

Dell EMC Networking OS10EE FCoE Deployment with FSB

Connecting server FCoE CNAs to Fibre Channel storage using Dell EMC PowerSwitch OS10EE switches in FSB and F_Port modes

[Abstract](#)

This document provides the deployment steps for configuring Dell EMC PowerSwitch OS10EE based switches in FSB and F_Port modes.

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1 Introduction

Our vision at Dell EMC is to be the essential infrastructure company from the edge, to the core, and to the cloud. Dell EMC Networking ensures modernization for today's applications and for the emerging cloud-native world. Dell EMC is committed to disrupting the fundamental economics of the market with an open strategy that gives you the freedom of choice for networking operating systems and top-tier merchant silicon. The Dell EMC strategy enables business transformations that maximize the benefits of collaborative software and standards-based hardware, including lowered costs, flexibility, freedom, and security. Dell EMC provides further customer enablement through validated deployment guides which demonstrate these benefits while maintaining a high standard of quality, consistency, and support.

Dell EMC Networking offers several switch models that may be used as a leaf pair in a leaf-spine network environment. Each of these switches can be used as a FIP Snooping Bridge (FSB) to provide transit for Fibre Channel over Ethernet (FCoE) traffic from server nodes to a dedicated FC storage network. Examples of common leaf switches are the S4100 series, S4200 series, and S5200 series switches.

This guide covers configuration of the FCoE and FC portion of the network. The configuration includes two Dell EMC PowerSwitch S4148U-ON switches in F_Port mode, two S5248-ON leaf switches as FSBs, PowerEdge servers, FCoE converged network adapters (CNAs), VMware ESXi hosts, and a Unity 500F storage array. The goal of this guide is to enable a network administrator or deployment services engineer to deploy a pair of OS10EE leaf switches in FSB mode, and a pair of S4148U-ONs in F_Port mode in an FC environment using the hardware and software described.

1.1 Typographical conventions

The CLI and GUI examples in this document use the following conventions:

Monospace Text	CLI examples
<u>Underlined Monospace Text</u>	CLI examples that wrap the page
<i>Italic Monospace Text</i>	Variables in CLI examples
Bold Monospace Text	Commands entered at the CLI prompt, or to highlight information in CLI output
Bold text	UI elements and information that is entered in the GUI

1.2 Attachments

This document in .pdf format includes one or more file attachments. To access attachments in Adobe Acrobat Reader, click the ► icon in the left pane halfway down the page, and then click the 📎 icon.

2 Hardware Overview

This section briefly describes the hardware that is used to validate the deployment examples in this document. [Appendix A](#) contains a complete listing of hardware and software that is validated for this guide.

Note: While the steps in this document were validated using the specified Dell EMC PowerSwitch models and operating system(s), they may be leveraged for other Dell EMC PowerSwitch models utilizing the same networking OS version or later assuming the switch has the available port numbers, speeds, and types. At the date of publication, the S4148U-ON switch is the only OS10 Enterprise Edition (OS10EE) based switch supporting Fibre Channel services.

2.1 Dell EMC PowerSwitch models

This section details the Dell EMC PowerSwitch models used on the portion of the networking topology that is the focus of this document.

2.1.1 Dell EMC PowerSwitch S5248-ON

The Dell EMC PowerSwitch S5248F-ON is a 1-Rack Unit (RU) switch with forty-eight 25GbE SFP28 ports, two 2x100GbE QSFP28-DD ports, and four 100GbE QSFP28 ports. The high-performance S5248F-ON switch is an optimal choice for ToR environments requiring connectivity for 10GbE and 25GbE compute and storage.



Figure 1 Dell EMC PowerSwitch S5248-ON

2.1.2 Dell EMC PowerSwitch S4148U-ON

The S4148U-ON enables converging LAN and SAN traffic in a single 1-RU, multilayer switch. It includes twenty-four 10GbE ports, two 40GbE ports, four 10/25/40/50/100GbE or FC8/16/32 ports, and twenty-four 10GbE or FC8/16 ports. Two S4148U-ONs are used as leaf switches in this guide for Fibre Channel connectivity to the SAN and Ethernet connectivity to the leaf-spine network.



Figure 2 Dell EMC PowerSwitch S4148U-ON

2.1.3 Dell EMC PowerSwitch S3048-ON

The Dell EMC PowerSwitch S3048-ON is a 1-RU switch with forty-eight 1GbE BASE-T ports and four 10GbE SFP+ ports. In this document, one S3048-ON supports out-of-band (OOB) management traffic for all examples.



Figure 3 Dell EMC PowerSwitch S3048-ON

2.2 Storage arrays, Fibre Channel switches, and servers

This section details the supplemental hardware that is used to validate a complete storage solution. Comparable hardware models can be substituted for the hardware that is listed in this section to operate on the network topology described in this document.

2.2.1 Dell EMC Unity 500F storage array

The Unity 500F storage platform delivers all-flash storage with up to 8PB raw capacity. It has concurrent support for NAS, iSCSI, and FC protocols. The Disk Processing Enclosure (DPE) has a 2-RU form factor, redundant Storage Processors (SPs), and supports up to twenty-five 2.5" drives. More 2-RU Disk Array Enclosures (DAEs) may be added providing twenty-five extra drives each.



Figure 4 Dell EMC Unity 500F front view

2.2.2 Dell EMC PowerEdge R740xd server

The Dell EMC PowerEdge R740xd server is a dual socket 2-RU platform that brings scalable storage performance and dataset processing to adapt to various applications. The R740xd server features Intel Xeon processors, with up to 3 terabytes of expandable memory and network interface technologies to cover various high-performance NIC and rNDC network interface options. The server adds extraordinary storage capacity options, making it well-suited for data-intensive applications that require greater storage, without sacrificing I/O performance.



Figure 5 Dell EMC PowerEdge R740xd server

3 Topology overview

This section details the FCoE and FC portions of the network to explain the network design for storage traffic.

In the leaf-spine portion of the topology, the leaf pair can be any OS10EE-based switch model. In this document, the S5248-ON is used. Figure 6 shows the leaf pair functioning in the FSB role to the dedicated FC storage network. The S4148U-ON switches that make up the dedicated storage network have a combination of unified ports (FC or Ethernet) and Ethernet ports that allow the switches to simultaneously connect directly to an FC SAN for storage traffic and to the leaf pair.

Figure 6 shows a leaf-spine topology and dedicated FC SAN:

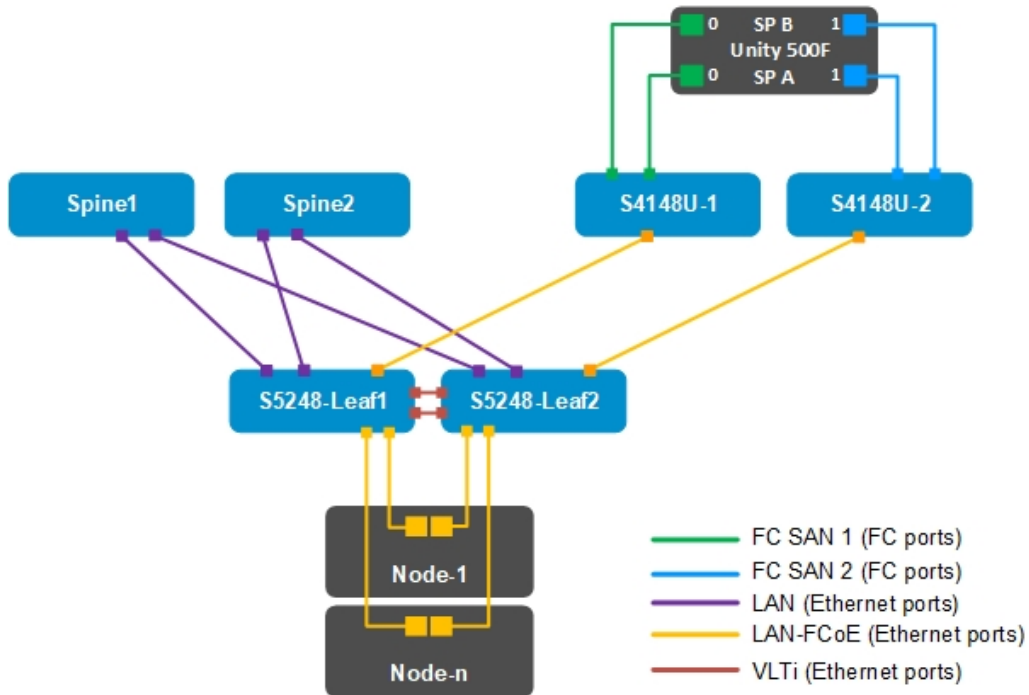


Figure 6 Combined FC SAN and leaf-spine topology

Note: Using a leaf-spine network in the data center is considered a best practice. For additional information about leaf-spine networks, see [Dell EMC Networking Layer 3 Leaf-Spine Deployment and Best Practices with OS10EE](#).

