FlexPod Select with Cloudera's Distribution including Apache Hadoop (CDH)

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About the Authors

Raghunath Nambiar

Raghunath Nambiar, Strategist, Data Center Solutions, Cisco Systems

Raghunath Nambiar is a Distinguished Engineer at Cisco's Data Center Business Group. His current responsibilities include emerging technologies and big data strategy.

Prem Jain

Prem Jain, Senior Solutions Architect, Big Data team, NetApp Systems

Prem Jain is a Senior Solutions Architect with the NetApp big data team. Prem’s 20+ year career in technology is comprised of solution development for data migration, virtualization, HPC and big data initiatives. He has architected innovative big data and data migration solutions and authored several reference architectures and technical white papers.

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FlexPod Select with Cloudera's Distribution including Apache Hadoop (CDH)

Overview

Apache Hadoop, a software framework is gaining importance in IT portfolios. The FlexPod Select for Hadoop is an extension of FlexPod initiative built based on Cisco Common Platform Architecture (CPA) for Big Data for deployments that need enterprise class external storage array features. The solution offers a comprehensive analytic stack for big data that includes compute, storage, connectivity, enterprise Hadoop distribution with a full range of services to manage heavy workloads. The offer is a pre-validated solution for enterprise Hadoop deployments with breakthroughs around Hadoop stability, operations, and storage efficiency. By integrating all the hardware and software components and using highly reliable products, businesses can meet their tight SLAs around data performance while reducing the risk of deploying Hadoop.

Audience

The intended audience of this document includes, but is not limited to, sales engineers, field consultants, professional services, IT managers, partner engineering, and customers who want to deploy FlexPod Select for Hadoop with Cloudera.

Big Data Challenges and Opportunities

Big data is defined as data that is so high in volume and high in speed that it cannot be affordably processed and analyzed using traditional relational database tools. Typically, machine generated data combined with other data sources creates challenges for both businesses and their IT organizations. With data in organizations growing explosively and most of that new data unstructured, companies and their IT groups are facing a number of extraordinary issues related to scalability and complexity.

Lines of business are motivated by top line business benefits to work on unsolvable or unaffordable problems involving machine generated data, often combined with other traditional data sources. They exploit big data to derive competitive advantage, provide better customer experiences and help make decisions faster. Big data can be used to prevent fraud, improve business logistics by correlating buyer

Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

behavior with inventory, correlate patient treatments to their cures, improve homeland security and government intelligence, cross correlating very huge data sets from credit card transactions, RFID scans, video surveillance, and many other sources. More specifically to cater to the big data needs, an Apache Hadoop workload or cluster is required.

Big data is more about business opportunities than reducing costs. To address these challenges and risks of big data, companies need analytical solutions that meet the following criteria:

- Provide resilient and reliable storage for Hadoop.
- Implement high-performance Hadoop clusters.
- Build on an open partner-based, ecosystem.
- Allow efficient Hadoop clustering.
- Scale compute and storage independently and quickly as data grows in volume.
- Cost effectiveness.

The FlexPod Select for Hadoop is designed to address these challenges.

FlexPod Select for Hadoop Benefits

The FlexPod Select for Hadoop combines leading edge technologies from Cisco and NetApp to deliver a solution that exceeds the requirements of emerging big data analytics so that businesses can manage, process, and unlock the value of new and large volume data types that they generate. Designed for enterprises in data-intensive industries with business critical SLAs, the solution offers pre-sized storage, networking, and compute in a highly reliable, ready to deploy Apache Hadoop stack.

The key benefits of this solutions are described in Table 1.

Table 1 Key benefits of FlexPod Select for Hadoop

Enterprise Class Big Data Architecture	Accelerate Time to Value	Co-existence with Enterprise Applications
- Easy manageability, more reliability, scalability and high performance. - Fully redundant architecture. - Superior reliability and stability. - Lower cluster downtime. - Faster recovery from drive failure. - Fewer copies of Hadoop data means less storage to manage, higher storage efficiency. - Dynamically add capacity to as data grows, expand storage while cluster is running. - Protection of namenode Single Point of Failure.	- Reduced risk, better power and floor space foot print, pre-validated solution. - Validated, pre-tested, reference architecture (Cisco Verified Design). - Pre-sized, leading-edge storage, compute, networking with Hadoop (Cloudera Enterprise Core). - Higher performance with faster interconnects, lower latency and less network congestion. - Well-established FlexPod channel. - Independent scaling of compute and storage or scale together. - Allocate more/less storage capacity to compute node.	- Seamless data and management integration with enterprise applications and traditional FlexPod deployments. - Global support and services. - Open analytical stack for higher interoperability within infrastructure. - Hadoop handles data well, in any kind of schema. - Open solution with best in class components. - Proven at PB scale. - Lower TCO, less rack-space needed, lower power. required (180TB in 4U).

FlexPod Select for Hadoop with Cloudera Architecture

This section provides an architectural overview on the FlexPod Select for Hadoop with Cloudera. In this section you will find information on solution components and their configuration brief:

- Solution Overview, page 8
- Configuration Overview, page 9

Solution Overview

Building upon the success of FlexPod, market leaders, Cisco and NetApp deliver the enterprise-class solution FlexPod Select for Hadoop with a pre-validated, faster Time to Value (*TtV) Hadoop solution for enterprises that provides control of and insights from big data. The FlexPod Select for Hadoop is based on a highly scalable architecture, that can scale from single rack to multiple racks, built using the following components:

*TtV is the time to realize a quantifiable business goal.

Connectivity and Management

- Cisco UCS 6200 Series Fabric Interconnects provide high speed, low latency connectivity for servers and centralized management for all connected devices with UCS Manager. Deployed in redundant pairs they offer full redundancy, performance (active-active), and exceptional scalability for large number of nodes typical in big data clusters. UCS Manger enables rapid and consistent server integration using service profile, ongoing system maintenance activities such as firmware update operations across the entire cluster as a single operation, advanced monitoring, and option to raise alarms and send notifications about the health of the entire cluster.
- Cisco Nexus 2200 Series Fabric Extenders, act as remote line cards for Fabric Interconnects providing a highly scalable and extremely cost-effective connectivity for large number of nodes.
- Cisco UCS Manager resides within the Cisco UCS 6200 Series Fabric Interconnects. It makes the system self-aware and self-integrating, managing all of the system components as a single logical entity. Cisco UCS Manager can be accessed through an intuitive GUI, a command-line interface (CLI), or an XML API. Cisco UCS Manager uses service profiles to define the personality, configuration, and connectivity of all resources within Cisco UCS, radically simplifying provisioning of resources so that the process takes minutes instead of days. This simplification allows IT departments to shift their focus from constant maintenance to strategic business initiatives. It also provides the most streamlined, simplified approach commercially available today for updating firmwares of all server components.

Compute

- Cisco UCS C220M3 Rack-Mount Servers, 2-socket server based on Intel® Xeon® E-2600 series processors optimized for performance and density. This server is expandable to 512 GB of main memory and has 8 small factor internal front-accessible, hot-swappable disk drives and two PCIe Gen 3.0 slots.
- Cisco UCS Virtual Interface Card 1225, unique to Cisco UCS is a dual-port PCIe Gen 2.0 x8 10-Gbps adapter designed for unified connectivity for Cisco UCS C-series Rack-Mount Servers.

Storage

- NetApp E5460 storage array provides increased performance and bandwidth for Hadoop clusters along with higher storage efficiency and scalability.
- NetApp FAS2220 and the Data ONTAP storage operating system provides high reliability for Hadoop with reduced single points of failure, faster recovery time and namenode metadata protection with hardware RAID.

Software

- Cloudera® Enterprise Core is the Cloudera Distribution for Apache Hadoop (CDH). CDH is a leading Apache Hadoop-based platform which is 100% open source based.
- Cloudera Manager is Cloudera's advanced Hadoop management platform.
- Red Hat® Enterprise Linux® Server, the leading enterprise Linux distribution.

Configuration Overview

The solution is offered in a single rack and in multiple racks. The architecture consists of:

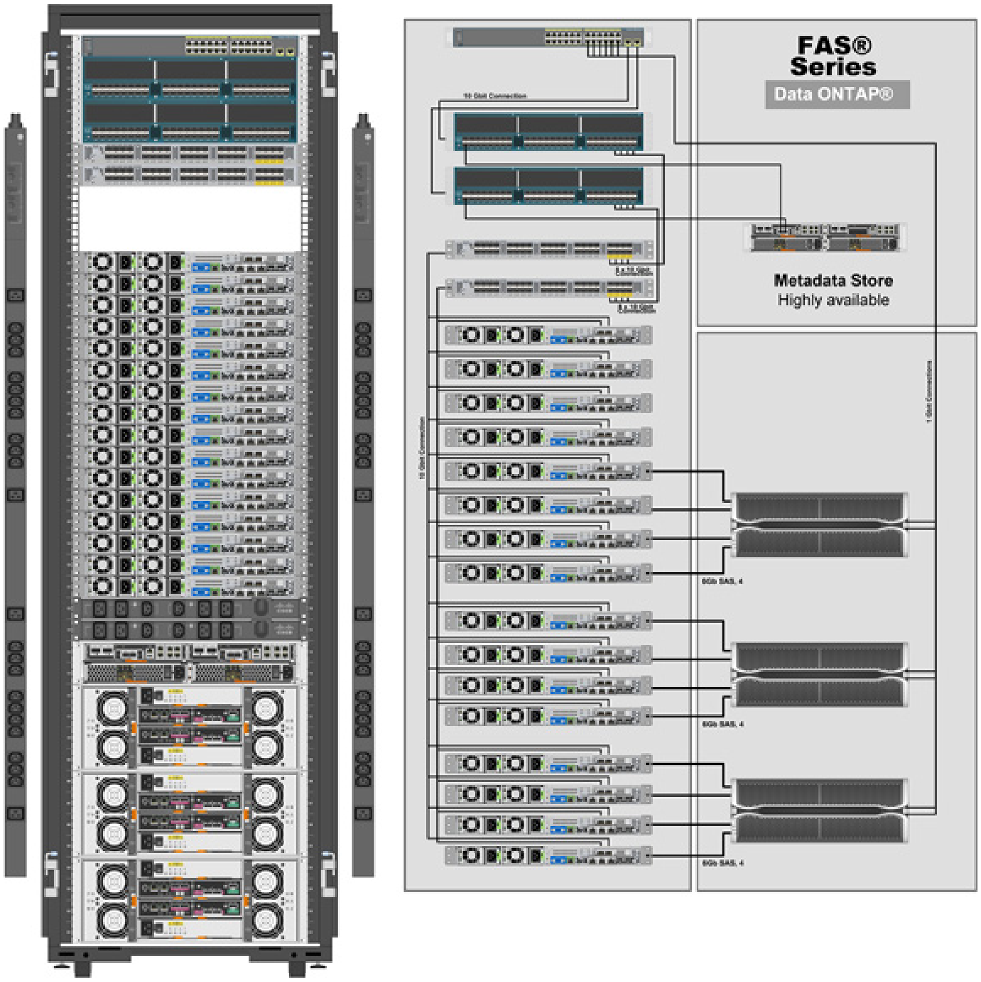
Master rack (single rack) is a standalone solution. The multiple rack solution consists of a master rack and one or more expansion racks. In a single UCS management domain, up to 9 expansion racks are supported. Deployments requiring more than 10 racks can be implemented by interconnecting multiple domains using Cisco Nexus 6000/7000 series switches and managed by UCS Central. Figure 1 shows the FlexPod Select for Hadoop master rack model.

Master Rack

The master rack consists of the following:

- Two Cisco UCS 6296UP Fabric Interconnects
- Two Cisco Nexus 2232PP Fabric Extenders
- Sixteen Cisco UCS C220M3 Rack-Mount Servers
- One Cisco Catalyst 2960S
- One NetApp FAS2220
- Three NetApp E5460
- Two vertical PDUs
- Two horizontal PDUs
- Cisco 42U Rack

Figure 1 Cisco Master Rack

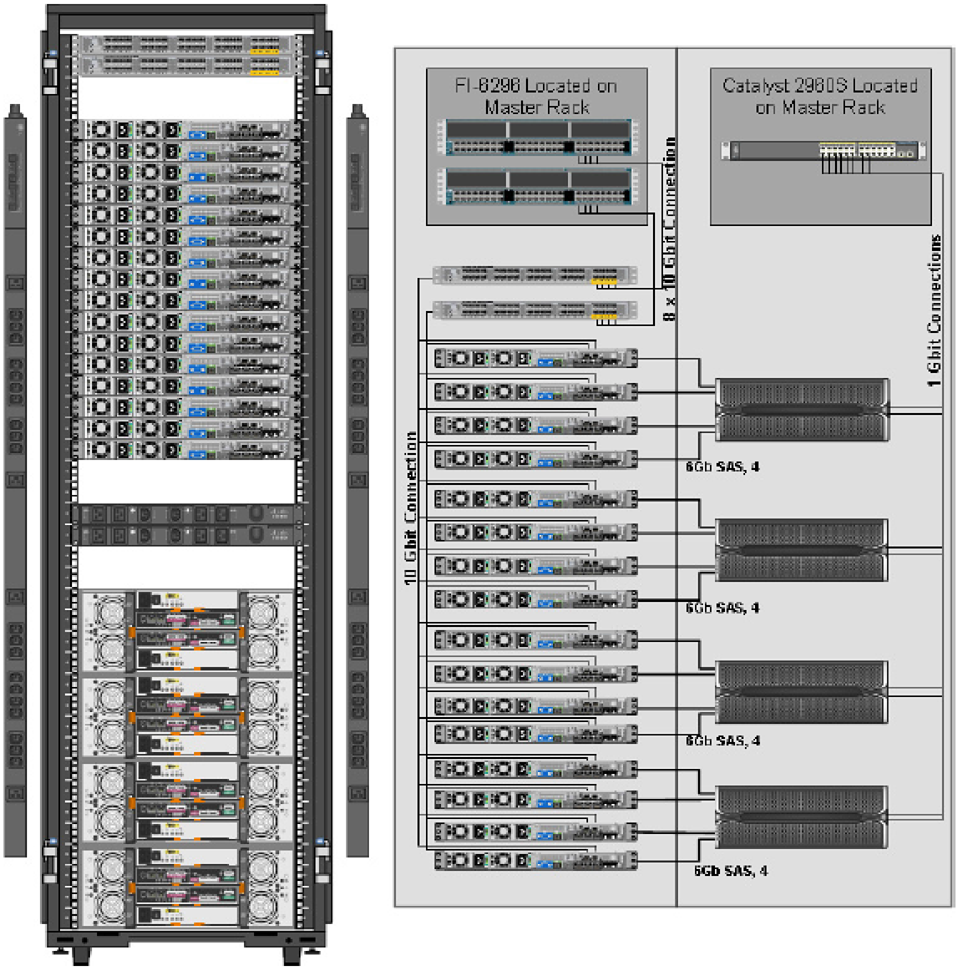


Expansion Rack

Figure 2 shows the FlexPod Select for Hadoop expansion rack model. The expansion rack consists of the following:

- Two Cisco Nexus 2232PP Fabric Extenders
- Sixteen UCS C220M3 Rack-Mount Servers
- Four NetApp E5460
- Two vertical PDUs
- Two horizontal PDUs
- Cisco 42U Rack

Figure 2 Cisco Expansion Rack



Rack and PDU Configuration

The rack configurations of the master rack and expansion rack are shown in Table 2 based on a Cisco 42U rack.

Table 2 Rack configuration details

Cisco 42U Racks	Master Rack	Expansion Rack
1	Cisco UCS FI 6296UP	
2		
3	Cisco UCS FI 6296UP	
4		
5	Cisco Nexus FEX 2232PP	Cisco Nexus FEX 2232PP
6	Cisco Nexus FEX 2232PP	Cisco Nexus FEX 2232PP

Table 2 ***Rack configuration details***

Cisco 42U Racks	Master Rack	Expansion Rack
7	Cisco UCS C220M3	Cisco UCS C220M3
8	Cisco UCS C220M3	Cisco UCS C220M3
9	Cisco UCS C220M3	Cisco UCS C220M3
10	Cisco UCS C220M3	Cisco UCS C220M3
11	Cisco UCS C220M3	Cisco UCS C220M3
12	Cisco UCS C220M3	Cisco UCS C220M3
13	Cisco UCS C220M3	Cisco UCS C220M3
14	Cisco UCS C220M3	Cisco UCS C220M3
15	Cisco UCS C220M3	Cisco UCS C220M3
16	Cisco UCS C220M3	Cisco UCS C220M3
17	Cisco UCS C220M3	Cisco UCS C220M3
18	Cisco UCS C220M3	Cisco UCS C220M3
19	Cisco UCS C220M3	Cisco UCS C220M3
20	Cisco UCS C220M3	Cisco UCS C220M3
21	Cisco UCS C220M3	Cisco UCS C220M3
22	Cisco UCS C220M3	Cisco UCS C220M3
23		
24	PDU	PDU
25	PDU	PDU
26	NetApp FAS 2220	
27		NetApp E5460
28	Cisco Catalyst 2960S	
29		
30		
31	NetApp E5460	NetApp E5460
32		
33		
34		
35	NetApp E5460	NetApp E5460
36		
37		
38		
39	NetApp E5460	NetApp E5460
40		
41		
42		

The configuration consists of two vertical PDUs and two horizontal PDUs. The Cisco UCS 6296UP Fabric Interconnects, NetApp E5460s and NetApp FAS2220 are connected to each of the horizontal PDUs. The Cisco Nexus 2232PP Fabric Extenders and Cisco UCS C220M3 Servers are connected to each of the vertical PDUs for redundancy; thereby, ensuring availability during power source failure.

Note Contact your Cisco representative for country specific information.

Fabric Configuration

The master rack configuration consists of two Cisco UCS 6296UP Fabric Interconnects and two Cisco Nexus Fabric Extender 2232PP forming two fabrics, Fabric A and Fabric B topology. The Cisco UCS C220M3 Servers 1 to 16 are connected to Fabric A and Fabric B using 10Gb Ethernet connectivity through Cisco Nexus 2232PP Fabric Extenders, with eight uplinks.

The configuration details of the master rack and expansion racks are shown in Figure 1 and Figure 2 respectively.

Storage Configuration

NetApp E5460 belong to the NetApp E5400 modular data storage system family that support big-bandwidth datasets requiring high sequential throughput. The NetApp E5460s are configured with dual SAS controllers and 60 3TB 7.2K RPM SAS disk drives.

For more information, see:

http://www.netapp.com/us/products/storage-systems/e5400/index.aspx

NetApp FAS2200 offers powerful, affordable, flexible data storage for midsized businesses and distributed enterprises. The NetApp FAS2220 has 6 drives (600GB, 10K rpm, SAS) and 4 x 1GbE ports and 2 x 10GbE ports.

For more information, see:

http://www.netapp.com/us/products/storage-systems/fas2200/

Server Configuration and Cabling

Figure 3 illustrates the physical connectivity of Cisco UCS 6296UP Fabric Interconnects, Cisco Nexus 2232PP Fabric Extenders, and Cisco UCS C220M3 Servers.

Figure 3 Cisco Hardware Connectivity

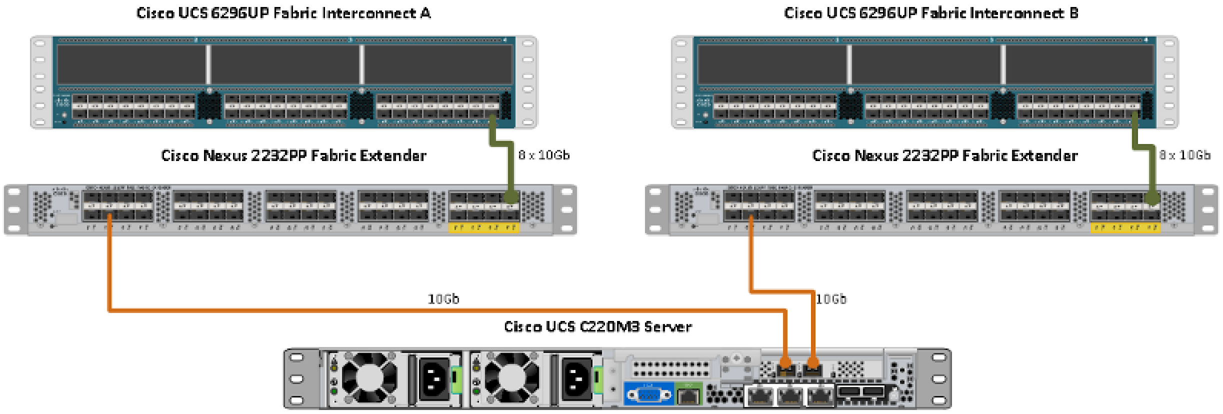
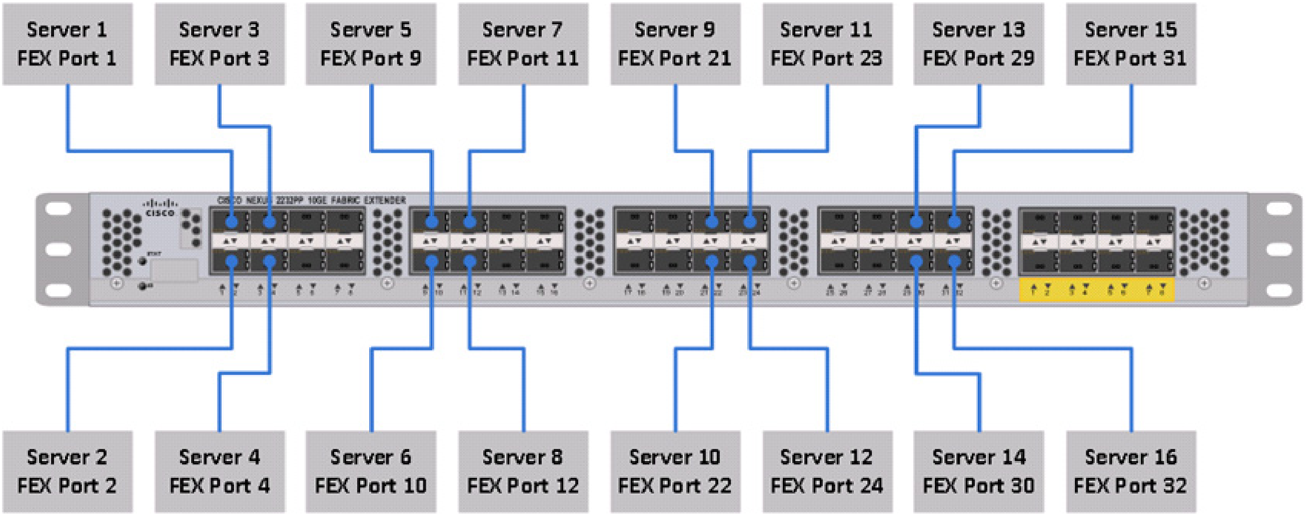

Cisco UCS 6296UP Fabric Interconnect A
Cisco UCS 6296UP Fabric Interconnect B
Cisco Nexus 2232PP Fabric Extender
8 x 10Gb
Cisco Nexus 2232PP Fabric Extender
8 x 10Gb
10Gb
10Gb
Cisco UCS C220M3 Server

Figure 4 shows the ports of the Cisco Nexus 2232PP Fabric Extender connecting the Cisco UCS C220M3 Servers. Sixteen Cisco UCS C220M3 Servers are used in the master and expansion rack configurations offered by the FlexPod Select for Hadoop.

Figure 4 Connectivity Diagram of Cisco Nexus 2232PP FEX and Cisco UCS C220M3 Servers



Note Cisco UCS Manager version used for this deployment is UCS 2.1(1e).

For more information on configuring single-wire management, see:

http://www.cisco.com/en/US/docs/unified_computing/ucs/c-series_integration/ucsm2.1/b_UCSM2-1_C-Integration_chapter_010.html

For more information on physical connectivity illustrations and cluster setup, see:

http://www.cisco.com/en/US/docs/unified_computing/ucs/c-series_integration/ucsm2.1/b_UCSM2-1_C-Integration_chapter_010.html#reference_FE5B914256CB4C47B30287D2F9CE3597

Software Requirements

For this deployment we have used Cloudera Distribution for Apache Hadoop (CDH), which is an open source distribution with the World's leading Apache Hadoop solution.

CDH

Cloudera software for Cloudera Distribution for Apache Hadoop is v4.x (CDH4). For more information on Cloudera, see:

www.cloudera.com.

RHEL

The operating system supported is Red Hat Enterprise Linux Server 6.2. For more information on the Linux support, see:

www.redhat.com.

Software Versions

Table 3 provides the software version details of all the software requirements for this model.

Table 3 Software version details

Layer	Components	Version or Release	Details
Compute	Cisco UCS C220M3	C220M3.1.4.7b.0.1005 20120256	Hardware BIOS version
Network	Cisco UCS 6296UP	UCS 2.1(1e)	Fabric Interconnect
	Cisco Nexus 2232PP	5.1(3)N2(2.11a)	Fabric Extender
Storage	NetApp FAS 2220	Data ONTAP 8.1.2 7-mode	FAS Storage
	NetApp E35460	07.84	E-Series Storage

Table 3 Software version details

Layer	Components	Version or Release	Details
Software	Red Hat Enterprise Linux Server	6.2 (x86_64)	Linux Distribution
	Cisco UCSM	2.1(1e)	UCS Embedded Management Software
	NetApp OnCommand System Manager	2.1	FAS Management Software
	NetApp SANtricity	10.84	E-Series Management Software
	Cloudera Enterprise Core	4.1.3 (x86_64)	Cloudera Hadoop Distribution
	Cloudera Manager	4.1.3 (x86_64)	Cloudera Hadoop Cluster management Software

Fabric Configuration

This section provides details for configuring a fully redundant, highly available configuration for a FlexPod Select for Hadoop. Follow these steps to configure Cisco 6296UP Fabric Interconnect.

1. Configure FI A
2. Configure FI B
3. Connect to IP address of FI A using web browser. Launch Cisco UCS Manger
4. Edit the chassis discovery policy.
5. Enable server and Uplink Ports
6. Create pools and polices for service profile template.
7. Create SP template, 16 profiles
8. Start discover process
9. Associate to server
10. FI Configuration for NetApp FAS2220

Performing an Initial Setup of Cisco UCS 6296UP Fabric Interconnects

Follow these steps for initial setup of the Cisco UCS 6296 Fabric Interconnects:

Cisco UCS 6296 FI A

1. Connect to the console port on the first Cisco UCS 6296 Fabric Interconnect.
2. At the configuration method prompt, enter **console**.
3. If asked to either do a new setup or restore from backup, enter **setup** to continue.
4. Enter **y** to continue to set up a new fabric interconnect.
5. Enter **y** to enforce strong passwords.

6. Enter the password for the admin user.
7. Enter the same password again to confirm the password for the admin user.
8. When asked if this fabric interconnect is part of a cluster, enter **y** to continue.
9. Enter **A** for the switch fabric.
10. Enter the cluster name for the system name.
11. Enter the Mgmt0 IPv4 address for management port on the fabric interconnect.
12. Enter the Mgmt0 IPv4 subnet mask for the management port on the fabric interconnect.
13. Enter the IPv4 address of the default gateway.
14. Enter the cluster IPv4 address.
15. To configure DNS, enter **y**.
16. Enter the DNS IPv4 address.
17. Enter **y** to set up the default domain name.
18. Enter the default domain name.
19. Review the settings that were printed to the console, and if they are correct, enter **yes** to save the configuration.
20. Wait for the login prompt to make sure the configuration is saved successfully.

Cisco UCS 6296UP FI B

1. Connect to the console port on the second Cisco UCS 6296 Fabric Interconnect.
2. At the configuration method prompt, enter **console**.
3. The installer detects the presence of the partner fabric interconnect and adds this fabric interconnect to the cluster. Enter **y** to continue the installation.
4. Enter the admin password for the first fabric interconnects.
5. Enter the Mgmt0 IPv4 address for the management port on the subordinate fabric interconnect.
6. Enter **y** to save the configuration.
7. Wait for the login prompt to make sure the configuration is saved successfully.

For more information on configuring Cisco UCS 6200 Series Fabric Interconnect, see:

http://www.cisco.com/en/US/docs/unified_computing/ucs/sw/gui/config/guide/2.0/b_UCSM_GUI_Configuration_Guide_2_0_chapter_0100.html

Logging into Cisco UCS Manager

Follow these steps to log into Cisco UCS Manager:

1. Open a Web browser and type the Cisco UCS 6296UP Fabric Interconnect cluster address.
2. If a Security Alert dialog box appears, click **Yes** to accept the security certificate and continue.
3. In the Cisco UCS Manager launch page, click **Launch UCS Manager**.
4. When prompted, enter admin for the user name and enter the administrative password and click **Login** to log in to the Cisco UCS Manager GUI.

Upgrade Cisco UCS Manager Software to Version 2.1(1e)

This document assumes the use of UCS 2.1(1e). For more information on upgrading the software version to Cisco UCS 2.0 release, see:

http://www.cisco.com/en/US/docs/unified_computing/ucs/sw/upgrading/from2.0/to2.1/b_UpgradingCiscoUCSFrom2.0To2.1.pdf

This link provides you information on upgrading Cisco UCS Manager software and Cisco UCS 6296 Fabric Interconnect software to version 2.1(1e).

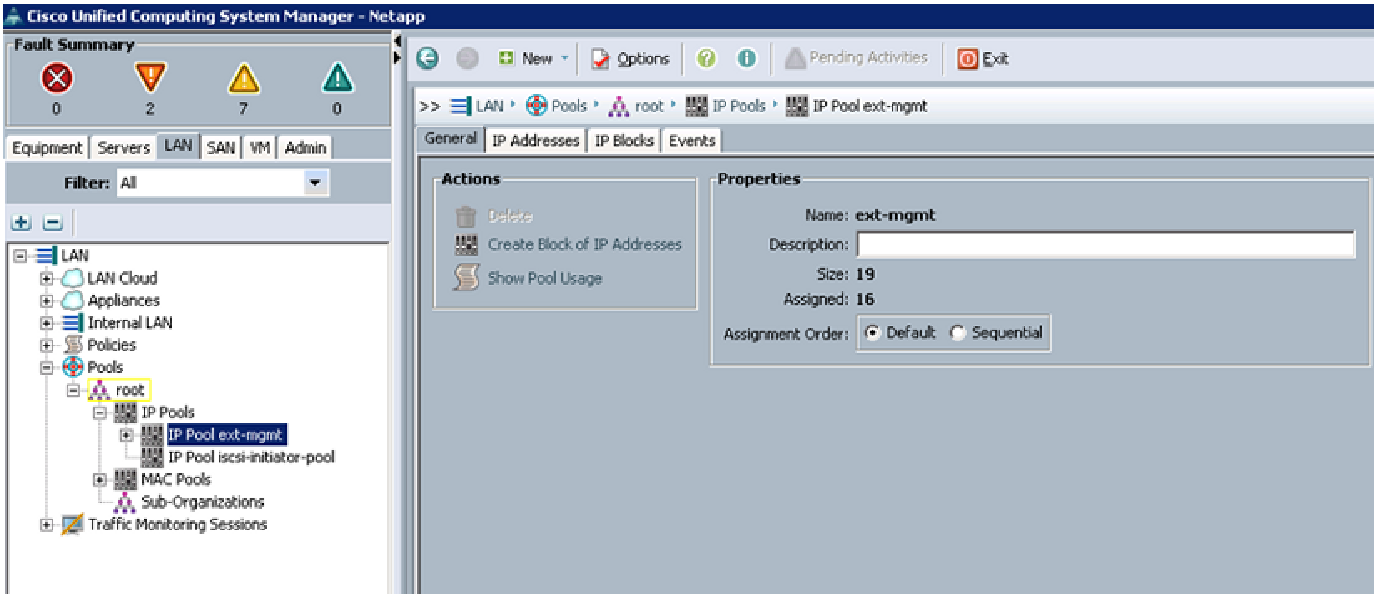
Note Make sure the Cisco UCS C-Series version 2.1(1e) software bundle is loaded on the Fabric Interconnects.

Adding a Block of IP Addresses for KVM Console

Follow these steps to create a block of KVM IP addresses for server access in the Cisco UCS Manager GUI:

1. Select the LAN tab at the top in the left pane in the UCSM GUI.
2. Select **Pools** > **IP Pools** > **IP Pool ext-mgmt** as shown in Figure 5.

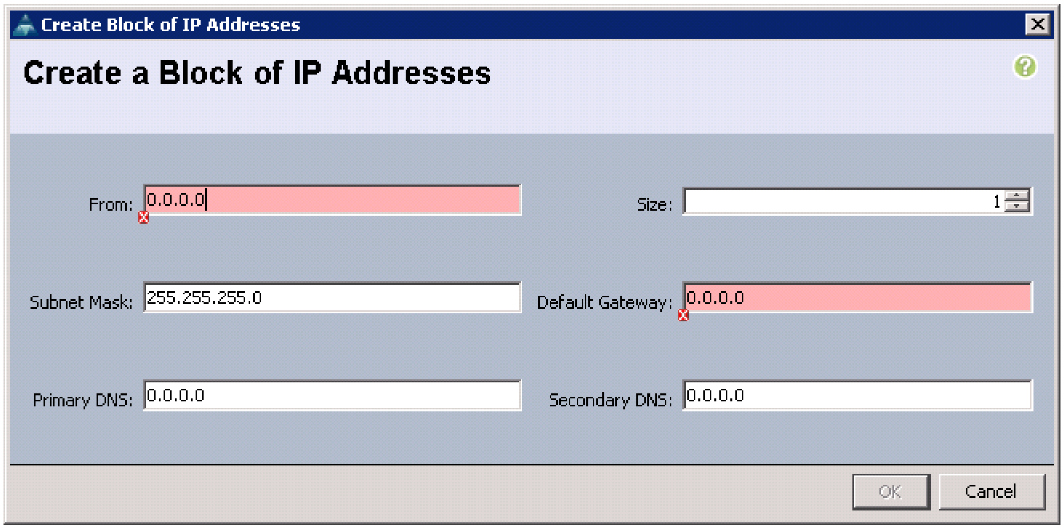
Figure 5 Management IP Pool in Cisco UCS Manager



Name: ext-mgmt
Description:
Size: 19
Assigned: 16
Assignment Order: ● Default ○ Sequential

3. Right-click the IP Pool ext-mgmt.
4. Select Create Block of IP Addresses. Create Block of IP Address window appears as shown in Figure 6.

Figure 6 Creating a Block of IP Addresses



Create Block of IP Addresses

Create a Block of IP Addresses

From: 0.0.0.0

Size: 1

Subnet Mask: 255.255.255.0

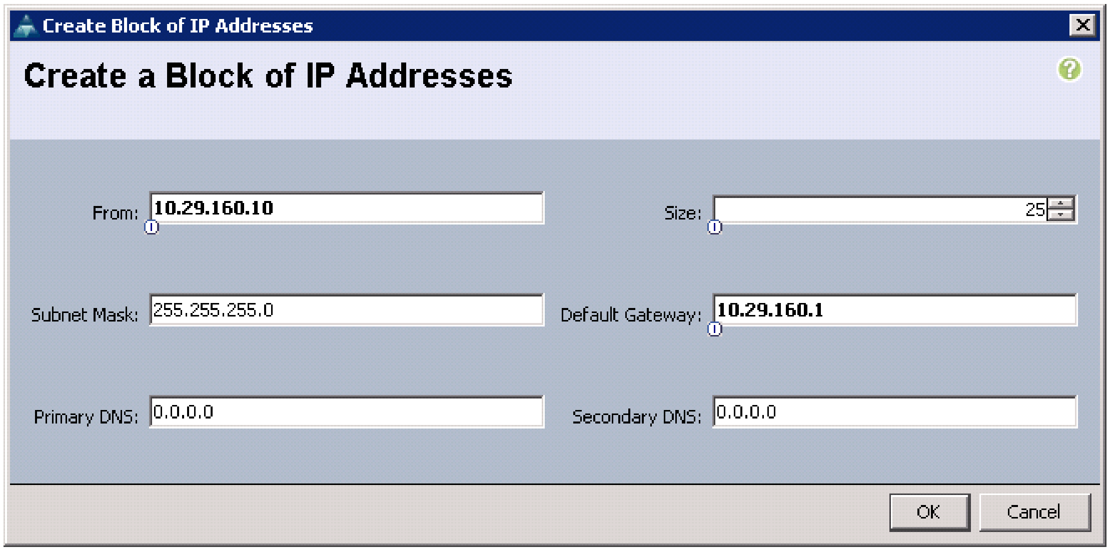
Default Gateway: 0.0.0.0

Primary DNS: 0.0.0.0

Secondary DNS: 0.0.0.0

5. Enter the starting IP address of the block and number of IPs needed as well as the subnet and gateway information.

Figure 7 Entering the Block of IP Addresses



Create Block of IP Addresses

Create a Block of IP Addresses

From: 10.29.160.10

Size: 25

Subnet Mask: 255.255.255.0

Default Gateway: 10.29.160.1

Primary DNS: 0.0.0.0

Secondary DNS: 0.0.0.0

6. Click **OK** to create the IP block.
7. Click **OK** in the confirmation message box.

Editing the Chassis Discovery Policy

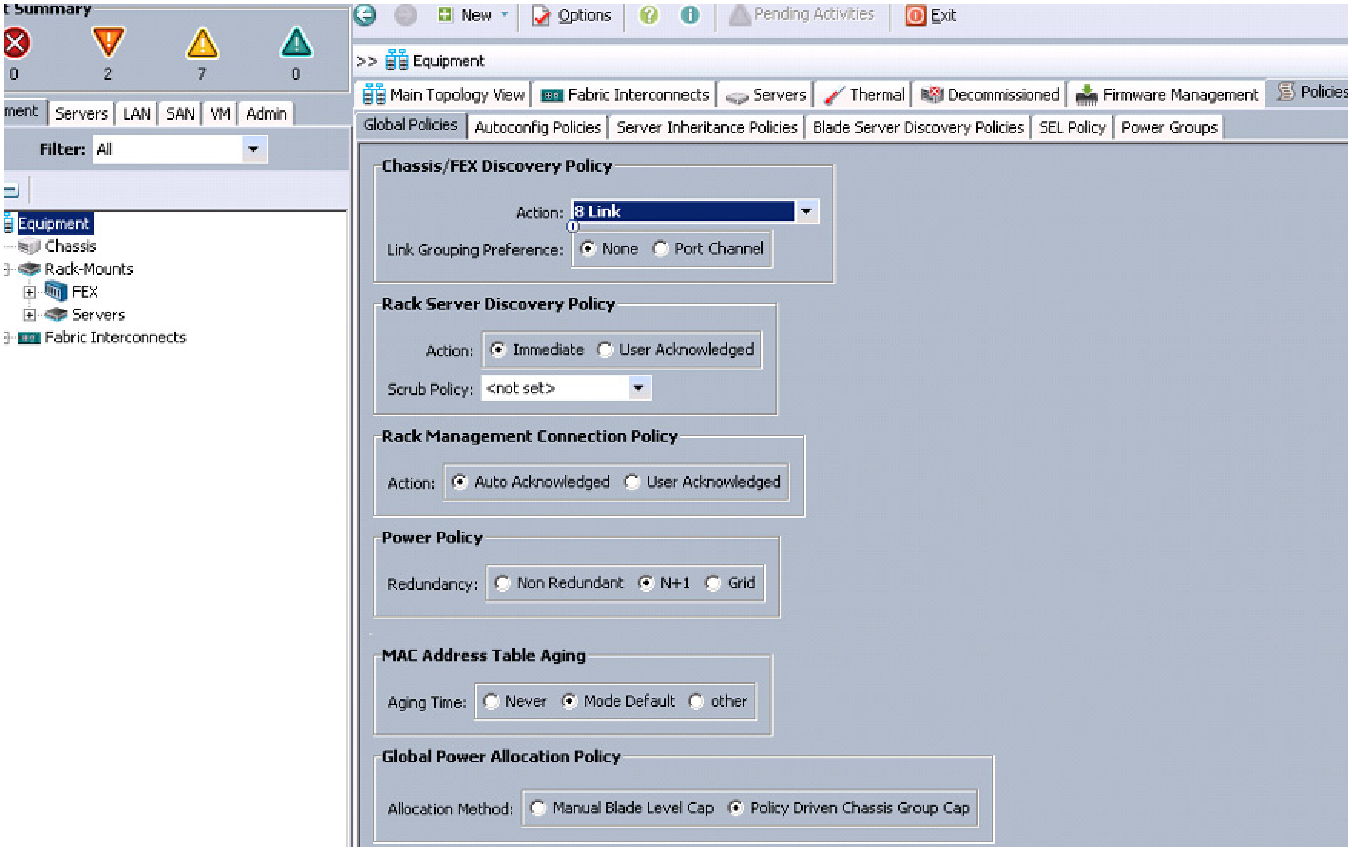
Setting the discovery policy now will simplify the addition of Cisco UCS B-Series Chassis in the future and additional fabric extenders for further C-Series connectivity.

To modify the chassis discovery policy, follow these steps:

1. Navigate to the Equipment tab in the left pane in the UCSM GUI.

2. In the right pane, select the Policies tab.
3. Under Global Policies, change the Chassis Discovery Policy to 8-link as shown in Figure 8.

Figure 8 Editing the Chassis Discovery Policy



Chassis/FEX Discovery Policy

Action: 8 Link

Link Grouping Preference: ● None ○ Port Channel

Rack Server Discovery Policy

Action: ● Immediate ○ User Acknowledged

Scrub Policy: <not set>

Rack Management Connection Policy

Action: ● Auto Acknowledged ○ User Acknowledged

Power Policy

Redundancy: ○ Non Redundant ● N+1 ○ Grid

MAC Address Table Aging

Aging Time: ○ Never ● Mode Default ○ other

Global Power Allocation Policy

Allocation Method: ○ Manual Blade Level Cap ● Policy Driven Chassis Group Cap

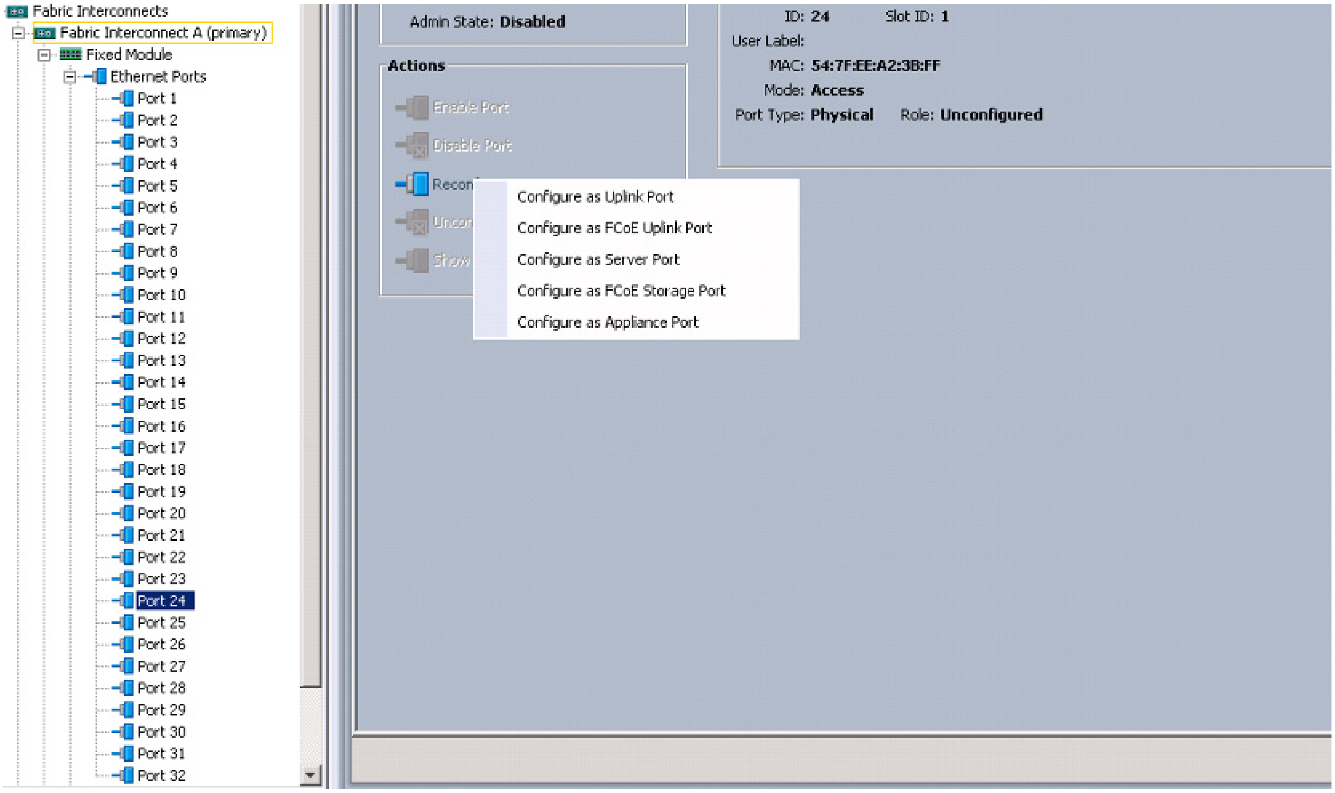
4. Click **Save Changes** in the bottom right corner in the Cisco UCSM GUI.
5. Click **OK**.

Enabling Server and Uplink Ports

To enable the server ports and uplink ports, follow these steps:

1. Select the Equipment tab on the top left corner in the left pane in the UCSM GUI.
2. Select **Equipment** > **Fabric Interconnects** > **Fabric Interconnect A (primary)** > **Fixed Module**.
3. Expand the Unconfigured Ethernet Ports.
4. Select the number of ports that are connected to the Cisco Nexus 2232PP FEXs (8 per FEX), right-click them, and select **Reconfigure** > **Configure as a Server Port** as shown in Figure 9.

Figure 9 Enabling Server Ports



Admin State: **Disabled**

ID: **24** Slot ID: **1**

User Label:

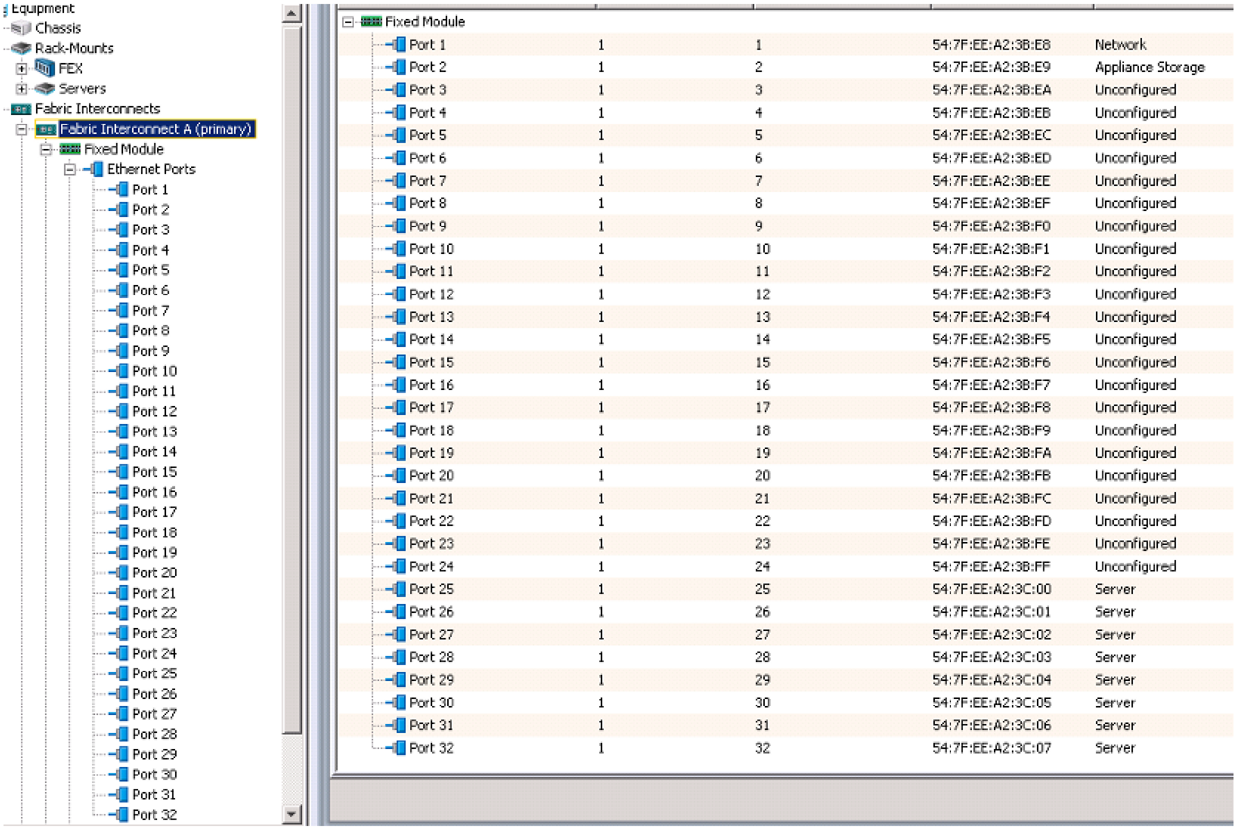
MAC: **54:7F:EE:A2:3B:FF**

Mode: **Access**

Port Type: **Physical** Role: **Unconfigured**

5. Select port 1 that is connected to the Cisco Catalyst 2960-S switches, right-click them, and select **Reconfigure** > **Configure as Uplink Port**.
6. Select Show Interface and select 10GB for Uplink Connection.
7. A pop-up window appears to confirm your selection. Click **Yes**, then **OK** to continue.
8. Select **Equipment** > **Fabric Interconnects** > **Fabric Interconnect B (subordinate)** > **Fixed Module**.
9. Expand the Unconfigured Ethernet Ports.
10. Select the number of ports that are connected to the Cisco Nexus 2232 FEXs (8 per FEX), right-click them, and select **Reconfigure** > **Configure as Server Port**.
11. A pop-up window appears to confirm your selection. Click **Yes**, then **OK** to continue.
12. Select port 1 that is connected to the Cisco Catalyst 2960-S switches, right-click and select **Reconfigure** > **Configure as Uplink Port**.
13. Select Show Interface and select 10GB for Uplink Connection.
14. A pop-up window appears to confirm your selection. Click **Yes**, then **OK** to continue.

Figure 10 Window Showing Server Ports and Uplink Ports



Fixed Module				
Port 1	1	1	54:7F:EE:A2:3B:E8	Network
Port 2	1	2	54:7F:EE:A2:3B:E9	Appliance Storage
Port 3	1	3	54:7F:EE:A2:3B:EA	Unconfigured
Port 4	1	4	54:7F:EE:A2:3B:EB	Unconfigured
Port 5	1	5	54:7F:EE:A2:3B:EC	Unconfigured
Port 6	1	6	54:7F:EE:A2:3B:ED	Unconfigured
Port 7	1	7	54:7F:EE:A2:3B:EE	Unconfigured
Port 8	1	8	54:7F:EE:A2:3B:EF	Unconfigured
Port 9	1	9	54:7F:EE:A2:3B:F0	Unconfigured
Port 10	1	10	54:7F:EE:A2:3B:F1	Unconfigured
Port 11	1	11	54:7F:EE:A2:3B:F2	Unconfigured
Port 12	1	12	54:7F:EE:A2:3B:F3	Unconfigured
Port 13	1	13	54:7F:EE:A2:3B:F4	Unconfigured
Port 14	1	14	54:7F:EE:A2:3B:F5	Unconfigured
Port 15	1	15	54:7F:EE:A2:3B:F6	Unconfigured
Port 16	1	16	54:7F:EE:A2:3B:F7	Unconfigured
Port 17	1	17	54:7F:EE:A2:3B:F8	Unconfigured
Port 18	1	18	54:7F:EE:A2:3B:F9	Unconfigured
Port 19	1	19	54:7F:EE:A2:3B:FA	Unconfigured
Port 20	1	20	54:7F:EE:A2:3B:FB	Unconfigured
Port 21	1	21	54:7F:EE:A2:3B:FC	Unconfigured
Port 22	1	22	54:7F:EE:A2:3B:FD	Unconfigured
Port 23	1	23	54:7F:EE:A2:3B:FE	Unconfigured
Port 24	1	24	54:7F:EE:A2:3B:FF	Unconfigured
Port 25	1	25	54:7F:EE:A2:3C:00	Server
Port 26	1	26	54:7F:EE:A2:3C:01	Server
Port 27	1	27	54:7F:EE:A2:3C:02	Server
Port 28	1	28	54:7F:EE:A2:3C:03	Server
Port 29	1	29	54:7F:EE:A2:3C:04	Server
Port 30	1	30	54:7F:EE:A2:3C:05	Server
Port 31	1	31	54:7F:EE:A2:3C:06	Server
Port 32	1	32	54:7F:EE:A2:3C:07	Server

Creating Pools for Service Profile Template

Creating an Organization

Organizations are used as a means to organize and restrict access to various groups within the IT organization, thereby enabling multi-tenancy of the compute resources. This document does not assume the use of Organizations; however the necessary steps are provided for future reference.

Follow these steps to configure an organization in the Cisco UCS Manager GUI:

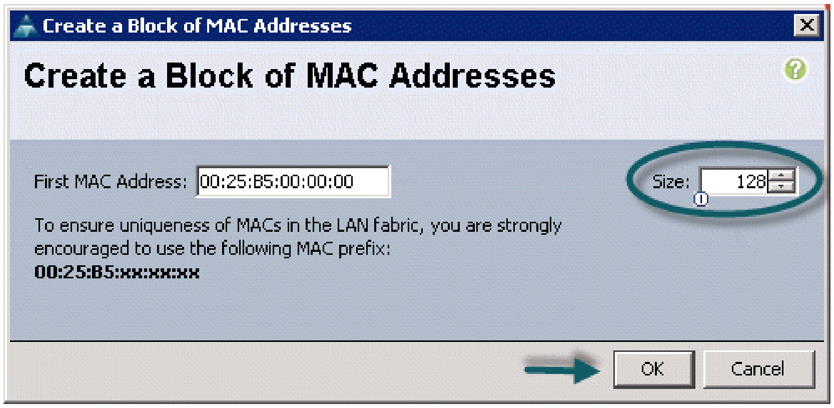
1. Click **New** on the top left corner in the right pane in the UCSM GUI.
2. Select Create Organization from the options.
3. Enter a name for the organization.
4. (Optional) enter a description for the organization.
5. Click **OK**.
6. Click **OK** in the success message box.

Creating MAC Address Pools

Follow these steps to configure the necessary MAC address pools in the Cisco UCS Manager GUI:

1. Select the LAN tab in the left pane in the UCSM GUI.
2. Select **Pools** > **root**.
3. Right-click the MAC Pools under the root organization.
4. Select Create MAC Pool to create the MAC address pool.
5. Enter nosh for the name of the MAC pool.
6. (Optional) enter a description of the MAC pool.
7. Click **Next**.
8. Click **Add**.
9. Specify a starting MAC address.
10. Specify a size of the MAC address pool sufficient to support the available server resources. See Figure 11, Figure 12, and Figure 13.

Figure 11 Specifying the First MAC Address and Size



Create a Block of MAC Addresses

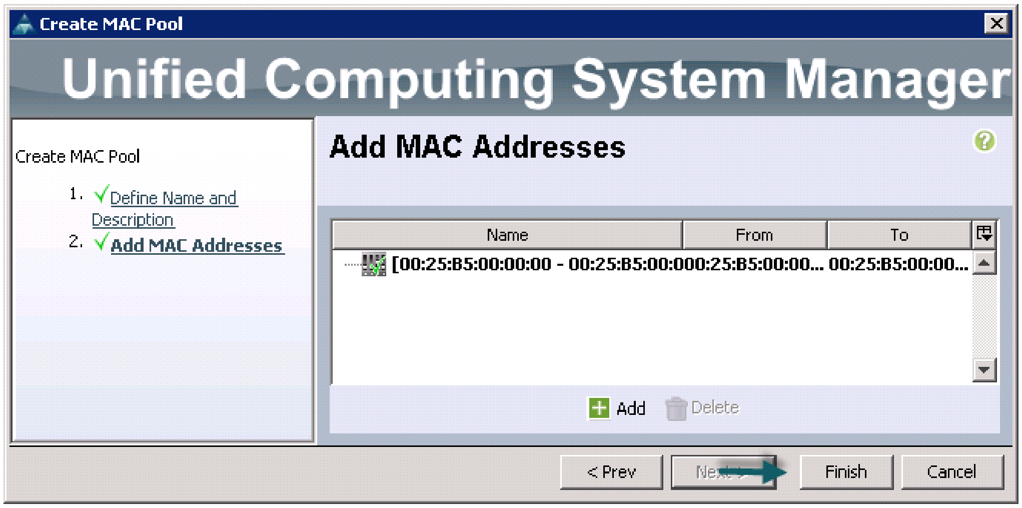
Create a Block of MAC Addresses

First MAC Address: 00:25:B5:00:00:00

Size: 128

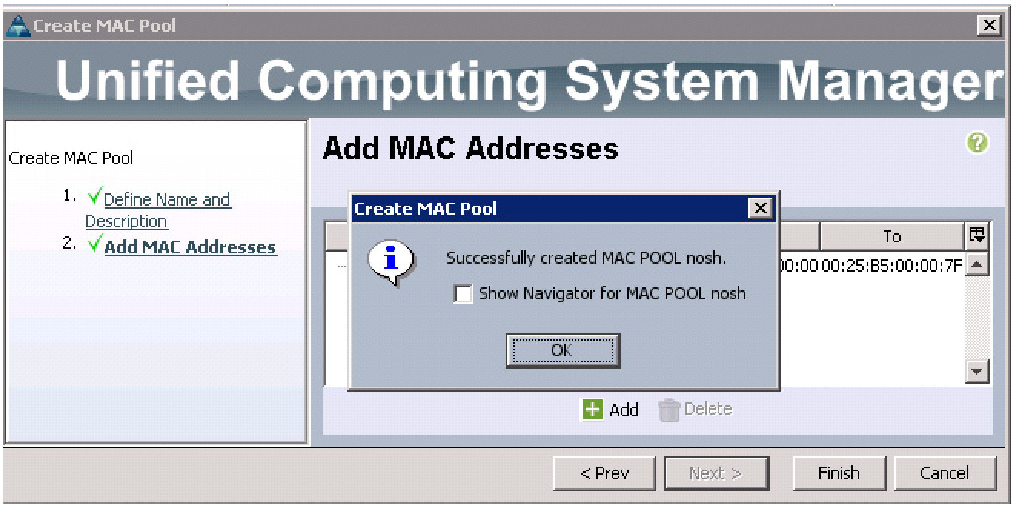
To ensure uniqueness of MACs in the LAN fabric, you are strongly encouraged to use the following MAC prefix:
00:25:B5:xx:xx:xx

Figure 12 Range of MAC Addresses



[00:25:B5:00:00:00 - 00:25:B5:00:000:25:B5:00:00... 00:25:B5:00:00...

Figure 13 Created MAC Pool



Successfully created MAC POOL nosh.

□ Show Navigator for MAC POOL nosh

)0:00 00:25:B5:00:00:7F

11. Click **OK**.
12. Click **Finish**.
13. Click **OK** in the success message box.

Configuring VLANs

VLANs are configured as shown in Table 4.

Table 4 VLAN Configurations

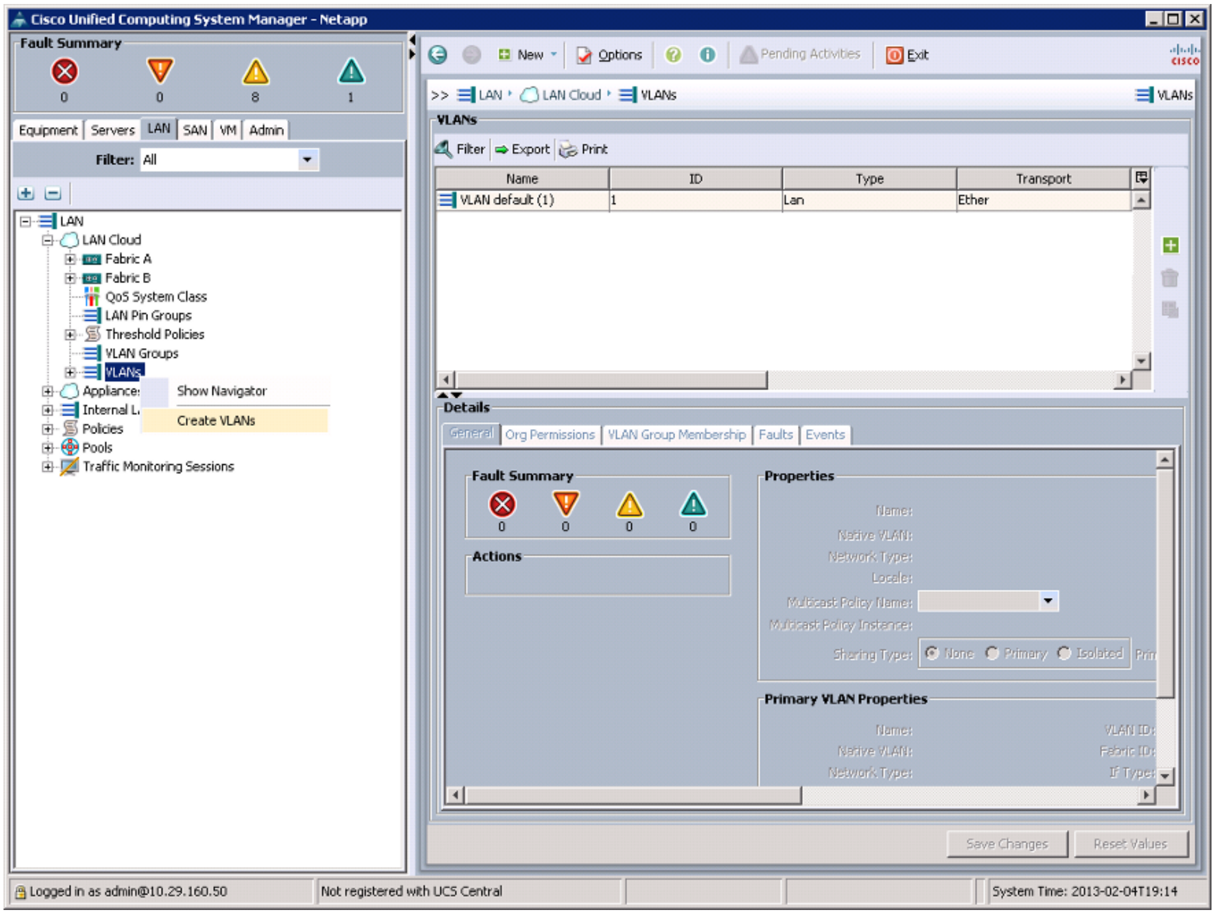
VLAN	Fabric	NIC Port	Function	Failover
vlan160_mgmt	A	eth0	Management, User connectivity	Fabric Failover to B
vlan11_NFS	A	eth1	NFS Traffic	Fabric Failover to B
vlan12_HDFS	B	eth2	HDFS Traffic	Fabric Failover to A

For this deployment we are using eth0 (vlan160_mgmt) for management packets, eth1 (vlan11_NFS) for NFS data traffic and eth2 (vlan12_HDFS) for HDFS data traffic.

Follow these steps to configure VLANs in the Cisco UCS Manager GUI:

1. Select the LAN tab in the left pane in the UCSM GUI.
2. Select **LAN** > **VLANs**.
3. Right-click the VLANs under the root organization.
4. Select Create VLANs to create the VLAN.

Figure 14 Creating VLANs



Filter: All

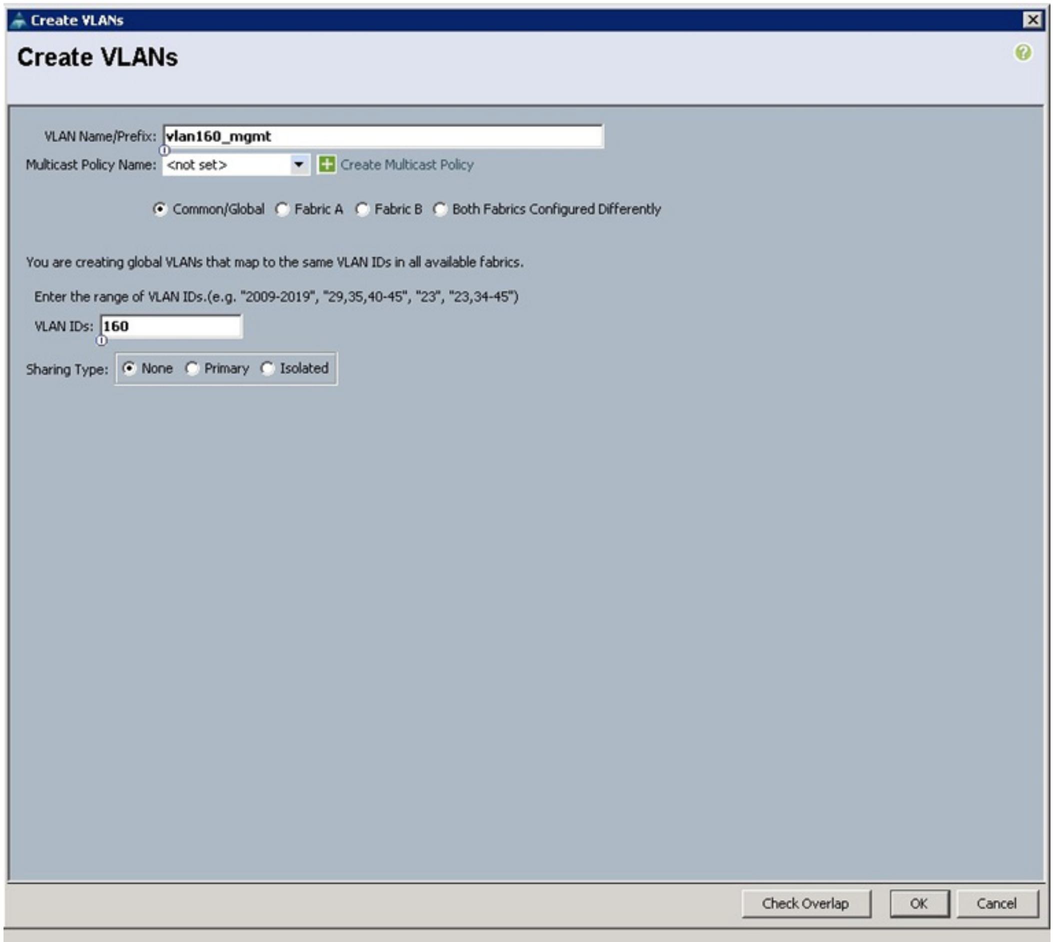
Name	ID	Type	Transport
VLAN default (1)	1	Lan	Ether

Sharing Type: ● None ○ Primary ○ Isolated

Logged in as admin@10.29.160.50 | Not registered with UCS Central | System Time: 2013-02-04T19:14

5. Enter vlan160_mgmt for the VLAN Name.
6. Select Common/Global for vlan160_mgmt.
7. Enter 160 on VLAN IDs of the Create VLAN IDs.

Figure 15 Creating VLAN for Fabric A



Create VLANs

VLAN Name/Prefix: vlan160_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.

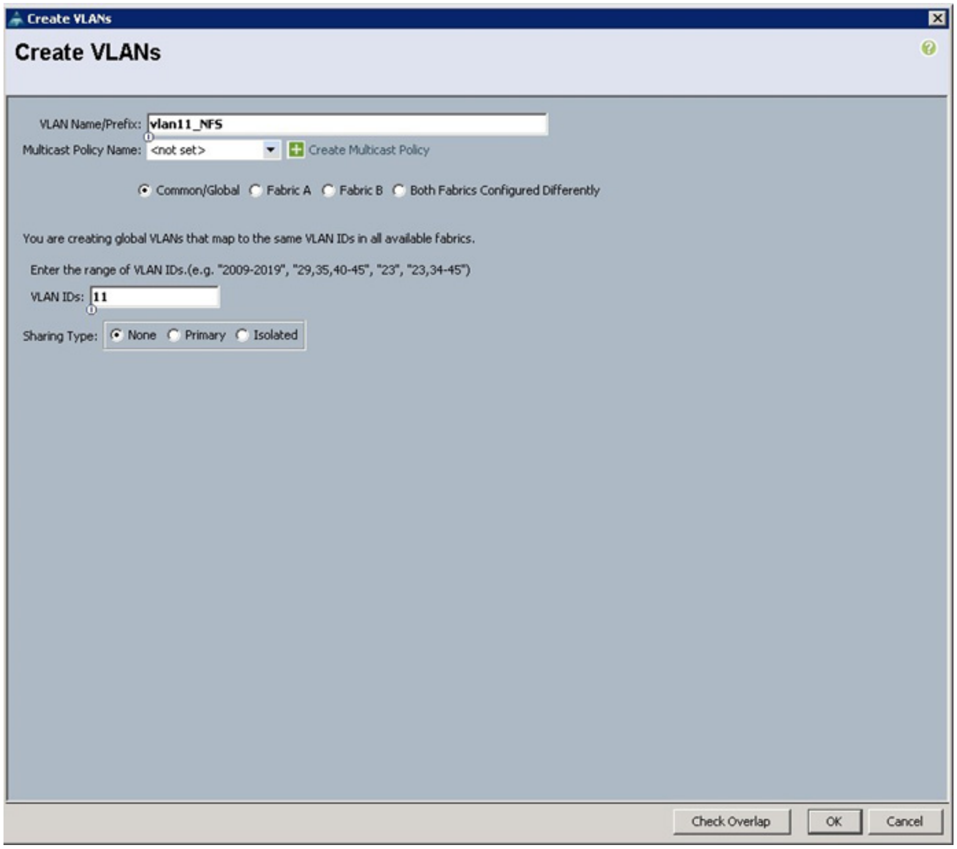
Enter the range of VLAN IDs.(e.g. "2009-2019", "29,35,40-45", "23", "23,34-45")

VLAN IDs: 160

Sharing Type: ● None ○ Primary ○ Isolated

8. Click **OK** and then, click **Finish**.
9. Click **OK** in the success message box.
10. Select the LAN tab in the left pane again.
11. Select **LAN** > **VLANs**.
12. Right-click the VLANs under the root organization.
13. Select Create VLANs to create the VLAN.
14. Enter vlan11_NFS for the VLAN Name.
15. Select Common/Global for vlan11_NFS.
16. Enter 11 on VLAN IDs of the Create VLAN IDs.

Figure 16 Creating VLAN for Fabric B



VLAN Name/Prefix: vlan11_NFS

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.

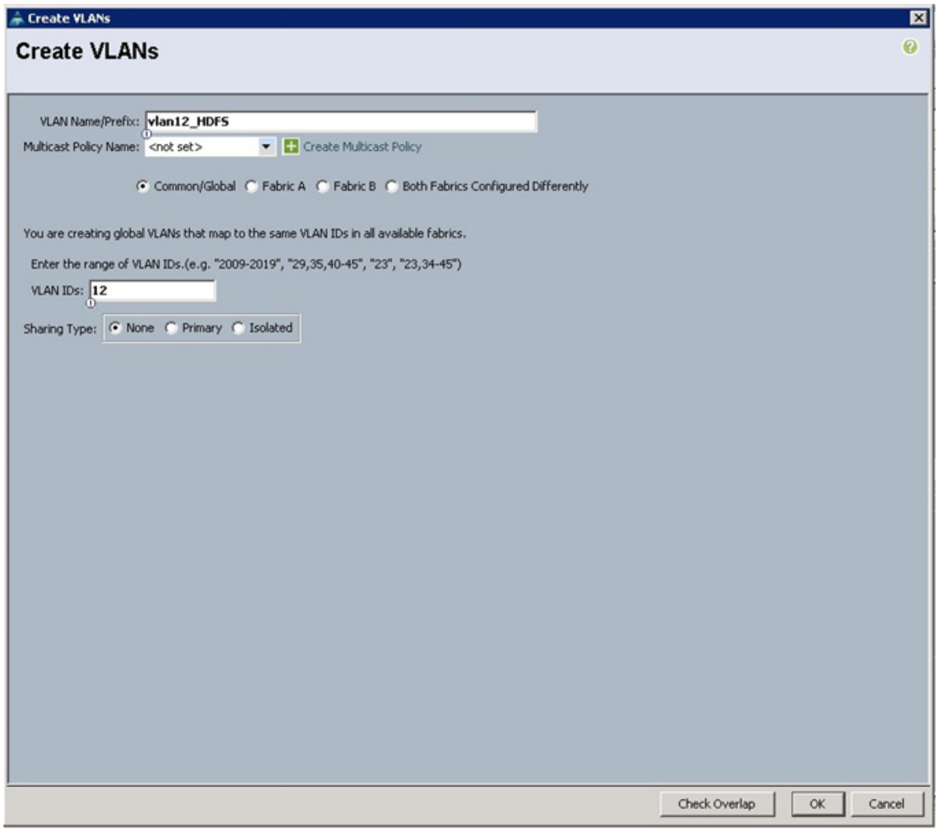
Enter the range of VLAN IDs.(e.g. "2009-2019", "29,35,40-45", "23", "23,34-45")

VLAN IDs: 11

Sharing Type: ● None ○ Primary ○ Isolated

17. Click **OK** and then, click **Finish**.
18. Click **OK** in the success message box.
19. Select the LAN tab in the left pane again.
20. Select **LAN** > **VLANs**.
21. Right-click the VLANs under the root organization.
22. Select Create VLANs to create the VLAN.
23. Enter vlan12_HDFS for the VLAN Name.
24. Select Common/Global for the vlan12_HDFS.
25. Enter 12 on VLAN IDs of the Create VLAN IDs.

Figure 17 Creating Global HDFS VLAN



Create VLANs

VLAN Name/Prefix: vlan12_HDFS

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: 12

Sharing Type: ● None ○ Primary ○ Isolated

26. Click **OK** then click **Finish**.

Note All of the VLANs created need to be trunked to the upstream distribution switch connecting the fabric interconnects.

