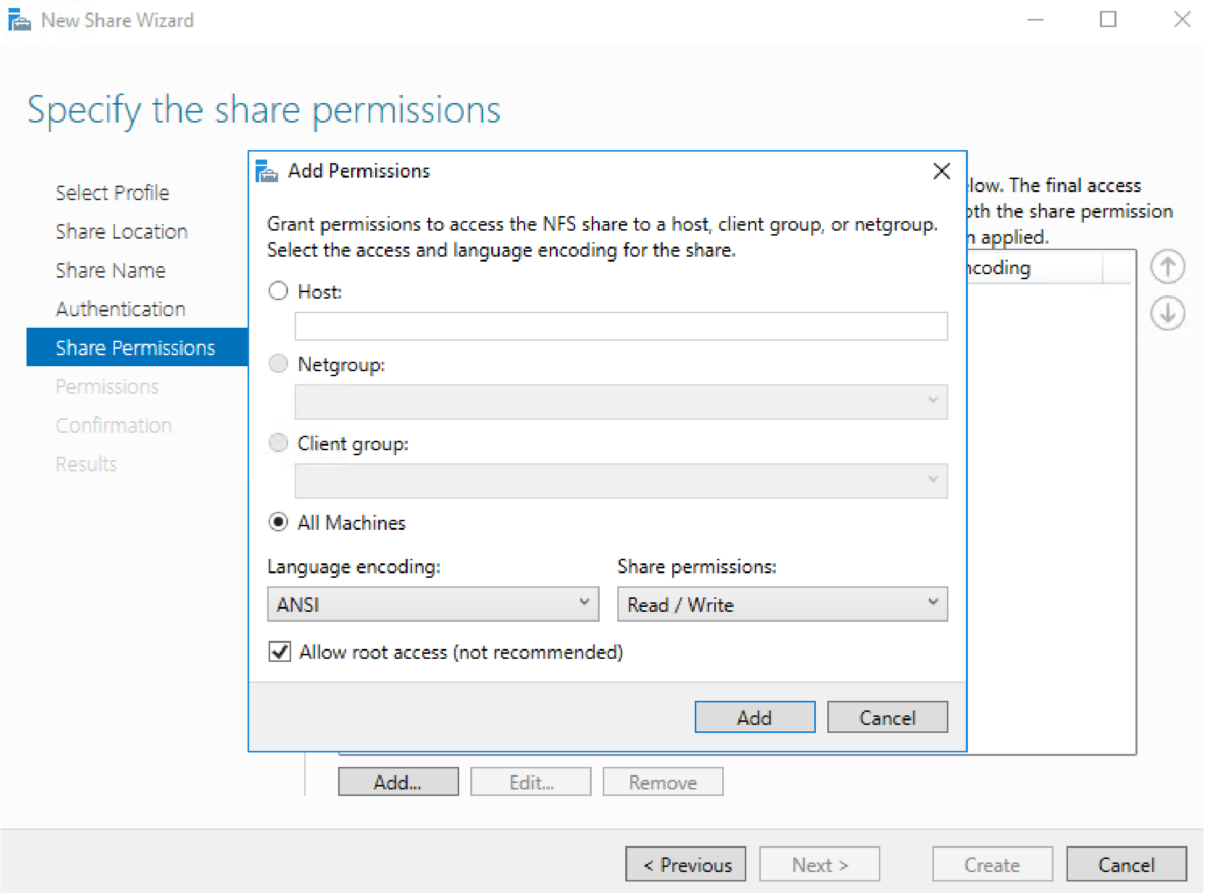
● Allow unmapped user access by UID/GID

○ Allow anonymous access

8. Click Next.

9. Select either individual hosts names (or IP addresses), groups or all host machines to allow access to the NFS share. In the lab environment we select All Machines.

10. Set the share permission to Read/Write and select Allow root access.



New Share Wizard

Specify the share permissions

Add Permissions

Grant permissions to access the NFS share to a host, client group, or netgroup. Select the access and language encoding for the share.

○ Host:

○ Netgroup:

○ Client group:

● All Machines

Language encoding: ANSI

Share permissions: Read / Write

☑ Allow root access (not recommended)

11. Click Add.

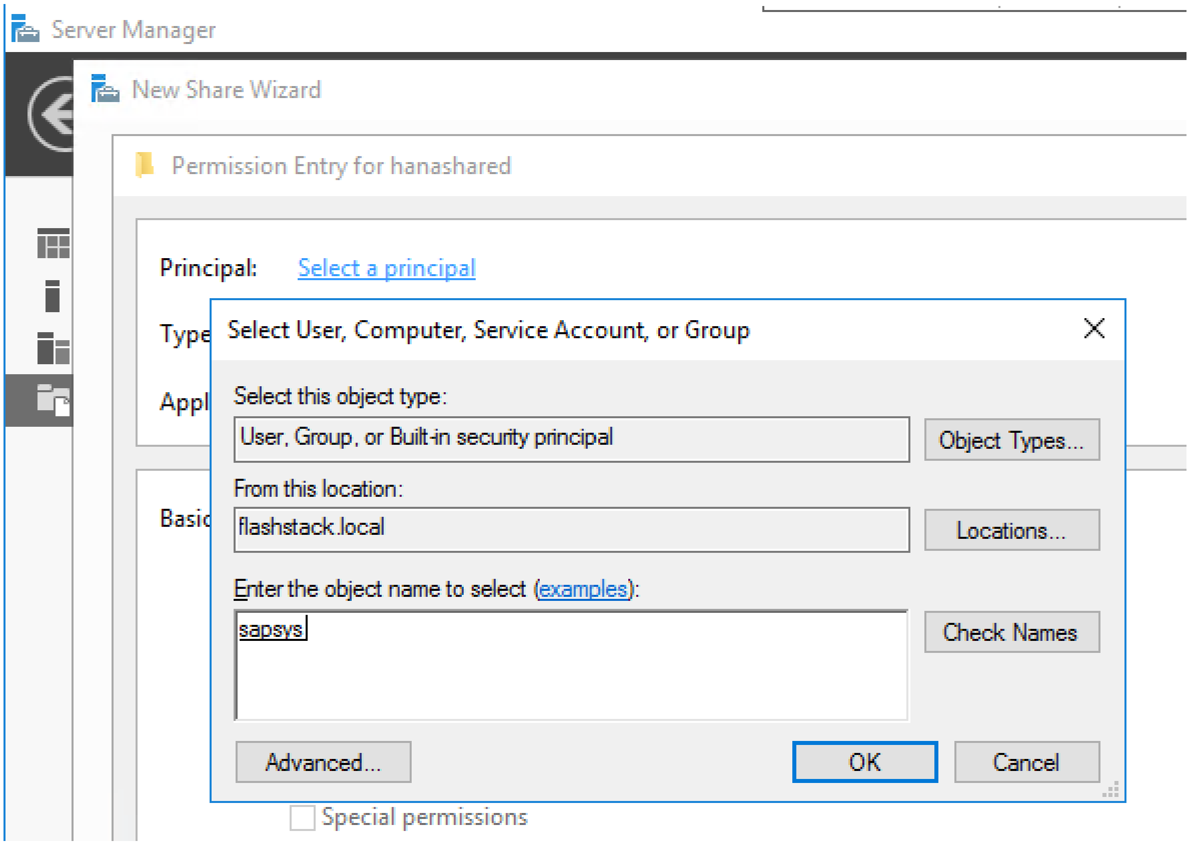
12. Verify the selected hosts, groups or all machines appear and click Next.

13. In the permission work pane, click Customized permissions.

14. In the Advanced Security Settings for hanashared click Add.

15. Click Select a Principal

16. In the empty boy, type sapsys and Click Check Names.



Select this object type:

User, Group, or Built-in security principal

From this location:

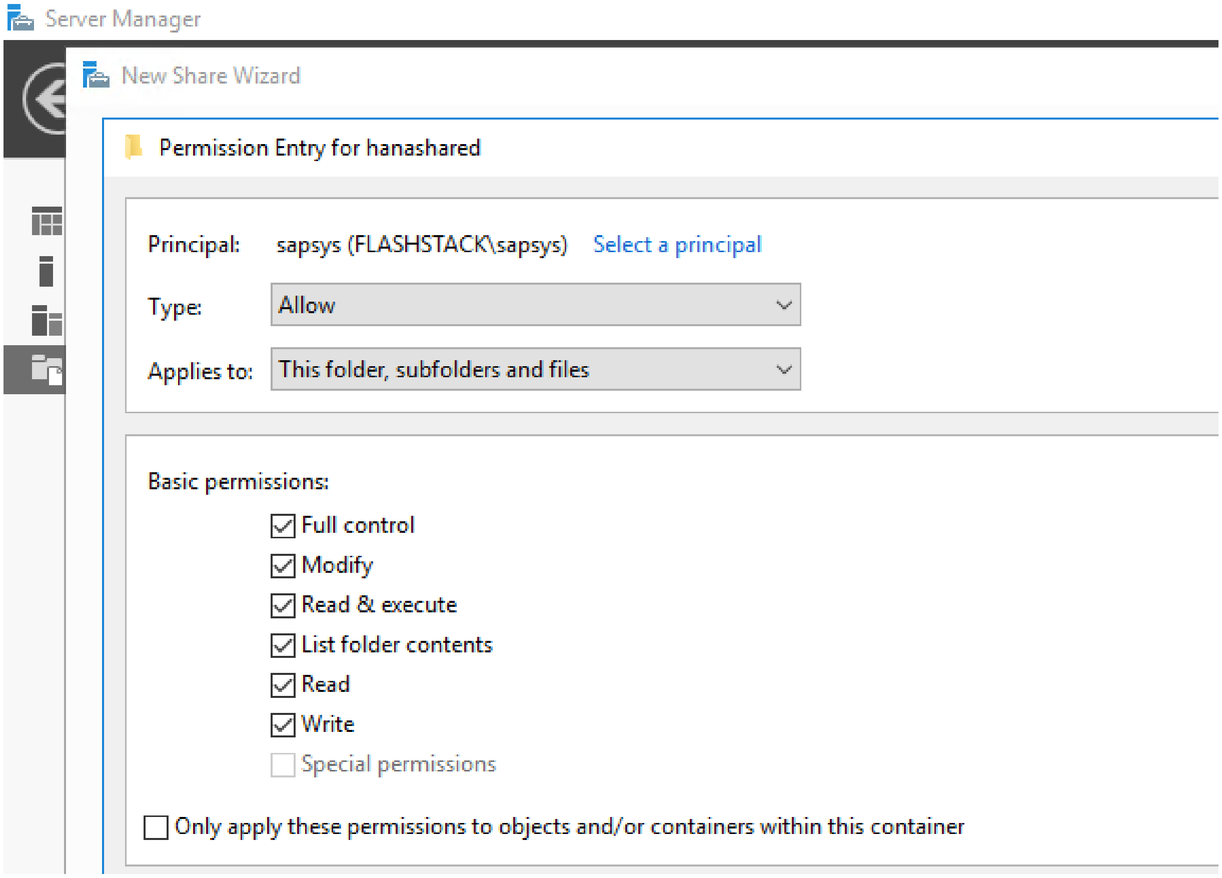
flashstack.local

Enter the object name to select (examples):

sapsys

17. Click OK.

18. Select the Full Control checkmark.



Permission Entry for hanashared

Principal: sapsys (FLASHSTACK\sapsys) Select a principal

Type: Allow

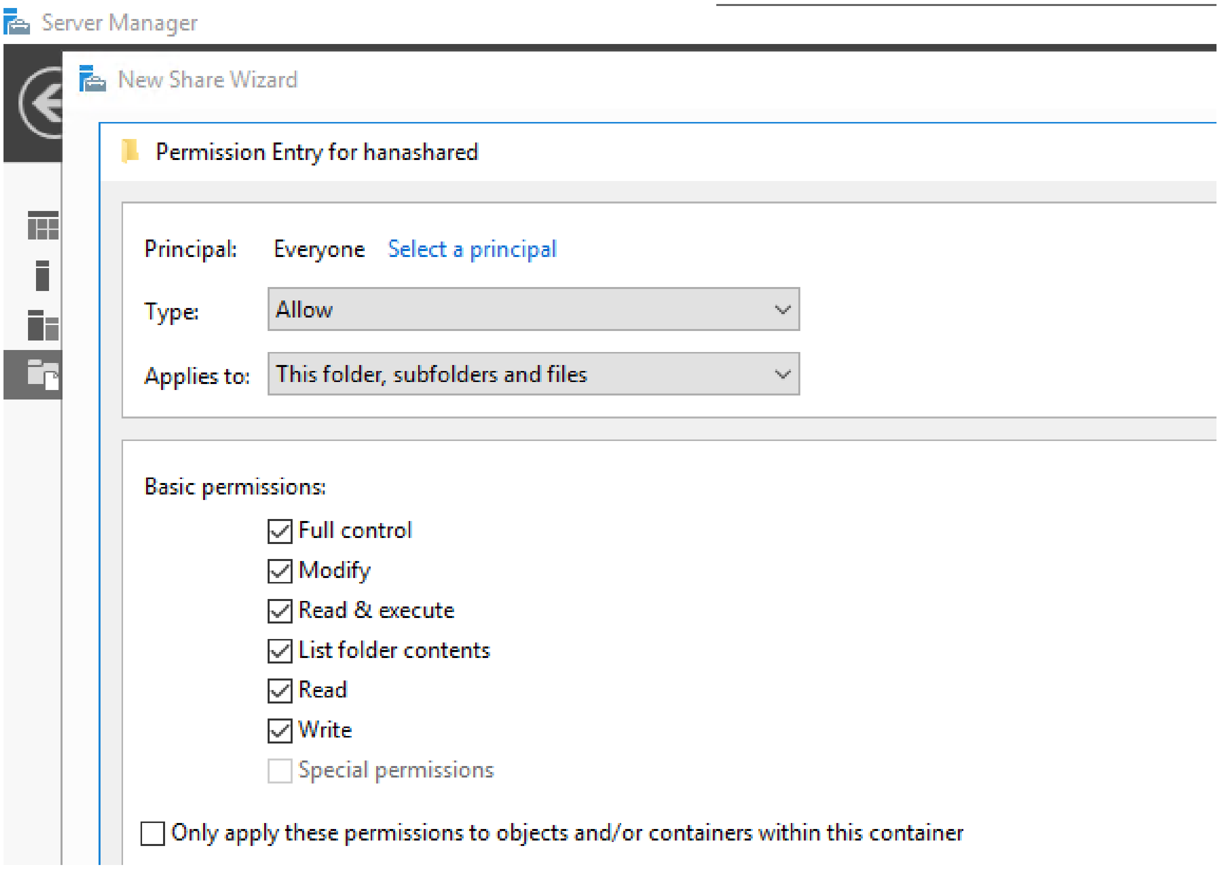
Applies to: This folder, subfolders and files

Basic permissions:

☑ Full control
☑ Modify
☑ Read & execute
☑ List folder contents
☑ Read
☑ Write
□ Special permissions

□ Only apply these permissions to objects and/or containers within this container

19. Add everyone as new principal and select the Full Control checkmark as well.



Permission Entry for hanashared

Principal: Everyone Select a principal

Type: Allow

Applies to: This folder, subfolders and files

Basic permissions:

☑ Full control

☑ Modify

☑ Read & execute

☑ List folder contents

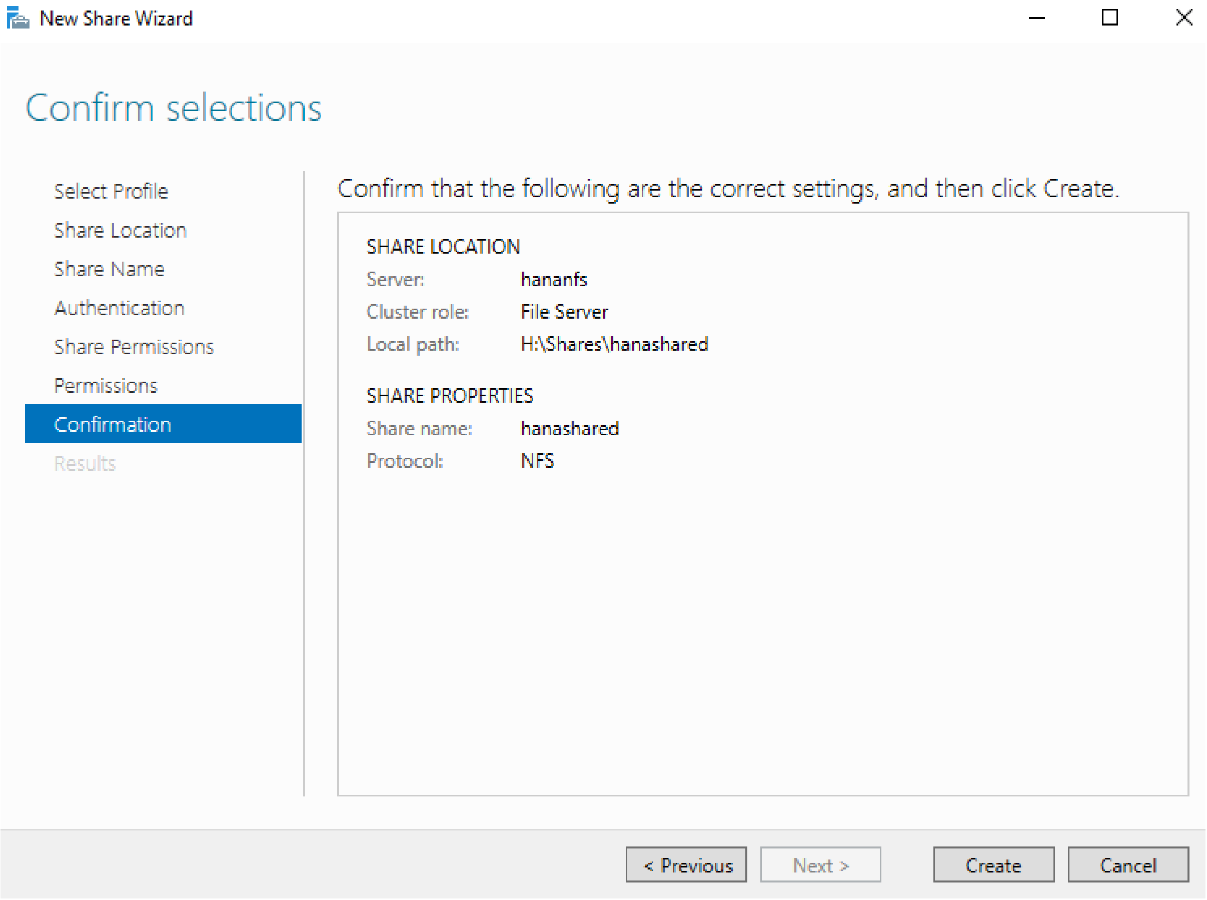
☑ Read

☑ Write

□ Special permissions

□ Only apply these permissions to objects and/or containers within this container

20. Confirm the selections and click Create. Click Close the confirmation dialog.



Confirm selections

Confirm that the following are the correct settings, and then click Create.

SHARE LOCATION

Server: hananfs

Cluster role: File Server

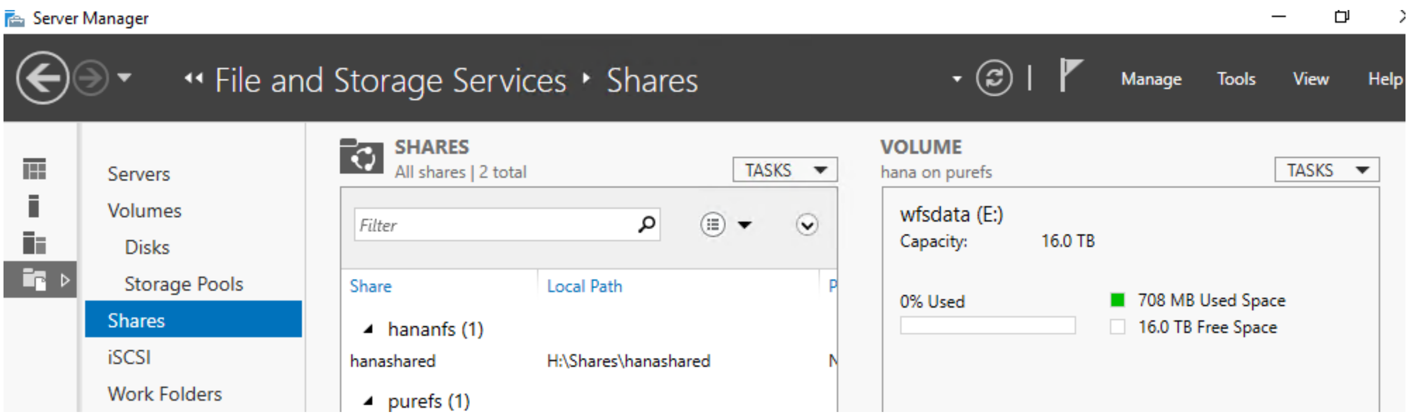
Local path: H:\Shares\hanashared

SHARE PROPERTIES

Share name: hanashared

Protocol: NFS

The new share is now visible from Server Manager and will be used as /hana/shared file system during the SAP HANA Scale-Out installation.



SHARES

All shares | 2 total

Share	Local Path
hananfs (1)	
hanashared	H:\Shares\hanashared
purefs (1)	

VOLUME

hana on purefs

wfsdata (E:)

Capacity: 16.0 TB

0% Used

🟩 708 MB Used Space

□ 16.0 TB Free Space

21. Use the default NFS mount options when mounting this HANA NFS share:

```
# cat /etc/fstab
192.168.111.26:/hanashared   /hana/shared  nfs   defaults  0  0
```

Operating System Installation

This section provides the Linux Operating System installation procedure using SAN Boot and includes operating system customization to fulfill all SAP HANA requirements. If you plan to install Red Hat Enterprise Linux for SAP Solutions skip the first SUSE Linux Enterprise Server for SAP Applications installation section.

SLES for SAP Applications 15 SP1

SLES for SAP 15 Installation

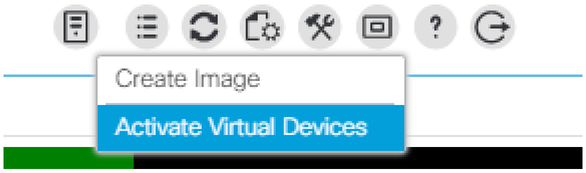
SUSE® Linux Enterprise Server for SAP Applications is the reference platform for the software development of SAP. It is optimized for SAP applications like SAP HANA. The installation follows the installation workflow documented in chapter 3.1 of https://documentation.suse.com/sles-sap/15-SP1/html/SLES4SAP-guide/index.html and this section lists where the lab installation deviates from the installation workflow.

The following supplement SUSE information is available from the SAP notes system:

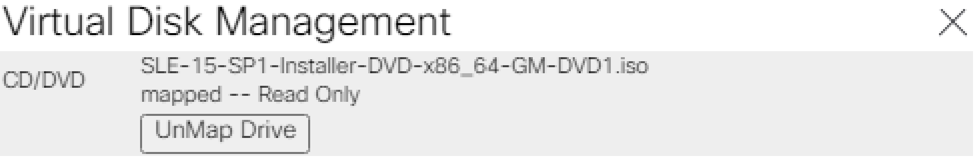
- SAP Note 2578899 - SUSE Linux Enterprise Server 15: Installation Note
- SAP Note 2684254 - SAP HANA DB: Recommended OS settings for SLES 15 for SAP Applications 15
- SAP Note 1275776 - Linux: Preparing SLES for SAP environments

To download the ISO image from https://download.suse.com and map the installation ISO image in the KVM console, follow these step:

1. In the Navigation pane of the Cisco UCS Manager, click Servers.
2. Select Service Profile > root > Sub-Organization > HANA > HANA-Server01.
3. In the Actions section click KVM Console.
4. Choose Virtual Media > Activate Virtual Devices.



5. For Unencrypted Virtual Media Session, select Accept this Session and then click Apply.
6. Click Virtual Media and choose Map CD/DVD.
7. Click Browse to navigate to the ISO media location. Select SLE-15-SP1-Installer-DVD-x86_64-GM-DVD1.ISO Click Open.
8. Click Map Device.