3.1 FC SAN topology detail

Each S4148U-ON switch is placed in F_Port mode. These switches de-encapsulate Fibre Channel over Ethernet (FCoE) frames to extract the Fibre Channel (FC) traffic.

Figure 7 shows the FC SAN topology used in this guide:

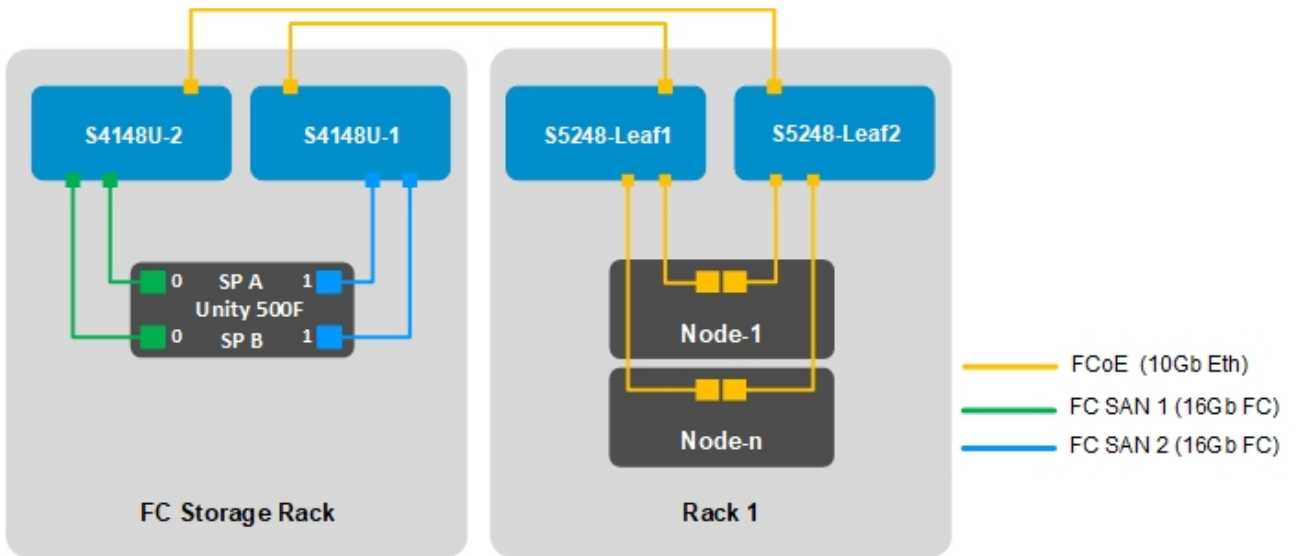


Figure 7 FC SAN topology

3.2 OOB management network

The out-of-band (OOB) management network is an isolated network for management traffic only. It is used by administrators to remotely configure and manage servers, switches, and storage devices. Production traffic that is initiated by network end users does not traverse the management network.

An S3048-ON switch is installed at the top of each rack for OOB management connections as shown.

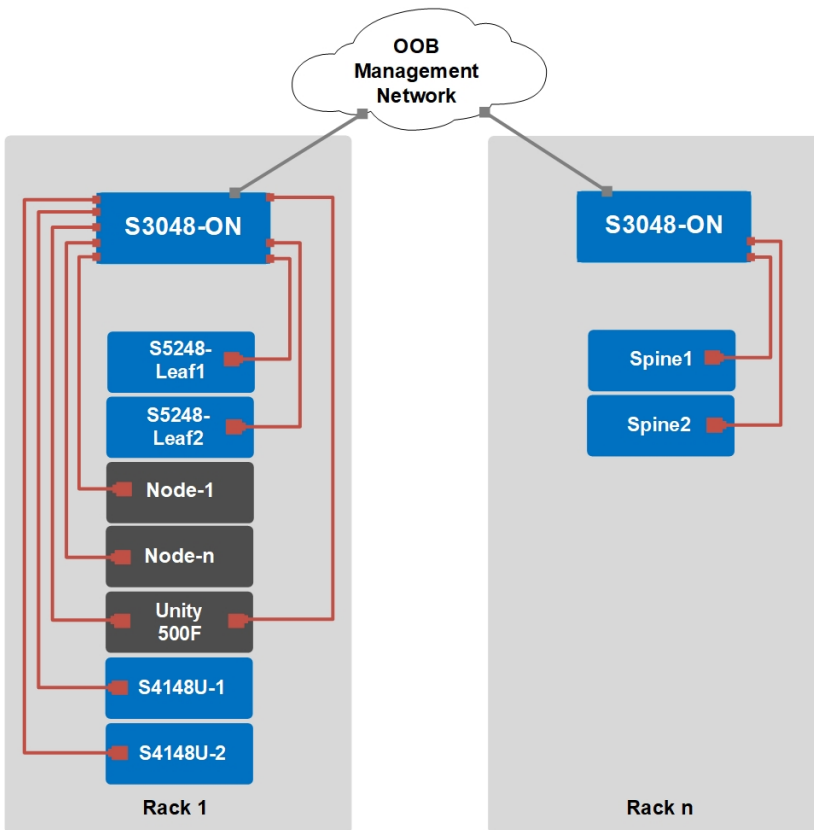


Figure 8 OOB management network connections

Four 10GbE SFP+ ports are available on each S3048-ON switch for use as uplinks to the OOB management network core. Downstream connections to servers, switches, and storage devices are 1GbE BASE-T.

The dedicated OOB management port of each leaf and spine switch is used for these connections. Each PowerEdge R740xd server has a connection to the S3048-ON via the server's iDRAC port.

The Unity 500F storage array has two dedicated management ports - one port for each Storage Processor (SP), SP A and SP B. Both are connected to the S3048-ON.

4 Deployment overview

This section provides high-level guidance for deploying the total solution to include FC storage, networking, server resources, and virtualization.

4.1 Configuration strategy and sequence

This document provides specific configuration examples for the S5248-ON leaf pair and S4148U-ON switch in F_Port mode.

Note: The Dell EMC Unity 500F storage array, and Dell EMC PowerEdge R740xd servers were used to validate the complete solution. For details related to setup and their components, see Appendix A & B.

The following sequence can be used as a guide for how the complete solution can be set up from start to finish. Basic connectivity and related SW installation are required before starting.