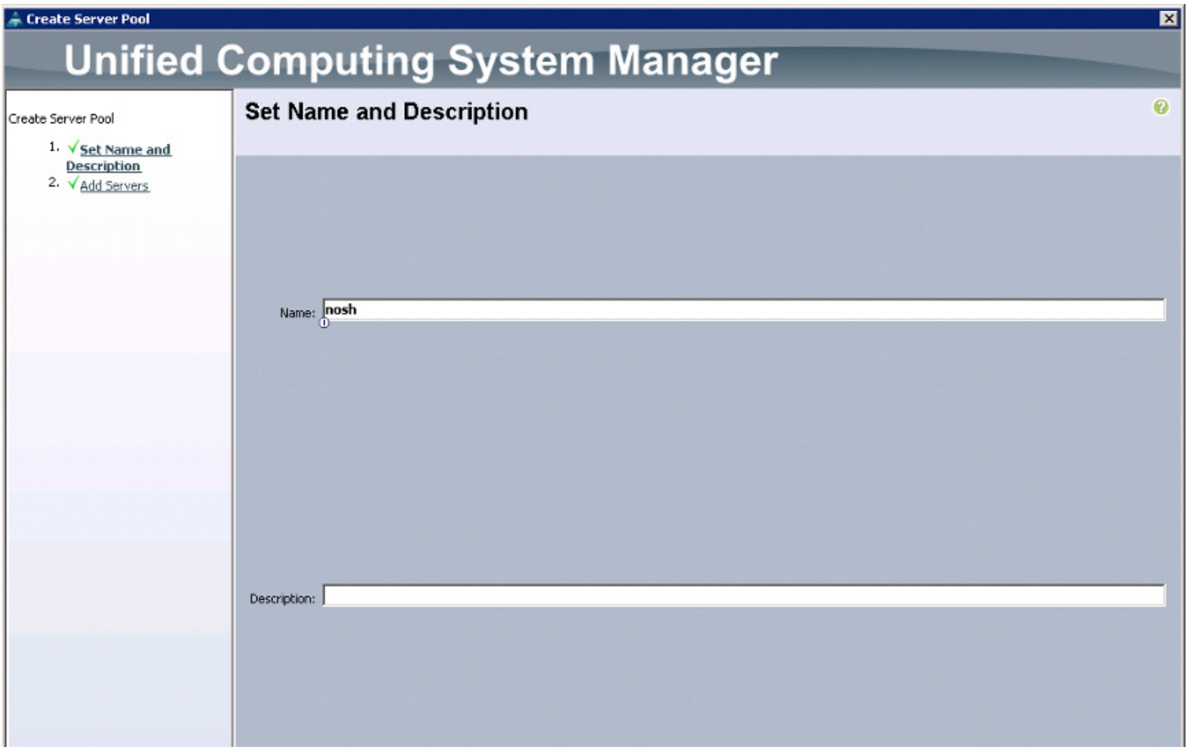
Creating Server Pool

A server pool contains a set of servers. These servers typically share the same characteristics. Those characteristics can be their location in the chassis, or an attribute such as server type, amount of memory, local storage, type of CPU, or local drive configuration. You can manually assign a server to a server pool, or use server pool policies and server pool policy qualifications to automate the assignment.

Follow these steps to configure the server pool in the Cisco UCS Manager GUI:

1. Select the Servers tab in the left pane in the Cisco UCS Manager GUI.
2. Select **Pools** > **root**.
3. Right-click the Server Pools.
4. Select Create Server Pool.
5. Enter nosh for the Server Pool Name.
6. (Optional) enter a description for the organization.

Figure 18 Creating Server Pool

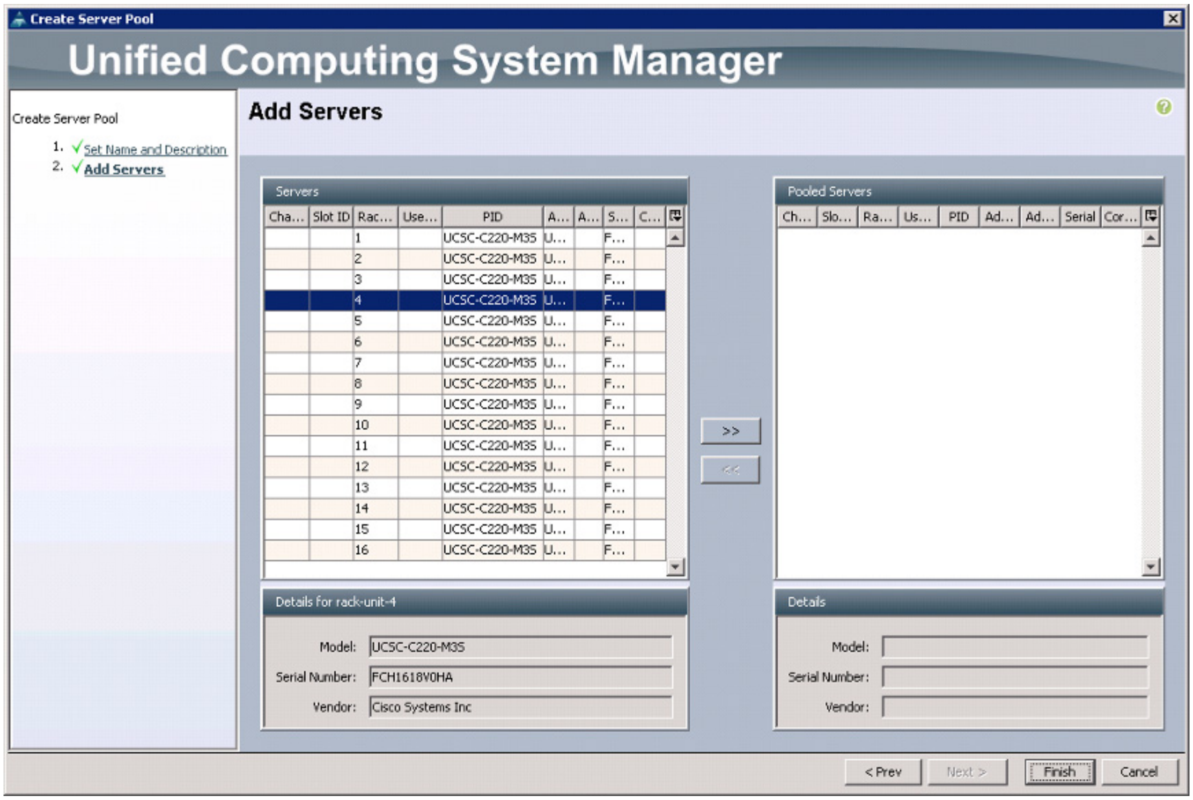


Name: nosh

Description:

7. Click **Next** to add servers.
8. Select all the Cisco UCS C220M3 servers to be added to the nosh server pool. Click **>>** to add them to the pool.

Figure 19 Adding Server Pool



Create Server Pool

Unified Computing System Manager

Create Server Pool

1. √Set Name and Description
2. √Add Servers

Add Servers

Servers

Cha...	Slot ID	Rac...	Use...	PID	A...	A...	S...	C...
		1		UCSC-C220-M3S	U...		F...	
		2		UCSC-C220-M3S	U...		F...	
		3		UCSC-C220-M3S	U...		F...	
		4		UCSC-C220-M3S	U...		F...	
		5		UCSC-C220-M3S	U...		F...	
		6		UCSC-C220-M3S	U...		F...	
		7		UCSC-C220-M3S	U...		F...	
		8		UCSC-C220-M3S	U...		F...	
		9		UCSC-C220-M3S	U...		F...	
		10		UCSC-C220-M3S	U...		F...	
		11		UCSC-C220-M3S	U...		F...	
		12		UCSC-C220-M3S	U...		F...	
		13		UCSC-C220-M3S	U...		F...	
		14		UCSC-C220-M3S	U...		F...	
		15		UCSC-C220-M3S	U...		F...	
		16		UCSC-C220-M3S	U...		F...	

Pooled Servers

Ch...	Slo...	Ra...	Us...	PID	Ad...	Ad...	Serial	Cor...

Details for rack-unit-4

Model: UCSC-C220-M3S

Serial Number: FCH1618V0HA

Vendor: Cisco Systems Inc

Details

Model:

Serial Number:

Vendor:

9. Click **Finish**.
10. Click **OK** and then click **Finish**.

Creating Policies for Service Profile Template

Creating Host Firmware Package Policy

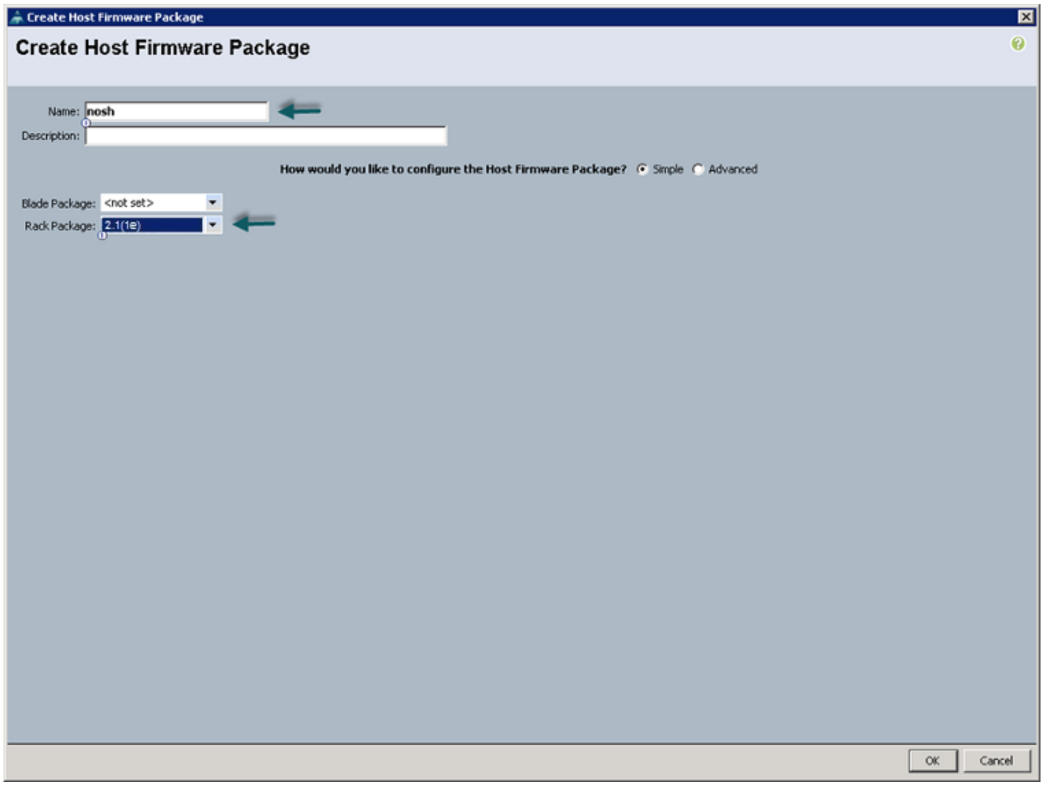
Firmware management policies allow the administrator to select the corresponding packages for a given server configuration. These often include adapter, BIOS, board controller, FC adapters, HBA option ROM, and storage controller properties.

Follow these steps create a firmware management policy for a given server configuration in the Cisco UCS Manager GUI:

1. Select the Servers tab in the left pane in the UCSM GUI.
2. Select **Policies** > **root**.
3. Right-click Host Firmware Packages.
4. Select Create Host Firmware Package.
5. Enter nosh as the Host firmware package name.
6. Select **Simple** radio button to configure the Host Firmware package.

7. Select the appropriate Rack package that you have.

Figure 20 Creating Host Firmware Package



Create Host Firmware Package

Name: nosh

Description:

How would you like to configure the Host Firmware Package? ● Simple ○ Advanced

Blade Package: <not set>

Rack Package: 2.1(1e)

8. Click **OK** to complete creating the management firmware package.
9. Click **OK**.

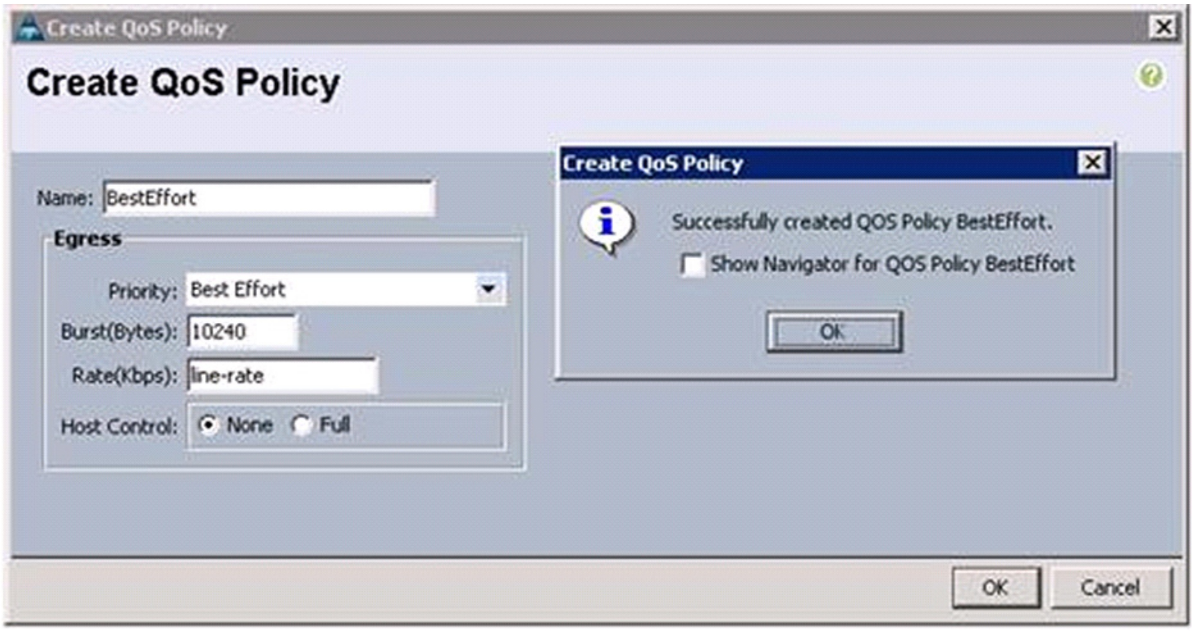
Creating QoS Policies

Follow these steps to create QoS policy for a given server configuration in the Cisco UCS Manager GUI:

BestEffort Policy

1. Select the LAN tab in the left pane in the UCSM GUI.
2. Select **Policies** > **root**.
3. Right-click QoS Policies and select Create QoS Policy.
4. Enter BestEffort as the name of the policy.
5. Select Best Effort for Priority from the drop down menu.
6. Keep the Burst (Bytes) field as default, which is 10240.
7. Keep the Rate (Kbps) field as default, which is line-rate.
8. Make sure the Host Control radio button is **None**.
9. Click **OK**.

Figure 21 Creating QoS Policy - BestEffort



Create QoS Policy

Name: BestEffort

Egress

Priority: Best Effort

Burst(Bytes): 10240

Rate(Kbps): line-rate

Host Control: ● None ○ Full

Successfully created QOS Policy BestEffort.

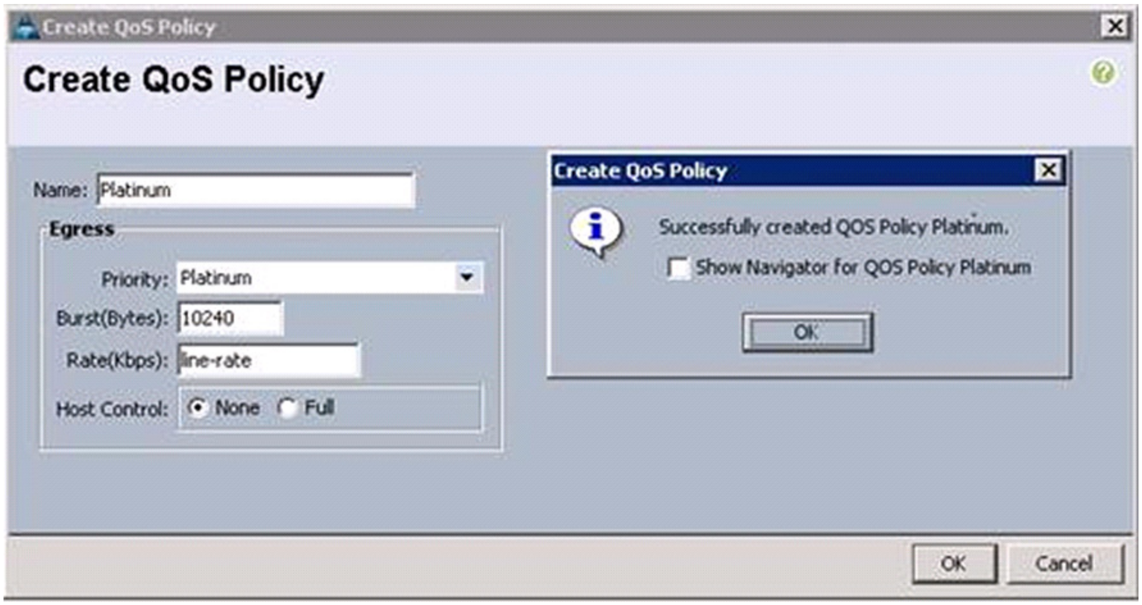
□ Show Navigator for QOS Policy BestEffort

10. In the pop-up window, click **OK** to complete the QoS policy creation.

Platinum Policy

1. Select the LAN tab in the left pane in the UCSM GUI.
2. Select **Policies** > **root**.
3. Right-click QoS Policies and select Create QoS Policy.
4. Enter Platinum as the name of the policy.
5. Select Platinum for Priority from the drop down menu.
6. Keep the Burst (Bytes) field as default, which is 10240.
7. Keep the Rate (Kbps) field as default, which is line-rate.
8. Make sure the Host Control radio button is **None**.
9. Click **OK**.

Figure 22 Creating QoS Policy - Platinum



Name: Platinum

Egress

Priority: Platinum

Burst(Bytes): 10240

Rate(Kbps): line-rate

Host Control: ● None ○ Full

Create QoS Policy

Successfully created QOS Policy Platinum.

□ Show Navigator for QOS Policy Platinum

OK

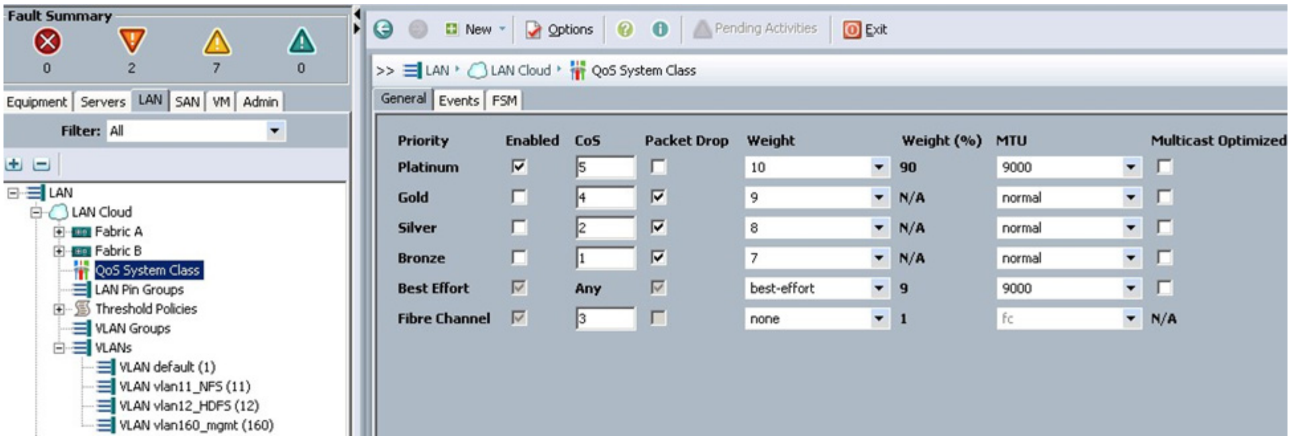
10. In the pop-up window, click **OK** to complete the QoS policy creation.

Setting Jumbo Frames

These steps provide details for setting Jumbo frames and enabling the quality of service in the Cisco UCS Fabric:

1. Select the Servers tab in the left pane in the UCSM GUI.
2. Select **LAN Cloud** > **QoS System Class**.
3. In the right pane, select the General tab.
4. In the Platinum row, enter 9000 for MTU.
5. In the Best Effort row, enter 9000 for MTU.
6. Check the Enabled check box next to Platinum.

Figure 23 Setting Jumbo Frame in Cisco UCS Fabric



Priority	Enabled	CoS	Packet Drop	Weight	Weight (%)	MTU	Multicast Optimized
Platinum	☑	5	☐	10	90	9000	☐
Gold	☐	4	☑	9	N/A	normal	☐
Silver	☐	2	☑	8	N/A	normal	☐
Bronze	☐	1	☑	7	N/A	normal	☐
Best Effort	☑	Any	☑	best-effort	9	9000	☐
Fibre Channel	☑	3	☐	none	1	fc	N/A

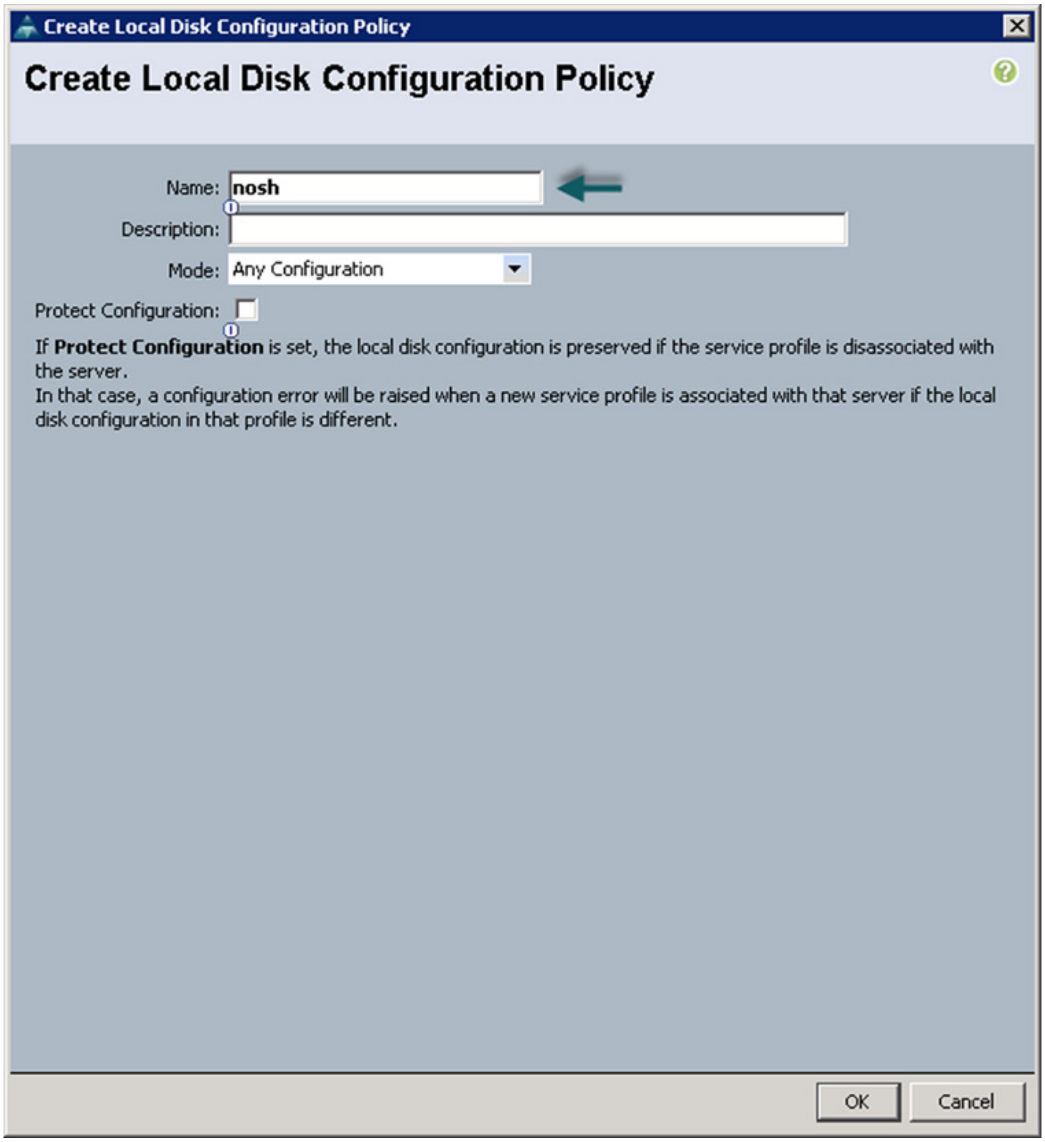
7. Click **Save Changes**.
8. Click **OK**.

Create a Local Disk Configuration Policy

Follow these steps to create local disk configuration in the Cisco UCS Manager GUI:

1. Select the Servers tab in the left pane in the UCSM GUI.
2. Select **Policies** > **root**.
3. Right-click Local Disk Config Policies.
4. Select Create Local Disk Configuration Policy.
5. Enter nosh as the local disk configuration policy name.
6. Change the Mode to Any Configuration. Uncheck the Protect Configuration check box.

Figure 24 Configuring Local Disk Policy



Create Local Disk Configuration Policy

Name: nosh

Description:

Mode: Any Configuration

Protect Configuration: □

If **Protect Configuration** is set, the local disk configuration is preserved if the service profile is disassociated with the server.
In that case, a configuration error will be raised when a new service profile is associated with that server if the local disk configuration in that profile is different.

7. Click **OK** to create the Local Disk Configuration Policy.
8. Click **OK**.

Create a Server BIOS Policy

The BIOS policy feature in Cisco UCS automates the BIOS configuration process.

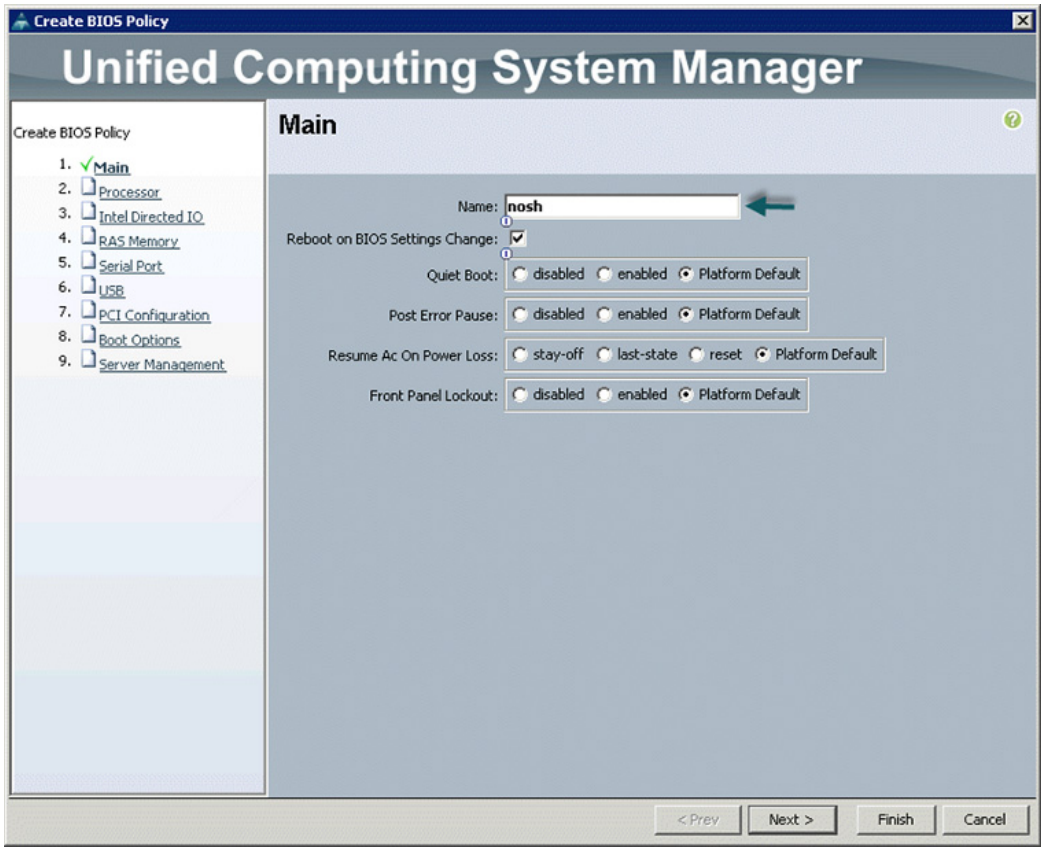
The traditional method of setting the BIOS is manual and often error-prone. By creating a BIOS policy and assigning the policy to a server or group of servers, you can have the transparency in BIOS settings and configuration.

Follow these steps to create a server BIOS policy in the Cisco UCS Manager GUI:

1. Select the Servers tab in the left pane in the UCSM GUI.

2. Select **Policies** > **root**.
3. Right-click BIOS Policies.
4. Select Create BIOS Policy.
5. Enter nosh as the BIOS policy name.
6. Change the BIOS settings as per Figure 25, Figure 26, Figure 27, and Figure 28.

Figure 25 Creating BIOS Policy



Create BIOS Policy

Unified Computing System Manager

Create BIOS Policy

1. ✓ Main
2. Processor
3. Intel Directed IO
4. RAS Memory
5. Serial Port
6. USB
7. PCI Configuration
8. Boot Options
9. Server Management

Main

Name: nosh

Reboot on BIOS Settings Change: ☑

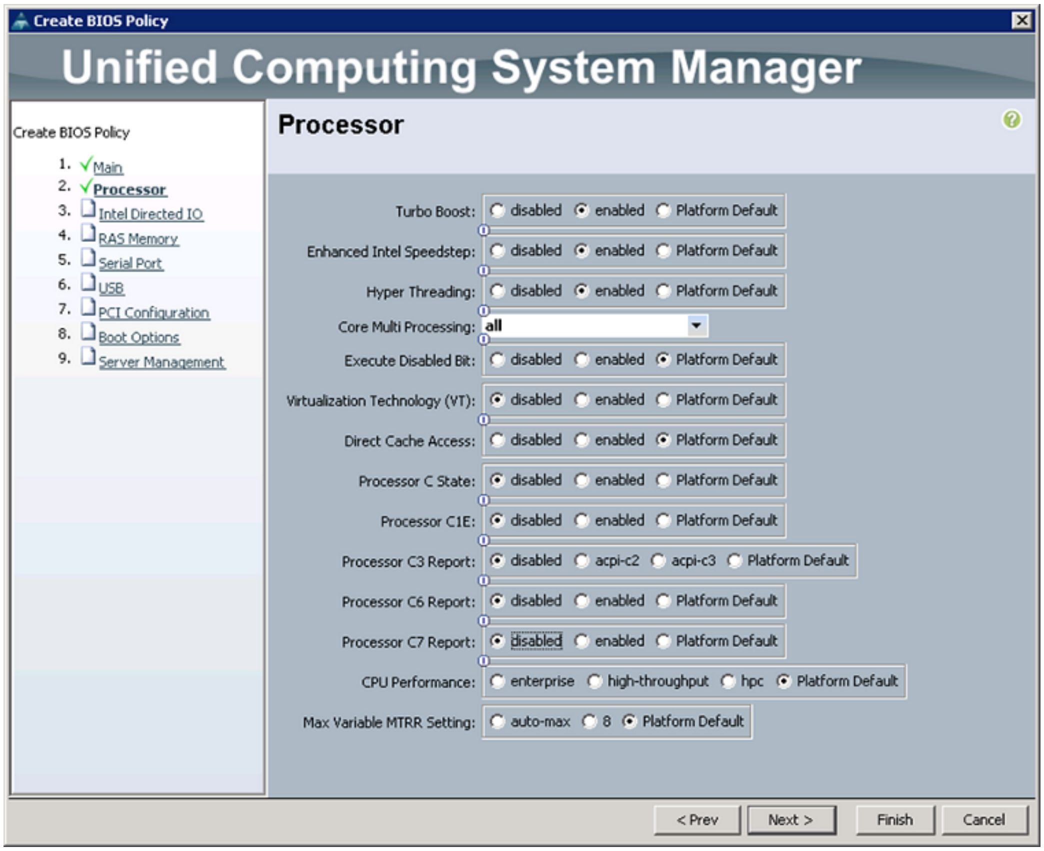
Quiet Boot: ○ disabled ○ enabled ● Platform Default

Post Error Pause: ○ disabled ○ enabled ● Platform Default

Resume Ac On Power Loss: ○ stay-off ○ last-state ○ reset ● Platform Default

Front Panel Lockout: ○ disabled ○ enabled ● Platform Default

Figure 26 Processor Settings



Processor

Turbo Boost: ○ disabled ● enabled ○ Platform Default

Enhanced Intel Speedstep: ○ disabled ● enabled ○ Platform Default

Hyper Threading: ○ disabled ● enabled ○ Platform Default

Core Multi Processing: all

Execute Disabled Bit: ○ disabled ○ enabled ● Platform Default

Virtualization Technology (VT): ● disabled ○ enabled ○ Platform Default

Direct Cache Access: ○ disabled ○ enabled ● Platform Default

Processor C State: ● disabled ○ enabled ○ Platform Default

Processor C1E: ● disabled ○ enabled ○ Platform Default

Processor C3 Report: ● disabled ○ acpi-c2 ○ acpi-c3 ○ Platform Default

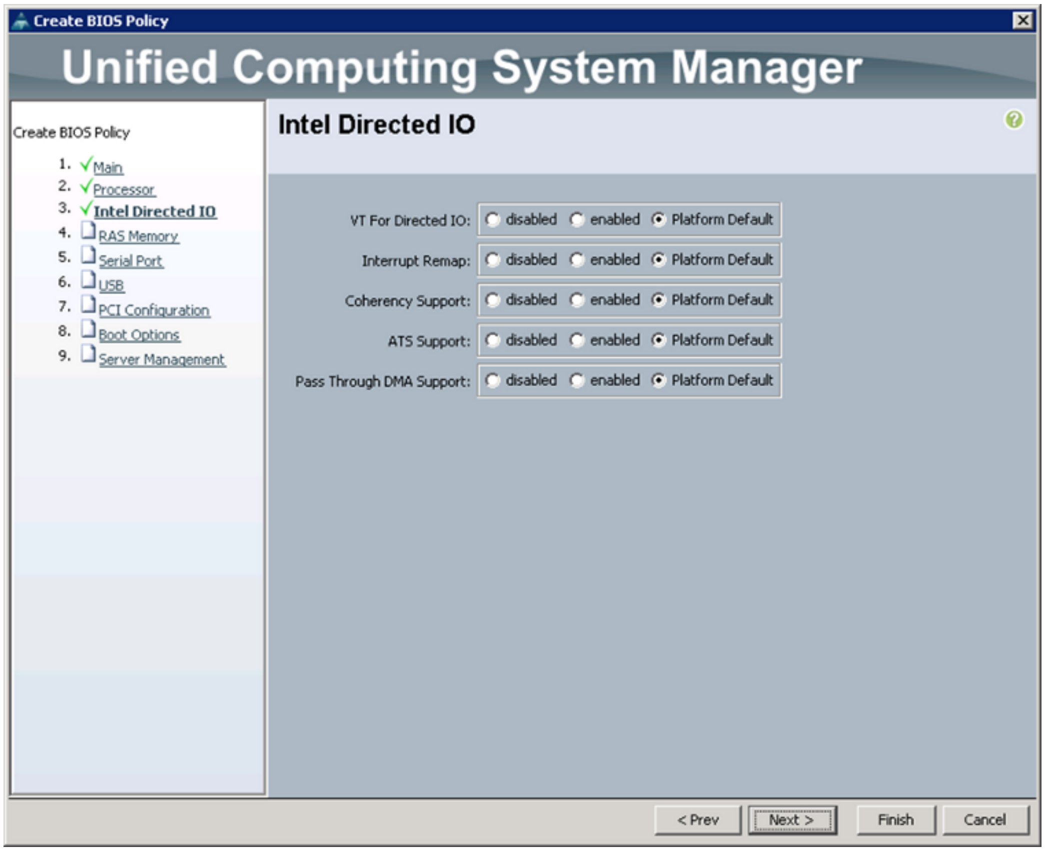
Processor C6 Report: ● disabled ○ enabled ○ Platform Default

Processor C7 Report: ● disabled ○ enabled ○ Platform Default

CPU Performance: ○ enterprise ○ high-throughput ○ hpc ● Platform Default

Max Variable MTRR Setting: ○ auto-max ○ 8 ● Platform Default

Figure 27 Intel Direct IO Settings



Create BIOS Policy

Unified Computing System Manager

Create BIOS Policy

1. ✓ Main
2. ✓ Processor
3. ✓ **Intel Directed IO**
4. RAS Memory
5. Serial Port
6. USB
7. PCI Configuration
8. Boot Options
9. Server Management

Intel Directed IO

VT For Directed IO: ○ disabled ○ enabled ● Platform Default

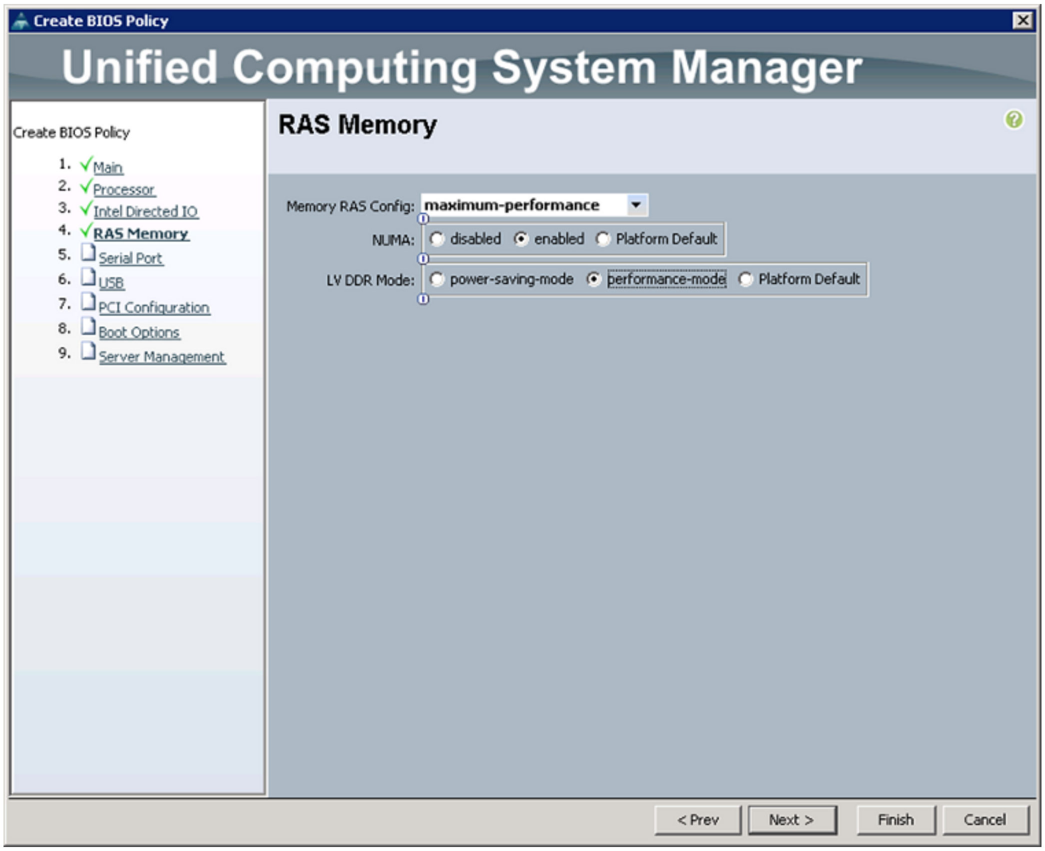
Interrupt Remap: ○ disabled ○ enabled ● Platform Default

Coherency Support: ○ disabled ○ enabled ● Platform Default

ATS Support: ○ disabled ○ enabled ● Platform Default

Pass Through DMA Support: ○ disabled ○ enabled ● Platform Default

Figure 28 Memory Settings



Memory RAS Config: maximum-performance

NUMA: ○ disabled ● enabled ○ Platform Default

LV DDR Mode: ○ power-saving-mode ● performance-mode ○ Platform Default

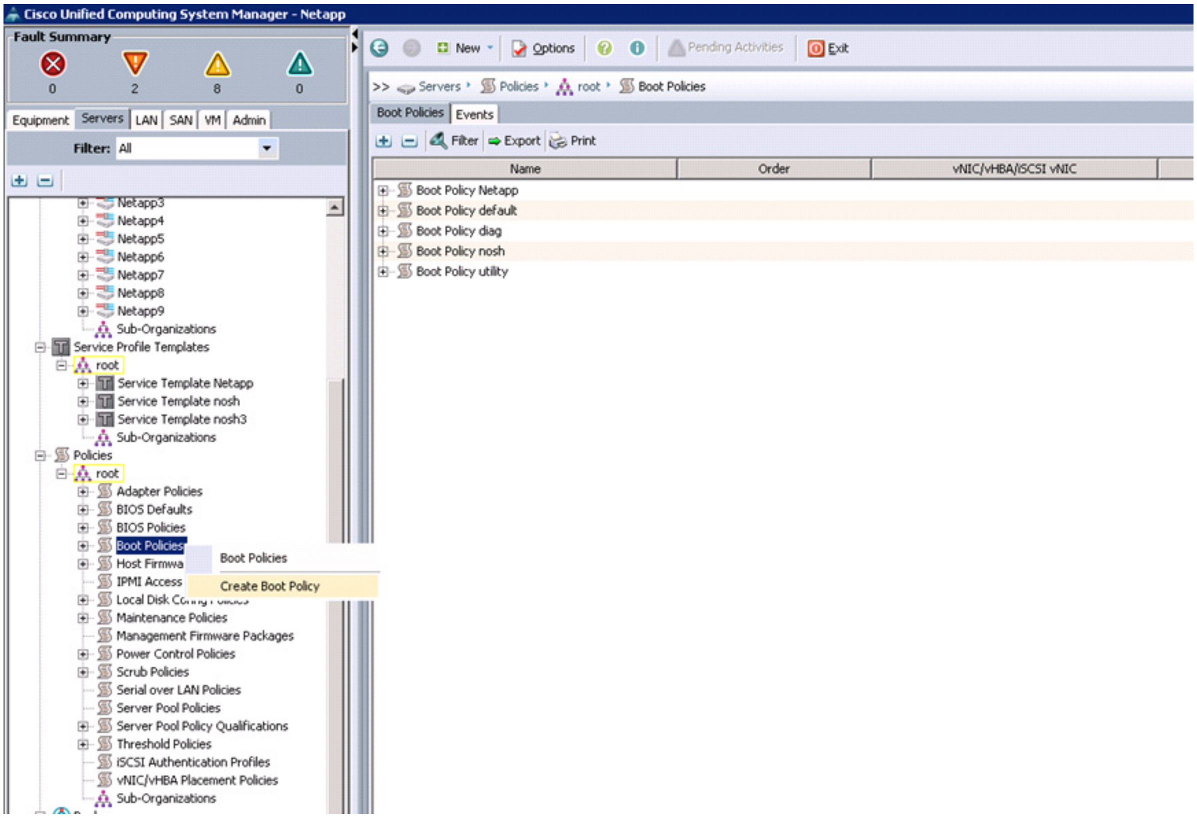
7. Click **Finish** to complete creating the BIOS policy.
8. Click **OK**.

Creating Boot Policies

Follow these steps to create boot policies within the Cisco UCS Manager GUI:

1. Select the Servers tab in the left pane in the UCSM GUI.
2. Select **Policies** > **root**.
3. Right-click the Boot Policies.
4. Select Create Boot Policy.

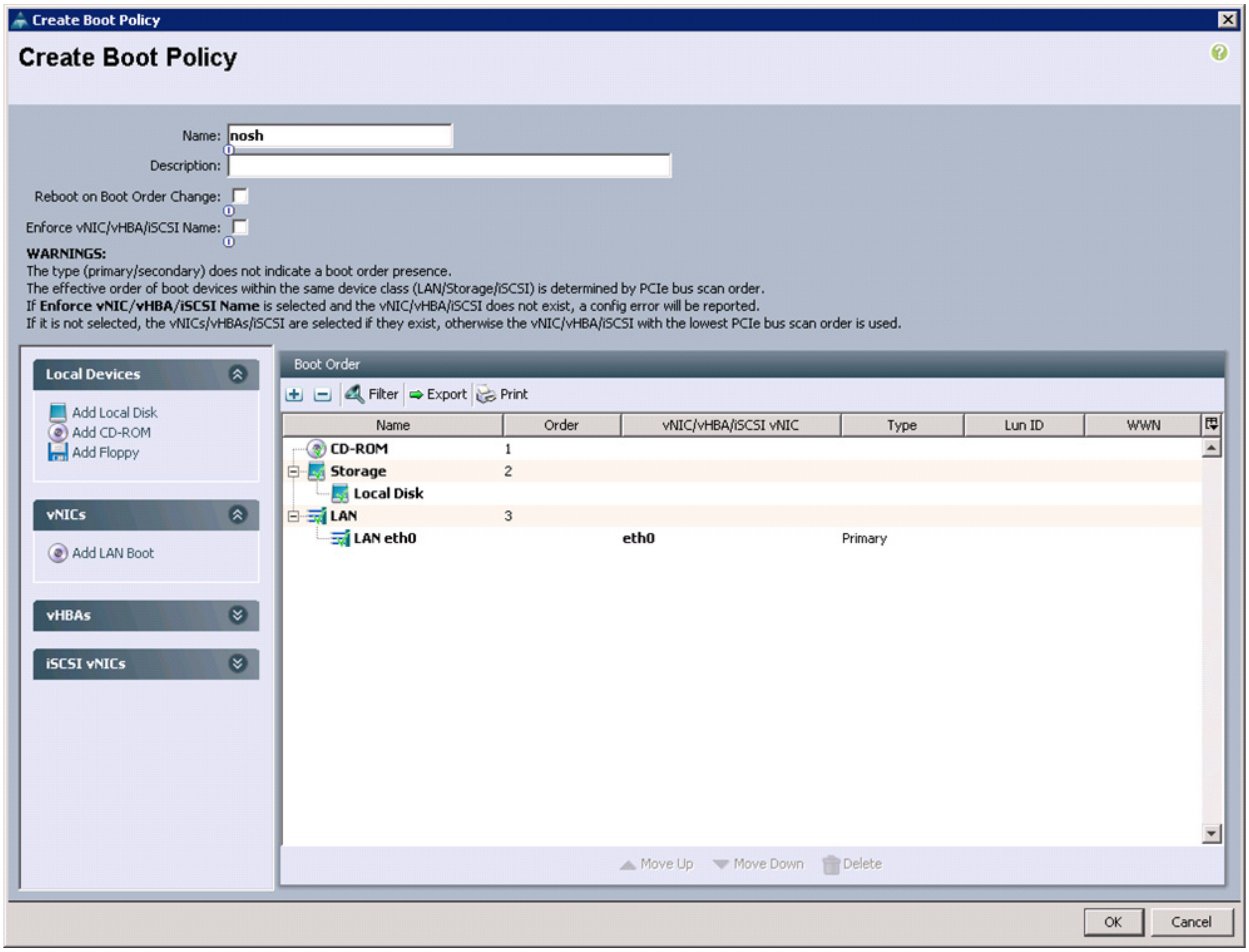
Figure 29 Creating Boot Policy



Name	Order	vNIC/vHBA/iSCSI vNIC
Boot Policy Netapp		
Boot Policy default		
Boot Policy diag		
Boot Policy nosh		
Boot Policy utility		

5. Enter nosh as the boot policy name.
6. (Optional) enter a description for the boot policy.
7. Keep the Reboot on Boot Order Change check box unchecked.
8. Expand Local Devices and select Add CD-ROM.
9. Expand Local Devices and select Add Local Disk.
10. Expand vNICs and select Add LAN Boot and enter eth0.

Figure 30 Creating Boot Order



Create Boot Policy

Name: nosh

Description:

Reboot on Boot Order Change: □

Enforce vNIC/vHBA/iSCSI Name: □

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/iSCSI are selected if they exist, otherwise the vNIC/vHBA/iSCSI with the lowest PCIe bus scan order is used.

Name	Order	vNIC/vHBA/iSCSI vNIC	Type	Lun ID	WWN
CD-ROM	1				
Storage	2				
Local Disk					
LAN	3				
LAN eth0		**eth0**	Primary		

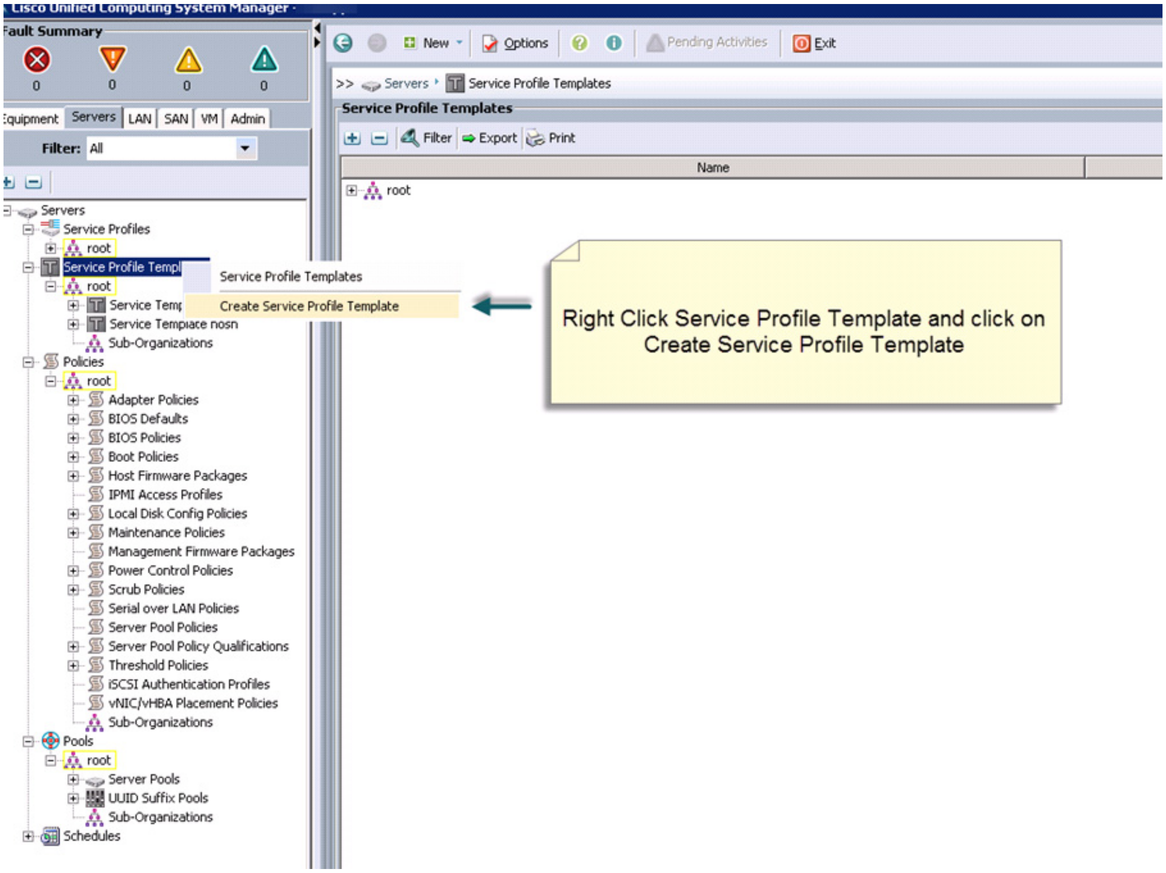
11. Click **OK** to add the Boot Policy.
12. Click **OK**.

Creating Service Profile Template

To create a service profile template, follow these steps:

1. Select the Servers tab in the left pane in the UCSM GUI.
2. Select **Policies** > **root**.
3. Right-click root.
4. Select Create Service Profile Template.

Figure 31 Creating Service Profile Template



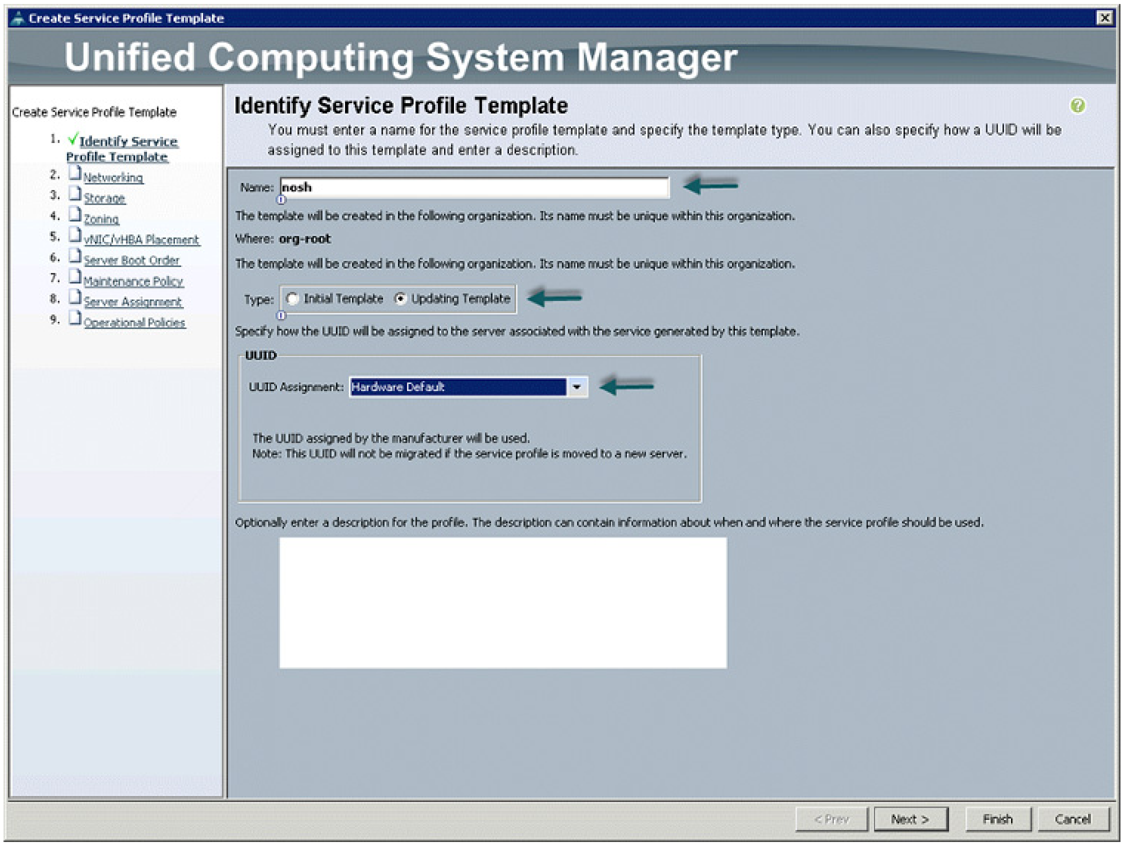
5. The Create Service Profile Template window appears.

   The following steps provide the detailed configuration procedure used to create a service profile template:

   a. Name the service profile template as nosh. Select the **Updating Template** radio button.

   b. In the UUID section, select Hardware Default as the UUID pool.

Figure 32 Identifying Service Profile Template



Identify 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: nosh

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

Where: org-root

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: Hardware Default

The UUID assigned by the manufacturer will be used.
Note: This UUID will not be migrated if the service profile is moved to a new server.

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

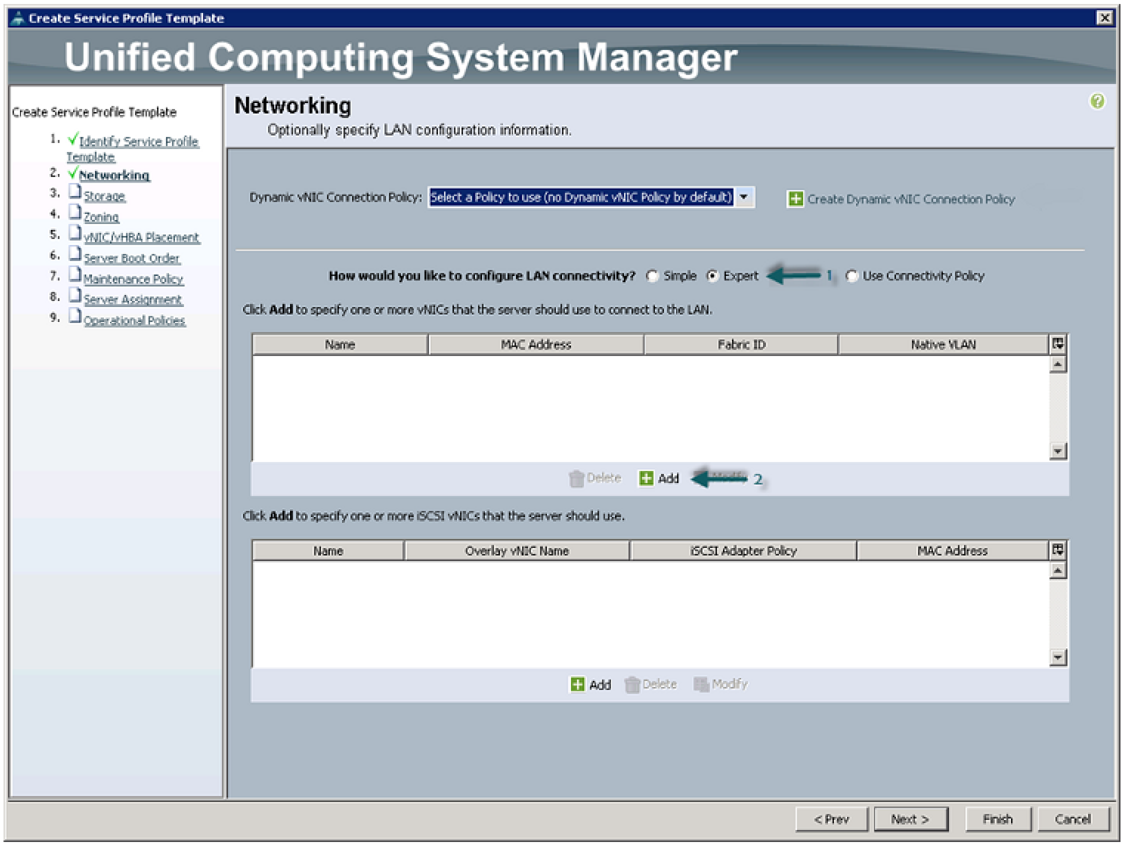
c. Click **Next** to continue to the next section.

Configuring Network Settings for the Template

In the Networking window, follow these steps to create vNICs:

1. Keep the Dynamic vNIC Connection Policy field as default.
2. Select the **Expert** radio button for the option How would you like to configure LAN connectivity?
3. Click **Add** to add a vNIC to the template.

Figure 33 Adding vNICs



Create Service Profile Template

Unified Computing System Manager

Create Service Profile Template

1. ✓ Identify Service Profile Template
2. ✓ Networking
3. □ Storage
4. □ Zoning
5. □ vNIC/vHBA Placement
6. □ Server Boot Order
7. □ Maintenance Policy
8. □ Server Assignment
9. □ Operational Policies

Networking

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 ○ Use Connectivity Policy

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

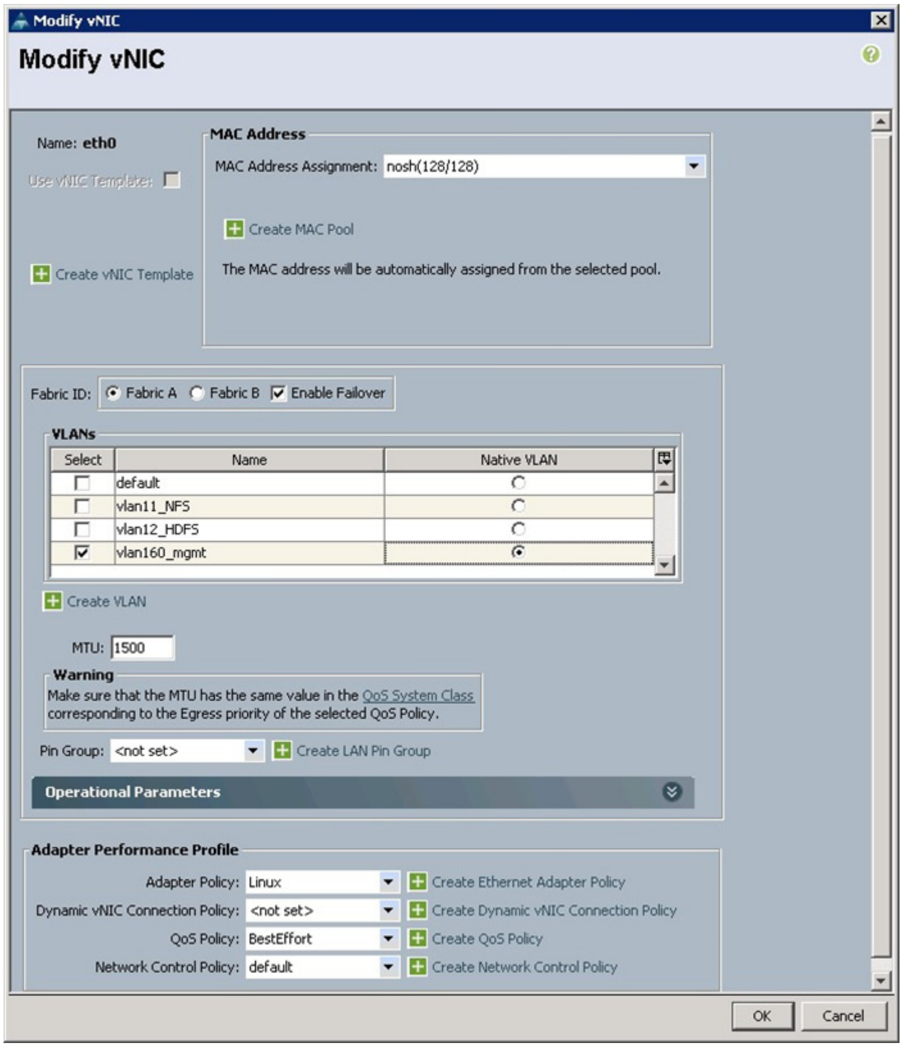
Name	MAC Address	Fabric ID	Native VLAN

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

Name	Overlay vNIC Name	iSCSI Adapter Policy	MAC Address

4. The Create vNIC window displays. Name the vNIC as eth0.
5. Select nosh in the Mac Address Assignment pool.
6. Select the **Fabric A** radio button and check the Enable failover check box for the Fabric ID.
7. Check the vlan160_mgmt check box for VLANs and select the **Native VLAN** radio button.
8. Select MTU size as 1500.
9. Select adapter policy as Linux.
10. Keep the Dynamic vNIC connection policy as <no set>.
11. Select QoS Policy as BestEffort.
12. Keep the Network Control Policy as Default.

Figure 34 Creating Management vNIC



Modify vNIC

Name: eth0

Use vNIC Template: □

Create vNIC Template

MAC Address

MAC Address Assignment: nosh(128/128)

Create MAC Pool

The MAC address will be automatically assigned from the selected pool.

Fabric ID: ● Fabric A ○ Fabric B ☑ Enable Failover

VLANs

Select	Name	Native VLAN
□	default	○
□	vlan11_NFS	○
□	vlan12_HDFS	○
☑	vlan160_mgmt	●

Create VLAN

MTU: 1500

Warning

Make sure that the MTU has the same value in the QoS System Class corresponding to the Egress priority of the selected QoS Policy.

Pin Group: <not set>

Create LAN Pin Group

Operational Parameters

Adapter Performance Profile

Adapter Policy: Linux

Create Ethernet Adapter Policy

Dynamic vNIC Connection Policy: <not set>

Create Dynamic vNIC Connection Policy

QoS Policy: BestEffort

Create QoS Policy

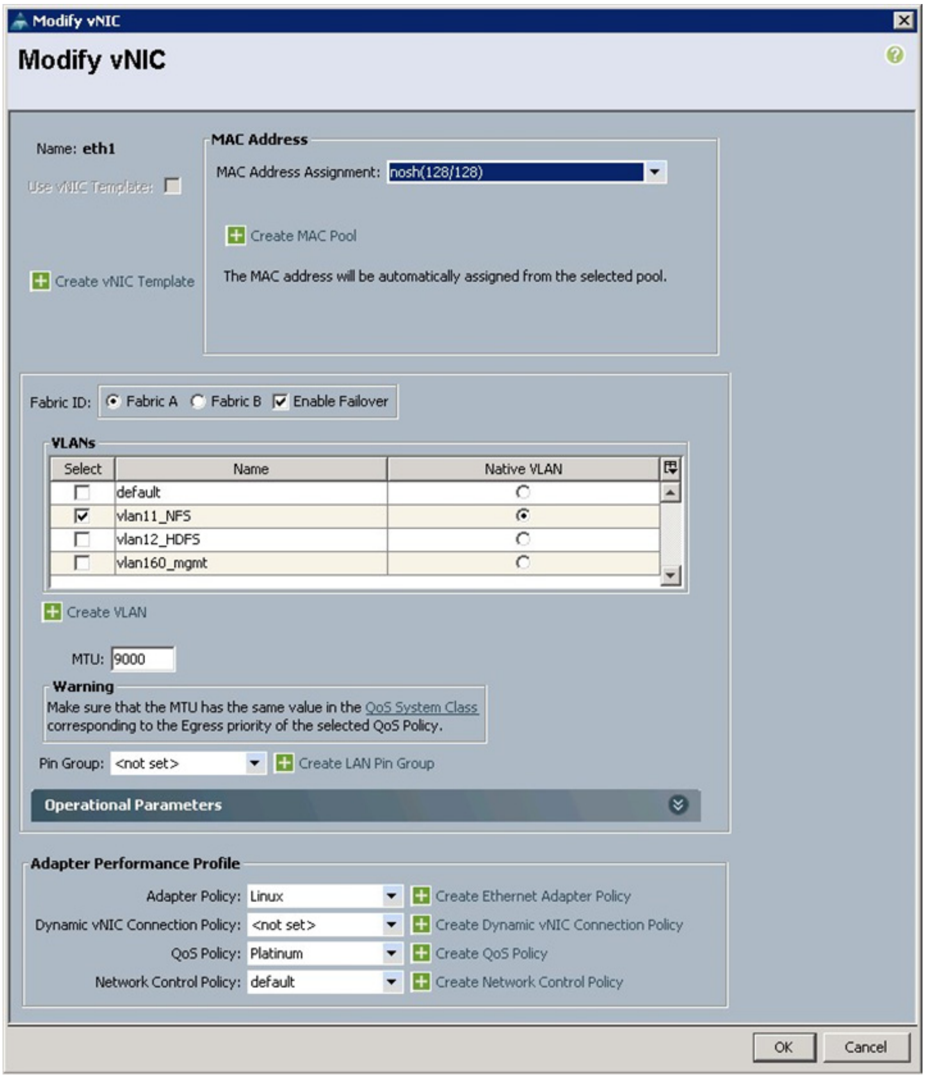
Network Control Policy: default

Create Network Control Policy

OK Cancel

13. Click **OK**.
14. Click **Add** to add another vNIC to the template.
15. The Create vNIC window appears. Name the vNIC as eth1.
16. Select nosh in the Mac Address Assignment pool.
17. Select the **Fabric A** radio button and check the Enable failover check box for the Fabric ID.
18. Check the Default and vlan11 check boxes for VLANs and select the **vlan11** radio button for Native VLAN.
19. Select MTU size as 9000.
20. Select Adapter Policy as Linux.
21. Keep the Dynamic vNIC Connection Policy as <not set>.
22. Select QoS Policy to Platinum.
23. Keep the Network Control Policy as Default.

Figure 35 Creating NFS vNIC



Modify vNIC

Name: eth1

Use vNIC Template: □

Create vNIC Template

MAC Address

MAC Address Assignment: nosh(128/128)

Create MAC Pool

The MAC address will be automatically assigned from the selected pool.

Fabric ID: ● Fabric A ○ Fabric B ☑ Enable Failover

VLANs

Select	Name	Native VLAN
□	default	○
☑	vlan11_NFS	●
□	vlan12_HDFS	○
□	vlan160_mgmt	○

Create VLAN

MTU: 9000

Warning

Make sure that the MTU has the same value in the QoS System Class corresponding to the Egress priority of the selected QoS Policy.

Pin Group: <not set> Create LAN Pin Group

Operational Parameters

Adapter Performance Profile

Adapter Policy: Linux Create Ethernet Adapter Policy

Dynamic vNIC Connection Policy: <not set> Create Dynamic vNIC Connection Policy

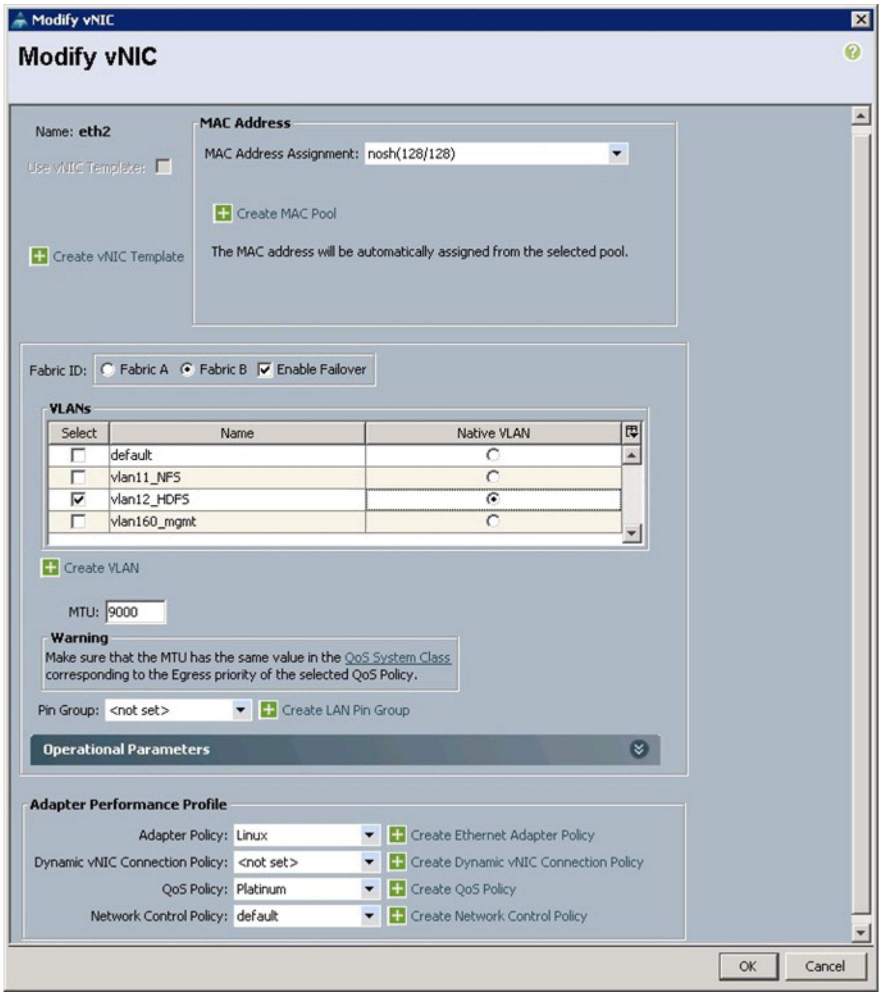
QoS Policy: Platinum Create QoS Policy

Network Control Policy: default Create Network Control Policy

OK Cancel

24. Click **OK**.
25. Click **Add** to add another vNIC to the template.
26. The Create vNIC window appears. Name the vNIC as eth2.
27. Select nosh in the Mac Address Assignment pool.
28. Select the **Fabric B** radio button and check the Enable failover check box for the Fabric ID.
29. Check the vlan12_HDFS check box for VLANs and select the **Native VLAN** radio button.
30. Select MTU size as 9000.
31. Select adapter policy as Linux.
32. Keep the Dynamic vNIC Connection Policy as <no set>.
33. Select QoS Policy as Platinum.
34. Keep the Network Control Policy as Default.

Figure 36 Creating HDFS vNIC



Modify vNIC

Name: eth2

Use vNIC Template: □

MAC Address

MAC Address Assignment: nosh(128/128)

The MAC address will be automatically assigned from the selected pool.

Fabric ID: ○ Fabric A ● Fabric B ☑ Enable Failover

VLANs

Select	Name	Native VLAN
□	default	○
□	vlan11_NFS	○
☑	vlan12_HDFS	●
□	vlan160_mgmt	○

MTU: 9000

Warning

Make sure that the MTU has the same value in the QoS System Class corresponding to the Egress priority of the selected QoS Policy.

Pin Group: <not set>

Adapter Performance Profile

Adapter Policy: Linux

Dynamic vNIC Connection Policy: <not set>

QoS Policy: Platinum

Network Control Policy: default

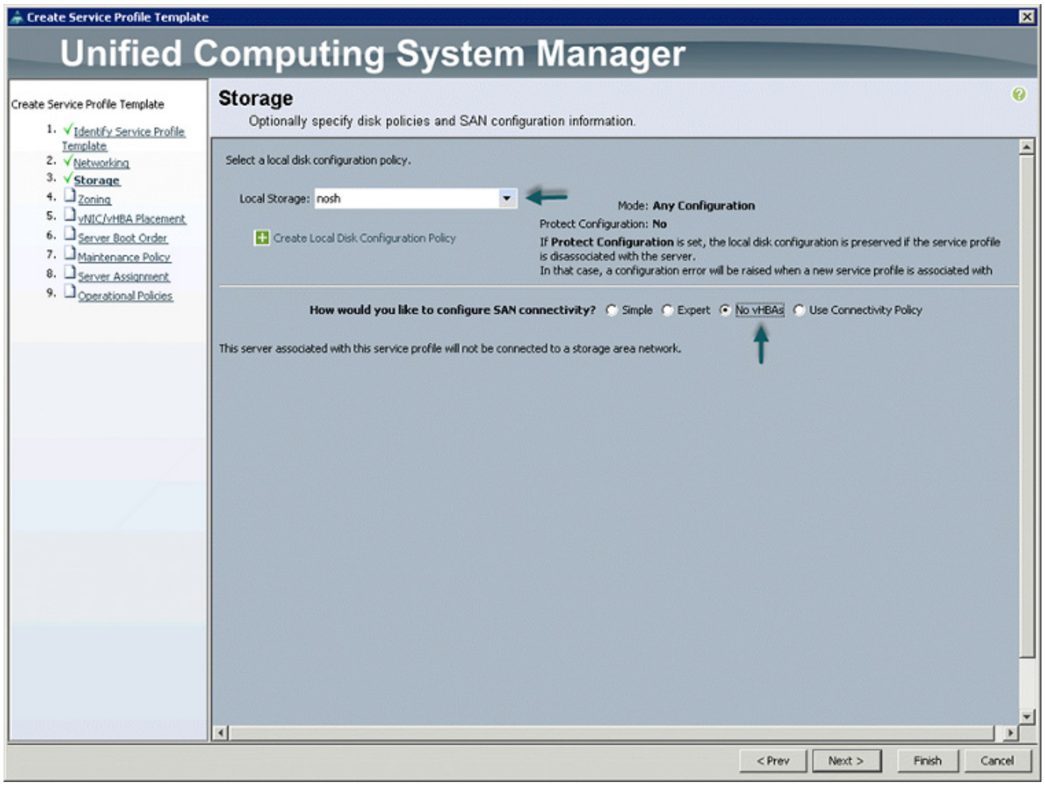
35. Click **OK**.
36. Click **Next** to continue to the next section.