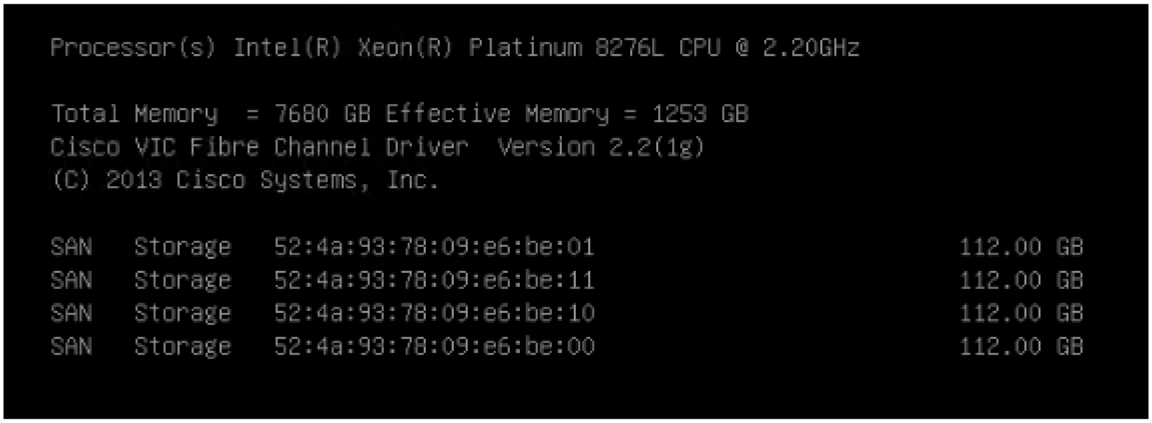


Virtual Disk Management

CD/DVD SLE-15-SP1-Installer-DVD-x86_64-GM-DVD1.iso
mapped -- Read Only

9. In the KVM Console menu, click Boot Server.

10. During the VIC FC boot driver verification at the server boot time the Pure Storage FlashArray//X target WWPN numbers are listed during the connection verification.



```
Processor(s) Intel(R) Xeon(R) Platinum 8276L CPU @ 2.20GHz

Total Memory  = 7680 GB Effective Memory = 1253 GB
Cisco VIC Fibre Channel Driver  Version 2.2(1g)
(C) 2013 Cisco Systems, Inc.

SAN   Storage   52:4a:93:78:09:e6:be:01                          112.00 GB
SAN   Storage   52:4a:93:78:09:e6:be:11                          112.00 GB
SAN   Storage   52:4a:93:78:09:e6:be:10                          112.00 GB
SAN   Storage   52:4a:93:78:09:e6:be:00                          112.00 GB
```

11. The System will automatically boot from the ISO image into the installation wizard.

Follow the SUSE Linux Enterprise installation workflow and choose SUSE Linux Enterprise Server for SAP Applications 15 SP1.

12. On the network settings screen configure the management network interface.

13. Identify the Ethernet device to vNIC interface mapping first from the Cisco UCS Manager:

    a. In the Navigation pane of UCSM, click Servers

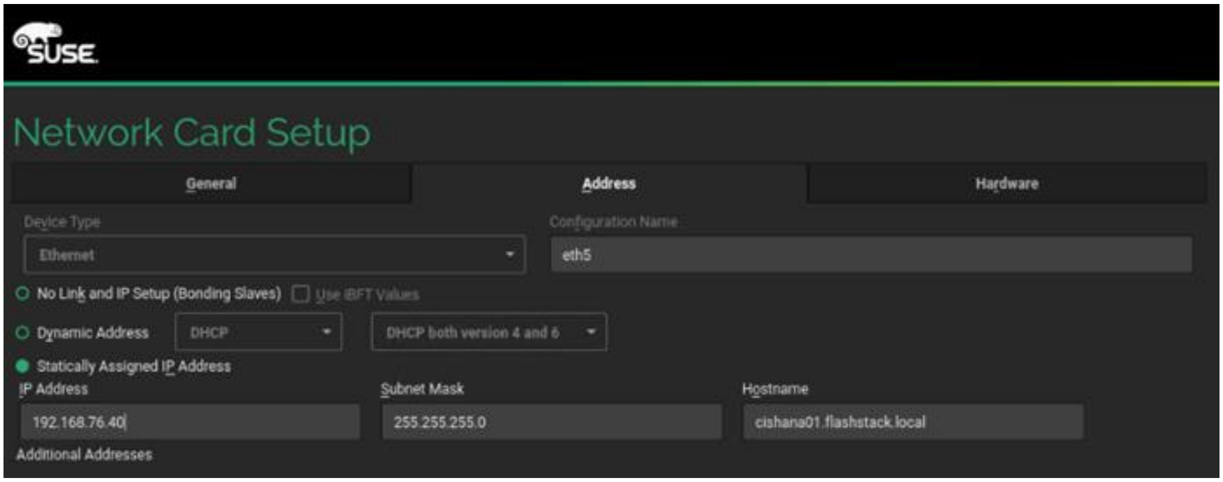
    b. Select Service Profile > root > Sub-Organizations > HANA > HANA-Server01

    c. In the network tab, scroll down to the vNIC section and list the vNICs with their MAC addresses

    d. Note down the MAC address of the HANA-Mgmt vNIC, in this lab installation “00:25:B5:00:0B:02”

14. In the SUSE network settings screen, find the network interface with the same MAC address, in this lab installation eth5 and click edit.

15. Provide the IP address <var_server01_mgmt_ip>, the subnet mask <var_oob_vlan_net> and the fully qualified host name <var_server01_mgmt_hostname> in the General tab.



Network Card Setup

General | Address | Hardware

Device Type: Ethernet

Configuration Name: eth5

○ No Link and IP Setup (Bonding Slaves) □ Use iBFT Values

○ Dynamic Address DHCP DHCP both version 4 and 6

● Statically Assigned IP Address

IP Address: 192.168.76.40

Subnet Mask: 255.255.255.0

Hostname: cishana01.flashstack.local

Additional Addresses

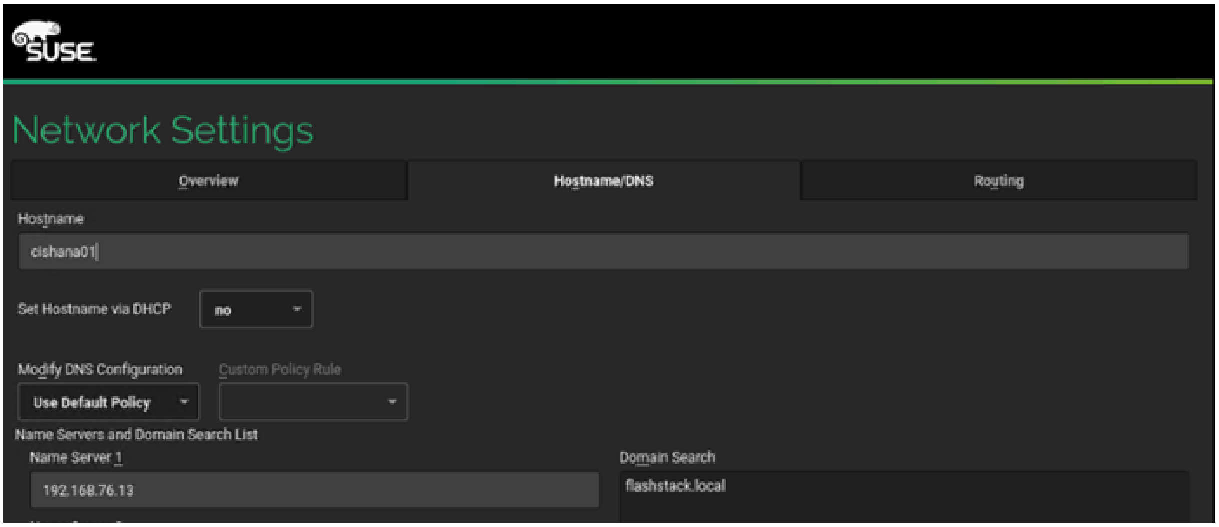
16. Select the Hostname/DNS tab.

17. Provide the server hostname: <var_server01_hostname>

18. Change the Set Hostname via DHCP drop down menu to no.

19. Enter the name server IP: <var_nameserver_ip>

20. Enter the domain name in the domain search field: <var_dns_domain_name>



Network Settings

Overview | Hostname/DNS | Routing

Hostname: cishana01

Set Hostname via DHCP: no

Modify DNS Configuration: Use Default Policy

Custom Policy Rule

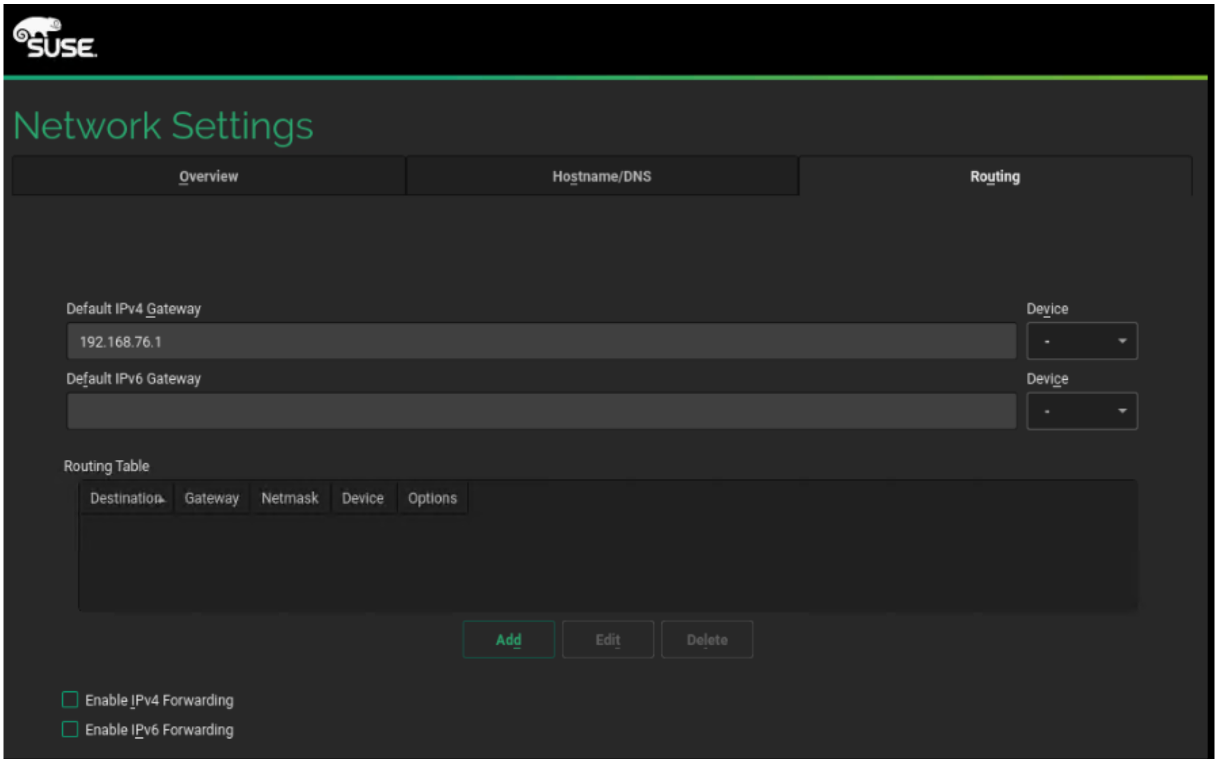
Name Servers and Domain Search List

Name Server 1: 192.168.76.13

Domain Search: flashstack.local

21. Select the Routing tab.

22. Enter the default IPv4 Gateway IP address: <var_os_default_IPv4_gateway> and change the device field to -



Network Settings

Default IPv4 Gateway: 192.168.76.1

Device: -

Default IPv6 Gateway:

Device: -

Routing Table

Destination	Gateway	Netmask	Device	Options

□ Enable IPv4 Forwarding

□ Enable IPv6 Forwarding

23. Select Next and continue with the SUSE Linux Enterprise installation workflow.

24. When the Add-On Product dialog appears select to install an additional Add-On Product.

25. In the UCS KVM click the virtual media button to UnMap the current ISO image and map the SLE-15-SP1-Packages-x86_64-GM-DVD1.ISO image instead.

26. Select DVD in the Add-On Product dialog and click Next.

27. Choose the Cisco vKCM-Mapped vDVD drive and click Continue.

28. Adapt the module and extension selection to your needs. Recommended modules are:

    - Basesystem-Module 15.1-0
    - Desktop-Applications-Module 15.1-0
    - Legacy-Module 15.1-0
    - SAP-Applications-Module 15.1-0
    - SLE-15-SP1-SAP 15.1-0 (Installation medium packages)
    - SLEHA15SP1 15.1-0 (SUSE Linux Enterprise High Availability Extension)
    - Server-Applications-Module 15.1-0

29. Continue with the SUSE Linux Enterprise installation workflow.

30. On the Suggested Partitioning dialog select Expert Partitioner and start with the current proposal.

31. Under Hostname > Volume Management delete all volumes

32. Under Hostname > Hard Disks search for the 112G boot LUN.

33. Under Partition Table select Create new partition table.

34. Select GPT as new Partition Table Type and click Next.

35. Change to the Partitions tab and click Add Partition.

36. Select 0.5 GiB as new partition custom size and click Next.

37. Select the Role EFI Boot Partition and click Next.

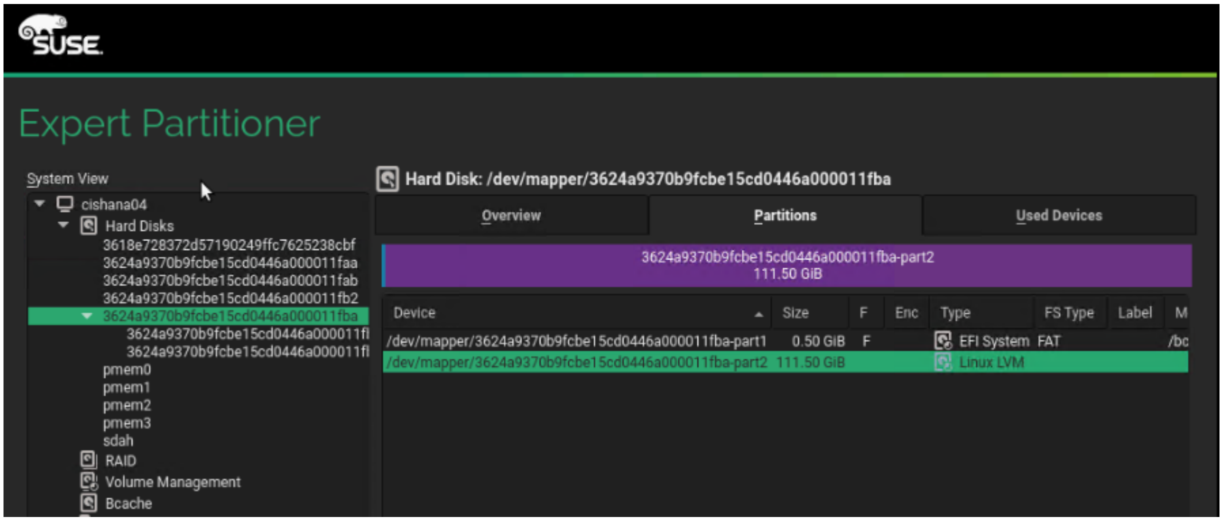
38. Format the device file system in format type FAT and mount the device at mount point /boot/efi. Click Next.

39. Create another partition and click Add Partition.

40. Select maximum size (111.49 GiB) and click Next.

41. Select the role Raw Volume (unformatted) and click Next.

42. Do not format the device. Keep partition ID Linux LVM and click Next.


SUSE
System View
cishana04
Hard Disks
3618e728372d57190249ffc7625238cbf
3624a9370b9fcbe15cd0446a000011faa
3624a9370b9fcbe15cd0446a000011fab
3624a9370b9fcbe15cd0446a000011fb2
3624a9370b9fcbe15cd0446a000011fba
3624a9370b9fcbe15cd0446a000011fl
3624a9370b9fcbe15cd0446a000011fl
pmem0
pmem1
pmem2
pmem3
sdah
RAID
Volume Management
Bcache
Overview
Partitions
Used Devices
3624a9370b9fcbe15cd0446a000011fba-part2
111.50 GiB

Expert Partitioner

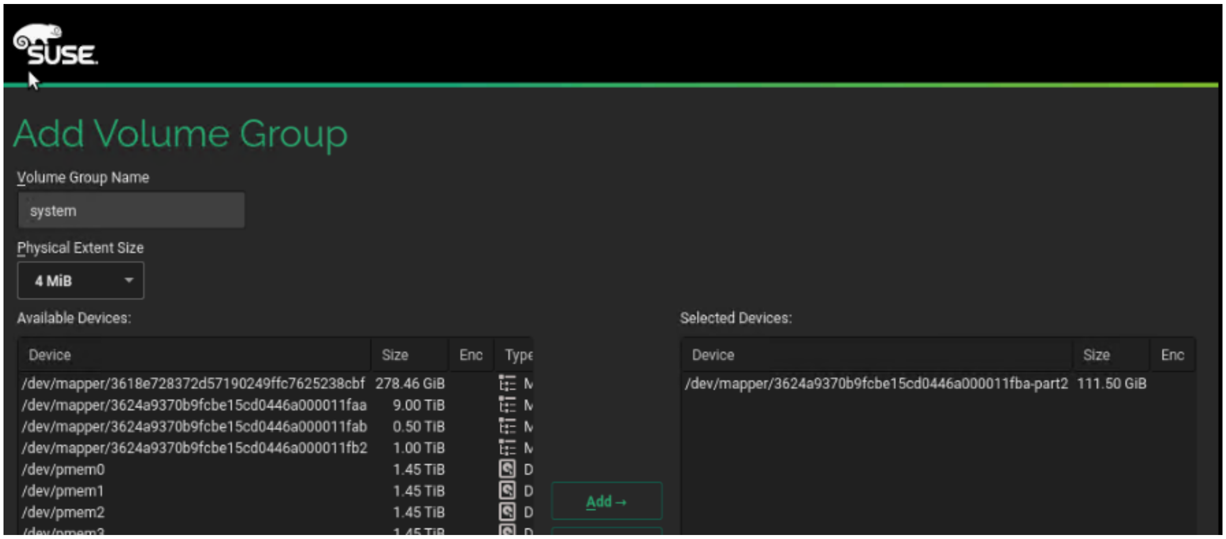
Hard Disk: /dev/mapper/3624a9370b9fcbe15cd0446a000011fba

Device	Size	F	Enc	Type	FS Type	Label	M
/dev/mapper/3624a9370b9fcbe15cd0446a000011fba-part1	0.50 GiB	F		EFI System	FAT		/bc
/dev/mapper/3624a9370b9fcbe15cd0446a000011fba-part2	111.50 GiB			Linux LVM			

43. Change to Hostname > Volume Management.

44. Add a volume group.

45. Provide the volume group name system. Click Add and then click Next.



Add Volume Group

Volume Group Name: system

Physical Extent Size: 4 MiB

Available Devices:

Device	Size	Enc	Type
/dev/mapper/3618e728372d57190249ffc7625238cbf	278.46 GiB		M
/dev/mapper/3624a9370b9fcbe15cd0446a000011faa	9.00 TiB		M
/dev/mapper/3624a9370b9fcbe15cd0446a000011fab	0.50 TiB		M
/dev/mapper/3624a9370b9fcbe15cd0446a000011fb2	1.00 TiB		M
/dev/pmem0	1.45 TiB		D
/dev/pmem1	1.45 TiB		D
/dev/pmem2	1.45 TiB		D
/dev/pmem3	1.45 TiB		D

Selected Devices:

Device	Size	Enc
/dev/mapper/3624a9370b9fcbe15cd0446a000011fba-part2	111.50 GiB	

46. Select the system volume group and click Add Logical Volume.

47. Provide the logical volume name swap and keep the normal type selected. Click Next.

48. Select 2 GiB as new logical volume custom size and click Next.

49. Select the swap role and click Next.

50. Select swap for format device filesystem and select the mount point swap. Click Next.

51. Select the system volume group again and click Add Logical Volume.

52. Provide the logical volume name root and keep the normal type selected. Click Next.

53. Select custom size (60 GiB) as new logical volume custom size and click Next.

54. Select the Operating System role and click Next.

55. Select BtrFS for format device filesystem and select the root mount point /. Click Next.

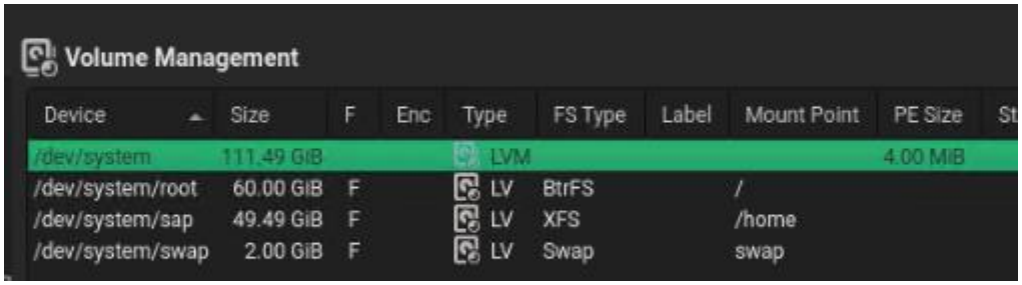
56. Select the system volume group again and click Add Logical Volume.

57. Provide the logical volume name sap and keep the normal type selected. Click Next.

58. Select maximum size (49.48 GiB) as new logical volume custom size and click Next.

59. Select Data and ISV Applications and click Next.

60. Keep the XFS filesystem and mount as /home. Click Next.



Volume Management

Device	Size	F	Enc	Type	FS Type	Label	Mount Point	PE Size	St
/dev/system	111.49 GiB			LVM				4.00 MiB	
/dev/system/root	60.00 GiB	F		LV	BtrFS		/		
/dev/system/sap	49.49 GiB	F		LV	XFS		/home		
/dev/system/swap	2.00 GiB	F		LV	Swap		swap		

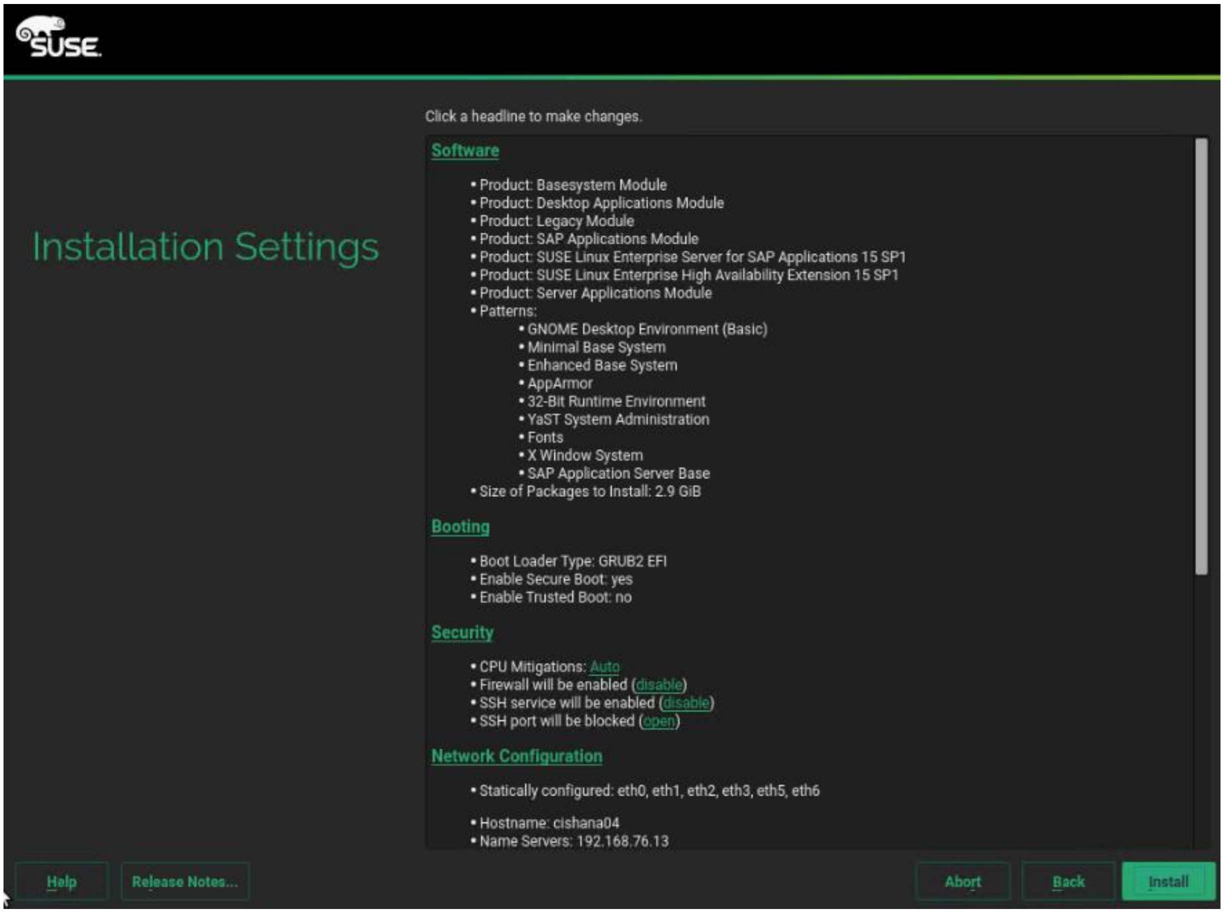
61. Accept the changes and leave the expert partitioner.

62. Click Next to accept the suggested partitioning.

63. Continue with the SUSE Linux Enterprise installation workflow.

64. Provide the system administrator root password <var_os_root_pw> and click Next.

65. Several customization steps are recommended from the Installation Settings screen.



Installation Settings

Click a headline to make changes.