4.1.1 FC storage array

1. Create storage pools
2. Add hosts
3. Create LUNs
4. Configure host access

4.1.2 Dell EMC PowerSwitch S4148U-ON switches for FC SAN

1. Configure F_Port mode
2. Enable Data Center Bridging Exchange (DCBx)
3. Configure zoning and activate zone set
4. Disable link-level flow control (LLFC) on interfaces requiring Priority-based Flow Control (PFC)
5. Configure Quality of Service (QoS); PFC with Enhanced Transmission Selection (ETS)
6. Configure interfaces to FSB (PFC, ETS, vFabric)
7. Configure interface to storage array (vFabric)

4.1.3 Dell EMC PowerSwitch S5248-ON leaf switches as FSBs

1. Enable FIP Snooping
2. Enable DCBx
3. Create FCoE VLAN, FCoE map
4. Disable link-level flow control (LLFC) on interfaces requiring PFC
5. Configure QoS (PFC with ETS)
6. Configure interfaces to hosts (PFC, ETS)
7. Configure interfaces to the Fibre Channel Forwarder (FCF); (PFC, ETS, FIP-snooping port mode FCF)

4.1.4 Server HW and Virtualization

1. Enable FCoE on CNAs from BIOS
2. Use VM host adapters to scan for storage
3. Create a SAN-backed datastore

5 S5248-ON FSB leaf switch configuration

This section details steps to configure the S5248-ON leaf switches running OS10EE.

5.1 Prepare switches

5.1.1 Factory default configuration

The configuration commands in the sections that follow begin with S5248-ON switches at their factory default settings. Dell EMC PowerSwitch models running OS10EE can be reset to their default configuration as follows:

```
OS10# delete startup-configuration
Proceed to delete startup-configuration [confirm yes/no(default)]:y

OS10# reload
System configuration has been modified. Save? [yes/no]:n
Proceed to reboot the system? [confirm yes/no]:y
```

The switch reboots to its factory default configuration. Repeat on the second S5248-ON switch.

Note: OS10EE at its default settings has Telnet disabled, SSH enabled, and the OOB management interface that is configured to get its IP address using DHCP. The default username and password are both **admin**. Dell EMC recommends changing the admin password to a complex password during the first login.

5.2 Configure switches

The commands in the tables that follow are run to complete the leaf and FSB configuration on both switches.

Note: The commands in the tables below should be entered in the order shown. Switch running-configuration files are provided as attachments named S5248-Leaf1.txt and S5248-Leaf2.txt.

5.2.1 Configure global switch settings

Configure the hostname, OOB management IP address, and OOB management default gateway.

Configure the port group 1/1/11 for 10GbE. These interfaces are used to connect to the S4148U-ON FCF switches.

S5248-Leaf1	S5248-Leaf2
<pre>configure terminal hostname S5248-Leaf1 interface mgmt 1/1/1 no ip address dhcp ip address 100.67.166.224/24 no shutdown management route 0.0.0.0/0 100.67.166.254</pre>	<pre>configure terminal hostname S5248-Leaf2 interface mgmt 1/1/1 no ip address dhcp ip address 100.67.166.223/24 no shutdown management route 0.0.0.0/0 100.67.166.254</pre>

<pre>spanning-tree mode rstp spanning-tree rstp priority 0 port-group 1/1/11 mode Eth 10g-4x</pre>	<pre>spanning-tree mode rstp spanning-tree rstp priority 4096 port-group 1/1/11 mode Eth 10g-4x</pre>
-----------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------

Note: The default port mode for the first twelve port groups on the S5248-ON switch is 25g-4x. Port mode commands for the link to the S4148U-ON switch are shown above, configured for 10g-4x. For server NICs operating at 10GbE, change the port mode corresponding to the appropriate downstream server interfaces. For more information on mapping ports to port groups, see [OS10 Enterprise Edition User Guide Release 10.4.2.0](#).

5.2.2 Configure VLT between the two S5248-ON switches

VLT synchronizes Layer 2 and ARP table information between the switches and enables a single port channel to be connected to the switch pair as if they are a single switch.

S5248-Leaf1	S5248-Leaf2
<pre>interface range ethernet 1/1/55-1/1/56 no switchport vlt-domain 127 backup destination 100.67.166.223 discovery-interface ethernet 1/1/55 discovery-interface ethernet 1/1/56 peer-routing</pre>	<pre>interface range ethernet 1/1/55-1/1/56 no switchport vlt-domain 127 backup destination 100.67.166.224 discovery-interface ethernet 1/1/55 discovery-interface ethernet 1/1/56 peer-routing</pre>

5.2.3 Configure FSB

The global command `feature fip-snooping` puts the switch in FSB mode.

Configure the FCoE VLAN and set the link to the S4148U-ON switch to FCF mode.

S5248-Leaf1	S5248-Leaf2
<pre>feature fip-snooping interface vlan 1001 fip-snooping enable fip-snooping fc-map 0xEFC64 interface ethernet 1/1/41:1 fip-snooping port-mode fcf</pre>	<pre>feature fip-snooping interface vlan 1002 fip-snooping enable fip-snooping fc-map 0xEFC65 interface ethernet 1/1/41:1 fip-snooping port-mode fcf</pre>

Note: After configuring the port mode on port-group 1/1/11, the OS appends :1 to the interface number 1/1/41:1.

5.2.4 Configure QoS

Quality of Service (QoS) configuration is a 3-step process:

1. Create class maps to classify traffic.
2. Create QoS and policy maps for the classified traffic.
3. Apply the QoS and policy maps.

FCoE traffic is assigned dot1p priority value 3 by default. In the following tables, dot1p priority value 3 is mapped to QoS group 3. The remaining dot1p priority values, 0-2 and 4-7, are mapped to QoS group 0. QoS group 3 is mapped to queue 3, and QoS group 0 is mapped to queue 0. In this example, bandwidth is allocated 50% to queue 3 for FCoE traffic and 50% to queue 0 for all other traffic using the `bandwidth percent` command.

Note: Bandwidth allocations should total 100% and may be adjusted accordingly to optimize traffic.

S5248-Leaf1	S5248-Leaf2
<pre>dcbx enable class-map type network-qos class_Dot1p_3 match qos-group 3 class-map type queuing map_ETSQueue_0 match queue 0 class-map type queuing map_ETSQueue_3 match queue 3 trust dot1p-map map_Dot1pToGroups qos-group 0 dot1p 0-2,4-7 qos-group 3 dot1p 3 qos-map traffic-class map_GroupsToQueues queue 0 qos-group 0 queue 3 qos-group 3 policy-map type network-qos policy_Input_PFC class class_Dot1p_3 pause pfc-cos 3 policy-map type queuing policy_Output_BandwidthPercent class map_ETSQueue_0 bandwidth percent 50 class map_ETSQueue_3 bandwidth percent 50 interface range ethernet 1/1/31- 1/1/34,1/1/41:1 flowcontrol receive off flowcontrol transmit off priority-flow-control mode on ets mode on service-policy input type network-qos policy_Input_PFC</pre>	<pre>dcbx enable class-map type network-qos class_Dot1p_3 match qos-group 3 class-map type queuing map_ETSQueue_0 match queue 0 class-map type queuing map_ETSQueue_3 match queue 3 trust dot1p-map map_Dot1pToGroups qos-group 0 dot1p 0-2,4-7 qos-group 3 dot1p 3 qos-map traffic-class map_GroupsToQueues queue 0 qos-group 0 queue 3 qos-group 3 policy-map type network-qos policy_Input_PFC class class_Dot1p_3 pause pfc-cos 3 policy-map type queuing policy_Output_BandwidthPercent class map_ETSQueue_0 bandwidth percent 50 class map_ETSQueue_3 bandwidth percent 50 interface range ethernet 1/1/31- 1/1/34,1/1/41:1 flowcontrol receive off flowcontrol transmit off priority-flow-control mode on ets mode on service-policy input type network-qos policy_Input_PFC</pre>

S5248-Leaf1	S5248-Leaf2
<pre>service-policy output type queuing policy_Output_BandwidthPercent system qos trust-map dot1p map_Dot1pToGroups qos-map traffic-class map_GroupsToQueues</pre>	<pre>service-policy output type queuing policy_Output_BandwidthPercent system qos trust-map dot1p map_Dot1pToGroups qos-map traffic-class map_GroupsToQueues</pre>

The bulk of the FSB configuration is now complete.

The following steps complete the configuration example by configuring common features found in a Layer 3 leaf-spine network. For more information about leaf-spine networks see [Dell EMC Networking Layer 3 Leaf-Spine Deployment and Best Practices with OS10EE](#).