Configuring Storage Policy for the Template

In the Storage window, follow these steps to configure storage:

1. Select nosh for the local disk configuration policy.
2. Select the **No vHBAs** radio button for the option How would you like to configure SAN connectivity?

Figure 37 *Storage Settings*



Create Service Profile Template
Unified Computing System Manager
Create Service Profile Template
1. ✓ Identify Service Profile Template
2. ✓ Networking
3. ✓ Storage
4. Zoning
5. vNIC/vHBA Placement
6. Server Boot Order
7. Maintenance Policy
8. Server Assignment
9. Operational Policies
Create Local Disk Configuration Policy
< Prev
Next >
Finish
Cancel

Storage

Optionally specify disk policies and SAN configuration information.

Select a local disk configuration policy.

Local Storage: nosh

Mode: **Any Configuration**

Protect Configuration: **No**

If **Protect Configuration** is set, the local disk configuration is preserved if the service profile is disassociated with the server.
In that case, a configuration error will be raised when a new service profile is associated with

How would you like to configure SAN connectivity? ○ Simple ○ Expert ● No vHBAs ○ Use Connectivity Policy

This server associated with this service profile will not be connected to a storage area network.

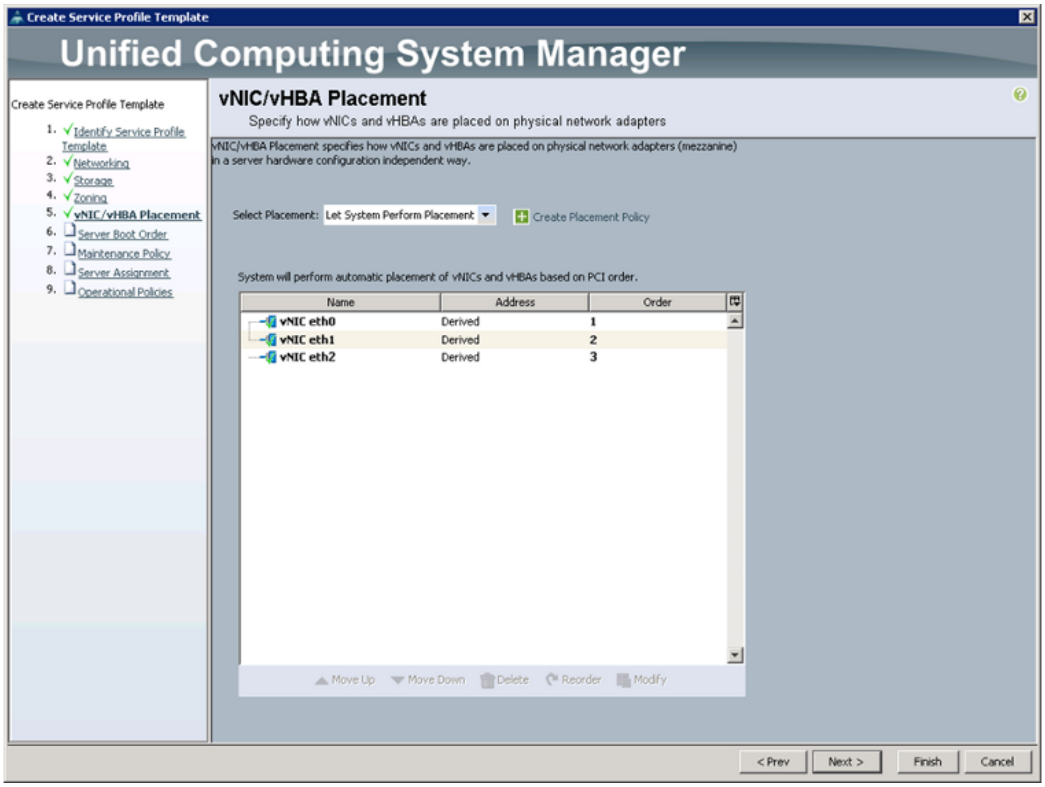
3. Click **Next** to continue to the next section.
4. Click **Next** in the Zoning Window to go to the next section.

Configuring vNIC/vHBA Placement for the Template

In the vNIC/vHBA Placement Section, follow these steps to configure placement policy:

1. Select the Default Placement Policy option for Select Placement field.
2. Select eth0, eth1, and eth2 assign the vNICs in the following order:
   - eth0
   - eth1
   - eth2
3. Review the table to make sure that all of the vNICs were assigned in the appropriate order.

Figure 38 Creating vNIC and vHBA Policy



vNIC/vHBA Placement

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

Create Placement Policy

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

Name	Address	Order
vNIC eth0	Derived	1
vNIC eth1	Derived	2
vNIC eth2	Derived	3

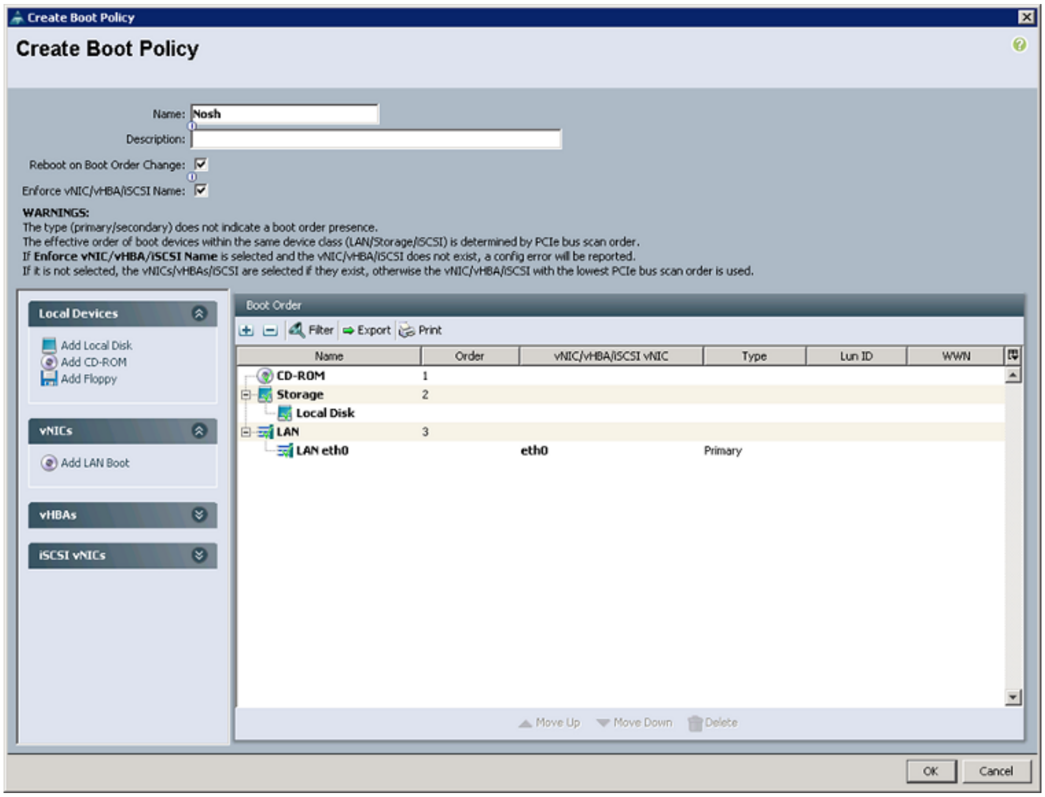
4. Click **Next** to continue to the next section.

Configuring Server Boot Order for the Template

In the Server Boot Order Section, follow these steps to set the boot order for servers:

1. Select nosh for the Boot Policy Name field.
2. Check the Reboot on Boot Order Change check box.
3. Check the Enforce vNIC/vHBA/iSCSI Name check box.
4. Review the table to make sure that all of the boot devices were created and identified. Verify that the boot devices are in the correct boot sequence.

Figure 39 Creating Boot Policy



Create Boot Policy

Name: Nosh

Description:

Reboot on Boot Order Change: ☑

Enforce vNIC/vHBA/iSCSI Name: ☑

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/iSCSI are selected if they exist, otherwise the vNIC/vHBA/iSCSI with the lowest PCIe bus scan order is used.

Boot Order

Name	Order	vNIC/vHBA/iSCSI vNIC	Type	Lun ID	WWN
CD-ROM	1				
Storage	2				
Local Disk					
LAN	3				
LAN eth0		eth0	Primary		

5. Click **OK**.
6. Click **Next** to continue to the next section.

Configuring Maintenance Policy for the Template

In the Maintenance Policy window, follow these steps to apply maintenance policy:

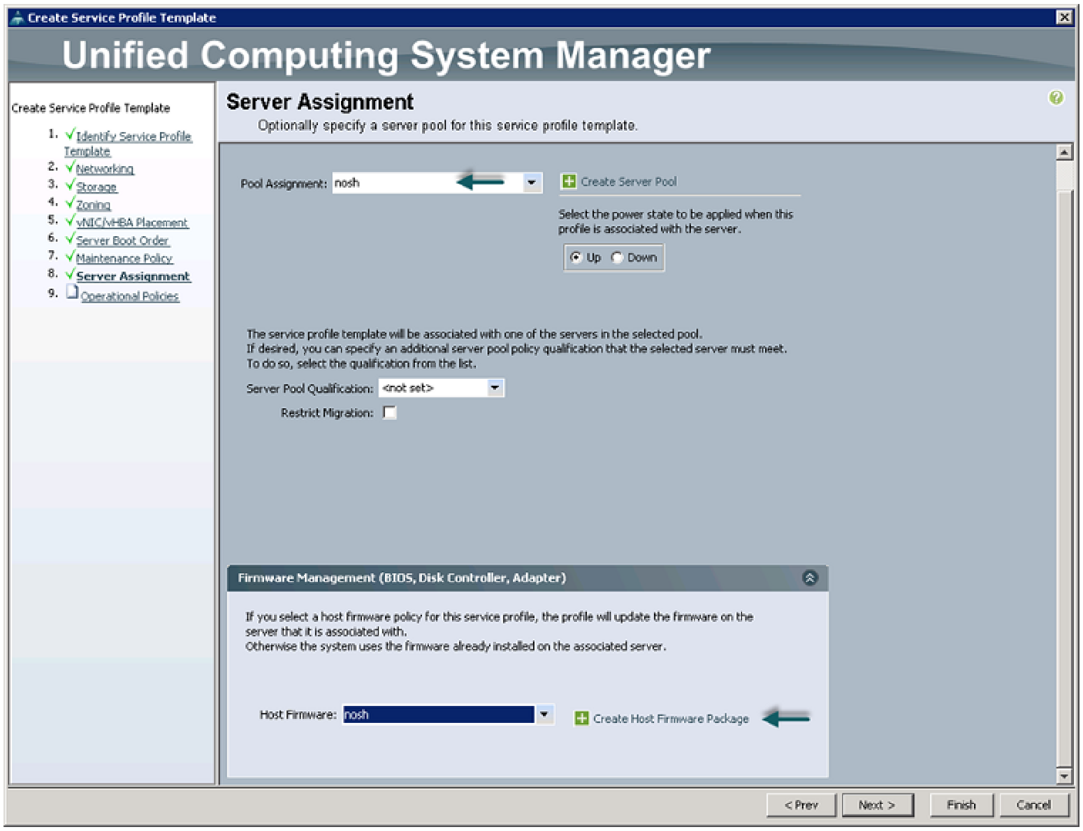
1. Keep the Maintenance Policy at no policy used by default.
2. Click **Next** to continue to the next section.

Configuring Server Assignment for the Template

In the Server Assignment window, follow these steps to assign servers to the pool:

1. Select nosh for the Pool Assignment field.
2. Keep the Server Pool Qualification field at default.
3. Select nosh for the Host Firmware Package.

Figure 40 Assigning Sever Pool for Service Profile Template



Server Assignment

Optionally specify a server pool for this service profile template.

Pool Assignment: nosh

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

● Up ○ Down

The service profile template will be associated with one of the servers in the selected pool.
If desired, you can specify an additional server pool policy qualification that the selected server must meet.
To do so, select the qualification from the list.

Server Pool Qualification: <not set>

Restrict Migration: □

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: nosh

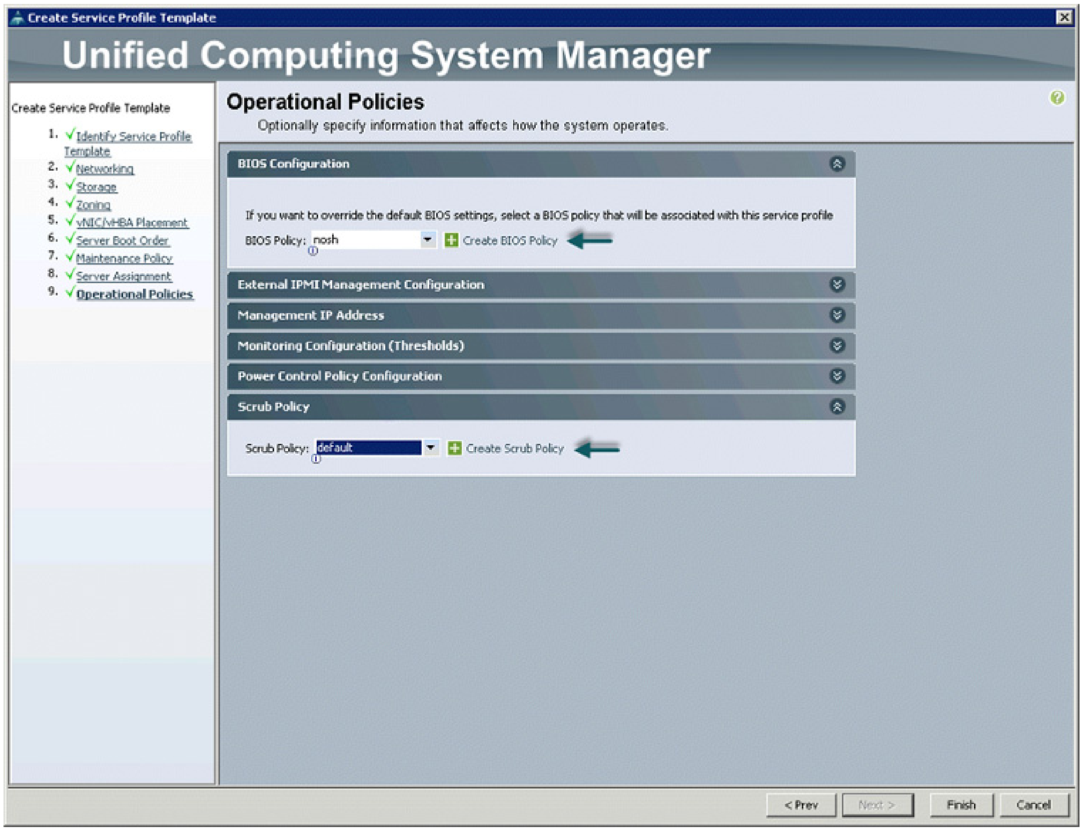
4. Click **Next** to continue to the next section.

Configuring Operational Policies for the Template

In the Operational Policies window, follow these steps:

1. Select nosh in the BIOS Policy field.

Figure 41 Creating Operational Policies


Create Service Profile Template
Unified Computing System Manager
Create Service Profile Template
1. Identify Service Profile Template
2. Networking
3. Storage
4. Zoning
5. vNIC/vHBA Placement
6. Server Boot Order
7. Maintenance Policy
8. Server Assignment
9. Operational Policies
Operational Policies
Optionally specify information that affects how the system operates.
BIOS Configuration
External IPMI Management Configuration
Management IP Address
Monitoring Configuration (Thresholds)
Power Control Policy Configuration
Scrub Policy
Create BIOS Policy
Create Scrub Policy
< Prev
Next >
Finish
Cancel

If you want to override the default BIOS settings, select a BIOS policy that will be associated with this service profile

BIOS Policy: nosh

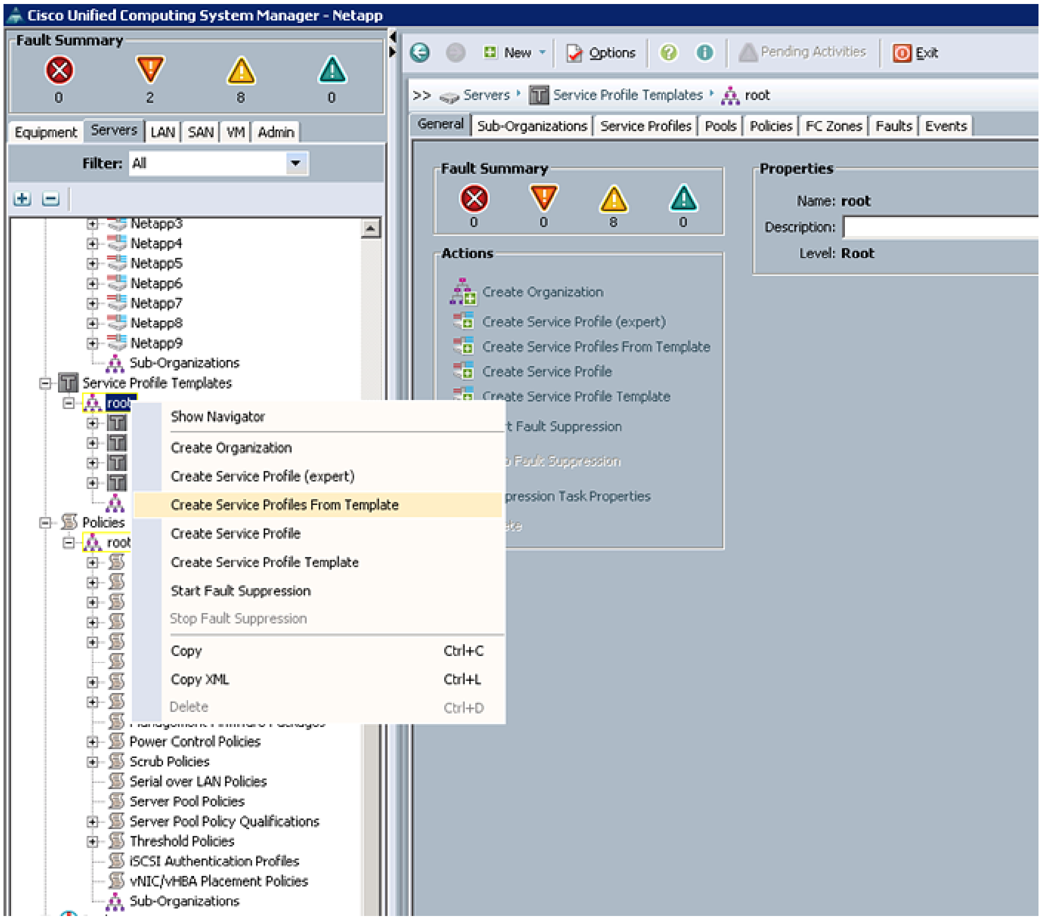
Scrub Policy: default

2. Click **Finish** to create the Service Profile template.
3. Click **OK** in the pop-up window to exit the wizard.

Select the Servers tab in the left pane in the UCSM GUI.

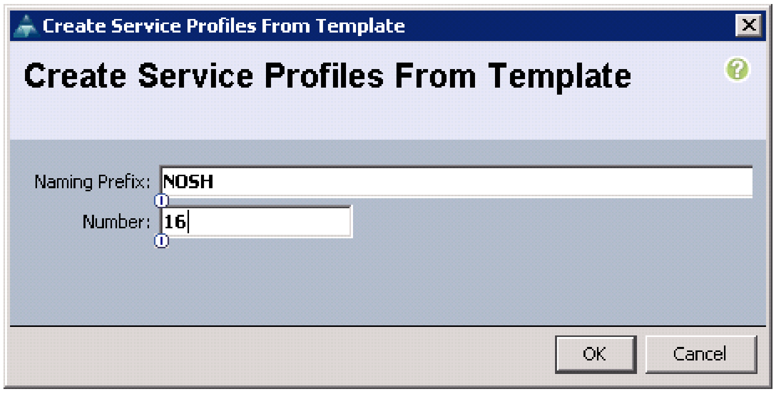
1. Select **Service Profile Templates** > **root.**
2. Right-click the root.
3. Select Create Service Profile Template.

Figure 42 *Creating Service Profile*



4. The Create Service Profile from Template window appears.

Figure 43 *Creating Service Profile from Template*


Create Service Profiles From Template
Create Service Profiles From Template
OK
Cancel

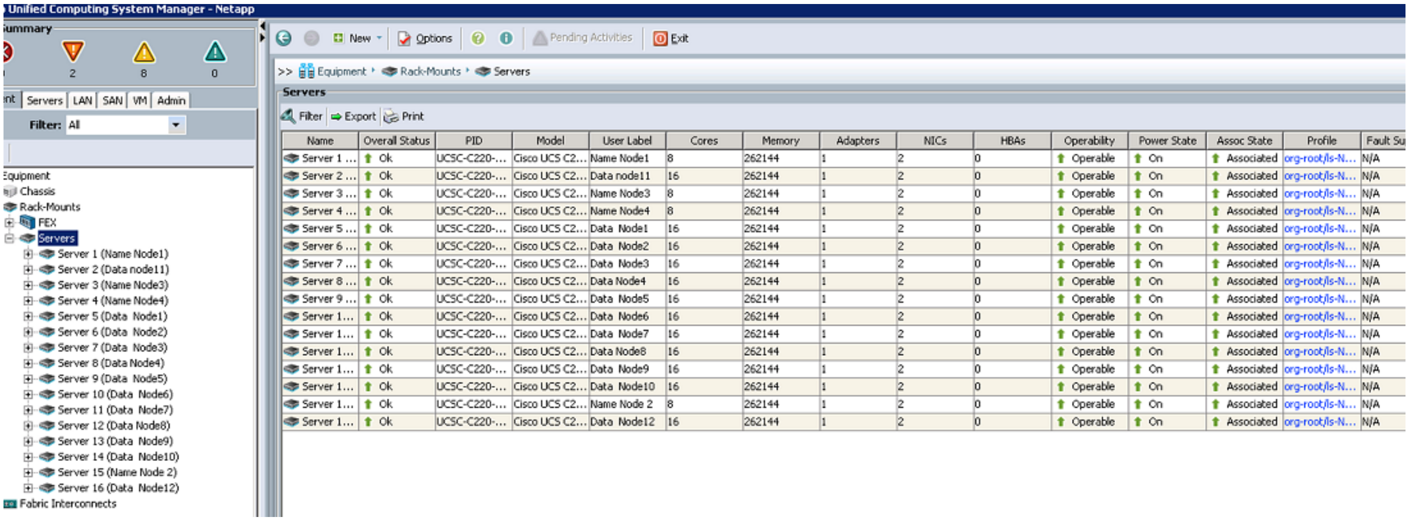
Naming Prefix: NOSH

Number: 16

5. Now connect the power cable to the servers.
6. Servers will the be discovered by UCS Manager.
7. Association of Service Profile will take place automatically.

8. The final Cisco UCS Manager window is shown in Figure 44.

Figure 44 UCS Manager Showing Sixteen Nodes



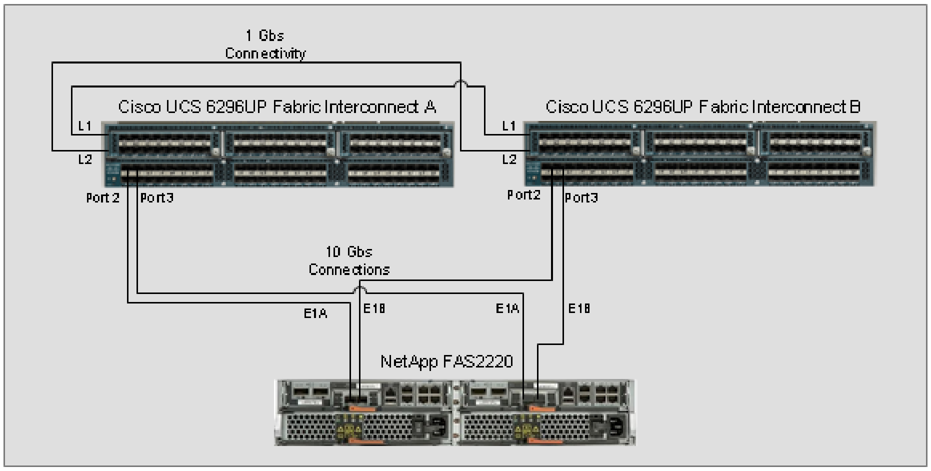
Equipment
Chassis
Rack-Mounts
FEX
Servers
Server 1 (Name Node1)
Server 2 (Data node11)
Server 3 (Name Node3)
Server 4 (Name Node4)
Server 5 (Data Node1)
Server 6 (Data Node2)
Server 7 (Data Node3)
Server 8 (Data Node4)
Server 9 (Data Node5)
Server 10 (Data Node6)
Server 11 (Data Node7)
Server 12 (Data Node8)
Server 13 (Data Node9)
Server 14 (Data Node10)
Server 15 (Name Node 2)
Server 16 (Data Node12)
Fabric Interconnects

Name	Overall Status	PID	Model	User Label	Cores	Memory	Adapters	NICs	HBAs	Operability	Power State	Assoc State	Profile	Fault Su
Server 1 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Name Node1	8	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 2 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Data node11	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 3 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Name Node3	8	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 4 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Name Node4	8	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 5 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node1	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 6 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node2	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 7 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node3	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 8 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node4	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 9 ...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node5	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node6	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node7	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node8	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node9	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node10	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Name Node 2	8	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A
Server 1...	Ok	UCSC-C220-...	Cisco UCS C2...	Data Node12	16	262144	1	2	0	Operable	On	Associated	org-root/ls-N...	N/A

Cisco UCS 6296UP FI Configuration for NetApp FAS 2220

The Cisco UCS 6296UP Fabric Interconnects are deployed in pairs with L1 to L1 and L2 to L2 connectivity for redundancy. NetApp FAS 2220 has one storage controllers. FAS controller port E1A is connected to FI A Port 2 as the Appliance port and E1B is connected to FI B Port 2 as the Appliance port with 10Gbs connectivity as shown in Figure 45.

Figure 45 Cisco UCS 6296UP FIs and NetApp FAS 2220 Connectivity



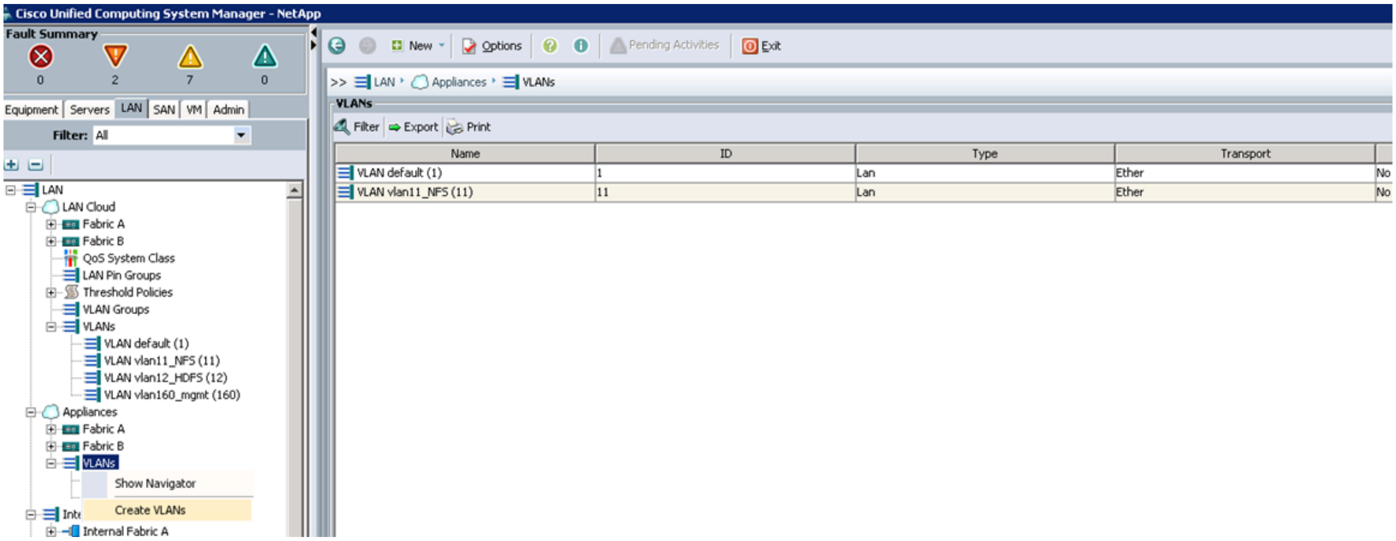
Configuring VLAN for Appliance Port

Follow these steps to configure VLAN appliance cloud:

1. Select the LAN tab in the left pane in the UCSM GUI.

2. Select **LAN** > **Appliances** > **VLANs**.
3. Right-click VLANs under the root organization.
4. Select Create VLANs to create the VLAN.

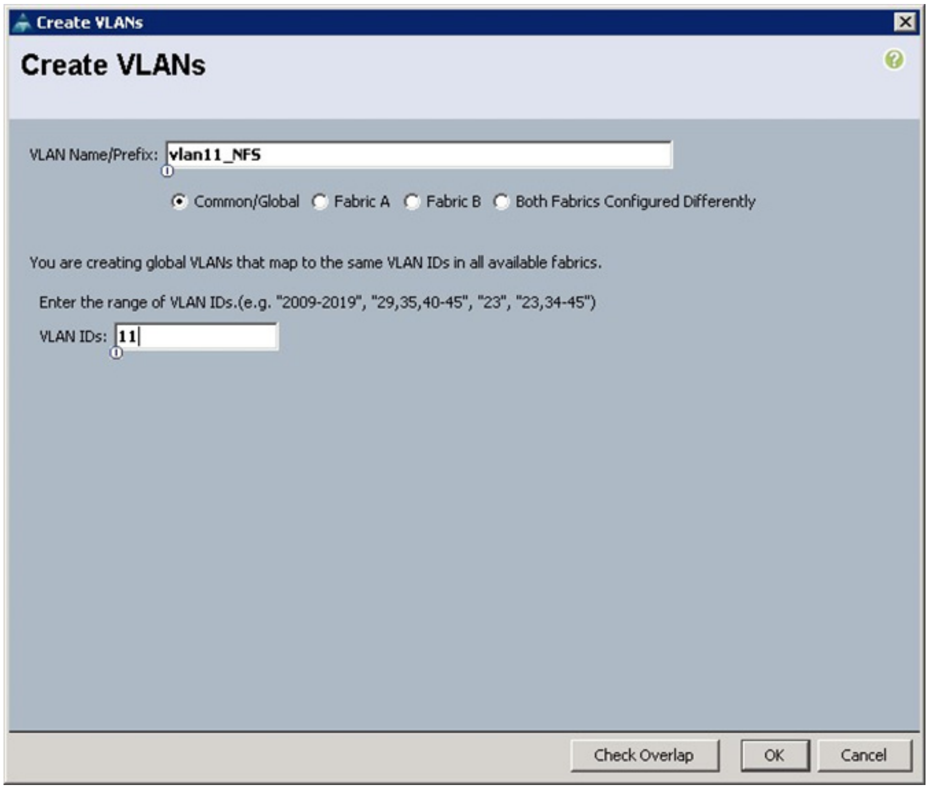
Figure 46 Creating VLANs for Appliance Cloud



Name	ID	Type	Transport	
VLAN default (1)	1	Lan	Ether	No
VLAN vlan11_NFS (11)	11	Lan	Ether	No

5. Enter vlan11_NFS for the VLAN Name.
6. Select the **Common/Global** radio button.
7. Enter 11 for VLAN ID.

Figure 47 Creating VLAN for Fabric A



Create VLANs

VLAN Name/Prefix: vlan11_NFS

● 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: 11

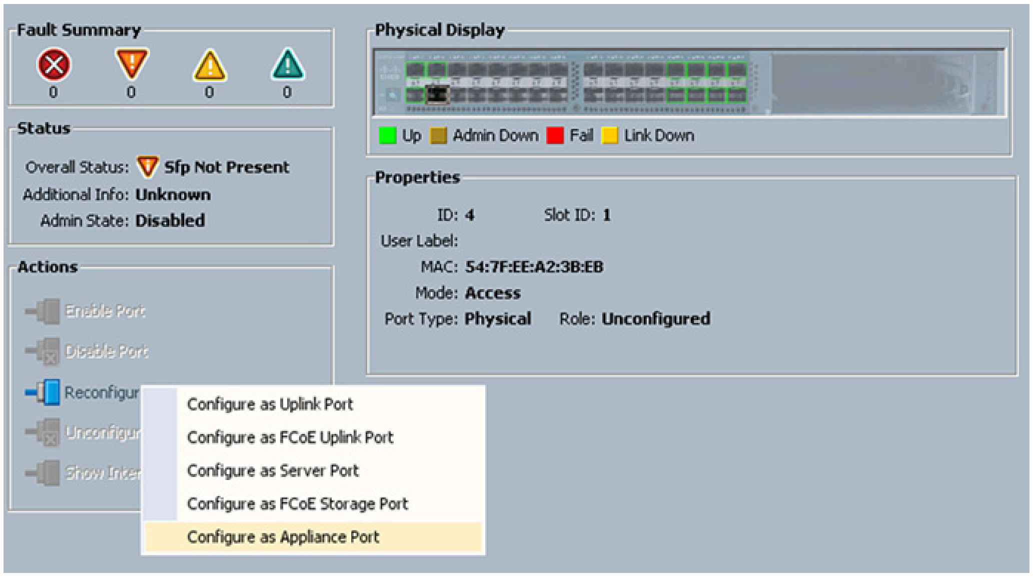
8. Click **OK** and then, click **Finish**.

Configure Appliance Port

Follow these steps to configure appliance ports:

1. Select the Equipment tab in the left pane in the UCSM GUI.
2. Select **Equipment** > **Fabric Interconnects** > **Fabric Interconnect A (primary)** > **Fixed Module**.
3. Expand the Unconfigured Ethernet Ports.
4. Select the port number 2, and select **Reconfigure** > **Configure as an Appliance Port**.

Figure 48 Configuring Fabric A Appliance Port



Status

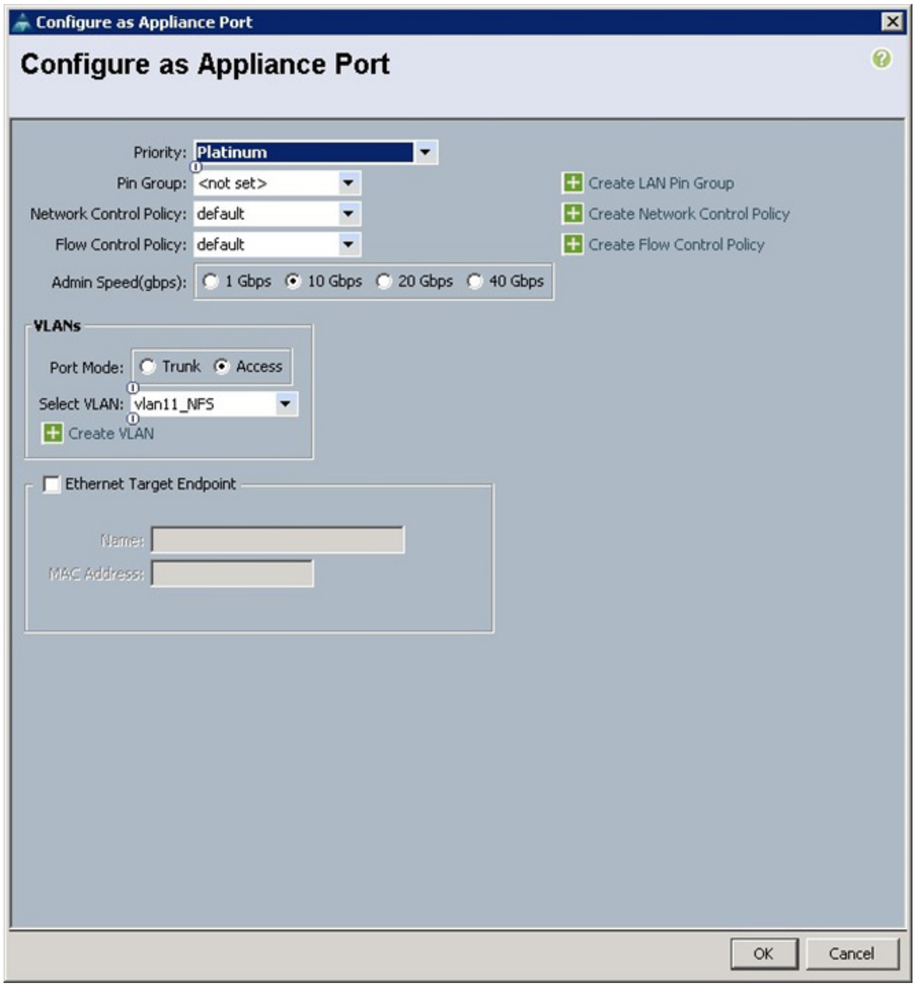
Overall Status: Sfp Not Present
Additional Info: Unknown
Admin State: Disabled

Properties

ID: 4 Slot ID: 1
User Label:
MAC: 54:7F:EE:A2:3B:EB
Mode: Access
Port Type: Physical Role: Unconfigured

5. A confirmation message box appears. Click **Yes**, then **OK** to continue.
6. Select Platinum for the Priority.
7. Keep the Pin Group as <not set>.
8. Keep the Network Control Policy as Default.
9. Keep the Flow Control Policy as Default.
10. Select the **10Gbps** radio button for the Admin Speed.
11. Select the **Access** radio button for the Port Mode.
12. Select vlan11_NFS from the dropdown menu for the Select VLAN.

Figure 49 Configuring Appliance Port



Configure as Appliance Port

Priority: Platinum

Pin Group: <not set>

Network Control Policy: default

Flow Control Policy: default

Admin Speed(gbps): ○ 1 Gbps ● 10 Gbps ○ 20 Gbps ○ 40 Gbps

VLANs

Port Mode: ○ Trunk ● Access

Select VLAN: vlan11_NFS

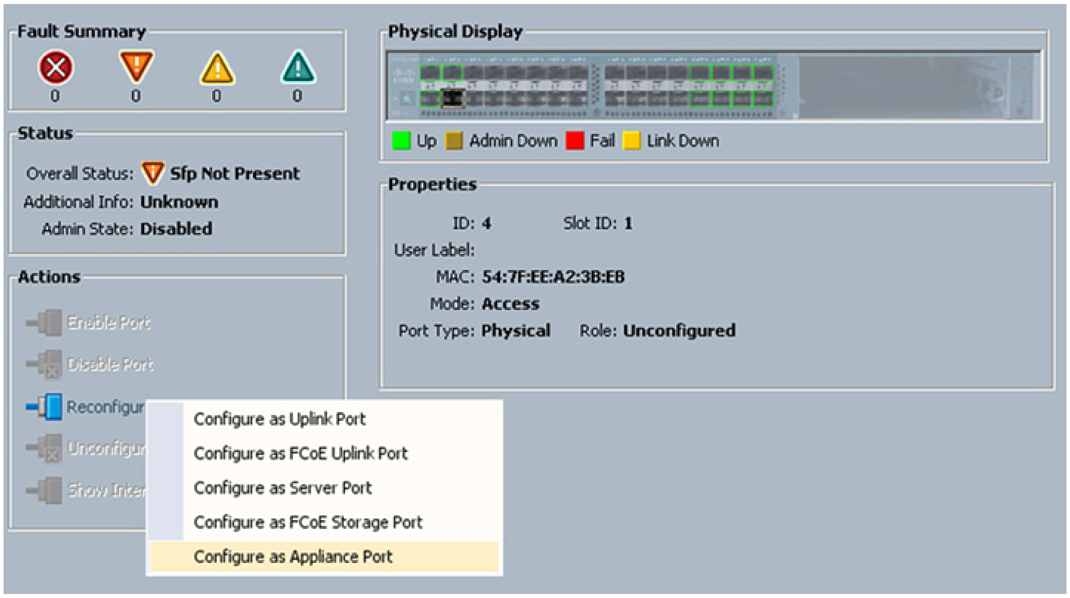
□ Ethernet Target Endpoint

Name:

MAC Address:

13. Click **OK**.
14. In the message box that appears, click **OK.**
15. Select **Equipment** > **Fabric Interconnects** > **Fabric Interconnect B (secondary)** > **Fixed Module**.
16. Expand the Unconfigured Ethernet Ports.
17. Select the port number 2, and select **Reconfigure** > **Configure as an Appliance Port**.

Figure 50 Configuring Fabric B Appliance Port



Status

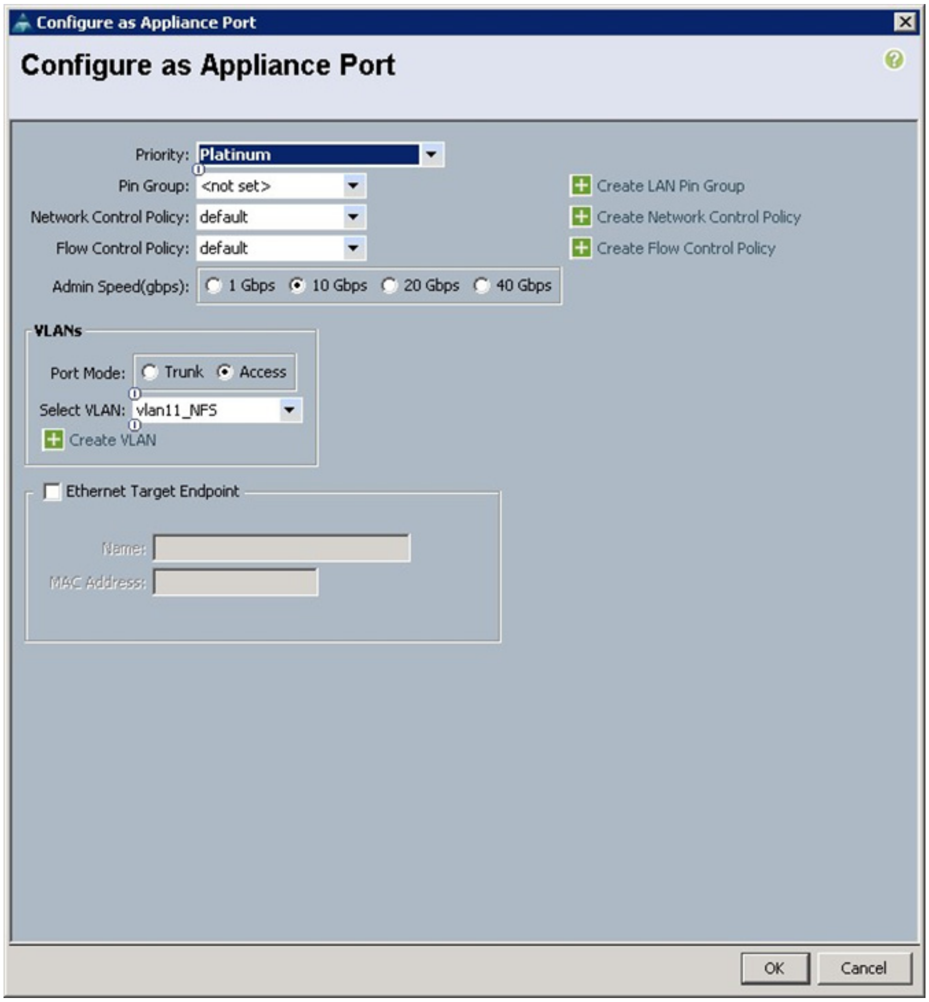
Overall Status: Sfp Not Present
Additional Info: Unknown
Admin State: Disabled

Properties

ID: 4 Slot ID: 1
User Label:
MAC: 54:7F:EE:A2:3B:EB
Mode: Access
Port Type: Physical Role: Unconfigured

18. A confirmation message box appears. Click **Yes**, then **OK** to continue.
19. Select Platinum for the Priority.
20. Keep the Pin Group as <not set>.
21. Keep the Network Control Policy as Default.
22. Keep the Flow Control Policy as Default.
23. Select the **10Gbps** radio button for the Admin Speed.
24. Select the **Access** radio button for the Port Mode.
25. Select vlan11_NFS from the dropdown menu for the Select VLAN.

Figure 51 Configuring Appliance Port



Configure as Appliance Port

Configure as Appliance Port

Priority: Platinum

Pin Group: <not set>

Network Control Policy: default

Flow Control Policy: default

Admin Speed(gbps): ○ 1 Gbps ● 10 Gbps ○ 20 Gbps ○ 40 Gbps

VLANs

Port Mode: ○ Trunk ● Access

Select VLAN: vlan11_NFS

□ Ethernet Target Endpoint

Name:

MAC Address:

26. Click **OK**.

27. In the message box that appears, click **OK**.

Server and Software Configuration

Service profile template creation is explained in "Fabric Configuration" section on page 17.

The following sections provide a detailed configuration procedure of the Cisco UCS C-Series Servers. These steps should be followed precisely because a failure to do so could result in an improper configuration.

Performing Initial Setup of C-Series Servers

These steps provide details for initial setup of the Cisco UCS C-Series Servers. It is important to get the systems to a known state with the appropriate firmware package.

Logging into the Cisco UCS 6200 Fabric Interconnects

To log into the Cisco UCS Manager application through Cisco UCS 6200 Series Fabric Interconnect, follow these steps:

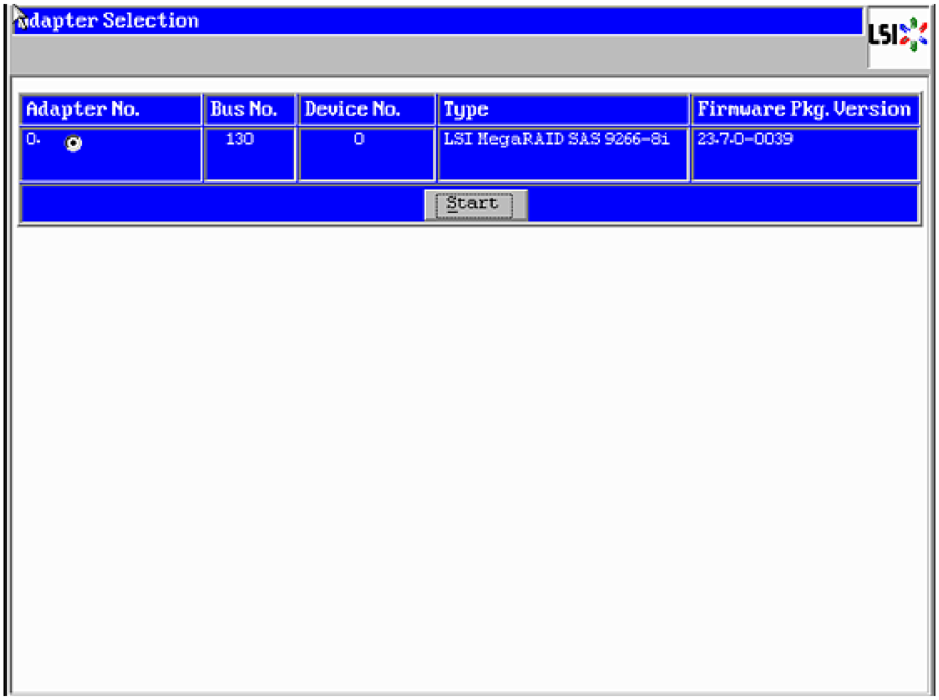
1. Log in to the Cisco UCS 6200 fabric interconnects and launch the Cisco UCS Manager application.
2. In the UCSM GUI, select the Servers tab.
3. Select Servers, right-click on Servers and Open KVM Console.
4. Navigate to the Actions section and click **KVM Console**.

Configuring Disk Drives for OS

There are several ways to configure RAID: using LSI WebBIOS Configuration Utility embedded in the MegaRAID BIOS, booting DOS and running MegaCLI commands or using third party tools that have MegaCLI integrated. For this deployment, the first disk drive is configured using LSI WebBIOS Configuration Utility. A RAID1 volume of two disk drives is configured for the operating system:

1. Once the server has booted and the MegaRAID Controller has been detected, the following will appear on the screen:
   - Press <Ctrl><H> for WebBIOS.
   - Press Ctrl+H immediately.
   - The Adapter Selection window appears.
2. Click **Start** to continue.

Figure 52 RAID Configuration for LSI MegaRAID SAS Controllers



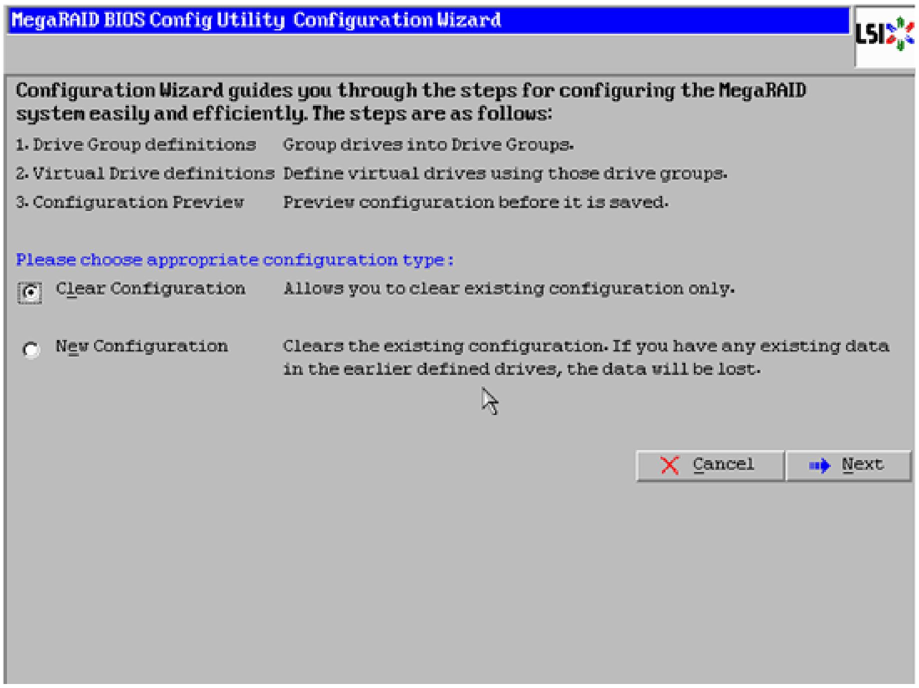
Adapter Selection

Adapter No.	Bus No.	Device No.	Type	Firmware Pkg. Version
0. ●	130	0	LSI MegaRAID SAS 9266-8i	23.7.0-0039

3. Click **Configuration Wizard**.

4. In the configure wizard window, select the configuration type as Clear Configuration and click **Next** to clear the existing configuration.

Figure 53 Clearing Existing Configuration



MegaRAID BIOS Config Utility Configuration Wizard

Configuration Wizard guides you through the steps for configuring the MegaRAID system easily and efficiently. The steps are as follows:

1. Drive Group definitions — Group drives into Drive Groups.
2. Virtual Drive definitions — Define virtual drives using those drive groups.
3. Configuration Preview — Preview configuration before it is saved.

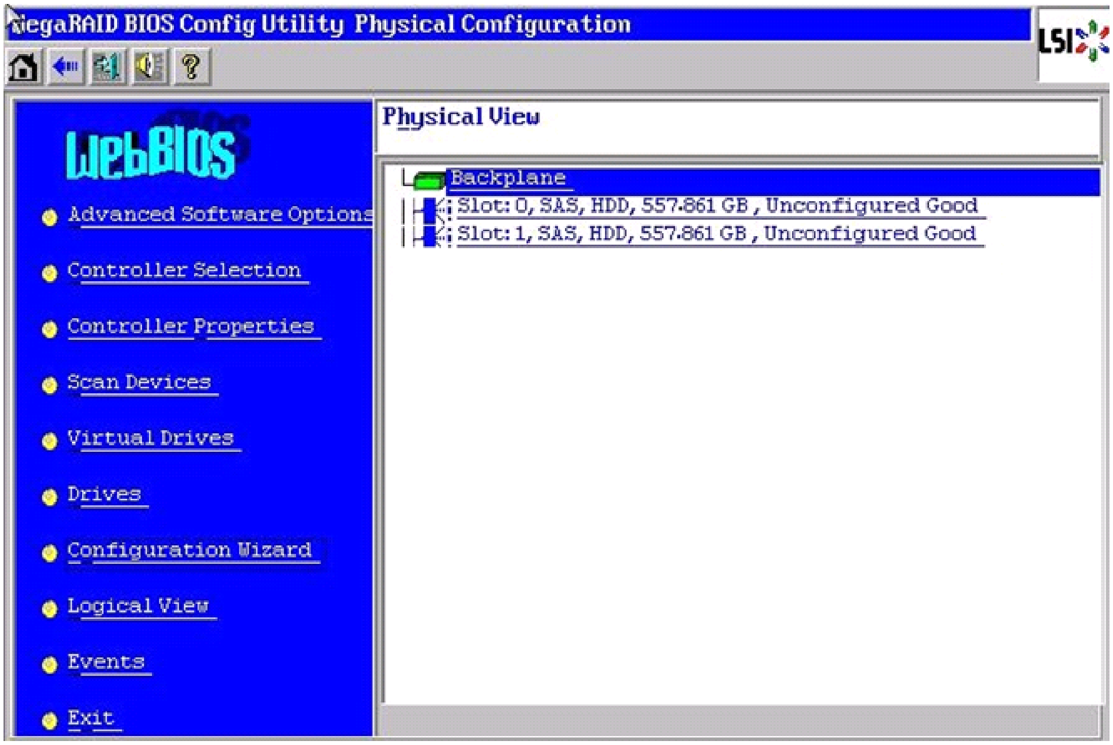
Please choose appropriate configuration type :

● Clear Configuration — Allows you to clear existing configuration only.

○ New Configuration — Clears the existing configuration. If you have any existing data in the earlier defined drives, the data will be lost.

5. Click **Yes** when asked to confirm clear configuration.
6. In the Physical View, make sure all the drives are Unconfigured Good.

Figure 54 Physical View of Unconfigured Drives



MegaRAID BIOS Config Utility Physical Configuration

Physical View

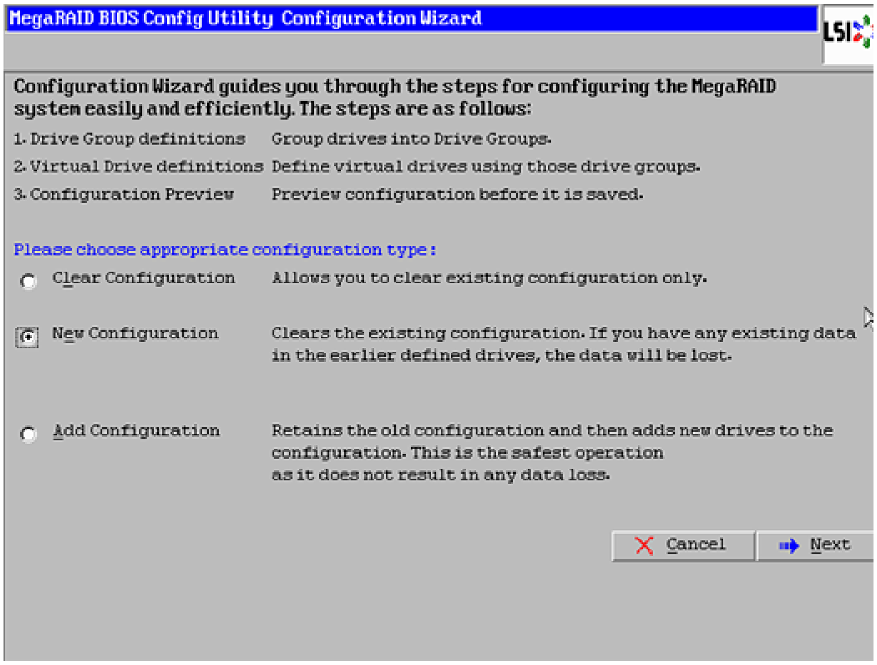
Backplane

Slot: 0, SAS, HDD, 557.861 GB, Unconfigured Good

Slot: 1, SAS, HDD, 557.861 GB, Unconfigured Good

7. Click **Configuration Wizard**.
8. In the configure wizard window, select the configuration type as New Configuration and click **Next**.

Figure 55 Selecting New Configuration



MegaRAID BIOS Config Utility Configuration Wizard

Configuration Wizard guides you through the steps for configuring the MegaRAID system easily and efficiently. The steps are as follows:

1. Drive Group definitions Group drives into Drive Groups.
2. Virtual Drive definitions Define virtual drives using those drive groups.
3. Configuration Preview Preview configuration before it is saved.

Please choose appropriate configuration type:

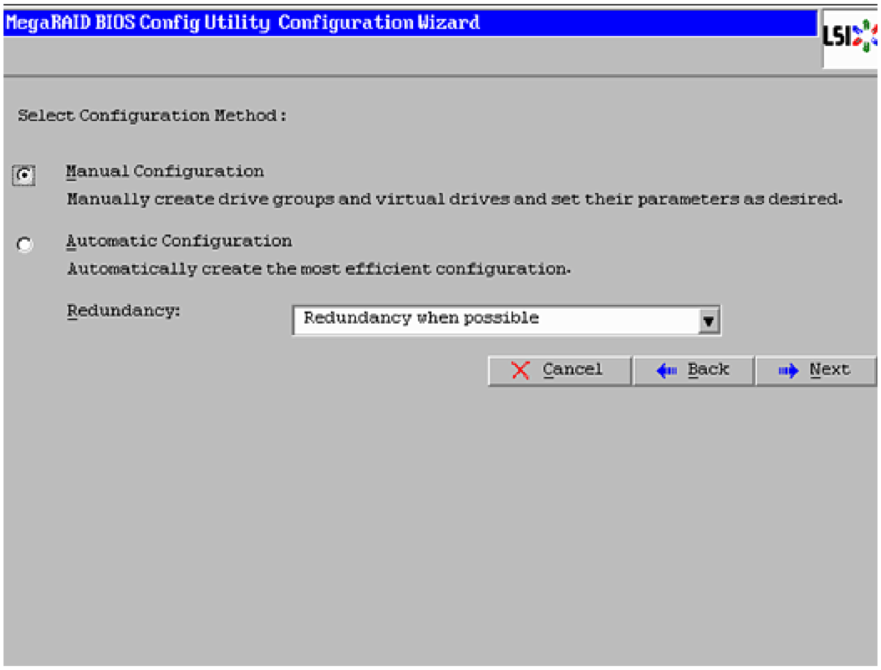
○ Clear Configuration Allows you to clear existing configuration only.

● New Configuration Clears the existing configuration. If you have any existing data in the earlier defined drives, the data will be lost.

○ Add Configuration Retains the old configuration and then adds new drives to the configuration. This is the safest operation as it does not result in any data loss.

9. Select the configuration method to be Manual Configuration to have control over all attributes of the new storage configuration such as drive groups, virtual drives, and to set their parameters.

Figure 56 Selecting Manual Configuration



MegaRAID BIOS Config Utility Configuration Wizard

Select Configuration Method:

● Manual Configuration
Manually create drive groups and virtual drives and set their parameters as desired.

○ Automatic Configuration
Automatically create the most efficient configuration.

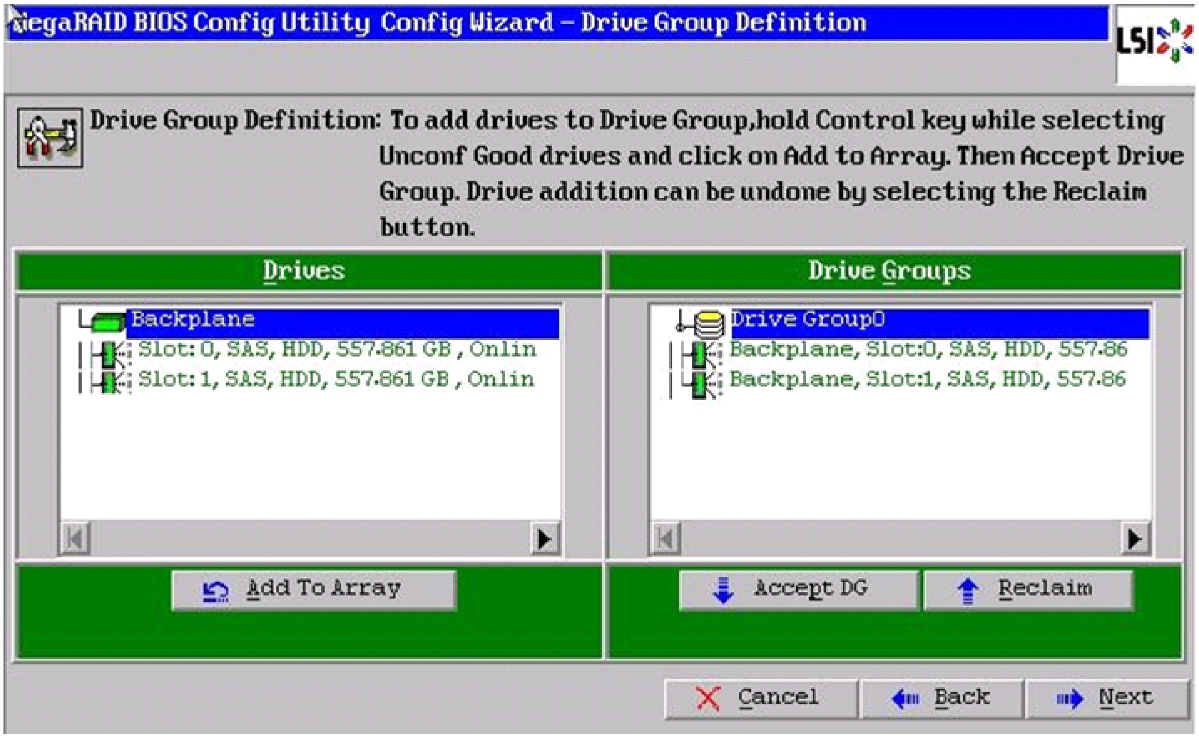
Redundancy: Redundancy when possible

10. Click **Next**.

11. The Drive Group Definition window appears. In this window select the two drives to create drive groups.

12. Click **Add to Array** to move the drives to a proposed drive group configuration in the Drive Groups pane. Click **Accept DG** and then, click **Next**.

Figure 57 Moving Drives to Drive Groups



MegaRAID BIOS Config Utility Config Wizard – Drive Group Definition

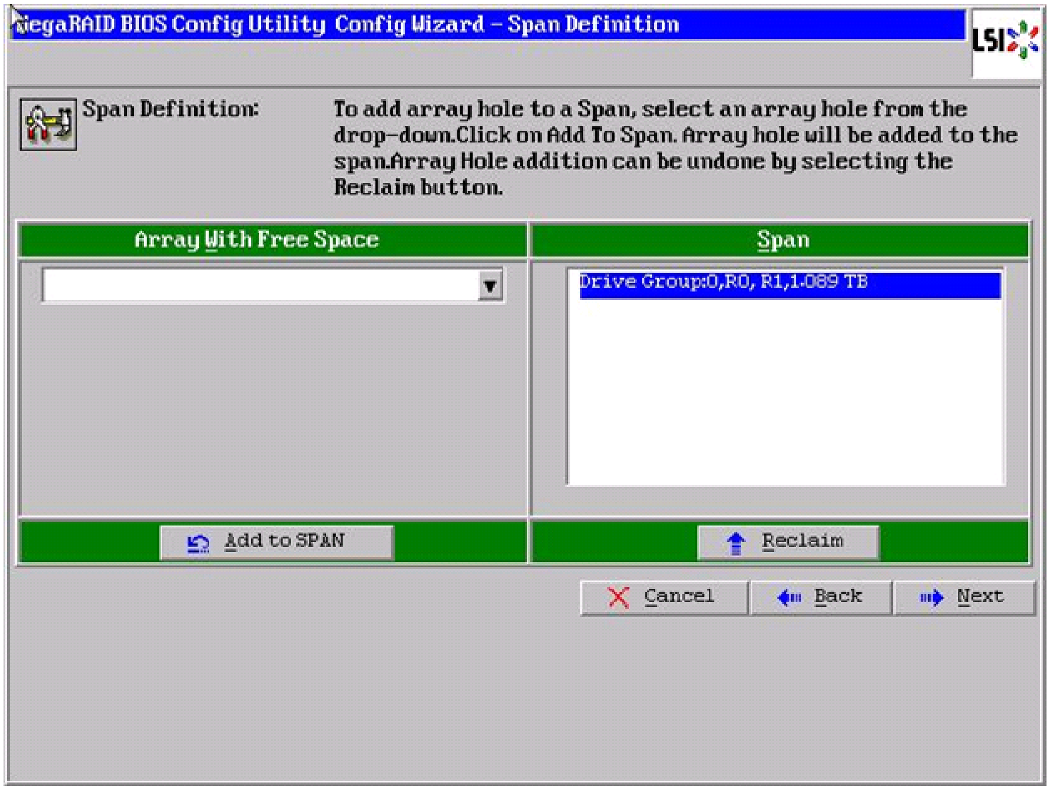
Drive Group Definition: To add drives to Drive Group,hold Control key while selecting Unconf Good drives and click on Add to Array. Then Accept Drive Group. Drive addition can be undone by selecting the Reclaim button.

Backplane
Slot: 0, SAS, HDD, 557.861 GB , Onlin
Slot: 1, SAS, HDD, 557.861 GB , Onlin

Drive Group0
Backplane, Slot:0, SAS, HDD, 557.86
Backplane, Slot:1, SAS, HDD, 557.86

13. In the Span definitions Window, Click **Add to SPAN** and then, click **Next**.

Figure 58 Adding Arrayhole to Span



MegaRAID BIOS Config Utility Config Wizard – Span Definition

Span Definition: To add array hole to a Span, select an array hole from the drop-down.Click on Add To Span. Array hole will be added to the span.Array Hole addition can be undone by selecting the Reclaim button.

14. In Virtual Drive definitions window, follow these steps to configure read normal and write through modes:

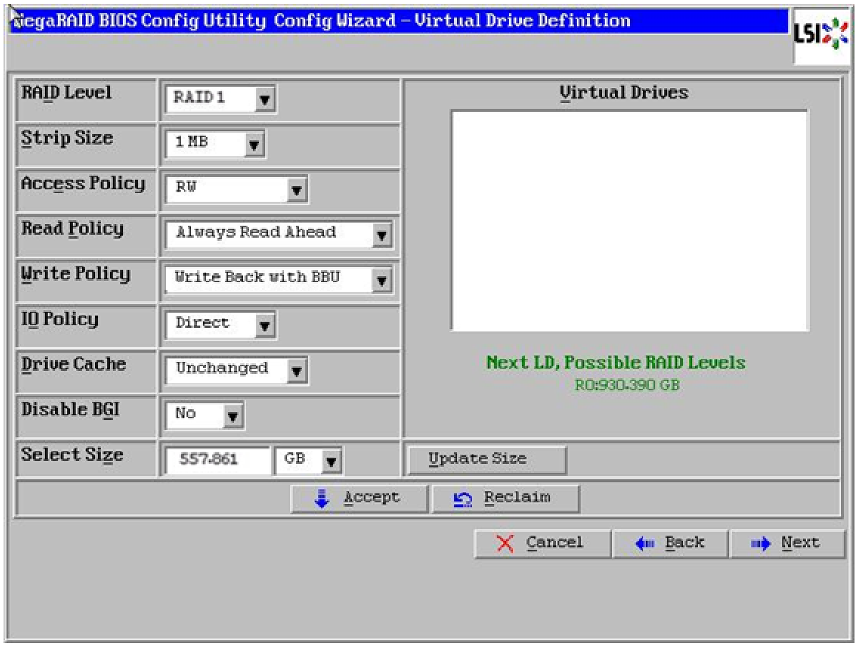
    a. Change Strip Size to 1MB. A larger strip size produces higher read performance. If your server regularly performs random read requests, select a smaller strip size.

    b. From the read Policy drop down list, choose Read Normal.

    c. From the Write Policy drop down list, choose Write Back with BBU.

    d. Make Sure RAID Level is set to RAID1.

Figure 59 Defining Virtual Drive



MegaRAID BIOS Config Utility Config Wizard – Virtual Drive Definition

RAID Level	RAID 1
Strip Size	1 MB
Access Policy	RW
Read Policy	Always Read Ahead
Write Policy	Write Back with BBU
IO Policy	Direct
Drive Cache	Unchanged
Disable BGI	No
Select Size	557.861 GB

Virtual Drives

Next LD, Possible RAID Levels
R0:930.390 GB

e. Click **Accept** to accept the changes to the virtual drive definitions.

f. Click **Next**.

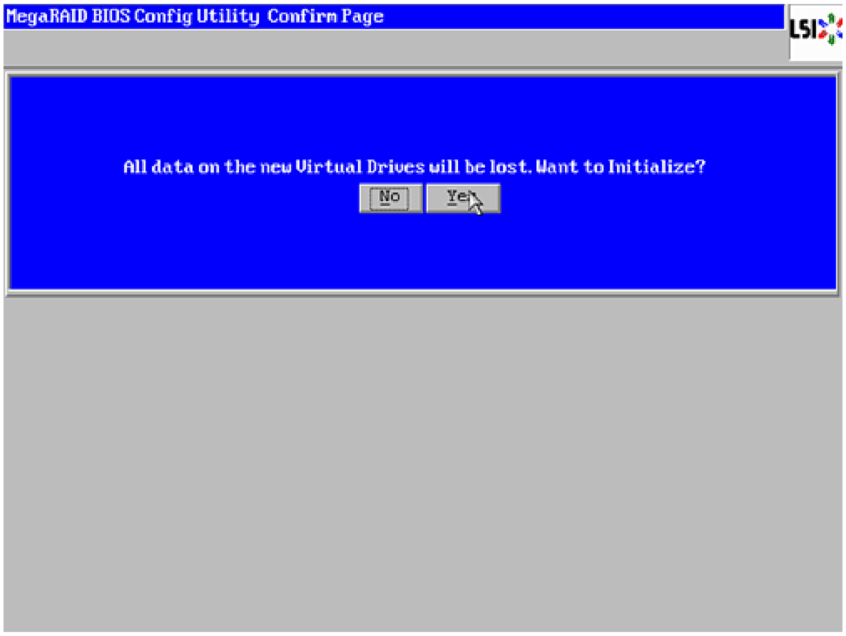
15. After you finish the virtual drive definitions, click **Next**. The Configuration Preview window appears.

16. Review the virtual drive configuration in the Configuration Preview window and click **Accept** to save the configuration.

17. Click **Yes** to save the configuration.

18. Click **Yes**. When asked to confirm to initialize.

Figure 60 Confirmation to Initialize

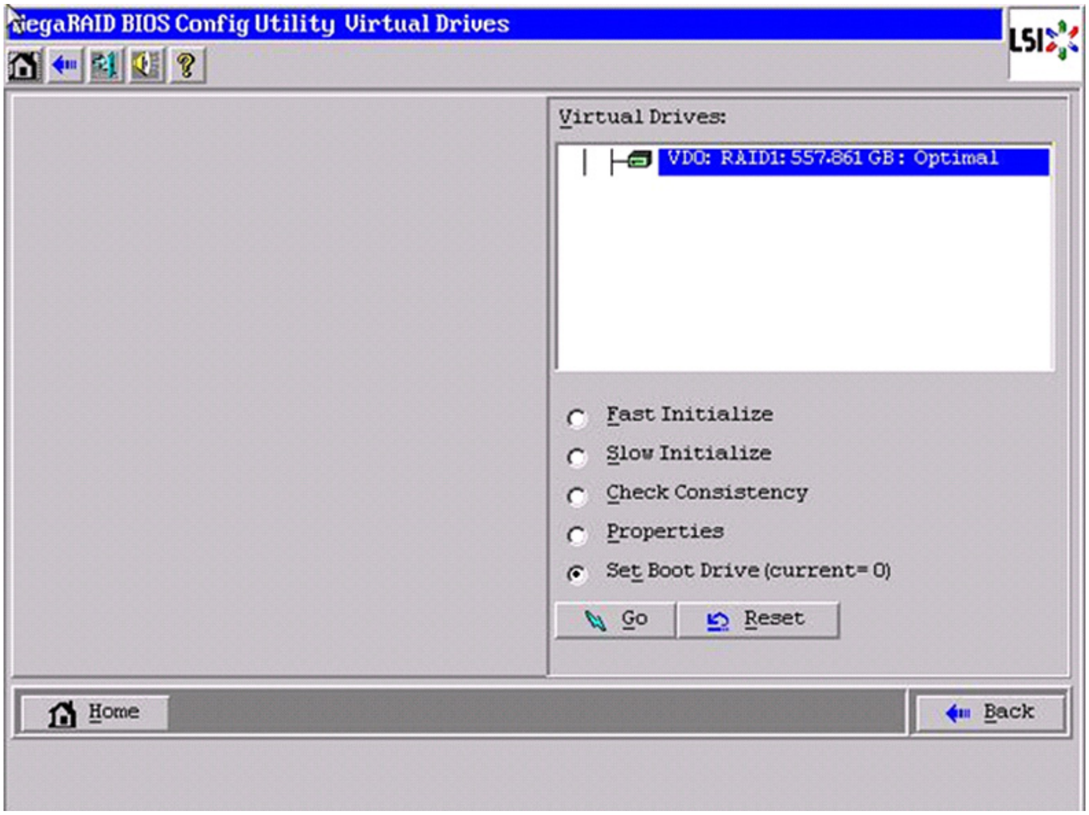


MegaRAID BIOS Config Utility Confirm Page

All data on the new Virtual Drives will be lost. Want to Initialize?