Software

- Product: Basesystem Module
- Product: Desktop Applications Module
- Product: Legacy Module
- Product: SAP Applications Module
- Product: SUSE Linux Enterprise Server for SAP Applications 15 SP1
- Product: SUSE Linux Enterprise High Availability Extension 15 SP1
- Product: Server Applications Module
- Patterns:
  - GNOME Desktop Environment (Basic)
  - Minimal Base System
  - Enhanced Base System
  - AppArmor
  - 32-Bit Runtime Environment
  - YaST System Administration
  - Fonts
  - X Window System
  - SAP Application Server Base
- Size of Packages to Install: 2.9 GiB

Booting

- Boot Loader Type: GRUB2 EFI
- Enable Secure Boot: yes
- Enable Trusted Boot: no

Security

- CPU Mitigations: Auto
- Firewall will be enabled (disable)
- SSH service will be enabled (disable)
- SSH port will be blocked (open)

Network Configuration

- Statically configured: eth0, eth1, eth2, eth3, eth5, eth6

- Hostname: cishana04
- Name Servers: 192.168.76.13

66. Click Software to apply the following changes:

   - Deselect GNOME Desktop Environment

  - Select Fonts
  - Select X Window System.
  - Select SAP HANA Server Base.
  - Deselect primary function SAP Application Sever Base.
  - (Optional) Select primary function high availability

67. Under Security > Firewall will be enabled click Disable.

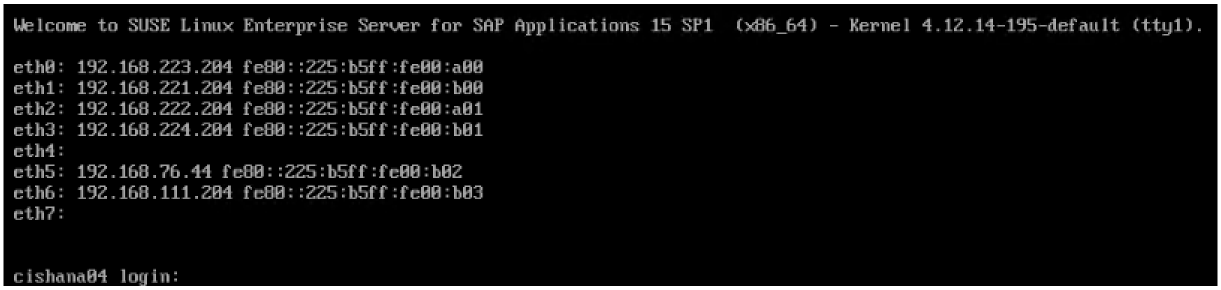
68. Click Kdump to disable kdump.

69. Set Default system target to text mode.

70. Click Install and follow the SUSE Linux Enterprise installation workflow.

71. Change the ISO image mapping in KVM on installation workflow request.

The server will reboot automatically to finish the installation.



```
Welcome to SUSE Linux Enterprise Server for SAP Applications 15 SP1  (x86_64) - Kernel 4.12.14-195-default (tty1).

eth0: 192.168.223.204 fe80::225:b5ff:fe00:a00
eth1: 192.168.221.204 fe80::225:b5ff:fe00:b00
eth2: 192.168.222.204 fe80::225:b5ff:fe00:a01
eth3: 192.168.224.204 fe80::225:b5ff:fe00:b01
eth4:
eth5: 192.168.76.44 fe80::225:b5ff:fe00:b02
eth6: 192.168.111.204 fe80::225:b5ff:fe00:b03
eth7:


cishana04 login:
```

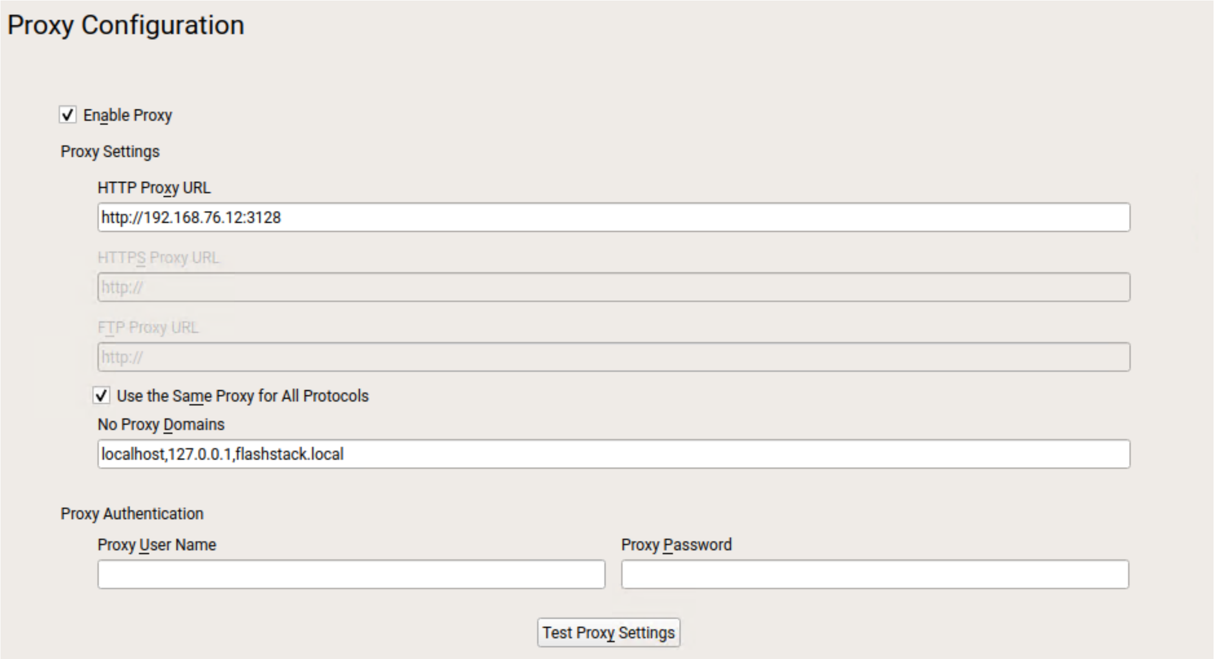
SLES for SAP 15 Post Installation

Apply the post installation steps to prepare the operating system for SAP HANA workload and connect to the SSH server terminal.

Proxy Configuration

Enter and test your proxy configuration:

```
    # yast proxy
```



Proxy Configuration

☑ Enable Proxy

Proxy Settings

HTTP Proxy URL: http://192.168.76.12:3128

HTTPS Proxy URL: http://

FTP Proxy URL: http://

☑ Use the Same Proxy for All Protocols

No Proxy Domains: localhost,127.0.0.1,flashstack.local

Proxy Authentication

Proxy User Name:

Proxy Password:

Replace File System Mount Point

1. Create a new mount point /usr/sap:

```
# mkdir -p /usr/sap
# umount /home
```

2. Replace the mount point /home with /usr/sap in /etc/fstab and re-mount:

```
# vi /etc/fstab
/dev/system/sap   /usr/sap/     xfs    defaults      0  0
# mount -a
```

Enable System Monitoring

1. Enable system utilization monitoring:

```
# systemctl enable sysstat
# systemctl start sysstat
```

2. (Optional) Install rsyslog to bring the /var/log/messages file back:

```
# zypper in rsyslog
# systemctl enable rsyslog
# systemctl start rsyslog
```

Additional Software Packages

1. (Optional) Install IPv4 and IPv6 Networking Utilities:

```
# zypper in iputils
```

2. Install the NFS client software if required. Mandatory for SAP HANA Scale Out deployments:

```
# zypper in nfs-utils
```

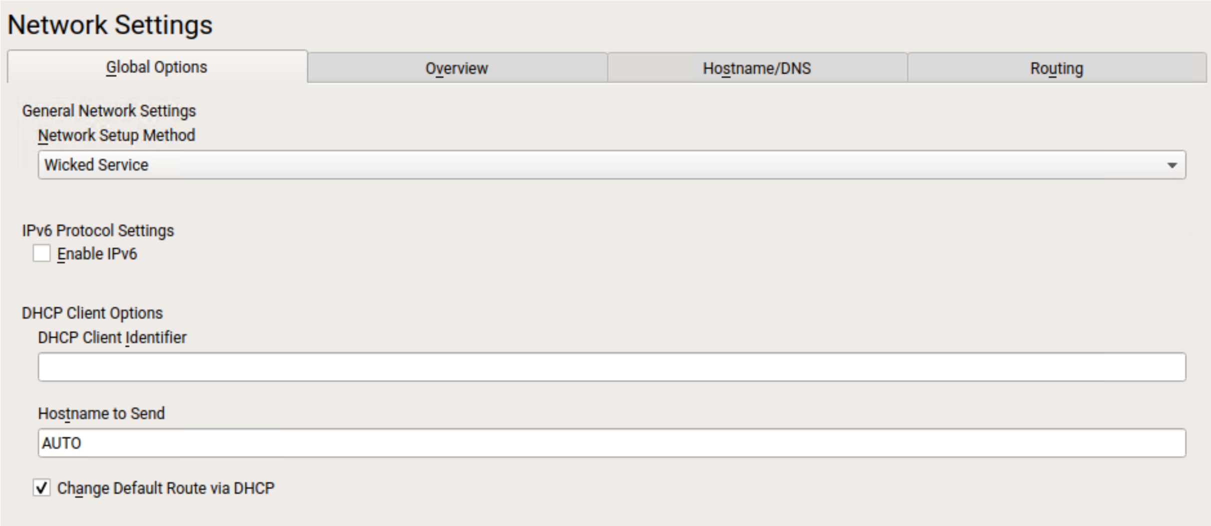
3. Install the supportutils and the latest supportconfig:

```
# zypper in supportutils
```

Network Configuration

Complete the network interface configuration. If not used, disable IPv6 in the global options tab.

```
# yast lan
```



Network Settings

General Network Settings

Network Setup Method: Wicked Service

IPv6 Protocol Settings

☐ Enable IPv6

DHCP Client Options

DHCP Client Identifier:

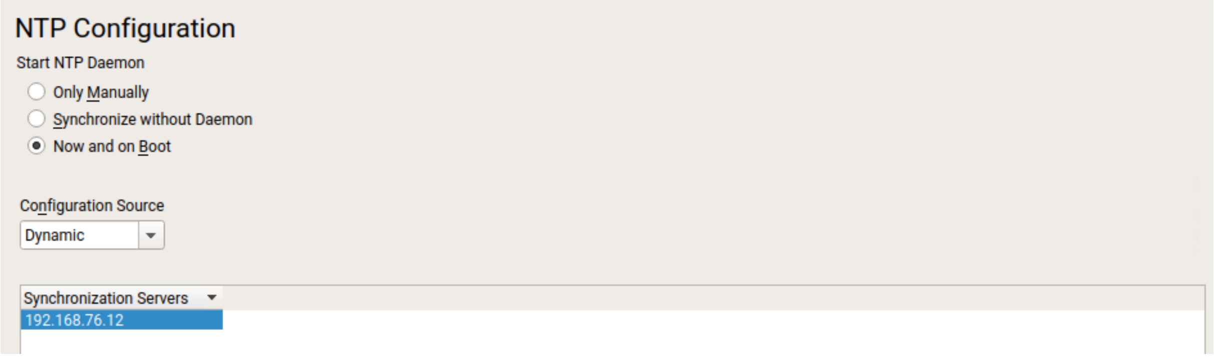
Hostname to Send: AUTO

☑ Change Default Route via DHCP

Network Time Configuration

1. Enable NTP and provide one or multiple synchronization server:

```
# yast ntp-client
```



NTP Configuration

Start NTP Daemon

○ Only Manually

○ Synchronize without Daemon

● Now and on Boot

Configuration Source: Dynamic

Synchronization Servers

192.168.76.12

2. Configure the domain name and start the idmap daemon for NFSv4 file system mapping:

```
# vi /etc/idmapd.conf
[General]
Verbosity = 0
Pipefs-Directory = /var/lib/nfs/rpc_pipe
Domain = flashstack.local
```

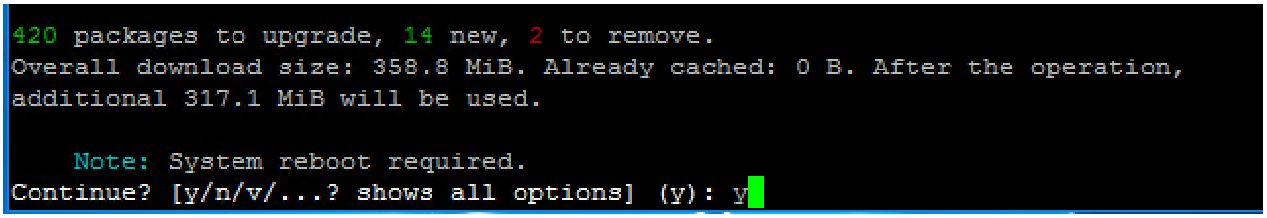
```
[Mapping]
Nobody-User = nobody
Nobody-Group = nobody

# systemctl start nfs-idmapd
```

3. Register the product and follow the workflow. Click select extension and review the extension selection still fits to the selection in step 29 of the OS installation. Select missing extensions and click Next.

```
# yast register
```

4. From the command line apply the current software patches:

```
# zypper update
```



```
420 packages to upgrade, 14 new, 2 to remove.
Overall download size: 358.8 MiB. Already cached: 0 B. After the operation,
additional 317.1 MiB will be used.

    Note: System reboot required.
Continue? [y/n/v/...? shows all options] (y): y
```

5. Reboot the system.

Disable OS-based Memory Error Monitoring

Linux supports two features related to error monitoring and logging. EDAC (Error Detection and Correction) and mcelog. Both are common in most recent Linux distributions. Cisco recommends disabling EDAC-based error collection, to allow all error reporting to be handled in firmware.

EDAC can be disabled by adding the option “edac_report=off” to the kernel command line. Mcelog is enabled by default in most recent Linux distributions.

For customers who prefer to collect all diagnostic and fault information from OS resident tools mcelog is recommended. In this case Cisco recommends disabling CMCI to prevent performance impact. Firmware logs may be incomplete when OS logging is enabled.

Update Cisco fnic/enic Drivers

Based on the serer type/model, processor version, OS release and version information download the firmware bundle corresponding to the UCS Server firmware installed from the Cisco UCS Hardware and Software Compatibility site.

To update the Cisco fnic/enic drivers, follow these steps:

1. Extract the rpm files of the fnic and enic driver from the driver bundle and copy them to the server.

2. Verify the current driver:

```
# cat /sys/module/enic/version
  2.3.0.53
# cat /sys/module/fnic/version
  1.6.0.34
```

3. RPM install the drivers:

```
rpm -ivh cisco-enic-usnic-kmp-default-4.0.0.8_k4.12.14_195-802.24.x86_64.rpm
rpm -ivh cisco-fnic-kmp-default-2.0.0.60-141.0.x86_64.rpm
```

4. Reboot the server:

5. Verify the driver installation after the reboot:

```
# cat /sys/module/enic/version
  4.0.0.8-802.24
# cat /sys/module/fnic/version
  2.0.0.60-141.0
```

Pure Storage UDEV Rule Configuration

Configure the kernel device manager. The most important parameters to be changed are nr_requests and scheduler. Create a rule set for the Pure Storage FlashArray//X:

```
# vi /etc/udev/rules.d/99-pure-storage.rules
# Recommended settings for Pure Storage FlashArray.
# Use none scheduler for high-performance solid-state storage
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 HANA devices to be 512kB rather than 4MB max size
ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block",
ENV{ID_VENDOR}=="PURE", ATTR{queue/max_sectors_kb}="512"
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block",
ENV{DM_NAME}=="3624a937*", ATTR{queue/max_sectors_kb}="512"

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

Set DM devices number of requests to 1024
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block",
ENV{DM_NAME}=="3624a937*", ATTR{queue/nr_requests}="1024"
```

DM-Multipath Configuration

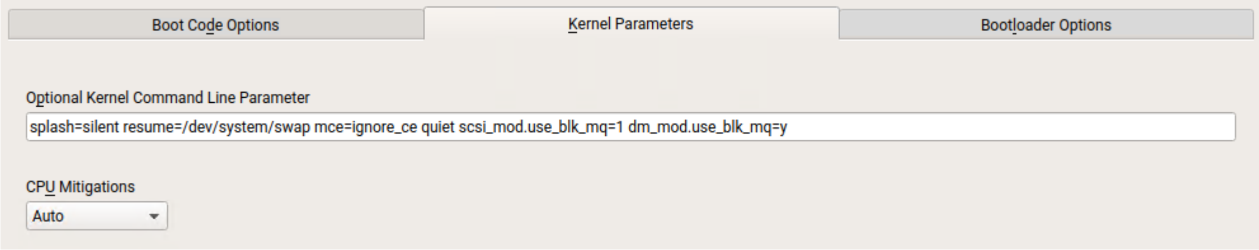
Multipathing needs to be setup to do group_by_prio to separate traffic into ALUA priority groups for all PURE LUNs. Create a /etc/multipath.conf configuration file:

```
# vi /etc/multipath.conf
defaults {
         polling_interval   10
}
blacklist {
         devnode "^(pmem)[0-9]*"
}
devices {
  device {
         vendor                   "PURE"
         product                  "FlashArray"
         path_grouping_policy     group_by_prio
         path_selector            "queue-length 0"
         path_checker             "tur"
         features                 "0"
         hardware_handler         "1 alua"
         prio                     "const"
         failback                 "immediate"
         fast_io_fail_tmo         10
         dev_loss_tmo             60
        }
}
```

Setting the Disk Scheduler

The recommended IO scheduler starting with RHEL 8.1 is “none” instead of “noop”.

```
# yast bootloader and add the kernel parameters “scsi_mod.use_blk_mq=1
dm_mod.use_blk_mq=y”
```



Optional Kernel Command Line Parameter

splash=silent resume=/dev/system/swap mce=ignore_ce quiet scsi_mod.use_blk_mq=1 dm_mod.use_blk_mq=y

CPU Mitigations

Auto

```
# grub2-mkconfig -o /boot/efi/EFI/sles/grub.cfg
# reboot
```

Verify the scheduler is set to none:

```
# cat /sys/block/sda/queue/scheduler
  [none] mq-deadline kyber bfq
```

System Tuning for SAP

List all available solutions to tune the SAP system and apply the one that is appropriate:

```
# saptune solution list
All solutions (* denotes enabled solution, O denotes override file exists for
solution, D denotes deprecated solutions):
    BOBJ                 - 941735 1771258 2578899 SAP_BOBJ
    HANA                 - 941735 1771258 1980196 2578899 2684254 2382421 2534844
 D  MAXDB                - 941735 1771258 2578899
    NETWEAVER            - 941735 1771258 2578899
    NETWEAVER+HANA       - 941735 1771258 1980196 2578899 2684254 2382421 2534844
    S4HANA-APP+DB        - 941735 1771258 1980196 2578899 2684254 2382421 2534844
    S4HANA-APPSERVER     - 941735 1771258 2578899
    S4HANA-DBSERVER      - 941735 1771258 1980196 2578899 2684254 2382421 2534844
    SAP-ASE              - 941735 1410736 1680803 1771258 2578899
```

Simulate the solution to apply and verify the output regarding any errors:

```
# saptune solution simulate HANA
```

Apply the solution and reboot the server:

```
# saptune solution apply HANA
# saptune daemon start
# reboot
```

Network Interface Configuration

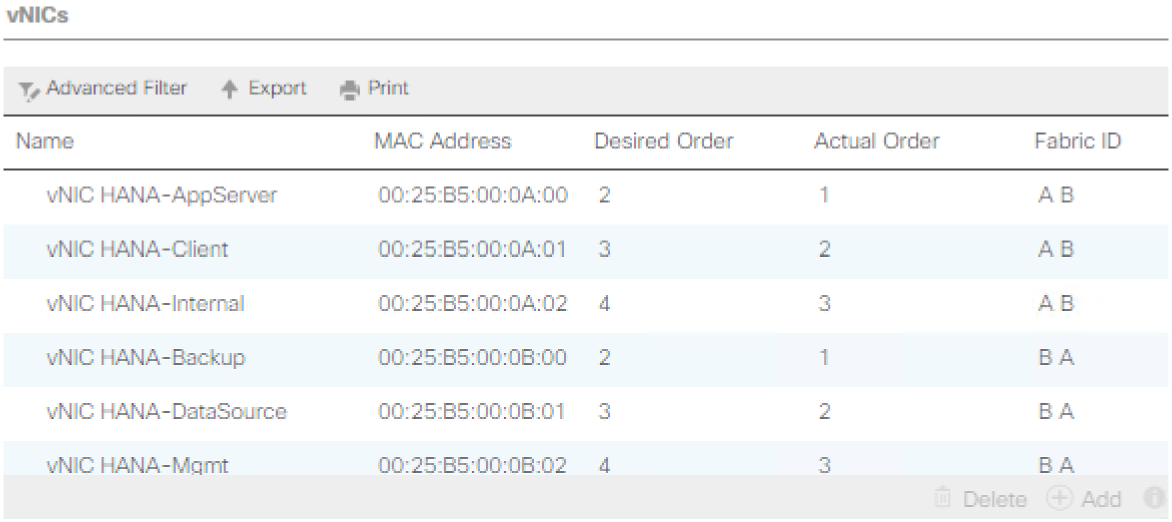
To complete the network interface configuration, follow these steps:

1. Identify the Ethernet device to vNIC interface mapping first from the Cisco UCS Manager:

   a. In the Navigation pane of UCSM, click Servers

   b. Select Service Profile > root > Sub-Organizations > HANA > HANA-Server01

   c. In the network tab, scroll down to the vNIC section and list the vNICs with their MAC addresses



Name	MAC Address	Desired Order	Actual Order	Fabric ID
vNIC HANA-AppServer	00:25:B5:00:0A:00	2	1	A B
vNIC HANA-Client	00:25:B5:00:0A:01	3	2	A B
vNIC HANA-Internal	00:25:B5:00:0A:02	4	3	A B
vNIC HANA-Backup	00:25:B5:00:0B:00	2	1	B A
vNIC HANA-DataSource	00:25:B5:00:0B:01	3	2	B A
vNIC HANA-Mgmt	00:25:B5:00:0B:02	4	3	B A

2. Configure the network interfaces:

```
# yast lan
```

3. In the SUSE network settings screen, find the network interface with the same MAC address and click edit to provide the appropriate IP address matching to the correct VLAN and provide a fully qualified hostname.

4. Verify all interfaces come up successfully:

```
# ip link show | egrep 'state|eth[:digit]' | tail -n +2
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc mq state UP mode
DEFAULT group default qlen 1000
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc mq state UP mode
DEFAULT group default qlen 1000
4: eth2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc mq state UP mode
DEFAULT group default qlen 1000
5: eth3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc mq state UP mode
DEFAULT group default qlen 1000
6: eth4: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc mq state UP mode
DEFAULT group default qlen 1000
7: eth5: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP mode
DEFAULT group default qlen 1000
```

SAP HANA Persistent Storage Configuration

To verify the multipath devices are listed, follow these steps. Eventually you will be required to rescan the bus.

1. (optional) # rescan-scsi-bus.sh:

```
# multipath -ll
3624a9370b9fcbe15cd0446a000011fa5 dm-3 PURE,FlashArray
size=512G features='0' hwhandler='1 alua' wp=rw
`-+- policy='round-robin 0' prio=50 status=active
  |- 7:0:0:3 sdd 8:48   active ready running
  |- 8:0:0:3 sdp 8:240  active ready running
  |- 7:0:1:3 sdg 8:96   active ready running
  |- 8:0:1:3 sds 65:32  active ready running
  |- 7:0:2:3 sdj 8:144  active ready running
  |- 8:0:2:3 sdv 65:80  active ready running
  |- 7:0:3:3 sdm 8:192  active ready running
  `- 8:0:3:3 sdy 65:128 active ready running
3624a9370b9fcbe15cd0446a000011fa4 dm-2 PURE,FlashArray
size=1.5T features='0' hwhandler='1 alua' wp=rw
`-+- policy='round-robin 0' prio=50 status=active
  |- 7:0:0:2 sdc 8:32   active ready running
  |- 8:0:0:2 sdo 8:224  active ready running
  |- 7:0:1:2 sdf 8:80   active ready running
  |- 8:0:1:2 sdr 65:16  active ready running
  |- 7:0:2:2 sdi 8:128  active ready running
  |- 8:0:2:2 sdu 65:64  active ready running
  |- 7:0:3:2 sdl 8:176  active ready running
  `- 8:0:3:2 sdx 65:112 active ready running
```

2. Construct and an XFS file system on both multipath devices:

```
# mkfs.xfs -f /dev/mapper/3624a9370b9fcbe15cd0446a000011fa5
# mkfs.xfs -f /dev/mapper/3624a9370b9fcbe15cd0446a000011fa4
```

If applicable, construct an XFS file system on the local HANA shared volume.