5.2.5 Configure VLAN interfaces

The VLANs shown in this example represent a generic converged or hyperconverged deployment and should be changed to apply to the deployment specifications.

S5248-Leaf1	S5248-Leaf2
<pre>interface Vlan 1612 ip address 172.16.12.1/24 description "vMotion" no shutdown interface Vlan 1613 ip address 172.16.13.1/24 description "vSAN" no shutdown interface Vlan 1614 ip address 172.16.14.1/24 description "web" no shutdown interface Vlan 1615 ip address 172.16.15.1/24 description "app" no shutdown interface Vlan 1616 ip address 172.16.16.1/24 description "db" no shutdown</pre>	<pre>interface Vlan 1612 ip address 172.16.12.2/24 description "vMotion" no shutdown interface Vlan 1613 ip address 172.16.13.2/24 description "vSAN" no shutdown interface Vlan 1614 ip address 172.16.14.2/24 description "web" no shutdown interface Vlan 1615 ip address 172.16.15.2/24 description "app" no shutdown interface Vlan 1616 ip address 172.16.16.2/24 description "db" no shutdown</pre>

5.2.6 Configure VRRP

VRRP is an active/standby first hop redundancy protocol. When used among VLT peers, it becomes active/active. Both VLT peers have the VRRP virtual MAC address in their forwarding table as a local destination address. This allows the backup VRRP router to forward intercepted frames whose destination MAC address matches the VRRP virtual MAC address.

S5248-Leaf1	S5248-Leaf2
<pre>vrrp version 3 interface vlan 1612 vrrp-group 12 virtual-address 172.16.12.254 interface vlan 1613 vrrp-group 13 virtual-address 172.16.13.254 interface vlan 1614 vrrp-group 14 virtual-address 172.16.14.254 interface vlan 1615 vrrp-group 15 virtual-address 172.16.15.254 interface vlan 1616 vrrp-group 16 virtual-address 172.16.16.254</pre>	<pre>vrrp version 3 interface vlan 1612 vrrp-group 12 virtual-address 172.16.12.254 interface vlan 1613 vrrp-group 13 virtual-address 172.16.13.254 interface vlan 1614 vrrp-group 14 virtual-address 172.16.14.254 interface vlan 1615 vrrp-group 15 virtual-address 172.16.15.254 interface vlan 1616 vrrp-group 16 virtual-address 172.16.16.254</pre>

5.2.7 Configure server-facing interfaces

S5248-Leaf1	S5248-Leaf2
<pre>interface ethernet 1/1/31 description "Server 1" switchport mode trunk switchport trunk allowed vlan 1001,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown interface ethernet 1/1/32 description "Server 2" switchport mode trunk switchport trunk allowed vlan 1001,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown interface ethernet 1/1/33</pre>	<pre>interface ethernet 1/1/31 description "Server 1" switchport mode trunk switchport trunk allowed vlan 1002,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown interface ethernet 1/1/32 description "Server 2" switchport mode trunk switchport trunk allowed vlan 1002,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown interface ethernet 1/1/33</pre>

S5248-Leaf1	S5248-Leaf2
<pre> description "Server 3" switchport mode trunk switchport trunk allowed vlan 1001,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown interface ethernet 1/1/34 description "Server 4" switchport mode trunk switchport trunk allowed vlan 1001,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown </pre>	<pre> description "Server 3" switchport mode trunk switchport trunk allowed vlan 1002,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown interface ethernet 1/1/34 description "Server 4" switchport mode trunk switchport trunk allowed vlan 1002,1612-1616 spanning-tree port type edge ets mode on mtu 9216 no shutdown </pre>

Note: If the port mode for the downstream server interface is changed to 10GbE, the interface port numbers are changed to include: 1. For example, interface ethernet 1/1/31 will be changed to interface ethernet 1/1/31:1.

5.2.8 Configure upstream interfaces

The upstream interfaces include links to spine switches and to the S4148U-ON switch.

S5248-Leaf1	S5248-Leaf2
<pre> interface ethernet 1/1/53 description "Z9264F-Spine1 eth 1/1/3" no switchport ip address 192.168.1.5/31 no shutdown interface ethernet 1/1/54 description "Z9264F-Spine2 eth 1/1/3" no switchport ip address 192.168.2.5/31 no shutdown interface ethernet 1/1/41:1 description "S4148U-F_Port-1" switchport mode trunk switchport trunk allowed vlan 1001 fip-snooping port-mode fcf no shutdown interface loopback 0 description "Router ID" ip address 10.0.2.1/32 no shutdown </pre>	<pre> interface ethernet 1/1/53 description "Z9264F-Spine1 eth 1/1/4" no switchport ip address 192.168.1.7/31 no shutdown interface ethernet 1/1/54 description "Z9264F-Spine2 eth 1/1/4" no switchport ip address 192.168.2.7/31 no shutdown interface ethernet 1/1/41:1 description "S4148U-F_Port-2" switchport mode trunk switchport trunk allowed vlan 1002 fip-snooping port-mode fcf no shutdown interface loopback 0 description "Router ID" ip address 10.0.2.2/32 no shutdown </pre>

Note: Configuration of the spine switches are not detailed in this document. For information about the leaf-spine architecture and detailed configuration, see [Dell EMC Networking Layer 3 Leaf-Spine Deployment and Best Practices with OS10EE](#).

5.2.9 Configure BGP routing

The example configuration use of BGP is for the application traffic that is associated with the layer 3 leaf-spine network. Other routing protocols can be used and will not affect the FC storage configuration.

S5248-Leaf1	S5248-Leaf2
<pre> route-map spine-leaf permit 10 match ip address prefix-list spine-leaf ip prefix-list spine-leaf seq 10 permit 10.0.0.0/8 ge 24 ip prefix-list spine-leaf seq 20 permit 172.16.0.0/16 ge 24 router bgp 64703 bestpath as-path multipath-relax maximum-paths ebgp 2 address-family ipv4 unicast redistribute connected route-map spine-leaf exit graceful-restart role receiver-only template spine-leaf fall-over advertisement-interval 1 timers 3 9 exit neighbor 192.168.1.4 remote-as 64601 inherit template spine-leaf no shutdown exit neighbor 192.168.2.4 remote-as 64602 inherit template spine-leaf no shutdown </pre>	<pre> route-map spine-leaf permit 10 match ip address prefix-list spine-leaf ip prefix-list spine-leaf seq 10 permit 10.0.0.0/8 ge 24 ip prefix-list spine-leaf seq 20 permit 172.16.0.0/16 ge 24 router bgp 64702 bestpath as-path multipath-relax maximum-paths ebgp 2 address-family ipv4 unicast redistribute connected route-map spine-leaf exit graceful-restart role receiver-only template spine-leaf fall-over advertisement-interval 1 timers 3 9 exit neighbor 192.168.1.2 remote-as 64601 inherit template spine-leaf no shutdown exit neighbor 192.168.2.2 remote-as 64602 inherit template spine-leaf no shutdown </pre>

5.2.10 Configure uplink failure detection (UFD)

UFD is recommended on all server interfaces.

Finally, exit configuration mode and save the configuration with the `end` and `write memory` commands.

S5248-Leaf1	S5248-Leaf2
<pre>uplink-state-group 1 name "UFD_Group_1" downstream ethernet1/1/31-1/1/34 upstream ethernet1/1/53-1/1/54 enable end write memory</pre>	<pre>uplink-state-group 1 name "UFD_Group_1" downstream ethernet1/1/31-1/1/34 upstream ethernet1/1/53-1/1/54 enable end write memory</pre>

6 S4148U-ON FCF switch configuration

This section details steps to configure the S4148U-ON switches running OS10EE in F_Port mode.

6.1 Prepare switches

6.1.1 Factory default configuration

The configuration commands in the sections that follow begin with S4148U-ON switches at their factory default settings. Dell EMC PowerSwitch models running OS10EE can be reset to their default configuration as follows:

```
OS10# delete startup-configuration
Proceed to delete startup-configuration [confirm yes/no(default)]:y

OS10# reload
System configuration has been modified. Save? [yes/no]:n
Proceed to reboot the system? [confirm yes/no]:y
```

The switch reboots to its factory default configuration. Repeat on the second S4148U-ON switch.