19. Set VD0 as the Boot Drive and click **Go**.

Figure 61 *Setting Boot Drive*



MegaRAID BIOS Config Utility Virtual Drives

Virtual Drives:

VD0: RAID1: 557.861 GB : Optimal

○ Fast Initialize

○ Slow Initialize

○ Check Consistency

○ Properties

● Set Boot Drive (current= 0)

20. Click **Home**.
21. Review the Configuration and Click **Exit**.

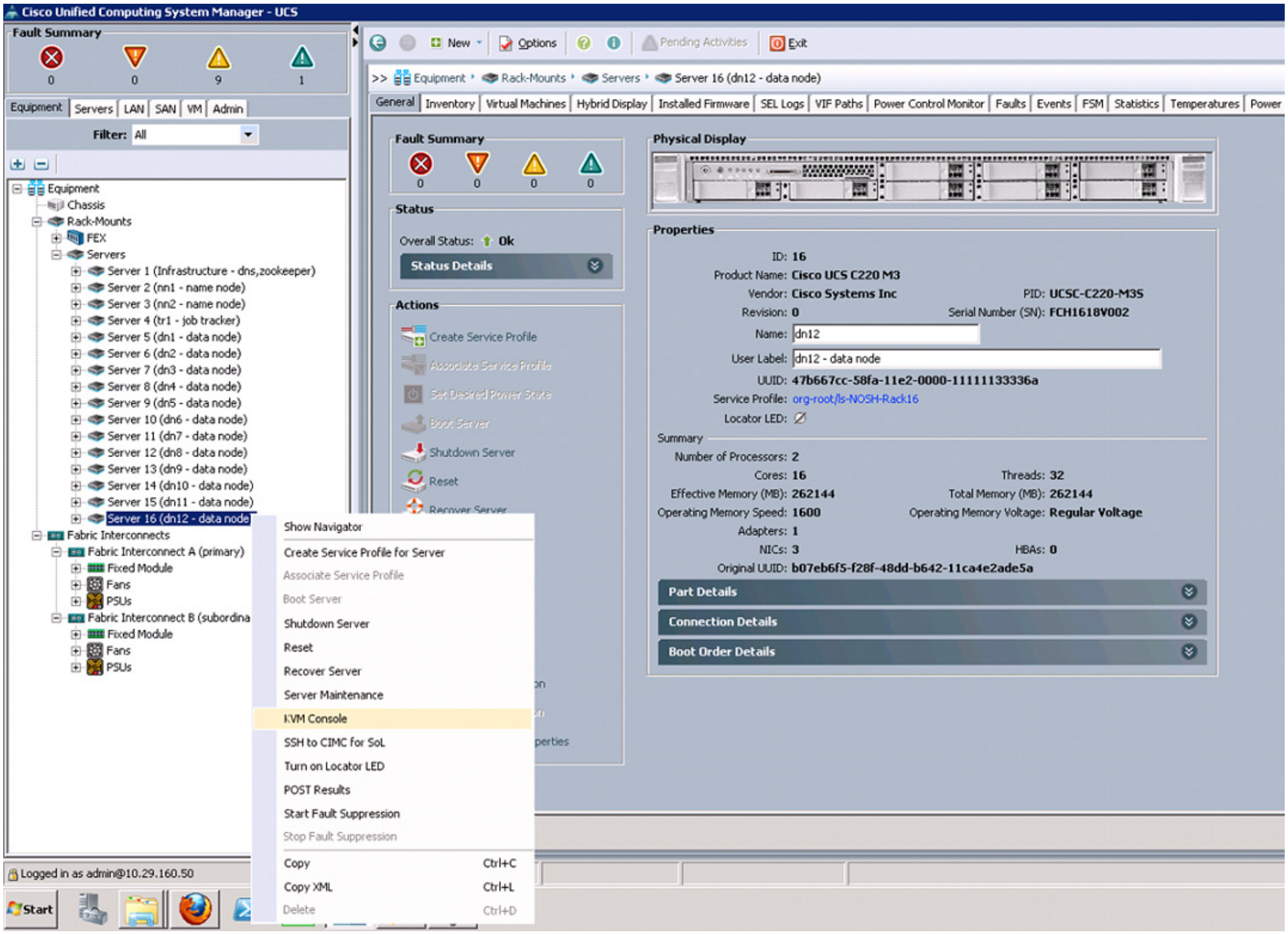
Installing Red Hat Enterprise Linux Server 6.2 using KVM

One of the options to install RHEL is explained in this section.

You can install Red Hat Enterprise Linux Server 6.2 using the KVM console of Cisco UCS Manager. To open the KVM console, follow these steps:

1. Login to Cisco UCS Manager.
2. Select Equipment tab and navigate to the servers.
3. Right-click on the server and select KVM Console.

Figure 62 Launching KVM Console



Overall Status: Ok

ID: 16
Product Name: Cisco UCS C220 M3
Vendor: Cisco Systems Inc
PID: UCSC-C220-M3S
Revision: 0
Serial Number (SN): FCH1618V002
Name: dn12
User Label: dn12 - data node
UUID: 47b667cc-58fa-11e2-0000-11111133336a
Service Profile: org-root/ls-NOSH-Rack16
Locator LED:

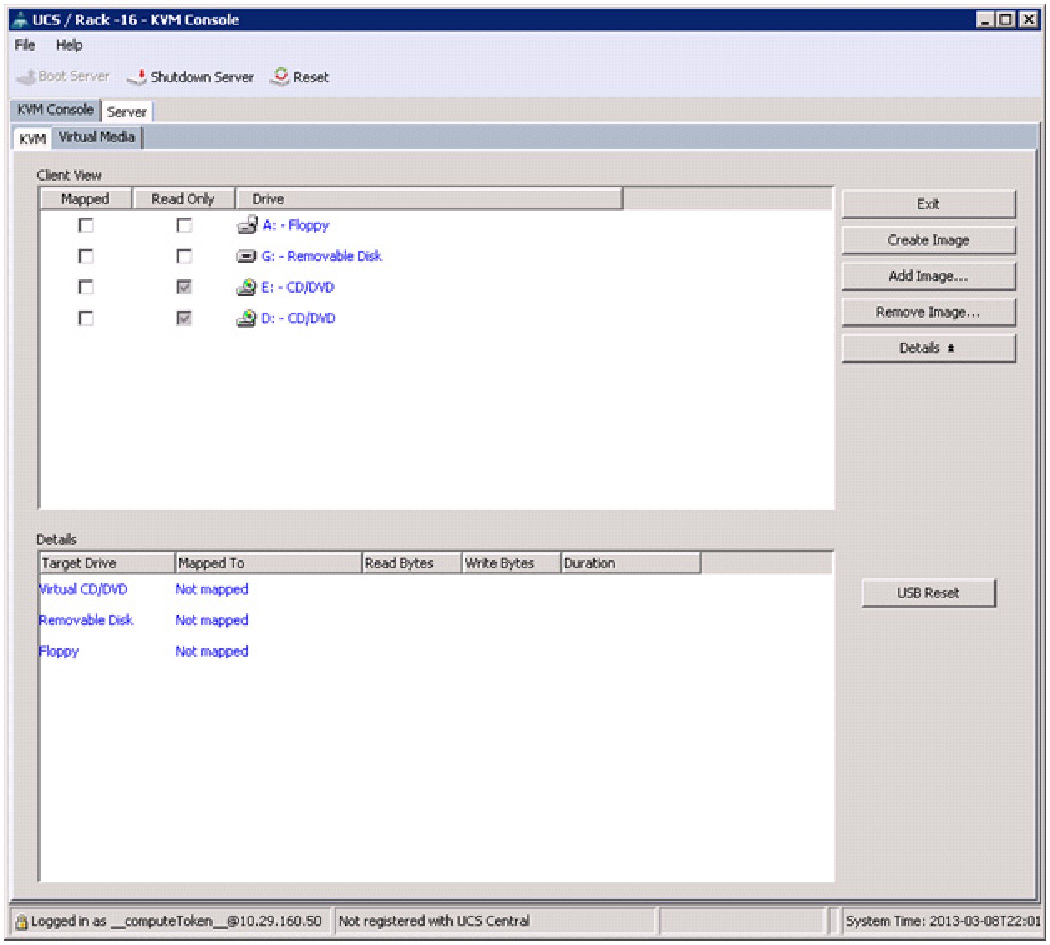
Summary
Number of Processors: 2
Cores: 16
Threads: 32
Effective Memory (MB): 262144
Total Memory (MB): 262144
Operating Memory Speed: 1600
Operating Memory Voltage: Regular Voltage
Adapters: 1
NICs: 3
HBAs: 0
Original UUID: b07eb6f5-f28f-48dd-b642-11ca4e2ade5a

Logged in as admin@10.29.160.50

To install Red Hat Linux Server 6.2, follow these steps:

1. In the KVM window, select the Virtual Media tab.

Figure 63 Adding ISO Image



Mapped	Read Only	Drive
□	□	A: - Floppy
□	□	G: - Removable Disk
□	☑	E: - CD/DVD
□	☑	D: - CD/DVD

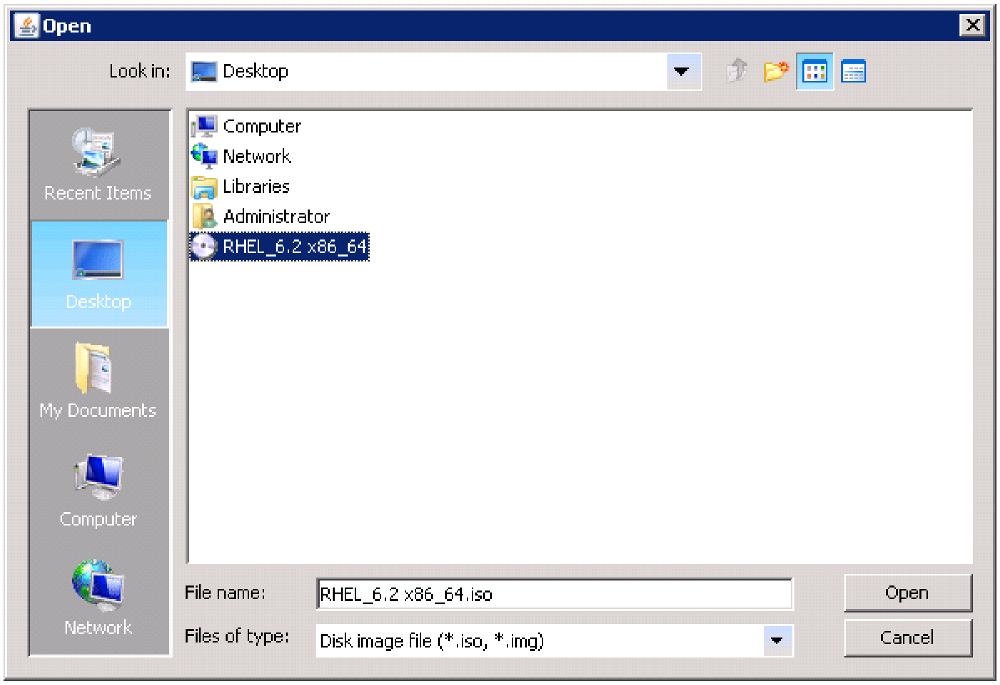
Target Drive	Mapped To	Read Bytes	Write Bytes	Duration
Virtual CD/DVD	Not mapped			
Removable Disk	Not mapped			
Floppy	Not mapped			

Logged in as __computeToken__@10.29.160.50 | Not registered with UCS Central | System Time: 2013-03-08T22:01

2. Click **Add Image** in the window that appeared.
3. Browse to the Red Hat Enterprise Linux Server 6.2 installer ISO image file.

Note The Red Hat Enterprise Linux 6.2 DVD is assumed to be on the client machine. If not, create an ISO Image of Red Hat Enterprise Linux DVD using software such as ImgBurn or MagicISO.

Figure 64 Selecting the Red Hat Enterprise Linux ISO Image



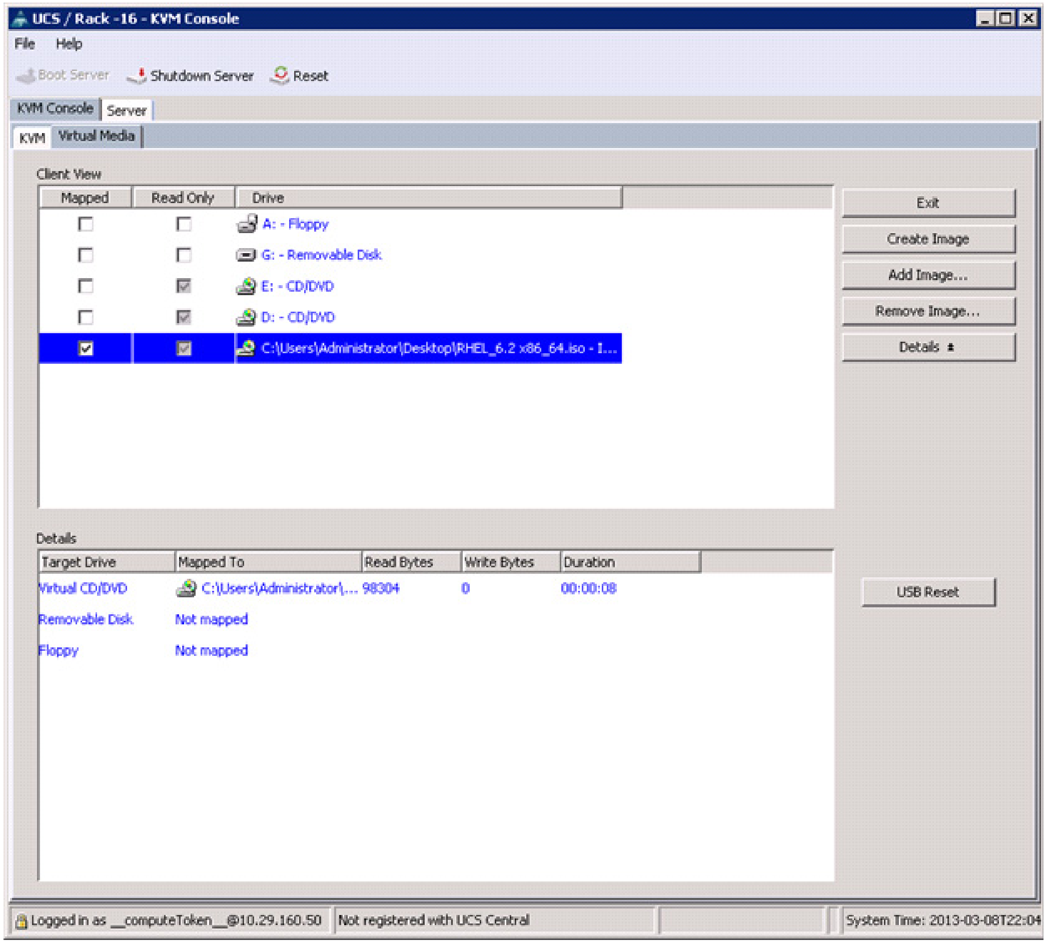
Look in: Desktop

File name: RHEL_6.2 x86_64.iso

Files of type: Disk image file (*.iso, *.img)

4. Click **Open** to add the image to the list of virtual media.
5. Check the check box for Mapped, next to the entry corresponding to the image you just added.

Figure 65 Mapping the ISO Image



Client View

Mapped	Read Only	Drive
☐	☐	A: - Floppy
☐	☐	G: - Removable Disk
☐	☑	E: - CD/DVD
☐	☑	D: - CD/DVD
☑	☑	C:\Users\Administrator\Desktop\RHEL_6.2 x86_64.iso - I...

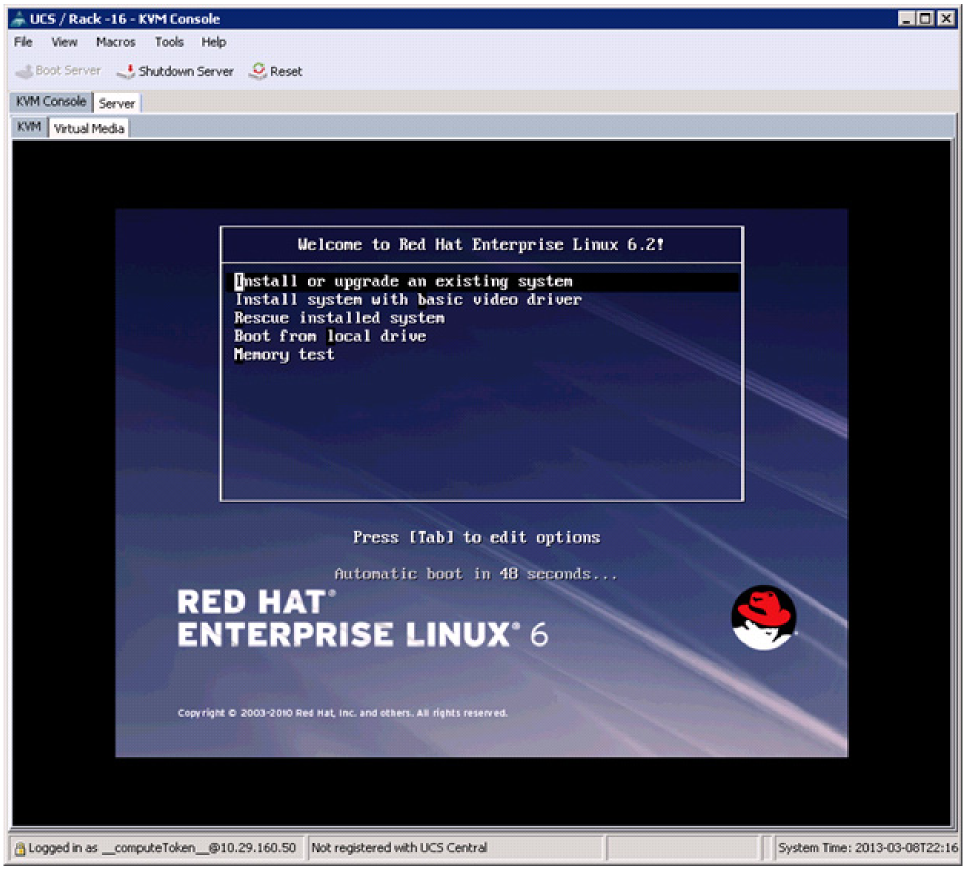
Details

Target Drive	Mapped To	Read Bytes	Write Bytes	Duration
Virtual CD/DVD	C:\Users\Administrator\...	98304	0	00:00:08
Removable Disk	Not mapped			
Floppy	Not mapped			

Logged in as __computeToken__@10.29.160.50 | Not registered with UCS Central | System Time: 2013-03-08T22:04

6. In the KVM window, select the KVM tab to monitor during boot.
7. In the KVM window, select the Boot Server button in the upper left corner.
8. Click **OK**.
9. Click **OK** to reboot the system.
10. On reboot, the machine detects the presence of the Red Hat Enterprise Linux Server 6.2 install media.
11. Select the Install or Upgrade an Existing System option.

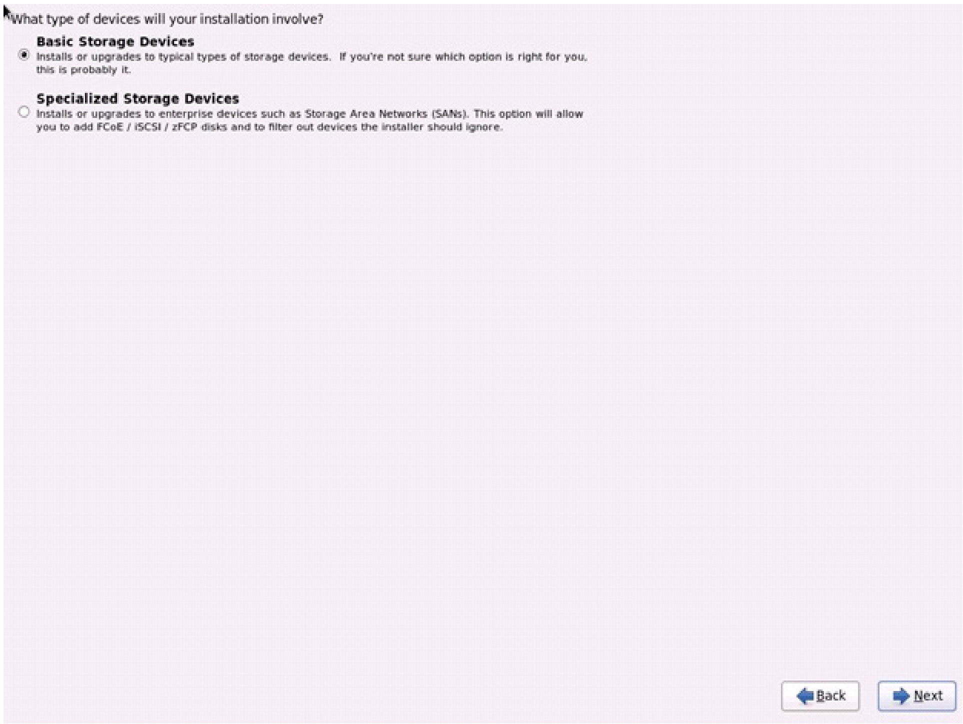
Figure 66 Selecting the RHEL Installation Option


UCS / Rack -16 - KVM Console
File
View
Macros
Tools
Help
Boot Server
Shutdown Server
Reset
KVM Console
Server
KVM
Virtual Media
RED HAT®
ENTERPRISE LINUX® 6
Copyright © 2003-2010 Red Hat, Inc. and others. All rights reserved.
Logged in as __computeToken__@10.29.160.50
Not registered with UCS Central
System Time: 2013-03-08T22:16

```
Welcome to Red Hat Enterprise Linux 6.2!

Install or upgrade an existing system
Install system with basic video driver
Rescue installed system
Boot from local drive
Memory test

Press [Tab] to edit options

Automatic boot in 48 seconds...
```

12. Skip the Media test as we are installing from ISO Image, click **Next** to continue.
13. Select Language for the Installation and click **Next**.
14. Select Basic Storage Devices and click **Next**.

Figure 67 Selecting Storage Device Type



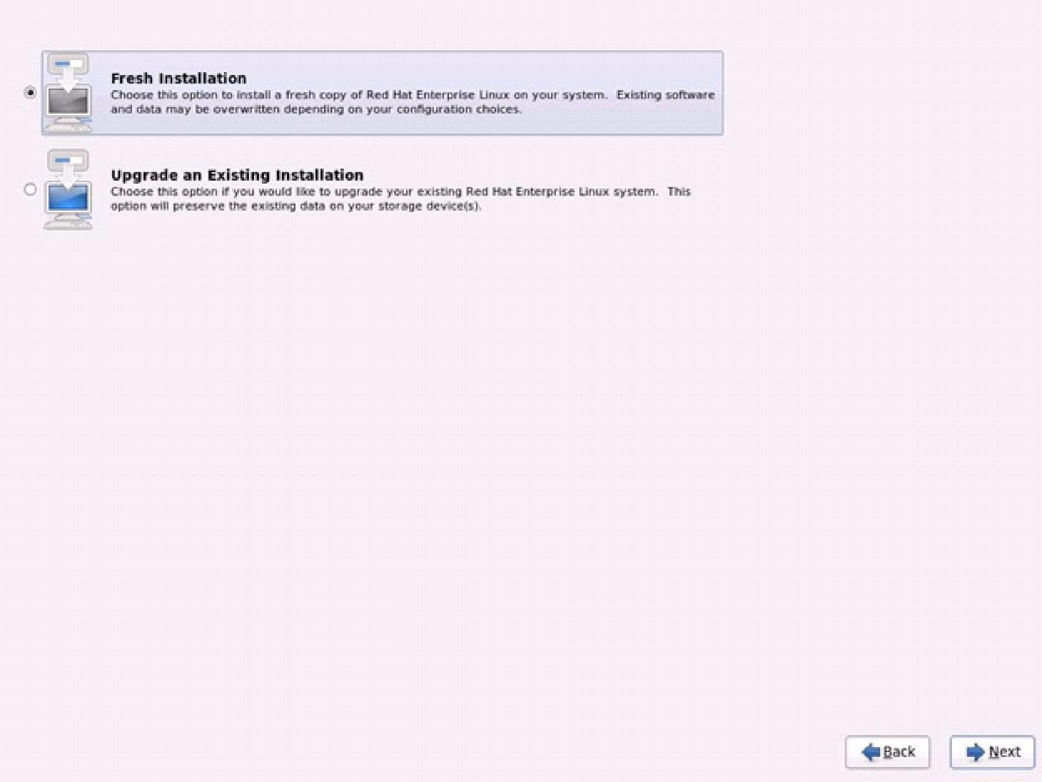
What type of devices will your installation involve?

● **Basic Storage Devices**
Installs or upgrades to typical types of storage devices. If you're not sure which option is right for you, this is probably it.

○ **Specialized Storage Devices**
Installs or upgrades to enterprise devices such as Storage Area Networks (SANs). This option will allow you to add FCoE / iSCSI / zFCP disks and to filter out devices the installer should ignore.

15. Select Fresh Installation and click **Next**.

Figure 68 Selecting Installation Type

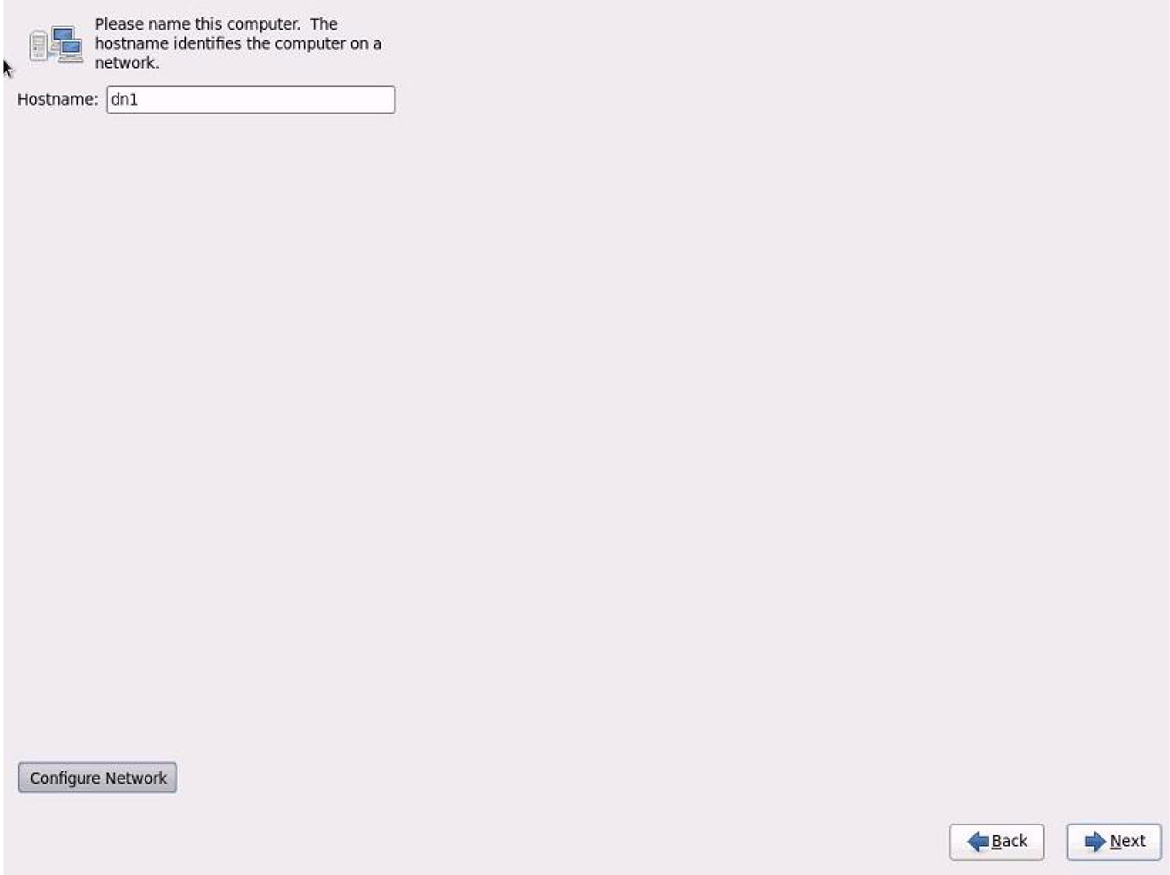


● **Fresh Installation**
Choose this option to install a fresh copy of Red Hat Enterprise Linux on your system. Existing software and data may be overwritten depending on your configuration choices.

○ **Upgrade an Existing Installation**
Choose this option if you would like to upgrade your existing Red Hat Enterprise Linux system. This option will preserve the existing data on your storage device(s).

16. Enter the Host name of the server and click **Configure Network**.

Figure 69 Entering the Host Name

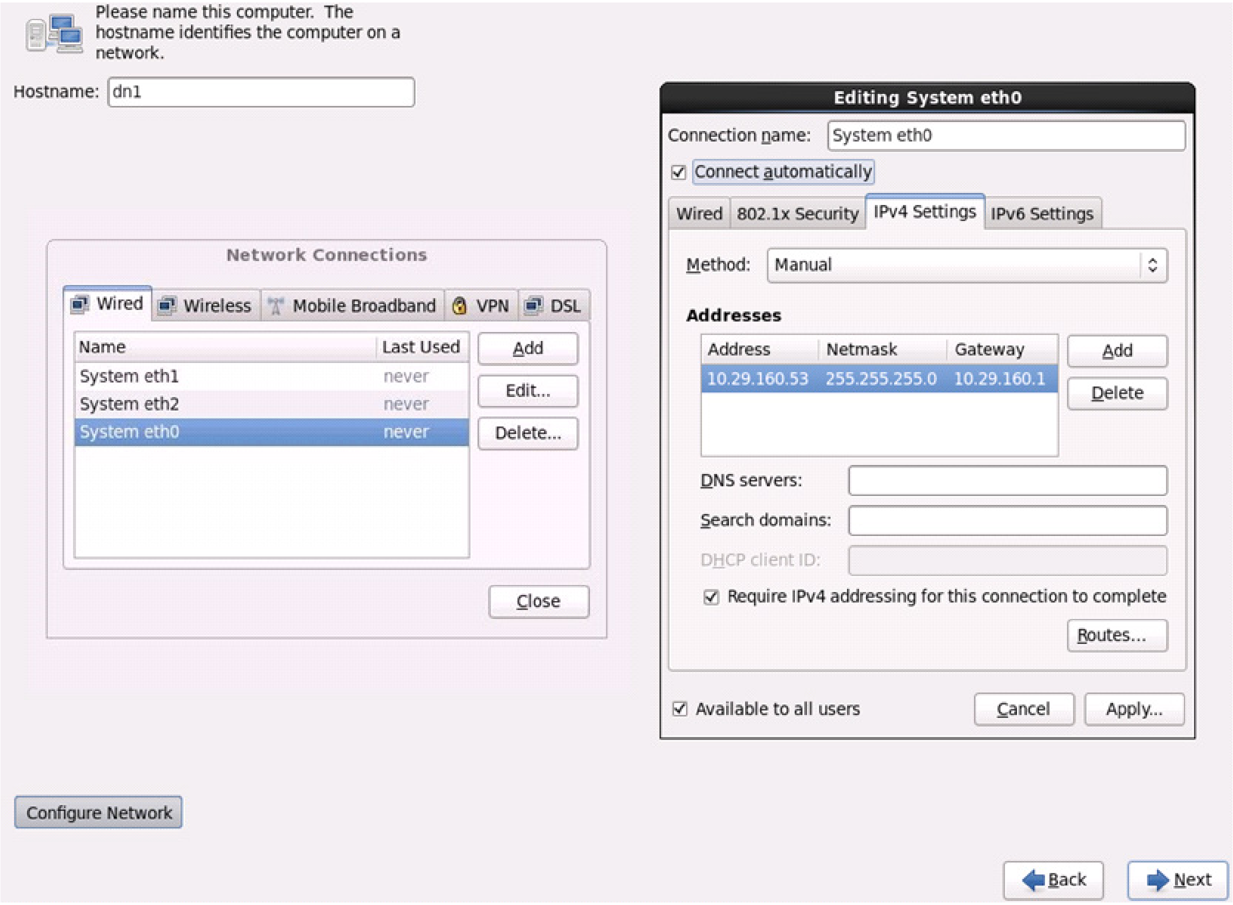


Please name this computer. The hostname identifies the computer on a network.

Hostname: dn1

17. Network Connections window appears.
18. In the Network Connections window, Select the tab Wired.
19. Select the interface System eth0, and click **Edit**.
20. Editing System eth0 window appears.
21. Check the Connect automatically check box.
22. For the field Method, select Manual from the drop down list.
23. Click **Add** and enter IP Address, Netmask and Gateway.
24. Click **Apply**.

Figure 70 Configuring Network Connections



Please name this computer. The hostname identifies the computer on a network.

Hostname: dn1

Network Connections

Name	Last Used
System eth1	never
System eth2	never
System eth0	never

Editing System eth0

Connection name: System eth0

☑ Connect automatically

Method: Manual

Addresses

Address	Netmask	Gateway
10.29.160.53	255.255.255.0	10.29.160.1

DNS servers:

Search domains:

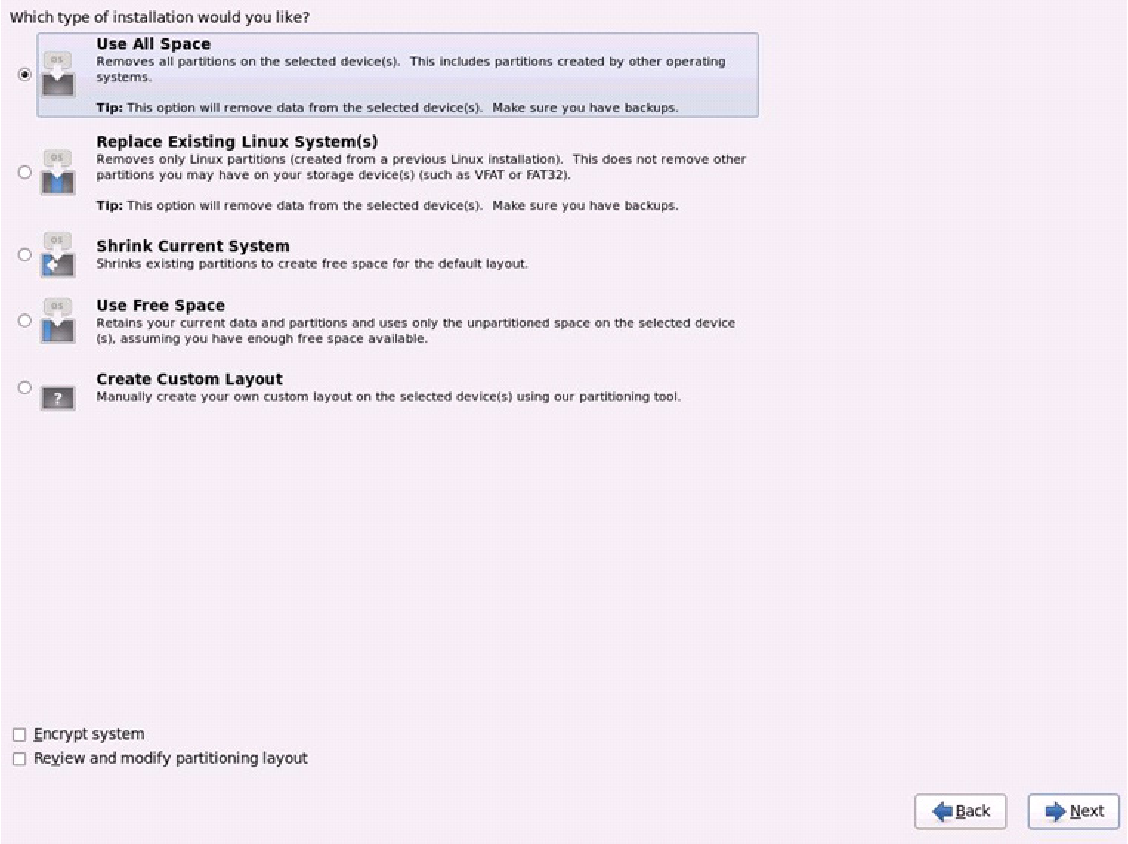
DHCP client ID:

☑ Require IPv4 addressing for this connection to complete

☑ Available to all users

25. Select the Appropriate Time Zone and click **Next**.
26. Enter the root Password and click **Next**.
27. Select Use All Space and Click **Next**.

Figure 71 Selecting RHEL Install Type



Which type of installation would you like?

● **Use All Space**
Removes all partitions on the selected device(s). This includes partitions created by other operating systems.

Tip: This option will remove data from the selected device(s). Make sure you have backups.

○ **Replace Existing Linux System(s)**
Removes only Linux partitions (created from a previous Linux installation). This does not remove other partitions you may have on your storage device(s) (such as VFAT or FAT32).

Tip: This option will remove data from the selected device(s). Make sure you have backups.

○ **Shrink Current System**
Shrinks existing partitions to create free space for the default layout.

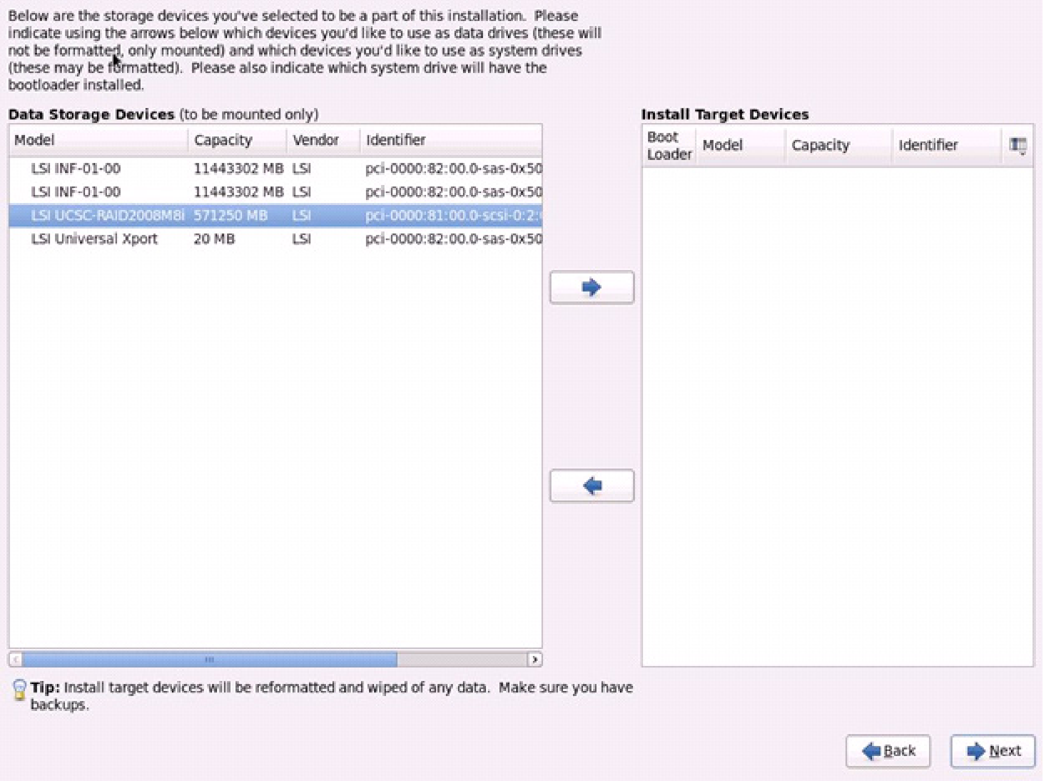
○ **Use Free Space**
Retains your current data and partitions and uses only the unpartitioned space on the selected device (s), assuming you have enough free space available.

○ **Create Custom Layout**
Manually create your own custom layout on the selected device(s) using our partitioning tool.

□ Encrypt system
□ Review and modify partitioning layout

28. Select appropriate boot device. In this example, LSI UCSC-RAID 2008M-8i is selected. Click ➡ to add the selected boot device to appear in the right pane under Install Target Devices and click **Next**.

Figure 72 Selecting the Data Storage Device



Below are the storage devices you've selected to be a part of this installation. Please indicate using the arrows below which devices you'd like to use as data drives (these will not be formatted, only mounted) and which devices you'd like to use as system drives (these may be formatted). Please also indicate which system drive will have the bootloader installed.

Data Storage Devices (to be mounted only)

Model	Capacity	Vendor	Identifier
LSI INF-01-00	11443302 MB	LSI	pci-0000:82:00.0-sas-0x50
LSI INF-01-00	11443302 MB	LSI	pci-0000:82:00.0-sas-0x50
LSI UCSC-RAID2008M8i	571250 MB	LSI	pci-0000:81:00.0-scsi-0:2:
LSI Universal Xport	20 MB	LSI	pci-0000:82:00.0-sas-0x50

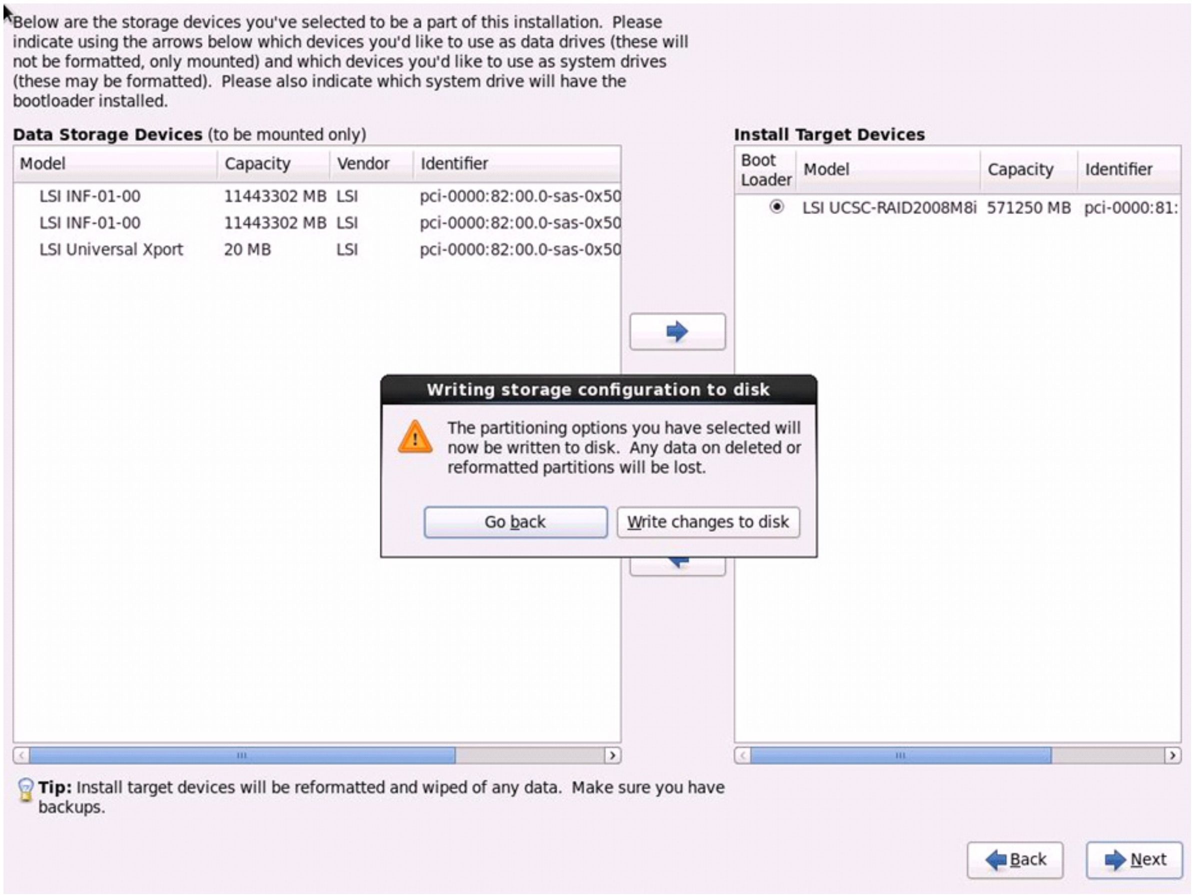
Install Target Devices

Boot Loader	Model	Capacity	Identifier

Tip: Install target devices will be reformatted and wiped of any data. Make sure you have backups.

29. Click **write changes to the disks** and then, click **Next**.

Figure 73 Writing Partitioning Options into the Disk



Below are the storage devices you've selected to be a part of this installation. Please indicate using the arrows below which devices you'd like to use as data drives (these will not be formatted, only mounted) and which devices you'd like to use as system drives (these may be formatted). Please also indicate which system drive will have the bootloader installed.

Data Storage Devices (to be mounted only)

Model	Capacity	Vendor	Identifier
LSI INF-01-00	11443302 MB	LSI	pci-0000:82:00.0-sas-0x50
LSI INF-01-00	11443302 MB	LSI	pci-0000:82:00.0-sas-0x50
LSI Universal Xport	20 MB	LSI	pci-0000:82:00.0-sas-0x50

Install Target Devices

Boot Loader	Model	Capacity	Identifier
●	LSI UCSC-RAID2008M8i	571250 MB	pci-0000:81:

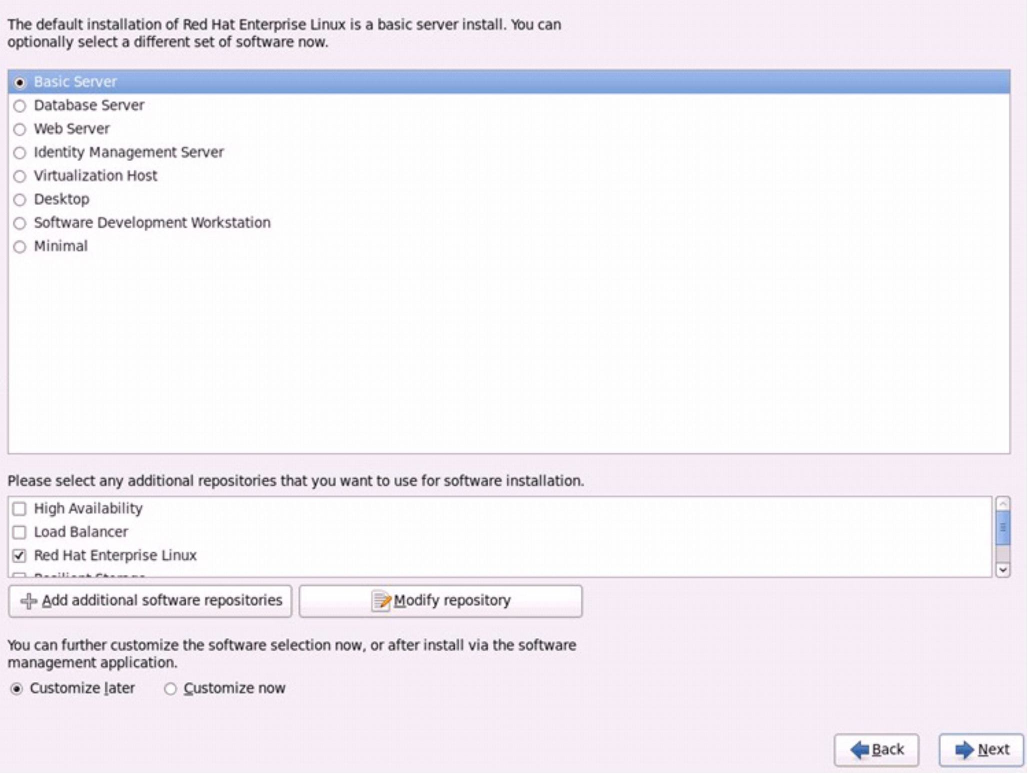
Writing storage configuration to disk

The partitioning options you have selected will now be written to disk. Any data on deleted or reformatted partitions will be lost.

Tip: Install target devices will be reformatted and wiped of any data. Make sure you have backups.

30. Select Basic Server Installation and Click **Next.**

Figure 74 Selecting RHEL Installation Option



The default installation of Red Hat Enterprise Linux is a basic server install. You can optionally select a different set of software now.

● Basic Server
○ Database Server
○ Web Server
○ Identity Management Server
○ Virtualization Host
○ Desktop
○ Software Development Workstation
○ Minimal

Please select any additional repositories that you want to use for software installation.

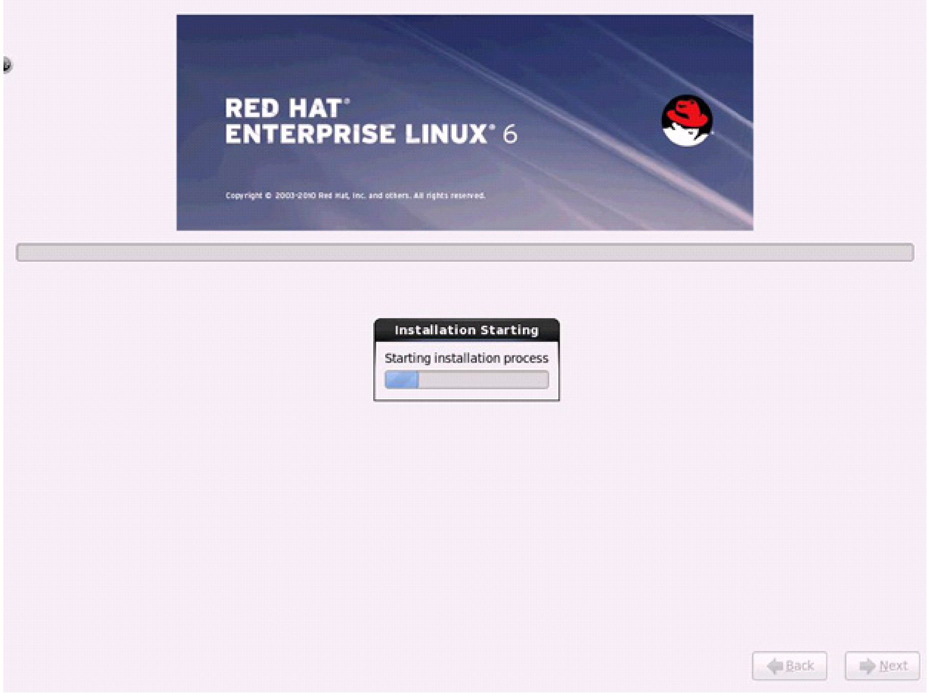
□ High Availability
□ Load Balancer
☑ Red Hat Enterprise Linux
□ Resilient Storage

You can further customize the software selection now, or after install via the software management application.

● Customize later ○ Customize now

31. After the installer is finished loading, press **Enter** to continue with the install.

Figure 75 Installation Process in Progress



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Back
Next

Installation Starting

Starting installation process

Post OS Install Configuration

Infrastructure Node

This section describes the steps needed to implement an infrastructure node for the cluster. The infrastructure node may provide some or all of the following services to the namenodes and datanodes in the cluster:

- NTP – time server
- DNS resolution for cluster-private hostnames
- DHCP IP address assignment for cluster-private NICs
- Local mirror of one or more software repository and/or distribution
- Management server

Note This section assumes that only the default basic server install has been done.

Installing and Configuring Parallel Shell

Parallel-SSH

Parallel SSH is used to run commands on several hosts at the same time. It takes a file of hostnames and a bunch of common ssh parameters as parameters, executes the given command in parallel on the nodes specified.

The tool can be downloaded from https://code.google.com/p/parallel-ssh/

Fetch and install this tool via the following commands:

```
cd /tmp/
curl https://parallel-ssh.googlecode.com/files/pssh-2.3.1.tar.gz -O -L
tar xzf pssh-2.3.1.tar.gz
cd pssh-2.3.1
python setup.py install
```

To make use of pssh, a file containing just only the IP addresses of the nodes in the cluster needs to be created. The following was used for the contents of the /root/pssh.hosts file on all of the nodes and will need to be customized to fit your implementation:

```
# /root/pssh.hosts - cluster node IPs or names
10.29.160.53
10.29.160.54
10.29.160.55
10.29.160.56
10.29.160.57
10.29.160.58
10.29.160.59
10.29.160.60
10.29.160.61
10.29.160.62
10.29.160.63
10.29.160.64
10.29.160.65
10.29.160.66
10.29.160.67
10.29.160.68
```

This file is used with pssh by specifying the -h option on the command line. For example, the following command will execute the hostname command on all of the nodes listed in the /root/pssh.hosts file:

```
pssh -h /root/pssh.hosts -A  hostname
```

For information on the -A option and other pssh options, use one or both of the following commands:

```
pssh -help
man pssh
```

Create Local Redhat Repo

If your infrastructure node and your cluster nodes have Internet access, you may be able to skip this section.

To create a repository using RHEL DVD or ISO on the infrastructure node (in this deployment 10.29.160.53 is as an infrastructure node), create a directory with all the required RPMs, run the createrepo command and then publish the resulting repository.

1. Create the directories where the local copies of the software installation packages will reside. In this example, they are created under the /var/www/html/ directory.

```
mkdir -p /var/www/html/Cloudera/
mkdir -p /var/www/html/JDK/
mkdir -p /var/www/html/RHEL/6.2/
```

2. Then mount the RHEL DVD. This can be done by loading the DVD disc into a DVD drive attached to the server or by mounting the .iso image as in this example.

```
mount /rhel-server-6.2-x86_64-dvd.iso/mnt -t iso9660 -o ro,loop=/dev/loop1
```

3. Next, copy the contents of the DVD to the /var/www/html/RHEL/6.2/ directory and then verify that the contents copied match their source.

```
cd /mnt/;tar -c -p -b 128 -f - .
cd /var/www/html/RHEL/6.2/;tar -x -p -b 128 -f - .
diff -r /mnt/ /var/www/html/RHEL/6.2/
```

4. Now create a .repo file for the yum command.

```
cat > /var/www/html/RHEL/6.2/rhel62copy.repo
[rhel6.2]
name=Red Hat Enterprise Linux 6.2
baseurl=file:///var/www/html/RHEL/6.2/
gpgcheck=0
enabled=1
```

Note Based on this repo file yum requires httpd to be running on the infrastructure node for the other nodes to access the repository. Steps to install and configure httpd are in the following section.

5. Copy the rhel62copy.repoto all the nodes of the cluster.

```
pscp -h  /root/pssh.hosts \
/var/www/html/RHEL/6.2/rhel62copy.repo /etc/yum.repos.d/
```

6. Creating the Red Hat Repository Database.

   Install the createrepo package. Use it to regenerate the repository database(s) for the local copy of the RHEL DVD contents. Then purge the yum caches.

```
yum -y install createrepo
cd /var/www/html/RHEL/6.2/
createrepo .
yum clean all
```

7. Update Yum on all nodes.

```
pssh -h /root/allnodes "yum clean all"
```

Install Required Packages

This section assumes that only the default basic server install has been done.

Table 5 provides a list of packages that are required.

Table 5 Required list of packages

Package	Description
xfsprogs	Utilities for managing XFS filesystem
jdk	Java SE Development Kit6, Update 39(JDK 6u39) or more recent
Utilities	dnsmasq, httpd, lynx

Note Installation of Java and JDK is detailed in a separate section.

Create the following script install_packages.sh to install required packages:

Script install_packages.sh

```
yum -y install dnsmasq httpd lynx
# get and install xfsprogs from local repo on Infrastructure node
cd /tmp/
curl http://10.29.160.53/RHEL/6.2/Packages/xfsprogs-3.1.1-6.el6.x86_64.rpm  -O  -L
rpm -i /tmp/xfsprogs-3.1.1-6.el6.x86_64.rpm
```

Copy script disable_services.sh to all nodes and run the script on all nodes:

```
pscp -h /root/pssh.hosts /root/install_packages.sh /root/
pssh -h /root/pssh.hosts “/root/install_packages.sh”
```

Disable SELinux

Execute the following commands to disable SELinux on all the nodes:

```
pssh -h /root/pssh.hosts “setenforce 0”
pssh -h /root/pssh.hosts “sed -i -e 's/=enforcing/=disabled/g;'\ /etc/selinux/config”
Disable Unwanted Services
```

Execute the following commands as a script to disable and turn off unwanted services on all nodes:

Script disable_services.sh

```
$cat disable_services.sh

# disble/shutdown things we do not need
for X in bluetooth certmonger cgconfigd cgred cpuspeed cups dnsmasq \
ebtables fcoe fcoe-target ip6tables iptables iscsi iscsid ksm ksmtuned \
libvirtd-guests libvirtd postfix psacct qpidd rhnsd rhsmcertd \
sendmail smartd virt-who vsftpd winbind wpa_supplicant ypbind NetworkManager
do
        /sbin/service $X stop
        /sbin/chkconfig $X off
done
```

Copy script disable_services.sh to all nodes and run the script on all nodes:

```
pscp -h /root/pssh.hosts /root/disable_servicesh.h /root/
pssh -h /root/pssh.hosts "/root/disable_services.sh"
```

Enable and start the httpd service

Before starting the httpd service, you may need to edit the server configuration file (/etc/httpd/conf/httpd.conf) to change one or more of the following settings:

- Listen
- ServerName
- ExtendedStatus
- server-status

Ensure httpd is able to read the repofiles

```
chcon -R -t httpd_sys_content_t /var/www/html/RHEL/6.2/
```

Perform the following commands to enable and start the httpd service:

```
chkconfig httpd on
service httpd start
```

JDK Installation

Download Java SE 6 Development Kit (JDK)

Using a web browser, click on the following link:

http://www.oracle.com/technetwork/java/index.html

and download the latest Java™ SE 6 Development Kit (JDK™6).

Once the JDK6 package has been downloaded, place it in the /var/www/html/JDK/ directory.

Install JDK6 on All Node

Create the following script install_jdk.sh to install JDK:

Script install_jdk.sh

```
# Copy and install JDK
cd /tmp/
curl http://10.29.160.53/JDK/jdk-6u41-linux-x64.bin -O -L
sh ./jdk-6u41-linux-x64.bin -noregister
```

Copy script disable_services.sh to all nodes and run the script on all nodes:

```
pscp -h /root/pssh.hosts /root/install_jdk.sh /root/
pssh -h /root/pssh.hosts "/root/install_jdk.sh"
```

Local Cloudera Software Repos

This section deals with making local mirrors of the Cloudera repositories for:

- Cloudera Manager, version 4.x (cm4)
- Cloudera Enterprise Core, version 4.x (CDH4)
- Cloudera Impala - beta, version 0.x (impala)

These instructions deal with mirroring the latest releases only.

Note The Hadoop distribution vendor (Cloudera) may change the layout or accessibility of their repositories. It is possible that any such changes could render one or more of these instructions invalid. For more information on Cloudera, see: http://www.cloudera.com/

Cloudera Manager Repo

The following commands will mirror the latest release of Cloudera Manager, version 4.x:

```
cd  /var/www/html/Cloudera/
curl  http://archive.cloudera.com/cm4/redhat/6/x86_64/cm/cloudera-manager.repo  -O  -L
reposync  --config=./cloudera-manager.repo  --repoid=cloudera-manager
createrepo  --baseurl http://10.29.160.53/Cloudera/cloudera-manager/  \
${PWD}/cloudera-manager
```

Cloudera Manager Installer

The following commands will mirror the latest release of the Cloudera Manager Installer utility:

```
cd  /var/www/html/Cloudera/cloudera-manager/
curl http://archive.cloudera.com/cm4/installer/latest/cloudera-manager-installer.bin -O
-L
chmod uog+rx cloudera-manager-installer.bin
```

Cloudera Enterprise Core Repo

The following commands will mirror the latest release of Cloudera Enterprise Core, version 4.x:

```
cd  /var/www/html/Cloudera/
curl  http://archive.cloudera.com/cdh4/redhat/6/x86_64/cdh/cloudera-cdh4.repo  -O  -L
reposync  --config=./cloudera-cdh4.repo  --repoid=cloudera-cdh4
createrepo  --baseurl http://10.29.160.53/Cloudera/cloudera-cdh4 ${PWD}/cloudera-cdh4
```

Next, a .repo file must be created. The following commands will create a .repo file:

```
cat  >  cloudera-manager/cloudera-manager.repo
[cloudera-manager]
name=Cloudera Manager
baseurl=http://10.29.160.53/Cloudera/cloudera-manager/
gpgcheck=0
enabled=1
priority=1

chmod  uog-wx  cloudera-manager/cloudera-manager.repo
cp  -pv  cloudera-manager/cloudera-manager.repo  /etc/yum.repos.d/
```

Cloudera Impala Repo

The following commands will mirror the latest release of Cloudera Impala - beta, version 0.x:

```
cd  /var/www/html/Cloudera/
curl http://beta.cloudera.com/impala/redhat/6/x86_64/impala/cloudera-impala.repo -O  -L
reposync  --config=./cloudera-impala.repo  --repoid=cloudera-impala
```

```
createrepo  --baseurl http://10.29.160.53/Cloudera/cloudera-impala  \
${PWD}/cloudera-impala
```

At this point, the Cloudera repositories for CDH4, CM, Impala and the CM Installer should be mirrored locally on the infrastructure node.

For more information, refer to Cloudera Installation Guide.

Services to Configure On Infrastructure Node

These are some of the other services that you may want to configure on the infrastructure node. This is optional.

DHCP for Cluster Private Interfaces

If DHCP service is needed, it may be done via one of the following services:

- dnsmasq
- dhcp

DNS for Cluster Private Interfaces

Hostname resolution for cluster private interfaces may be done by one or two of the following services running on the infrastructure node:

- **/etc/hosts** file propagated to all nodes in the cluster
- **dnsmasq**
- **bind**

The configuration described in this document used both the /etc/hosts file and the dnsmasq service to provide DNS services. The FAS2220 is the main user of the DNS service in this configuration.

The following was used for the contents of the /etc/resolv.conf file on all of the nodes and will need to be customized to fit your implementation:

```
domain hadoop.local
search hadoop.local
nameserver 10.29.160.53
```

Once configured, the **/etc/resolv.conf** file can be pushed to all nodes via the following command:

```
pssh –h /root/pssh.hosts –A /etc/resolv.conf  /etc/resolv.conf
```

The following was used for the contents of the **/etc/nsswitch.conf** file on all of the nodes and may need to be customized to fit your implementation:

```
# /etc/nsswitch.conf - for all nodes
passwd:     files
shadow:     files
group:      files
#hosts:     db files nisplus nis dns
hosts:      files dns
ethers:     files
netmasks:   files
networks:   files
protocols:  files
```

```
rpc:        files
services:   files
automount:  files nisplus
aliases:    files nisplus
netgroup:   nisplus
publickey:  nisplus
bootparams: nisplus [NOTFOUND=return] files
```

Once configured, the **/etc/nsswitch.conf** file can be pushed to all nodes via the following command:

```
pssh –h /root/pssh.hosts –A /etc/nsswitch.conf  /etc/nsswitch.conf
```

The following was used for the contents of the **/etc/hosts file** on all of the nodes and will need to be customized to fit your implementation:

```
# /etc/hosts file for all nodes
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4 
localhost-stack
::1         localhost localhost.localdomain localhost6 localhost6.localdomain6
10.29.160.1     gateway
#
# NTAP FAS2220 unit
# 0.0.0.0       fas2220-e0P
10.29.160.43    fas2220-e0M.hadoop.local fas2220-e0M
#10.29.160.45    fas2220-e0a.hadoop.local fas2220-e0a
# 0.0.0.0       fas2220-e0b
# 0.0.0.0       fas2220-e0
# 0.0.0.0       fas2220-e0d
192.168.11.43   fas2220-e1a.hadoop.local fas2220-e1a
192.168.11.45   fas2220.hadoop.local fas2220-e1b fas2220
#192.168.11.45   vif-a
#
# NTAP E-Series E5460 units
10.29.160.33    e5460-2-A.hadoop.local e5460-2-A
10.29.160.34    e5460-2-B.hadoop.local e5460-2-B
10.29.160.37    e5460-1-A.hadoop.local e5460-1-A
10.29.160.38    e5460-1-B.hadoop.local e5460-1-B
10.29.160.35    e5460-3-A.hadoop.local e5460-3-A
10.29.160.36    e5460-3-B.hadoop.local e5460-3-B
#
# CISCO eth0 mappings  -VLAN160
10.29.160.53   infra.hadoop.local infra infra-0.hadoop.local infra-0 mailhost 
infrastructure-0
10.29.160.54   nn1-0.hadoop.local nn1-0 namenode1-0 namenode-1-0 nn01-0
10.29.160.55   nn2-0.hadoop.local nn2-0 namenode2-0 namenode-2-0 nn02-0
10.29.160.56   tr1-0.hadoop.local tr1-0 tracker1-0 tracker-1-0 tr01-0
10.29.160.57   dn1-0.hadoop.local dn1-0 datanode1-0 datanode-1-0 dn01-0
10.29.160.58   dn2-0.hadoop.local dn2-0 datanode2-0 datanode-2-0 dn02-0
10.29.160.59   dn3-0.hadoop.local dn3-0 datanode3-0 datanode-3-0 dn03-0
10.29.160.60   dn4-0.hadoop.local dn4-0 datanode4-0 datanode-4-0 dn04-0
10.29.160.61   dn5-0.hadoop.local dn5-0 datanode5-0 datanode-5-0 dn05-0
10.29.160.62   dn6-0.hadoop.local dn6-0 datanode6-0 datanode-6-0 dn06-0
10.29.160.63   dn7-0.hadoop.local dn7-0 datanode7-0 datanode-7-0 dn07-0
10.29.160.64   dn8-0.hadoop.local dn8-0 datanode8-0 datanode-8-0 dn08-0
10.29.160.65   dn9-0.hadoop.local dn9-0 datanode9-0 datanode-9-0 dn09-0
10.29.160.66   dn10-0.hadoop.local dn10-0 datanode10-0 datanode-10-0
10.29.160.67   dn11-0.hadoop.local dn11-0 datanode11-0 datanode-11-0
10.29.160.68   dn12-0.hadoop.local dn12-0 datanode12-0 datanode-12-0
#
# CISCO eth1 mappings - VLAN11
192.168.11.11   infra-1 infra-1 infrastructure-1
192.168.11.12   nn1-1.hadoop.local nn1-1 namenode1-1 nn01-1
192.168.11.13   nn2-1.hadoop.local nn2-1 namenode2-1 nn02-1
192.168.11.14   tr1-1.hadoop.local tr1-1 tracker1-1 tracker-1-1 tr01-1
```

```
192.168.11.15   dn1-1.hadoop.local dn1-1 dn01-1
192.168.11.16   dn2-1.hadoop.local dn2-1 dn02-1
192.168.11.17   dn3-1.hadoop.local dn3-1 dn03-1
192.168.11.18   dn4-1.hadoop.local dn4-1 dn04-1
192.168.11.19   dn5-1.hadoop.local dn5-1 dn05-1
192.168.11.20   dn6-1.hadoop.local dn6-1 dn06-1
192.168.11.21   dn7-1.hadoop.local dn7-1 dn07-1
192.168.11.22   dn8-1.hadoop.local dn8-1 dn08-1
192.168.11.23   dn9-1.hadoop.local dn9-1 dn09-1
192.168.11.24   dn10-1.hadoop.local dn10-1
192.168.11.25   dn11-1.hadoop.local dn11-1
192.168.11.26   dn12-1.hadoop.local dn12-1
#
# eth2 mappings - VLAN12
192.168.12.11   infra-2.hadoop.local infra-2 infrastructure-2
192.168.12.12   nn1-2.hadoop.local nn1-2 namenode1-2 nn01-2
192.168.12.13   nn2-2.hadoop.local nn2-2 namenode2-2 nn02-2
192.168.12.14   tr1-2.hadoop.local tr1-2 tracker1-2 tracker-1-2 tr01-2
192.168.12.15   dn1-2.hadoop.local dn1-2 dn01-2
192.168.12.16   dn2-2.hadoop.local dn2-2 dn02-2
192.168.12.17   dn3-2.hadoop.local dn3-2 dn03-2
192.168.12.18   dn4-2.hadoop.local dn4-2 dn04-2
192.168.12.19   dn5-2.hadoop.local dn5-2 dn05-2
192.168.12.20   dn6-2.hadoop.local dn6-2 dn06-2
192.168.12.21   dn7-2.hadoop.local dn7-2 dn07-2
192.168.12.22   dn8-2.hadoop.local dn8-2 dn08-2
192.168.12.23   dn9-2.hadoop.local dn9-2 dn09-2
192.168.12.24   dn10-2.hadoop.local dn10-2
192.168.12.25   dn11-2.hadoop.local dn11-2
192.168.12.26   dn12-2.hadoop.local dn12-2
```

When configured, the **/etc/hosts** file can be pushed to all nodes through the following command:

```
pssh –h /root/pssh.hosts –A /etc/hosts  /etc/hosts
```

The following was used for the contents of the **/etc/dnsmasq.conf** file on the infrastructure node and will need to be customized to fit your implementation should you choose to use the **dnsmasq** service:

```
# Configuration file for dnsmasq.
#
# Format is one option per line, legal options are the same
# as the long options legal on the command line. See
# "/usr/sbin/dnsmasq --help" or "man 8 dnsmasq" for details.
domain-needed
bogus-priv
filterwin2k
no-resolv
local=/hadoop.local/
address=/doubleclick.net/127.0.0.1
address=/www.google-analytics.com/127.0.0.1
address=/google-analytics.com/127.0.0.1
interface=eth0
interface=eth1
interface=eth2

bind-interfaces
expand-hosts

domain=hadoop.local,10.29.160.0/24,local
domain=hadoop.local,192.168.11.0/24,local
domain=hadoop.local,192.168.12.0/24,local
#
dhcp-range=tag:mgmt,10.29.160.54,10.29.160.68,255.255.255.0,24h
dhcp-range=tag:csco_eth1,192.168.11.12,192.168.11.39,255.255.255.0,24h
```

```
dhcp-range=tag:csco_eth2,192.168.12.12,192.168.12.39,255.255.255.0,24h
#
dhcp-range=tag:data11,192.168.11.40,192.168.11.49,255.255.255.0,24h
dhcp-range=tag:data12,192.168.12.40,192.168.12.49,255.255.255.0,24h
#

# NTAP
# E-Series E5460 units
dhcp-host=net:mgmt,00:08:E5:1F:69:34,10.29.160.33,e5460-3-a
dhcp-host=net:mgmt,00:80:E5:1F:83:08,10.29.160.34,e5460-3-b
#
dhcp-host=net:mgmt,00:08:E5:1F:69:F4,10.29.160.35,e5460-2-a
dhcp-host=net:mgmt,00:08:E5:1F:9F:2C,10.29.160.36,e5460-2-b
#
dhcp-host=net:mgmt,00:08:E5:1F:6B:1C,10.29.160.37,e5460-1-a
dhcp-host=net:mgmt,00:08:E5:1F:67:A8,10.29.160.38,e5460-1-b
#
# NTAP
# FAS2220 unit
dhcp-host=net:mgmt,00:a0:98:30:58:1d,10.29.160.43,fas2220-e0M
dhcp-host=net:mgmt,00:a0:98:30:58:18,10.29.160.45,fas2220-e0a
dhcp-host=net:data11,00:a0:98:1a:19:6c,192.168.11.43,fas2220-e1a
dhcp-host=net:data11,00:a0:98:1a:19:6d,192.168.11.45,fas2220
#
# CISCO
# management (eth0)
# name nodes and tracker nodes
dhcp-host=net:mgmt,00:25:B5:02:20:6F,10.29.160.53,infra-0
dhcp-host=net:mgmt,00:25:B5:02:20:5F,10.29.160.54,nn1-0
dhcp-host=net:mgmt,00:25:B5:02:20:0F,10.29.160.55,nn2-0
dhcp-host=net:mgmt,00:25:B5:02:20:FF,10.29.160.56,tr1-0
dhcp-host=net:mgmt,00:25:B5:02:20:BF,10.29.160.57,dn1-0
dhcp-host=net:mgmt,00:25:B5:02:20:8E,10.29.160.58,dn2-0
dhcp-host=net:mgmt,00:25:B5:02:20:7E,10.29.160.59,dn3-0
dhcp-host=net:mgmt,00:25:B5:02:20:2E,10.29.160.60,dn4-0
dhcp-host=net:mgmt,00:25:B5:02:20:1E,10.29.160.61,dn5-0
dhcp-host=net:mgmt,00:25:B5:02:20:DE,10.29.160.62,dn6-0
dhcp-host=net:mgmt,00:25:B5:02:20:CE,10.29.160.63,dn7-0
dhcp-host=net:mgmt,00:25:B5:02:20:9D,10.29.160.64,dn8-0
dhcp-host=net:mgmt,00:25:B5:02:20:4D,10.29.160.65,dn9-0
dhcp-host=net:mgmt,00:25:B5:02:20:3D,10.29.160.66,dn10-0
dhcp-host=net:mgmt,00:25:B5:02:21:0D,10.29.160.67,dn11-0
#
# 10GbE cluster members (eth1)
# name nodes and tracker nodes
#
dhcp-host=net:data11,00:25:B5:02:20:9F,192.168.11.11,infra-1
dhcp-host=net:data11,00:25:B5:02:20:4F,192.168.11.12,nn1-1
dhcp-host=net:data11,00:25:B5:02:20:3F,192.168.11.13,nn2-1
dhcp-host=net:data11,00:25:B5:02:21:0F,192.168.11.14,tr1-1
dhcp-host=net:data11,00:25:B5:02:20:EF,192.168.11.15,dn1-1
dhcp-host=net:data11,00:25:B5:02:20:AF,192.168.11.16,dn2-1
dhcp-host=net:data11,00:25:B5:02:20:6E,192.168.11.17,dn3-1
dhcp-host=net:data11,00:25:B5:02:20:5E,192.168.11.18,dn4-1
dhcp-host=net:data11,00:25:B5:02:20:0E,192.168.11.19,dn5-1
dhcp-host=net:data11,00:25:B5:02:20:FE,192.168.11.20,dn6-1
dhcp-host=net:data11,00:25:B5:02:20:BE,192.168.11.21,dn7-1
dhcp-host=net:data11,00:25:B5:02:20:8D,192.168.11.22,dn8-1
dhcp-host=net:data11,00:25:B5:02:20:7D,192.168.11.23,dn9-1
dhcp-host=net:data11,00:25:B5:02:20:2D,192.168.11.24,dn10-1
dhcp-host=net:data11,00:25:B5:02:20:1D,192.168.11.25,dn11-1
dhcp-host=net:data11,00:25:B5:02:20:DD,192.168.11.26,dn12-1
#
# 10GbE cluster members (eth2)
# name nodes and tracker nodes
#
dhcp-host=net:data12,00:25:B5:02:20:8F,192.168.12.11,infra-2
dhcp-host=net:data12,00:25:B5:02:20:7F,192.168.12.12,nn1-2
dhcp-host=net:data12,00:25:B5:02:20:2F,192.168.12.13,nn2-2
dhcp-host=net:data12,00:25:B5:02:20:1F,192.168.12.14,tr1-2
dhcp-host=net:data12,00:25:B5:02:20:DF,192.168.12.15,dn1-2
dhcp-host=net:data12,00:25:B5:02:20:CF,192.168.12.16,dn2-2
dhcp-host=net:data12,00:25:B5:02:20:9E,192.168.12.17,dn3-2
dhcp-host=net:data12,00:25:B5:02:20:4E,192.168.12.18,dn4-2
dhcp-host=net:data12,00:25:B5:02:20:3E,192.168.12.19,dn5-2
dhcp-host=net:data12,00:25:B5:02:21:0E,192.168.12.20,dn6-2
dhcp-host=net:data12,00:25:B5:02:20:EE,192.168.12.21,dn7-2
dhcp-host=net:data12,00:25:B5:02:20:AE,192.168.12.22,dn8-2
dhcp-host=net:data12,00:25:B5:02:20:6D,192.168.12.23,dn9-2
dhcp-host=net:data12,00:25:B5:02:20:5D,192.168.12.24,dn10-2
dhcp-host=net:data12,00:25:B5:02:20:0D,192.168.12.25,dn11-2
dhcp-host=net:data12,00:25:B5:02:20:FD,192.168.12.26,dn12-2

dhcp-vendorclass=set:csco_eth1,Linux
dhcp-vendorclass=set:csco_eth2,Linux

dhcp-option=26,9000

# Set the NTP time server addresses to 192.168.0.4 and 10.10.0.5
dhcp-option=option:ntp-server,10.29.160.53

dhcp-lease-max=150
dhcp-leasefile=/var/lib/misc/dnsmasq.leases
dhcp-authoritative
local-ttl=5
```

Once the **/etc/dnsmasq.conf** file has been configured, the **dnsmasq** service must be started via the commands:

```
chkconfig dnsmasq on
service dnsmasq restart
```

NTP

If needed, the Infrastructure server can act as a time server for all nodes in the cluster via one of the following methods:

- **ntp** service
- **cron** or at job to push the time to the rest of the nodes in the cluster

The configuration described in this document used the **ntp** service running on the infrastructure node to provide time services for the other nodes in the cluster.