3. Create directories for the SAP HANA data, log, and shared file systems:

```
# mkdir -p /hana/data
# mkdir -p /hana/log
# mkdir -p /hana/shared
```

4. Persist all mount points and add them to the /etc/fstab file. Mount the volumes afterwards:

```
# cat /etc/fstab
…
/dev/mapper/3624a9370b9fcbe15cd0446a000011fa5 /hana/log    xfs
nobarrier,noatime,nodiratime,logbufs=8,logbsize=256k,async,swalloc,allocsize=72k
/dev/mapper/3624a9370b9fcbe15cd0446a000011fa4 /hana/data   xfs
nobarrier,noatime,nodiratime,logbufs=8,logbsize=256k,async,swalloc,allocsize=72k
192.168.111.26:/hanashared                    /hana/shared nfs     defaults 0 0
# mount -a
```

5. Verify the information in /etc/hosts is correct:

```
# cat /etc/hosts
127.0.0.1       localhost

# special IPv6 addresses
::1     localhost ipv6-localhost ipv6-loopback
fe00::0 ipv6-localnet
ff00::0 ipv6-mcastprefix
ff02::1 ipv6-allnodes
ff02::2 ipv6-allrouters
ff02::3 ipv6-allhosts

# AppServer network
192.168.223.200 cishana01a.flashstack.local cishana01a
# Backup network
192.168.221.200 cishana01b.flashstack.local cishana01b
# Client network
192.168.222.200 cishana01c.flashstack.local cishana01c
# DataSource network
192.168.224.200 cishana01d.flashstack.local cishana01d
# Internal internode network
192.168.220.200 cishana01i.flashstack.local cishana01i
# Management network
192.168.76.41   cishana01.flashstack.local cishana01
# NFS HANA shared network
192.168.111.200 cishana01s.flashstack.local cishana01s
# Replication Network
192.168.225.200 cishana01r.flashstack.local cishana01r
```

Persistent Memory Configuration

Configure and manage Intel Optane DC PMM from the command line with the ipmctl and ndctl utilities. The tools are not installed by default but required to manage the libnvdimm (non-volatile memory device) sub-system in the Linux kernel.

To open an SSH prompt as root to install the host tools, follow these steps:

1. Install the ipmctl host utility:

```
# zypper in ipmctl
```

2. Install the ndctl utility:

```
# zypper in ndctl
```

3. Verify the persistent memory modules have been discovered and the software can communicate with them:

```
# ipmctl show -dimm
DimmID | Capacity  | HealthState | ActionRequired | LockState | FWVersion
==============================================================================
 0x0011 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x0021 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x0001 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x0111 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x0121 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x0101 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x1011 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x1021 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x1001 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x1111 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x1121 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x1101 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x2011 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x2021 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x2001 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x2111 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x2121 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x2101 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x3011 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x3021 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x3001 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x3111 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x3121 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
 0x3101 | 252.4 GiB | Healthy     | 0              | Disabled  | 01.02.00.5435
```

4. Add a UDEV rule:

```
# vi /etc/udev/rules.d/60-persistent-storage.rules
# PMEM devices
KERNEL=="pmem*", ENV{DEVTYPE}=="disk", ATTRS{uuid}=="?*", SYMLINK+="disk/by-
id/pmem-$attr{uuid}"
```

5. Create the goal:

```
# ipmctl create -goal MemoryMode=0 PersistentMemoryType=AppDirect Reserved=0
The following configuration will be applied:
 SocketID | DimmID | MemorySize | AppDirect1Size | AppDirect2Size
==================================================================
 0x0000   | 0x0011 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0000   | 0x0021 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0000   | 0x0001 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0000   | 0x0111 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0000   | 0x0121 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0000   | 0x0101 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0001   | 0x1011 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0001   | 0x1021 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0001   | 0x1001 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0001   | 0x1111 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0001   | 0x1121 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0001   | 0x1101 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0002   | 0x2011 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0002   | 0x2021 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0002   | 0x2001 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0002   | 0x2111 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0002   | 0x2121 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0002   | 0x2101 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0003   | 0x3011 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0003   | 0x3021 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0003   | 0x3001 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0003   | 0x3111 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0003   | 0x3121 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
 0x0003   | 0x3101 | 0.0 GiB    | 252.0 GiB      | 0.0 GiB
Do you want to continue? [y/n]
```

6. Confirm with Y and reboot the server to apply the new memory allocations.

7. Verify regions have been created:

```
# ipmctl show -region
SocketID | ISetID         | Persistent | Capacity   | FreeCapacity | HealthState
         |                | MemoryType |            |              |
=================================================================================
 0x0000   | 0xd7d..9c2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
 0x0001   | 0xfba..9b2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
 0x0002   | 0xc67..af2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
 0x0003   | 0x685..9f2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
```

8. Create a name space for each region; on a 4-socket server invoke the command four times:

```
# ndctl create-namespace
```

9. Verify the namespace has been created successfully:

```
# ndctl list
[
  {
    "dev":"namespace1.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"81257c85-4410-4def-8dba-3c120943c6b7",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem1"
  },
  {
    "dev":"namespace3.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"197dc10f-cd0d-4a84-bba3-f104df3e70be",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem3"
  },
  {
    "dev":"namespace0.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"23526924-74bf-4bab-8fd9-27be6190ce56",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem0"
  },
  {
    "dev":"namespace2.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"5847f6d4-4a3d-447c-b299-7d0e38c1dcdd",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem2"
  }
]
```

10. Construct an XFS file system on the block devices:

```
# for i in {0..3}; do mkfs.xfs -f -d su=2m,sw=1 -m reflink=0 /dev/pmem$i; done
```

11. Create directories and mount the block devices using the DAX file system option:

```
# for i in {0..3}; do mkdir -p /hana/pmem/nvmem$i; done
# for i in {0..3}; do mount -t xfs -o dax,lazytime /dev/pmem0 /hana/pmem/nvmem$i;
done
```

12. Change the permission of the mount points:

```
# chmod 755 /hana/pmem/nvmem*
# chown <SID>adm:sapsys /hana/pmem/nvmem*
```

13. Add the mount points to /etc/fstab to persist them:

```
# vi /etc/fstab
/dev/pmem0 /hana/pmem/nvmem0 xfs dax,lazytime 1 2
/dev/pmem1 /hana/pmem/nvmem1 xfs dax,lazytime 1 2
/dev/pmem2 /hana/pmem/nvmem2 xfs dax,lazytime 1 2
/dev/pmem3 /hana/pmem/nvmem3 xfs dax,lazytime 1 2
```

The device names chosen by the kernel are subject to creation order and discovery. For static configuration they usually don’t change, alternatively consider using persistent naming instead to mount the pmem namespace.

```
# ls -l /dev/disk/by-id/pmem*
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-39afa860-5b33-4956-
a1ec-1c176cf34608 -> ../../pmem2
```

```
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-76c312d8-86e0-4f3d-
b630-b816f95f4ff8 -> ../../pmem1
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-af000a5b-14ac-4f49-
a919-c89bc462944d -> ../../pmem3
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-df203ae8-13ef-4b65-
bd2e-c7f959794993a -> ../../pmem0
```

The persistent name for a pmem namespace in /etc/fstab will look like the following:

```
/dev/disk/by-id/pmem-df203ae8-13ef-4b65-bd2e-c7f95979493a /hana/pmem/nvmem0 xfs
dax,lazytime 1 2
```

RHEL 8 for SAP Solutions

Red Hat Enterprise Linux 8 (RHEL) for SAP Solutions is the reference platform for the software deployment of SAP. It is optimized for SAP applications like SAP HANA. Install the operating system as described in the standard RHEL installation guide. This section lists where the lab installation deviates from the installation workflow.

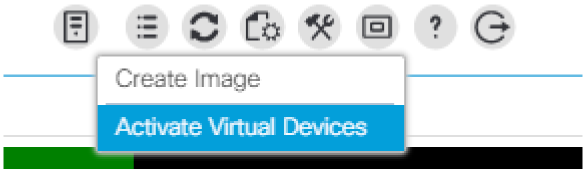
The following supplement RHEL information is available from the SAP notes system:

- SAP Note 2526952 - Red Hat Enterprise Linux for SAP Solutions
- SAP Note 2772999 - Red Hat Enterprise Linux 8.x: Installation and Configuration
- SAP Note 2777782 - SAP HANA DB: Recommended OS Settings for RHEL 8

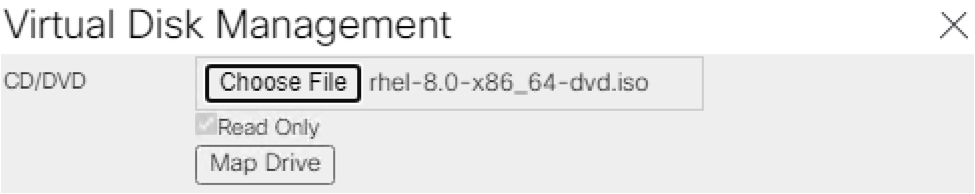
RHEL for SAP Solutions Installation

Download the standard RHEL ISO image from https://access.redhat.com/downloads and map the installation ISO image in the KVM console:

1. In the Navigation pane of the Cisco UCS Manager, click Servers.
2. Select Service Profile > root > Sub-Organization > HANA > HANA-Server04.
3. In the Actions section click KVM Console.
4. Choose Virtual Media > Activate Virtual Devices.



5. For Unencrypted Virtual Media Session, select Accept this Session and then click Apply.
6. Click Virtual Media and choose Map CD/DVD.
7. Click Browse to navigate to the ISO media location. Select rhel-8.0-x86_64.ISO. Click Open.
8. Click Map Device.



Virtual Disk Management

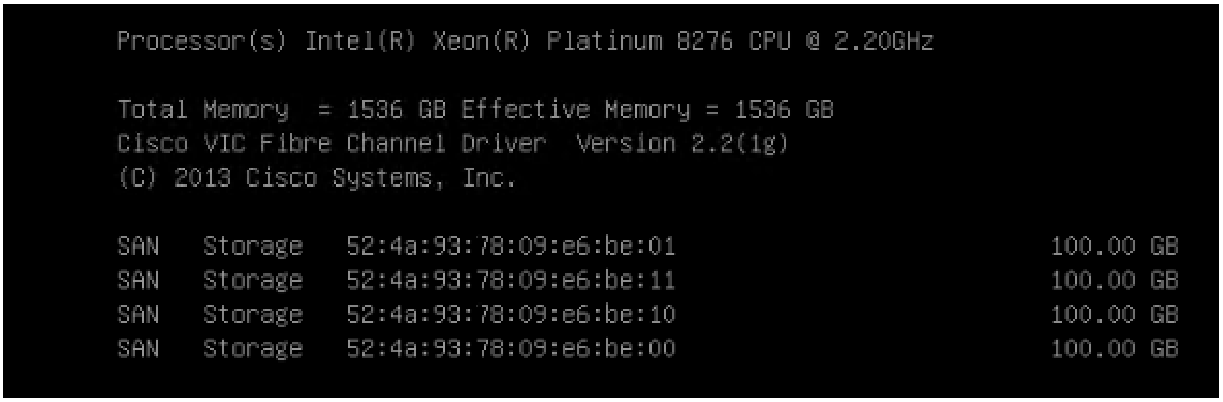
CD/DVD: Choose File rhel-8.0-x86_64-dvd.iso

☑ Read Only

Map Drive

9. In the KVM Console menu, click Boot Server.

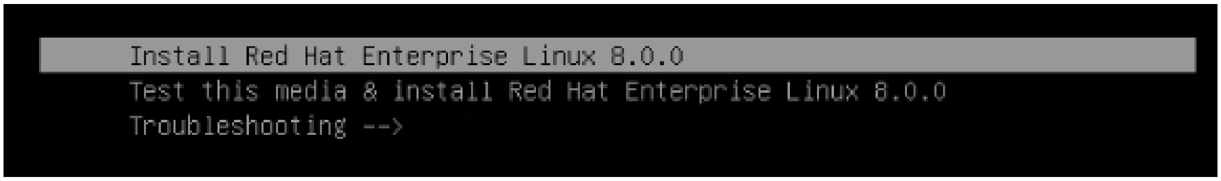
10. During the VIC FC boot driver verification at the server boot time the Pure Storage FlashArray//X target WWPN numbers are listed during the connection verification.



```
Processor(s) Intel(R) Xeon(R) Platinum 8276 CPU @ 2.20GHz

Total Memory  = 1536 GB Effective Memory = 1536 GB
Cisco VIC Fibre Channel Driver  Version 2.2(1g)
(C) 2013 Cisco Systems, Inc.

SAN   Storage   52:4a:93:78:09:e6:be:01                        100.00 GB
SAN   Storage   52:4a:93:78:09:e6:be:11                        100.00 GB
SAN   Storage   52:4a:93:78:09:e6:be:10                        100.00 GB
SAN   Storage   52:4a:93:78:09:e6:be:00                        100.00 GB
```

The system will automatically boot from the ISO image into the installation wizard.

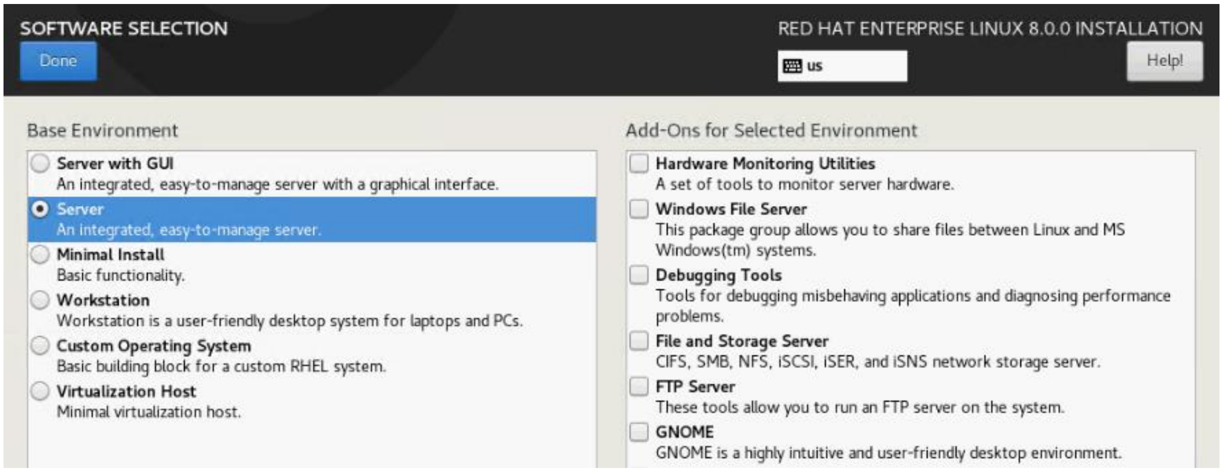
11. Select Install Red Hat Enterprise Linux 8.0.0 to start the interactive installation process using the server base installation option.



```
Install Red Hat Enterprise Linux 8.0.0
Test this media & install Red Hat Enterprise Linux 8.0.0
Troubleshooting -->
```

12. The installation summary page appears. Complete all items before starting the installation.

13. Select Software Selection and use the “Server” Base Environment. No Add-Ons are required during installation. Click Done to return to the main screen.



SOFTWARE SELECTION

Done

RED HAT ENTERPRISE LINUX 8.0.0 INSTALLATION

us

Help!

Base Environment

○ **Server with GUI**
An integrated, easy-to-manage server with a graphical interface.

● **Server**
An integrated, easy-to-manage server.

○ **Minimal Install**
Basic functionality.

○ **Workstation**
Workstation is a user-friendly desktop system for laptops and PCs.

○ **Custom Operating System**
Basic building block for a custom RHEL system.

○ **Virtualization Host**
Minimal virtualization host.

Add-Ons for Selected Environment

□ **Hardware Monitoring Utilities**
A set of tools to monitor server hardware.

□ **Windows File Server**
This package group allows you to share files between Linux and MS Windows(tm) systems.

□ **Debugging Tools**
Tools for debugging misbehaving applications and diagnosing performance problems.

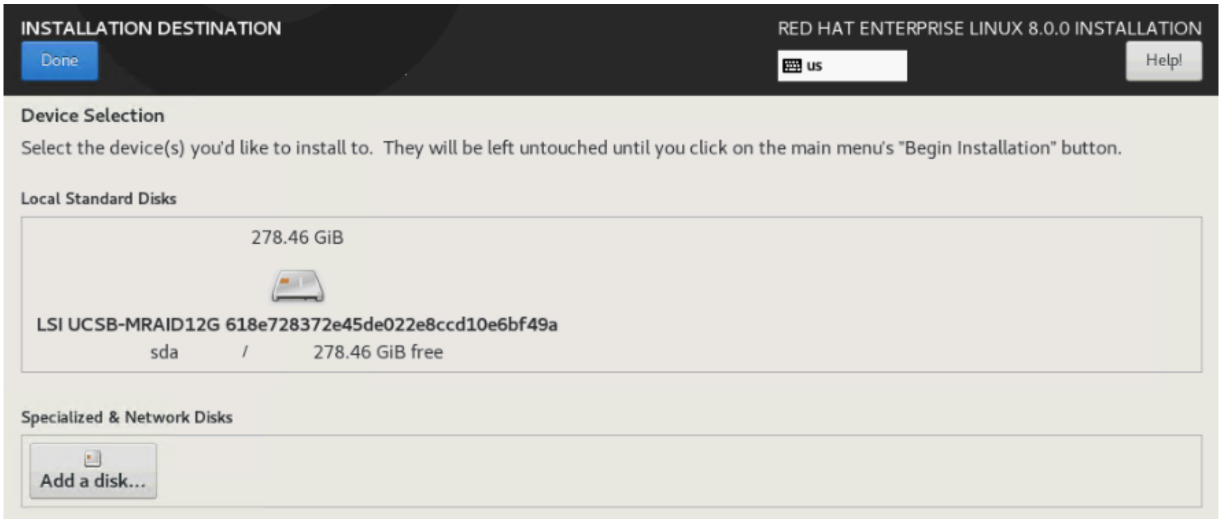
□ **File and Storage Server**
CIFS, SMB, NFS, iSCSI, iSER, and iSNS network storage server.

□ **FTP Server**
These tools allow you to run an FTP server on the system.

□ **GNOME**
GNOME is a highly intuitive and user-friendly desktop environment.

14. Select Time & Date. Select the timezone of your choice and ensure the date and time are set correct.

15. Select Installation Destination and Add a disk.



INSTALLATION DESTINATION

Done

RED HAT ENTERPRISE LINUX 8.0.0 INSTALLATION

us

Help!

Device Selection

Select the device(s) you'd like to install to. They will be left untouched until you click on the main menu's "Begin Installation" button.

Local Standard Disks

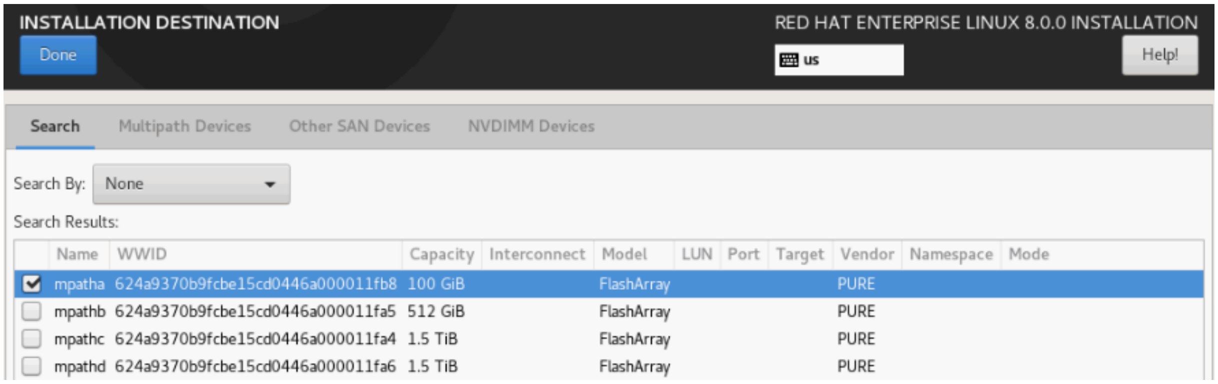
278.46 GiB

LSI UCSB-MRAID12G 618e728372e45de022e8ccd10e6bf49a
sda / 278.46 GiB free

Specialized & Network Disks

Add a disk...

16. Select the 100 GB boot LUN created before. Click Done.



INSTALLATION DESTINATION

Done

RED HAT ENTERPRISE LINUX 8.0.0 INSTALLATION

us

Help!

Search | Multipath Devices | Other SAN Devices | NVDIMM Devices

Search By: None

Search Results:

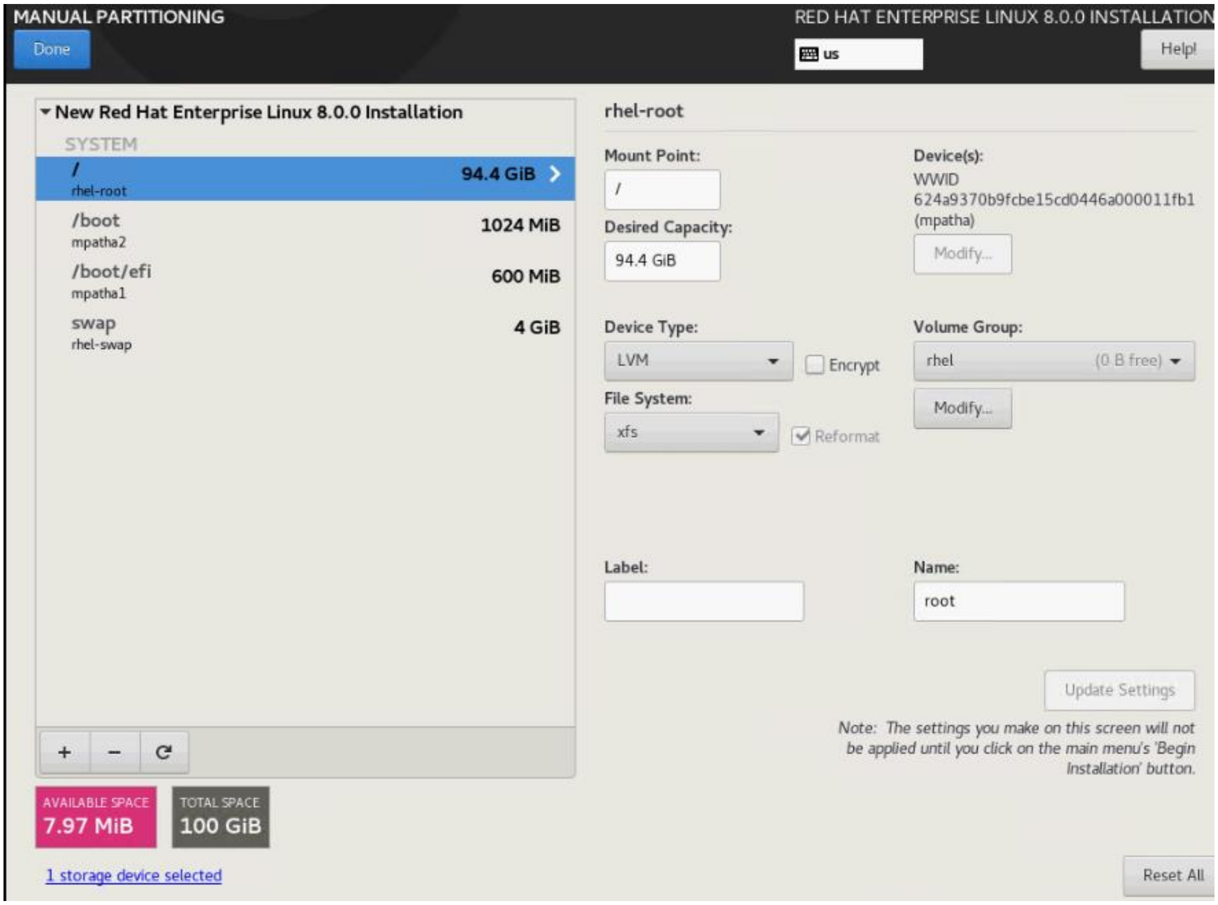
	Name	WWID	Capacity	Interconnect	Model	LUN	Port	Target	Vendor	Namespace	Mode
☑	mpatha	624a9370b9fcbe15cd0446a000011fb8	100 GiB		FlashArray				PURE		
□	mpathb	624a9370b9fcbe15cd0446a000011fa5	512 GiB		FlashArray				PURE		
□	mpathc	624a9370b9fcbe15cd0446a000011fa4	1.5 TiB		FlashArray				PURE		
□	mpathd	624a9370b9fcbe15cd0446a000011fa6	1.5 TiB		FlashArray				PURE		

17. Change the radio button Storage Configuration to Custom. Click Done.

18. Click the link to create the file system layout automatically.

19. Delete the home file system pressing the - button.

20. Select the root volume and resize to 94.4 GiB. Click Done.



MANUAL PARTITIONING

RED HAT ENTERPRISE LINUX 8.0.0 INSTALLATION

▾ New Red Hat Enterprise Linux 8.0.0 Installation

SYSTEM

/ rhel-root	94.4 GiB
/boot mpatha2	1024 MiB
/boot/efi mpatha1	600 MiB
swap rhel-swap	4 GiB

rhel-root

Mount Point: /

Desired Capacity: 94.4 GiB

Device(s): WWID 624a9370b9fcbe15cd0446a000011fb1 (mpatha)

Device Type: LVM □ Encrypt

File System: xfs ☑ Reformat

Volume Group: rhel (0 B free)

Label:

Name: root

Note: The settings you make on this screen will not be applied until you click on the main menu's 'Begin Installation' button.