Note: OS10EE at its default settings has Telnet disabled, SSH enabled, and the OOB management interface that is configured to get its IP address using DHCP. The default username and password are both admin. Dell EMC recommends changing the admin password to a complex password during the first login.

6.1.2 Set switch port profile

A switch port profile determines the enabled front-panel ports and supported breakout modes on Ethernet and unified ports. Changing the profile removes the existing switch configuration, so the switch port profile is configured first. Switch port profile-3 is used in this deployment to provide twelve 16Gb FC ports for storage connections.

Note: See [OS10 Enterprise Edition User Guide Release 10.4.2.0](#) for switch-port profile options and details.

To change the switch-port profile from its current setting:

```
OS10# configure terminal
OS10(config)# switch-port-profile 1/1 profile-3
Warning: Switch port profile will be applied only after a save and reload.
All management port configurations will be retained but all other
configurations will be wiped out after the reload.
OS10(config)# exit
OS10# write memory
OS10# reload

Proceed to reboot the system? [confirm yes/no]:y
```

6.2 Configure switches

After the switch port profile is set on both S4148U-ONs, the commands in the tables that follow are run to complete the F_Port mode configuration on both switches.

Note: The commands in the following tables should be entered in the order shown. Switch running-configuration files are provided as attachments named S4148U-F-Port-1.txt and S4148U-F-Port-2.txt.

6.2.1 Configure global switch settings

Configure the hostname, OOB management IP address, and OOB management default gateway.

S4148U-F-Port-1	S4148U-F-Port-2
<pre>configure terminal hostname S4148U-F-Port-1 interface mgmt 1/1/1 no ip address dhcp ip address 100.67.166.222/24 no shutdown management route 0.0.0.0/0 100.67.166.254 spanning-tree mode rstp port-group 1/1/1 mode fc 16g-2x</pre>	<pre>configure terminal hostname S4148U-F-Port-2 interface mgmt 1/1/1 no ip address dhcp ip address 100.67.166.221/24 no shutdown management route 0.0.0.0/0 100.67.166.254 spanning-tree mode rstp port-group 1/1/1 mode fc 16g-2x</pre>

Note: For more information about mapping ports to switch profiles and port groups, see [OS10 Enterprise Edition User Guide Release 10.4.2.0](#), Unified port groups, p.84.

6.2.2 Configure FC aliases and FC zoning

The global command `feature fc domain-id domain-id` enables F_Port mode.

S4148U-F-Port-1	S4148U-F-Port-2
<pre>feature fc domain-id 100 fc alias r740xd-1p1 member wwn 20:01:f4:e9:d4:61:c6:6a fc alias r740xd-2p1 member wwn 20:01:f4:e9:d4:62:4a:d0 fc alias r740xd-3p1 member wwn 20:01:f4:e9:d4:62:4b:72 fc alias r740xd-4p1 member wwn 20:01:f4:e9:d4:62:4b:ba fc alias SpB-0 member wwn 50:06:01:66:47:E0:1B:19 fc alias SpA-0 member wwn 50:06:01:6E:47:E0:1B:19 fc zone r740xd-1p1zone member alias-name SpA-0 member alias-name SpB-0 member alias-name r740xd-1p1</pre>	<pre>feature fc domain-id 100 fc alias r740xd-1p2 member wwn 20:01:f4:e9:d4:61:c6:6b fc alias r740xd-2p2 member wwn 20:01:f4:e9:d4:62:4a:d1 fc alias r740xd-3p2 member wwn 20:01:f4:e9:d4:62:4b:73 fc alias r740xd-4p2 member wwn 20:01:f4:e9:d4:62:4b:bb fc alias SpB-1 member wwn 50:06:01:6F:47:E0:1B:19 fc alias SpA-1 member wwn 50:06:01:67:47:E0:1B:19 fc zone r740xd-1p2zone member alias-name SpA-1 member alias-name SpB-1 member alias-name r740xd-1p2</pre>

<pre> fc zone r740xd-2p1zone member alias-name SpA-0 member alias-name SpB-0 member alias-name r740xd-2p1 fc zone r740xd-3p1zone member alias-name SpA-0 member alias-name SpB-0 member alias-name r740xd-3p1 fc zone r740xd-4p1zone member alias-name SpA-0 member alias-name SpB-0 member alias-name r740xd-4p1 fc zoneset zoneset1 member r740xd-1p1zone member r740xd-2p1zone member r740xd-3p1zone member r740xd-4p1zone </pre>	<pre> fc zone r740xd-2p2zone member alias-name SpA-1 member alias-name SpB-1 member alias-name r740xd-2p2 fc zone r740xd-3p2zone member alias-name SpA-1 member alias-name SpB-1 member alias-name r740xd-3p2 fc zone r740xd-4p2zone member alias-name SpA-1 member alias-name SpB-1 member alias-name r740xd-4p2 fc zoneset zoneset1 member r740xd-1p2zone member r740xd-2p2zone member r740xd-3p2zone member r740xd-4p2zone </pre>
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6.2.3 Configure the VLAN and virtual fabrics

For each switch, define the VLANs and virtual fabrics.

S4148U-F-Port-1	S4148U-F-Port-2
<pre> vfabric 101 zoneset activate zoneset1 interface vlan 1001 vfabric 101 vlan 1001 fcoe fcmmap 0xEFC64 interface fibrechannel 1/1/1 no shutdown vfabric 101 interface fibrechannel 1/1/3 no shutdown vfabric 101 </pre>	<pre> vfabric 102 zoneset activate zoneset1 interface vlan 1002 vfabric 102 vlan 1002 fcoe fcmmap 0xEFC65 interface fibrechannel 1/1/1 no shutdown vfabric 102 interface fibrechannel 1/1/3 no shutdown vfabric 102 </pre>

6.2.4 Configure the FCoE interfaces to the leaf switches

S4148U-F-Port-1	S4148U-F-Port-2
<pre> interface ethernet 1/1/41 vfabric 101 </pre>	<pre> interface ethernet 1/1/41 vfabric 102 </pre>

6.2.5 Configure QoS

Quality of Service (QoS) configuration is a 3-step process:

1. Create class maps to classify traffic.
2. Create QoS and policy maps for the classified traffic.
3. Apply the QoS and policy maps.

FCoE traffic is assigned dot1p priority value 3 by default. In the following tables, dot1p priority value 3 is mapped to QoS group 3. The remaining dot1p priority values, 0-2 and 4-7, are mapped to QoS group 0. QoS group 3 is mapped to queue 3, and QoS group 0 is mapped to queue 0. In this example, bandwidth is allocated 50% to queue 3 for FCoE traffic and 50% to queue 0 for all other traffic using the `bandwidth percent` command. (Bandwidth allocations should total 100% and may be adjusted accordingly to optimize traffic).

Finally, exit configuration mode and save the configuration with the `end` and `write memory` commands.