The following was used for the contents of the **/etc/ntp.conf** file on the infrastructure node and may need to be customized to fit your implementation should you choose to use the **ntp** service:

```
# /etc/ntp.conf - infrastructure node NTP config
# For more information about this file, see the man pages ntp.conf(5),
# ntp_acc(5), ntp_auth(5), ntp_clock(5), ntp_misc(5), ntp_mon(5).
driftfile /var/lib/ntp/drift
# Permit time synchronization with our time source, but do not
# permit the source to query or modify the service on this system.
restrict default kod nomodify notrap nopeer noquery
restrict -6 default kod nomodify notrap nopeer noquery
# Permit all access over the loopback interface.
```

```
restrict 127.0.0.1
restrict -6 ::1
# Hosts on local network are less restricted.
#restrict 192.168.1.0 mask 255.255.255.0 nomodify notrap
# Use public servers from the pool.ntp.org project.
# Please consider joining the pool (http://www.pool.ntp.org/join.html).
#server 0.rhel.pool.ntp.org
#server 1.rhel.pool.ntp.org
#server 2.rhel.pool.ntp.org
#broadcast 192.168.1.255 autokey        # broadcast server
#broadcastclient                        # broadcast client
#broadcast 224.0.1.1 autokey            # multicast server
#multicastclient 224.0.1.1              # multicast client
#manycastserver 239.255.254.254         # manycast server
#manycastclient 239.255.254.254 autokey # manycast client
# Undisciplined Local Clock. This is a fake driver intended for backup
# and when no outside source of synchronized time is available.
server  127.127.1.0     # local clock
fudge   127.127.1.0 stratum 10
includefile /etc/ntp/crypto/pw
keys /etc/ntp/keys
```

The following was used for the contents of the **/etc/ntp.conf** file on the other nodes and may need to be customized to fit your implementation should you choose to use the **ntp** service:

```
# /etc/ntp.conf – all other nodes
server 10.29.160.53
driftfile /var/lib/ntp/drift
restrict default kod nomodify notrap nopeer noquery
restrict -6 default kod nomodify notrap nopeer noquery
restrict 127.0.0.1
restrict -6 ::1
includefile /etc/ntp/crypto/pw
keys /etc/ntp/keys
```

Once all of the /etc/ntp.conf files have been configured, the ntpd service must be started by executing the following commands on then infrastructure node and then all of the other nodes:

```
chkconfig ntpd on
service ntpd restart
pssh –h /root/pssh.hosts –A chkconfig ntpd on
pssh –h /root/pssh.hosts –A service ntpd restart
```

System Tunings

/etc/sysctl.conf

The following should be appended to the /etc/sysctl.conf file on all of the nodes:

```
# ----------
# /etc/sysctl.conf -- append to the file on all nodes
# BEGIN: Hadoop tweaks
#
sunrpc.tcp_slot_table_entries=128
net.core.rmem_default=262144
net.core.rmem_max=16777216
net.core.wmem_default=262144
net.core.wmem_max=16777216
net.ipv4.tcp_window_scaling=1
fs.file-max=6815744
fs.xfs.rotorstep=254
```

```
vm.dirty_background_ratio=1
#
# END: Hadoop tweaks
# ----------
```

This can be accomplished via the following commands:

```
cat > /tmp/sysctl.cnf << _EOD
# ----------
# /etc/sysctl.conf -- append to the file on all nodes
# BEGIN: Hadoop tweaks
#
sunrpc.tcp_slot_table_entries=128
net.core.rmem_default=262144
net.core.rmem_max=16777216
net.core.wmem_default=262144
net.core.wmem_max=16777216
net.ipv4.tcp_window_scaling=1
fs.file-max=6815744
fs.xfs.rotorstep=254
vm.dirty_background_ratio=1
#
# END: Hadoop tweaks
# ----------
_EOD

cat /tmp/sysctl.cnf >> /etc/sysctl.conf
sysctl -p

pscp -h /root/pssh.hosts -A /tmp/sysctl.cnf /tmp/sysctl.cnf
pssh -h /root/pssh.hosts -A cat /tmp/sysctl.cnf >> /etc/sysctl.conf
pssh -h /root/pssh.hosts -A sysctl -p
```

/etc/rc.d/rc.local

The following should be appended to the /etc/rc.d/rc.local file on all of the nodes:

```
# ----------
# /etc/rc.d/rc.local - append to the file on all nodes
# BEGIN: Hadoop tweaks
#
svcpgm="/sbin/service"
svcact=" stop "
svctyp=""
queue_depth=128
nr_requests=128
read_ahead_kb=3072
max_sectors_kb=1024
scheduler="deadline"
dirty_background_ratio=1
dirty_ratio=20
dirty_expire_centisecs=3000
devsd="/dev/sd"

while (( ${#devsd} ))
do
  devsd="${devsd}[[:alpha:]]"
  for i in ${devsd}
  do
    [[ "${i}" != "${i##*]]}" ]] && devsd="" && break
    if [[ -b ${i} && `/sbin/parted -s ${i} print|/bin/grep -c boot` -eq 0 ]]
    then
      /sbin/parted -s ${i} print | /bin/grep xfs
      [[ 1 == $? ]] && continue
      /sbin/blockdev --setra 1024 ${i}
      dev=`echo  ${i} |/bin/cut -d/ -f 3`
      echo ${queue_depth}     > /sys/block/${dev}/device/queue_depth
      echo ${nr_requests}     > /sys/block/${dev}/queue/nr_requests
      echo ${read_ahead_kb}   > /sys/block/${dev}/queue/read_ahead_kb
      echo ${max_sectors_kb}  > /sys/block/${dev}/queue/max_sectors_kb
      echo ${scheduler}       > /sys/block/${dev}/queue/scheduler
    fi
  done
done

echo $dirty_background_ratio > /proc/sys/vm/dirty_background_ratio
echo $dirty_ratio > /proc/sys/vm/dirty_ratio
echo ${dirty_expire_centisecs} > /proc/sys/vm/dirty_expire_centisecs
echo never > /sys/kernel/mm/redhat_transparent_hugepage/defrag
echo never > /sys/kernel/mm/redhat_transparent_hugepage/enabled
echo 0 > /proc/sys/vm/nr_hugepages

# Stop some services that may be problematic.
for i in cpuspeed irqbalance
do
  ${svcpgm} ${i}${svctyp} ${svcact}
done
#
# END: Hadoop tweaks
# ----------
```

This can be accomplished by copying the above to the file /tmp/rc.tmp and then executing the following commands:

```
cat /tmp/rc.tmp >> /etc/rc.d/rc.local
/etc/rc.d/rc.local

pscp -h /root/pssh.hosts -A /tmp/rc.tmp /tmp/rc.tmp
pssh -h /root/pssh.hosts -A cat /tmp/rc.tmp >> /etc/rc.d/rc.local
pssh -h /root/pssh.hosts -A m/etc/rc.d/rc.local
```

Storage Configuration

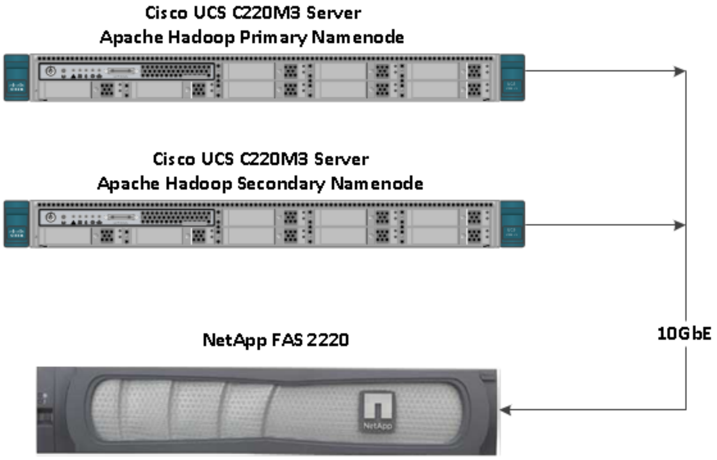
NetApp Storage Overview

The FlexPod Select for Hadoop leverages both the NetApp fabric-attached storage (FAS) and E-Series storage platforms to protect Hadoop Distributed File System (HDFS) metadata, and to provide HDFS data storage, respectively. The following subsections provide details of how both types of storage arrays are set up and provisioned, and how the provisioned storage is mapped to the servers in the Hadoop cluster.

FAS Overview

A NetApp FAS2220 storage system running Data ONTAP hosts a mirrored copy of the namenode metadata over a Network File System (NFS) mount, as shown in Figure 76. Notice that the secondary namenode is also connected to the FAS2220 to facilitate namenode recovery to the secondary namenode server, in the event of namenode failure.

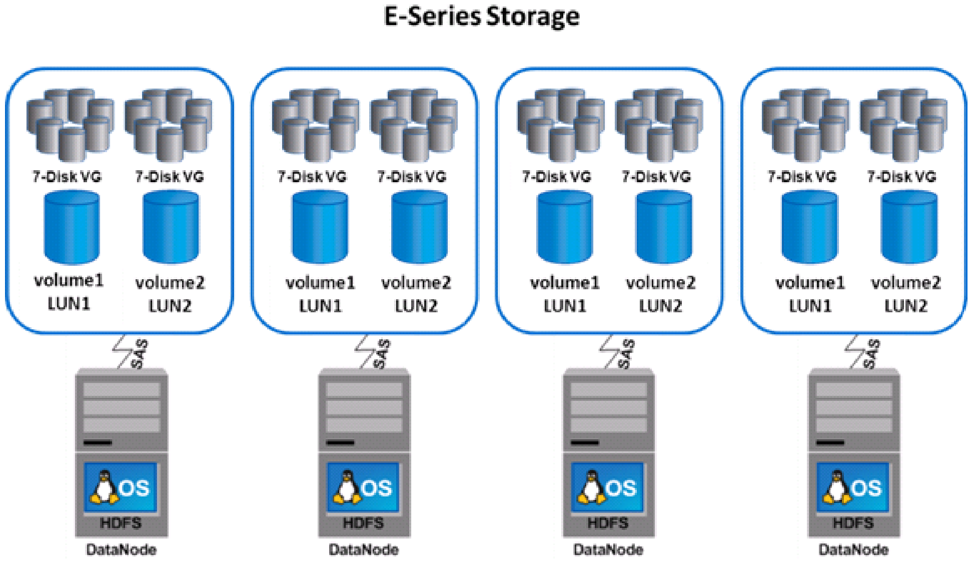
Figure 76 NFS Connectivity Between Namenodes and NetApp FAS 2220



E-Series Overview

NetApp recommends creating datanode servers on the E-Series array at a ratio of four nodes to one E5460 array, with each node having a single SAS path to one of the storage array controllers.

Figure 77 NetApp E5460 Array



FAS2220 and Data ONTAP 8

Initial setup of the FAS2220 is done with the Data ONTAP command line interface via the console serial port. Once the initial setup is done, further configuration and management of the FAS2220, the Data ONTAP 8 operating system and Data ONTAP features is done via the NetApp OnCommand System Manager management software.

FAS Initial Configuration

Table 6 lists the values for each parameter in the NetApp FAS2220 storage system configuration.

Table 6 NetApp FAS2220 storage system configuration template

Parameter Name	Sample Value
Hostname of the storage system	ntap-fas2220 (must resolve by DNS)
Hadoop Primary Namenode	nn1 (must resolve by DNS)
Hadoop secondary Namenode	nn2 (must resolve by DNS)
Aggregate size	Use existing aggr0 with the default RAID level of RAID-DP
Volumes	/vol/fsimage_bkp (100GB) Optional: /vol/common (100GB)
NFS share	/vol/fsimage_bkp (mounted on primary namenode and secondary namenode) Optional: /vol/common (mounted on all servers in the cluster)

Note The NetApp FAS2220 for Hadoop includes 6 disks in the 24-disk chassis. The factory default Raid DP aggr0 aggregate contains three of the six assigned disks. NetApp recommends adding the other three disks to the existing aggr0 to carve out data volumes instead of creating a new aggregate. The NetApp FAS2240 for Hadoop includes 12 disks in the 24-disk chassis. Out of these 12 disks, six are assigned to each controller. On each controller, the factory default Raid DP aggr0 contains three of the six assigned disks. Because of limited disk space in the FAS2220, NetApp recommends using the existing aggr0 to carve out data volumes instead of creating a new aggregate. This configuration is designed so that two additional disks will be added to aggr0, leaving one disk as a hot spare.

Data ONTAP 8.1.2 7-Mode

1. Complete Configuration Worksheet

   Before running the setup script, complete the configuration worksheet that is included in the Data ONTAP® 8.1 Software Setup Guide For 7-Mode, see:

   https://library.netapp.com/ecm/ecm_get_file/ECMP1119529

   Note You must have access to the NetApp Support site to download the Software Setup Guide.

2. Run Setup Process

   Initial setup of the FAS2220 must be done via the serial console port using the Data ONTAP command line interface.

   When Data ONTAP is installed on a new storage system, the following files are not populated:

   – /etc/rc

   – /etc/exports

- /etc/hosts
- /etc/hosts.equiv

To setup these files, follow these steps:

a. Enter the configuration values the first time you power on the new system. The configuration values populate these files and configure the installed functionality of the system.

b. Connect to the console port on the controller to access the CLI.

c. Run the setup command at the storage system command prompt.

d. Enter the following information:

```
Please enter the new hostname []: fas2220
Do you want to enable IPv6? [n]: RETURN
Do you want to configure interface groups? [n]: RETURN
Please enter the IP address for Network Interface e0a []:RETURN
```

e. Press RETURN to accept the blank IP address

f. Continue entering the following information:

```
Should interface e0a take over a partner IP address during failover? [n]: RETURN
Please enter the IP address for the Network Interface e0b []:Enter
Should interface e0b take over a partner IP address during failover? [n]: RETURN
Please enter the IP address for the Network Interface e0c []:Enter
Should interface e0c take over a partner IP address during failover? [n]: RETURN
Please enter the IP address for the Network Interface e0d []:Enter
Should interface e0d take over a partner IP address during failover? [n]: RETURN

Please enter the IP address for the Network Interface e1a []:Enter
Should interface e1a take over a partner IP address during failover? [n]: RETURN
Please enter the IP address for the Network Interface e1b []:Enter
Should interface e1b take over a partner IP address during failover? [n]: RETURN

Please enter the IP address for Network Interface e0M []: 10.29.160.43
Please enter the netmaskfor the Network Interface e0M [255.255.255.0]:
255.255.255.0

Should interface e0M take over a partner IP address during failover? [n]: y
Please enter the IPv4 address or interface name to be taken over by e0M []: e0M
Please enter flow control for e0M {none, receive, send, full} [full]: RETURN

Would you like to continue setup through the Web interface? [n]: RETURN

Please enter the name or IP address of the IPv4 default gateway: 10.29.160.1

The administration host is given root access to the storage system's / etc files
for system administration. To allow /etc root access to all NFS clients enter
RETURN below.
Please enter the name or IP address for administrative host: RETURN

Please enter timezone [GTM]: US/Pacific
```

Note Example time zone: America/New_York.

```
Where is the filer located? Hadoop Lab
Enter the root directory for HTTP files [home/http]: RETURN
Do you want to run DNS resolver? [n]: y
Please enter DNS domain name []: hadoop.local
Please enter the IP address for first nameserver []: 10.29.160.53
Do you want another nameserver? [n]: RETURN
```

Note Optionally, enter up to three name server IP addresses.

```
Do you want to run NIS client? [n]: RETURN
Press the Return key to continue through AutoSupport message
would you like to configure SP LAN interface [y]: RETURN
Would you like to enable DHCP on the SP LAN interface [y]: n
Please enter the IP address for the SP: RETURN
Please enter the netmask for the SP []:RETURN
Please enter the IP address for the SP gateway: RETURN
Please enter the name or IP address of the mail host [mailhost]: <<var_mailhost>>
Please enter the IP address for <<var_mailhost>> []:<<var_mailhost>>
New password: change_me
Retype new password: change_me
```

g. Enter the password for admin to login to the controller.

h. Enter reboot to activate the settings.

i. After the FAS unit reboots, you should be able to use OnCommand System Manager to connect to the FAS e0M interface that you configured above.

To configure the FAS2220 to serve NFS data by creating two NFS shares, follow these steps:

1. Log in to the FAS2220 as root, using putty or a similar SSH utility.
2. Add two additional disks to aggr0 to make it a total of five disks (three data disks and two parity disks) by running the aggr add command.

```
aggr add aggr0 2
```

3. Each controller contains a root volume named vol0. This root volume contains the file-system and files needed for the running Data ONTAP. From the factory, this volume is initially sized much larger than is required for array operation in the FlexPod Select for Hadoop environment. This volume should be resized, thereby releasing valuable storage space for use by other volumes being created on aggregate aggr0. By issuing the following command on each controller, the vol0 root volume will be down-sized to be smaller, but adequately sized for operations.

   ```
   vol size vol0 200g
   ```

4. Create two 100GB volumes.

```
vol create fsimage_bkp aggr0 100g
vol create common aggr0 100g
```

5. Share the directories through NFS.

```
exportfs -p
sec=sys,rw=192.168.11.0/24:192.168.12.0/24,root=192.168.11.0/24:192.168.12.0/24
/vol/fsimage_bkp

exportfs -p
sec=sys,rw=192.168.11.0/24:192.168.12.0/24,root=192.168.11.0/24:192.168.12.0/24
/vol/common
```

NetApp OnCommand System Manager 2.1

OnCommand® System Manager is the simple yet powerful browser-based management tool that enables administrators to easily configure and manage individual NetApp storage systems or clusters of systems.

System Manager is designed with wizards and workflows, simplifying common storage tasks such as creating volumes, LUNS, qtrees, shares, and exports, which saves time and prevents errors. System Manager works across all NetApp storage: FAS2000, 3000, and 6000 series as well as V-Series systems.

The following are NetApp OnCommand System Manager 2.1 prerequisites:

- If a proxy server is being used, it must be disabled.
- Sun JRE 6 must be installed.
- If running Windows or Linux guest OS on Mac OS using VMware Fusion:
  - The shared-folders feature must be disabled.
  - The desktop option of the mirrored-folders feature must be disabled.

Launch OnCommand System Manager

Double-click the System Manager icon on your desktop to launch System Manager. The NetApp OnCommand System Manager icon is shown in Figure 78.

Figure 78 NetApp OnCommand System Manager Icon

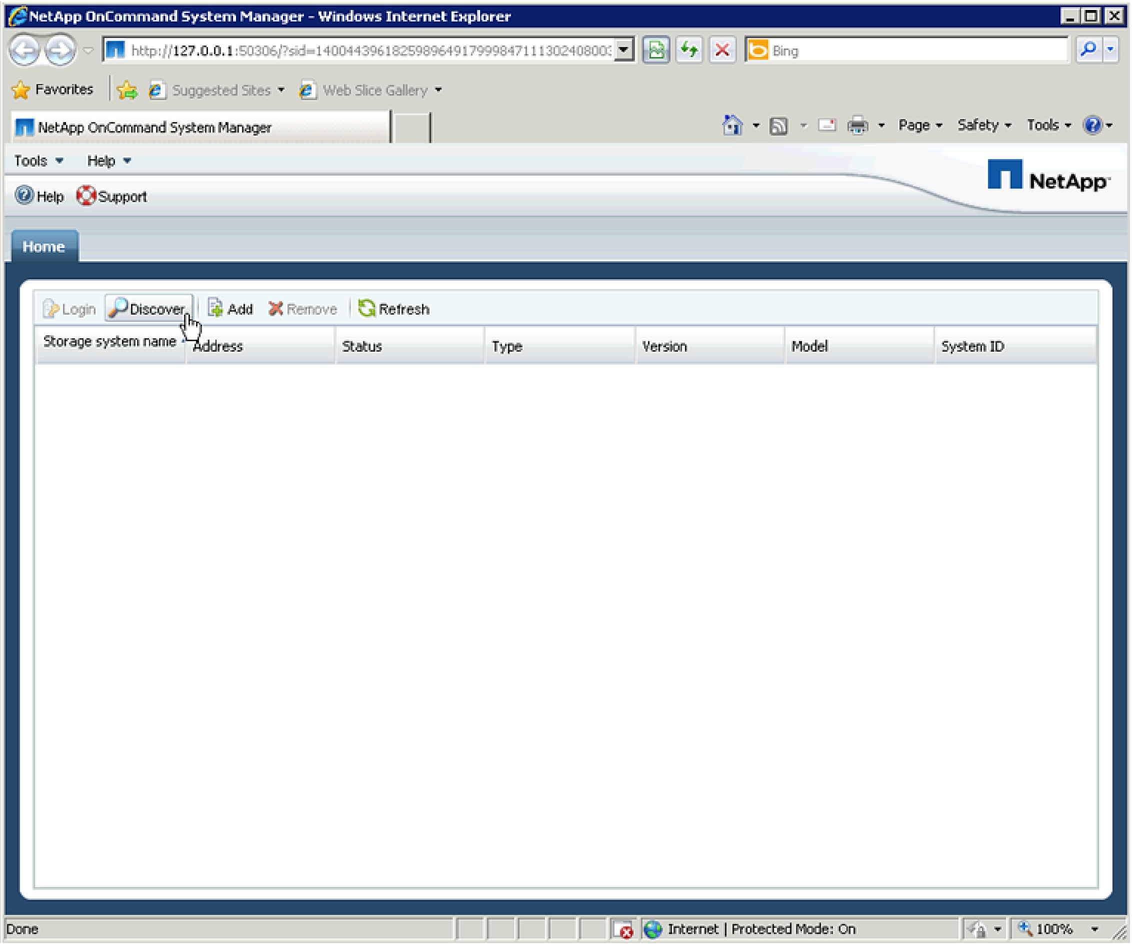
Location: SystemManager (C:\Program Files (x86)\NetApp\OnCommand System Manager\2.0)

Discover Storage Systems

To add storage system or HA pair, follow these steps:

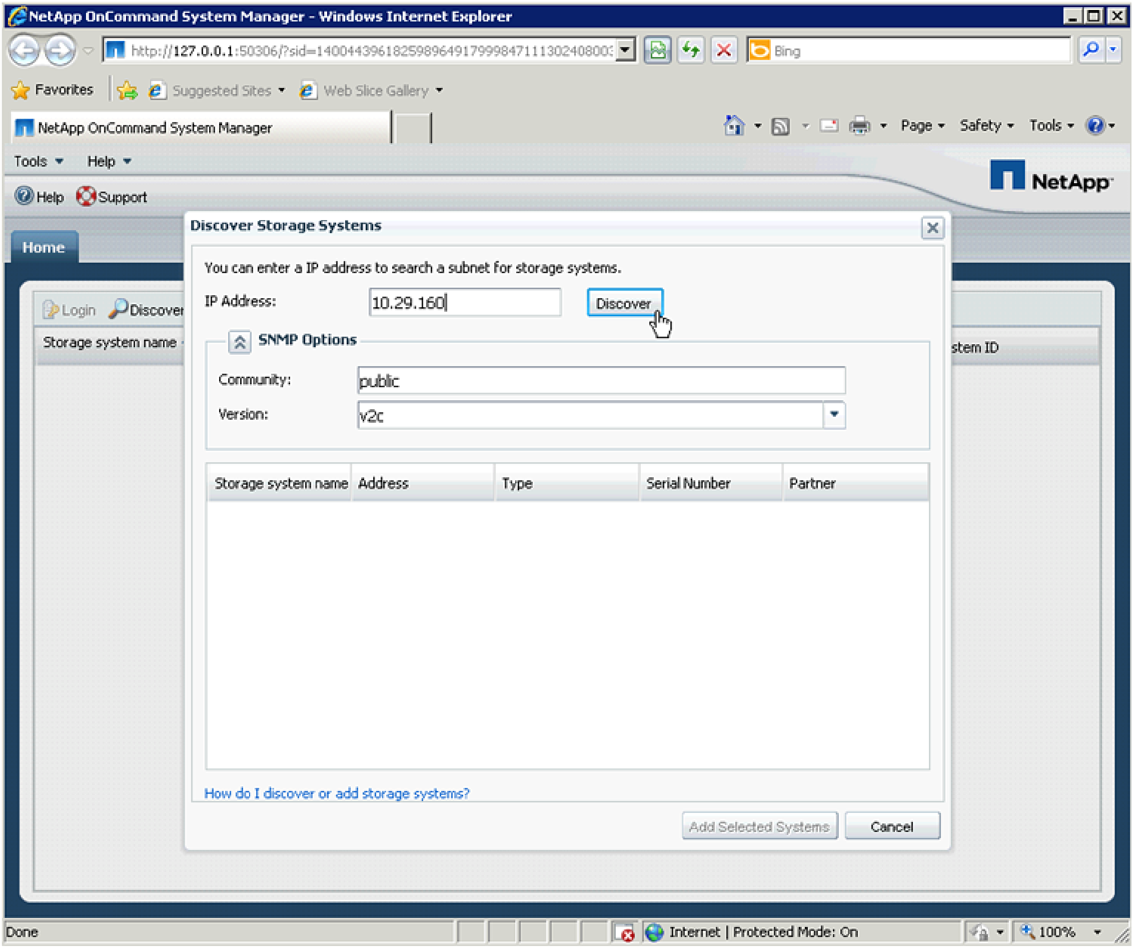
1. In the NetApp System Manager, select Home tab and click **Discover**.

Figure 79 Discovering Storage Systems


NetApp OnCommand System Manager - Windows Internet Explorer
http://127.0.0.1:50306/?sid=140044396182598964917999847111302408003
Bing
Favorites
Suggested Sites
Web Slice Gallery
NetApp OnCommand System Manager
Page
Safety
Tools
Tools
Help
Help
Support
NetApp
Home
Login
Discover
Add
Remove
Refresh
Storage system name
Address
Status
Type
Version
Model
System ID
Done
Internet | Protected Mode: On
100%

2. In the Discover Storage Systems dialog box, enter the subnet IP address and click **Discover**.

Figure 80 Entering the IP Address for Discovering Storage Systems


NetApp OnCommand System Manager - Windows Internet Explorer
http://127.0.0.1:50306/?sid=14004439618259896491799984711130240800
Bing
Favorites
Suggested Sites
Web Slice Gallery
NetApp OnCommand System Manager
Page
Safety
Tools
Tools
Help
NetApp
Help
Support
Home
Login
Discover
Storage system name
stem ID
Discover
Add Selected Systems
Cancel
Internet | Protected Mode: On
100%
Done

Discover Storage Systems

You can enter a IP address to search a subnet for storage systems.

IP Address: 10.29.160

SNMP Options

Community: public

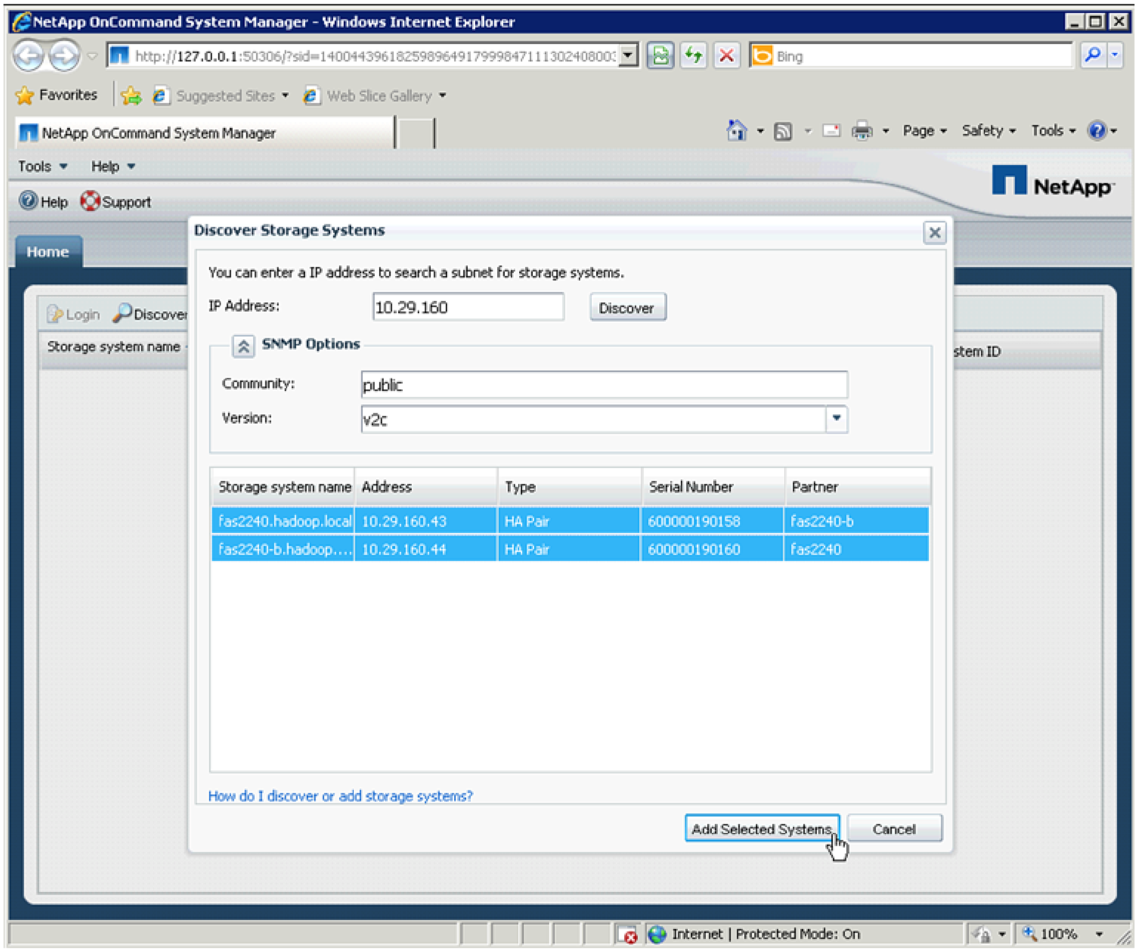
Version: v2c

Storage system name	Address	Type	Serial Number	Partner

How do I discover or add storage systems?

3. Select one or more storage systems from the list of discovered systems and click **Add Selected Systems**.

Figure 81 Adding Selected Storage Systems


NetApp OnCommand System Manager - Windows Internet Explorer
http://127.0.0.1:50306/?sid=14004439618259896491799984711130240800
Bing
Favorites
Suggested Sites
Web Slice Gallery
NetApp OnCommand System Manager
Page
Safety
Tools
Tools
Help
NetApp
Help
Support
Home
Login
Discover
Storage system name
stem ID
Discover
SNMP Options
How do I discover or add storage systems?
Add Selected Systems
Cancel
Internet | Protected Mode: On
100%

Discover Storage Systems

You can enter a IP address to search a subnet for storage systems.

IP Address: 10.29.160

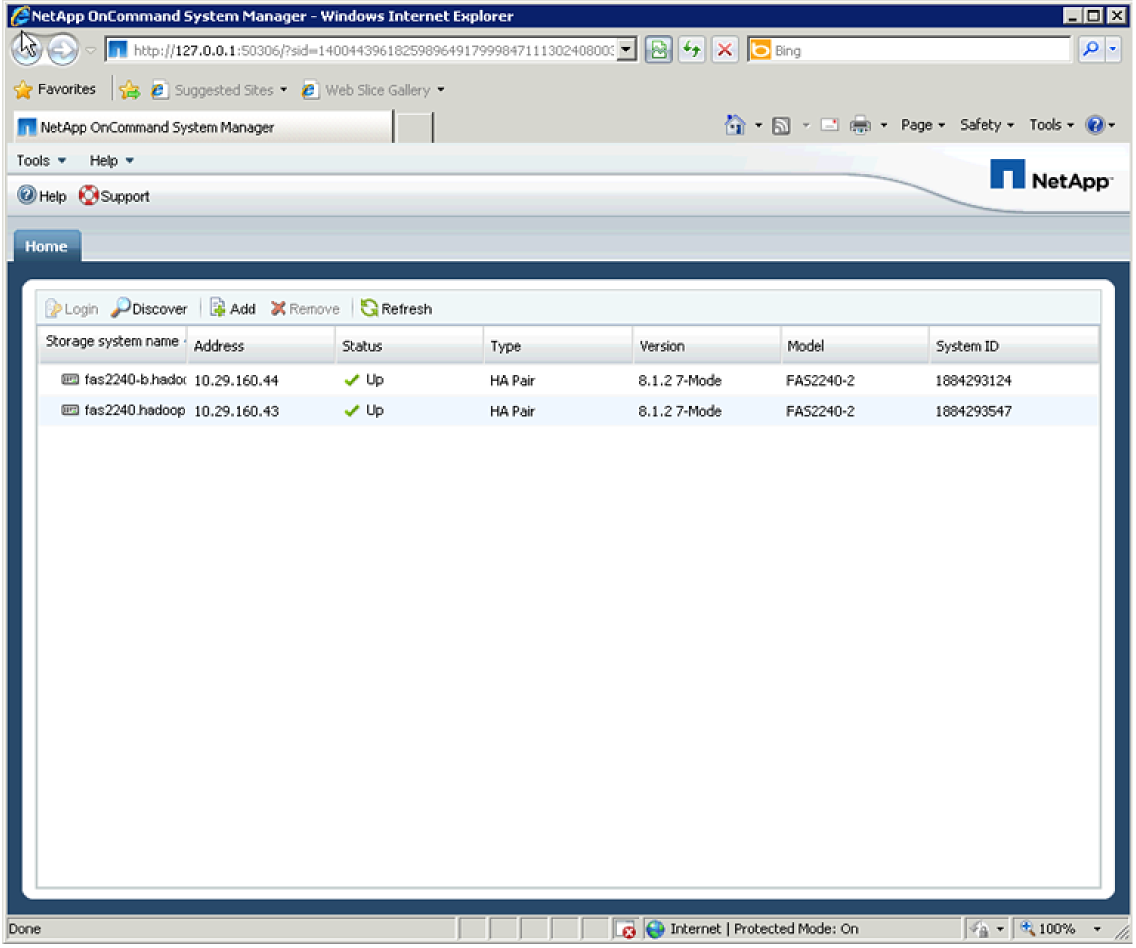
Community: public

Version: v2c

Storage system name	Address	Type	Serial Number	Partner
fas2240.hadoop.local	10.29.160.43	HA Pair	600000190158	fas2240-b
fas2240-b.hadoop....	10.29.160.44	HA Pair	600000190160	fas2240

4. Verify that the storage system or the HA pair that you added is included in the list of managed systems.

Figure 82 Verifying the Added Storage Systems


NetApp OnCommand System Manager - Windows Internet Explorer
http://127.0.0.1:50306/?sid=140044396182598964917999847111302408003
Bing
Favorites
Suggested Sites
Web Slice Gallery
NetApp OnCommand System Manager
Page
Safety
Tools
Tools
Help
Help
Support
NetApp
Home
Login
Discover
Add
Remove
Refresh
Done
Internet | Protected Mode: On
100%

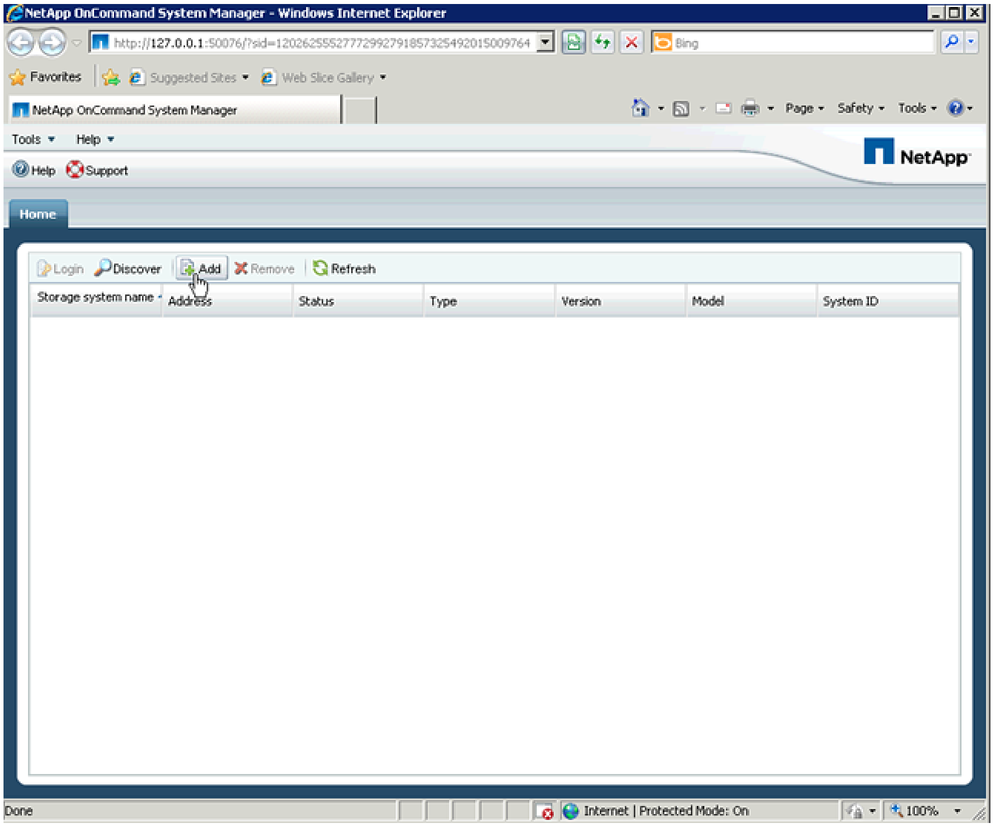
Storage system name	Address	Status	Type	Version	Model	System ID
fas2240-b.hadoo	10.29.160.44	✓ Up	HA Pair	8.1.2 7-Mode	FAS2240-2	1884293124
fas2240.hadoop	10.29.160.43	✓ Up	HA Pair	8.1.2 7-Mode	FAS2240-2	1884293547

Adding Storage Systems

If you need to add a FAS unit to an existing System Manager setup, follow these steps within System Manager:

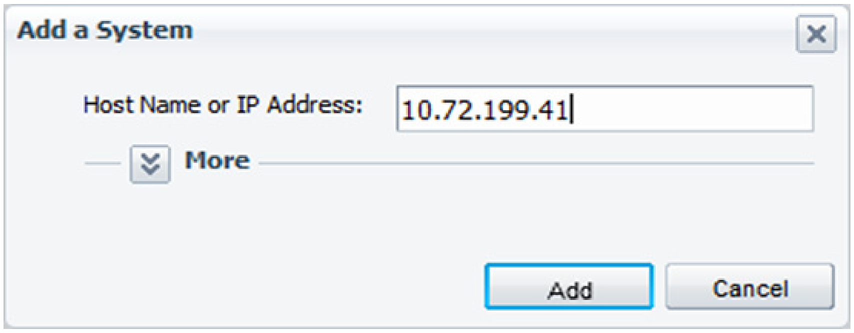
1. In the Home tab, click **Add**.

Figure 83 Adding FAS Storage Unit


NetApp OnCommand System Manager - Windows Internet Explorer
http://127.0.0.1:50076/?sid=120262555277729927918573254920150097764
Bing
Favorites
Suggested Sites
Web Slice Gallery
NetApp OnCommand System Manager
Page
Safety
Tools
Tools
Help
NetApp
Help
Support
Home
Login
Discover
Add
Remove
Refresh
Storage system name
Address
Status
Type
Version
Model
System ID
Done
Internet | Protected Mode: On
100%

2. Type the fully qualified DNS host name or the IPv4 address of the storage system.

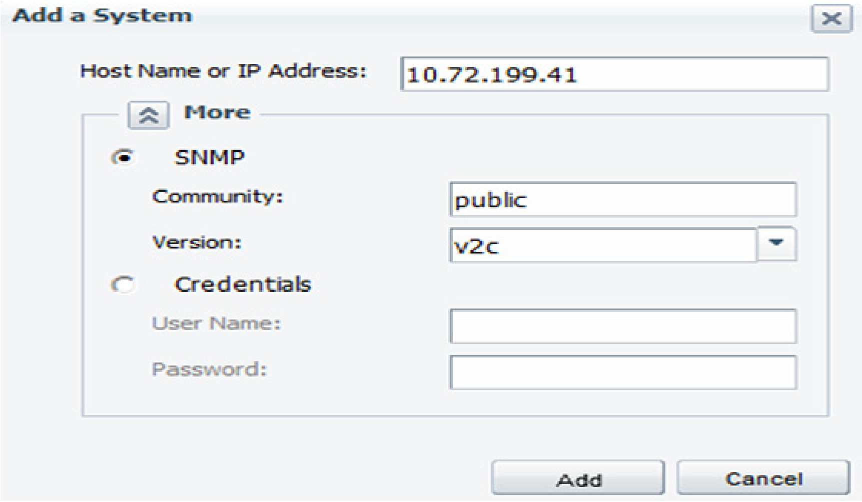
Figure 84 Entering Host IP Address


Add a System

Host Name or IP Address: 10.72.199.41

3. Click More.
4. Select the **SNMP** radio button method for discovering and adding the storage system.
5. You need to specify the SNMP community and the SNMP version.

Figure 85 Specifying SNMP Details



Add a System

Host Name or IP Address: 10.72.199.41

● SNMP

Community: public

Version: v2c

○ Credentials

User Name:

Password:

6. Enter user name and password.
7. Click **Add**.

E-Series Configuration & Management

The configuration and management of the E-Series E5460 storage array is done via the NetApp SANtricity management software.

Record Storage Configurations

Use the template in Table 7 to capture and keep a record of all volume groups, volumes, serving controllers, and Hadoop datanode hosts. The entries in the Table 7 are intended to serve as an example of a useful naming convention; however, individual customer requirements vary widely with respect to naming conventions. As a result, the specific names for individual projects should be substituted for those in the example template.

Note The recommended naming best practice is to associate the volume group name with the storage system and controller ID hosting the volume group. Similarly, the volume name should clearly reflect which datanode it serves.

Table 7 Storage provisioning details template

Volume	Volume Group	E-Series Storage System	Controller Slot	Datanode
vol1_datanode1	Vg1a_ntap01-A	Ntap01	A	Datanode1
vol2_datanode1	Vg1b_ntap01-A			
vol1_datanode2	Vg1a_ntap01-B	Ntap01	A	Datanode2
vol2_datanode2	Vg1b_ntap01-B			

Table 7 Storage provisioning details template

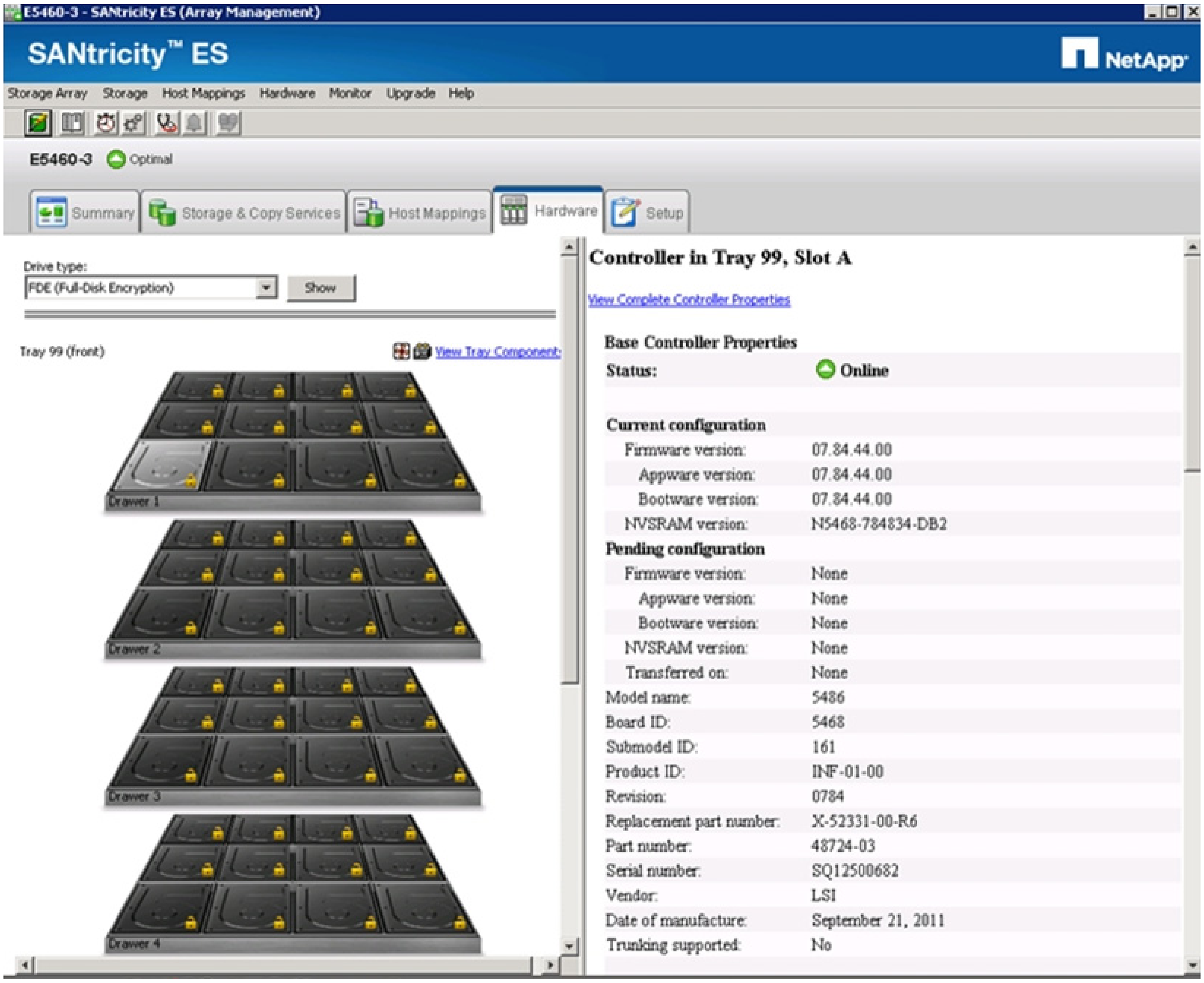
Volume	Volume Group	E-Series Storage System	Controller Slot	Datanode
vol1_datanode3	Vg2a_ntap01-A	Ntap01	B	Datanode3
vol2_datanode3	Vg2b_ntap01-A			
vol1_datanode4	Vg2a_ntap01-B	Ntap01	B	Datanode4
vol2_datanode4	Vg2b_ntap01-B			

Confirm That All Disks Are in Optimal Status

To confirm the health status of all disks, follow these steps:

1. Select the Hardware tab of SANtricity ES Storage Manager to view an inventory of all the hard disks in the array.

Figure 86 Hard Disk Details in SANtricity ES Manager



Drive type: FDE (Full-Disk Encryption)

Controller in Tray 99, Slot A

Base Controller Properties

Status: **Online**

Current configuration

Firmware version:	07.84.44.00
Appware version:	07.84.44.00
Bootware version:	07.84.44.00
NVSRAM version:	N5468-784834-DB2

Pending configuration

Firmware version:	None
Appware version:	None
Bootware version:	None
NVSRAM version:	None
Transferred on:	None
Model name:	5486
Board ID:	5468
Submodel ID:	161
Product ID:	INF-01-00
Revision:	0784
Replacement part number:	X-52331-00-R6
Part number:	48724-03
Serial number:	SQ12500682
Vendor:	LSI
Date of manufacture:	September 21, 2011
Trunking supported:	No

2. Check the Status Online, for the health of all drives and look for any errors. If there are no errors, proceed to the next step. If fault conditions are present, correct the faults before proceeding.

Selecting Drives for Volume Groups and Hot Spares

For highest performance, NetApp recommends balancing the use of even and odd disk slots for each controller, which provides balanced I/O across drive side channels. Table 8 defines the correct mapping of disk drives to volume groups.

Table 8 Mapping disk drives to volume groups

Host Name	Volume Group/Volume	Disk List Strings	Datanode
Host1	VG1/VOL1	[99,1,1],[99,2,1],[99,3,1],[99,4,1],[99,1,2], [99,2,2],[99,3,2]	A
Host1	VG2/VOL2	[99,5,1],[99,1,3],[99,2,3],[99,4,2],[99,5,2], [99,1,4],[99,2,4]	B
Host2	VG1/VOL1	[99,3,3],[99,4,3],[99,5,3],[99,1,5],[99,3,4], [99,4,4],[99,5,4]	A
Host2	VG2/VOL2	[99,2,5],[99,3,5],[99,4,5],[99,1,6],[99,2,6], [99,3,6],[99,4,6]	B
Host3	VG1/VOL1	[99,5,5],[99,1,7],[99,2,7],[99,3,7],[99,5,6], [99,1,8],[99,2,8]	A
Host3	VG2/VOL2	[99,4,7],[99,5,7],[99,1,9],[99,3,8],[99,4,8], [99,5,8],[99,1,10]	B
Host4	VG1/VOL1	[99,2,9],[99,3,9],[99,4,9],[99,5,9],[99,2,10], [99,3,10],[99,4,10]	A
Host4	VG2/VOL2	[99,1,11],[99,2,11],[99,4,11],[99,5,10],[99,1,12], [99,3,12], [99,5,12]	B

Note The remaining four drives ([99,2,12], [99,3,11], [99,4,12] and [99,5,11]) should be designated as hot spares.

Creating and Assigning Hot Spares

To allocate hot spares in the E-Series array, follow these steps:

1. Start the SANtricity ES Storage Manager client.
2. Select the Devices tab.
3. In the left pane (tree view), double-click the array where the volume group will be created. This step opens the Array Management Window (AMW) for that array.
4. In the AMW, select the Hardware tab and follow these steps:

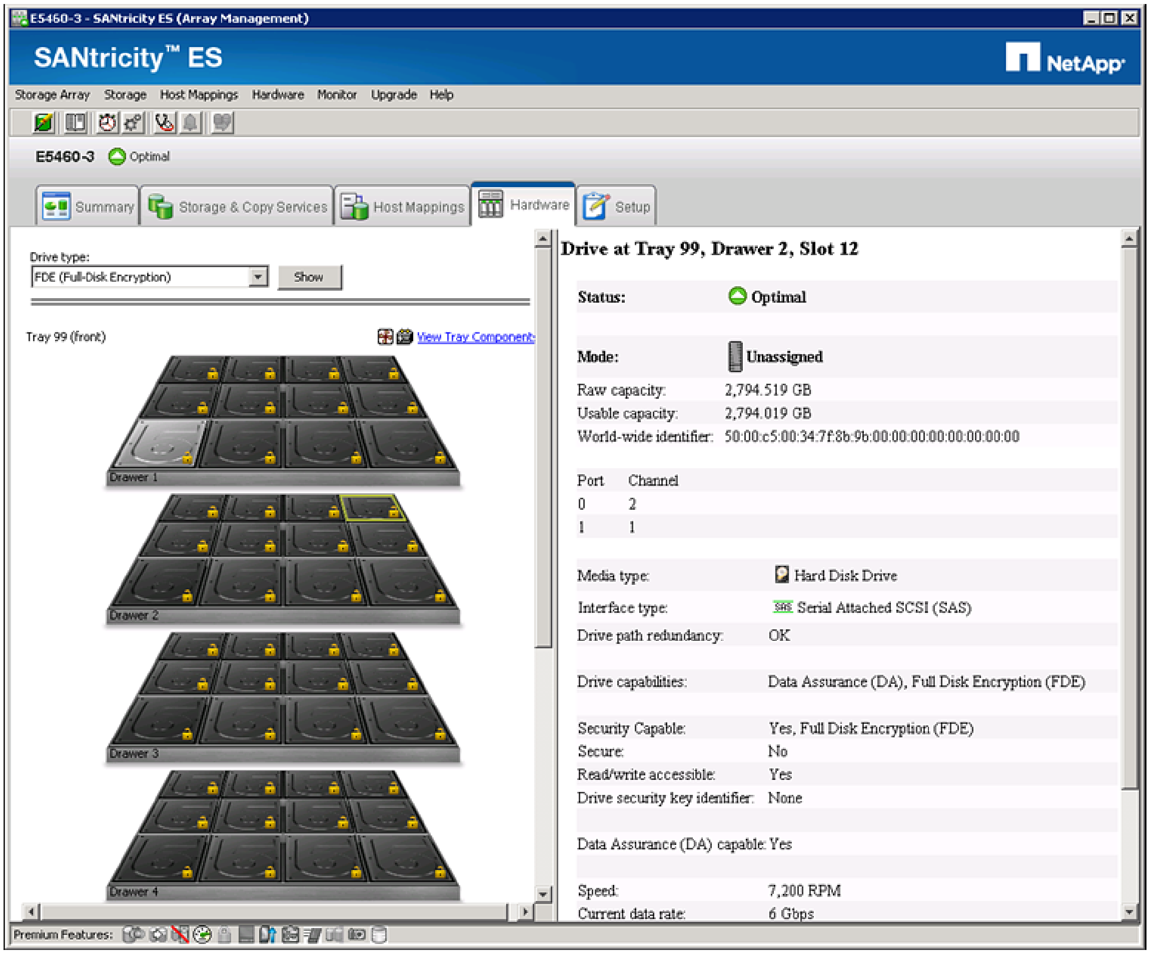
a. Select hot spares beginning with slot 12 in drawer 2.

b. Choose slot 11 in drawer 3 for the second spare disk.

c. Choose slot 12 in drawer 4 for the third spare disk.

d. Choose slot 11 in drawer 5 for the fourth spare disk.

Figure 87 Selecting a Drive as Spare



Drive type: FDE (Full-Disk Encryption)

Drive at Tray 99, Drawer 2, Slot 12

Status:	**Optimal**
Mode:	**Unassigned**
Raw capacity:	2,794.519 GB
Usable capacity:	2,794.019 GB
World-wide identifier:	50:00:c5:00:34:7f:8b:9b:00:00:00:00:00:00:00:00

Port	Channel
0	2
1	1

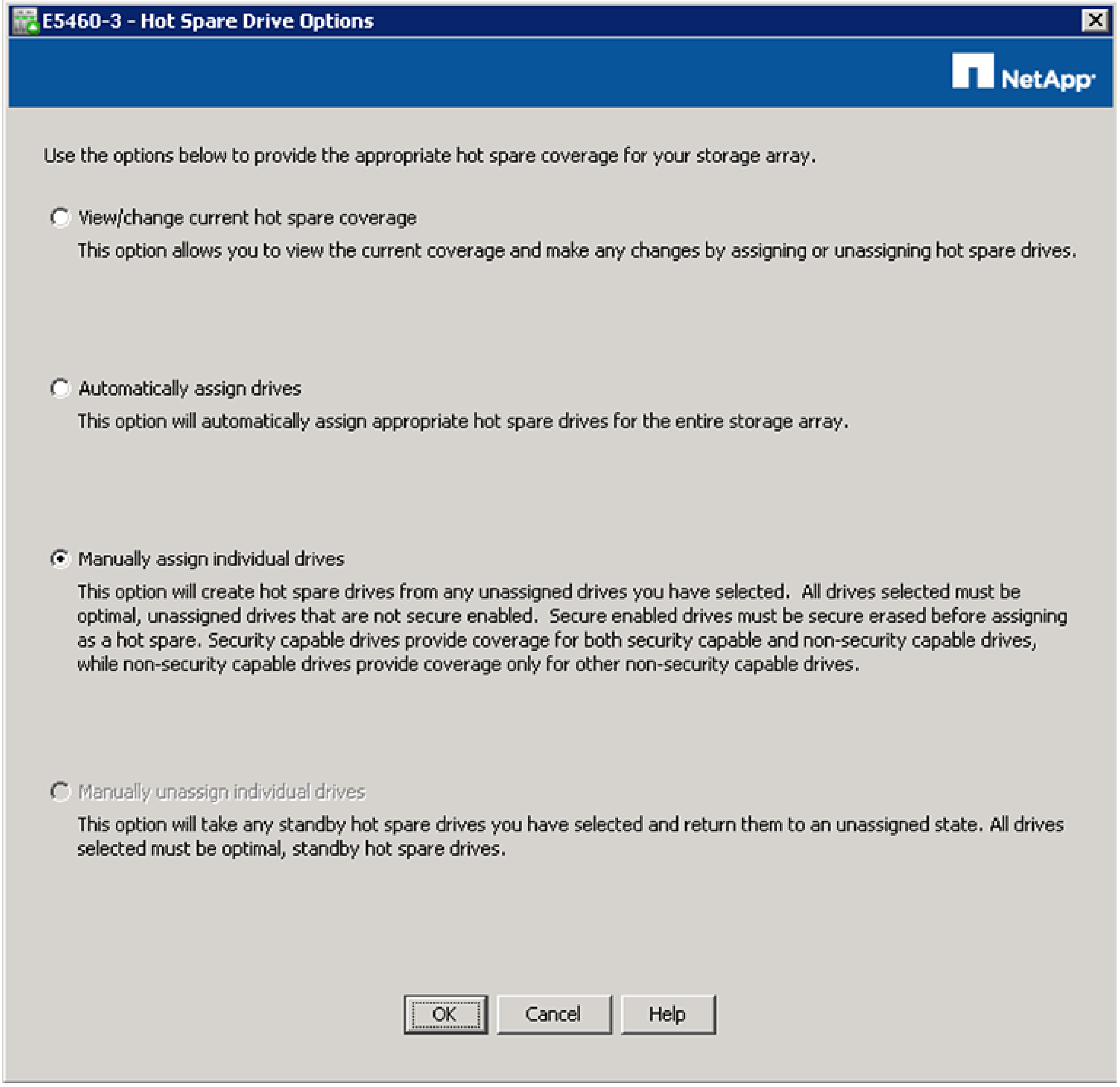
Media type:	Hard Disk Drive
Interface type:	Serial Attached SCSI (SAS)
Drive path redundancy:	OK
Drive capabilities:	Data Assurance (DA), Full Disk Encryption (FDE)
Security Capable:	Yes, Full Disk Encryption (FDE)
Secure:	No
Read/write accessible:	Yes
Drive security key identifier:	None
Data Assurance (DA) capable:	Yes
Speed:	7,200 RPM
Current data rate:	6 Gbps

Note The drive selected in this step is allocated as a hot spare. The allocated hot spare drive is indicated by a red plus sign over the drive icon.

e. Right-click on the image of the chosen drive, and then select **Hot Spare Coverage**.

f. In the Hot Spare Drive Options dialog box, select the **Manually Assign Individual Drives** radio button and click **OK**.

Figure 88 Assigning Drives Manually



E5460-3 - Hot Spare Drive Options

Use the options below to provide the appropriate hot spare coverage for your storage array.

○ View/change current hot spare coverage

This option allows you to view the current coverage and make any changes by assigning or unassigning hot spare drives.

○ Automatically assign drives

This option will automatically assign appropriate hot spare drives for the entire storage array.

● Manually assign individual drives

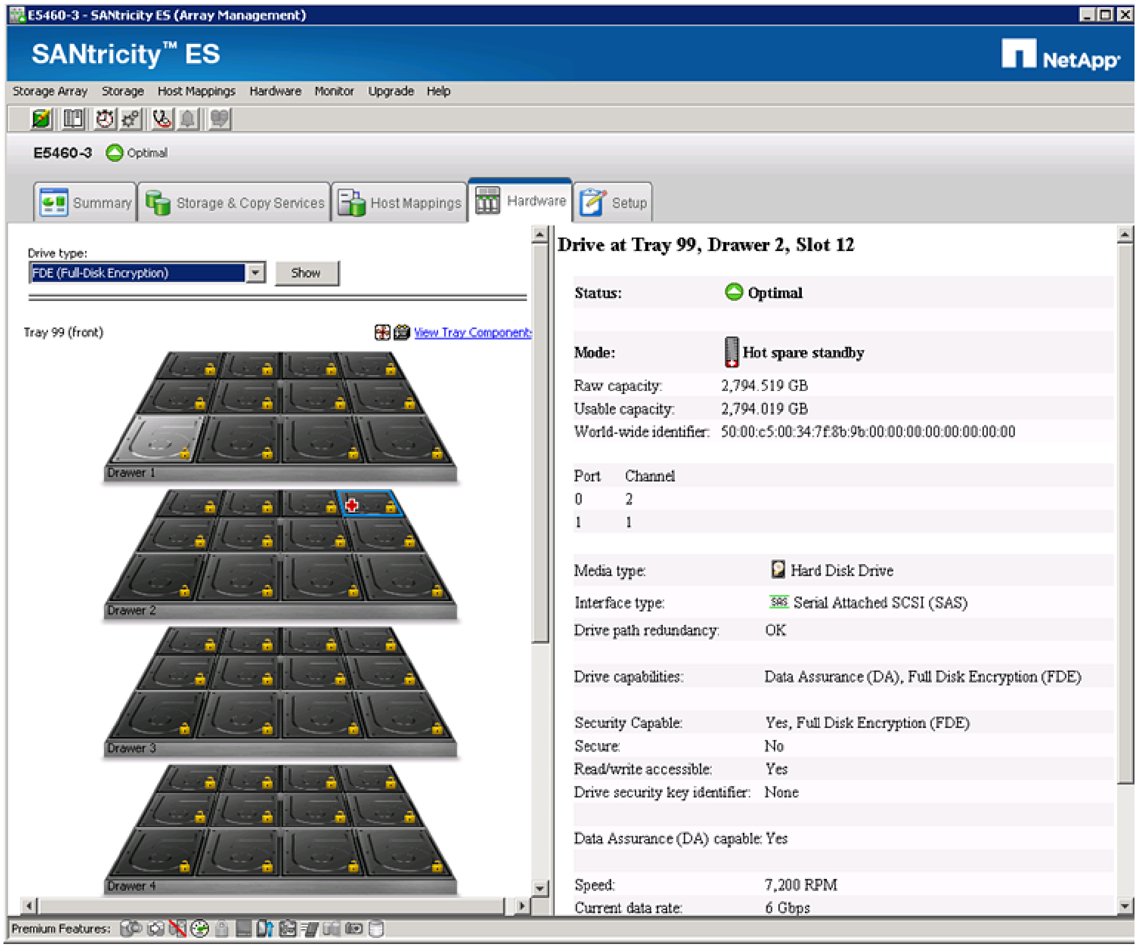
This option will create hot spare drives from any unassigned drives you have selected. All drives selected must be optimal, unassigned drives that are not secure enabled. Secure enabled drives must be secure erased before assigning as a hot spare. Security capable drives provide coverage for both security capable and non-security capable drives, while non-security capable drives provide coverage only for other non-security capable drives.

○ Manually unassign individual drives

This option will take any standby hot spare drives you have selected and return them to an unassigned state. All drives selected must be optimal, standby hot spare drives.

Figure 89 shows assigned Hot spare in standby mode in the SANtricity Manager window.

Figure 89 Hot Spare in Standby Mode

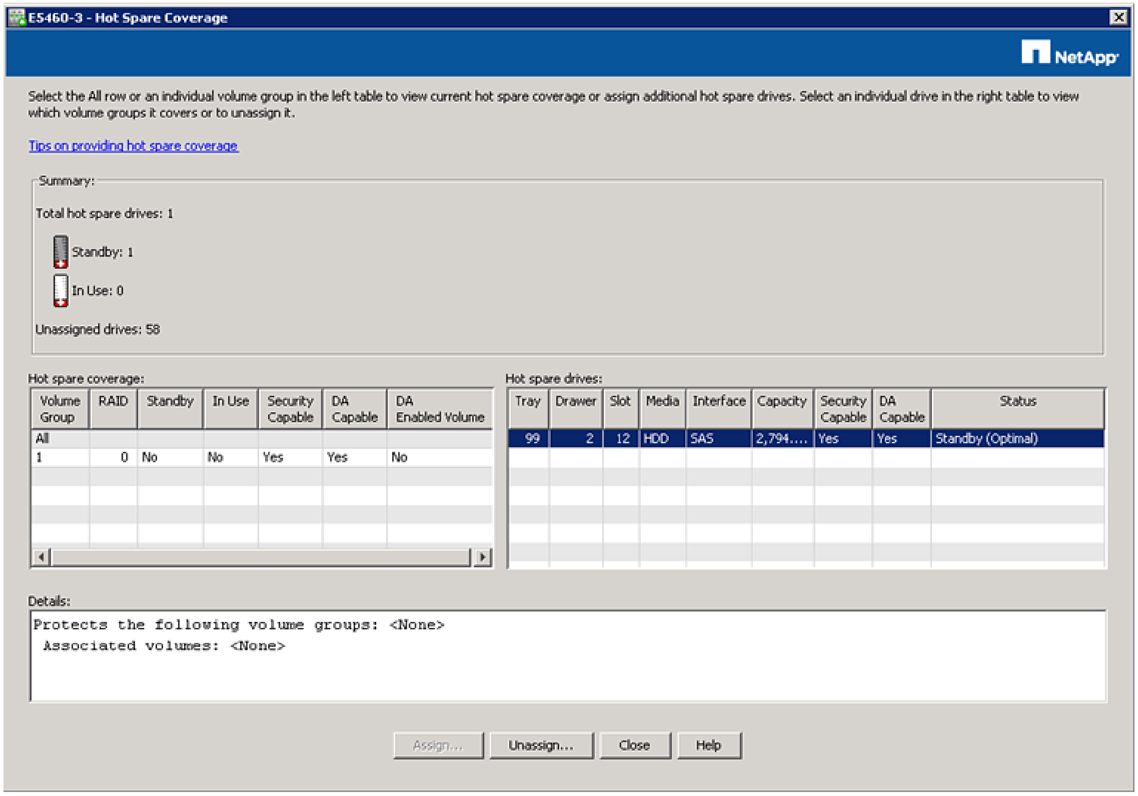


Drive at Tray 99, Drawer 2, Slot 12

```
Status:                        Optimal

Mode:                          Hot spare standby
Raw capacity:                  2,794.519 GB
Usable capacity:               2,794.019 GB
World-wide identifier:         50:00:c5:00:34:7f:8b:9b:00:00:00:00:00:00:00:00

Port    Channel
0       2
1       1

Media type:                    Hard Disk Drive
Interface type:                Serial Attached SCSI (SAS)
Drive path redundancy:         OK

Drive capabilities:            Data Assurance (DA), Full Disk Encryption (FDE)

Security Capable:              Yes, Full Disk Encryption (FDE)
Secure:                        No
Read/write accessible:         Yes
Drive security key identifier: None

Data Assurance (DA) capable: Yes

Speed:                         7,200 RPM
Current data rate:             6 Gbps
```

5. To change the drives that are allocated as hot spares, follow these steps:
   a. In the Hardware tab of the AMW, select the drive to be changed.
   b. From the main menu, select **Hardware** > **Hot Spare Coverage**.
   c. In the Hot Spare Drive Options dialog box, select View/Change Current Hot Spare Coverage. Click **OK**.

Figure 90 Summary Showing Total Hot Spare Drives



Select the All row or an individual volume group in the left table to view current hot spare coverage or assign additional hot spare drives. Select an individual drive in the right table to view which volume groups it covers or to unassign it.

Tips on providing hot spare coverage

Summary:

Total hot spare drives: 1

Standby: 1

In Use: 0

Unassigned drives: 58

Hot spare coverage:

Volume Group	RAID	Standby	In Use	Security Capable	DA Capable	DA Enabled Volume
All						
1	0	No	No	Yes	Yes	No

Hot spare drives:

Tray	Drawer	Slot	Media	Interface	Capacity	Security Capable	DA Capable	Status
99	2	12	HDD	SAS	2,794....	Yes	Yes	Standby (Optimal)

Details:

```
Protects the following volume groups: <None>
 Associated volumes: <None>
```

Creating Volume Groups

A volume group is a set of disk drives that are logically grouped together to provide storage with a single RAID level for all volumes in the group. Every E-Series storage array has eight RAID 5 volume groups of 6+1 disks (6 data disks and 1 parity disk). This leaves all 60 disks assigned in each shelf given the four hot spare drives previously prescribed.

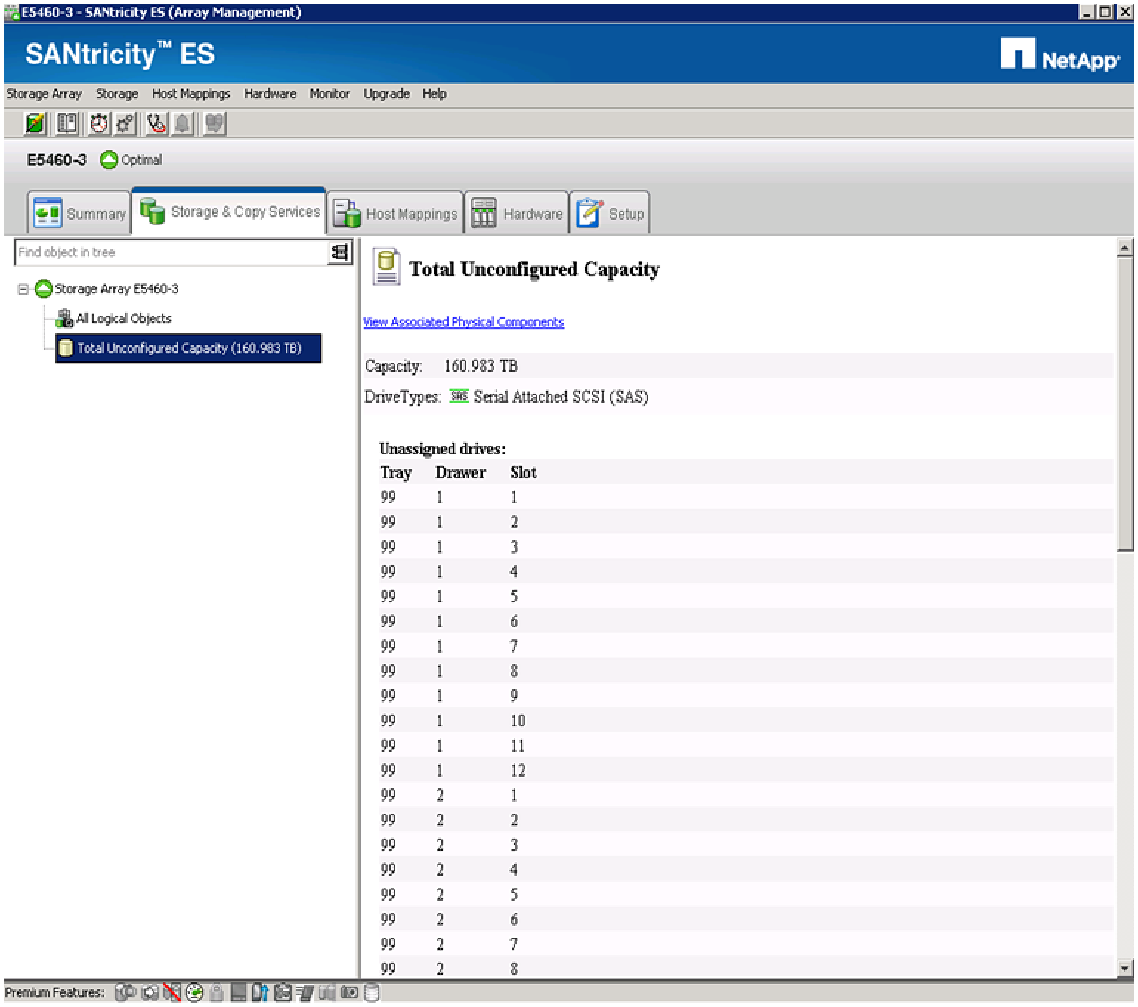
To create the volume groups, select the disks from across the five drawers starting with drawer one, slot one and alternating between odd and even slot numbers as the disks are selected in a round robin fashion. For more details on Hot spares, see "Selecting Drives for Volume Groups and Hot Spares" section on page 111.

Creating New Volume Groups

To create a volume group, follow these steps:

1. Log into SANtricity ES or Array Management window.
   a. In the Array Management window, select the Storage and Copy Services tab.
   b. Select Total Unconfigured Capacity in the volume group tree view.