AVAILABLE SPACE 7.97 MiB

TOTAL SPACE 100 GiB

1 storage device selected

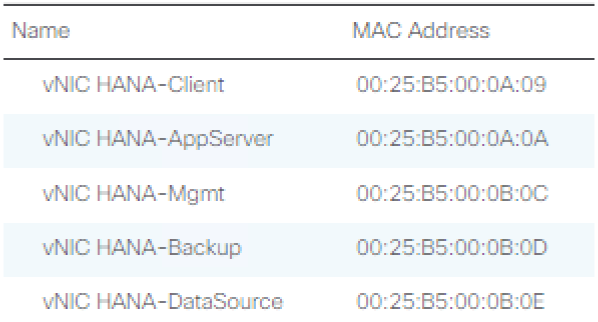
21. Uncheck Enable KDump.

22. Select Network & Host Name.

   a. Enter a short host name (cishana04) and click Apply.

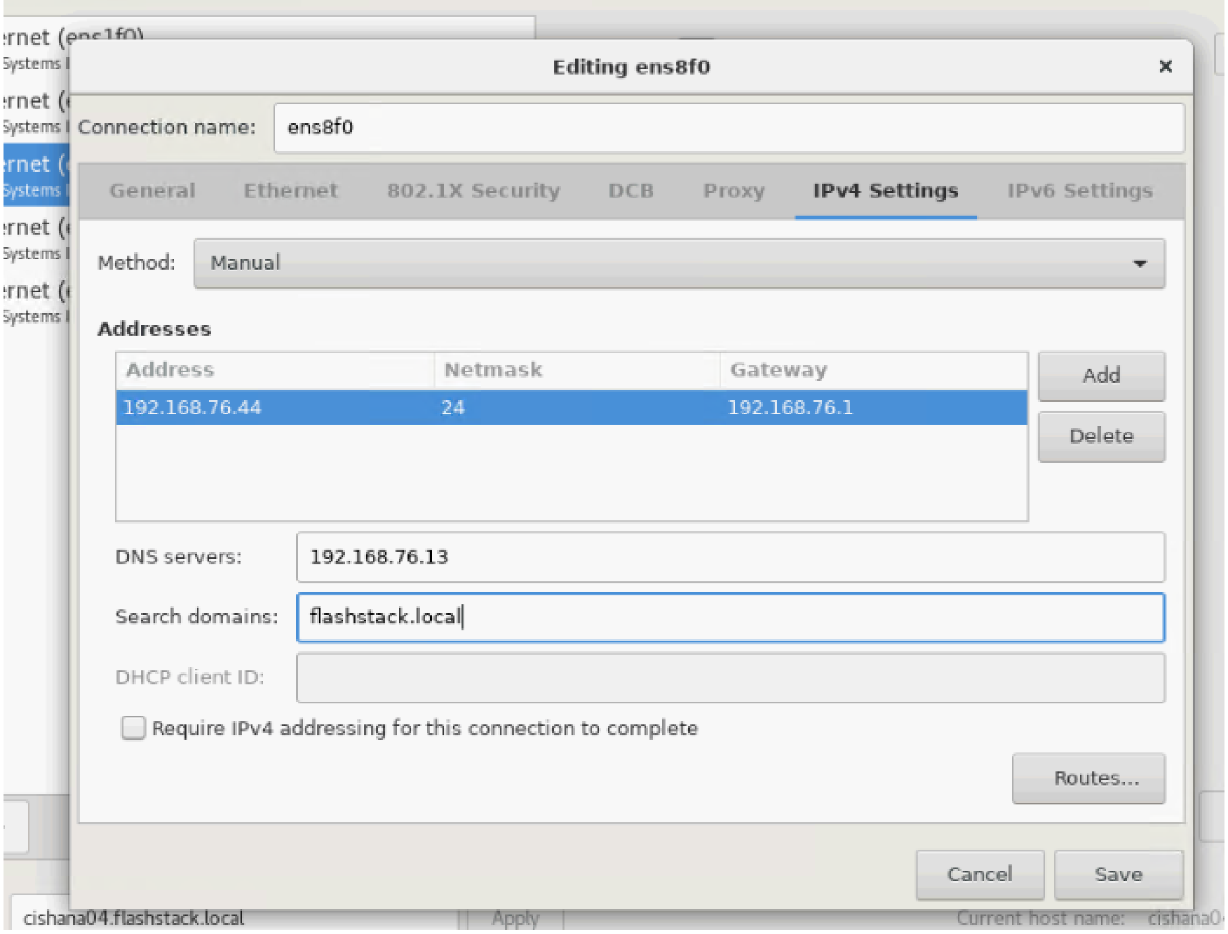
   b. Identify the Ethernet device to vNIC interface mapping first from the Cisco UCS Manager.

      i. In the Navigation pane of UCSM, click Servers
      ii. Select Service Profile > root > Sub-Organizations > HANA > HANA-Server04
      iii. In the network tab, scroll down to the vNIC section and list the vNICs with their MAC addresses



Name	MAC Address
vNIC HANA-Client	00:25:B5:00:0A:09
vNIC HANA-AppServer	00:25:B5:00:0A:0A
vNIC HANA-Mgmt	00:25:B5:00:0B:0C
vNIC HANA-Backup	00:25:B5:00:0B:0D
vNIC HANA-DataSource	00:25:B5:00:0B:0E

c. Compare the Ethernet hardware addresses and configure the network interfaces



Editing ens8f0

Connection name: ens8f0

Method: Manual

Addresses

Address	Netmask	Gateway
192.168.76.44	24	192.168.76.1

DNS servers: 192.168.76.13

Search domains: flashstack.local

DHCP client ID:

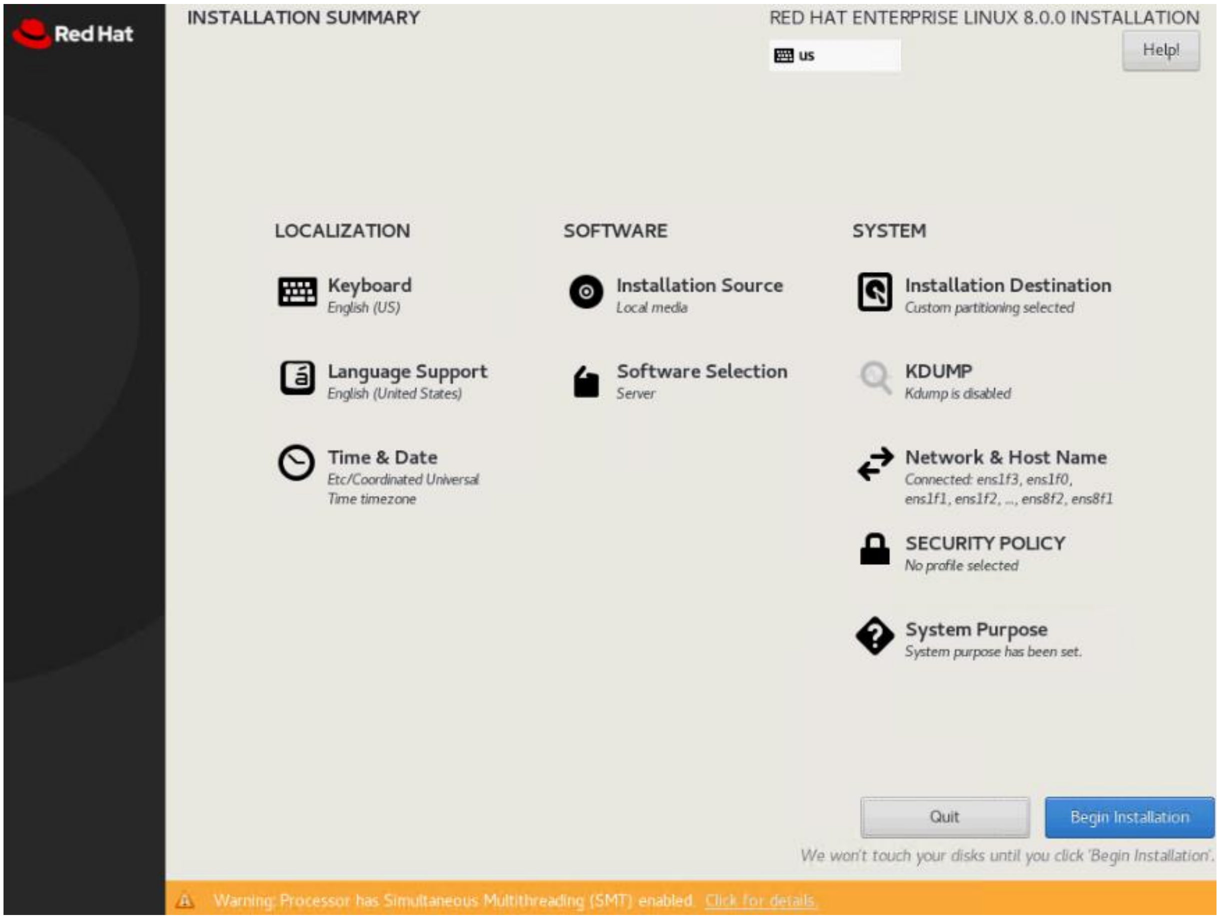
□ Require IPv4 addressing for this connection to complete

cishana04.flashstack.local

Current host name: cishana0

23. Switch the interfaces On and click Done.

24. Select System Purpose Role: Red Hat Enterprise Linux Server and the appropriate SLA and usage information. Click Done.



INSTALLATION SUMMARY

RED HAT ENTERPRISE LINUX 8.0.0 INSTALLATION

us

LOCALIZATION

Keyboard
English (US)

Language Support
English (United States)

Time & Date
Etc/Coordinated Universal Time timezone

SOFTWARE

Installation Source
Local media

Software Selection
Server

SYSTEM

Installation Destination
Custom partitioning selected

KDUMP
Kdump is disabled

Network & Host Name
Connected: ens1f3, ens1f0, ens1f1, ens1f2, ..., ens8f2, ens8f1

SECURITY POLICY
No profile selected

System Purpose
System purpose has been set.

We won't touch your disks until you click 'Begin Installation'.

Warning: Processor has Simultaneous Multithreading (SMT) enabled. Click for details.

25. Click Begin Installation and provide a root password while the installation is running in the background.

26. Before rebooting, unmap the ISO image from the KVM console.

RHEL for SAP Solutions Post Installation

Proxy Configuration

Multiple configuration files to configure a system wide proxy exist. Open an SSH terminal and edit the following configuration files to setup a permanent proxy configuration.

```
# echo "export http_proxy=http://proxy.example.com:3128/" >
/etc/profile.d/http_proxy.sh
# echo "setenv http_proxy http://proxy.example.com:3128/" >
/etc/profile.d/http_proxy.csh
```

Attach a proxy configuration line to the YUM configuration:

```
# echo "proxy=http://proxy.example.com:3128" >> /etc/yum.conf
```

Configure a proxy for the subscription-manager:

```
# vi /etc/rhsm/rhsm.conf
proxy_hostname=proxy.example.com
```

```
proxy_port=3128
```

Configure a proxy for the rhn-register and up2date services:

```
# vi /etc/sysconfig/rhn/up2date
EnableProxy=1
httpProxy=proxy.example.com:3128
```

Enable Access to Red Hat Software Updates

Register the system on the Red Hat Customer Portal or a local Red Hat Satellite server to retrieve update packages. It is recommended to update all packages (including kernel and glibc) to the latest version available and certified to run SAP HANA workload after the initial OS installation and at regular intervals in the future.

Follow the Red Hat documentation (https://access.redhat.com/solutions/4714781) to subscribe the SAP HANA system to the Update Services for SAP Solutions.

```
# subscription-manager register --username <username> --password <password>
# subscription-manager role --set="Red Hat Enterprise Linux Server"
# subscription-manager service-level --set="Standard"
# subscription-manager usage --set="Development/Test"
# subscription-manager attach
# subscription-manager repos --disable="*"
# subscription-manager repos --enable="rhel-8-for-x86_64-baseos-e4s-rpms" --
enable="rhel-8-for-x86_64-appstream-e4s-rpms" --enable="rhel-8-for-x86_64-sap-
solutions-e4s-rpms" --enable="rhel-8-for-x86_64-sap-netweaver-e4s-rpms"
# subscription-manager release --set=8.1
```

Validate the System Purpose had been set:

```
# syspurpose show
{
  "role": "Red Hat Enterprise Linux Server",
  "service_level_agreement": "Self-Support",
  "usage": "Development/Test"
}
System purpose successfully sent to subscription management server.
```

Additional Software Packages

Install additional software packages required by all SAP products and SAP HANA:

```
# yum -y install uuidd libnsl tcsh psmisc nfs-utils bind-utils python2
# yum -y install expect graphviz iptraf-ng krb5-workstation libatomic
libcanberra-gtk2 libibverbs libicu libpng12 libssh2 lm_sensors numactl
PackageKit-gtk3-module xorg-x11-xauth compat-sap-c++-9
# yum group install Server
```

Apply Security Patches

Apply the most recent security patches immediately after the RHEL installation completes and disable SELinux which can conflict with several components of an SAP server environment like the installation tools.

```
# yum -y update
# sed -i 's/\(SELINUX=enforcing\|SELINUX=permissive\)/SELINUX=disabled/g'
/etc/selinux/config
```

```
# reboot
```

Python Configuration

The SAP HANA installer fails to execute the python interpreter if alternatives are not set.

```
# alternatives --set python /usr/bin/python2
```

Firewall Configuration

To avoid problems with the firewall during installation, disable it completely. To protect your SAP HANA server from unauthorized access, configure the built-in firewall of the RHEL system to only allow access via the ports which the SAP software uses for communication.

```
# systemctl stop firewalld
# systemctl disable firewalld
```

Disable Core Dumps and kdump, Configure File Handles and Processes

All crashes of SAP HANA are typically analyzed by SAP support, so they do not rely on operating system mechanisms for crash reporting. To avoid delays when a Linux kernel crash or a core dump occurs, disable the application crash and core file handling of the operating system.

Some components (for example, the SAP J2EE engine, Oracle RDBMS software, and so on) need to keep many file handles opened simultaneously. The RHEL 8 default of 1024 is too small in certain cases. In addition, some components need to create a higher amount of processes per user from time to time, which might exceed the default maximum allowed number of processes per user on RHEL 8.

```
# vi /etc/security/limits.d/99-sap.conf
* soft core 0
* hard core 0

@sapsys    hard    nofile    65536
@sapsys    soft    nofile    65536
@sapsys    hard    nproc    unlimited
@sapsys    soft    nproc    unlimited
```

Disable the kernel crash dump facility:

```
# systemctl stop kdump
# systemctl disable kdump
```

Hostname Configuration

Use the command **hostname -s** to display the short hostname and **hostname -f** to display the long, full qualified hostname.

Add the full qualified hostname to the /etc/hosts file:

```
# vi /etc/hosts
127.0.0.1       localhost

# special IPv6 addresses
::1     localhost ipv6-localhost ipv6-loopback
fe00::0 ipv6-localnet
```

```
ff00::0 ipv6-mcastprefix
ff02::1 ipv6-allnodes
ff02::2 ipv6-allrouters
ff02::3 ipv6-allhosts

# AppServer network
192.168.223.200 cishana01a.flashstack.local cishana01a
# Backup network
192.168.221.200 cishana01b.flashstack.local cishana01b
# Client network
192.168.222.200 cishana01c.flashstack.local cishana01c
# DataSource network
192.168.224.200 cishana01d.flashstack.local cishana01d
# Internal internode network
192.168.220.200 cishana01i.flashstack.local cishana01i
# Management network
192.168.76.41   cishana01.flashstack.local cishana01
# NFS HANA shared network
192.168.111.200 cishana01s.flashstack.local cishana01s
# Replication Network
192.168.225.200 cishana01r.flashstack.local cishana01r
```

Add any additional full qualified hostname to the /etc/hosts file as well, like for the application, client, backup, datasource or replication network.

Network Configuration

Ensure the network devices configured during installation will be enabled during boot. The following command will change the ONBOOT variable in line 15 of the network configuration file to yes. Verify the successful change.

# sed -i " 15s/no/yes/" /etc/sysconfig/network-scripts/ifcfg-ens*

# grep ONBOOT /etc/sysconfig/network-scripts/ifcfg-ens*

Review Network Time and Date Configuration

During the installation a local NTP server was configured. Review the configuration is working.

```
# vi /etc/chrony.conf
# Use public servers from the pool.ntp.org project.
# Please consider joining the pool (http://www.pool.ntp.org/join.html).
# pool 2.rhel.pool.ntp.org iburst
server 192.168.76.12 iburst
```

Restart the chronyd service:

```
# systemctl restart chronyd
# systemctl enable chronyd
```

Validate the service is running and connected to the local time server:

```
# chronyc sources
210 Number of sources = 1
MS Name/IP address         Stratum Poll Reach LastRx Last sample
===============================================================================
^* 192.168.76.12                 2   6    17    36   +607ns[ -113us] +/- 1549us
```

Configure Linux Kernel Parameter

Increase some Linux kernel parameters to meet the requirements of the SAP HANA software:

```
#  vi /etc/sysctl.d/sap.conf
# SAP settings
vm.max_map_count = 2147483647
kernel.pid_max = 4194304

# SAP Note 2382421 - Optimizing the Network Configuration
net.core.somaxconn = 4096
net.ipv4.tcp_max_syn_backlog = 8192
net.ipv4.tcp_slow_start_after_idle = 0
```

Configure systemd tmpfiles

Ensure important lock files and sockets in /tmp will not be deleted by systemd-tmpfiles:

```
# vi /etc/tmpfiles.d/sap.conf
# systemd.tmpfiles exclude file for SAP
# SAP software stores some important files in /tmp which should not be deleted
automatically

# Exclude SAP socket and lock files
x /tmp/.sap*

# Exclude HANA lock file
x /tmp/.hdb*lock

# Exclude TREX lock file
x /tmp/.trex*lock
```

Configure Tuned to Use SAP-HANA Profile

The tuned profile "sap-hana" provided by Red Hat as part of the RHEL for SAP Solutions subscription, contains many required settings and configurations for SAP HANA. Therefore the "sap-hana" tuned profile must be activated on all systems running SAP HANA.

Use the following commands to install and activate the tuned profile "sap-hana" and check if it is active:

```
# yum -y install tuned-profiles-sap-hana
# systemctl start tuned
# systemctl enable tuned
# tuned-adm profile sap-hana
# tuned-adm active
  Current active profile: sap-hana
```

Update Cisco fnic/enic drivers

Based on the serer type/model, processor version, OS release and version information download the firmware bundle corresponding to the UCS Server firmware installed from the Cisco UCS Hardware and Software Compatibility site.

To extract the rpm files of the fnic and enic driver from the driver bundle and copy them to the server, follow these steps:

1. Verify the current driver:

```
# cat /sys/module/enic/version
  2.3.0.53
# cat /sys/module/fnic/version
  1.6.0.47
```

2. RPM install the drivers:

```
rpm -ivh kmod-enic-4.0.0.8-802.24.rhel8u1.x86_64.rpm
rpm -ivh kmod-fnic-2.0.0.60-141.0.rhel8u1.x86_64.rpm
```

3. Reboot the server:

4. Verify the driver installation after the reboot:

```
# cat /sys/module/enic/version
  4.0.0.8-802.24
# cat /sys/module/fnic/version
  2.0.0.60-141.0
```

Pure Storage UDEV Rule Configuration

Configure the kernel device manager. The most important parameters to be changed are nr_requests and scheduler.

Create a rule set for the Pure Storage FlashArray//X:

```
# vi /etc/udev/rules.d/99-pure-storage.rules
# Recommended settings for Pure Storage FlashArray.
# Use none scheduler for high-performance solid-state storage
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 HANA devices to be 512kB rather than 4MB max size
ACTION=="add|change", KERNEL=="sd*[!0-9]", SUBSYSTEM=="block",
ENV{ID_VENDOR}=="PURE", ATTR{queue/max_sectors_kb}="512"
```

```
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block",
ENV{DM_NAME}=="3624a937*", ATTR{queue/max_sectors_kb}="512"

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

Set DM devices number of requests to 1024
ACTION=="add|change", KERNEL=="dm-[0-9]*", SUBSYSTEM=="block",
ENV{DM_NAME}=="3624a937*", ATTR{queue/nr_requests}="1024"
```

DM-Multipath Configuration

Setup multipathing with group by prio policy for all PURE LUNs:

```
# vi /etc/multipath.conf
defaults {
         find_multipaths yes
         user_friendly_names no
         polling_interval   10
}
blacklist {
         devnode "^(pmem)[0-9]*"
}
devices {
  device {
         vendor                   "PURE"
         product                  "FlashArray"
         path_grouping_policy     group_by_prio
         failback                 "immediate"
         fast_io_fail_tmo         10
         prio                     "alua"
         hardware_handler         "1 alua"
         max_sectors_kb           4096
        }
}
```

Set the Disk Scheduler

The recommended IO scheduler starting with RHEL 8.1 is “none” instead of “noop”.

```
# grubby --default-kernel
  /boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64
#  grubby --args="scsi_mod.use_blk_mq=1 dm_mod.use_blk_mq=y" --update-kernel
/boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64
# grubby --info /boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64
  index=0
  kernel="/boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64"
  args="ro resume=/dev/mapper/rhel-swap rd.lvm.lv=rhel/root rd.lvm.lv=rhel/swap
  rhgb quiet $tuned_params scsi_mod.use_blk_mq=1 dm_mod.use_blk_mq=y"
  root="/dev/mapper/rhel-root"
  initrd="/boot/initramfs-4.18.0-147.27.1.el8_1.x86_64.img $tuned_initrd"
  title="Red Hat Enterprise Linux (4.18.0-147.27.1.el8_1.x86_64) 8.1 (Ootpa)"

# grub2-mkconfig -o /boot/efi/EFI/redhat/grub.cfg
  Generating grub configuration file ...
  Adding boot menu entry for EFI firmware configuration
  Done

# reboot
```

SAP HANA Persistent Storage Configuration

Verify the multipath devices are listed:

```
# multipath -ll
3624a9370b9fcbe15cd0446a000011fb2 dm-6 PURE,FlashArray
size=1.0T features='0' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 1:0:0:4 sde   8:64   active ready running
  |- 1:0:1:4 sdi   8:128  active ready running
  |- 1:0:2:4 sdm   8:192  active ready running
  |- 1:0:3:4 sdq   65:0   active ready running
  |- 8:0:0:4 sdu   65:64  active ready running
  |- 8:0:1:4 sdy   65:128 active ready running
  |- 8:0:2:4 sdac  65:192 active ready running
  `- 8:0:3:4 sdag  66:0   active ready running
3624a9370b9fcbe15cd0446a000011fab dm-5 PURE,FlashArray
size=512G features='0' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 1:0:0:3 sdd   8:48   active ready running
  |- 1:0:1:3 sdh   8:112  active ready running
  |- 1:0:2:3 sdl   8:176  active ready running
  |- 1:0:3:3 sdp   8:240  active ready running
  |- 8:0:0:3 sdt   65:48  active ready running
  |- 8:0:1:3 sdx   65:112 active ready running
  |- 8:0:2:3 sdab  65:176 active ready running
  `- 8:0:3:3 sdaf  65:240 active ready running
3624a9370b9fcbe15cd0446a000011faa dm-1 PURE,FlashArray
size=9.0T features='0' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 1:0:0:2 sdc   8:32   active ready running
  |- 1:0:1:2 sdg   8:96   active ready running
  |- 1:0:2:2 sdk   8:160  active ready running
  |- 1:0:3:2 sdo   8:224  active ready running
  |- 8:0:0:2 sds   65:32  active ready running
  |- 8:0:1:2 sdw   65:96  active ready running
  |- 8:0:2:2 sdaa  65:160 active ready running
  `- 8:0:3:2 sdae  65:224 active ready running
```

Verify the IO scheduler none is set accordingly:

```
# cat /sys/block/dm-1/queue/scheduler
[none] mq-deadline kyber bfq
```

Construct and an XFS file system on both multipath devices:

```
# mkfs.xfs -f /dev/mapper/3624a9370b9fcbe15cd0446a000011fb2
# mkfs.xfs -f /dev/mapper/3624a9370b9fcbe15cd0446a000011fab
# mkfs.xfs -f /dev/mapper/3624a9370b9fcbe15cd0446a000011faa
```

Create directories for the SAP HANA data, log, and shared file systems:

```
# mkdir -p /hana/data/<SID>
# mkdir -p /hana/log/<SID>
# mkdir -p /hana/shared
```

Persist all mount points and add them to the /etc/fstab file. Mount the volumes afterwards:

```
# cat /etc/fstab
…
/dev/mapper/3624a9370b9fcbe15cd0446a000011fab /hana/log/<SID>  xfs   inode64 0 0
/dev/mapper/3624a9370b9fcbe15cd0446a000011faa /hana/data/<SID> xfs   inode64 0 0
/dev/mapper/3624a9370b9fcbe15cd0446a000011fb2 /hana/shared     xfs   inode64 0 0
# NFS HANA Shared for SAP HANA Scale Out
#192.168.111.26:/hanashared                    /hana/shared    nfs   defaults 0 0

# mount -a
```

Disable OS-based Memory Error Monitoring

Linux supports two features related to error monitoring and logging. EDAC (Error Detection and Correction) and mcelog. Both are common in most recent Linux distributions. Cisco recommends disabling EDAC based error collection, to allow all error reporting to be handled in firmware.