S4148U-F-Port-1	S4148U-F-Port-2
<pre> dcbx enable class-map type network-qos class_Dot1p_3 match qos-group 3 class-map type queuing map_ETSQueue_0 match queue 0 class-map type queuing map_ETSQueue_3 match queue 3 trust dot1p-map map_Dot1pToGroups qos-group 0 dot1p 0-2,4-7 qos-group 3 dot1p 3 qos-map traffic-class map_GroupsToQueues queue 0 qos-group 0 queue 3 qos-group 3 policy-map type network-qos policy_Input_PFC class class_Dot1p_3 pause pfc-cos 3 policy-map type queuing policy_Output_BandwidthPercent class map_ETSQueue_0 bandwidth percent 50 class map_ETSQueue_3 bandwidth percent 50 interface ethernet 1/1/41 flowcontrol receive off flowcontrol transmit off priority-flow-control mode on ets mode on service-policy input type network-qos policy_Input_PFC </pre>	<pre> dcbx enable class-map type network-qos class_Dot1p_3 match qos-group 3 class-map type queuing map_ETSQueue_0 match queue 0 class-map type queuing map_ETSQueue_3 match queue 3 trust dot1p-map map_Dot1pToGroups qos-group 0 dot1p 0-2,4-7 qos-group 3 dot1p 3 qos-map traffic-class map_GroupsToQueues queue 0 qos-group 0 queue 3 qos-group 3 policy-map type network-qos policy_Input_PFC class class_Dot1p_3 pause pfc-cos 3 policy-map type queuing policy_Output_BandwidthPercent class map_ETSQueue_0 bandwidth percent 50 class map_ETSQueue_3 bandwidth percent 50 interface ethernet 1/1/41 flowcontrol receive off flowcontrol transmit off priority-flow-control mode on ets mode on service-policy input type network-qos policy_Input_PFC </pre>

<pre>service-policy output type queuing policy_Output_BandwidthPercent system qos trust-map dot1p map_Dot1pToGroups qos-map traffic-class map_GroupsToQueues end write memory</pre>	<pre>service-policy output type queuing policy_Output_BandwidthPercent system qos trust-map dot1p map_Dot1pToGroups qos-map traffic-class map_GroupsToQueues end write memory</pre>
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7 S5248-ON FSB validation

After configuring connected devices, many commands are available to validate the network configuration. This section provides a list of the most common commands and their output for this topology.

Note: The following commands and outputs that are shown are for the S5248F-Leaf1. The output for the S5248U-Leaf2 is similar. For additional commands and outputs related to the leaf-spine portion of the topology, such as VLT, and BGP, see [Dell EMC Networking Layer 3 Leaf-Spine Deployment and Best Practices with OS10EE](#).

7.1 show interface status

The `show interface status | grep up` command is used to verify required interfaces are up, and links are established at their appropriate speeds.

```
S5248-Leaf1# show interface status | grep up
Port          Description      Status  Speed  Duplex  Mode  Vlan  Tagged-Vlans
Eth 1/1/31    Server 1         up      10G    full    T     1     1001,1612-1616
Eth 1/1/32    Server 2         up      10G    full    T     1     1001,1612-1616
Eth 1/1/33    Server 3         up      10G    full    T     1     1001,1612-1616
Eth 1/1/34    Server 4         up      10G    full    T     1     1001,1612-1616
Eth 1/1/41:1  S4148U-F_Port.. up      10G    full    T     1     1001
Eth 1/1/53    Z9264F-Spine1.. up      100G   full    -     -     -
Eth 1/1/54    Z9264F-Spine2.. up      100G   full    -     -     -
Eth 1/1/55    VLTi             up      100G   full    -     -     -
Eth 1/1/56    VLTi             up      100G   full    -     -     -
```

7.2 show vlan

The `show vlan` command is used to verify configured VLANs and the interfaces they are applied to.

```
S5248-Leaf1# show vlan
Codes: * - Default VLAN, M - Management VLAN, R - Remote Port Mirroring VLANs,
       @ - Attached to Virtual Network
Q: A - Access (Untagged), T - Tagged
  NUM  Status  Description                                Q Ports
*   1   Active  1/1/40,1/1/41:1,1/1/42:1,1/1/43:1,1/1/44:1,1/1/45-1/1/52
                                     A Eth1/1/1-
                                     A Po1000
  1001  Active  vMotion                                    T Eth1/1/31-1/1/34,1/1/41:1
  1612  Active  vMotion                                    T Eth1/1/31-1/1/34
                                     T Po1000
  1613  Active  vSAN                                        T Eth1/1/31-1/1/34
                                     T Po1000
  1614  Active  web                                         T Eth1/1/31-1/1/34
                                     T Po1000
  1615  Active  app                                         T Eth1/1/31-1/1/34
                                     T Po1000
  1616  Active  db                                           T Eth1/1/31-1/1/34
                                     T Po1000
  4094  Active  Po1000                                      T Po1000
```

7.3 show fcoe sessions

The `show fcoe sessions` command shows all currently active FCoE sessions on the switch. In this example, four FCoE sessions are active on each switch.

```
S5248-Leaf1# show fcoe sessions
```

Enode MAC VLAN	FCoE MAC	Enode Interface FC-ID	FCF MAC PORT WWPN	FCF interface PORT WWNN
f4:e9:d4:61:c6:6a	0e:fc:64:64:05:02	Eth 1/1/31	e4:f0:04:6b:02:41	Eth 1/1/41:1
1001	20:00:f4:e9:d4:61:c6:6a	64:05:02	20:01:f4:e9:d4:61:c6:6a	
f4:e9:d4:62:4a:d0	0e:fc:64:64:05:03	Eth 1/1/32	e4:f0:04:6b:02:41	Eth 1/1/41:1
1001	20:00:f4:e9:d4:62:4a:d0	64:05:03	20:01:f4:e9:d4:62:4a:d0	
f4:e9:d4:62:4b:72	0e:fc:64:64:05:00	Eth 1/1/34	e4:f0:04:6b:02:41	Eth 1/1/41:1
1001	20:00:f4:e9:d4:62:4b:72	64:05:00	20:01:f4:e9:d4:62:4b:72	
f4:e9:d4:62:4b:ba	0e:fc:64:64:05:01	Eth 1/1/33	e4:f0:04:6b:02:41	Eth 1/1/41:1
1001	20:00:f4:e9:d4:62:4b:ba	64:05:01	20:01:f4:e9:d4:62:4b:ba	

7.4 show fcoe fcf

The `show fcoe fcf` command shows all active FCoE sessions on the switch. In this example, four FCoE sessions are active on each switch.

```
S5248-Leaf1# show fcoe fcf
```

FCF MAC	FCF Interface	VLAN	FC-MAP	FKA_ADV_PERIOD	No. of Enodes
e4:f0:04:6b:02:41	Eth 1/1/41:1	1001	0e:fc:64	8000	4

7.5 show fcoe enode

The `show fcoe enode` command shows that nodes are currently logged in through the switch.

```
S5248-Leaf1# show fcoe enode
```

Enode MAC	Enode Interface	VLAN	FCFs	Sessions
f4:e9:d4:61:c6:6a	Eth 1/1/31	1001	1	1
f4:e9:d4:62:4a:d0	Eth 1/1/32	1001	1	1
f4:e9:d4:62:4b:72	Eth 1/1/34	1001	1	1
f4:e9:d4:62:4b:ba	Eth 1/1/33	1001	1	1

8 S4148U-ON FCF (F_Port) validation

After configuring connected devices, many commands are available to validate the network configuration. This section provides a list of the most common commands and their output for this topology.

Note: The following commands and outputs are for the S4148U-F-Port-1. The output for the S4148U-F-Port-2 is similar. For more commands and outputs related to the leaf-spine portion of the topology, such as VLT, and BGP, see [Dell EMC Networking Layer 3 Leaf-Spine Deployment and Best Practices with OS10EE](#).