Figure 91 Array Management Window Showing Unassigned Drive Details



Total Unconfigured Capacity

View Associated Physical Components

Capacity: 160.983 TB

DriveTypes: SAS Serial Attached SCSI (SAS)

Unassigned drives:

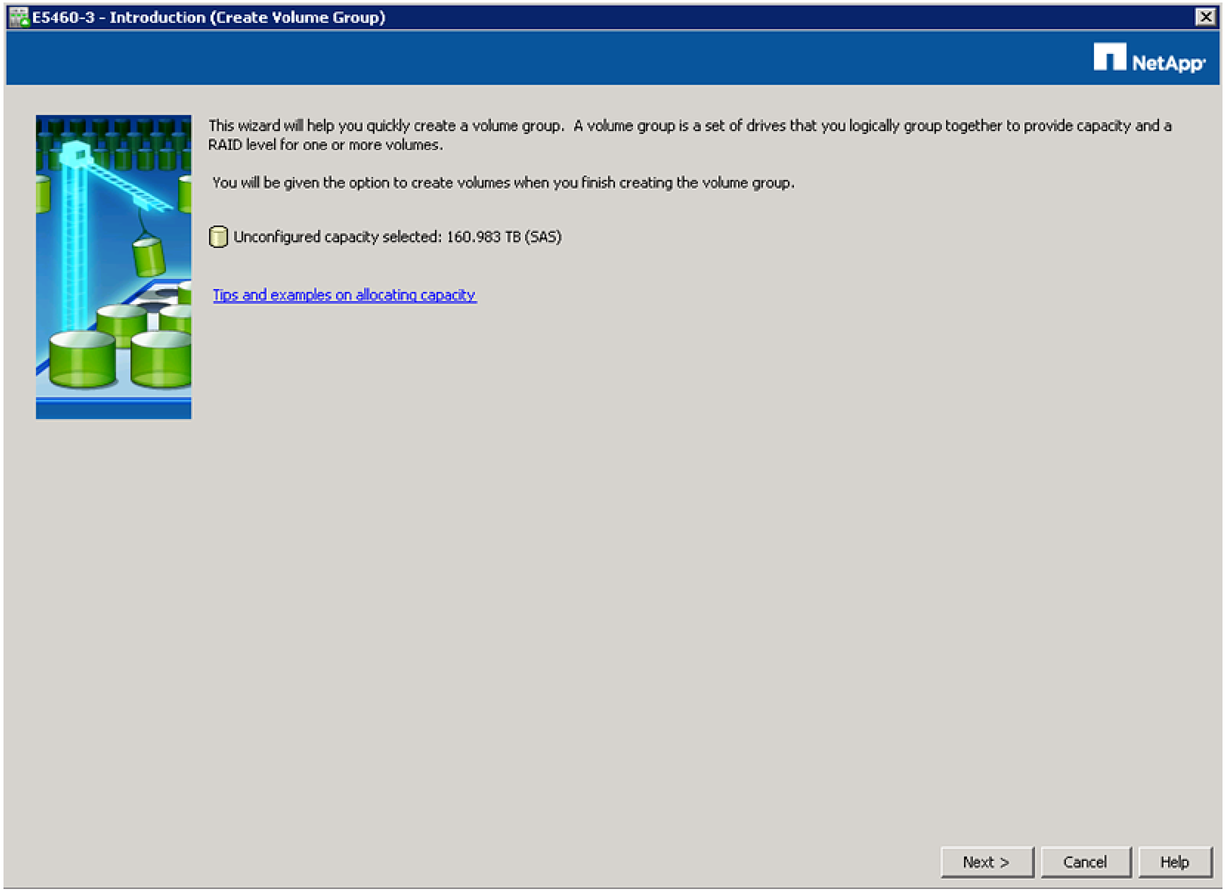
Tray	Drawer	Slot
99	1	1
99	1	2
99	1	3
99	1	4
99	1	5
99	1	6
99	1	7
99	1	8
99	1	9
99	1	10
99	1	11
99	1	12
99	2	1
99	2	2
99	2	3
99	2	4
99	2	5
99	2	6
99	2	7
99	2	8

c. Right-click on Total Unconfigured Capacity, select Volume Group.

d. Click **Create,** to launch the Create Volume Group wizard.

2. In the Create Volume Group wizard, click **Next**.

Figure 92 Creating Volume Group Wizard



E5460-3 - Introduction (Create Volume Group)

This wizard will help you quickly create a volume group. A volume group is a set of drives that you logically group together to provide capacity and a RAID level for one or more volumes.

You will be given the option to create volumes when you finish creating the volume group.

Unconfigured capacity selected: 160.983 TB (SAS)

Tips and examples on allocating capacity

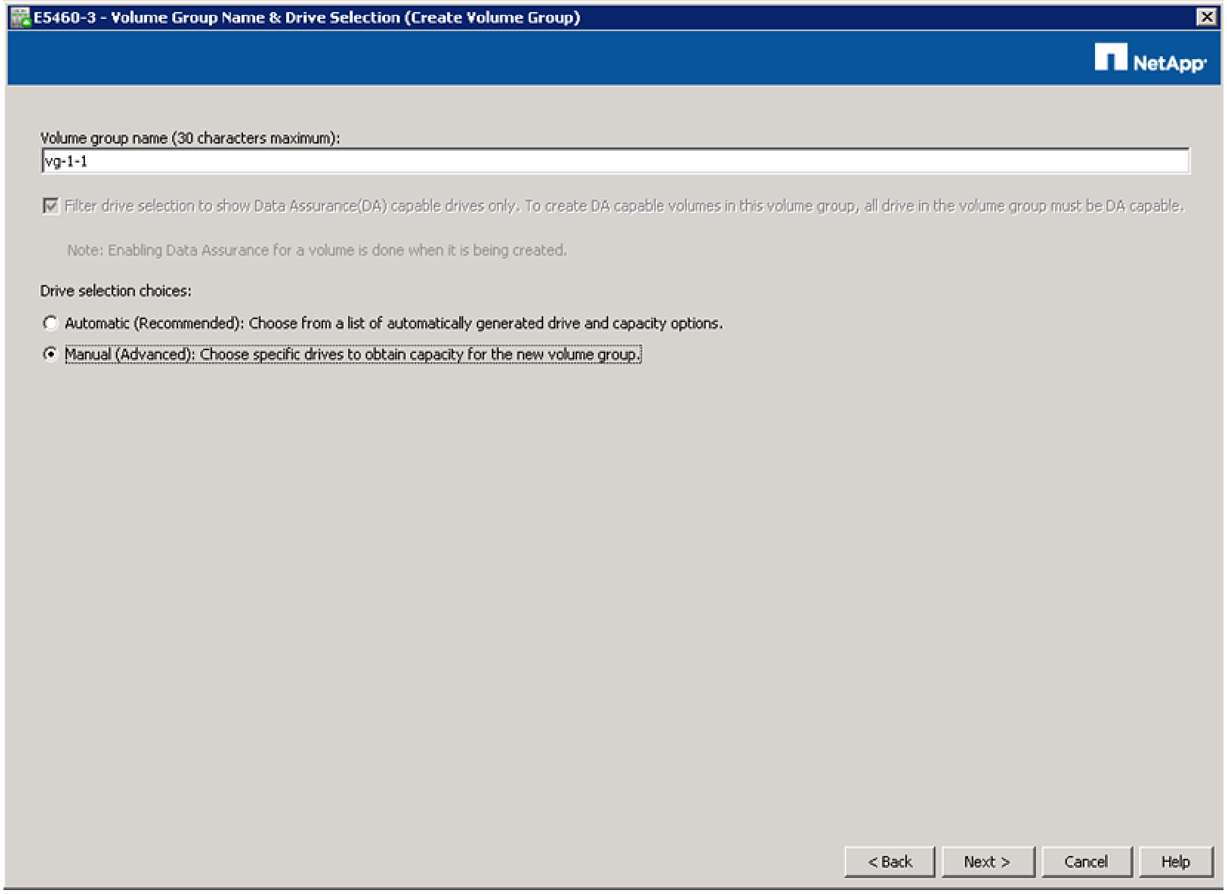
3. Specify a name and select drives for the volume group:

   a. Enter the volume group name.

Note The volume group name cannot contain spaces. Use underscores or dashes to separate the elements of the volume group name (for example, Test_Group_1 or Test-Group-1).

   b. Select the **Manual (Advanced)** radio button. Click **Next**.

Figure 93 Manual Drive Selection



E5460-3 - Volume Group Name & Drive Selection (Create Volume Group)

Volume group name (30 characters maximum):

vg-1-1

☑ Filter drive selection to show Data Assurance(DA) capable drives only. To create DA capable volumes in this volume group, all drive in the volume group must be DA capable.

Note: Enabling Data Assurance for a volume is done when it is being created.

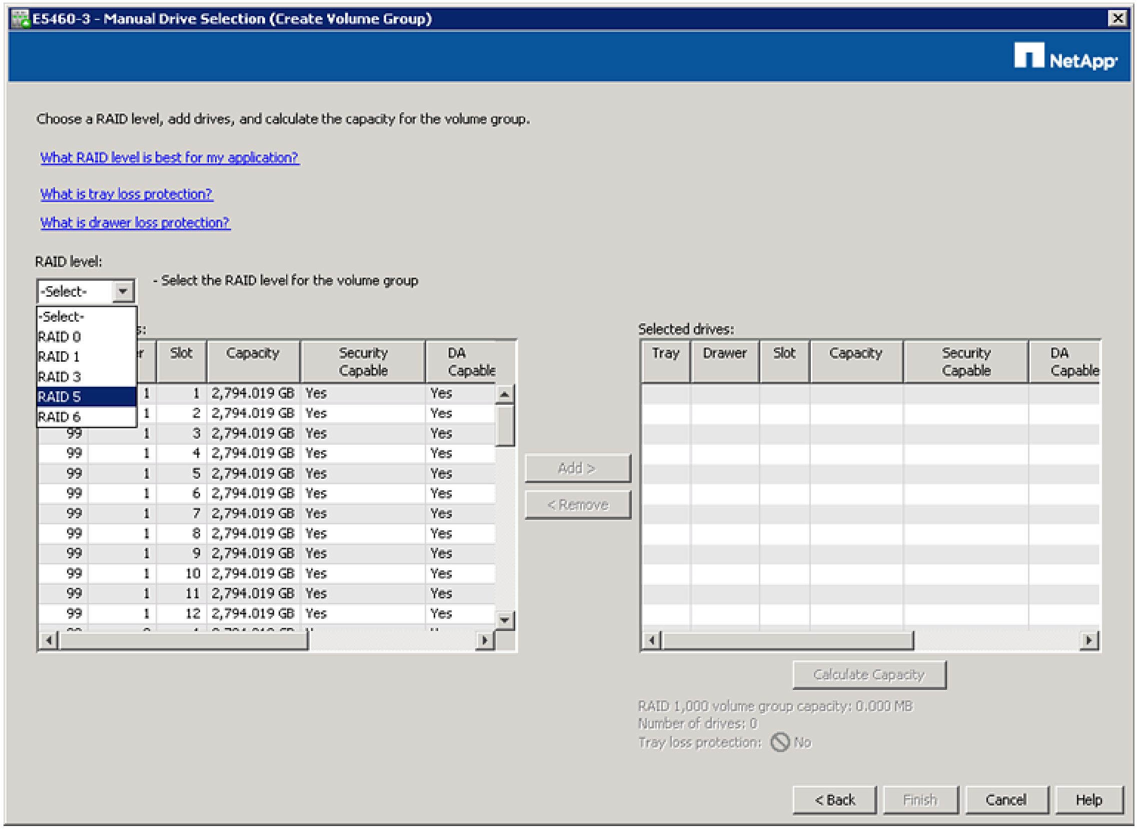
Drive selection choices:

○ Automatic (Recommended): Choose from a list of automatically generated drive and capacity options.

● Manual (Advanced): Choose specific drives to obtain capacity for the new volume group.

c. Select a RAID level for the volume group (in this example, RAID5 is selected).

Figure 94 Selecting RAID Levels for Volume Group



E5460-3 - Manual Drive Selection (Create Volume Group)

Choose a RAID level, add drives, and calculate the capacity for the volume group.

What RAID level is best for my application?

What is tray loss protection?

What is drawer loss protection?

RAID level:

-Select- - Select the RAID level for the volume group

s:

	r	Slot	Capacity	Security Capable	DA Capable
	1	1	2,794.019 GB	Yes	Yes
	1	2	2,794.019 GB	Yes	Yes
99	1	3	2,794.019 GB	Yes	Yes
99	1	4	2,794.019 GB	Yes	Yes
99	1	5	2,794.019 GB	Yes	Yes
99	1	6	2,794.019 GB	Yes	Yes
99	1	7	2,794.019 GB	Yes	Yes
99	1	8	2,794.019 GB	Yes	Yes
99	1	9	2,794.019 GB	Yes	Yes
99	1	10	2,794.019 GB	Yes	Yes
99	1	11	2,794.019 GB	Yes	Yes
99	1	12	2,794.019 GB	Yes	Yes

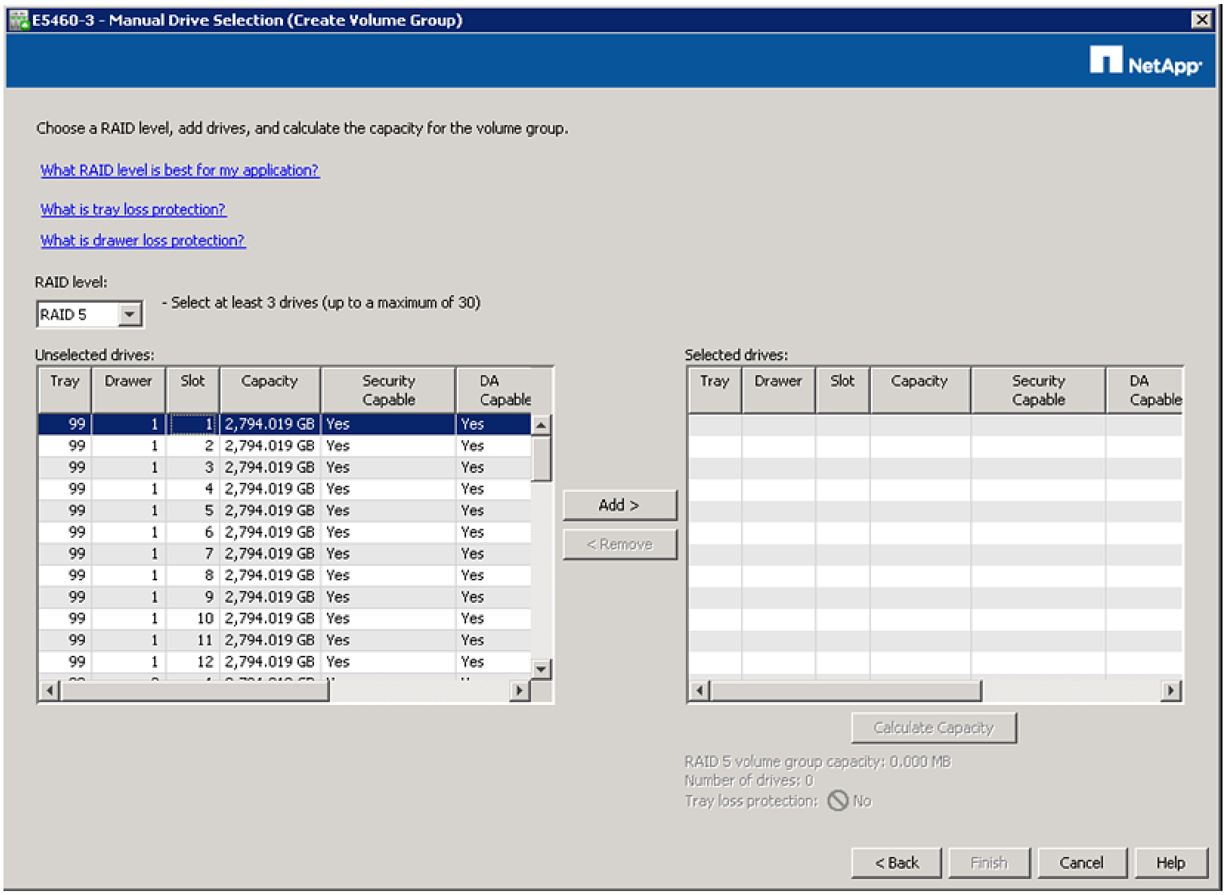
Selected drives:

Tray	Drawer	Slot	Capacity	Security Capable	DA Capable

RAID 1,000 volume group capacity: 0.000 MB
Number of drives: 0
Tray loss protection: ⊘ No

d. Using vertical striping, select the first available disk in the first drawer. Click Add > to add desired disks to the volume group.

Figure 95 Adding Drives for Volume Group



E5460-3 - Manual Drive Selection (Create Volume Group)

Choose a RAID level, add drives, and calculate the capacity for the volume group.

What RAID level is best for my application?

What is tray loss protection?

What is drawer loss protection?

RAID level: RAID 5 - Select at least 3 drives (up to a maximum of 30)

Unselected drives:

Tray	Drawer	Slot	Capacity	Security Capable	DA Capable
99	1	1	2,794.019 GB	Yes	Yes
99	1	2	2,794.019 GB	Yes	Yes
99	1	3	2,794.019 GB	Yes	Yes
99	1	4	2,794.019 GB	Yes	Yes
99	1	5	2,794.019 GB	Yes	Yes
99	1	6	2,794.019 GB	Yes	Yes
99	1	7	2,794.019 GB	Yes	Yes
99	1	8	2,794.019 GB	Yes	Yes
99	1	9	2,794.019 GB	Yes	Yes
99	1	10	2,794.019 GB	Yes	Yes
99	1	11	2,794.019 GB	Yes	Yes
99	1	12	2,794.019 GB	Yes	Yes

Selected drives:

Tray	Drawer	Slot	Capacity	Security Capable	DA Capable

RAID 5 volume group capacity: 0.000 MB

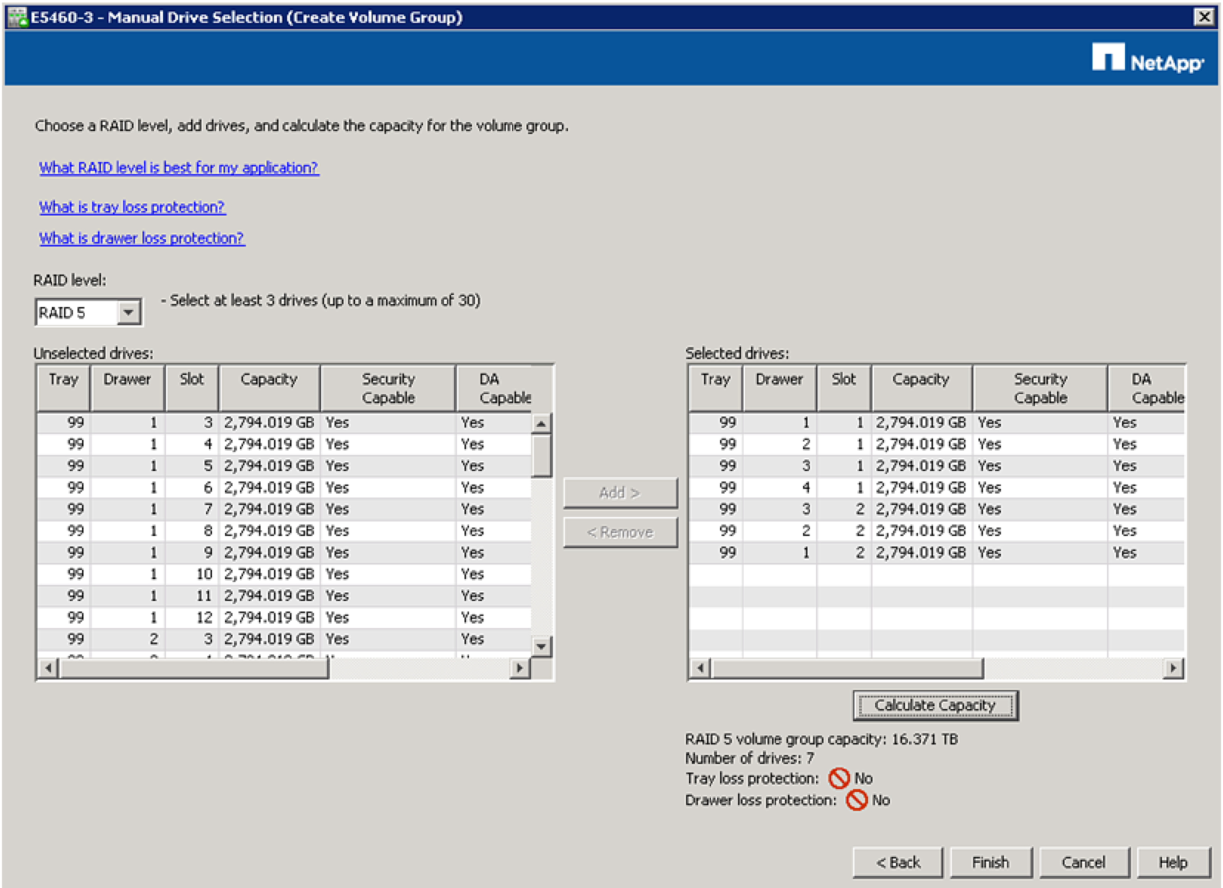
Number of drives: 0

Tray loss protection: ⃠ No

e. Continue selecting disks until seven disks are selected. Disks should be selected across drawers in a vertical fashion. Avoid selecting more than two disks in the same drawer for a single volume group. Since seven disks are needed per volume group and there are only five drawers, three disks will be chosen from individual drawers, with four disks split evenly across the remaining two drawers (two per drawer).

f. After seven disks are selected, click **Calculate Capacity** to confirm that the capacity of the new volume group satisfies all the requirements for the group and that the desired RAID protection is achieved.

Figure 96 Calculating the Volume Group Capacity



E5460-3 - Manual Drive Selection (Create Volume Group)

Choose a RAID level, add drives, and calculate the capacity for the volume group.

What RAID level is best for my application?

What is tray loss protection?

What is drawer loss protection?

RAID level: RAID 5 - Select at least 3 drives (up to a maximum of 30)

Unselected drives:

Tray	Drawer	Slot	Capacity	Security Capable	DA Capable
99	1	3	2,794.019 GB	Yes	Yes
99	1	4	2,794.019 GB	Yes	Yes
99	1	5	2,794.019 GB	Yes	Yes
99	1	6	2,794.019 GB	Yes	Yes
99	1	7	2,794.019 GB	Yes	Yes
99	1	8	2,794.019 GB	Yes	Yes
99	1	9	2,794.019 GB	Yes	Yes
99	1	10	2,794.019 GB	Yes	Yes
99	1	11	2,794.019 GB	Yes	Yes
99	1	12	2,794.019 GB	Yes	Yes
99	2	3	2,794.019 GB	Yes	Yes

Selected drives:

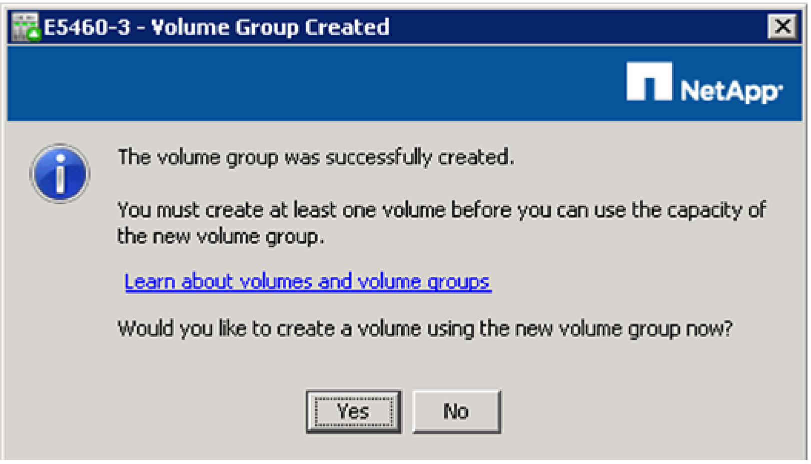
Tray	Drawer	Slot	Capacity	Security Capable	DA Capable
99	1	1	2,794.019 GB	Yes	Yes
99	2	1	2,794.019 GB	Yes	Yes
99	3	1	2,794.019 GB	Yes	Yes
99	4	1	2,794.019 GB	Yes	Yes
99	3	2	2,794.019 GB	Yes	Yes
99	2	2	2,794.019 GB	Yes	Yes
99	1	2	2,794.019 GB	Yes	Yes

RAID 5 volume group capacity: 16.371 TB
Number of drives: 7
Tray loss protection: ⊘ No
Drawer loss protection: ⊘ No

g. Click **Finish** to create the new volume group. A message is displayed, confirming that the volume group was successfully created and providing the option to create a new volume.

h. Click **Yes** to create a volume in the new volume group. This will launch the Create Volume wizard.

Figure 97 Selected Drives Added Successfully to the Volume Group



E5460-3 - Volume Group Created

The volume group was successfully created.

You must create at least one volume before you can use the capacity of the new volume group.

Learn about volumes and volume groups

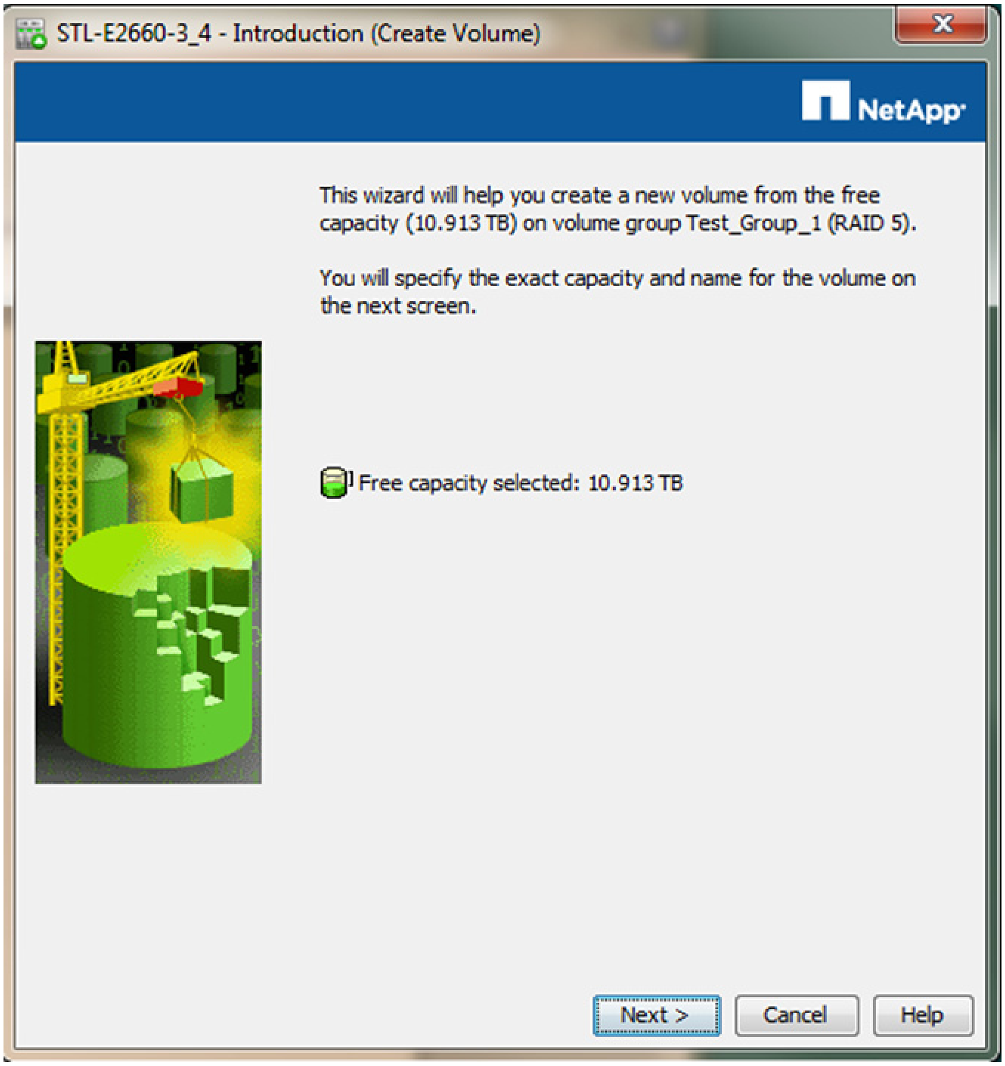
Would you like to create a volume using the new volume group now?

Create New Volume

To create new volume, follow these steps:

1. In the Create Volume wizard, click **Next** to continue.

Figure 98 Creating Volume



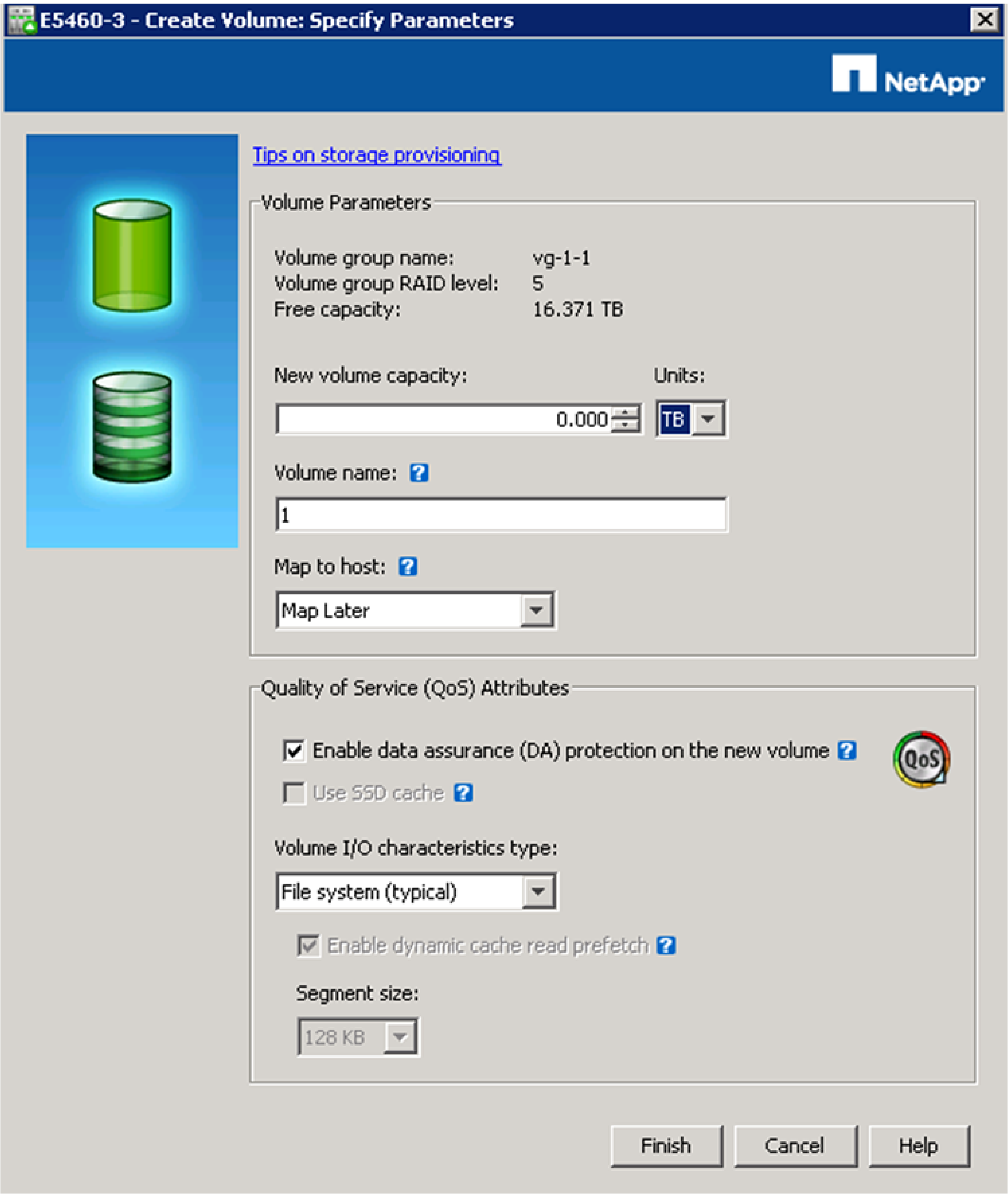
This wizard will help you create a new volume from the free capacity (10.913 TB) on volume group Test_Group_1 (RAID 5).

You will specify the exact capacity and name for the volume on the next screen.

Free capacity selected: 10.913 TB

2. Specify the volume parameters.
   a. Select the appropriate unit for the new volume capacity. For the volume group free capacity shown in this example, the correct unit is TB.

Figure 99 Entering Volume Parameters



E5460-3 - Create Volume: Specify Parameters

Tips on storage provisioning

Volume Parameters

Volume group name: vg-1-1
Volume group RAID level: 5
Free capacity: 16.371 TB

New volume capacity: 0.000
Units: TB

Volume name: 1

Map to host: Map Later

Quality of Service (QoS) Attributes

☑ Enable data assurance (DA) protection on the new volume
□ Use SSD cache

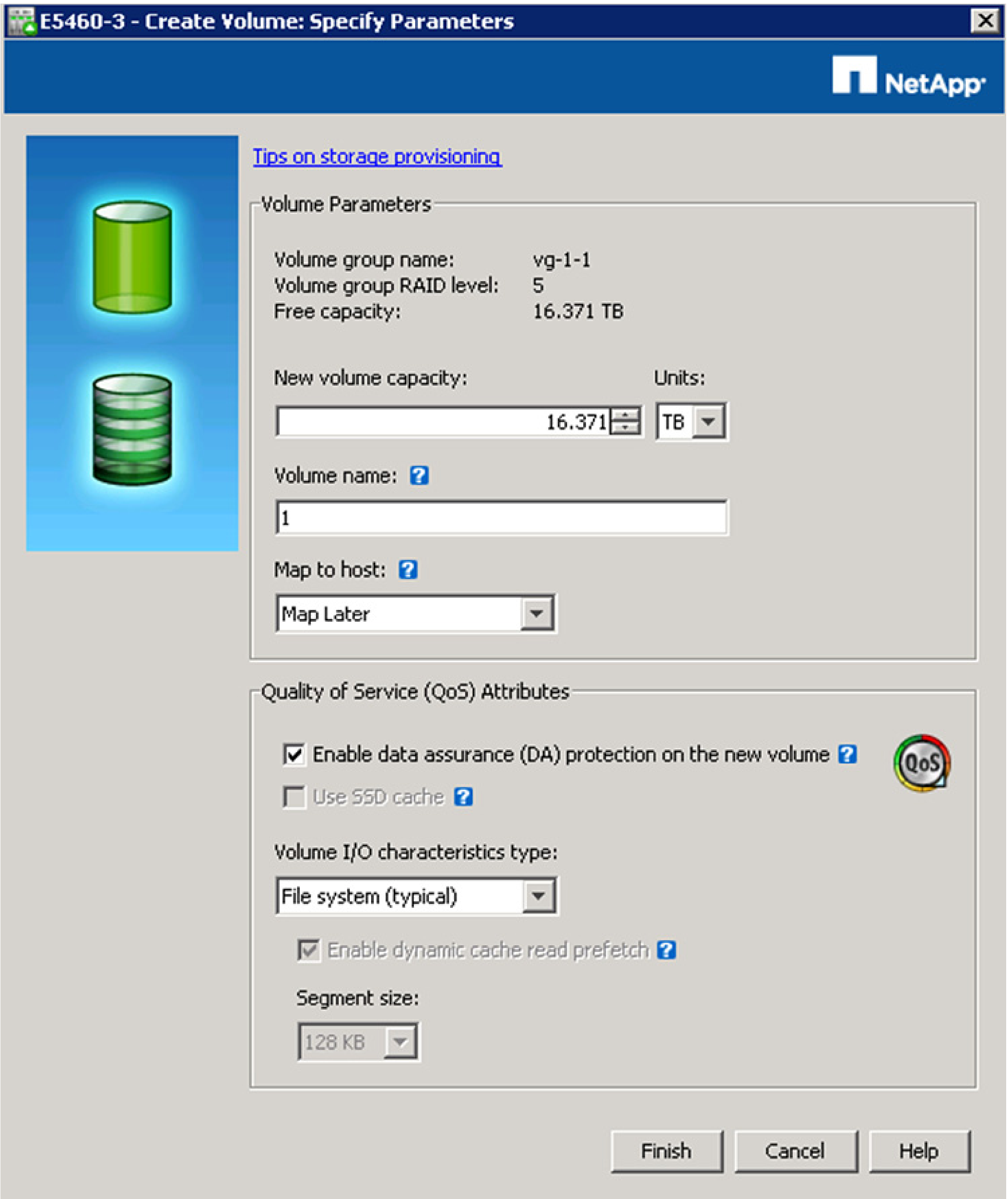
Volume I/O characteristics type: File system (typical)

☑ Enable dynamic cache read prefetch

Segment size: 128 KB

b. Enter the new volume capacity to be taken from the free capacity of the selected volume group. Because the entire volume group is used for this volume, enter the maximum size available for the available capacity (free capacity). In this example, the free capacity of 16.371 is entered for the new volume capacity.

Figure 100 Specifying New Volume Capacity



E5460-3 - Create Volume: Specify Parameters

Tips on storage provisioning

Volume Parameters

Volume group name: vg-1-1
Volume group RAID level: 5
Free capacity: 16.371 TB

New volume capacity: 16.371
Units: TB

Volume name: 1

Map to host: Map Later

Quality of Service (QoS) Attributes

☑ Enable data assurance (DA) protection on the new volume

□ Use SSD cache

Volume I/O characteristics type: File system (typical)

☑ Enable dynamic cache read prefetch

Segment size: 128 KB

c. Enter the volume name.

d. Keep the Map to host field at default.

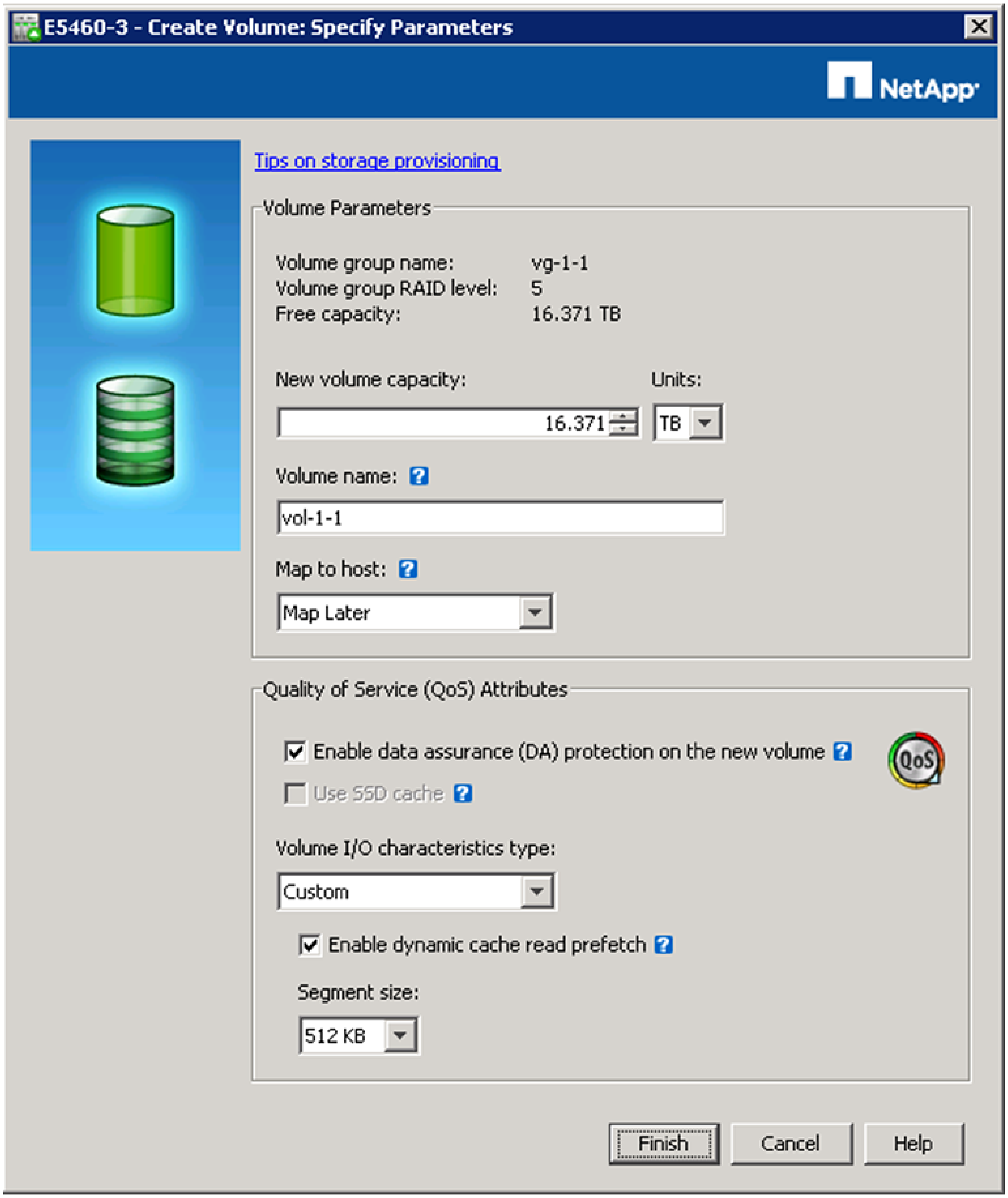
Note The volume name cannot contain spaces. Use underscores or dashes to separate elements within the volume name (for example, vol-1-1).

3. Configure the following quality of service attributes for the volume:

a. Select the volume I/O characteristics type from the drop down list. Select the type as Custom.

b. Check the Enable Dynamic Cache Read Prefetch check box and then select the 512KB segment size.

Figure 101 Setting QoS Attributes for Volume



E5460-3 - Create Volume: Specify Parameters

Tips on storage provisioning

Volume Parameters

Volume group name: vg-1-1
Volume group RAID level: 5
Free capacity: 16.371 TB

New volume capacity: 16.371
Units: TB

Volume name: vol-1-1

Map to host: Map Later

Quality of Service (QoS) Attributes

☑ Enable data assurance (DA) protection on the new volume

□ Use SSD cache

Volume I/O characteristics type: Custom

☑ Enable dynamic cache read prefetch

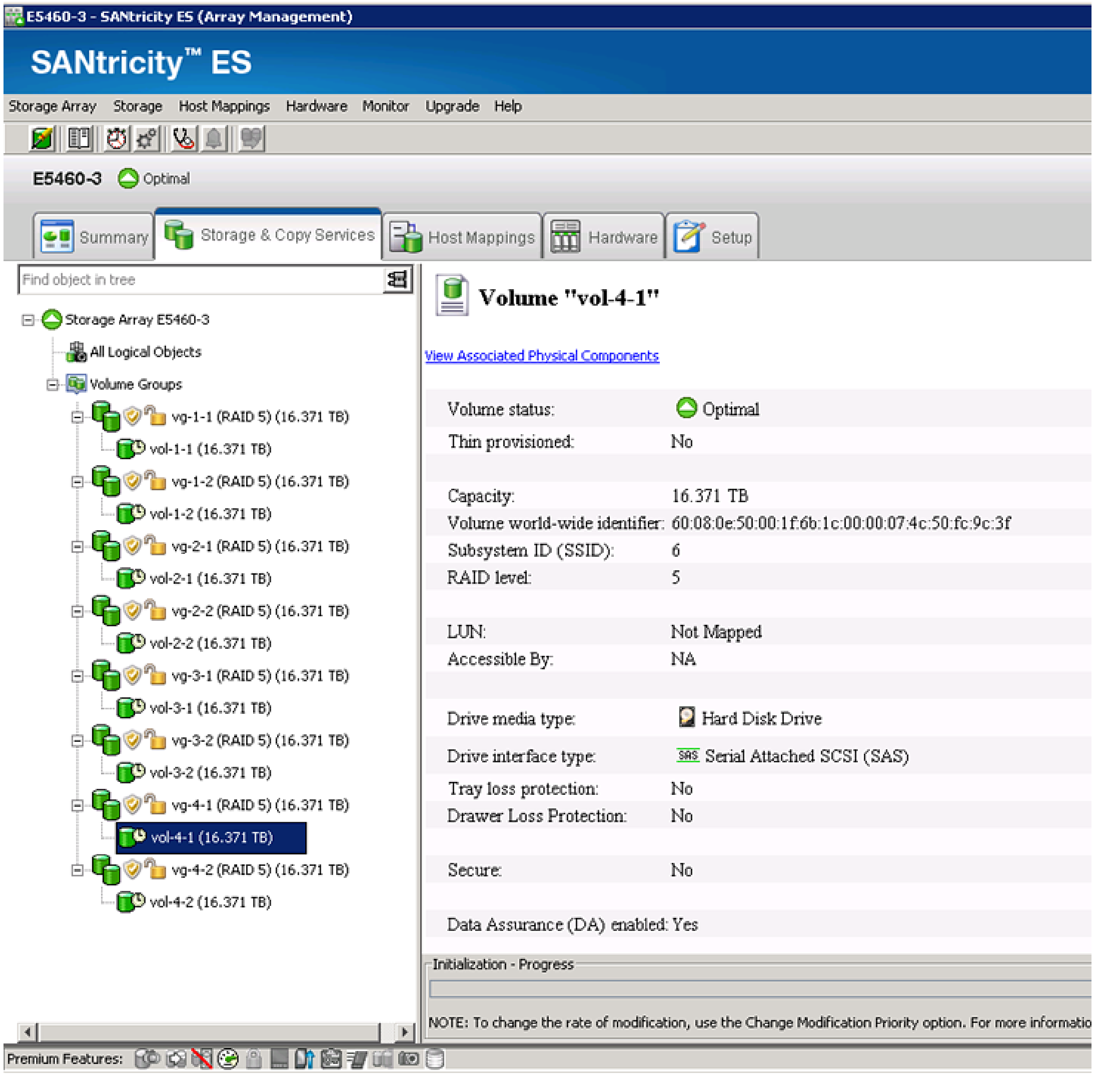
Segment size: 512 KB

c. Click **Finish**.

d. On Create Volume Complete, a confirmation message box appears. Click **OK**.

4. The volume group and the new volume are displayed in the Storage and Copy Services tab of the Array Management window.

Figure 102 Volume Group and Volume Capacity Details



Volume "vol-4-1"

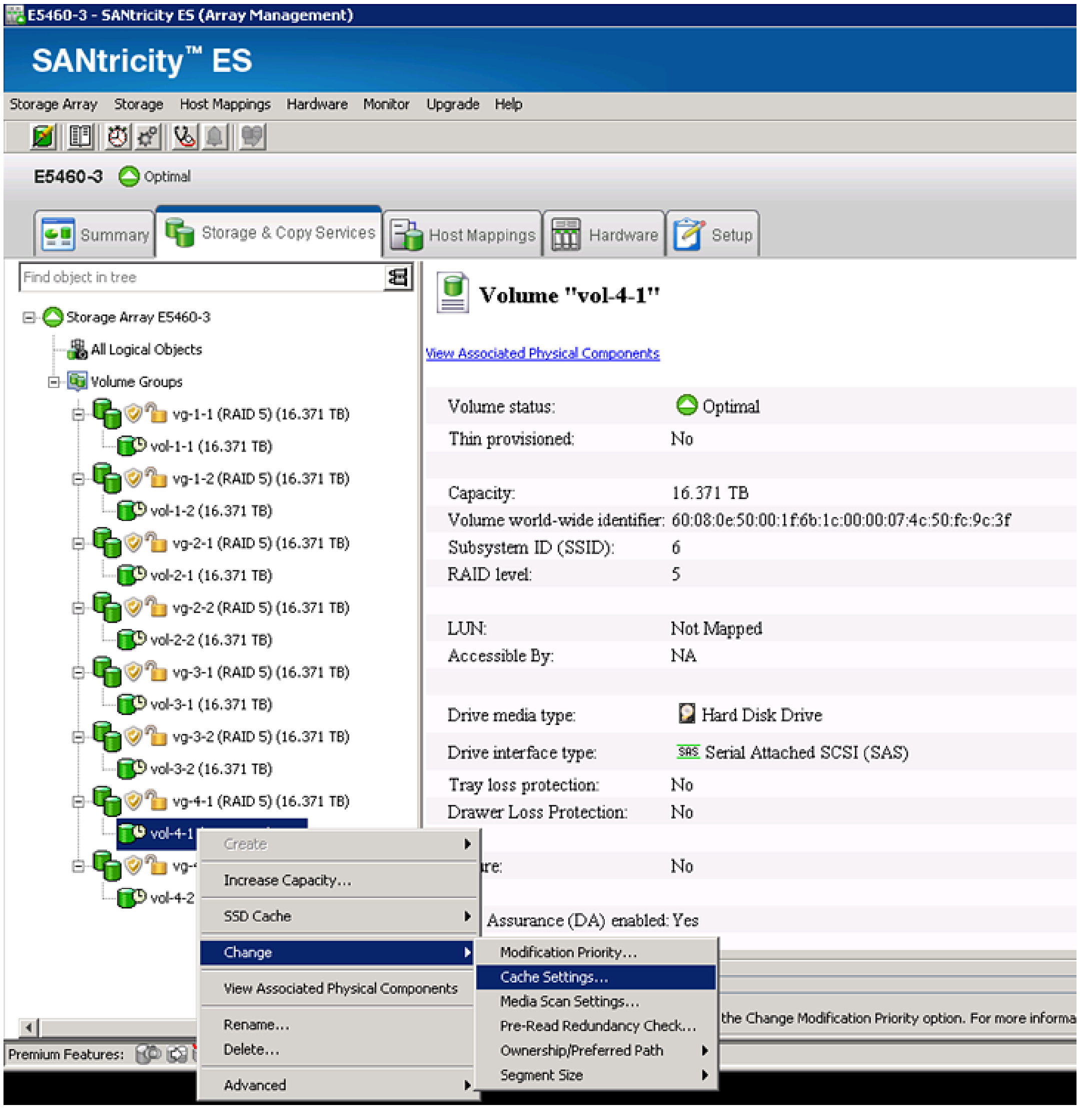
Volume status:	Optimal
Thin provisioned:	No
Capacity:	16.371 TB
Volume world-wide identifier:	60:08:0e:50:00:1f:6b:1c:00:00:07:4c:50:fc:9c:3f
Subsystem ID (SSID):	6
RAID level:	5
LUN:	Not Mapped
Accessible By:	NA
Drive media type:	Hard Disk Drive
Drive interface type:	SAS Serial Attached SCSI (SAS)
Tray loss protection:	No
Drawer Loss Protection:	No
Secure:	No
Data Assurance (DA) enabled:	Yes

NOTE: To change the rate of modification, use the Change Modification Priority option. For more informatio

5. Select the appropriate cache settings for the new volume:

   a. Right-click the volume name in the left pane in the Array Management window, and then select **Change** > **Cache Settings**.

Figure 103 Cache Settings



Volume "vol-4-1"

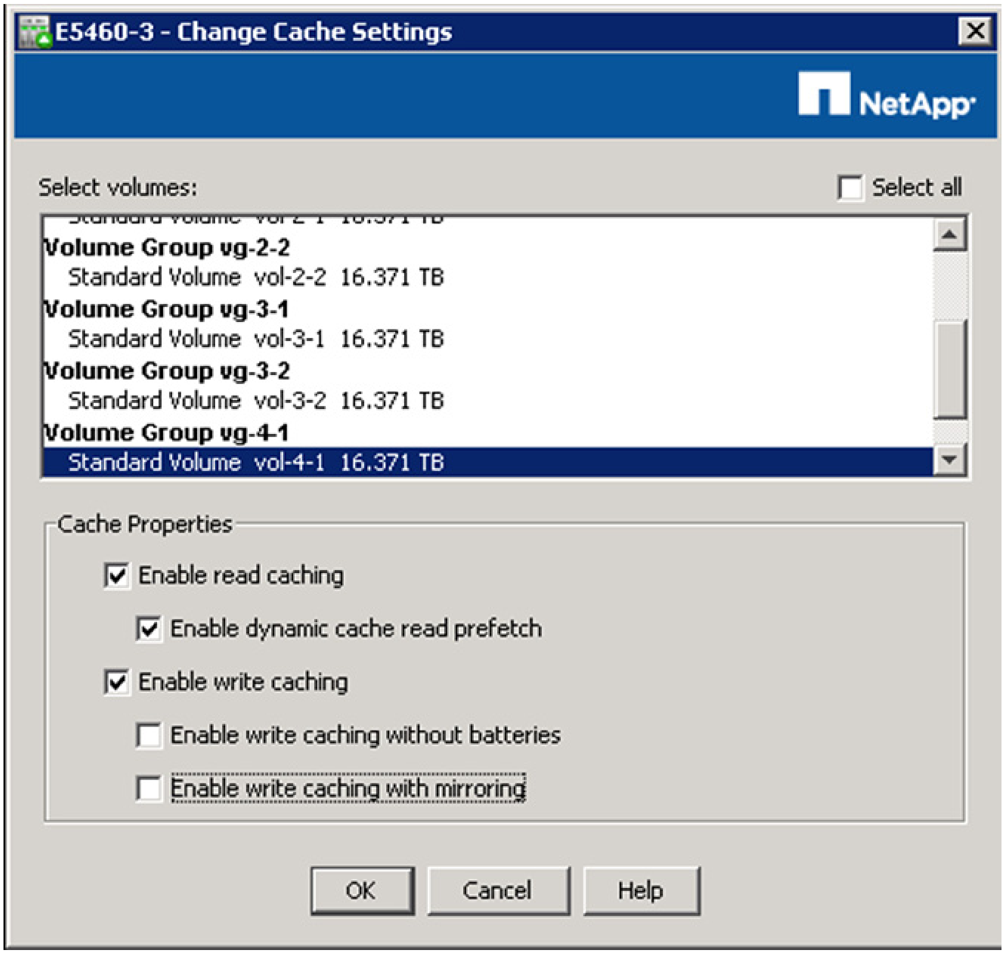
Volume status:	Optimal
Thin provisioned:	No
Capacity:	16.371 TB
Volume world-wide identifier:	60:08:0e:50:00:1f:6b:1c:00:00:07:4c:50:fc:9c:3f
Subsystem ID (SSID):	6
RAID level:	5
LUN:	Not Mapped
Accessible By:	NA
Drive media type:	Hard Disk Drive
Drive interface type:	Serial Attached SCSI (SAS)
Tray loss protection:	No
Drawer Loss Protection:	No
re:	No
Assurance (DA) enabled:	Yes

the Change Modification Priority option. For more informa

6. Verify the following cache properties are enabled:
   a. Enable Read Caching
   b. Enable Write Caching
   c. Enable Dynamic Cache Read Prefetch

Note Verify that Enable Write Caching with Mirroring check box is deselected. This property is selected by default.

Figure 104 Verifying Cache Settings



E5460-3 - Change Cache Settings

Select volumes: □ Select all

Standard Volume vol-2-1 16.371 TB
Volume Group vg-2-2
Standard Volume vol-2-2 16.371 TB
Volume Group vg-3-1
Standard Volume vol-3-1 16.371 TB
Volume Group vg-3-2
Standard Volume vol-3-2 16.371 TB
Volume Group vg-4-1
Standard Volume vol-4-1 16.371 TB

Cache Properties

☑ Enable read caching

☑ Enable dynamic cache read prefetch

☑ Enable write caching

□ Enable write caching without batteries

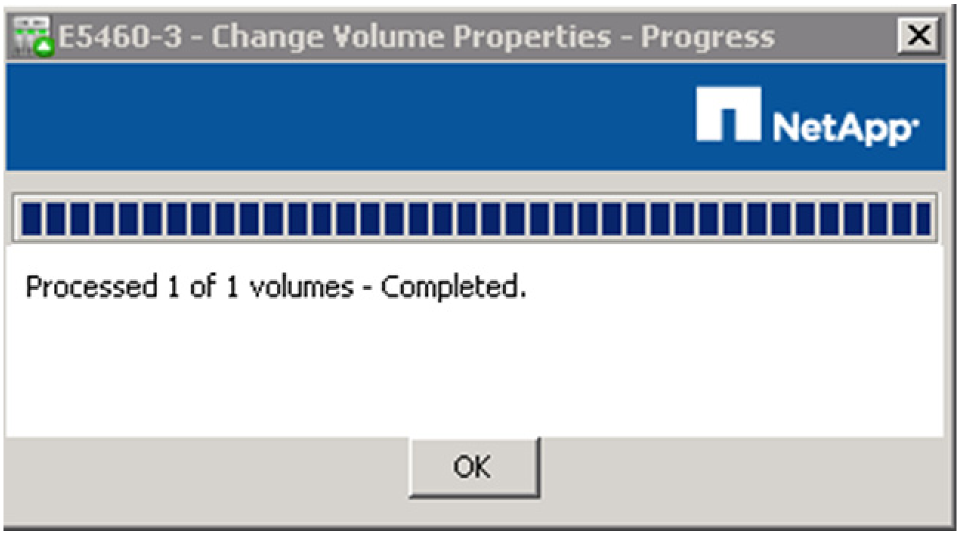
□ Enable write caching with mirroring

d. Click **OK**.

7. A pop-up message window appears displaying all the cache settings. Click **Yes** to confirm the settings.

8. Any Change in the Volume Properties on saving, will show a pop-up window showing progress indicator to indicate the change is completed successfully, click **OK**.

Figure 105 Changing Volume Properties

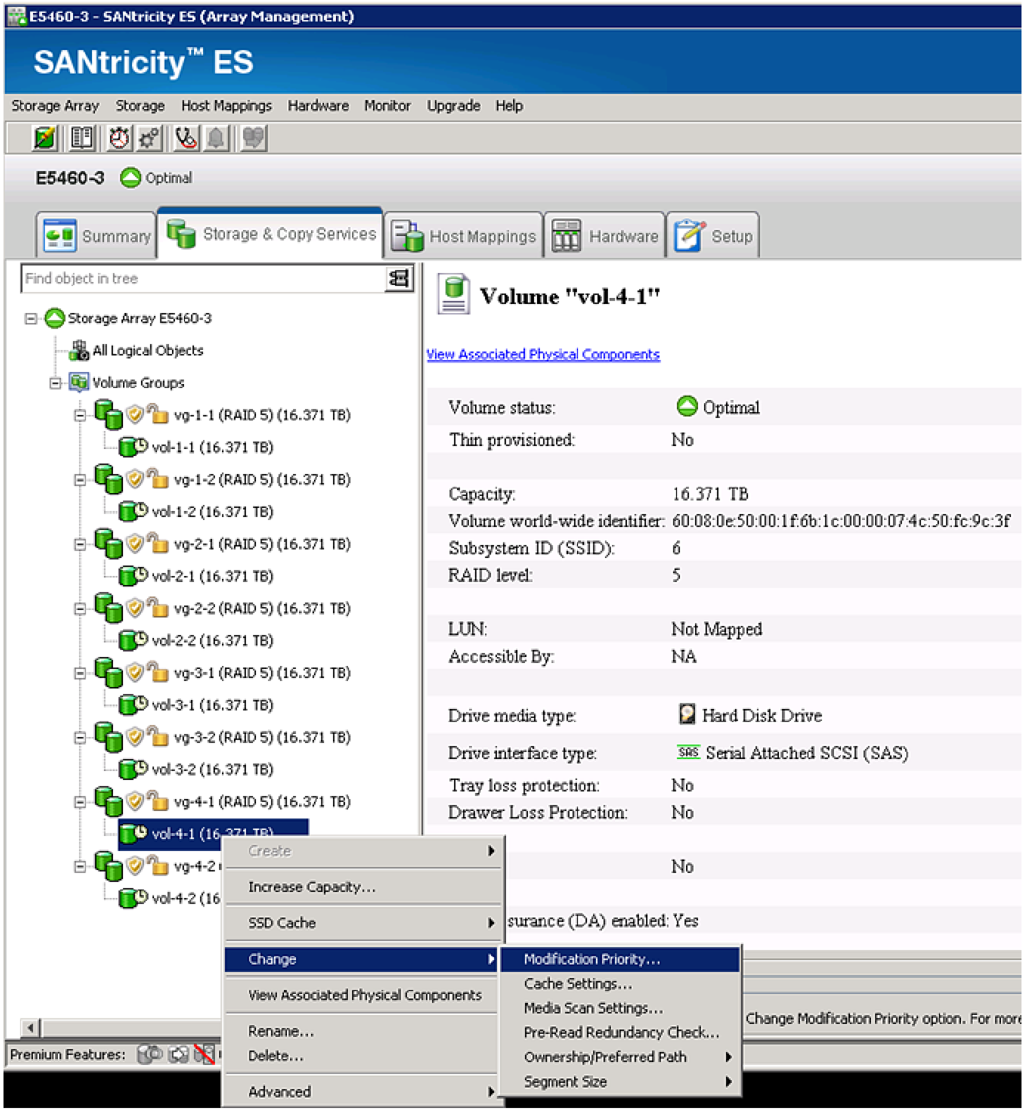


E5460-3 - Change Volume Properties - Progress

Processed 1 of 1 volumes - Completed.

9. Right-click on the new volume. Select **Change** > **Modification Priority**.

Figure 106 Priority Settings



Volume "vol-4-1"

View Associated Physical Components

Volume status: Optimal
Thin provisioned: No

Capacity: 16.371 TB
Volume world-wide identifier: 60:08:0e:50:00:1f:6b:1c:00:00:07:4c:50:fc:9c:3f
Subsystem ID (SSID): 6
RAID level: 5

LUN: Not Mapped
Accessible By: NA

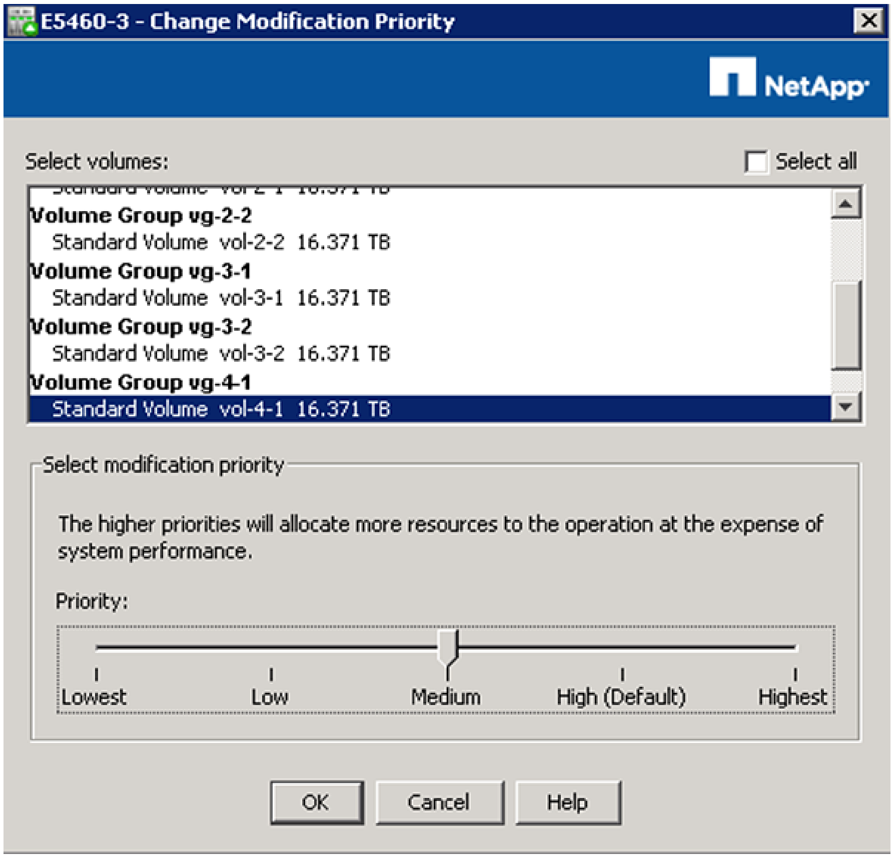
Drive media type: Hard Disk Drive
Drive interface type: SAS Serial Attached SCSI (SAS)
Tray loss protection: No
Drawer Loss Protection: No

No

surance (DA) enabled: Yes

10. Use the priority slider to set the modification priority to the middle and click **OK**.

Figure 107 Allocating Resources Based on Priority Chosen



E5460-3 - Change Modification Priority

Select volumes:

Volume Group vg-2-2
Standard Volume vol-2-2 16.371 TB
Volume Group vg-3-1
Standard Volume vol-3-1 16.371 TB
Volume Group vg-3-2
Standard Volume vol-3-2 16.371 TB
Volume Group vg-4-1
Standard Volume vol-4-1 16.371 TB

Select modification priority

The higher priorities will allocate more resources to the operation at the expense of system performance.

Priority: Medium

11. Click **Yes** in the confirmation message box, to confirm the change in the Priority.
12. Any Change in the Volume Properties on saving, will show a pop-up window showing progress indicator to indicate the change is completed successfully, click **OK**.

Table 9 provides the standard storage configuration:

Table 9 E-Series Hadoop standard storage configuration

Configuration	Value	Comments
Total number of disks	60	The DE6600 shelf provides 60 disk slots. When the E5400 controllers are installed in the shelf, the model is referred to as an E5460 shelf.
Number of volume groups	8	Stripe vertically across drawers in a shelf. There are two volume groups per host.
Volume group size	6+1 (RAID 5)	The volume group size is RAID 5.
Number of hot spares	4	One per drawer on drawers 2 through 5 for a total of 4 global hot spare drives per 60-disk shelf.
Number of volumes (LUNs)	8	Create two volumes of equal size (one volume per volume group) for each host.
Volumes per volume group	1	Create one volume per volume group.

Table 9 E-Series Hadoop standard storage configuration

Configuration	Value	Comments
Volume-to-host mapping	2:1	Each host maps exclusively to two volumes (LUNs).
Host groups	none	The Hadoop configuration does not share storage between hosts in the architecture.
Number of SAN share storage partitions	0	

After the volumes are created and the LUNs are available, the LUNs must be mapped to datanodes (hosts). It is critically important that each host has exclusive access to its LUNs through the assigned controller. NetApp strongly recommends using a naming convention that reflects the host-to-volume mappings.

Map Datanodes to E-Series SAS Ports

You need to determine the SAS port addresses of the datanodes and how they map to the SAS ports of the E-Series controllers. To map SAS ports of E-series controllers with the datanodes, follow these steps:

1. Identify all the hosts with their hostnames and SAS port addresses.
2. Identify hostnames and E-Series storage systems by name and label them accordingly.
3. Use the logic of physical proximity to assign hosts to E-Series controllers.
4. Use Table 10 to map datanodes to the E-Series SAS ports.

Table 10 SAS port-mapping template

Host Name	Storage Subsystem	Controller Port	Port Location	Datanode SAS ID
dn1	e5460-3	1	Controller A, Port 1	500605b002661880
dn2	e5460-3	4	Controller A, Port 4	
dn3	e5460-3	5	Controller B, port 5	
dn4	e5460-3	8	Controller B, Port 8	

Identify SAS Port ID Using LSI SAS2Flash Utility

The sas2flash utility is a product of LSI Corporation. It is designed to support the LSI SAS 9200-8e HBA installed in each host attached to the E5460 arrays, primarily to display the Port IDs assigned to the SAS host bus adapter (HBA) ports or to periodically update the BIOS and firmware on the HBA.

The sas2flash utility usually comes bundled with the following items:

- The sas2flash binary executable
- Version release notes in PDF format
- A reference guide in PDF format
- A BIOS binary file appropriate for the version (for example: mptsas2.rom)
- A firmware binary appropriate for the version (for example: 9200-8e.bin)

Issue the following command to list the port ID of the LSI SAS HBA:

```
./sas2flash -list
Output will look similar to this:
Version 11.00.00.00 (2011.08.22)
Copyright (c) 2008-2011 LSI Corporation. All rights reserved

        Adapter Selected is a LSI SAS: SAS2008(B2)

        Controller Number              : 0
        Controller                     : SAS2008(B2)
        PCI Address                    : 00:02:00:00
        SAS Address                    : 500605b-0-0266-1880
        NVDATA Version (Default)       : 0a.03.00.02
        NVDATA Version (Persistent)    : 0a.03.00.02
        Firmware Product ID            : 0x2213
        Firmware Version               : 11.00.00.00
        NVDATA Vendor                  : LSI
        NVDATA Product ID              : SAS9200-8e
        BIOS Version                   : 07.21.00.00
        UEFI BSD Version               : 04.30.03.00
        FCODE Version                  : N/A
        Board Name                     : 9200-3080
        Board Assembly                 : H3-25217-00C
        Board Tracer Number            : SP10414124

        Finished Processing Commands Successfully.
        Exiting SAS2Flash.
```

Note The line containing SAS Address provides the SAS port ID of the active port. Stripping out the hyphens allows the value to be used as the SAS port ID for that host when the host topology is created on the array being configured. In this case, the port ID is 500605b002661880.

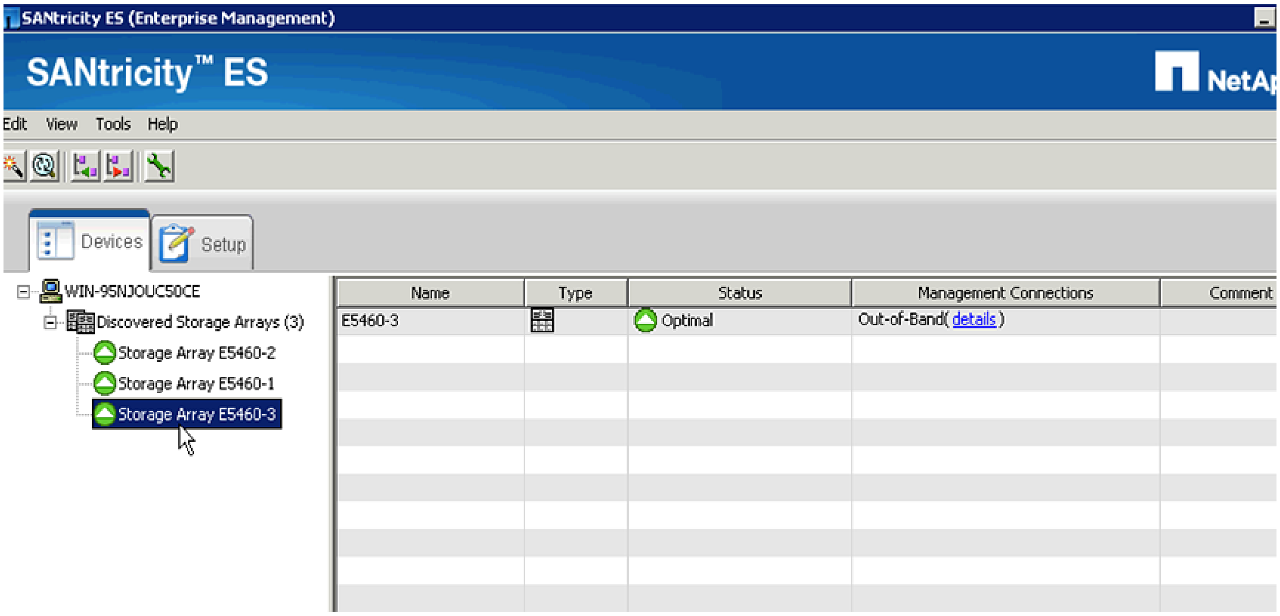
Map Datanodes to SAS Port IDs

After the SAS Port IDs for the datanode servers have been identified, map those IDs to the SAS ports on the E-Series storage array. Use the SANtricity ES Storage Manager to perform the mapping.

To map the datanodes, follow these steps:

1. Launch SANtricity ES Storage Manager on Windows or Linux as appropriate.
2. If the E-Series is already up and running, Storage Manager will list the array in the inventory. If not, add the appropriate storage controller IP addresses to SANtricity ES Storage Manager.

Figure 108 Discovered Storage Array



Name	Type	Status	Management Connections	Comment
E5460-3		Optimal	Out-of-Band(details)	

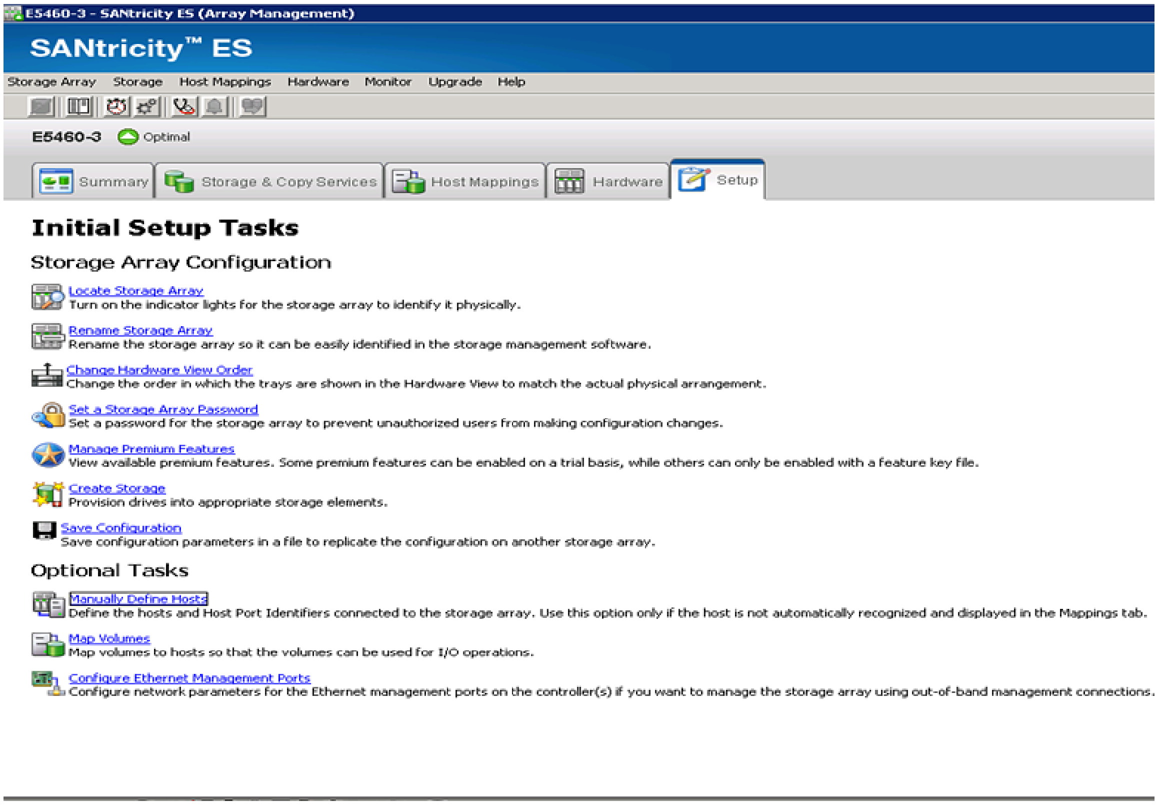
Note You must associate host port identifiers (World Wide Identifiers or WWIDs) with the applicable host before you can map storage to datanodes. Associating the wrong host ports can result in incorrect mapping of storage.

Hosts can be mapped using two different methods:

- The Define Host Wizard—In this example, we use the Define Host Wizard that is accessed via the Setup tab and then the Manually Define Hosts option on the Initial Setup Tasks page. With this method, hosts are matched to port identifiers from a list containing unassociated host port identifiers, which have been automatically detected by the storage controllers. Each host port identifier must be correctly associated with its host; otherwise, the host will access incorrect volumes and might fail to access any storage at all.
- The Manage Host Port Identifiers menu option—When adding host port identifiers, an alias or user label must be provided. The user label or the alias must not exceed 30 characters. Choose a meaningful user label or alias to easily identify the host port identifier. For example, include the host name and storage array name in the user label. As host port identifiers are associated with the applicable hosts, the identifiers are removed from the known unassociated host port identifiers list.