EDAC can be disabled by adding the option “edac_report=off” to the kernel command line. Mcelog is enabled by default in most recent Linux distributions.

For customers who prefer to collect all diagnostic and fault information from OS resident tools mcelog is recommended. In this case Cisco recommends disabling CMCI to prevent performance impact. Firmware logs may be incomplete when OS logging is enabled.

Configure C-States for Lower Latency in Linux

The Linux kernel shipped with RHEL 8 on the x86_64 platform includes a cpuidle driver for recent Intel CPUs: intel_idle. This driver leads to a different behavior in C-states switching. The normal operating state is C0, when the processor is put to a higher C state, which saves power. For low latency applications, the additional time needed to stop and start the execution of the code again will cause performance degradations. Therefore, it is recommended to limit the C-states to C0 and C1:

```
# grubby --default-kernel
  /boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64
#  grubby --args="processor.max_cstate=1 intel_idle.max_cstate=1" --update-kernel
/boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64
# grubby --info /boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64
  index=0
  kernel="/boot/vmlinuz-4.18.0-147.27.1.el8_1.x86_64"
  args="ro resume=/dev/mapper/rhel-swap rd.lvm.lv=rhel/root rd.lvm.lv=rhel/swap
  rhgb quiet $tuned_params scsi_mod.use_blk_mq=1 dm_mod.use_blk_mq=y
  processor.max_cstate=1 intel_idle.max_cstate=1"
  root="/dev/mapper/rhel-root"
  initrd="/boot/initramfs-4.18.0-147.27.1.el8_1.x86_64.img $tuned_initrd"
  title="Red Hat Enterprise Linux (4.18.0-147.27.1.el8_1.x86_64) 8.1 (Ootpa)"

# grub2-mkconfig -o /boot/efi/EFI/redhat/grub.cfg
  Generating grub configuration file ...
  Adding boot menu entry for EFI firmware configuration
  Done

# reboot
```

Persistent Memory Configuration

Configure and manage Intel Optane DC PMM from the command line with the ipmctl and ndctl utilities. The tools are not installed by default but required to manage the libnvdimm (non-volatile memory device) sub-system in the Linux kernel.

To open an SSH prompt as root to install the host tools, follow these steps:

1. EPEL packages assume that the 'codeready-builder' repository is enabled.

```
# subscription-manager repos --enable "codeready-builder-for-rhel-8-$(arch)-rpms"
```

2. Enable the EPEL 8 repository or download the required rpm file from https://dl.fedoraproject.org/pub/epel/8/Everything/x86_64/Packages/.

```
# yum install https://dl.fedoraproject.org/pub/epel/epel-release-latest-
8.noarch.rpm
# yum info ipmctl
# yum -y install ipmctl
```

3. Install the ndctl utility

```
# yum -y install ndctl
```

4. Verify the persistent memory modules have been discovered and the software can communicate with them.

```
# ipmctl show -dimm
DimmID  | Capacity    | LockState | HealthState | FWVersion
===============================================================
 0x0001 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x0011 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x0021 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x0101 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x0111 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x0121 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x1001 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x1011 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x1021 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x1101 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x1111 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x1121 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x2001 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x2011 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x2021 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x2101 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x2111 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x2121 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x3001 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x3011 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x3021 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x3101 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x3111 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
 0x3121 | 252.454 GiB | Disabled  | Healthy     | 01.02.00.5435
```

5. Add a UDEV rule:

```
# vi /etc/udev/rules.d/60-persistent-storage.rules
# PMEM devices
KERNEL=="pmem*", ENV{DEVTYPE}=="disk", ATTRS{uuid}=="?*", SYMLINK+="disk/by-
id/pmem-$attr{uuid}"
```

6. Create the goal:

```
# ipmctl create -goal
The following configuration will be applied:
 SocketID | DimmID | MemorySize | AppDirect1Size | AppDirect2Size
==================================================================
 0x0000   | 0x0001 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0000   | 0x0011 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0000   | 0x0021 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0000   | 0x0101 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0000   | 0x0111 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0000   | 0x0121 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0001   | 0x1001 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0001   | 0x1011 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0001   | 0x1021 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0001   | 0x1101 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0001   | 0x1111 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0001   | 0x1121 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0002   | 0x2001 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0002   | 0x2011 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0002   | 0x2021 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0002   | 0x2101 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0002   | 0x2111 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0002   | 0x2121 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0003   | 0x3001 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0003   | 0x3011 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0003   | 0x3021 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0003   | 0x3101 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0003   | 0x3111 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
 0x0003   | 0x3121 | 0.000 GiB  | 252.000 GiB    | 0.000 GiB
Do you want to continue? [y/n]
```

7. Confirm with Y and reboot the server to apply the new memory allocations.

8. Verify regions had been created:

```
# ipmctl show -region
SocketID | ISetID         | Persistent | Capacity   | FreeCapacity | HealthState
         |                | MemoryType |            |              |
=================================================================================
 0x0000   | 0xd7d..9c2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
 0x0001   | 0xfba..9b2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
 0x0002   | 0xc67..af2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
 0x0003   | 0x685..9f2ccc | AppDirect  | 1512.0 GiB | 1512.0 GiB   | Healthy
```

9. Create a name space for each region; on a 4-socket server invoke the command four times.

```
# ndctl create-namespace
```

10. Verify the namespace have been created successfully:

```
# ndctl list
[
  {
    "dev":"namespace1.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"81257c85-4410-4def-8dba-3c120943c6b7",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem1"
  },
  {
    "dev":"namespace3.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"197dc10f-cd0d-4a84-bba3-f104df3e70be",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem3"
  },
  {
    "dev":"namespace0.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"23526924-74bf-4bab-8fd9-27be6190ce56",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem0"
  },
  {
    "dev":"namespace2.0",
    "mode":"fsdax",
    "map":"dev",
    "size":1598128390144,
    "uuid":"5847f6d4-4a3d-447c-b299-7d0e38c1dcdd",
    "sector_size":512,
    "align":2097152,
    "blockdev":"pmem2"
  }
]
```

11. Construct an XFS file system on the block devices:

```
# for i in {0..3}; do mkfs.xfs -f -d su=2m,sw=1 -m reflink=0 /dev/pmem$i; done
```

12. Create directories and mount the block devices using the DAX file system option:

```
# for i in {0..3}; do mkdir -p /hana/pmem/nvmem$i; done
# for i in {0..3}; do mount -t xfs -o dax,lazytime /dev/pmem0 /hana/pmem/nvmem$i;
done
```

13. Change the permission of the mount points:

```
# chmod 755 /hana/pmem/nvmem*
# chown <SID>adm:sapsys /hana/pmem/nvmem*
```

14. Add the mount points to /etc/fstab to persist them:

```
# vi /etc/fstab
/dev/pmem0 /hana/pmem/nvmem0 xfs dax,lazytime 1 2
/dev/pmem1 /hana/pmem/nvmem1 xfs dax,lazytime 1 2
/dev/pmem2 /hana/pmem/nvmem2 xfs dax,lazytime 1 2
/dev/pmem3 /hana/pmem/nvmem3 xfs dax,lazytime 1 2
```

The device names chosen by the kernel are subject to creation order and discovery. For static configurations they usually don't change, alternatively consider using persistent naming instead to mount the pmem namespace.

```
# ls -l /dev/disk/by-id/pmem*
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-39afa860-5b33-4956-
a1ec-1c176cf34608 -> ../../pmem2
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-76c312d8-86e0-4f3d-
b630-b816f95f4ff8 -> ../../pmem1
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-af000a5b-14ac-4f49-
a919-c89bc462944d -> ../../pmem3
lrwxrwxrwx 1 root root 11 Oct 29 15:34 /dev/disk/by-id/pmem-df203ae8-13ef-4b65-
bd2e-c7f95979493a -> ../../pmem0
```

The persistent name for pmem namespace 0 in /etc/fstab will look like the following:

```
/dev/disk/by-id/pmem-df203ae8-13ef-4b65-bd2e-c7f95979493a /hana/pmem/nvmem0 xfs
dax,lazytime 1 2
```

SAP HANA Installation

All version specific SAP installation and administration documentation is available from the SAP HANA Help portal: https://help.sap.com/hana. Please refer to the official SAP documentation which describes the different SAP HANA installation options.

Review all relevant SAP notes related to the SAP HANA installation on recent changes.

SAP HANA 2.0 Platform Installation

The official SAP documentation describes in detail how to install the HANA software and its required components. For SAP HANA Scale-Up installations the required file systems are already mounted when the installation starts different to Scale-Out installations when the HANA data and log volumes are not mounted upfront. SAP HANA includes a ready-to-use storage connector client to manage fibre channel attached devices with native multipath. This enables host auto-failover on block storage level which is required for a successful failover to a standby host.

The fcCLient/fcClientLVM implementation uses standard Linux commands, such as multipath and sg_persist. It is responsible for mounting the SAP HANA data and log volumes and implements the fencing mechanism during a host failover by means of SCSI-3 persistent reservations.

SAP HANA Scale Up Installation

Download and extract the SAP HANA Platform 2.0 software to an installation sub-folder on the HANA shared volume.

SAP Storage Connector API Configuration

Prepare an initial SAP HANA configuration file the SAP Storage Connector API will use during the installation process. The file itself is not required any longer post installation.

```
# vi /tmp/cisco/global.ini
[communication]
listeninterface = .global

[persistence]
basepath_datavolumes = /hana/data/ANA
basepath_logvolumes = /hana/log/ANA
basepath_shared=yes

[storage]
ha_provider = hdb_ha.fcClient
partition_*_*__prtype = 5
partition_1_data__wwid = 3624a9370b9fcbe15cd0446a000011fa4
partition_1_log__wwid  = 3624a9370b9fcbe15cd0446a000011fa5

[trace]
ha_fcclient = info
```

SAP HANA installation

Follow the installation workflow of the SAP HANA Database Lifecycle Manager (hdblcm) and provide the user passwords when being asked for:

1. Change to the folder <path>/DATA_UNITS/HDB_LCM_Linux_X86_64.

2. Adapt below command in regards of the SAP SID, SAP system ID number and hostnames:

```
# ./hdblcm --action install --components=server,client --install_hostagent \
 --number 00 --sapmnt=/hana/shared --sid=ANA --storage_cfg=/tmp/cisco \
 --hostname=cishana01 --certificates_hostmap=cishana01=hana001
```

3. Switch user to <sid>adm (In this validation test example anaadm).

4. Validate SAP HANA is up and running:

```
# sapcontrol -nr 00 -function GetProcessList
```

SAP HANA Parameter Configuration

To receive the optimal performance of the storage subsystem, add the following fileio section and add the two parameters. Save the file and restart SAP HANA to apply the change:

```
# vi /usr/sap/<SID>/SYS/global/hdb/custom/config/global.ini
  [fileio]
  num_submit_queues = 8
  num_completion_queues = 8
```

Persistent Memory Base Path Configuration

To enable SAP HANA using non-volatile memory configure the DAX volumes created before within the SAP HANA configuration file global.ini. In the [persistence] section create the new base path configuration parameter basepath_persistent_memory_volumes. Separate multiple locations by semicolon.

This change requires a restart of SAP HANA database:

```
(<sid>adm) # cdglo
(<sid>adm) # vi hdb/custom/config/global.ini
[persistence]
basepath_datavolumes = /hana/data/<SID>
basepath_logvolumes = /hana/log/<SID>
basepath_persistent_memory_volumes =
/hana/pmem/nvmem0;/hana/pmem/nvmem1;/hana/pmem/nvmem2;/hana/pmem/nvmem3
```

SAP HANA Scale-Out Installation

Download and extract the SAP HANA Platform 2.0 software to an installation sub-folder on the HANA shared volume. Pre-Installation steps are required prior of starting the SAP HANA installation.

Host file configuration

On each node provide the host name information of the Scale-Out environment in the host's file:

```
# vi /etc/hosts
# Hostnames
192.168.76.41   cishana01.flashstack.local cishana01
192.168.76.42   cishana02.flashstack.local cishana02
192.168.76.43   cishana03.flashstack.local cishana03

# Internode Communication Network
192.168.220.201 cishana01i.flashstack.local cishana01i
192.168.220.202 cishana02i.flashstack.local cishana02i
192.168.220.203 cishana03i.flashstack.local cishana03i
```

SAP Storage Connector API Configuration

Prepare an initial SAP HANA configuration file the SAP Storage Connector API will use during the installation process. The file itself is not required any longer post installation.

```
# vi /tmp/cisco/global.ini
[communication]
listeninterface = .global

[persistence]
basepath_datavolumes = /hana/data/ANA
basepath_logvolumes = /hana/log/ANA
basepath_shared=yes

[storage]
ha_provider = hdb_ha.fcClient
partition_*_*__prtype = 5
partition_1_data__wwid = 3624a9370b9fcbe15cd0446a000011fa4
partition_1_log__wwid  = 3624a9370b9fcbe15cd0446a000011fa5
partition_2_data__wwid = 3624a9370b9fcbe15cd0446a000011fa6
partition_2_log__wwid  = 3624a9370b9fcbe15cd0446a000011fa7

[trace]
ha_fcclient = info
```

SAP HANA Installation

Follow the installation workflow of the SAP HANA Database Lifecycle Manager (hdblcm) and provide the user passwords when being asked for:

1. Change to the folder <path>/DATA_UNITS/HDB_LCM_Linux_X86_64

2. Adapt below command in regards of the SAP SID, SAP system ID number and hostnames:

```
# ./hdblcm --action install --components=server,client --install_hostagent \
 --number 00 --sapmnt=/hana/shared --sid=ANA --storage_cfg=/tmp/cisco \
 --hostname=cishana01 --certificates_hostmap=cishana01=hana001
```

3. Switch user to <sid>adm (In this validation test example anaadm)

4. Validate SAP HANA is up and running

```
# sapcontrol -nr 00 -function GetProcessList
```

5. Stop SAP HANA to update the SAP HANA configuration file

```
# HDB stop
```

6. Include the hostname resolution section to the global.ini file.

```
(<sid>adm) # cdglo
(<sid>adm) # vi hdb/custom/config/global.ini
[internal_hostname_resolution]
192.168.220.201 = cishana01i
192.168.220.202 = cishana02i
192.168.220.203 = cishana03i
```

7. Start SAP HANA:

```
# HDB start
```

8. Change to the resident SAP HANA Lifecycle Manager to add hosts:

```
# /<sapmnt>/<SID>/hdblcm/hdblcm --action=add_hosts
```

9. Enter comma-separated host names to add (In this validation test example: cishana02,cishana03)

10. Provide the hosts roles like worker and standby for the two hosts.

11. Provide the required passwords during the installation workflow.

12. Validate SAP HANA Scale Out is up and running:

```
(<sid>adm) # sapcontrol -nr 00 -function GetSystemInstanceList
```

13. Stop SAP HANA:

```
(<sid>adm) # sapcontrol -nr 00 -function StopSystem
```

14. Change the internode communication from global to internal:

```
(<sid>adm) # /<sapmnt>/<SID>/hdblcm/hdblcm --action=configure_internal_network --
listen_interface=internal --internal_network=192.168.220/24
```

15. Restart SAP HANA:

```
(<sid>adm) # sapcontrol -nr 00 -function StartSystem
```

SAP HANA Parameter Configuration

To receive the optimal performance of the storage subsystem, add the following fileio section and add the two parameters. At the same time change the host to host network communication to .internal.

Save the file and restart SAP HANA to apply the change:

```
# vi /usr/sap/<SID>/SYS/global/hdb/custom/config/global.ini
  [communication]
  listeninterface = .internal

  [fileio]
  num_submit_queues = 8
  num_completion_queues = 8
```

Cisco Intersight

Cisco Intersight is an intelligent Software-as-a-Service (SaaS) platform for IT staff to manage and get support for their Intersight-connected environment when and where they need it. It simplifies the infrastructure management and provides proactive support for the FlashStack environment.

Cisco Intersight Assist helps to add endpoint devices like the Pure Storage FlashArray//X to Cisco Intersight and provides the connection mechanism to claim the device in Cisco Intersight.

Cisco Intersight Assist is available as part of the Cisco Intersight Virtual Appliance, which is distributed as a deployable virtual machine contained within an Open Virtual Appliance (OVA) file format. Install the appliance on an ESXi server on-premise. For more information see the Cisco Intersight Assist Getting Started Guide.

The Cisco Intersight Help Center provides an overview and information on how to get started with Cisco Intersight. The Help Center is available from https://intersight.com/help/home.

Requirements

The following prerequisites are necessary to setup access to Cisco Intersight and to connect the core FlashStack components to Intersight:

- A valid Cisco Intersight account. Navigate to https://intersight.com to create an account and follow the account creation instructions. The account creation requires at least one device to be registered in Intersight including its Device ID and Claim ID information.
- Valid Advanced or Premier License for Cisco Intersight.
- Cisco UCS Fabric Interconnects must be able to do a DNS lookup to access Cisco Intersight.
- External endpoints registration messages to be routed to Cisco Intersight
- Calls from non-registered endpoints (or other infrastructure devices) to be routed to Cisco Intersight

Table 14. Connectivity requirements (direct or through HTTP proxy)

Name	Service	Protocol	Port	Target Host
expe.example.com	Smart Licensing	TCP/UDP	443	tools.cisco.com
expe.example.com	Software download	TCP/UDP	443	api.cisco.com
expe.example.com	Intersight Cloud Services	TCP/UDP	443	svc.intersight.com

Cisco Intersight Virtual Assist Installation

Cisco Intersight Assist helps to add endpoint devices to Cisco Intersight which do not connect directly with Cisco Intersight. The Pure Storage FlashArray//X doesn’t connect directly with Cisco Intersight and requires a connection mechanism. Cisco Intersight Assist provides that connection mechanism which helps to add the FlashArray//X into Cisco Intersight.

Cisco Intersight Virtual Assist can connect multiple Pure Storage FlashArray//X at the same time.

The requirements are as follows:

- VMWare ESXi 6.0 and higher
- VMWare vSphere WebClient 6.5 and higher
- System Requirements are 8 to 23 vCPU and 16 to 64 GB of main memory

The DNS Setup is as follows:

- myhost.example.com (A record and PTR record) with a valid IP address
- dc-myhost.example.com (CNAME record of myhost.example.com)

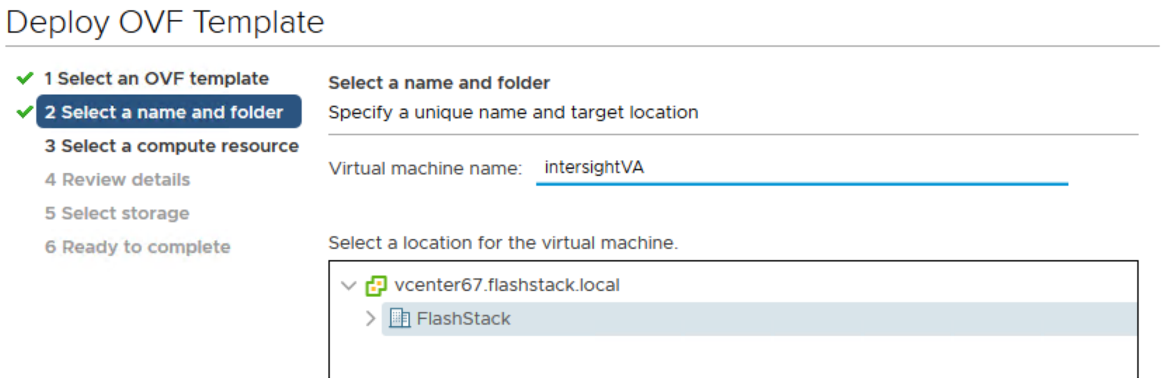
Deploy Cisco Intersight Virtual Appliance

The getting started guide https://www.cisco.com/c/en/us/td/docs/unified_computing/Intersight/b_Cisco_Intersight_Appliance_Getting_Started_Guide.html provides an overview of the Cisco Intersight Virtual Appliances and details the installation steps required to get started.

To deploy Cisco Intersight Virtual Appliance, follow these steps:

This deployment guide uses the Intersight Virtual Appliance 1.0.9-148 OVA template.

1. Log into the VMWare vSphere Web Client with administrator credentials.
2. Specify the source location to deploy the OVF template.
3. Select the name and location and go to the next page.


Deploy OVF Template

Select a name and folder

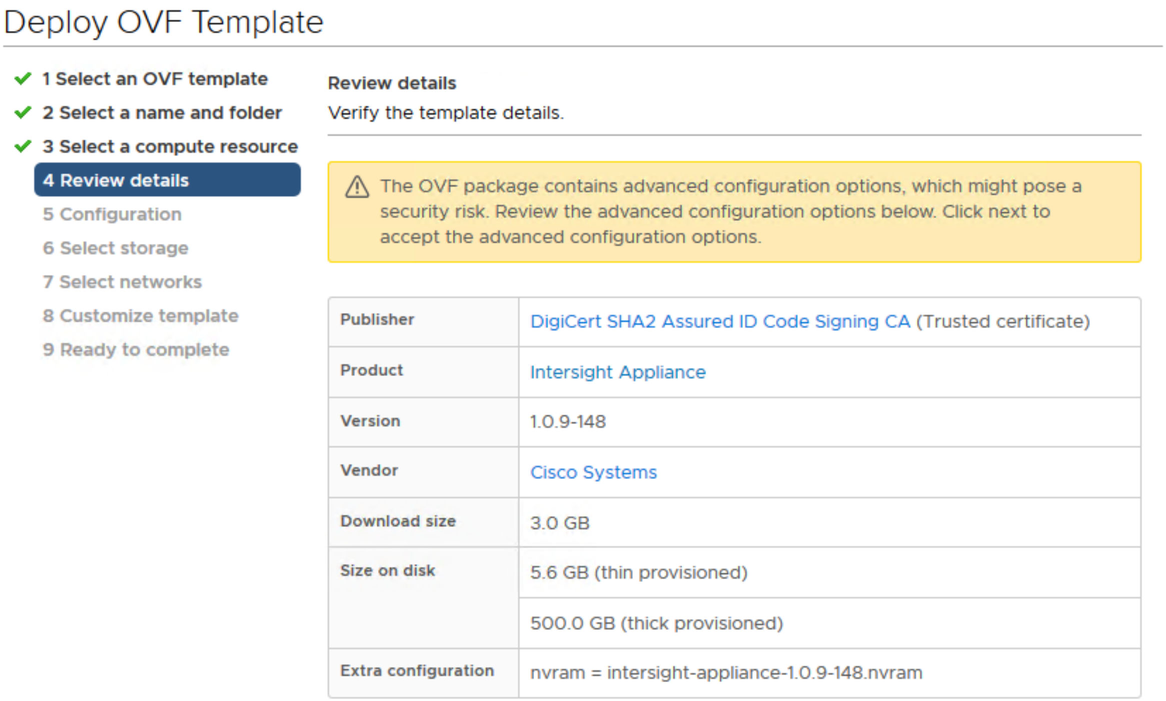
Specify a unique name and target location

Virtual machine name: intersightVA

Select a location for the virtual machine.

✓ 1 Select an OVF template
✓ 2 Select a name and folder
3 Select a compute resource
4 Review details
5 Select storage
6 Ready to complete
vcenter67.flashstack.local
FlashStack

4. Select the destination compute resource and go to the next page.
5. Verify the template details and go to the next page.



Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- **4 Review details**
- 5 Configuration
- 6 Select storage
- 7 Select networks
- 8 Customize template
- 9 Ready to complete

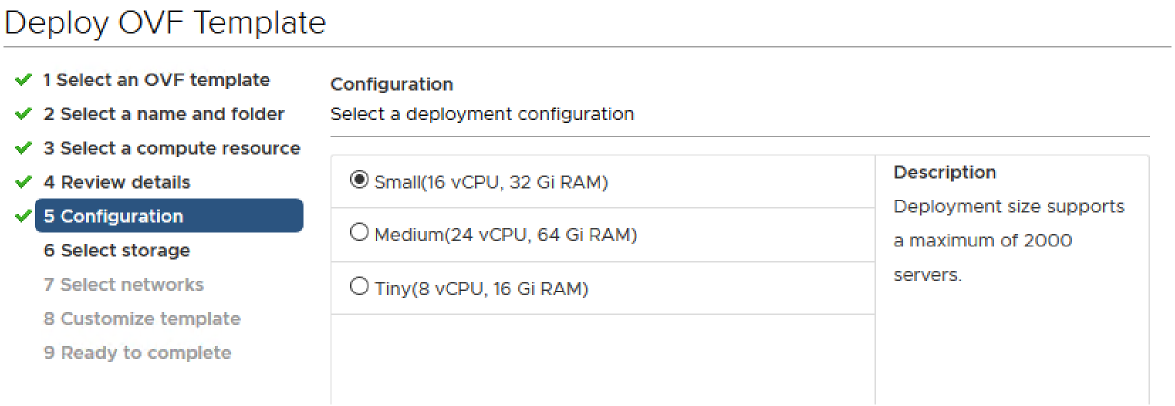
Review details

Verify the template details.

⚠ The OVF package contains advanced configuration options, which might pose a security risk. Review the advanced configuration options below. Click next to accept the advanced configuration options.

Publisher	DigiCert SHA2 Assured ID Code Signing CA (Trusted certificate)
Product	Intersight Appliance
Version	1.0.9-148
Vendor	Cisco Systems
Download size	3.0 GB
Size on disk	5.6 GB (thin provisioned)
	500.0 GB (thick provisioned)
Extra configuration	nvram = intersight-appliance-1.0.9-148.nvram

6. Select the appropriate deployment size.



Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- ✓ **5 Configuration**
- 6 Select storage
- 7 Select networks
- 8 Customize template
- 9 Ready to complete

Configuration

Select a deployment configuration

● Small(16 vCPU, 32 Gi RAM)

○ Medium(24 vCPU, 64 Gi RAM)

○ Tiny(8 vCPU, 16 Gi RAM)

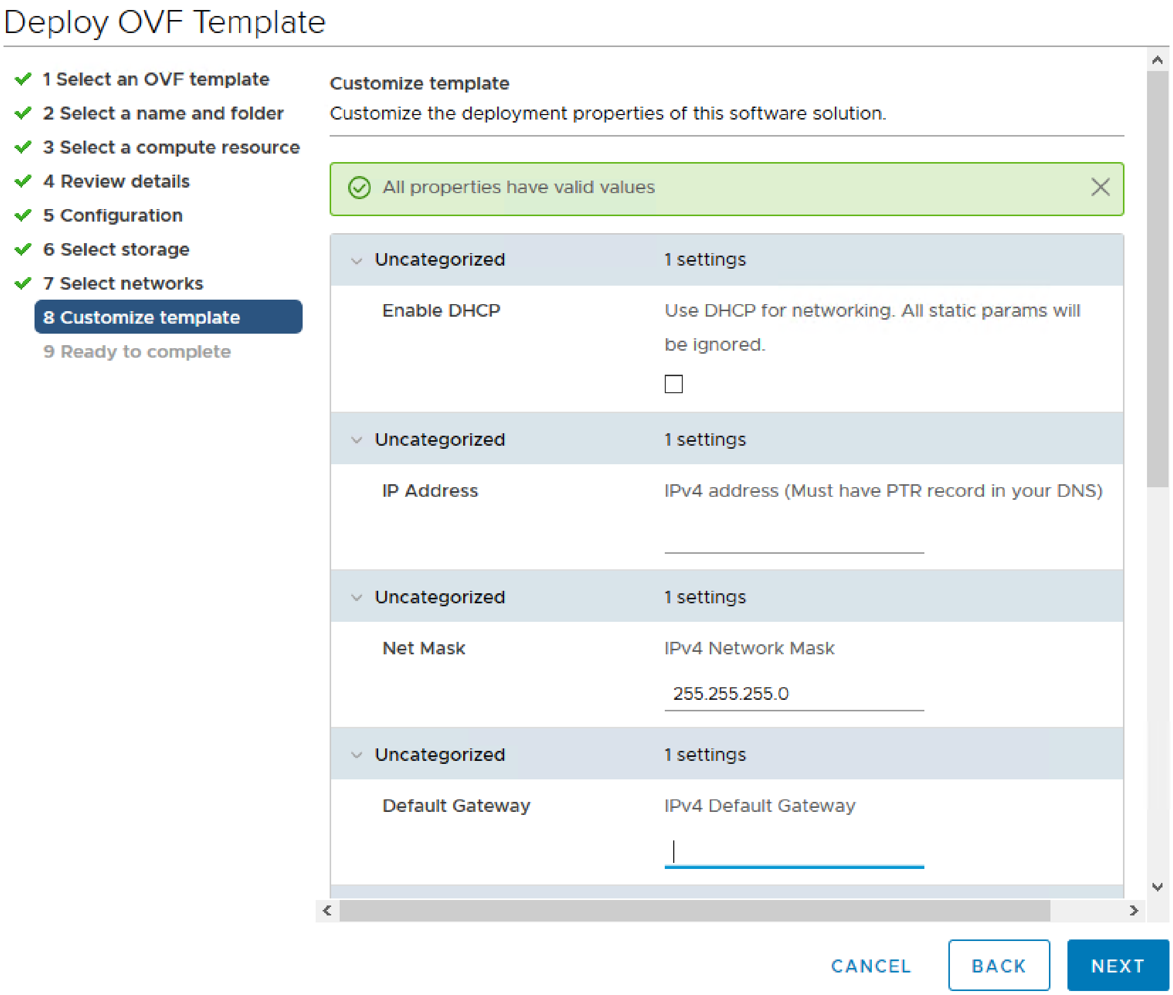
Description

Deployment size supports a maximum of 2000 servers.

7. Select a destination and thin provision to optimize disk usage on the Select Storage page.

8. Select a source network and map it to the destination network.

9. On the customize template page, customize the deployment properties of the OVF template and provide an Admin Password and NTP and DNS server information. Click Next.



Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- ✓ 5 Configuration
- ✓ 6 Select storage
- ✓ 7 Select networks
- 8 Customize template
- 9 Ready to complete

Customize template

Customize the deployment properties of this software solution.

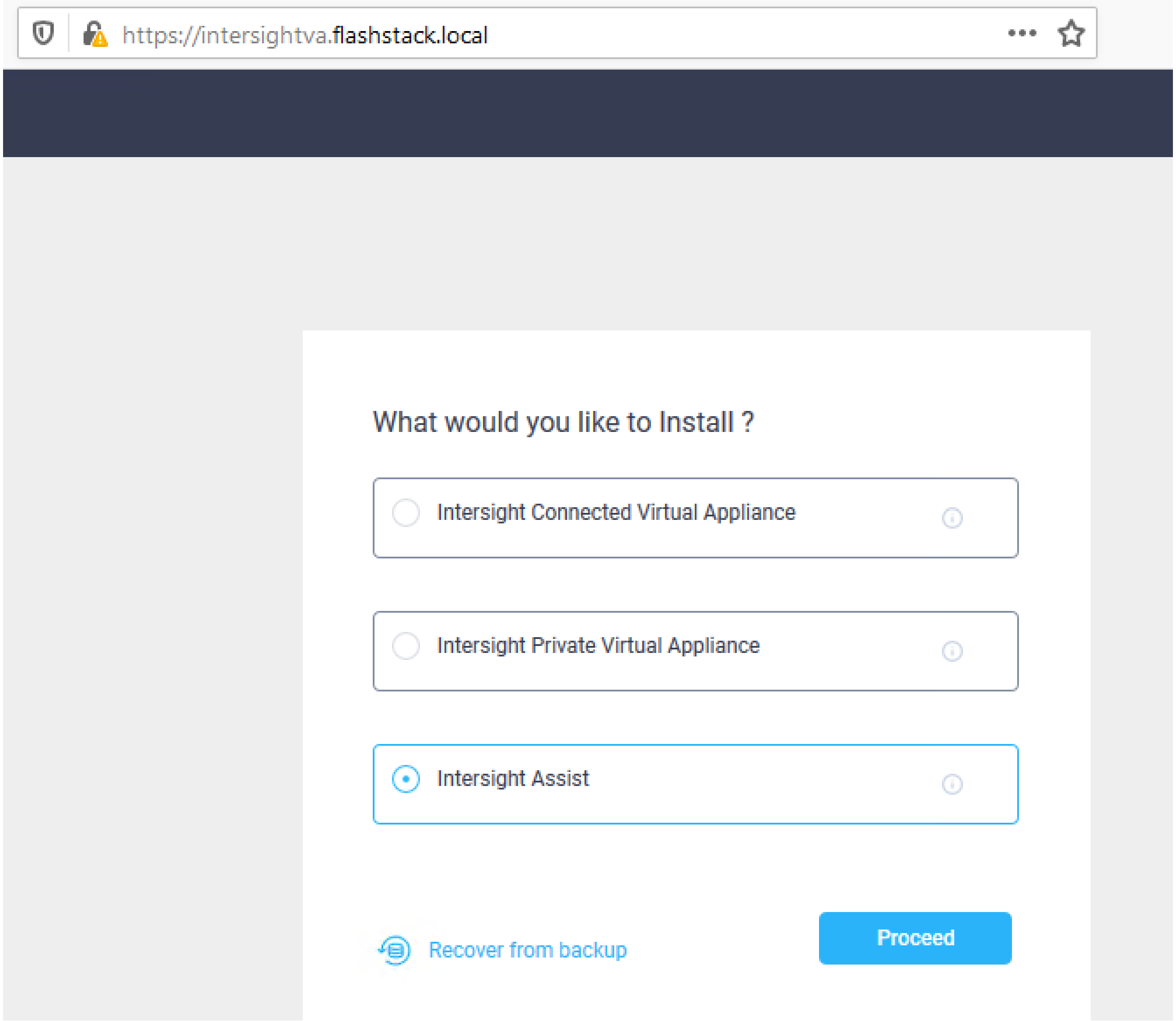
All properties have valid values

Uncategorized		1 settings
	Enable DHCP	Use DHCP for networking. All static params will be ignored. □
Uncategorized		1 settings
	IP Address	IPv4 address (Must have PTR record in your DNS)
Uncategorized		1 settings
	Net Mask	IPv4 Network Mask 255.255.255.0
Uncategorized		1 settings
	Default Gateway	IPv4 Default Gateway

Set Up Cisco Intersight Assist

After installing Intersight Virtual Appliance, start the VM host in vCenter. After a short period of time connect to the host using your web browser to proceed with the configuration. Provide your proxy configuration in the settings section to connect the installer to the Internet.

To set up Cisco Intersight Assist, follow these steps:



What would you like to Install ?

○ Intersight Connected Virtual Appliance

○ Intersight Private Virtual Appliance

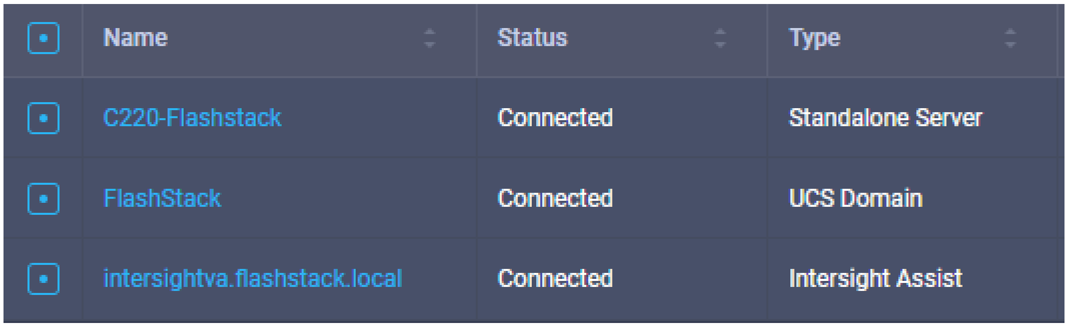
● Intersight Assist

1. Select Intersight Assist and click Proceed to start the two-step approach installation.

2. Connect Intersight Virtual Appliance.

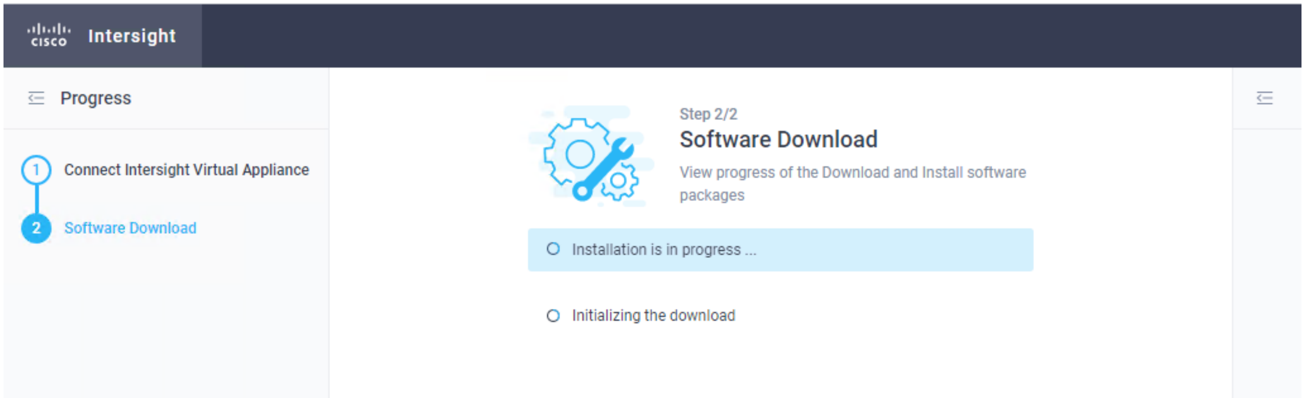
3. Software Download.

The first step provides the Device ID and Claim Code to claim the Virtual Appliance like a standard device in Cisco Intersight.



○	Name	Status	Type
○	C220-Flashstack	Connected	Standalone Server
○	FlashStack	Connected	UCS Domain
○	intersightva.flashstack.local	Connected	Intersight Assist

4. Once connected click Continue to move to the second setup step and wait for the download to complete which can take some time.



Step 2/2

Software Download

View progress of the Download and Install software packages

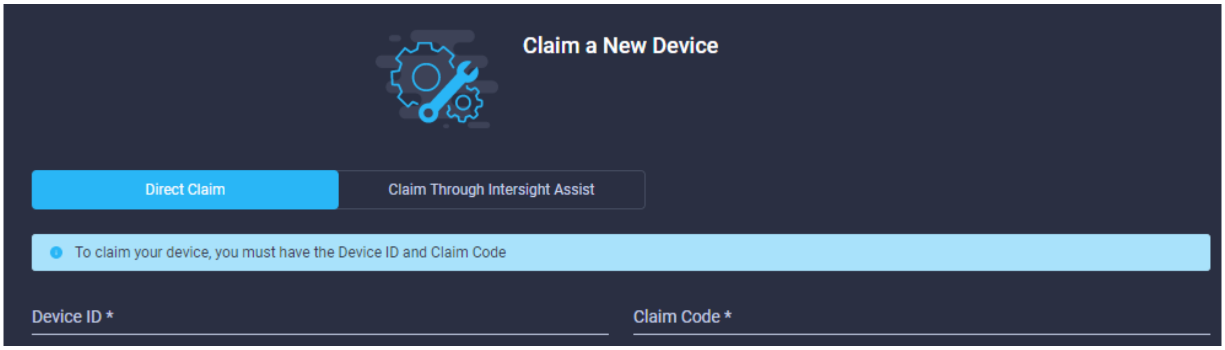
○ Installation is in progress ...

○ Initializing the download

Claim the Fabric Interconnects

To connect and access Cisco Intersight, follow these steps:

1. In Cisco UCS Manager, click the Admin tab in the navigation pane.
2. Select Device Connector from the drop-down list.
3. Click Settings and provide the DNS, NTP and proxy configuration. Click Save.
4. Enable Intersight Management.
5. In Cisco Intersight, click the Admin > Devices tab in the navigation pane.
6. Click Claim a new device.
7. Copy & Paste the Device ID and Claim Code from Cisco USCM.

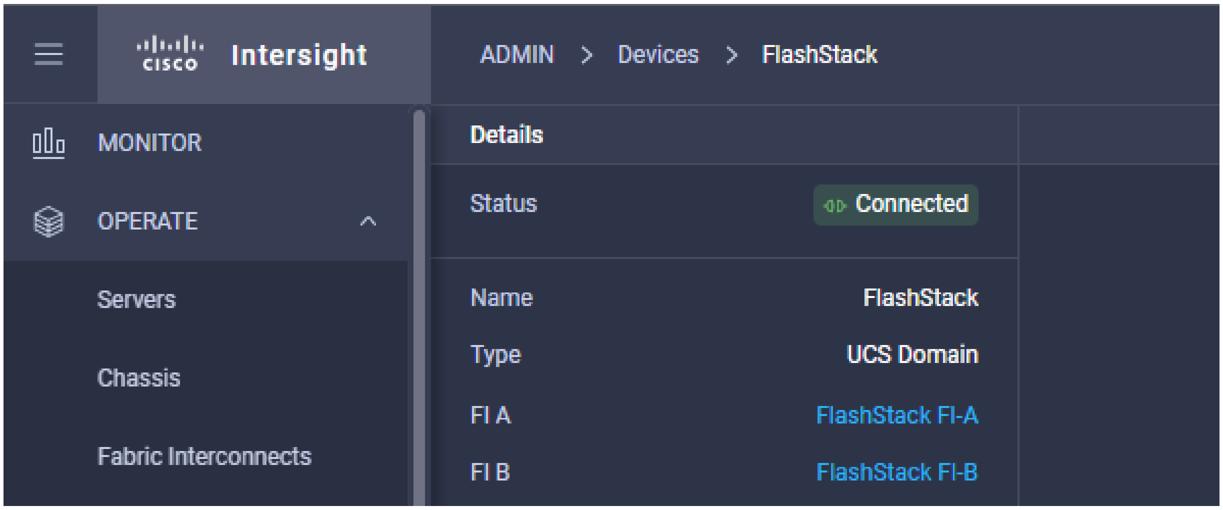


To claim your device, you must have the Device ID and Claim Code

Device ID *

Claim Code *

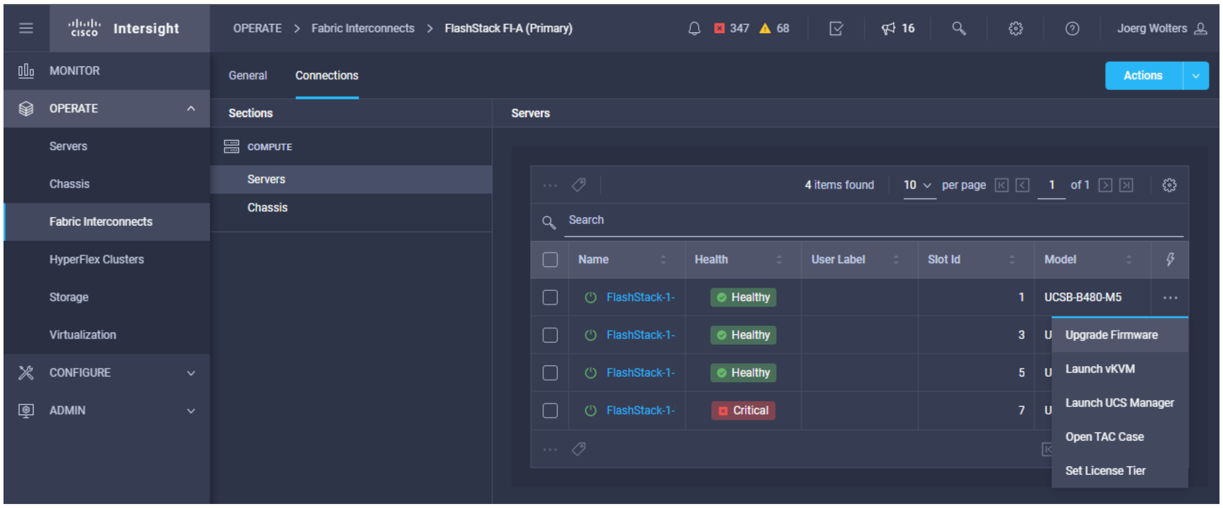
8. Click Claim to connect the fabric interconnects to Cisco Intersight.



Details

Status	Connected
Name	FlashStack
Type	UCS Domain
FI A	FlashStack FI-A
FI B	FlashStack FI-B

9. Click on one of the Fabric Interconnects to review chassis and server status. From the tool menu it is possible to open a TAC support case right away from Intersight uploading the tech support information for further trouble-shooting as well.

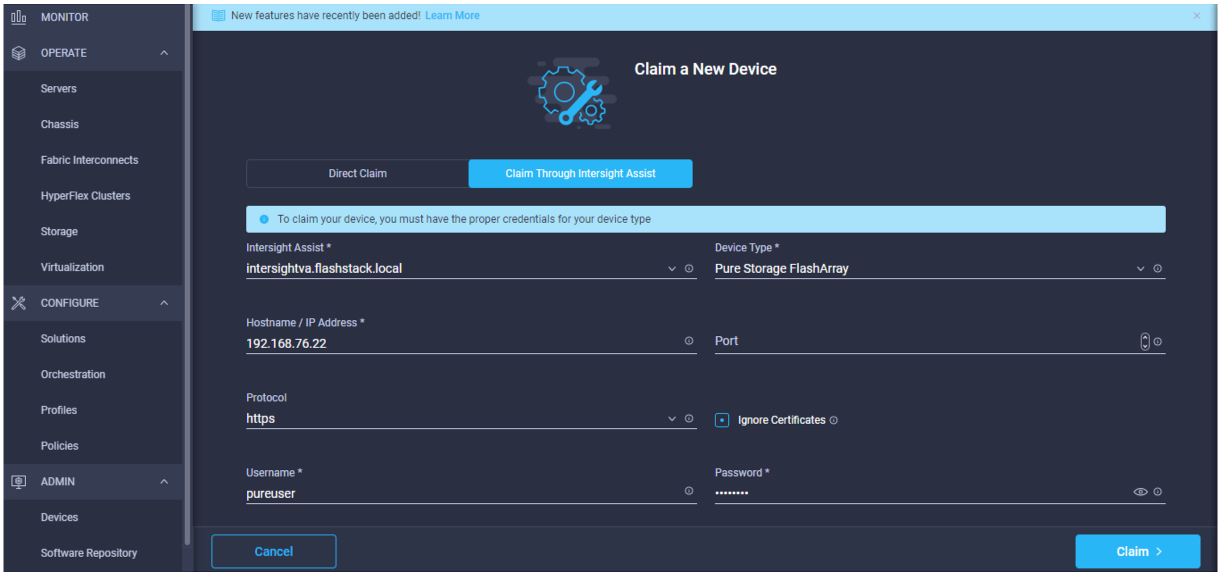


Name	Health	User Label	Slot Id	Model
FlashStack-1-	Healthy		1	UCSB-B480-M5
FlashStack-1-	Healthy		3	U
FlashStack-1-	Healthy		5	U
FlashStack-1-	Critical		7	U

Claim the FlashArray//X

To claim the FlashArray as new device in Cisco Intersight, follow these steps:

1. Connect to Cisco Intersight.
2. In Cisco Intersight, click the Admin > Devices tab in the navigation pane.
3. Click Claim a new device.
4. Click the Claim Through Intersight Assist tab.



Claim a New Device

To claim your device, you must have the proper credentials for your device type

Intersight Assist *: intersightva.flashstack.local

Device Type *: Pure Storage FlashArray

Hostname / IP Address *: 192.168.76.22

Port

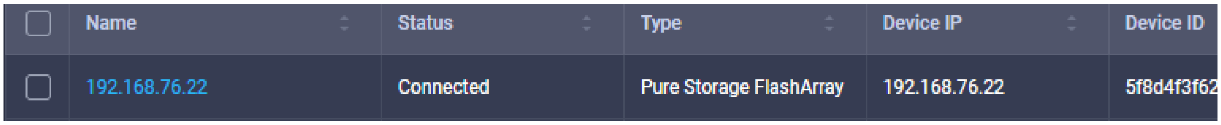
Protocol: https

☑ Ignore Certificates

Username *: pureuser

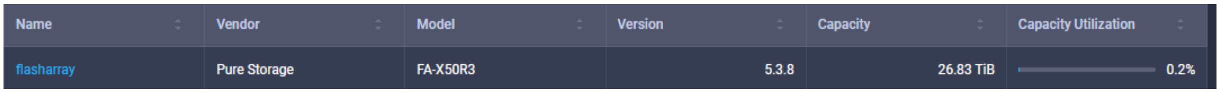
Password *: ••••••••

5. Select device type Pure Storage FlashArray.
6. Enter the hostname or IP address.
7. Enter pureuser as username and the user password. Click Claim.
8. Once the claim process completes the FlashArray//X is listed as new device.