8.1 show interface status

The `show interface status | grep up` command is used to verify that the required interfaces are up, and links are established at their appropriate speeds.

```
S4148U-F-Port-1# show interface status | grep up
Port          Description      Status  Speed  Duplex  Mode  Vlan  Tagged-Vlans
Eth 1/1/41    10G Ethernet     up      10G    full    A     1     -
Fc 1/1/1      16G Fibre Channel  up      16G    auto    -     -     -
Fc 1/1/3      16G Fibre Channel  up      16G    auto    -     -     -
```

8.2 show vlan

The `show vlan` command is used to verify configured VLANs and the interfaces they are applied to.

```
S4148U-F-Port-1# show vlan
Codes: * - Default VLAN, M - Management VLAN, R - Remote Port Mirroring VLANs,
       @ - Attached to Virtual Network
Q: A - Access (Untagged), T - Tagged
    NUM    Status    Description                                Q Ports
*    1      Active    Eth1/1/9-1/1/26,1/1/29-1/1/54            A Eth1/1/9-1/1/26,1/1/29-1/1/54
    1001   Active    Eth1/1/41                                  T Eth1/1/41
```

8.3 show fcoe system

The `show fcoe system` command is used to show FCoE-related information.

```
S4148U-F-Port-1# show fcoe system
Mode                : FPORT
FCOE VLAN List (Operational) : 1001
FCFs                 : 1
Enodes               : 4
Sessions             : 4
```

8.4 show fc ns switch

The `show fc ns switch` command shows all device ports that are logged into the fabric. In this deployment, four ports are logged in to each switch: two storage ports and two CNA ports.

```
S4148U-F-Port-1# show fc ns switch
```

```
Total number of devices = 6
```

```
Switch Name          10:00:e4:f0:04:6b:01:42
Domain Id            100
Switch Port          fibrechannel1/1/1
FC-Id                64:00:00
Port Name            50:06:01:66:47:e0:1b:19
Node Name            50:06:01:60:c7:e0:1b:19
Class of Service     8
Symbolic Port Name   UNITY::::SPA10::FC:::::
Symbolic Node Name   UNITY::::SPA::FC:::::
Port Type            N_PORT
Registered with NameServer Yes
Registered for SCN   Yes
```

```
Switch Name          10:00:e4:f0:04:6b:01:42
Domain Id            100
Switch Port          fibrechannel1/1/3
FC-Id                64:04:00
Port Name            50:06:01:6e:47:e0:1b:19
Node Name            50:06:01:60:c7:e0:1b:19
Class of Service     8
Symbolic Port Name   UNITY::::SPB10::FC:::::
Symbolic Node Name   UNITY::::SPB::FC:::::
Port Type            N_PORT
Registered with NameServer Yes
Registered for SCN   Yes
```

```
Switch Name          10:00:e4:f0:04:6b:01:42
Domain Id            100
Switch Port          ethernet1/1/41
FC-Id                64:05:00
Port Name            20:01:f4:e9:d4:62:4b:72
Node Name            20:00:f4:e9:d4:62:4b:72
Class of Service     8
Symbolic Port Name
Symbolic Node Name
Port Type            N_PORT
Registered with NameServer Yes
Registered for SCN   Yes
```

```
Switch Name          10:00:e4:f0:04:6b:01:42
Domain Id            100
```

Switch Port	ethernet1/1/41
FC-Id	64:05:01
Port Name	20:01:f4:e9:d4:62:4b:ba
Node Name	20:00:f4:e9:d4:62:4b:ba
Class of Service	8
Symbolic Port Name	
Symbolic Node Name	
Port Type	N_PORT
Registered with NameServer	Yes
Registered for SCN	Yes
Switch Name	10:00:e4:f0:04:6b:01:42
Domain Id	100
Switch Port	ethernet1/1/41
FC-Id	64:05:02
Port Name	20:01:f4:e9:d4:61:c6:6a
Node Name	20:00:f4:e9:d4:61:c6:6a
Class of Service	8
Symbolic Port Name	
Symbolic Node Name	
Port Type	N_PORT
Registered with NameServer	Yes
Registered for SCN	Yes
Switch Name	10:00:e4:f0:04:6b:01:42
Domain Id	100
Switch Port	ethernet1/1/41
FC-Id	64:05:03
Port Name	20:01:f4:e9:d4:62:4a:d0
Node Name	20:00:f4:e9:d4:62:4a:d0
Class of Service	8
Symbolic Port Name	
Symbolic Node Name	
Port Type	N_PORT
Registered with NameServer	Yes
Registered for SCN	Yes

8.5 show fc zoneset

The `show fc zoneset active` command shows the zones and zone members in the configured zone sets. Members that are logged into the fabric are shown with an asterisk (*).

```
S4148U-F-Port-1# show fc zoneset
```

```
ZoneSetName      ZoneName          ZoneMember
=====
zoneset1
      r740xd-1p1zone
                SpA-0
                SpB-0
                r740xd-1p1
      r740xd-2p1zone
                SpA-0
                SpB-0
                r740xd-2p1
      r740xd-3p1zone
                SpA-0
                SpB-0
                r740xd-3p1
      r740xd-4p1zone
                SpA-0
                SpB-0
                r740xd-4p1
```

```
vFabric id: 101
```

```
Active Zoneset: zoneset1
```

```
ZoneName          ZoneMember
=====
r740xd-1p1zone    *20:01:f4:e9:d4:61:c6:6a
                  *50:06:01:66:47:e0:1b:19
                  *50:06:01:6e:47:e0:1b:19
r740xd-2p1zone    *20:01:f4:e9:d4:62:4a:d0
                  *50:06:01:66:47:e0:1b:19
                  *50:06:01:6e:47:e0:1b:19
r740xd-3p1zone    *20:01:f4:e9:d4:62:4b:72
                  *50:06:01:66:47:e0:1b:19
                  *50:06:01:6e:47:e0:1b:19
r740xd-4p1zone    *20:01:f4:e9:d4:62:4b:ba
                  *50:06:01:66:47:e0:1b:19
                  *50:06:01:6e:47:e0:1b:19
```


8.6 show vfabric

The `show vfabric` command output provides various information including the default zone mode, the active zone set, and interfaces that are members of the vfabric.

```
S4148U-F-Port-1# show vfabric
Fabric Name
Fabric Type          FPORT
Fabric Id            101
Vlan Id              1001
FC-MAP                0xEFC64
Vlan priority         3
FCF Priority          128
FKA-Adv-Period       Enabled,8
Config-State         ACTIVE
Oper-State           UP
=====
Switch Config Parameters
=====
Domain ID             100
=====
Switch Zoning Parameters
=====
Default Zone Mode:   Deny
Active ZoneSet:      zoneset1
=====
Members
fibrenchannel1/1/1
fibrenchannel1/1/3
ethernet1/1/41
=====
```

A Validated components

Table 1 Leaf switches

Qty	Item	Version
2	Dell EMC S5248-ON	10.4.2.1

Table 2 Management switches

Qty	Item	Version
2	Dell EMC S3048-ON	10.4.2.1

Table 3 Spine switches

Qty	Item	Version
2	Dell EMC Z9264-ON	10.4.2.1

Table 4 Fibre Channel switches

Qty	Item	Version
2	Dell EMC S4148U-ON	10.4.2.1

Table 5 Storage

Qty	Item	Version
2	Dell EMC Unity 500F	4.3.0.1522077968

Table 6 Servers

Qty	Item	Version
4	Dell EMC PowerEdge R740xd	
	- BIOS	1.6.12
	- iDRAC	3.21.26.22
	- rNDC Intel(R) Gigabit 4P X710/I350 rNDC firmware	18.8.9
	- CNA QLogic 25GE 2P QL41262HxCU-DE Adapter firmware	14.07.50
	- CNA QLogic 25GE 2P QL41262HxCU-DE Adapter ESXi drivers	qedf 1.2.24.6 qedentv 3.7.9.1

B PowerEdge server, Unity storage, and VMware setup

B.1 PowerEdge server configuration

This section details the configuration of the CNAs used to validate the network topology.

Note: Exact iDRAC steps in this section may vary depending on hardware, software and browser versions used. See the PowerEdge server documentation for steps to connect to the iDRAC.

B.1.1 Reset server CNA interfaces to factory defaults

Note: Resetting to defaults is only necessary if installed CNA has been modified from their factory default settings.

1. Connect to the server's iDRAC in a web browser and launch the virtual console.
2. In the virtual console, from the **Next Boot** menu, select **BIOS Setup**.
3. Reboot the server.
4. From the System Setup Main Menu, select **Device Settings**.
5. From the **Device Settings** page, select the first CNA adapter port.
6. From the **Main Configuration Page**, click **Default** and then **Yes** to load the default settings.
7. Click **OK** and then click **Finish**.
8. Click **Yes** to save changes. Click **OK**.
9. Repeat steps 5 through 8 for the second FC adapter port.
10. Repeat steps 1 through 9 for remaining servers.