3. Select the Setup tab and then click **Manually Define Hosts**.

Figure 109 Defining Host Manually



Initial Setup Tasks

Storage Array Configuration

Locate Storage Array
Turn on the indicator lights for the storage array to identify it physically.

Rename Storage Array
Rename the storage array so it can be easily identified in the storage management software.

Change Hardware View Order
Change the order in which the trays are shown in the Hardware View to match the actual physical arrangement.

Set a Storage Array Password
Set a password for the storage array to prevent unauthorized users from making configuration changes.

Manage Premium Features
View available premium features. Some premium features can be enabled on a trial basis, while others can only be enabled with a feature key file.

Create Storage
Provision drives into appropriate storage elements.

Save Configuration
Save configuration parameters in a file to replicate the configuration on another storage array.

Optional Tasks

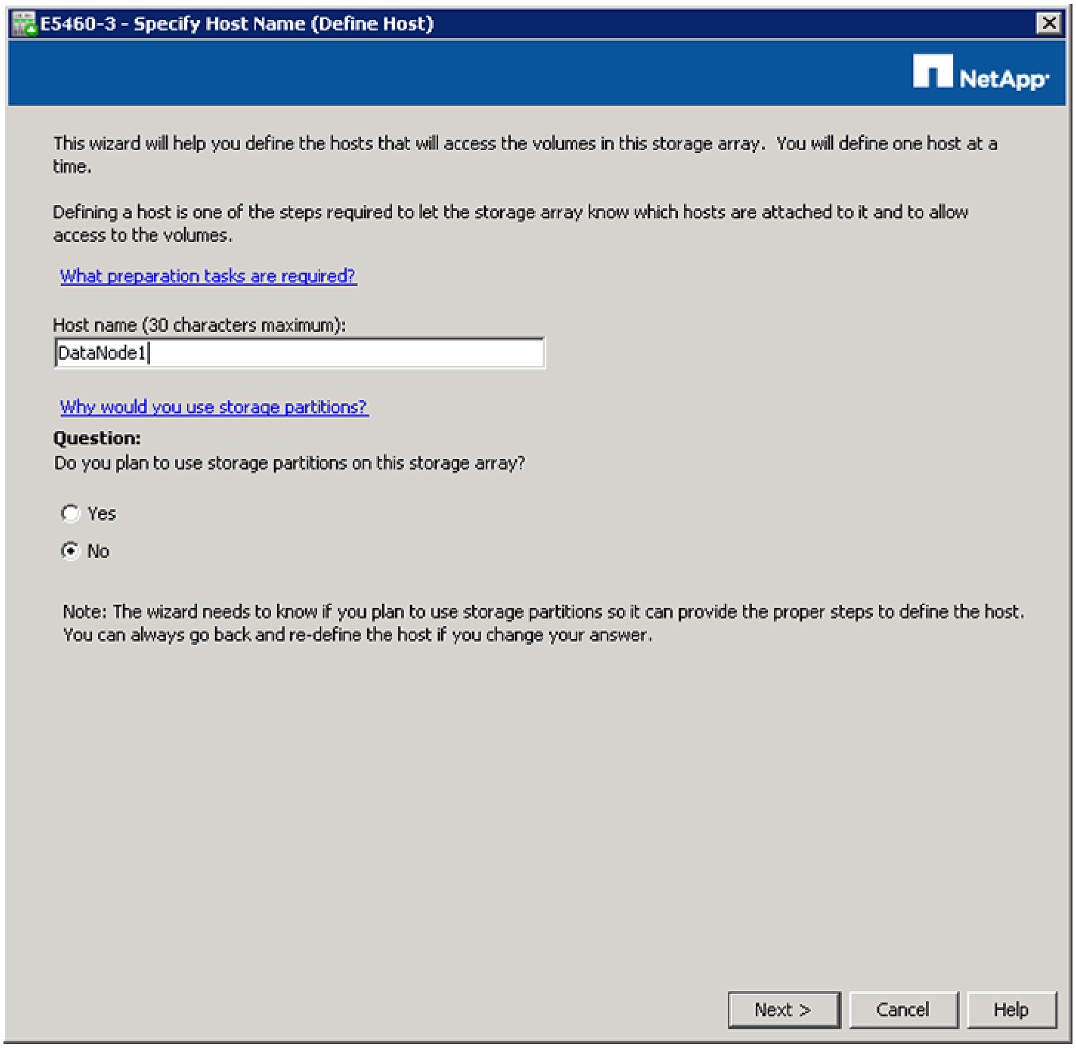
Manually Define Hosts
Define the hosts and Host Port Identifiers connected to the storage array. Use this option only if the host is not automatically recognized and displayed in the Mappings tab.

Map Volumes
Map volumes to hosts so that the volumes can be used for I/O operations.

Configure Ethernet Management Ports
Configure network parameters for the Ethernet management ports on the controller(s) if you want to manage the storage array using out-of-band management connections.

4. Enter the desired host name and click **Next**.

Figure 110 Entering Host Details



E5460-3 - Specify Host Name (Define Host)

This wizard will help you define the hosts that will access the volumes in this storage array. You will define one host at a time.

Defining a host is one of the steps required to let the storage array know which hosts are attached to it and to allow access to the volumes.

What preparation tasks are required?

Host name (30 characters maximum):
DataNode1

Why would you use storage partitions?

Question:
Do you plan to use storage partitions on this storage array?

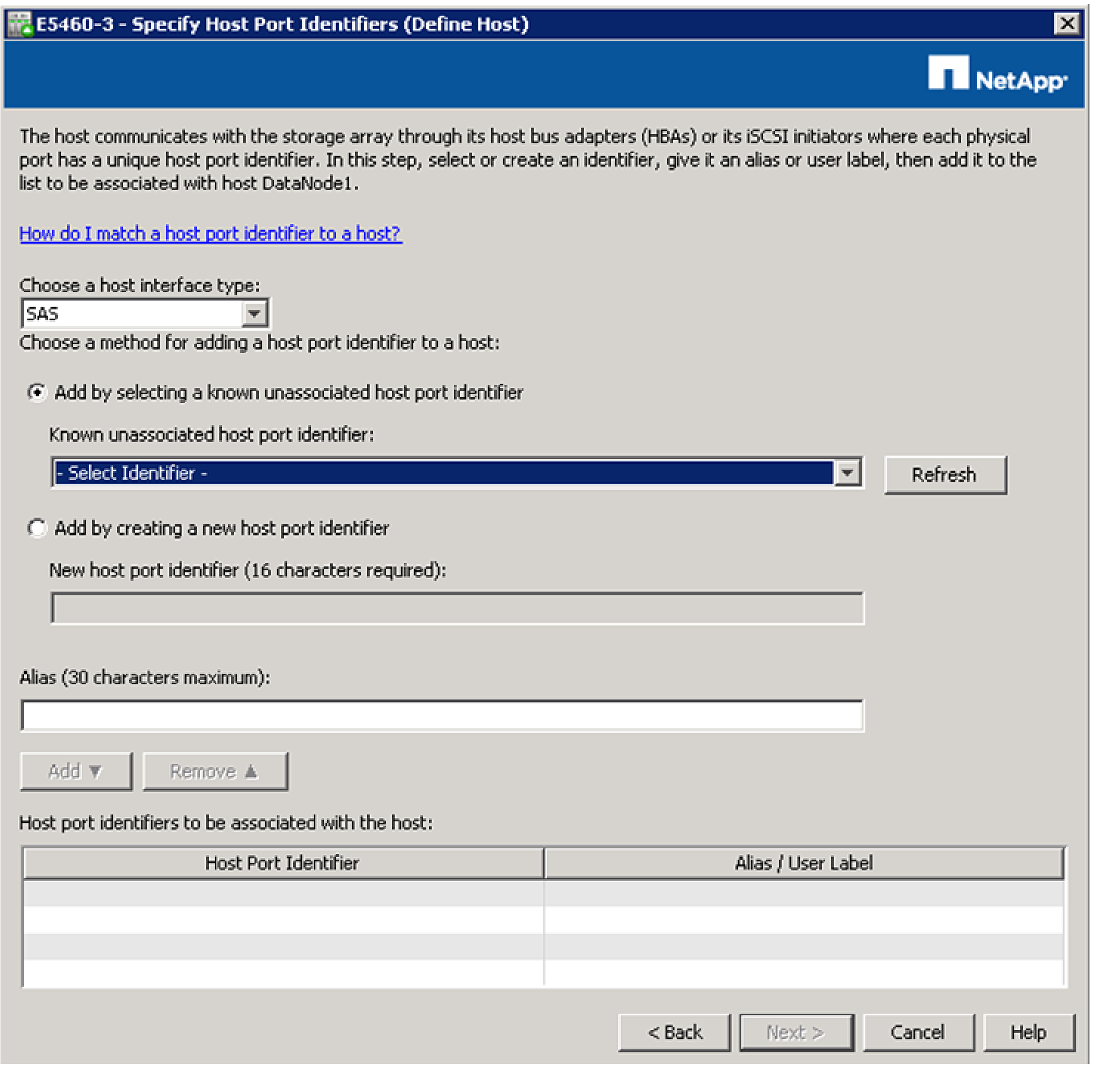
○ Yes

● No

Note: The wizard needs to know if you plan to use storage partitions so it can provide the proper steps to define the host. You can always go back and re-define the host if you change your answer.

5. For Choose the host interface type option, select SAS from the drop down list.
6. Select the **Add by selecting a known unassociated host port identifier** radio button.
7. From the known unassociated host port identifier drop down list, select SAS ID of this host.

Figure 111 Entering Host Port Identifiers



E5460-3 - Specify Host Port Identifiers (Define Host)

The host communicates with the storage array through its host bus adapters (HBAs) or its iSCSI initiators where each physical port has a unique host port identifier. In this step, select or create an identifier, give it an alias or user label, then add it to the list to be associated with host DataNode1.

How do I match a host port identifier to a host?

Choose a host interface type: SAS

Choose a method for adding a host port identifier to a host:

● Add by selecting a known unassociated host port identifier

Known unassociated host port identifier: - Select Identifier -

○ Add by creating a new host port identifier

New host port identifier (16 characters required):

Alias (30 characters maximum):

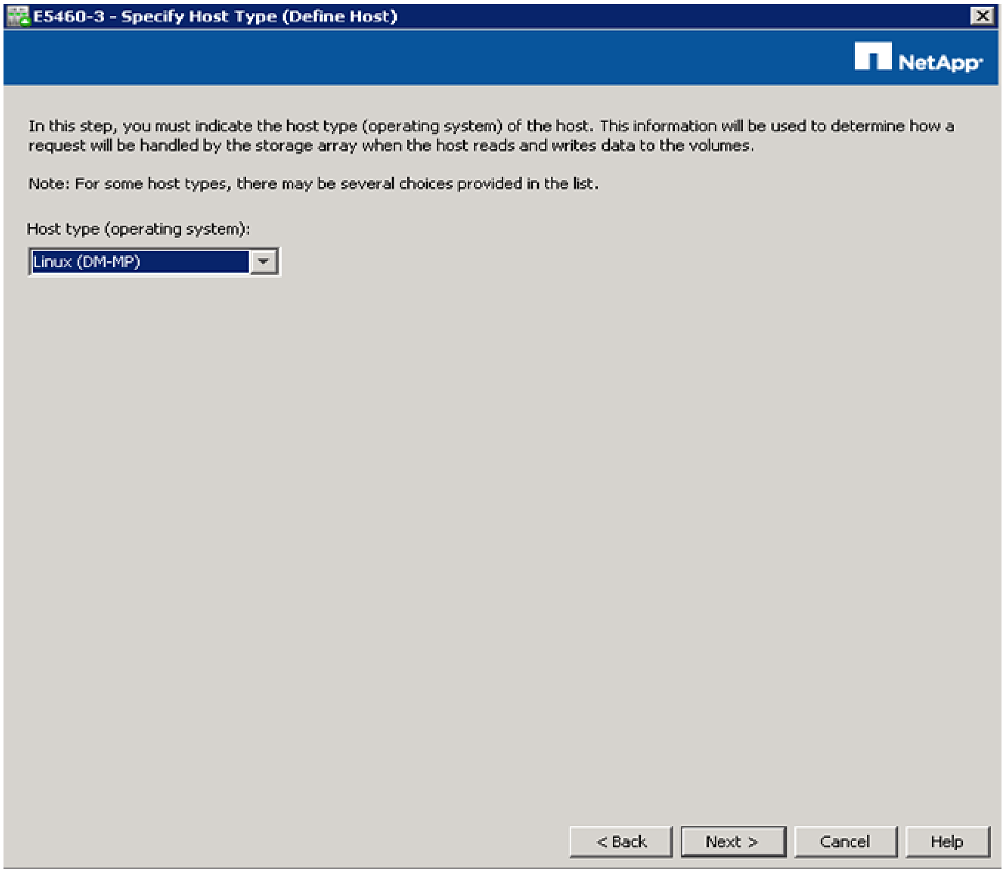
Host port identifiers to be associated with the host:

Host Port Identifier	Alias / User Label

Note Refer to the data gathered in, "Identify SAS Port ID Using LSI SAS2Flash Utility" section on page 133 that matches your host SAS connection.

8. Select Add By Selecting a Known Unassociated Host Port Identifier and then from the drop down list select the appropriate host port identifier.
9. Enter the alias, click **Add**, and then click **Next**.
10. From the Host type (operating system) drop down list, select Linux (DM-MP) as the host type.

Figure 112 Specifying Host Type



E5460-3 - Specify Host Type (Define Host)

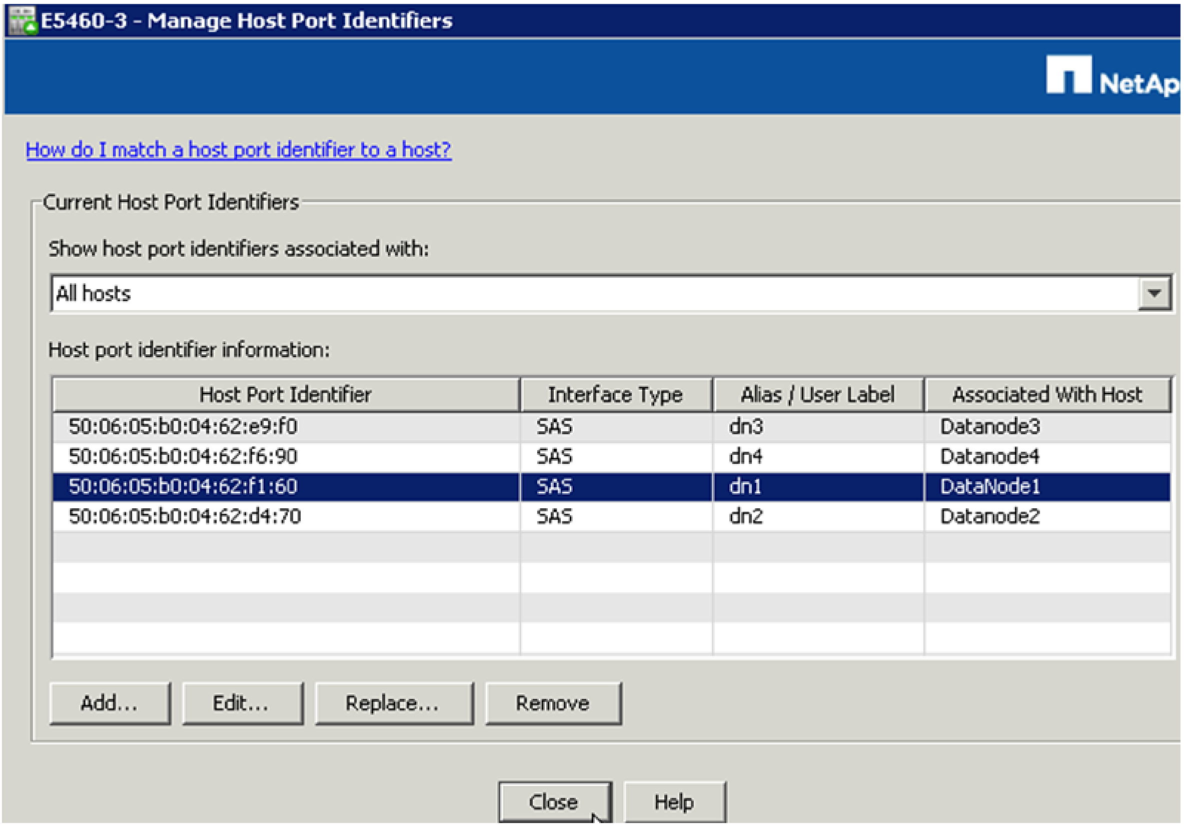
In this step, you must indicate the host type (operating system) of the host. This information will be used to determine how a request will be handled by the storage array when the host reads and writes data to the volumes.

Note: For some host types, there may be several choices provided in the list.

Host type (operating system): Linux (DM-MP)

11. The Preview (Define Host) pane appears. Click **Finish**.
12. Repeat steps 1 to11 for the remaining datanodes and host port identifiers.

Figure 113 Summary of Host Port Identifiers


E5460-3 - Manage Host Port Identifiers
NetAp
How do I match a host port identifier to a host?
Current Host Port Identifiers
Show host port identifiers associated with:
All hosts
Host port identifier information:
Add...
Edit...
Replace...
Remove
Close
Help

Host Port Identifier	Interface Type	Alias / User Label	Associated With Host
50:06:05:b0:04:62:e9:f0	SAS	dn3	Datanode3
50:06:05:b0:04:62:f6:90	SAS	dn4	Datanode4
50:06:05:b0:04:62:f1:60	SAS	dn1	DataNode1
50:06:05:b0:04:62:d4:70	SAS	dn2	Datanode2

Note To test, click **Host Mappings** at the top of the page and select Manage Host Port Identifiers from the list displayed. All of the hosts and port mappings are displayed. Verify that this list matches the information captured in Table 10.

E-Series Disk Initialization

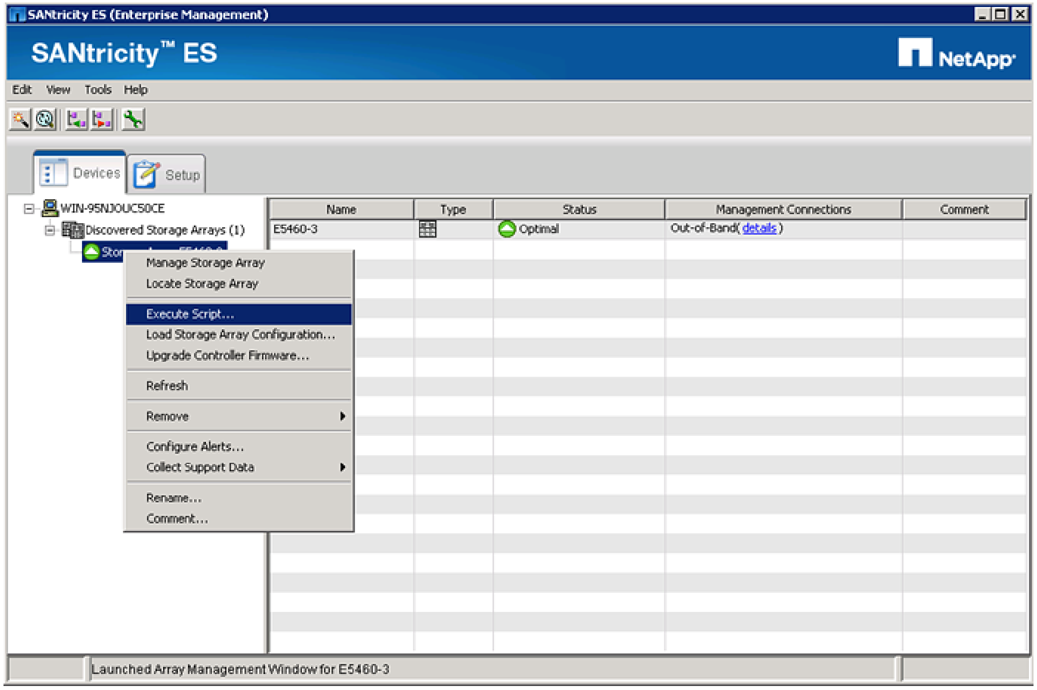
The disk initialization format is set to Immediate Availability Format (IAF) by default. When the disk initialization time, which can take more than 24 hours, can be a concern, NetApp recommends that IAF be disabled. This change blocks writes to the disks during the initialization process; however, the initialization process shortens dramatically. The decrease in initialization time ranges from minutes to several hours, depending on the size of the volume groups.

Note NetApp recommends that IAF be disabled when using 2TB and 3TB 7200-RPM disk drives; however, the setting should not be changed when Data Assurance (T10PI) is not enabled.

To disable the IAF disk initialization setting, follow these steps:

1. Open the SANtricity ES Management client, right-click the array where the setting need to be changed, and select Execute Script.

Figure 114 Selecting Execute Script to Verify Disk Initialization



Name	Type	Status	Management Connections	Comment
E5460-3		Optimal	Out-of-Band(details)	

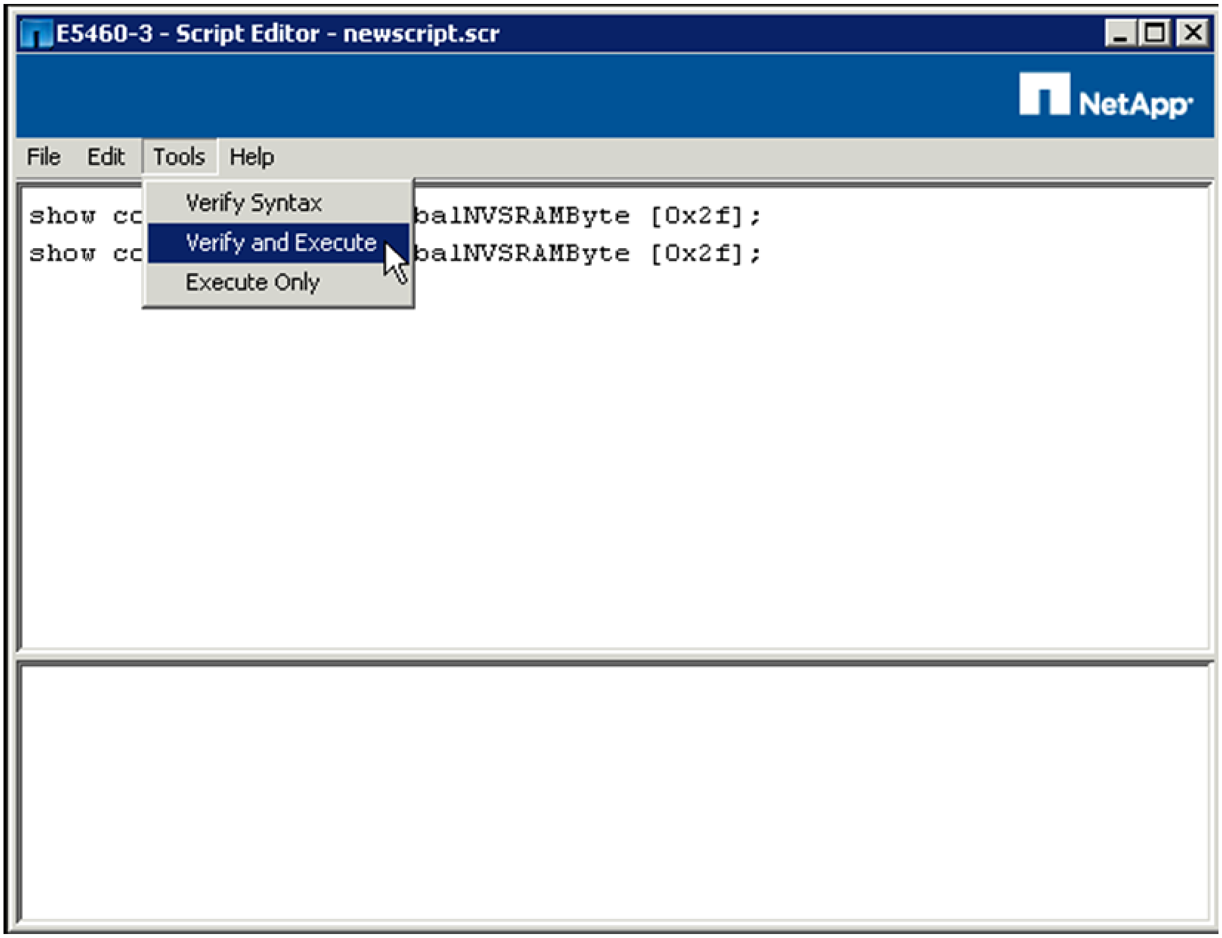
Launched Array Management Window for E5460-3

2. In the Script Editor – newscript.scr window, enter the show controller command to verify the current disk initialization method setting.

```
show controller [a] globalNVSRAMByte [0x2f];
show controller [b] globalNVSRAMByte [0x2f];
```

3. Select **Tools** > **Verify and Execute**. Confirm that the commands executed successfully.

Figure 115 Execute Commands and Verify



```
show cc balNVSRAMByte [0x2f];
show cc balNVSRAMByte [0x2f];
```

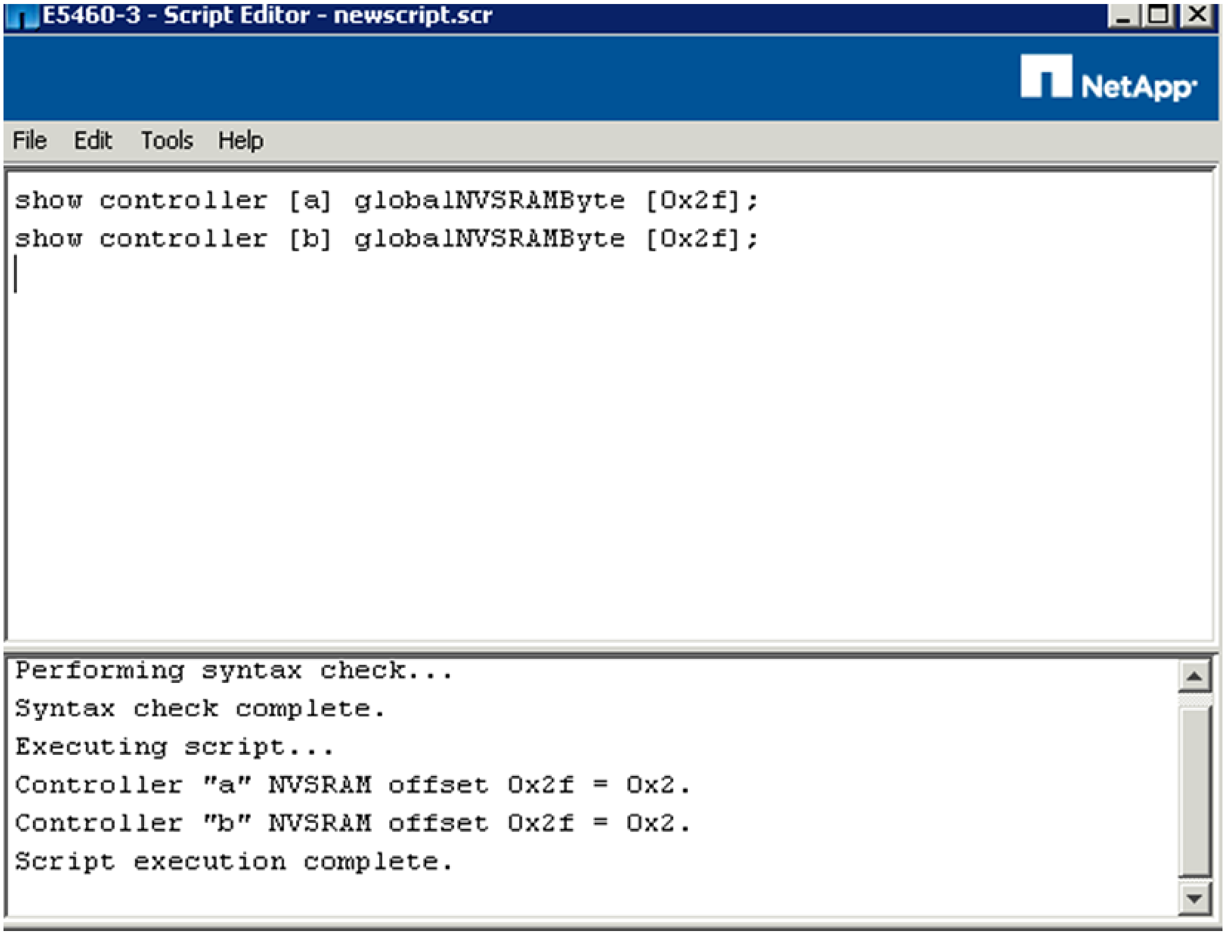
4. A setting of 0x0 indicates that IAF is enabled. To disable IAF, enter the set controller commands in the Script Editor window.

```
set controller [a] globalNVSRAMByte [0x2f] = 0x02, 0x02;
set controller [b] globalNVSRAMByte [0x2f] = 0x02, 0x02;
```

5. Select **Tools** > **Verify and Execute**. Confirm that the commands executed successfully.

6. Run the show controller commands again and confirm that the settings have been updated to 0x2 for both controllers.

Figure 116 Completion of Script Execution



```
show controller [a] globalNVSRAMByte [0x2f];
show controller [b] globalNVSRAMByte [0x2f];
```

```
Performing syntax check...
Syntax check complete.
Executing script...
Controller "a" NVSRAM offset 0x2f = 0x2.
Controller "b" NVSRAM offset 0x2f = 0x2.
Script execution complete.
```

Note With IAF disabled, disk initialization routines must complete before the array will allow data to be written to the newly created volume groups. If disk initialization cycles longer than 24 hours are acceptable, use the default IAF method. The disk initialization method must be selected before volume groups are created.

Disable E-Series Auto Volume Transfer

Auto volume transfer (AVT) is a feature of E-Series firmware that enables storage controller failover in the event that a controller becomes unavailable to datanodes. With the FlexPod Select for Hadoop, datanodes are directly connected to storage controllers using a single SAS cable. AVT is not applicable to this configuration, because connectivity to storage provides no redundancy. Failure of an E5460 controller is handled by the self-healing capability of Hadoop. Self-healing is supported by HDFS replication, which results in multiple copies of data being locally available to other nodes in the cluster. If a controller fails, MapReduce tasks using storage on that controller are reassigned to other healthy nodes in the Hadoop cluster that have access to another copy of the missing data. Since AVT adds no value to FlexPod Select for Hadoop, NetApp recommends that it be disabled.

To disable AVT, follow these steps:

1. Open the SANtricity ES Management client, right-click the array where the setting need to be changed, and select Execute Script as shown in Figure 114.
2. In the Script Editor – newscript.scr window, enter the show controller command to verify the current AVT setting.

```
show controller [a] hostNVSRAMByte [7,0x24];
show controller [b] hostNVSRAMByte [7,0x24];
```

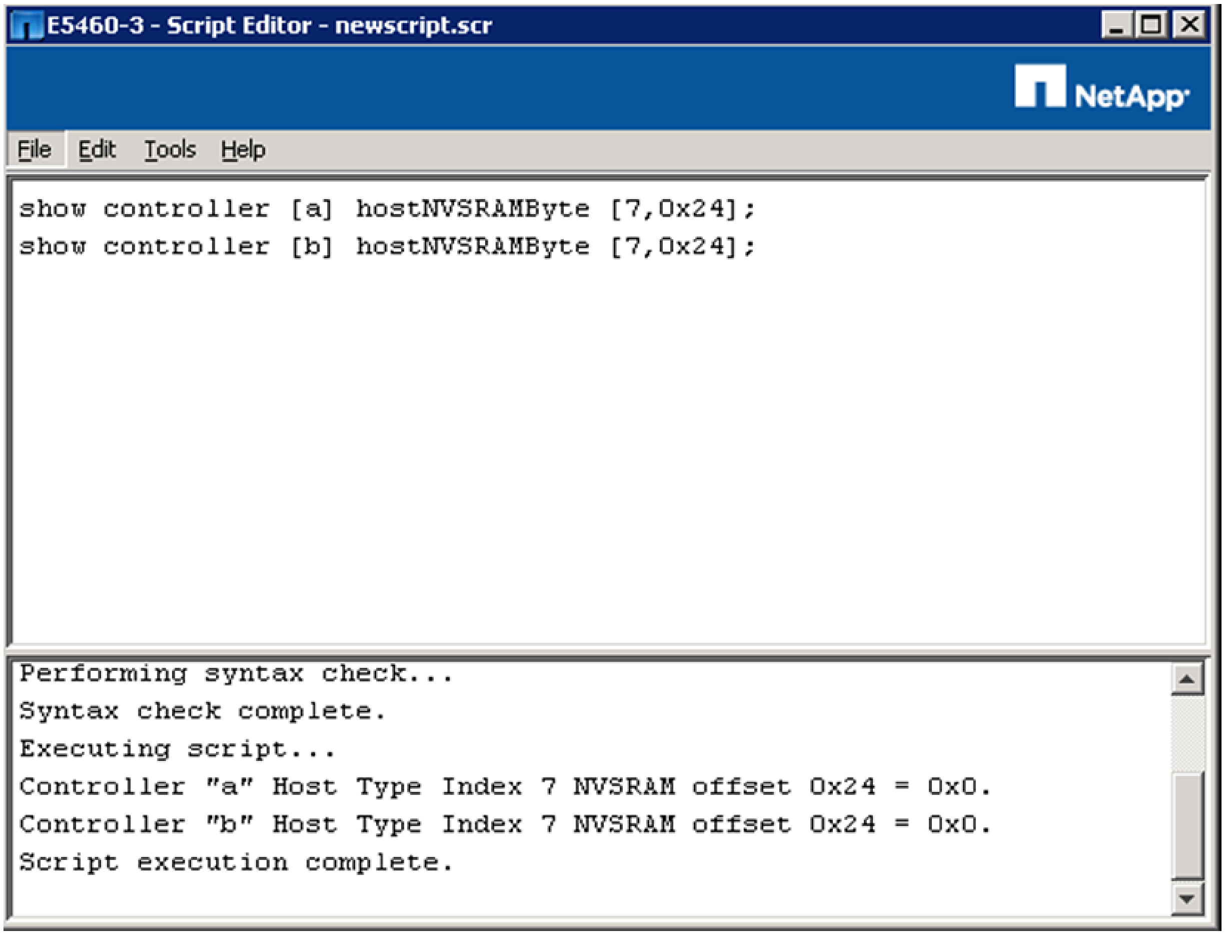
3. Select **Tools** > **Verify and Execute** as shown in Figure 115. Confirm that the commands executed successfully.
4. A setting of 0x1 indicates that AVT is enabled. To disable AVT, enter the set controller commands in the Script Editor window.

```
set controller [a] hostNVSRAMByte[7,0x24]=0x00;
set controller [b] hostNVSRAMByte[7,0x24]=0x00;
```

5. Select the **Tools** > **Verify and Execute**. Confirm that the commands executed successfully.
6. Rerun the show controller commands from step 2.

   Confirm the settings have been updated to 0x0 for both controllers.

Figure 117 Completion of Script Execution



```
show controller [a] hostNVSRAMByte [7,0x24];
show controller [b] hostNVSRAMByte [7,0x24];
```

```
Performing syntax check...
Syntax check complete.
Executing script...
Controller "a" Host Type Index 7 NVSRAM offset 0x24 = 0x0.
Controller "b" Host Type Index 7 NVSRAM offset 0x24 = 0x0.
Script execution complete.
```

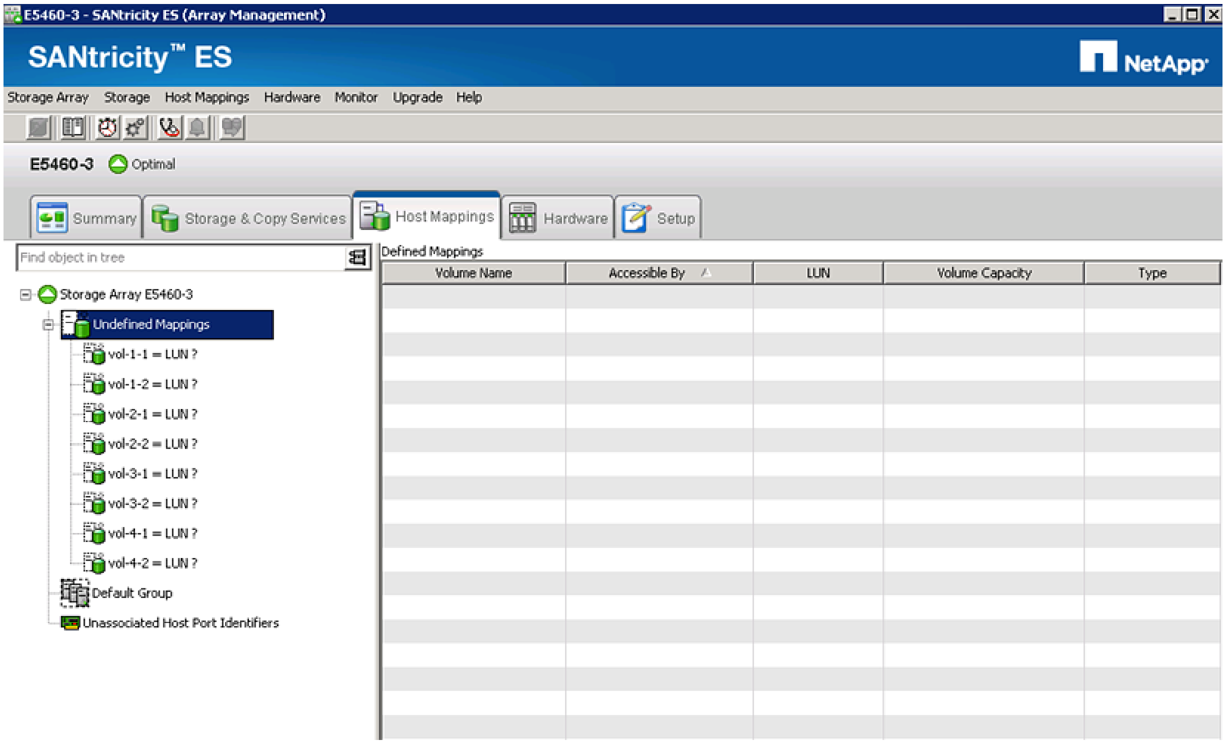
7. Close the Script Editor window and proceed with creating volume groups.

Map Volumes

To map the volumes to the assigned datanode, follow these steps:

1. Select the Host Mappings tab at the top of the Array Management window. Expand the Undefined Mappings.

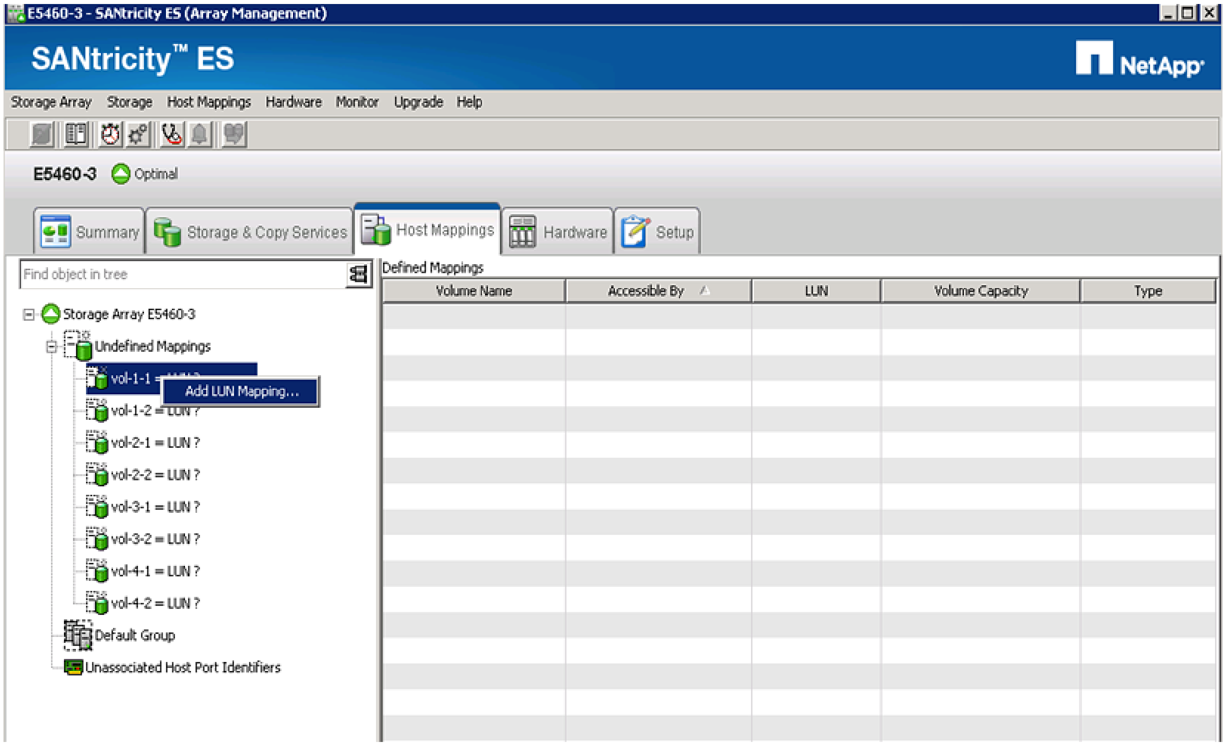
Figure 118 Unmapped LUNs



Volume Name	Accessible By	LUN	Volume Capacity	Type

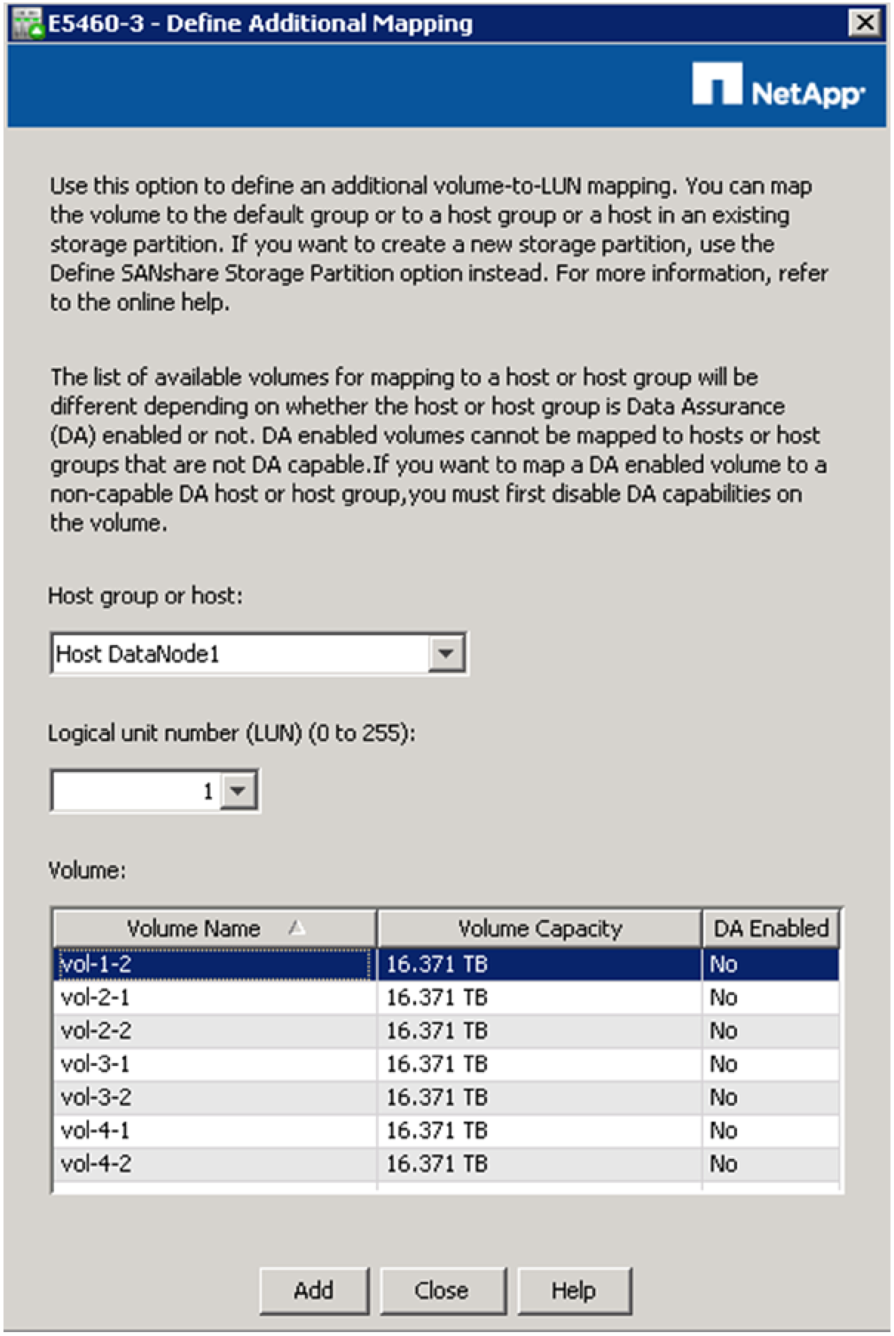
2. Right-click the new volume name under the Undefined Mappings. click **Add LUN Mapping**.

Figure 119 Adding LUN Mapping



3. In the Define Additional Mapping window, perform the following actions:
   a. Select the host to use for the mapping.
   b. Set the desired logical unit number (LUN) [in this example: 1].
   c. Select the desired volume.

Figure 120 Entering Additional Mapping Information



E5460-3 - Define Additional Mapping

Use this option to define an additional volume-to-LUN mapping. You can map the volume to the default group or to a host group or a host in an existing storage partition. If you want to create a new storage partition, use the Define SANshare Storage Partition option instead. For more information, refer to the online help.

The list of available volumes for mapping to a host or host group will be different depending on whether the host or host group is Data Assurance (DA) enabled or not. DA enabled volumes cannot be mapped to hosts or host groups that are not DA capable.If you want to map a DA enabled volume to a non-capable DA host or host group,you must first disable DA capabilities on the volume.

Host group or host:

Host DataNode1

Logical unit number (LUN) (0 to 255):

1

Volume:

Volume Name	Volume Capacity	DA Enabled
vol-1-2	16.371 TB	No
vol-2-1	16.371 TB	No
vol-2-2	16.371 TB	No
vol-3-1	16.371 TB	No
vol-3-2	16.371 TB	No
vol-4-1	16.371 TB	No
vol-4-2	16.371 TB	No

d. Click **Add**.

e. Repeat the above steps (a-d) for each volume to map to each host.

Note If a window opens giving the option to map more volumes, click **Close**. In order to maintain consistency with other applications that use E-Series storage, never use a LUN number of 0. NetApp recommends starting with a LUN number of 1.

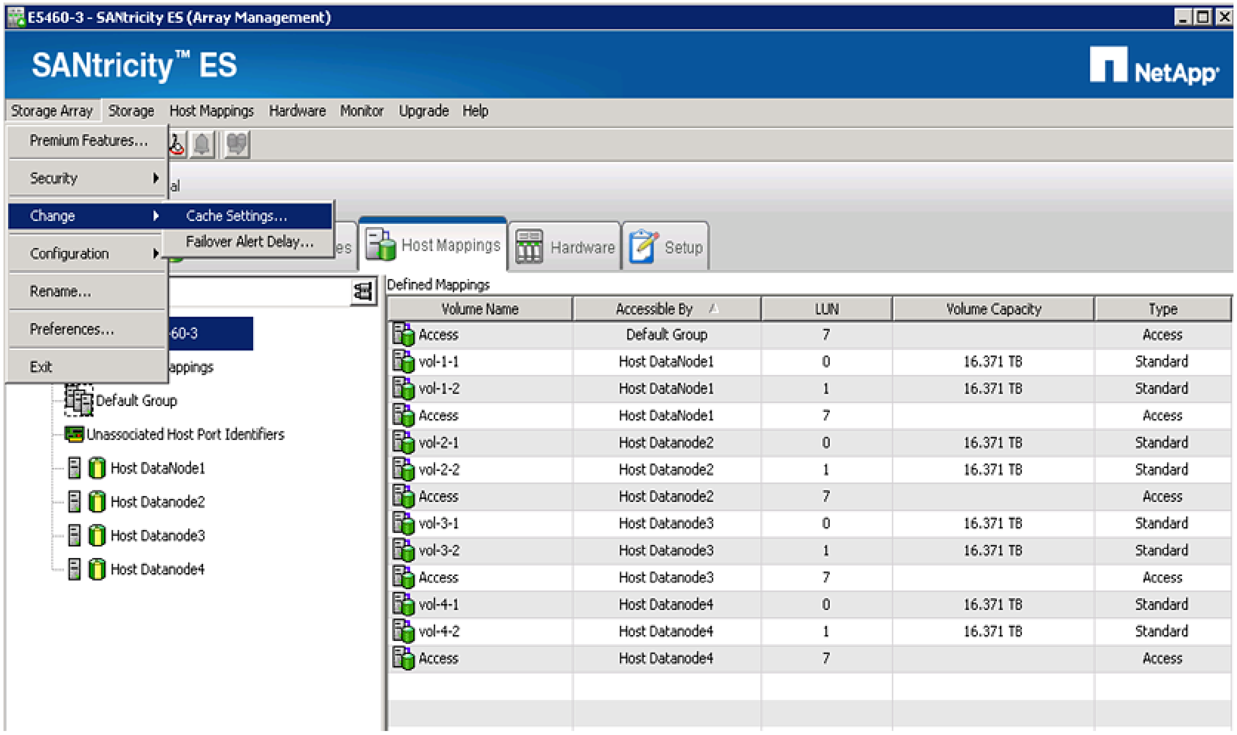
4. After all LUNs are mapped, reboot the hosts so that they recognize their LUNs.

Configure Cache Settings for Array

To configure caching for the entire storage array, follow these steps:

1. From the top menu of the SANtricity Array Management window, select Storage Array. Then select **Change** > **Cache Settings**.

Figure 121 Cache Settings

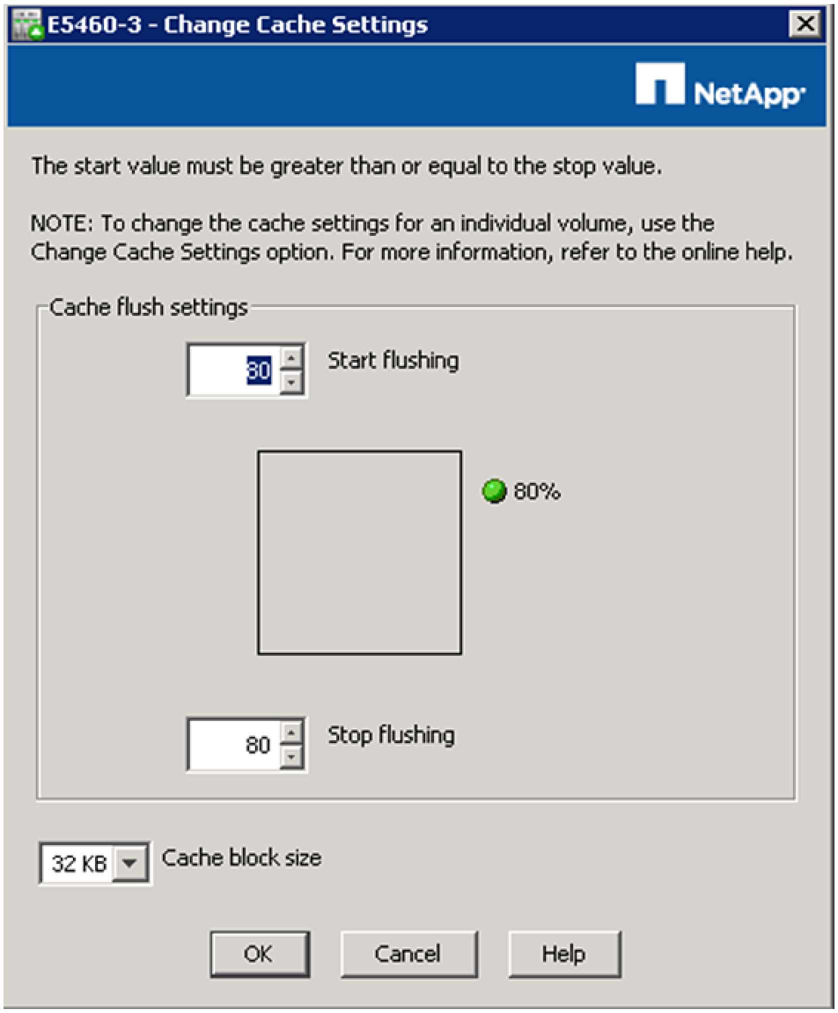


Defined Mappings

Volume Name	Accessible By	LUN	Volume Capacity	Type
Access	Default Group	7		Access
vol-1-1	Host DataNode1	0	16.371 TB	Standard
vol-1-2	Host DataNode1	1	16.371 TB	Standard
Access	Host DataNode1	7		Access
vol-2-1	Host Datanode2	0	16.371 TB	Standard
vol-2-2	Host Datanode2	1	16.371 TB	Standard
Access	Host Datanode2	7		Access
vol-3-1	Host Datanode3	0	16.371 TB	Standard
vol-3-2	Host Datanode3	1	16.371 TB	Standard
Access	Host Datanode3	7		Access
vol-4-1	Host Datanode4	0	16.371 TB	Standard
vol-4-2	Host Datanode4	1	16.371 TB	Standard
Access	Host Datanode4	7		Access

2. In the Change Cache Settings window, change the Cache Block Size setting to 32KB, verify that the Stop Flushing setting is 80, and click **OK**.

Figure 122 Changing the Cache Block Size



The start value must be greater than or equal to the stop value.

NOTE: To change the cache settings for an individual volume, use the Change Cache Settings option. For more information, refer to the online help.

Start flushing: 80

80%

Stop flushing: 80

Cache block size: 32 KB

Note Do not make any other changes.

This completes the E5460 initialization and storage configuration.

DataNode File Systems on E5460 LUNs

Once the E5460 systems have finished their initialization, it is time to create partition tables and file systems on the LUNs supplied to each of the datanodes.

The following script should be run as root user on each of the datanodes:

```
#!/bin/bash
[[ “-x” == “${1}” ]] && set -x && set -v && shift 1
# rescan scsi devs
for X in /sys/class/scsi_host/host?/scan
do
  echo '- - -' > ${X}
done
# find new LUNs
```

```
for X in /dev/sd?
do
  echo $X
  if [[ -b ${X} && `/sbin/parted -s ${X} print quit|/bin/grep -c boot` -ne 0 ]]
  then
    echo "$X bootable - skipping."
    continue
  else
    Y=${X##*/}1
    /sbin/parted  -s  ${X} mklabel gpt quit
    /sbin/parted  -s  ${X} mkpart 1 6144s 100% quit
    /sbin/mkfs.xfs  -f  -q  -l size=65536b,lazy-count=1,su=256k  -d sunit=1024,swidth=6144
-r extsize=256k  -L ${Y}  ${X}1
    (( $? )) && continue
    /bin/mkdir  -p  /CDH/${Y}
    (( $? )) && continue
    /bin/mount  -t xfs  -o allocsize=128m,noatime,nobarrier,nodiratime  ${X}1  /CDH/${Y}
    (( $? )) && continue
    echo "LABEL=${Y}  /CDH/${Y}   xfs   allocsize=128m,noatime,nobarrier,nodiratime  0  2"
>> /etc/fstab
  fi
done
```

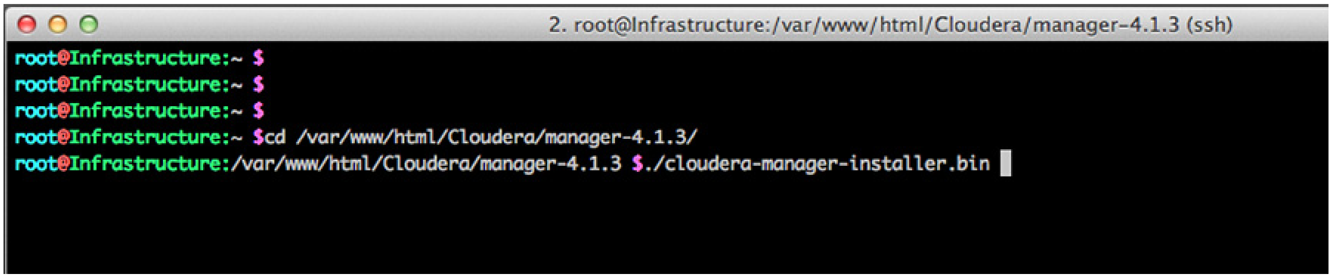
Cloudera Manager and Cloudera Enterprise Core Installation

Installing Cloudera Manager

The Cloudera Manager Installer is used for installing the Cloudera Manager and the Cloudera Enterprise Core software on our cluster. The installation is performed on the infrastructure node. Follow these steps to install the Cloudera Manager:

1. Start the Cloudera Manager Installer.

Figure 123 Starting Cloudera Manager Installer

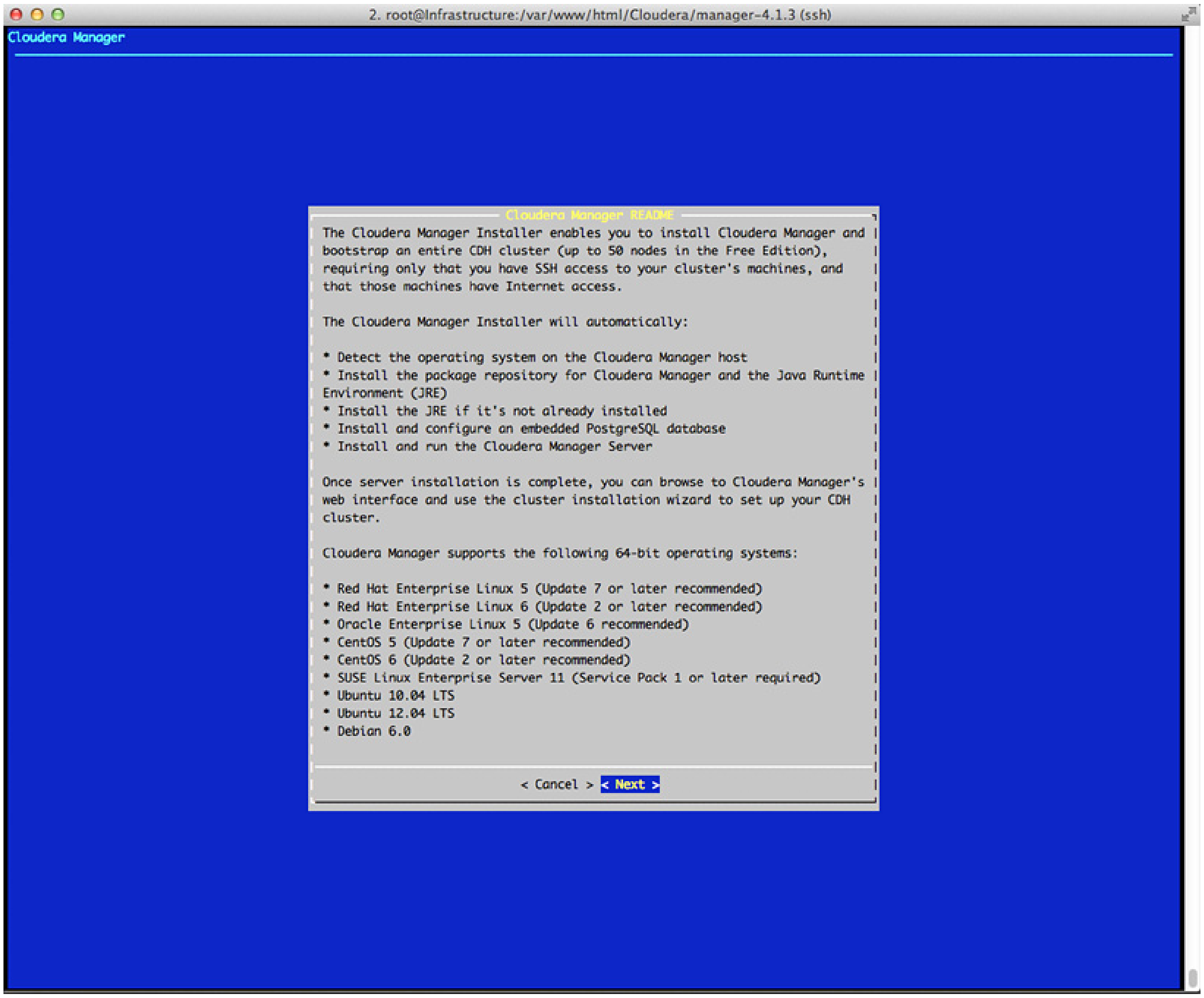


2. root@Infrastructure:/var/www/html/Cloudera/manager-4.1.3 (ssh)

```
root@Infrastructure:~ $
root@Infrastructure:~ $
root@Infrastructure:~ $
root@Infrastructure:~ $cd /var/www/html/Cloudera/manager-4.1.3/
root@Infrastructure:/var/www/html/Cloudera/manager-4.1.3 $./cloudera-manager-installer.bin
```

2. Installing Cloudera Manager.

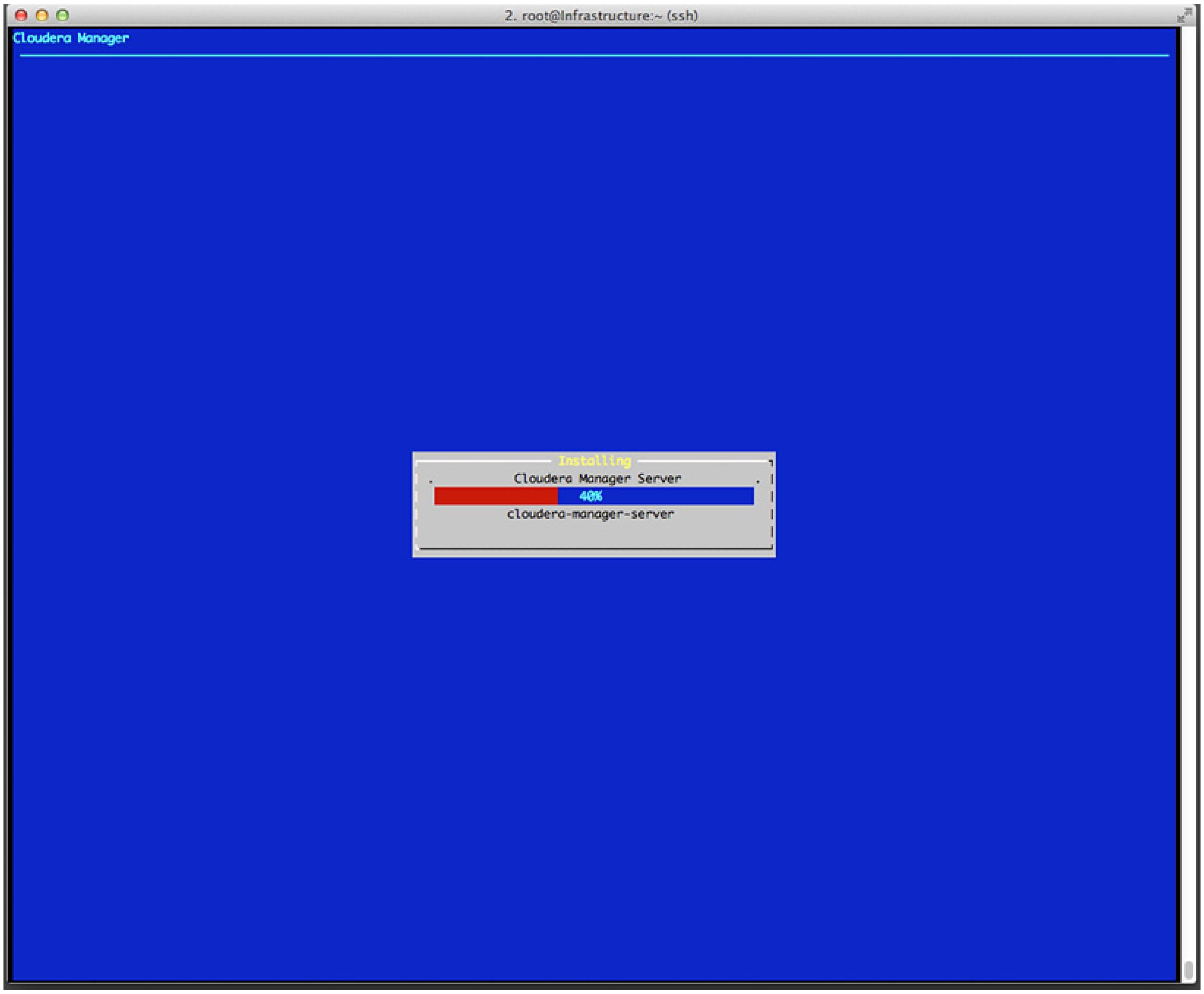
Figure 124 Cloudera Manager Installer


2. root@Infrastructure:/var/www/html/Cloudera/manager-4.1.3 (ssh)
Cloudera Manager
Cloudera Manager README
< Cancel >
< Next >

```
The Cloudera Manager Installer enables you to install Cloudera Manager and
bootstrap an entire CDH cluster (up to 50 nodes in the Free Edition),
requiring only that you have SSH access to your cluster's machines, and
that those machines have Internet access.

The Cloudera Manager Installer will automatically:

* Detect the operating system on the Cloudera Manager host
* Install the package repository for Cloudera Manager and the Java Runtime
Environment (JRE)
* Install the JRE if it's not already installed
* Install and configure an embedded PostgreSQL database
* Install and run the Cloudera Manager Server

Once server installation is complete, you can browse to Cloudera Manager's
web interface and use the cluster installation wizard to set up your CDH
cluster.

Cloudera Manager supports the following 64-bit operating systems:

* Red Hat Enterprise Linux 5 (Update 7 or later recommended)
* Red Hat Enterprise Linux 6 (Update 2 or later recommended)
* Oracle Enterprise Linux 5 (Update 6 recommended)
* CentOS 5 (Update 7 or later recommended)
* CentOS 6 (Update 2 or later recommended)
* SUSE Linux Enterprise Server 11 (Service Pack 1 or later required)
* Ubuntu 10.04 LTS
* Ubuntu 12.04 LTS
* Debian 6.0
```

3. Click **Next** in the End User License agreement page.
4. Click **Yes** in the license agreement confirmation page.
5. Click **Next** in the Oracle Binary Code License Agreement for the Java SE Platform Products page.
6. Click **Yes** in the license agreement confirmation page.
7. Wait for the installer to install the packages needed for Cloudera Manager.

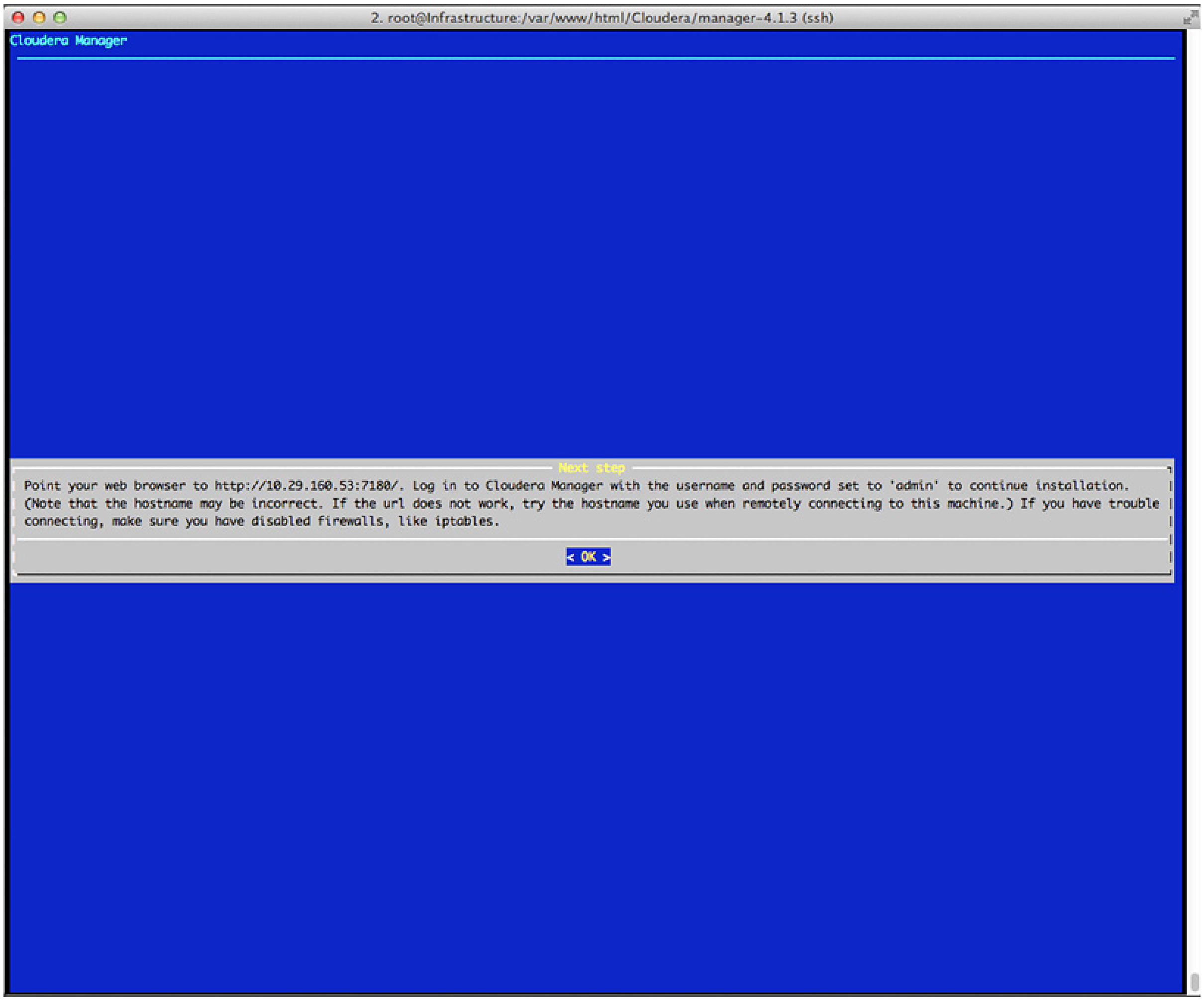
Figure 125 Installation In Progress



```
Cloudera Manager

Installing
Cloudera Manager Server
40%
cloudera-manager-server
```

8. Take note of the URL displayed. This URL needed to access the Cloudera Manager.

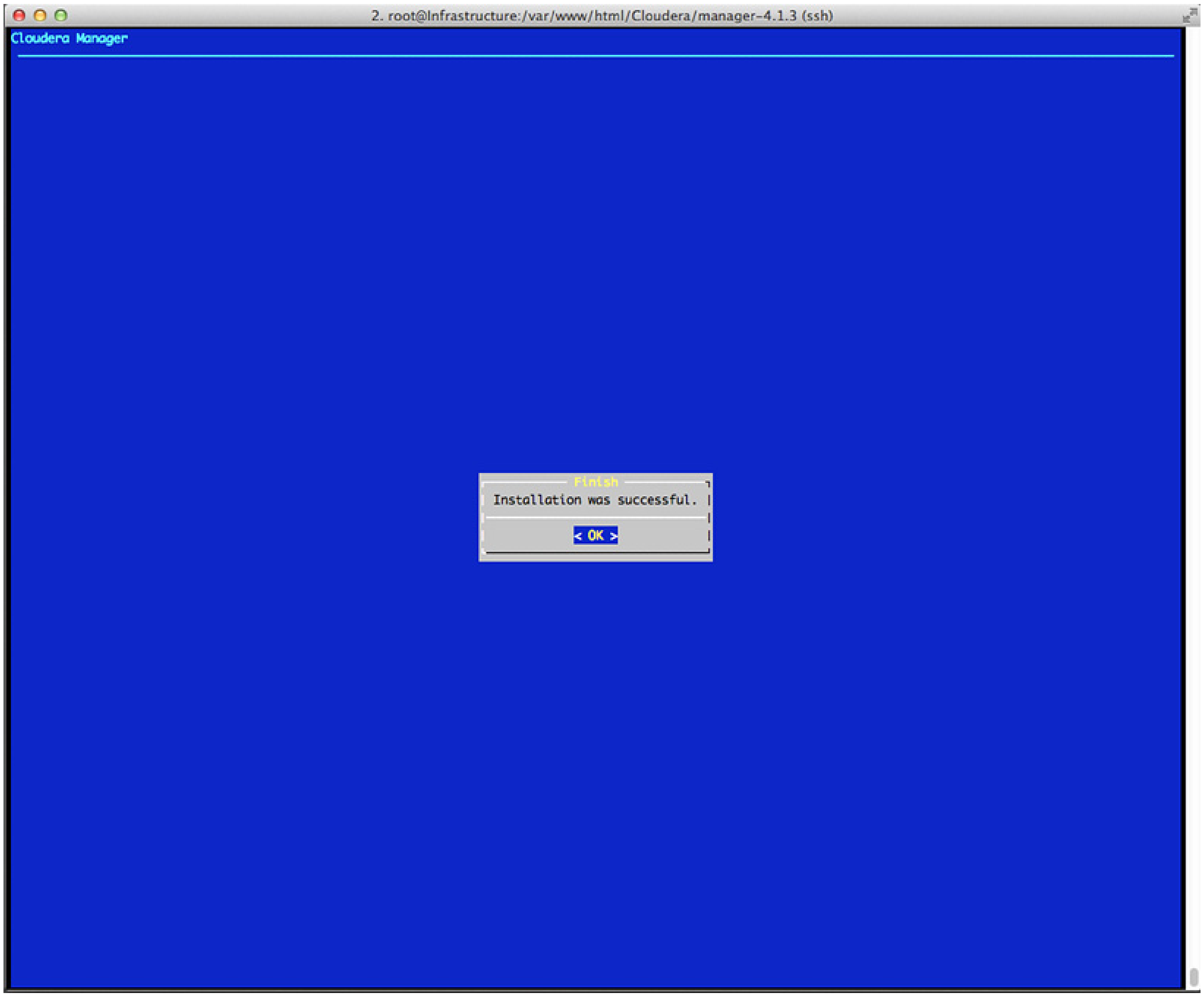
Figure 126 Cloudera Manager URL


2. root@Infrastructure:/var/www/html/Cloudera/manager-4.1.3 (ssh)
Cloudera Manager
Next step
< OK >

```
Point your web browser to http://10.29.160.53:7180/. Log in to Cloudera Manager with the username and password set to 'admin' to continue installation.
(Note that the hostname may be incorrect. If the url does not work, try the hostname you use when remotely connecting to this machine.) If you have trouble
connecting, make sure you have disabled firewalls, like iptables.
```

9. Click **OK**.

Figure 127 Cloudera Manager is Installed on the Cluster



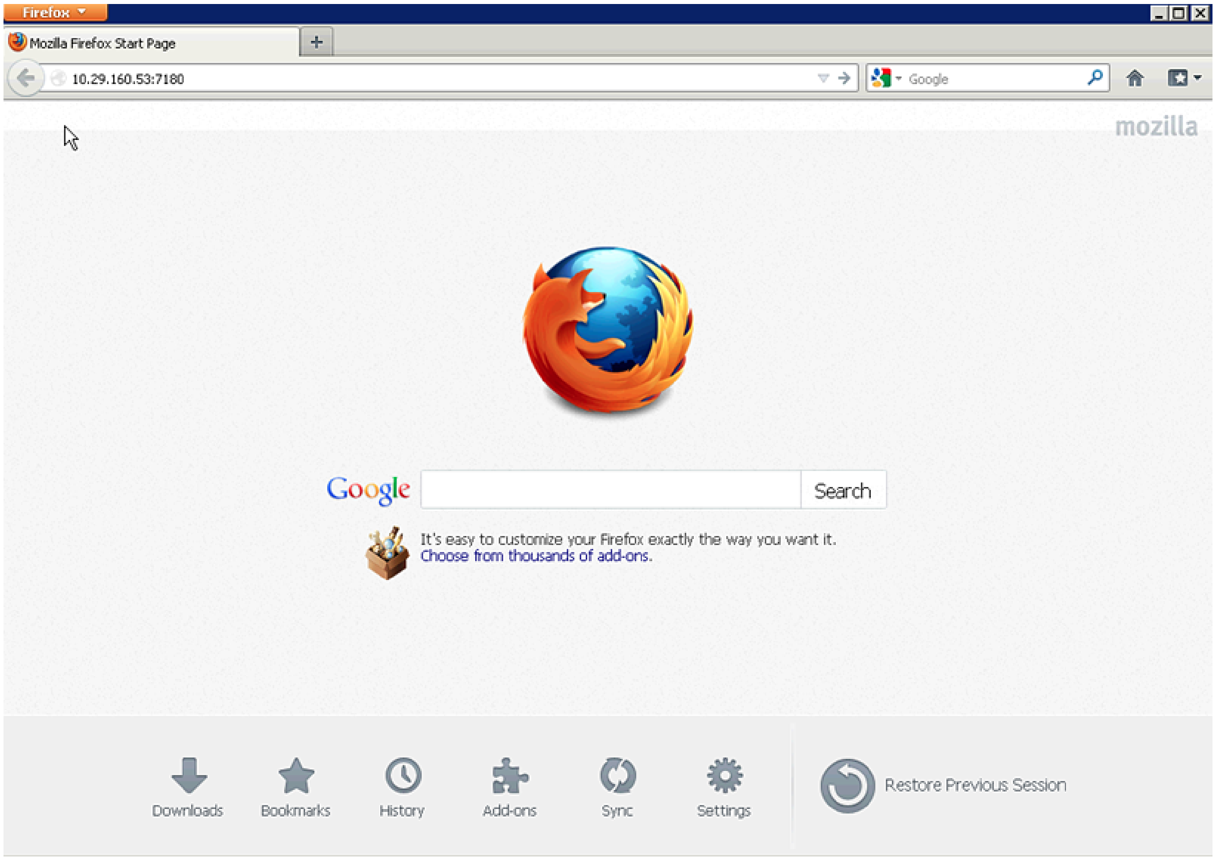
```
2. root@Infrastructure:/var/www/html/Cloudera/manager-4.1.3 (ssh)
Cloudera Manager

                              Finish
                  Installation was successful.

                             < OK >
```

Install Cloudera Enterprise Core (CDH4)

To install Cloudera Enterprise Core, follow these steps:

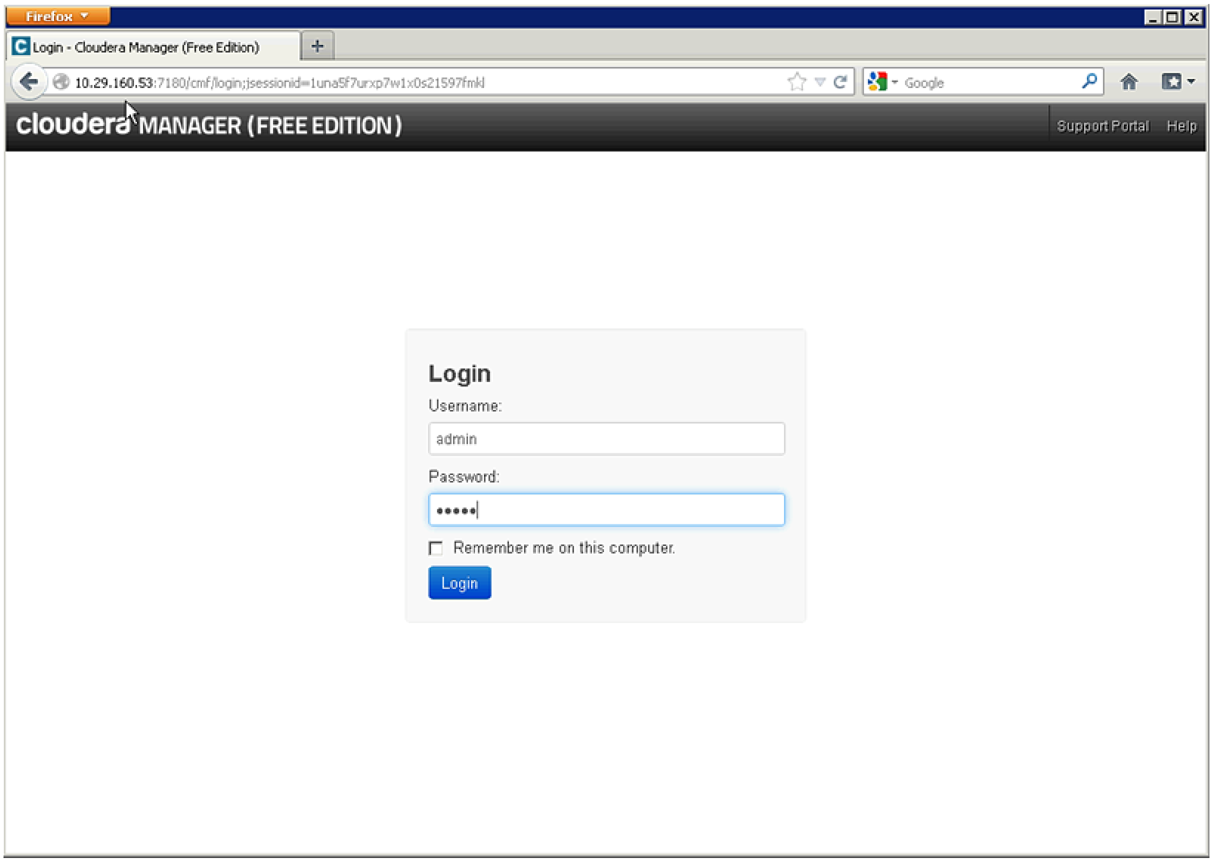
1. Access the Cloudera Manager using the URL displayed by the Installer.