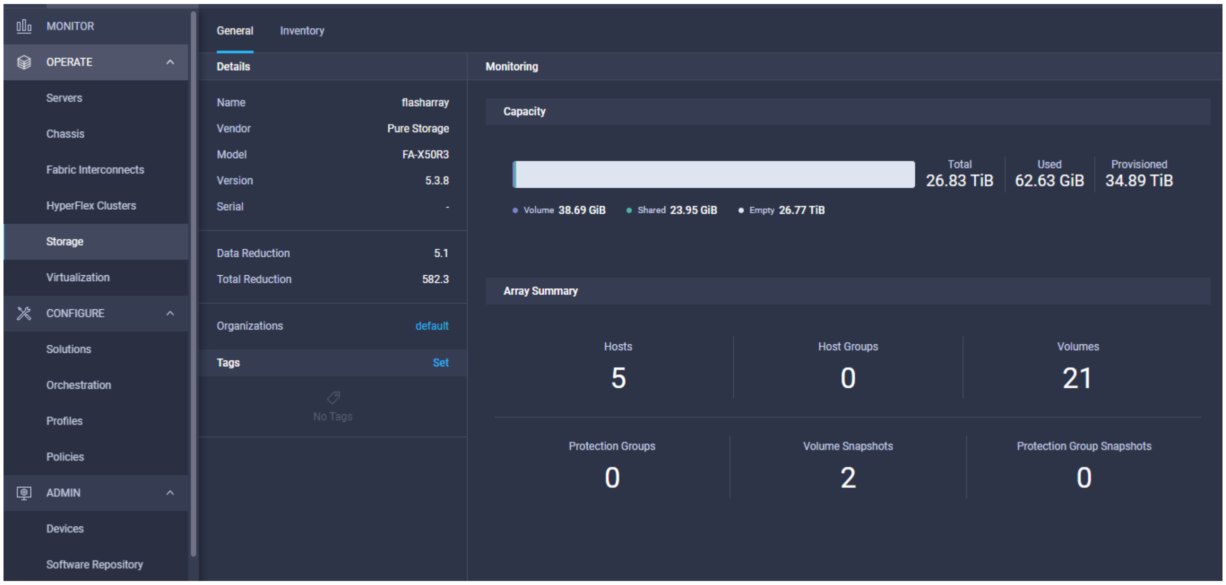
□	Name	Status	Type	Device IP	Device ID
□	192.168.76.22	Connected	Pure Storage FlashArray	192.168.76.22	5f8d4f3f62

9. Click Operation > Storage tab in the navigation pane.



Name	Vendor	Model	Version	Capacity	Capacity Utilization
flasharray	Pure Storage	FA-X50R3	5.3.8	26.83 TiB	0.2%

10. Select the FlashArray//X and obtain capacity and usage information from the overview tab.



Details

Name	flasharray
Vendor	Pure Storage
Model	FA-X50R3
Version	5.3.8
Serial	-
Data Reduction	5.1
Total Reduction	582.3
Organizations	default
Tags	Set

No Tags

Monitoring

Capacity

Total 26.83 TiB | Used 62.63 GiB | Provisioned 34.89 TiB

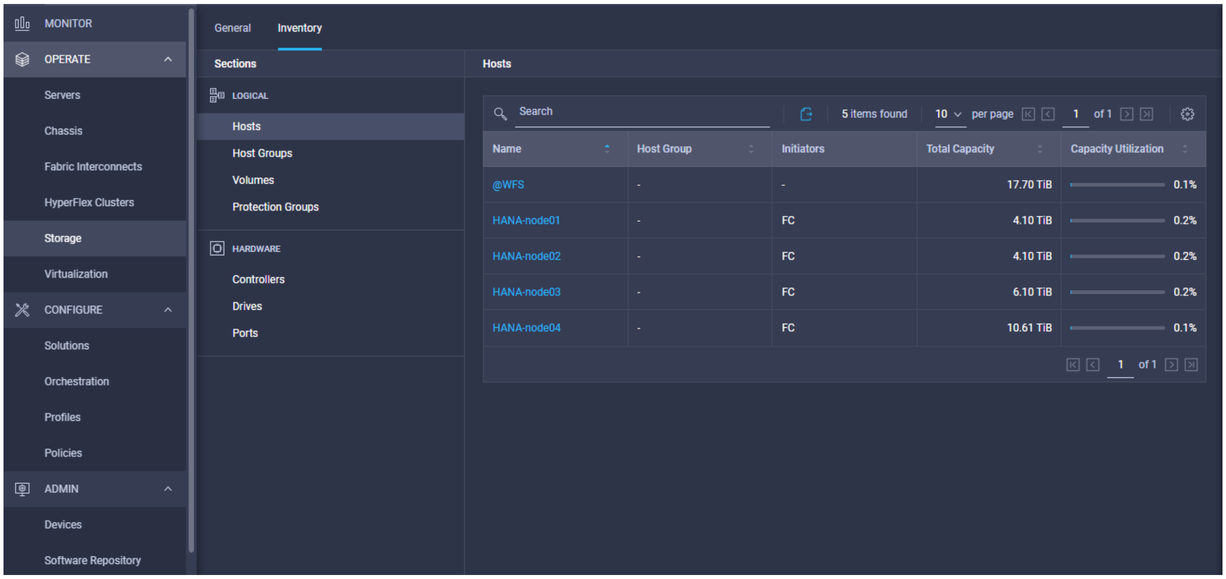
● Volume 38.69 GiB ● Shared 23.95 GiB ● Empty 26.77 TiB

Array Summary

Hosts	Host Groups	Volumes
5	0	21

Protection Groups	Volume Snapshots	Protection Group Snapshots
0	2	0

11. Monitor all host and volume information from the Inventory tab.



Hosts

5 items found | 10 per page | 1 of 1

Name	Host Group	Initiators	Total Capacity	Capacity Utilization
@WFS	-	-	17.70 TiB	0.1%
HANA-node01	-	FC	4.10 TiB	0.2%
HANA-node02	-	FC	4.10 TiB	0.2%
HANA-node03	-	FC	6.10 TiB	0.2%
HANA-node04	-	FC	10.61 TiB	0.1%

1 of 1

Validation

Test Plan

SAP HANA Hardware and Cloud Measurement

The SAP HANA hardware and cloud measurement tool (HCMT) collects information on the infrastructure intended for SAP HANA deployments. The tool measures the key performance indicator requirements defined by SAP and helps to understand the infrastructure can achieve satisfactory base performance as well as overall performance given the intended SAP HANA usage. The measurement results are saved into a single file, which can be uploaded to the SAP HANA hardware and cloud measurement analysis web page for further analysis and reporting.

SAP note 2493172 - SAP HANA Hardware and Cloud Measurement Tools provides more detailed information on the usage of the HCMT tool. It runs a series of automated tests, for example network tests, file system consistency tests or storage and CPU benchmark tests.

The HCMT execution plan for SAP HANA Scale Up environments doesn't require any modification. To include the non-volatile DC PMM memory configuration, adapt the execution plan and provide the appropriate value for the parameter NvmBasePath:

```
# vi <path>/setup/config/executionplan.json
{
   "Comment": "Persistent memory mount paths, keep this empty for non nvm
systems",
   "Name": "NvmBasePath",
   "Value": [
"/hana/pmem/nvmem0,/hana/pmem/nvmem1,/hana/pmem/nvmem2,/hana/pmem/nvmem3" ],
   "Request": "true"
 },
```

The HCMT execution plan for SAP HANA Scale Out environments require some modifications as well. Add the Scale Out hosts for the Hosts parameter and insert two new sections with the HANA log and data volume information of the additional hosts:

```
# vi <path>/setup/config/executionplan.json
{
   "Comment": "Hosts for scale-out measurements, keep this empty for scale-up",
   "Name": "Hosts",
   "Value": "cishana02,cishana03",
   "Request": "true"
},
{
   "Comment": "Hosts for scale-out measurements, keep this empty for scale-up",
   "Name": "LogVolumeHosts",
   "Value": [ "/hana/log", "/hana/log" ],
   "Request": "true"
},
{
   "Comment": "Hosts for scale-out measurements, keep this empty for scale-up",
   "Name": "DataVolumeHosts",
   "Value": [ "/hana/data", "/hana/data" ],
   "Request": "true"
```

```
    },
```

Because of the long HCMT runtime it is recommended to run the SSH terminal(s) within the jump host. Execute the tool on the command line:

```
    # ./hcmt -v -p <path>/setup/config/executionplan.json
```

Upload the measurement result file to see whether the infrastructure setup meets the configuration and performance requirements.

1. Connect to https://hotui-supportportal.dispatcher.hana.ondemand.com/index.html

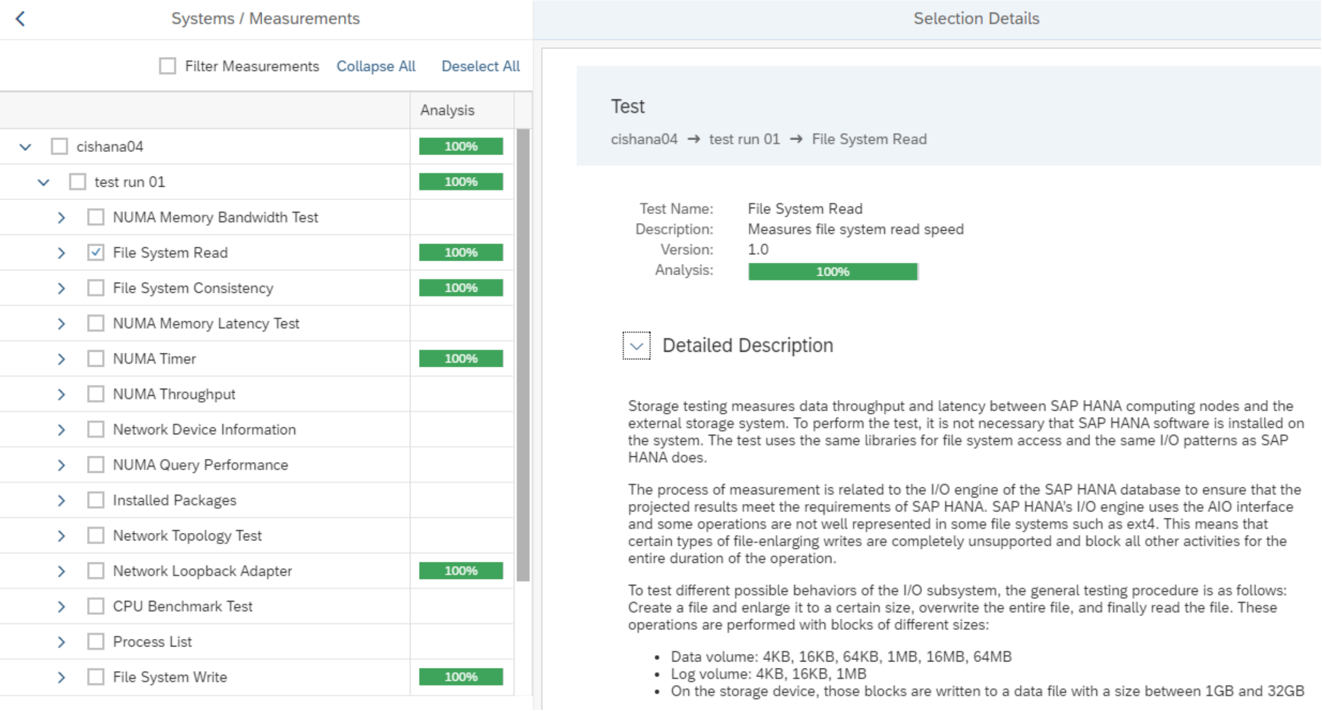
2. Authenticate with your S-User ID.

3. Create a new host entry and provide the requested server details.

4. Select the host entry and press the arrow menu entry to upload the measurement data.

5. Follow the onscreen instructions and click Submit.

The HCMT analysis provides a graphical and textual representation of your measurement results. It allows you to see which parts of your system are doing well and which parts may need some changes or improvements to achieve the required performance.



	Analysis
☐ cishana04	100%
☐ test run 01	100%
☐ NUMA Memory Bandwidth Test	
☑ File System Read	100%
☐ File System Consistency	100%
☐ NUMA Memory Latency Test	
☐ NUMA Timer	100%
☐ NUMA Throughput	
☐ Network Device Information	
☐ NUMA Query Performance	
☐ Installed Packages	
☐ Network Topology Test	
☐ Network Loopback Adapter	100%
☐ CPU Benchmark Test	
☐ Process List	
☐ File System Write	100%

Test

cishana04 → test run 01 → File System Read

Test Name: File System Read
Description: Measures file system read speed
Version: 1.0
Analysis: 100%

Detailed Description

Storage testing measures data throughput and latency between SAP HANA computing nodes and the external storage system. To perform the test, it is not necessary that SAP HANA software is installed on the system. The test uses the same libraries for file system access and the same I/O patterns as SAP HANA does.

The process of measurement is related to the I/O engine of the SAP HANA database to ensure that the projected results meet the requirements of SAP HANA. SAP HANA's I/O engine uses the AIO interface and some operations are not well represented in some file systems such as ext4. This means that certain types of file-enlarging writes are completely unsupported and block all other activities for the entire duration of the operation.

To test different possible behaviors of the I/O subsystem, the general testing procedure is as follows: Create a file and enlarge it to a certain size, overwrite the entire file, and finally read the file. These operations are performed with blocks of different sizes:

- Data volume: 4KB, 16KB, 64KB, 1MB, 16MB, 64MB
- Log volume: 4KB, 16KB, 1MB
- On the storage device, those blocks are written to a data file with a size between 1GB and 32GB

For Scale-Out environments HCMT will run on all nodes in parallel and the HCMT analysis provides the result of the network topology tests for the host to host communication in addition to the test runs of a Scale Up node.

SAP HANA Scale Out High Availability Test

SAP HANA Scale-Out deployments leverage the inherit HA capabilities of SAP HANA having a standby host running within the same SAP HANA topology.

The test plan included four different failover test scenarios:

- Deactivate a worker node by rebooting the node
- Failover and failback with tidy mountpoints from and to the master nameserver
- Trigger a double failover when the standby node is not a master as well.
- Cause a split-brain situation deactivating the management and internode network interfaces.

All scenarios provide either a continuous operation except of the split-brain situation in the 2+1 setup, when SAP HANA operation continued after ethernet network connectivity is reestablished.

Summary

The Cisco and Pure Storage converged infrastructure solution, FlashStack, delivers maximum performance and reliability for business-critical applications with all flash storage. The best-in-class storage, server and network components serve as a foundation for a variety of workloads not limited to SAP HANA. The architectural design can be quickly and confidently deployed. FlashStack Datacenter is predesigned to provide agility to the large enterprise data centers with high availability and storage scalability. With a FlashStack solution, customers can leverage a secure, integrated, and optimized stack that includes compute, network, and storage resources that are sized, configured, and deployed in a flexible manner.

Cisco Intersight provides management and support capabilities for the Intersight-connected environment including the Pure Storage FlashArray//X and all information pertaining to VMware vSphere vCenter. It simplifies the infrastructure management and provides proactive support for the FlashStack environment.

Some Intersight capabilities are:

- View general and inventory hardware information including the Pure Storage FlashArray//X.
- Manage and monitor the Cisco UCS server nodes and the Pure Storage FlashArray//X.
- View VMware vSphere vCenter general and inventory information - Datacenters, Clusters, Hosts, Virtual Machines and Datastores.
- Using the workflow designer, create and execute your own workflows manipulating storage and other infrastructure components together to automate initial deployment/ device reconfiguration or to deploy/configure VMware vSphere components.

FlashStack is a flexible infrastructure platform composed of pre-sized storage, networking, and server components. It is designed to ease your IT transformation and operational challenges with maximum efficiency and minimal risk.

FlashStack differs from other solutions and is so powerful for SAP environments by providing:

- Integrated, validated technologies from industry leaders and top-tier software partners.
- Cisco UCS stateless computing architecture provided by the Service Profile capability of Cisco UCS allows for fast, non-disruptive workload changes to be executed simply and seamlessly across the integrated Cisco UCS infrastructure and Cisco x86 servers.
- A single platform built from unified compute, fabric, and storage technologies, allowing you to scale to large-scale data centers without architectural changes.
- Centralized, simplified management of all infrastructure resources, including the FlashArray//X through Cisco Intersight.
- Evergreen storage so you will never pay for more storage than you need, but still have ample storage available on demand when you need it.
- A flexible Cooperative Support Model that resolves issues rapidly and spans across new and legacy products.

Appendix

Appendix 1: Configuration Variables

This appendix summarized the configuration variables required to configure the FlashStack environment.

Table 15. Cisco Nexus Switch Configuration Variables

Variable name	Description	Custom Value
<var_nexus_A_hostname>	Cisco Nexus A host name	
<var_nexus_A_mgmt0_ip>	Out-of-band Cisco Nexus A management IP address	
<var_oob_vlan_net>	Out-of-band management network netmask	
<var_oob_vlan_gw>	Out-of-band management network default gateway	
<var_nexus_B_hostname>	Cisco Nexus B host name	
<var_nexus_B_mgmt0_ip>	Out-of-band Cisco Nexus B management IP address	
<var_global_ntp_server_ip>	NTP server IP address	
<var_nexus_vpc_domain_id>	Unique Cisco Nexus switch VPC domain ID for Nx93180YC-FX switch pair	
<var_ucs_clustername>	Cisco UCS Manager cluster host name	

Table 16. VLAN ID Configuration Variables

Variable name	Description	Custom Value
<var_oob_vlan_id>	Out-of-band management interfaces	76
<var_client_vlan_id>	Client Network for HANA Data/log VLAN ID	222
<var_appserver_vlan_id>	Application Server Network for HANA Data/log VLAN ID	223
<var_datasource_vlan_id>	Data source Network for HANA Data/log VLAN ID	224
<var_backup_vlan_id>	Backup Network for HANA Data/log VLAN ID	221
<var_nfs-shared_vlan_id>	/hana/shared NFS network	111
<var_internal_vlan_id>	Node to Node Network for HANA Data/log VLAN ID	220

<var_replication_vlan_id>	Replication Network for HANA Data/log VLAN ID	225

Table 17. Cisco MDS Switch Configuration Variables

Variable name	Description	Custom Value
<var_mds-A_hostname>	Cisco MDS A host name	
<var_mds-A_ mgmt0_ip>	Out-of-band Cisco MDS A management IP address	
<var_mds-B_hostname>	Cisco MDS B host name	
<var_mds-B_ mgmt0_ip>	Out-of-band Cisco MDS B management IP address	
<var_oob_vlan_net>	Out-of-band management network netmask	
<var_oob_vlan_gw>	Out-of-band management network default gateway	
<var_global_ntp_server_ip>	NTP server IP address	
<var_fc-pc_A_id>	Fibre Channel - Port Channel ID for MDS A	
<var_fc-pc_B_id>	Fibre Channel - Port Channel ID for MDS B	
<var_san_A_id>	VSAN ID for MDS A	
<var_san_B_id>	VSAN ID for MDS B	

Table 18. Cisco Fabric Interconnect Configuration Variables

Variable name	Description	Custom Value
<var_passwd>	Cisco UCS Admin Password	
<var_ucs_clustername>	Cisco UCS Manager cluster host name	
<var_ucsa_mgmt_ip>	Cisco UCS fabric interconnect (FI) A out-of-band management IP address	
<var_ucsb_mgmt_ip>	Cisco UCS fabric interconnect (FI) B out-of-band management IP address	
<var_oob_vlan_net>	Out-of-band management network netmask	
<var_oob_vlan_gw>	Out-of-band management network default gateway	
<var_ucs_cluster_ip>	Cisco UCS Manager cluster IP address	
<var_ucsb_mgmt_ip>	Cisco UCS FI B out-of-band management IP address	

<var_nameserver_ip>	DNS Server IP address	
<var_dns_domain_name>	Default Domain Name	

Table 19. Cisco UCS Configuration Variables

Variable name	Description	Custom Value
<var_ipmi_username>	IPMI/Redfish username	sapadm
<var_ipmi_password>	IPMI/Redfish user password	

Table 20. Server01 Configuration Variables

Variable name	Description	Custom Value
<var_server01_mgmt_ip>	Management Host IP address	
<var_server01_mgmt_hostname>	Management Host name	
<var_server01_hostname>	Server Host Name	
<var_os_default_IPv4_gateway>	Default IPv4 Gateway	
<var_client_ipaddr-node1>	Client Network IP address	
<var_appserver_ipaddr-node1>	Application Server Network IP address	
<var_datasource_ipaddr-node1>	Data source Network IP address	
<var_backup_ipaddr-node1>	Backup Network IP address	
<var_nfs-shared_ipaddr-node1>	HANA shared NFS network IP address	
<var_internal_ipaddr-node1>	Internode Network IP address	
<var_replication_ipaddr-node1>	Replication Network IP address	
<var_os_root_pw>	Root password	

Table 21. Pure Storage Configuration Variables Windows Failover Cluster IPs

Ethernet IP Address Requirement	Default DNS Hostname	Validation setup values
<var_oob_purect0_ip>	FlashArray//X CT0 controller out-of-band management IP	
<var_oob_purect1_ip>	FlashArray//X CT1 controller out-of-band management IP	
<var_oob_pure_gw>	FlashArray//X out-of-band management network default gateway	
< var_oob_purec_net>	FlashArray//X out-of-band management network netmask	

<var_purecluster_net>	Purity//FA Cluster IP netmask	

Appendix 2: Reference

SAP HANA TDI Documentation

SAP HANA TDI: Overview

http://go.sap.com/documents/2016/05/827c26ba-717c-0010-82c7-eda71af511fa.html

SAP HANA TDI: FAQ

http://go.sap.com/documents/2016/05/e8705aae-717c-0010-82c7-eda71af511fa.html

SAP HANA TDI: Storage Requirements

http://go.sap.com/documents/2015/03/74cdb554-5a7c-0010-82c7-eda71af511fa.html

SAP HANA TDI: Network Requirements

https://www.sap.com/documents/2016/08/1cd2c2fb-807c-0010-82c7-eda71af511fa.html

SAP Notes

- SAP Note 2235581 - SAP HANA: Supported Operating Systems
- SAP Note 2578899 - SUSE Linux Enterprise Server 15: Installation Note
- SAP Note 2684254 - SAP HANA DB: Recommended OS settings for SLES 15 for SAP Applications 15
- SAP Note 1275776 - Linux: Preparing SLES for SAP environments
- SAP Note 2526952 - Red Hat Enterprise Linux for SAP Solutions
- SAP Note 2772999 - Red Hat Enterprise Linux 8.x: Installation and Configuration
- SAP Note 2777782 - SAP HANA DB: Recommended OS Settings for RHEL 8
- SAP Note 2382421 - Optimizing the Network Configuration on HANA- and OS-Level
- SAP Note 2493172 - SAP HANA Hardware and Cloud Measurement Tools

Cisco

FlashStack for SAP HANA TDI Design Guide

https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/UCS_CVDs/flashstack_sap_hana_tdi_design.html

Performance Tuning Guide for Cisco UCS M5 Servers

https://www.cisco.com/c/dam/en/us/products/collateral/servers-unified-computing/ucs-b-series-blade-servers/whitepaper_c11-740098.pdf

Cisco UCS for SAP HANA with Intel Optane DC Persistent Memory Module

https://www.cisco.com/c/dam/en/us/products/servers-unified-computing/ucs-b-series-blade-servers/whitepaper-c11-742627.pdf

Cisco MDS 9000 Family NX-OS Fabric Configuration Guide - Configuring and Managing Zones

https://www.cisco.com/c/en/us/td/docs/switches/datacenter/mds9000/sw/6_2/configuration/guides/fabric/nx-os/nx_os_fabric/zone.html#47933

Cisco Intersight Help Center

https://intersight.com/help/home

Overview Cisco Intersight Assist

https://www.cisco.com/c/en/us/td/docs/unified_computing/Intersight/cisco-intersight-assist-getting-started-guide/m-overview-of-cisco-intersight-assist.pdf

Configure a Cisco AppDynamics Monitoring Solution for SAP Applications:
https://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/unified-computing/appd-sap-monitoring-wp.html

Pure Storage

SAP HANA Implementation Best Practices on FlashArray//X

https://support.purestorage.com/Solutions/SAP/SAP_HANA_on_FlashArray/Getting_Started/SAP_HANA_Implementation_and_Best_Practices

SAP Applications on Pure Storage FlashStack

https://www.purestorage.com/solutions/applications/sap.html

FlashArray//X Series

https://www.purestorage.com/products/nvme/flasharray-x.html

Intel

Persistent Memory Wiki

https://nvdimm.wiki.kernel.org/2mib_fs_dax

Linux

EDAC project

http://bluesmoke.sourceforge.net

MCE log

http://bluesmoke.sourceforge.net

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Acknowledgements

For their support and contribution to the design, validation, and creation of this Cisco Validated Design and Deployment Guide, the author would like to thank:

- Shailendra Mruthunjaya, Technical Marketing Engineer, Cisco Systems, Inc.
- Pramod Ramamurthy, Technical Marketing Engineer, Cisco System GmbH
- Andrew Sillifant, Solution Architect, Pure Storage UK Ltd.

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