Figure 128 Starting Cloudera Manager


Firefox
Mozilla Firefox Start Page
10.29.160.53:7180
Google
mozilla
Google
Search
It's easy to customize your Firefox exactly the way you want it.
Choose from thousands of add-ons.
Downloads
Bookmarks
History
Add-ons
Sync
Settings
Restore Previous Session

2. Successful connection to the Cloudera Manager browser interface.
3. For both the Username and Password, enter “admin”.

Figure 129 Cloudera Manager Login page


Firefox
Login - Cloudera Manager (Free Edition)
10.29.160.53:7180/cmf/login;jsessionid=1una5f7urxp7w1x0s21597fmkl
Google
cloudera MANAGER (FREE EDITION)
Support Portal
Help

Login

Username: admin

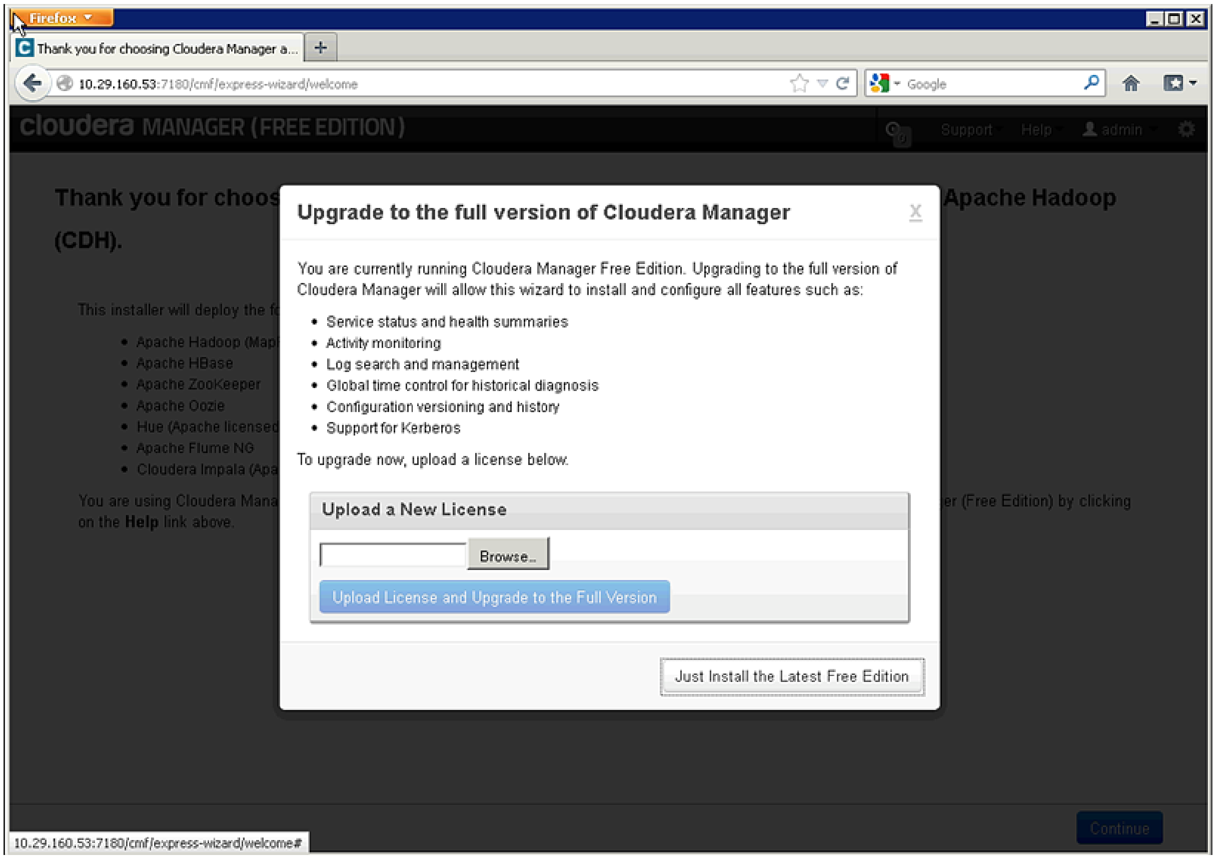
Password: •••••

□ Remember me on this computer.

Login

4. To upload Enterprise license, click **Browse** and then click **Upload License and Upgrade to the Full version**.
5. If not, click **Just Install the Latest Free Edition**.

Figure 130 Installing Cloudera Manager


Firefox
Thank you for choosing Cloudera Manager a...
10.29.160.53:7180/cmf/express-wizard/welcome
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin
Thank you for choos
Apache Hadoop
(CDH).
This installer will deploy the f
Apache Hadoop (Map
Apache HBase
Apache ZooKeeper
Apache Oozie
Hue (Apache licensed
Apache Flume NG
Cloudera Impala (Apa
You are using Cloudera Mana
er (Free Edition) by clicking
on the Help link above.
Browse...
Upload License and Upgrade to the Full Version
Just Install the Latest Free Edition
Continue
10.29.160.53:7180/cmf/express-wizard/welcome#

Upgrade to the full version of Cloudera Manager

You are currently running Cloudera Manager Free Edition. Upgrading to the full version of Cloudera Manager will allow this wizard to install and configure all features such as:

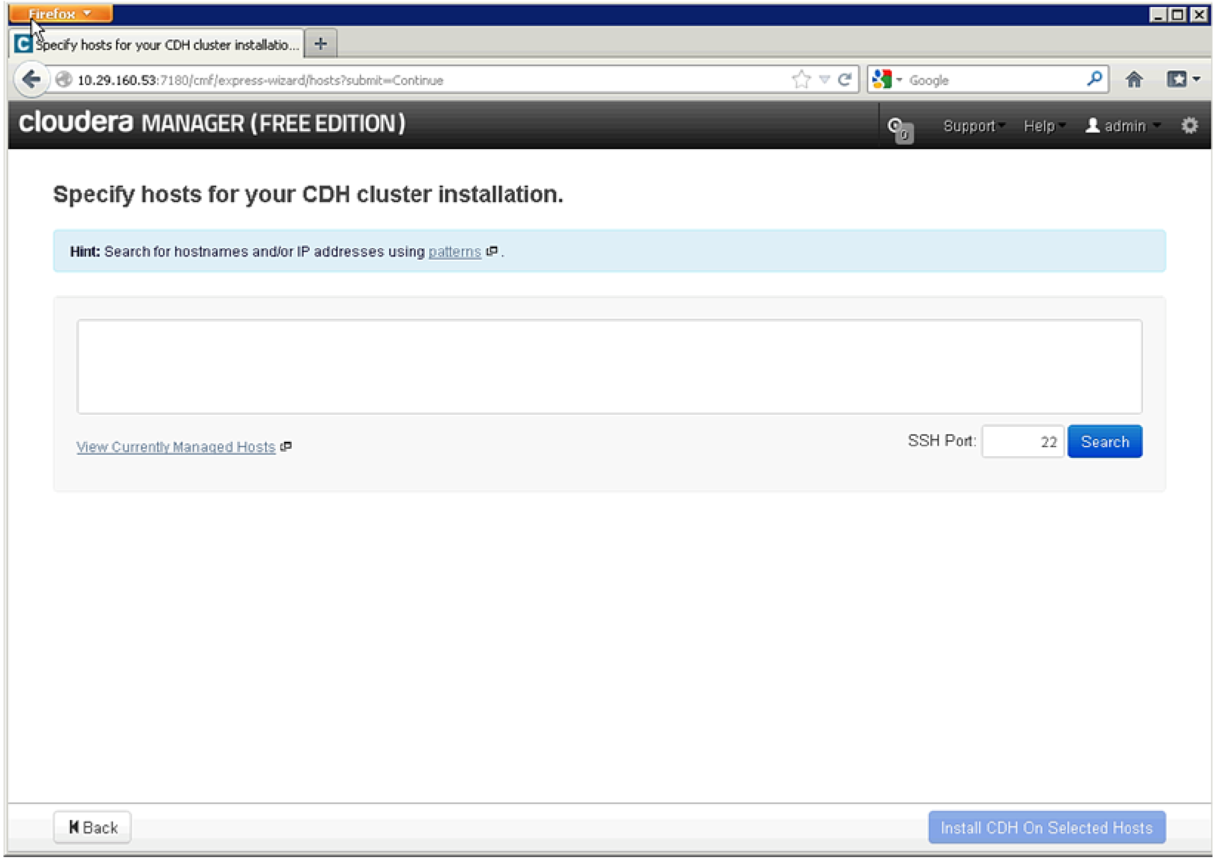
- Service status and health summaries
- Activity monitoring
- Log search and management
- Global time control for historical diagnosis
- Configuration versioning and history
- Support for Kerberos

To upgrade now, upload a license below.

Upload a New License

6. Click **Continue** in the confirmation page.
7. Next, the nodes making up the cluster need to be identified to Cloudera Manager.

Figure 131 Specifying SSH Port


Firefox
Specify hosts for your CDH cluster installatio...
10.29.160.53:7180/cmf/express-wizard/hosts?submit=Continue
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin
View Currently Managed Hosts
Search
Back
Install CDH On Selected Hosts

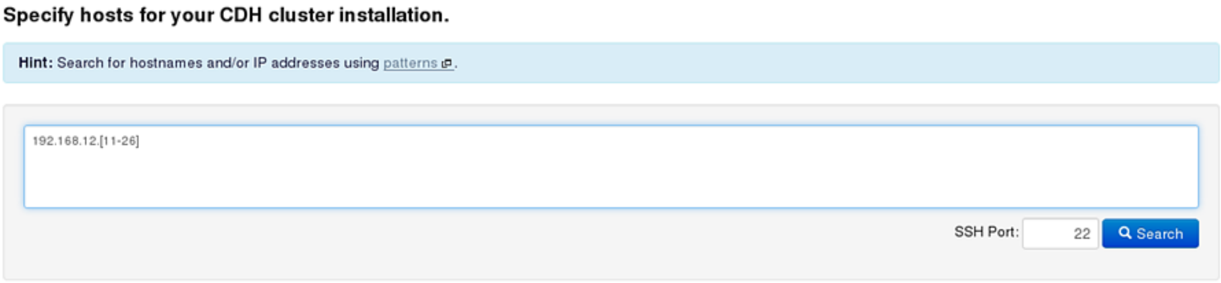
Specify hosts for your CDH cluster installation.

Hint: Search for hostnames and/or IP addresses using patterns .

SSH Port: 22

8. Enter the IP addresses in this example.
9. After the IP addresses are entered, click **Search**.

Figure 132 Searching for Cluster Nodes



Specify hosts for your CDH cluster installation.

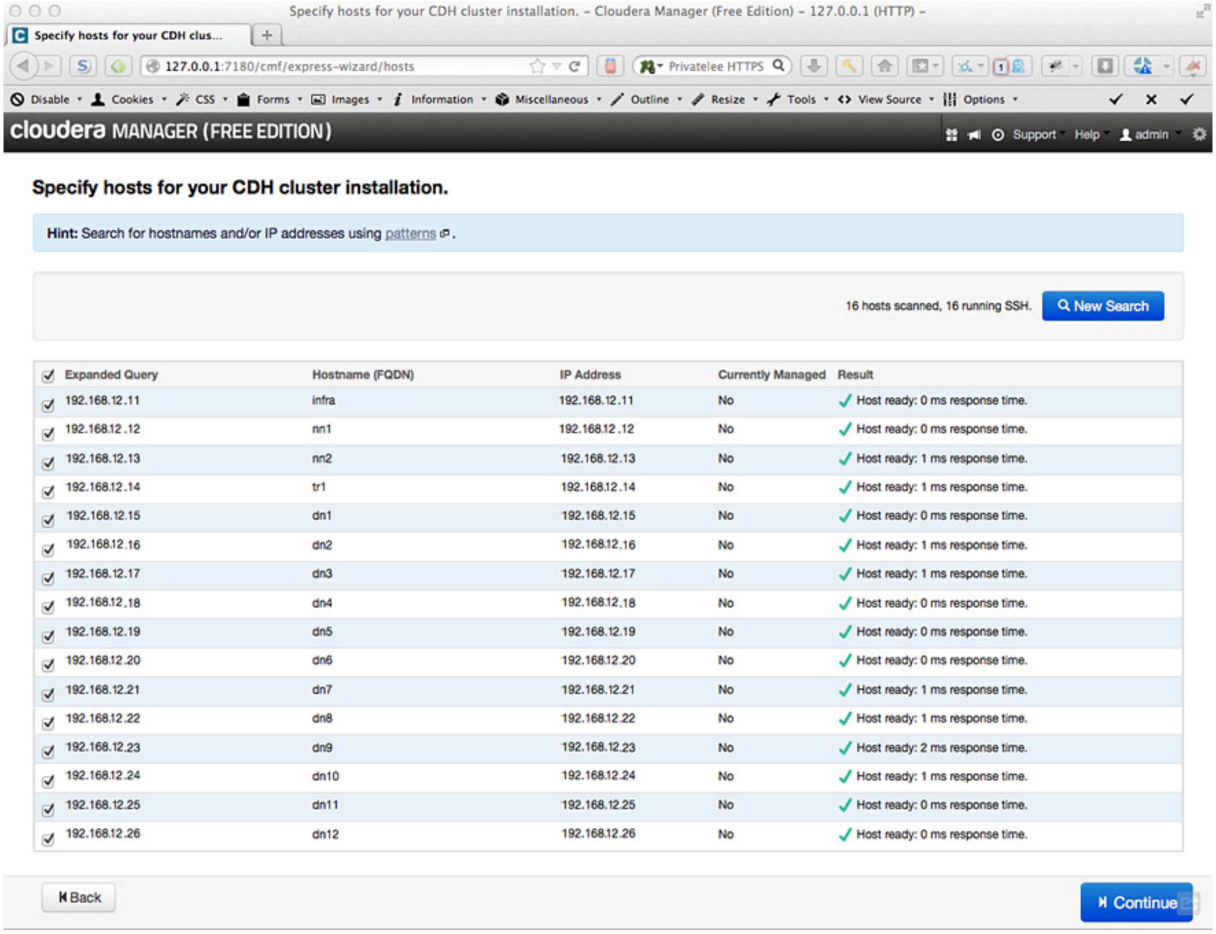
Hint: Search for hostnames and/or IP addresses using patterns .

192.168.12.[11-26]

SSH Port: 22

10. Cloudera Manager will “discover” the nodes in the cluster. Verify that all desired nodes have been found and selected for installation.
11. Click **Install CDH On Selected Host**. CDH is Cloudera Distribution for Apache Hadoop.

Figure 133 Verifying and Selecting the Hosts


Specify hosts for your CDH cluster installation. – Cloudera Manager (Free Edition) – 127.0.0.1 (HTTP) –
Specify hosts for your CDH clus...
127.0.0.1:7180/cmf/express-wizard/hosts
Privatelee HTTPS
Disable
Cookies
CSS
Forms
Images
Information
Miscellaneous
Outline
Resize
Tools
View Source
Options
cloudera MANAGER (FREE EDITION)
Support
Help
admin

Specify hosts for your CDH cluster installation.

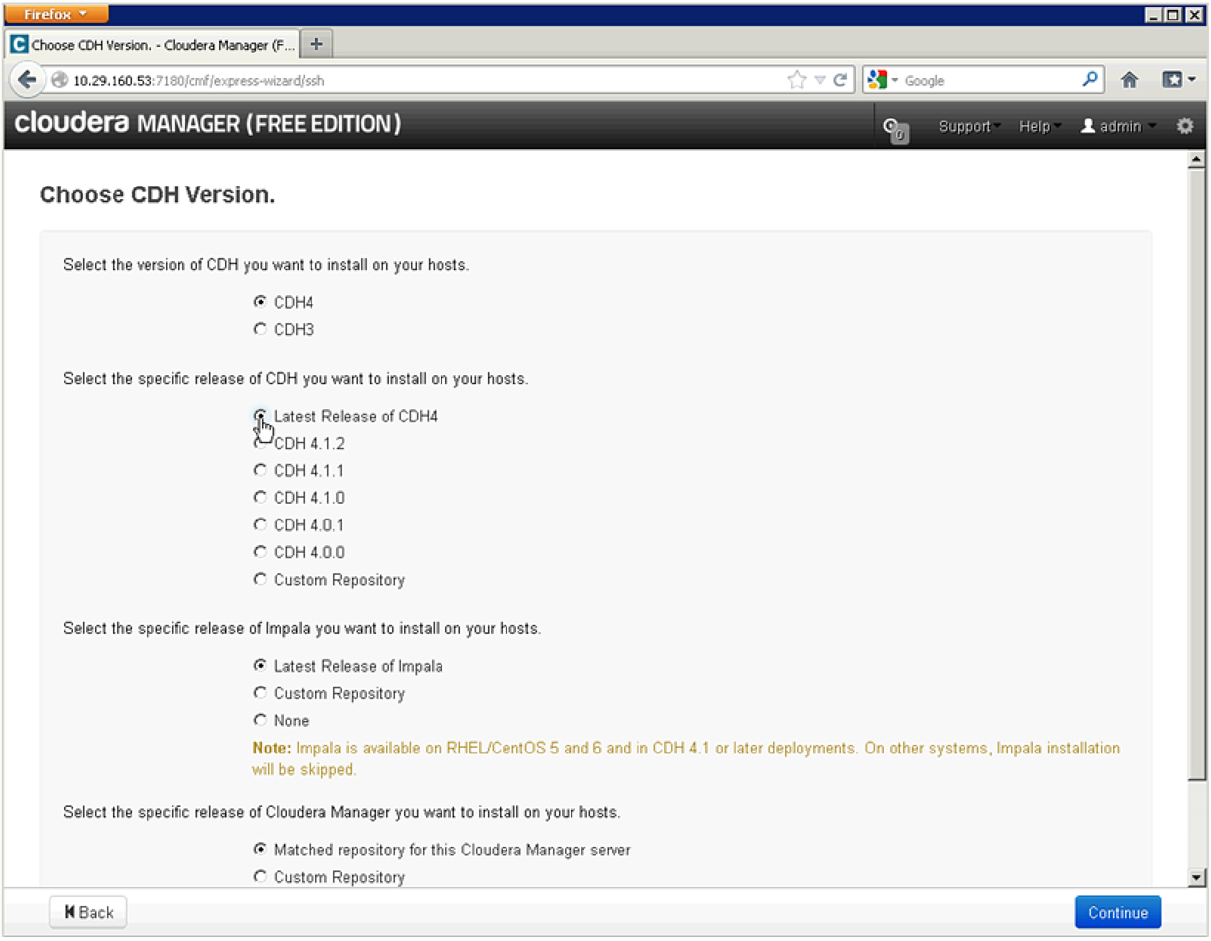
Hint: Search for hostnames and/or IP addresses using patterns.

16 hosts scanned, 16 running SSH. New Search

☑	Expanded Query	Hostname (FQDN)	IP Address	Currently Managed	Result
☑	192.168.12.11	infra	192.168.12.11	No	✓ Host ready: 0 ms response time.
☑	192.168.12.12	nn1	192.168.12.12	No	✓ Host ready: 0 ms response time.
☑	192.168.12.13	nn2	192.168.12.13	No	✓ Host ready: 1 ms response time.
☑	192.168.12.14	tr1	192.168.12.14	No	✓ Host ready: 1 ms response time.
☑	192.168.12.15	dn1	192.168.12.15	No	✓ Host ready: 0 ms response time.
☑	192.168.12.16	dn2	192.168.12.16	No	✓ Host ready: 1 ms response time.
☑	192.168.12.17	dn3	192.168.12.17	No	✓ Host ready: 1 ms response time.
☑	192.168.12.18	dn4	192.168.12.18	No	✓ Host ready: 0 ms response time.
☑	192.168.12.19	dn5	192.168.12.19	No	✓ Host ready: 0 ms response time.
☑	192.168.12.20	dn6	192.168.12.20	No	✓ Host ready: 0 ms response time.
☑	192.168.12.21	dn7	192.168.12.21	No	✓ Host ready: 1 ms response time.
☑	192.168.12.22	dn8	192.168.12.22	No	✓ Host ready: 1 ms response time.
☑	192.168.12.23	dn9	192.168.12.23	No	✓ Host ready: 2 ms response time.
☑	192.168.12.24	dn10	192.168.12.24	No	✓ Host ready: 1 ms response time.
☑	192.168.12.25	dn11	192.168.12.25	No	✓ Host ready: 0 ms response time.
☑	192.168.12.26	dn12	192.168.12.26	No	✓ Host ready: 0 ms response time.

12. For the CDH version, select **CDH4** radio button.

Figure 134 Selecting the CDH Version


Firefox
Choose CDH Version. - Cloudera Manager (F...
10.29.160.53:7180/cmf/express-wizard/ssh
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin

Choose CDH Version.

Select the version of CDH you want to install on your hosts.

● CDH4
○ CDH3

Select the specific release of CDH you want to install on your hosts.

● Latest Release of CDH4
○ CDH 4.1.2
○ CDH 4.1.1
○ CDH 4.1.0
○ CDH 4.0.1
○ CDH 4.0.0
○ Custom Repository

Select the specific release of Impala you want to install on your hosts.

● Latest Release of Impala
○ Custom Repository
○ None

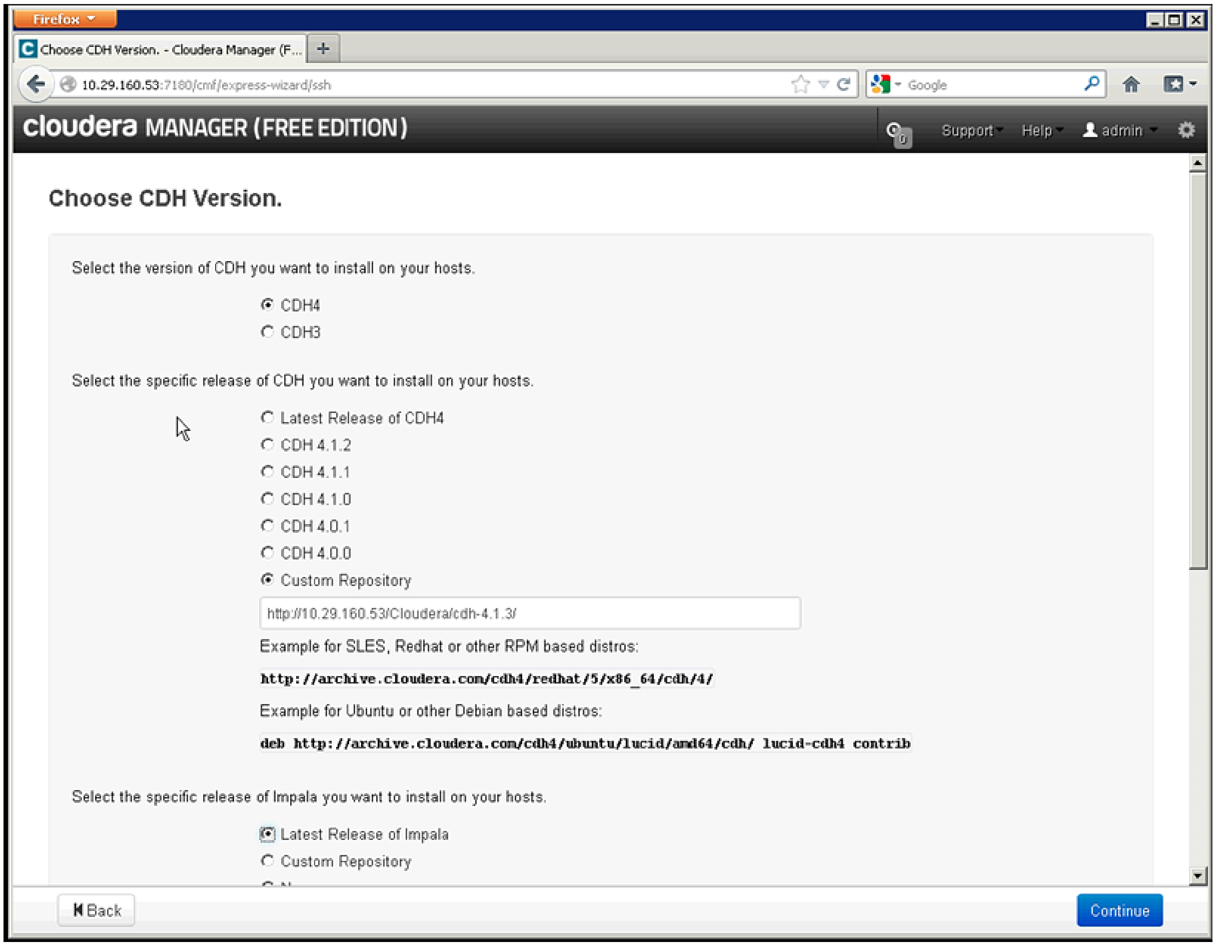
Note: Impala is available on RHEL/CentOS 5 and 6 and in CDH 4.1 or later deployments. On other systems, Impala installation will be skipped.

Select the specific release of Cloudera Manager you want to install on your hosts.

● Matched repository for this Cloudera Manager server
○ Custom Repository

13. For the specific CDH release, select **Custom Repository** radio button.
14. Enter the URL for the repository in the Infrastructure server.

Figure 135 Selecting Specific CDH Release


Firefox
Choose CDH Version. - Cloudera Manager (F...
10.29.160.53:7180/cmf/express-wizard/ssh
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin
Back
Continue

Choose CDH Version.

Select the version of CDH you want to install on your hosts.

● CDH4
○ CDH3

Select the specific release of CDH you want to install on your hosts.

○ Latest Release of CDH4
○ CDH 4.1.2
○ CDH 4.1.1
○ CDH 4.1.0
○ CDH 4.0.1
○ CDH 4.0.0
● Custom Repository

http://10.29.160.53/Cloudera/cdh-4.1.3/

Example for SLES, Redhat or other RPM based distros:

```
http://archive.cloudera.com/cdh4/redhat/5/x86_64/cdh/4/
```

Example for Ubuntu or other Debian based distros:

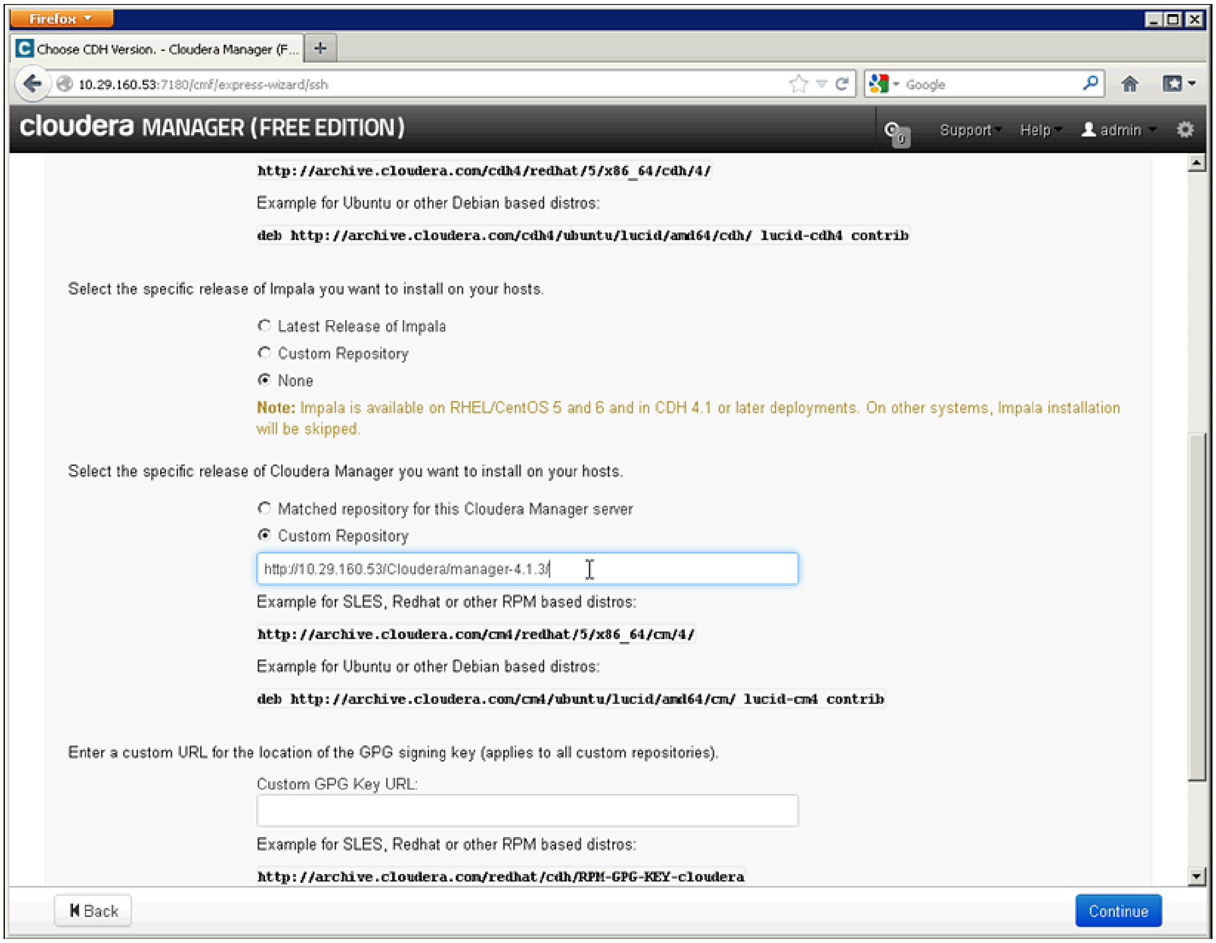
```
deb http://archive.cloudera.com/cdh4/ubuntu/lucid/amd64/cdh/ lucid-cdh4 contrib
```

Select the specific release of Impala you want to install on your hosts.

● Latest Release of Impala
○ Custom Repository

15. We will not be installing Impala.
16. For the specific Impala release, select **None** radio button.
17. For the specific release of Cloudera Manager, select **Custom Repository** radio button.
18. Enter the URL for the repository in the Infrastructure server.

Figure 136 Other Installation Details for the Cluster


Firefox
Choose CDH Version. - Cloudera Manager (F...
10.29.160.53:7180/cmf/express-wizard/ssh
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin
Back
Continue

```
http://archive.cloudera.com/cdh4/redhat/5/x86_64/cdh/4/
```

Example for Ubuntu or other Debian based distros:

```
deb http://archive.cloudera.com/cdh4/ubuntu/lucid/amd64/cdh/ lucid-cdh4 contrib
```

Select the specific release of Impala you want to install on your hosts.

○ Latest Release of Impala
○ Custom Repository
● None

Note: Impala is available on RHEL/CentOS 5 and 6 and in CDH 4.1 or later deployments. On other systems, Impala installation will be skipped.

Select the specific release of Cloudera Manager you want to install on your hosts.

○ Matched repository for this Cloudera Manager server
● Custom Repository

http://10.29.160.53/Cloudera/manager-4.1.3/

Example for SLES, Redhat or other RPM based distros:

```
http://archive.cloudera.com/cm4/redhat/5/x86_64/cm/4/
```

Example for Ubuntu or other Debian based distros:

```
deb http://archive.cloudera.com/cm4/ubuntu/lucid/amd64/cm/ lucid-cm4 contrib
```

Enter a custom URL for the location of the GPG signing key (applies to all custom repositories).

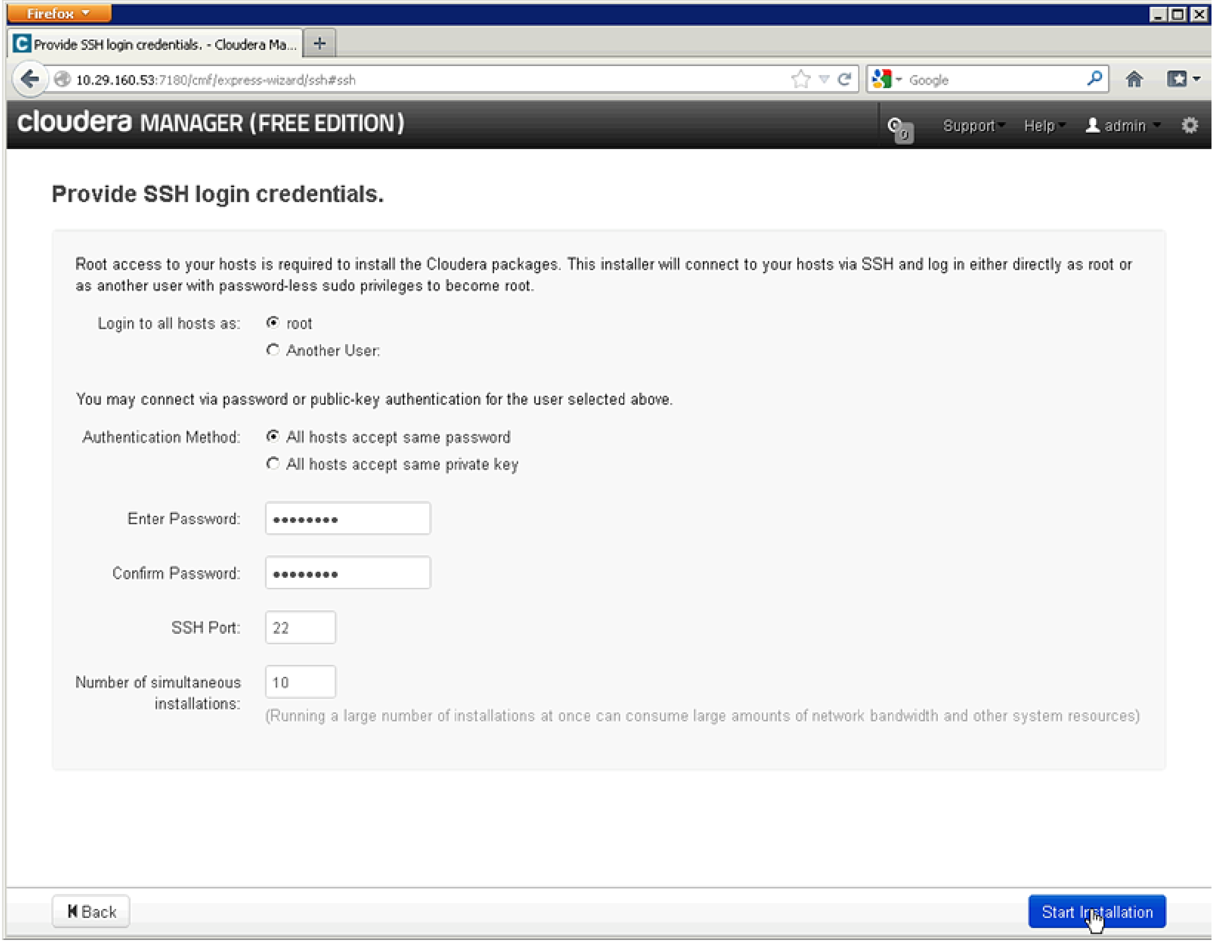
Custom GPG Key URL:

Example for SLES, Redhat or other RPM based distros:

```
http://archive.cloudera.com/redhat/cdh/RPM-GPG-KEY-cloudera
```

19. Click **Continue**
20. For this example, all hosts accept the same password.
21. Enter the password in both boxes.
22. Click **Start Installation**.

Figure 137 Login Credentials to Start CDH Installation



Firefox
Provide SSH login credentials. - Cloudera Ma...
10.29.160.53:7180/cmf/express-wizard/ssh#ssh
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin

Provide SSH login credentials.

Root access to your hosts is required to install the Cloudera packages. This installer will connect to your hosts via SSH and log in either directly as root or as another user with password-less sudo privileges to become root.

Login to all hosts as: ● root ○ Another User:

You may connect via password or public-key authentication for the user selected above.

Authentication Method: ● All hosts accept same password ○ All hosts accept same private key

Enter Password: ••••••••

Confirm Password: ••••••••

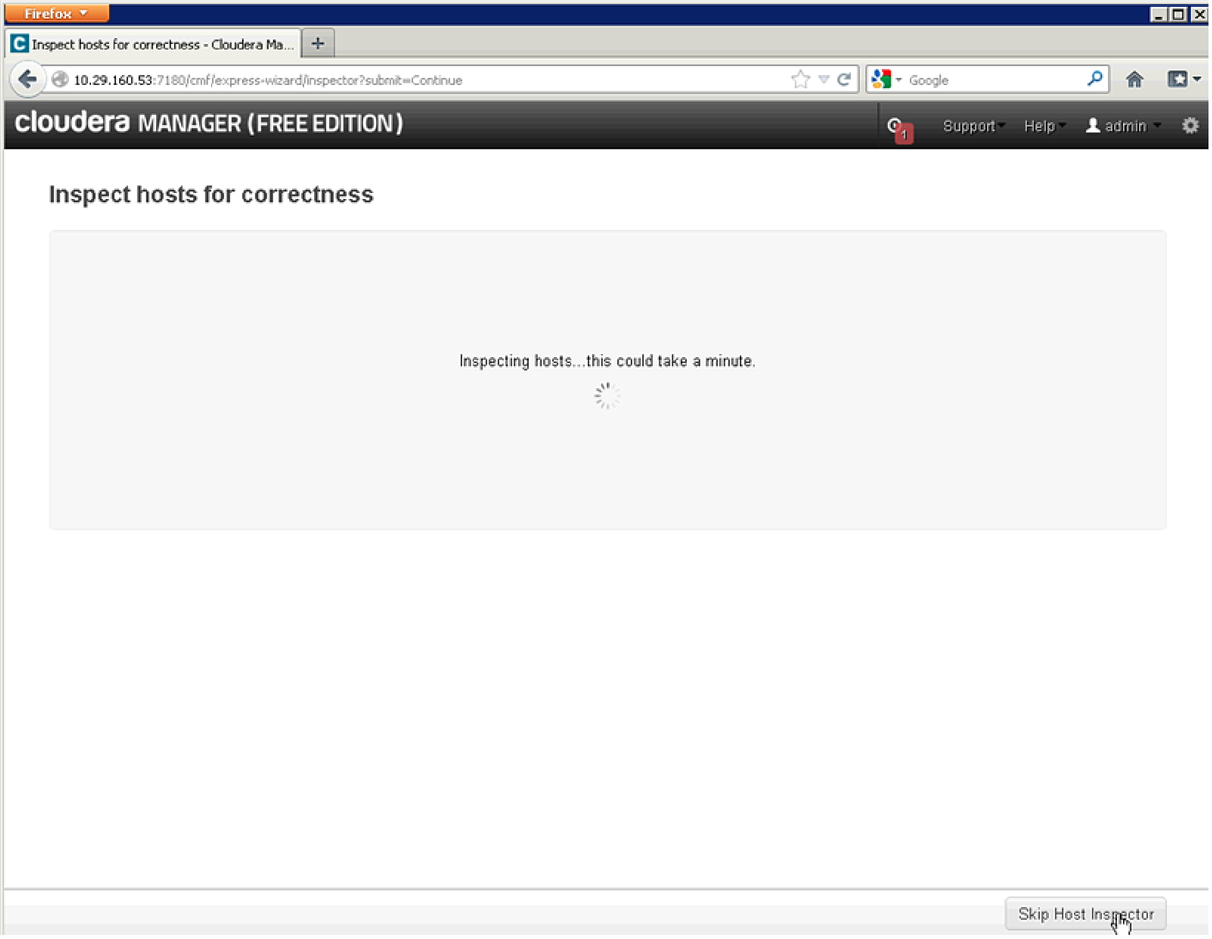
SSH Port: 22

Number of simultaneous installations: 10

(Running a large number of installations at once can consume large amounts of network bandwidth and other system resources)

23. Wait for Cloudera Manager to install the CM4 and CDH4 software on all of the nodes in the cluster.
24. After the installation is complete, click **Continue.**
25. Wait for Cloudera Manager to inspect the hosts on which it has just performed the installation.

Figure 138 Inspecting Hosts

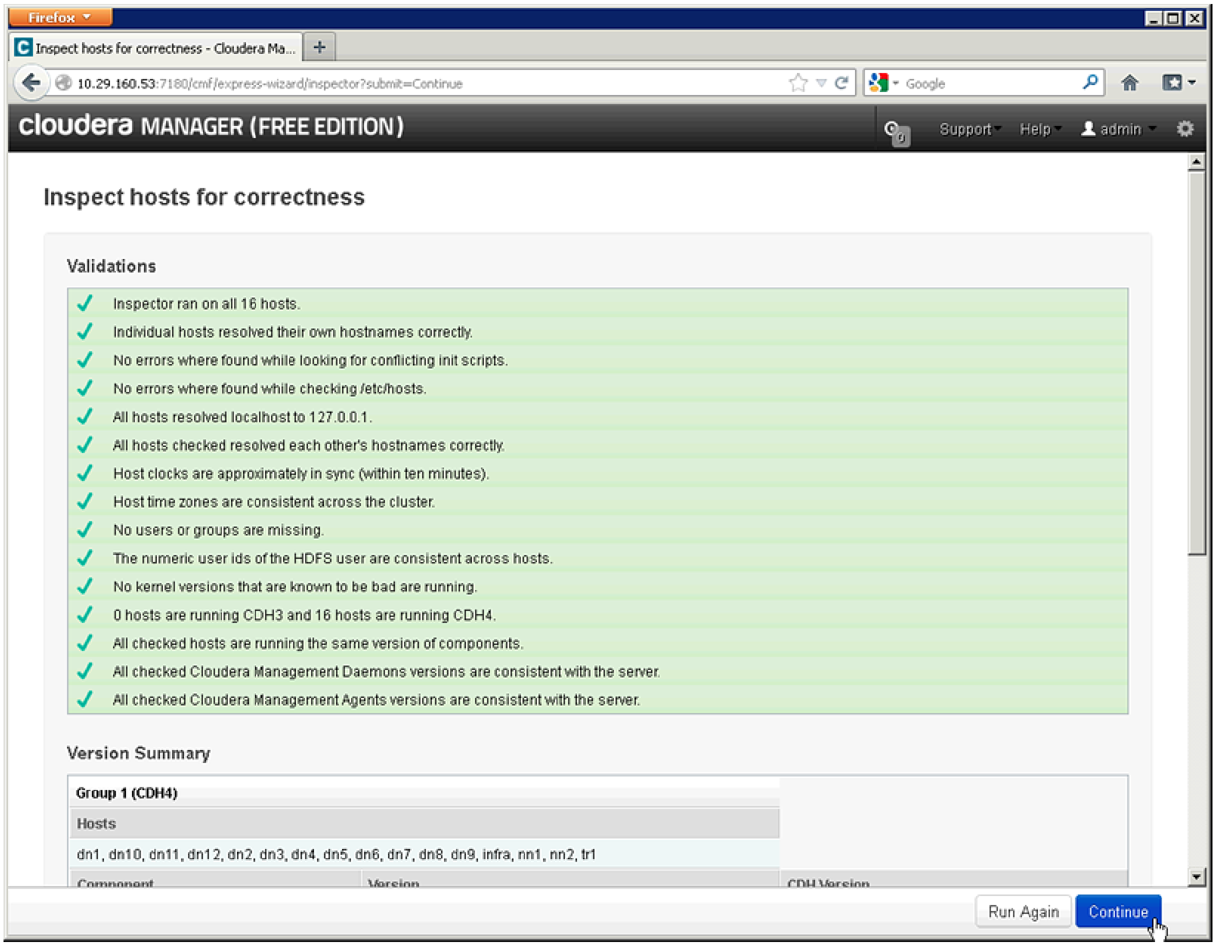

Firefox
Inspect hosts for correctness - Cloudera Ma...
10.29.160.53:7180/cmf/express-wizard/inspector?submit=Continue
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin

Inspect hosts for correctness

Inspecting hosts...this could take a minute.

26. Click **Continue**.

Figure 139 Inspecting Hosts for Correctness



Firefox
Inspect hosts for correctness - Cloudera Ma...
10.29.160.53:7180/cmf/express-wizard/inspector?submit=Continue
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin

Inspect hosts for correctness

Validations

- ✓ Inspector ran on all 16 hosts.
- ✓ Individual hosts resolved their own hostnames correctly.
- ✓ No errors where found while looking for conflicting init scripts.
- ✓ No errors where found while checking /etc/hosts.
- ✓ All hosts resolved localhost to 127.0.0.1.
- ✓ All hosts checked resolved each other's hostnames correctly.
- ✓ Host clocks are approximately in sync (within ten minutes).
- ✓ Host time zones are consistent across the cluster.
- ✓ No users or groups are missing.
- ✓ The numeric user ids of the HDFS user are consistent across hosts.
- ✓ No kernel versions that are known to be bad are running.
- ✓ 0 hosts are running CDH3 and 16 hosts are running CDH4.
- ✓ All checked hosts are running the same version of components.
- ✓ All checked Cloudera Management Daemons versions are consistent with the server.
- ✓ All checked Cloudera Management Agents versions are consistent with the server.

Version Summary

Group 1 (CDH4)

Hosts

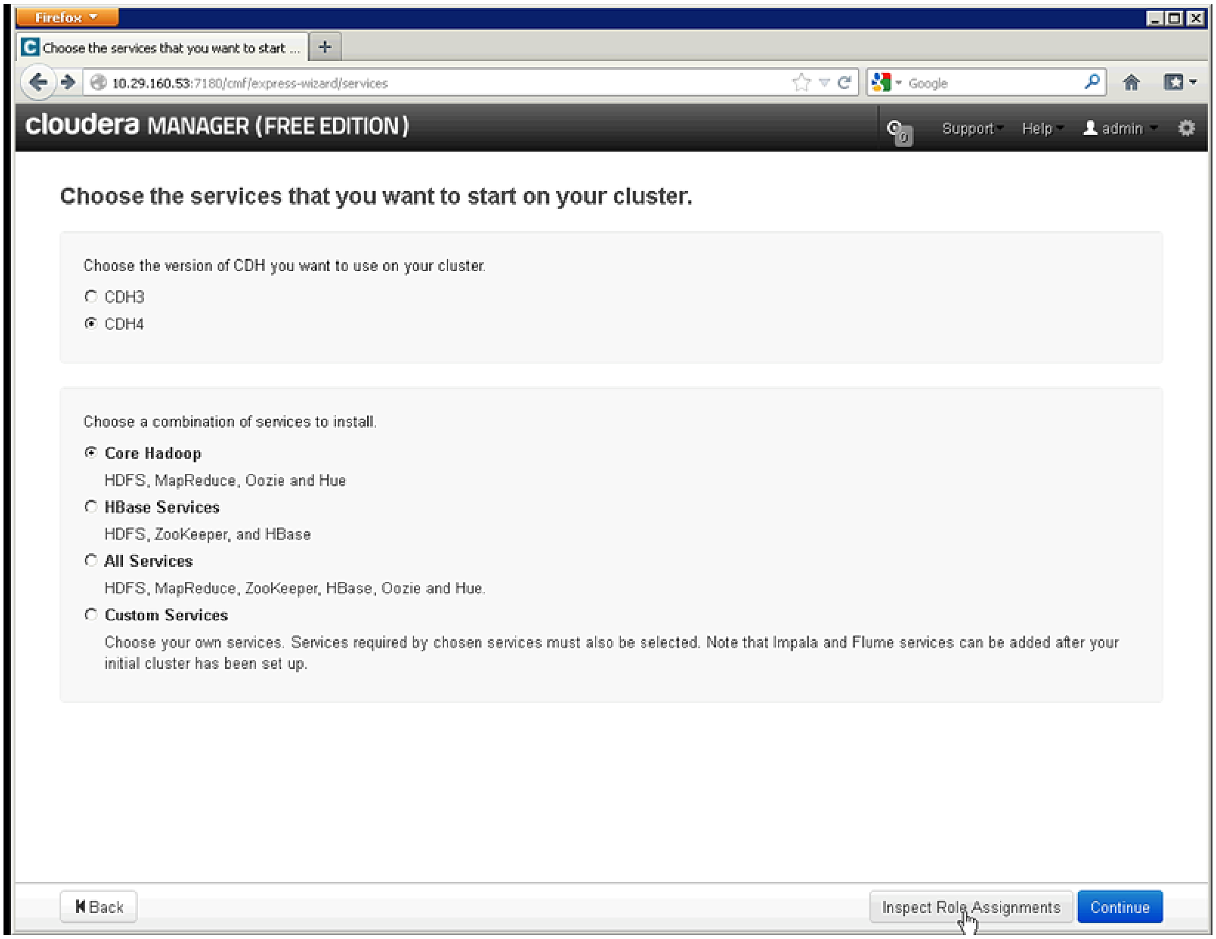
dn1, dn10, dn11, dn12, dn2, dn3, dn4, dn5, dn6, dn7, dn8, dn9, infra, nn1, nn2, tr1

Component Version CDH Version

27. Make sure that CDH4 and Core Hadoop are selected.

28. Click **Inspect Role Assignments.**

Figure 140 Selecting CDH Version and Services



Firefox
Choose the services that you want to start ...
10.29.160.53:7180/cmf/express-wizard/services
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin

Choose the services that you want to start on your cluster.

Choose the version of CDH you want to use on your cluster.

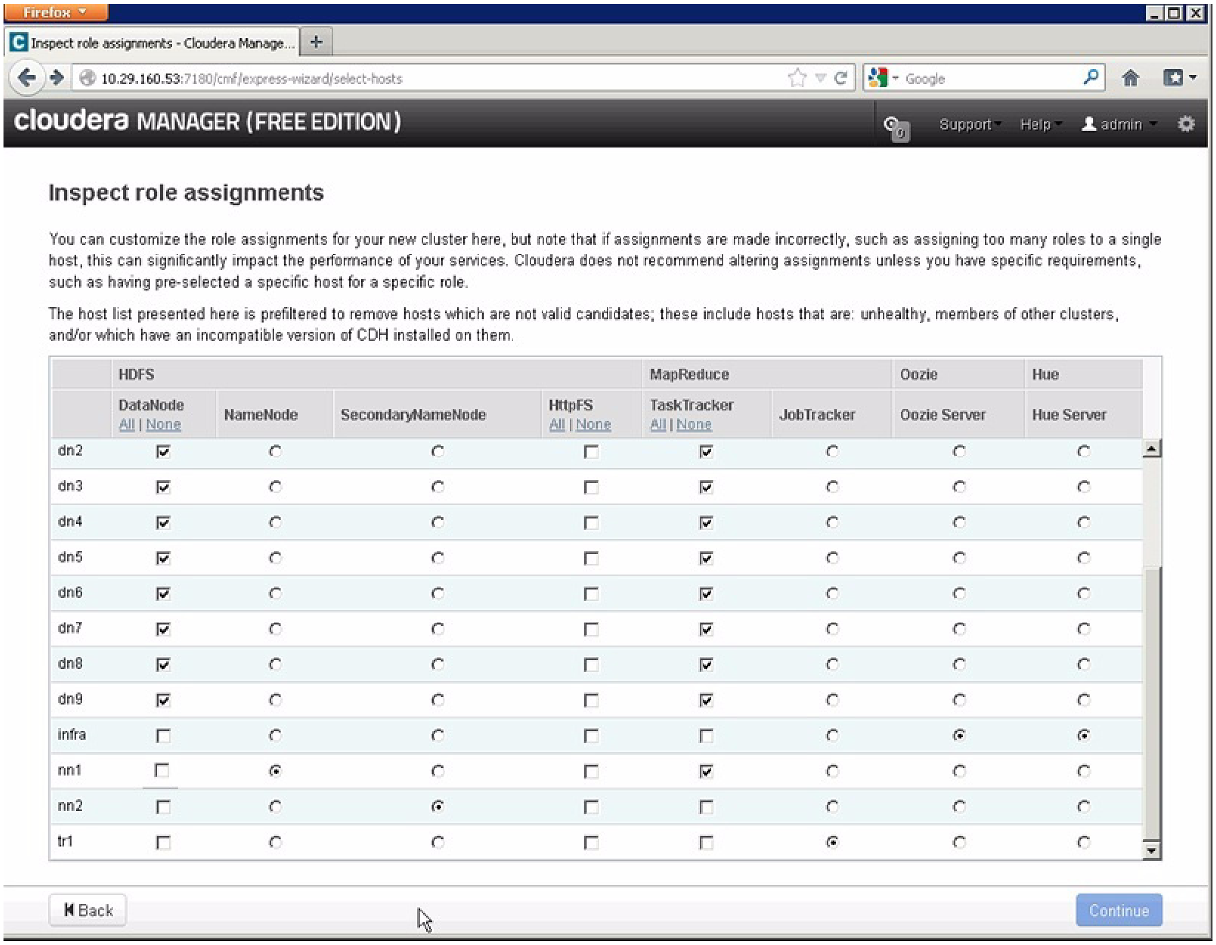
○ CDH3
● CDH4

Choose a combination of services to install.

● **Core Hadoop**
HDFS, MapReduce, Oozie and Hue
○ **HBase Services**
HDFS, ZooKeeper, and HBase
○ **All Services**
HDFS, MapReduce, ZooKeeper, HBase, Oozie and Hue.
○ **Custom Services**
Choose your own services. Services required by chosen services must also be selected. Note that Impala and Flume services can be added after your initial cluster has been set up.

29. Inspect the node role assignments and adjust as needed. In this case, we have specific nodes configured for Name, Tracker and Infrastructure.

Figure 141 Reviewing the Role Assignments


Firefox
Inspect role assignments - Cloudera Manage...
10.29.160.53:7180/cmf/express-wizard/select-hosts
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin
Back
Continue

Inspect role assignments

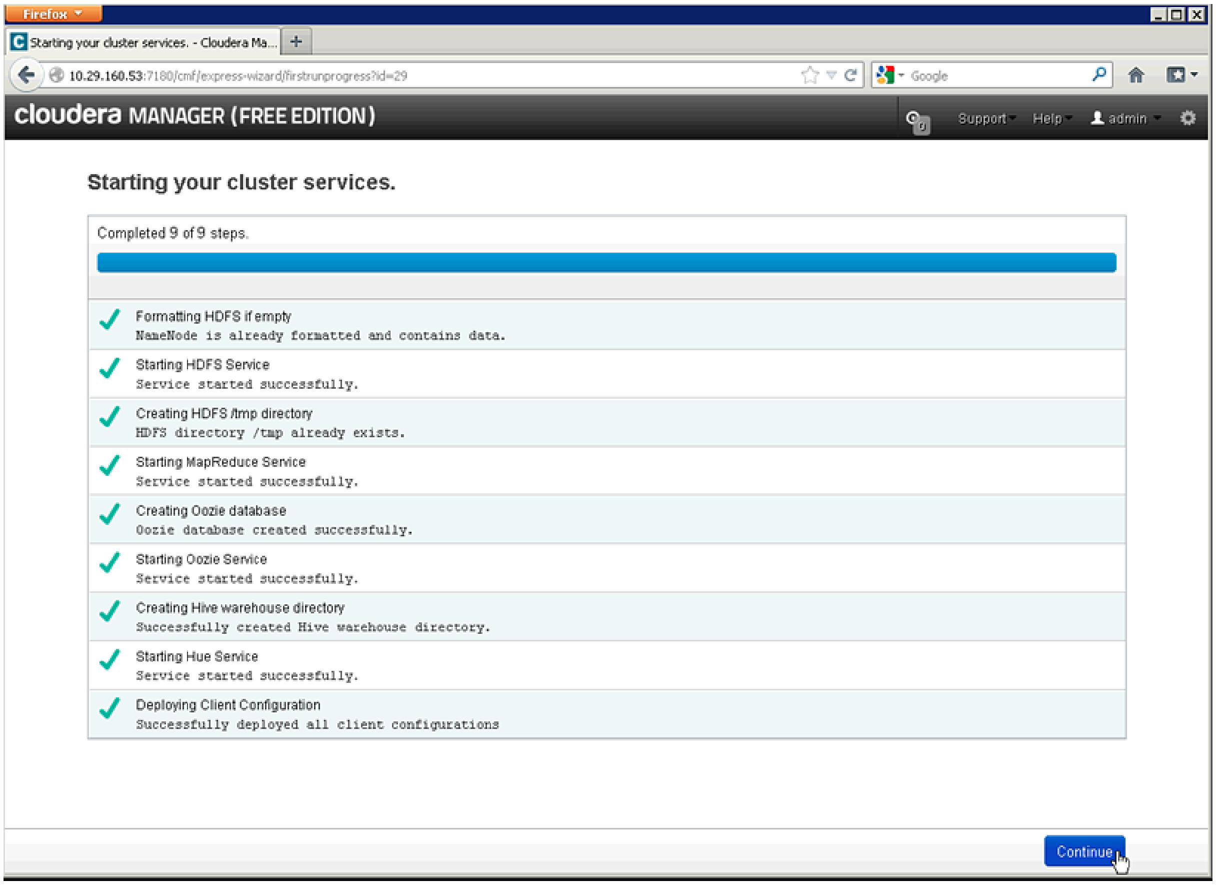
You can customize the role assignments for your new cluster here, but note that if assignments are made incorrectly, such as assigning too many roles to a single host, this can significantly impact the performance of your services. Cloudera does not recommend altering assignments unless you have specific requirements, such as having pre-selected a specific host for a specific role.

The host list presented here is prefiltered to remove hosts which are not valid candidates; these include hosts that are: unhealthy, members of other clusters, and/or which have an incompatible version of CDH installed on them.

	HDFS				MapReduce		Oozie	Hue
	DataNode All | None	NameNode	SecondaryNameNode	HttpFS All | None	TaskTracker All | None	JobTracker	Oozie Server	Hue Server
dn2	☑	○	○	□	☑	○	○	○
dn3	☑	○	○	□	☑	○	○	○
dn4	☑	○	○	□	☑	○	○	○
dn5	☑	○	○	□	☑	○	○	○
dn6	☑	○	○	□	☑	○	○	○
dn7	☑	○	○	□	☑	○	○	○
dn8	☑	○	○	□	☑	○	○	○
dn9	☑	○	○	□	☑	○	○	○
infra	□	○	○	□	□	○	●	●
nn1	□	●	○	□	☑	○	○	○
nn2	□	○	●	□	□	○	○	○
tr1	□	○	○	□	□	●	○	○

30. Once the roles are set correctly, click **Continue.**
31. Click **Continue** to start the Cluster Services.
32. Now your Cisco – NetApp – Cloudera Hadoop cluster is ready to use.
33. Click **Continue**.
34. Cloudera Manager showing the status of the cluster.

Figure 142 Cluster Services are Ready


Firefox
Starting your cluster services. - Cloudera Ma...
10.29.160.53:7180/cmf/express-wizard/firstrunprogress?id=29
Google
cloudera MANAGER (FREE EDITION)
Support
Help
admin
Continue

Starting your cluster services.

Completed 9 of 9 steps.

✓ Formatting HDFS if empty
```
NameNode is already formatted and contains data.
```
✓ Starting HDFS Service
```
Service started successfully.
```
✓ Creating HDFS /tmp directory
```
HDFS directory /tmp already exists.
```
✓ Starting MapReduce Service
```
Service started successfully.
```
✓ Creating Oozie database
```
Oozie database created successfully.
```
✓ Starting Oozie Service
```
Service started successfully.
```
✓ Creating Hive warehouse directory
```
Successfully created Hive warehouse directory.
```
✓ Starting Hue Service
```
Service started successfully.
```
✓ Deploying Client Configuration
```
Successfully deployed all client configurations
```

35. Click **Continue** to start using Cloudera services.

Conclusion

FlexPod Select for Hadoop is an innovative solution that combines technologies from the market leaders to enhance reliability and capacity. The fully redundant fabric architecture with industry-leading namenode resiliency, RAID protection with data replication and hot-swappable spares can significantly lower the risk of failure and application downtime. Leading edge Hadoop management tools provide an analytic stack for big data that is highly reliable, scalable and easier to operate.

The solution addresses today's data-driven environment, in which complex and large data sets need to be processed quickly and efficiently. Seamless data and management integration capabilities co-exist with FlexPod running enterprise applications such as Oracle®, Microsoft®, and SAP®, among many others. Compatibility with traditional FlexPod deployments, that is, the existing resources, can still be used and extended. The solution is offered in a master and an expansion configuration for easy scaling. This is a pre-validated solution that enables quick and easy deployment.

Bill of Materials

The FlexPod Select for Hadoop is offered in a master configuration and an expansion configuration for easy scaling.

Up to 160 servers, 2560 processor cores, and up to 10 petabytes of user storage capacity is supported in one single domain. Applications that need to scale beyond one domain can interconnect several UCS domains using Cisco Nexus Series switches. Scalable to thousands of servers and hundreds of petabytes of data, these domains can be managed from a single pane by using UCS Central in a data center or in remote global locations.

This section provides the hardware and software specifications for deploying the FlexPod Select for Hadoop.

Cisco Bill of Materials

Table 11 provides Cisco BOM for both master rack and expansion rack solutions.

Table 11 Cisco BOM

Hardware / Software	Description	Master Rack Quantity	Expansion Rack Quantity
Cisco UCS C220M3 Servers (UCSC-C220-M3S)	UCS C220 M3 SFF w/o CPU mem HDD PCIe PSU w/ rail kit	16	16
CON-UCW3-C220M3SF	UC PLUS 24X7X4 UCS C220 M3 SFF w/o	48	48
UCS-CPU-E5-2680*	2.70 GHz E5-2680 130W 8C/20MB Cache/DDR3 1600MHz	32	32
UCS-MR-1X162RY-A	16GB DDR3-1600-MHz RDIMM/PC3-12800/dual rank/1.35v	256	256
A03-D600GA2	600GB 6Gb SAS 10K RPM SFF HDD/hot plug/drive sled mounted	32	32
CAB-N5K6A-NA	Power Cord, 200/240V 6A, North America	32	32
UCSC-PSU-650W	650W power supply for C-series rack servers	32	32
UCSC-RAID-ROM55	Embedded SW RAID 0/1/10/5 8 ports SAS/SATA	16	16
UCSC-PCIE-CSC-02	Cisco VIC 1225 Dual Port 10Gb SFP+ CAN	16	16
N20-BBLKD	UCS 2.5 inch HDD blanking panel	96	96

Table 11 Cisco BOM

Hardware / Software	Description	Master Rack Quantity	Expansion Rack Quantity
UCSC-HS-C220M3	Heat Sink for UCS C220 M3 Rack Server	32	32
UCSC-PCIF-01F	Full height PCIe filler for C-Series	16	16
UCSC-PCIF-01H	Half height PCIe filler for UCS	16	16
UCSC-RAIL1	Rail Kit for C220 C22 C24 rack servers	16	16
Cisco RP208-30-1P-U-1	Cisco RP208-30-U-1 Single Phase PDU 2x C13 4x C19	2	2
CON-UCW3-RPDUX	UC PLUS 24X7X4 Cisco RP208-30-U-X Single Phase PDU 2x	6	6
RACK-BLANK-001	Filler panels (qty 12) 1U plastic toolless	1	1
Cisco R42610 standard rack (RACK-UCS2)	Cisco R42610 standard rack w/side panels	1	1
Cisco RP208-30-1P-U-2	Cisco RP208-30-U-2 Single Phase PDU 20x C13 4x C19	2	2
CON-UCW3-RPDUX	UC PLUS 24X7X4 Cisco RP208-30-U-X Single Phase PDU 2x	12	12
Cisco UCS 6296UP Fabric Interconnect (UCS-FI-6296UP)	UCS 6296UP 2RU Fabric Int/No PSU/48 UP/ 18p LIC	2	-
UCS-PSU-6296UP-AC	UCS 6296UP Power Supply/100-240VAC	4	-
CON-UCW7-FI6296UP	36X24X7 Support UCS 6296UP 2RU Fabric Int/2 PSU/4 Fans	1	-
Cisco Catalyst 2960S (WS-C2960S-48FPS-L)	Catalyst 2960S 48 GigE PoE 740W, 4 x SFP LAN Base	1	-
CON-SNT3-2960S4FS	SMARTNET 3YR 8X5XNBD Cat2960S Stk48 GigE PoE 740W,4xSFP Base	1	-
Cisco Nexus 2232PP Fabric Extender (N2K-UCS2232PP-10GE)	N2K 10GE, 2 AC PS, 1 Fan (Std Air), 32x1/10GE+8x10GE	2	2
CON-SNTP-N2232F	Smart Net Services 24X7X4	6	6
SFP-H10GB-CU3M	10GBASE-CU SFP+ Cable 3 Meter	16	16

Table 11 Cisco BOM

Hardware / Software	Description	Master Rack Quantity	Expansion Rack Quantity
SFP-H10GB-CU2M	10GBASE-CU SFP+ Cable 2 Meter	20	16
SFP-H10GB-CU1M	10GBASE-CU SFP+ Cable 1 Meter	16	16**

* E5-2680 can be replaced with E5-2670v2.

** Select appropriate cables based on distance to base rack

(8 uplinks from N2K toUCS6296)

Note Contact your Cisco sales representatives for additional information.

NetApp Bill of Materials

Table 12 provides NetApp BOM for both master rack and expansion rack solutions.

Table 12 NetApp BOM

Hardware / Software	Description	Master Rack Quantity	Expansion Rack Quantity
NetApp FAS Components			
FAS2220-6X1TB-R6	FAS2220, 6x1TB, base	1	0
X800E-R6	Power cable North America, R6	2	0
X5526A-R6	Rackmount Kit, 4-Post,Universal, R6	1	0
NetApp E-Series Components			
E5400-SYS-R6	E5400, SYS, -R6	3	4
X5526A-R6	E5400A, 6GB Controller	6	8
DE6600-SYS-ENCL-R6	DE6600 system enclosure	3	4
E-X5680A-R6	Enclosure, 4U-60, DE6600, empty, 2PS	3	4
X-54736-00- R6	HIC, E5400, E5500, SAS, 4-Port, 6Gb	6	8
E-X4021A-10-R6	Disk Drives,10x3TB,7.2k, DE6600	18	24
X-48619-00-R6	Battery, 5400	6	8
Software Licensing			

Table 12 NetApp BOM

Hardware / Software	Description	Master Rack Quantity	Expansion Rack Quantity
SW-2220-ONTAP8-P	SW, Data ONTAP® Essentials, 2220-P	1	0
SW-NFS-C	SW, NFS, -C	1	0
SW-CIFS-C	SW, CIFS, -C	1	0
SW-FCP-C	SW, FCP, -C	1	0
SW-ISCSI-C	SW, iSCSI, -C	1	0

Related Information

Table 13 provides information on RHEL specifications for both master rack and expansion rack solutions.

Table 13 Red Hat Enterprise Linux specifications

Red Hat Enterprise Linux	Description	Master Rack Quantity	Expansion Rack Quantity
RHEL-2S-1G-3A	Rhel/2 Socket/1 Guest/3Yr Svcs Required	16	16
CON-ISV1-RH2S1G3A	ISV 24X7 Rhel/2 Socket/1 Guest List Price 3Y	16	16

Table 14 provides information on the other hardware/software specifications required for both master rack and expansion rack solutions.

For information on LSI products and information on how to buy these products, see:

http://www.lsi.com/channel/products/storagecomponents/Pages/LSISAS9200-8e.aspx

Table 14 LSI Hardware/Software specifications

Hardware/Software	Description	Master Rack Quantity	Expansion Rack Quantity
LSI 00118	LSI SAS 9200-8e HBA*	12	16
LSI CBL-SFF8088 SAS-20M	2M External Mini SAS SFF-8088(26-pin 4x) to Mini-SAS SFF-8088 (26-pin 4x) Cables	12	16
LSI 00118	Support	12	16

*LSI SAS 9200-8e HBA can be replaced with LSI SAS 9207-8e HBA.

Note Contact your Cisco sales representatives for additional information.

Table 15 provides information on the Cloudera software required for both master rack and expansion rack solutions.

Table 15 Cloudera Software specifications

Software	Description	Master Rack Quantity	Expansion Rack Quantity
CECO-2407	Cloudera Enterprise Core CDH	16	16