B.1.2 Determine FCoE CNA port WWPNs

The FCoE CNA World Wide Port Names (WWPNs) for the PowerEdge R740xd server are used for FC zone configuration. WWPNs may be determined using the iDRAC as follows:

1. Connect to the first server's iDRAC in a web browser and log in.
2. Select **System > Network Devices**.
3. Under **Network Devices**, click the CNA.

Note: In this example, click NIC Slot 2. The NIC ports are displayed as shown in Figure 9.

Network Devices

Summary Integrated NIC 1 NIC Slot 1 NIC Slot 4 **NIC Slot 5**

NIC Slot 5: QLogic 25GE 2P QL41262 Adapter

Port Properties

Product Name	QLogic 25GE 2P QL41262 Adapter
Vendor Name	QLogic
Number of Ports	2

Ports and Partitioned Ports

Link Status	Port	Partition	Protocol	Switch Connection ID
+ Up	1	1	NIC, RDMA	3c:2c:30:10:36:00
+ Up	1	2	FCoE	N/A
+ Unknown	1	3	none	N/A
+ Unknown	1	4	none	N/A
+ Up	2	1	NIC, RDMA	3c:2c:30:10:41:00
+ Up	2	2	FCoE	N/A

Figure 9 CNA ports listed in iDRAC

- Under **Ports and Partitioned Ports**, click the icon next to the first port to expand the details as shown:

NIC in Slot 5 Port 1 Partition 2

Link Connection

Link Status	Up
Link Speed	25 Gbps
OS Driver State	Operational
Auto Negotiation	Disabled

MAC Addresses

MAC Addresses	✓ F4:E9:D4:62:4A:D0	Virtual MAC Addresses
FIP	✓ F4:E9:D4:62:4A:D0	Virtual FIP
WWN	✓ 20:00:F4:E9:D4:62:4A:D0	Virtual WWN
WWPN	✓ 20:01:F4:E9:D4:62:4A:D0	Virtual WWPN

Figure 10 WWPN for FCoE CNA port 1

- Record the World Wide Port Name outlined in red in Figure 10. A convenient method is to copy and paste it into a text file. The WWPN is used in the S4148U-ON switch FC zone configuration.
- Repeat steps 4 and 5 for CNA port 2.
- Repeat steps 1 through 6 for remaining servers.


The FC WWPNs used in this deployment example are shown in Table 1. The **Switch** column has been added for reference per the cable connections in the SAN topology diagram (Figure 7).

Table 7 Server FCoE CNA port WWPNs

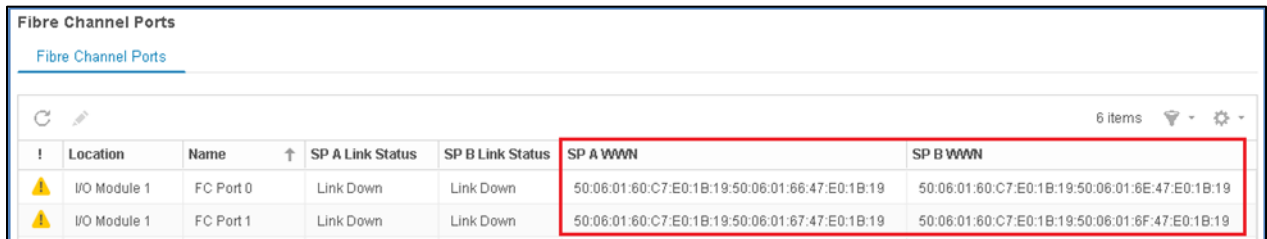
Server	Port	Switch	WWPN
R740xd-1	1	S4148U-Leaf1	20:01:F4:E9:D4:61:C6:6A
R740xd-1	2	S4148U-Leaf2	20:01:F4:E9:D4:61:C6:6B
R740xd-2	1	S4148U-Leaf1	20:01:F4:E9:D4:62:4A:D0
R740xd-2	2	S4148U-Leaf2	20:01:F4:E9:D4:62:4A:D1
R740xd-3	1	S4148U-Leaf1	20:01:F4:E9:D4:62:4B:BA
R740xd-3	2	S4148U-Leaf2	20:01:F4:E9:D4:62:4B:BB
R740xd-4	1	S4148U-Leaf1	20:01:F4:E9:D4:62:4B:72
R740xd-4	2	S4148U-Leaf2	20:01:F4:E9:D4:62:4B:73

B.2 Dell EMC Unity 500F storage array configuration

The WWPNs of FC adapters in storage arrays are also used for FC zone configuration. WWPNs on Unity storage arrays are determined as follows:

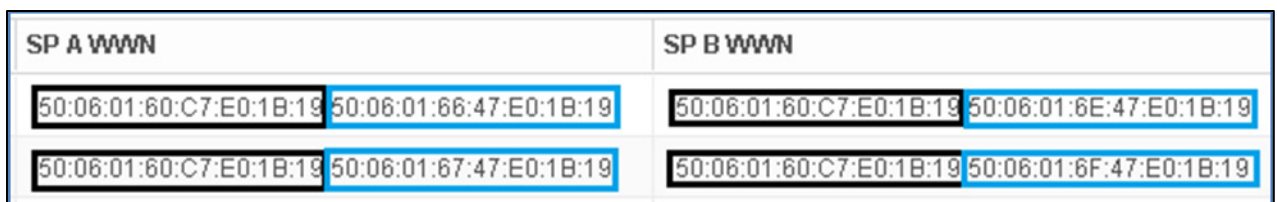
1. Connect to the Unisphere GUI in a web browser and log in. Click the **Settings** icon  near the top right corner of the page.
2. In the left pane of the **Settings** window, select **Access > Fibre Channel**.

The **Fibre Channel Ports** page is displayed as shown in Figure 11. A zoomed-in view of the area inside the red box is shown in Figure 12.



Fibre Channel Ports							
Fibre Channel Ports							
!	Location	Name	↑	SP A Link Status	SP B Link Status	SP A WWN	SP B WWN
⚠	I/O Module 1	FC Port 0		Link Down	Link Down	50:06:01:60:C7:E0:1B:19:50:06:01:66:47:E0:1B:19	50:06:01:60:C7:E0:1B:19:50:06:01:6E:47:E0:1B:19
⚠	I/O Module 1	FC Port 1		Link Down	Link Down	50:06:01:60:C7:E0:1B:19:50:06:01:67:47:E0:1B:19	50:06:01:60:C7:E0:1B:19:50:06:01:6F:47:E0:1B:19

Figure 11 Unisphere Fibre Channel Ports page



SP A WWN		SP B WWN	
50:06:01:60:C7:E0:1B:19	50:06:01:66:47:E0:1B:19	50:06:01:60:C7:E0:1B:19	50:06:01:6E:47:E0:1B:19
50:06:01:60:C7:E0:1B:19	50:06:01:67:47:E0:1B:19	50:06:01:60:C7:E0:1B:19	50:06:01:6F:47:E0:1B:19

Figure 12 Zoomed-in view of SP A and SP B WWNs on Fibre Channel Ports page

Two WWNs are listed for each port. The World Wide Node Name (WWNN), outlined in black, identifies this Unity storage array (the node). It is not used in zone configuration. The WWPNS, outlined in blue, identify the individual ports and are used for FC zoning.

- Record the WWPNS as shown in Table 8. The Switch column has been added based on the physical cable connections that are shown in Figure 7.

Table 8 Storage array FC adapter WWPNS

Service processor	Port	Switch	WWPN
SP A	0	6510-1 FC	50:06:01:66:47:E0:1B:19
SP A	1	6510-2 FC	50:06:01:6E:47:E0:1B:19
SP B	0	6510-1 FC	50:06:01:67:47:E0:1B:19
SP B	1	6510-2 FC	50:06:01:6F:47:E0:1B:19

B.2.1 Create a storage pool

- Connect to the Unisphere GUI in a web browser and log in.
- In the left pane under **STORAGE**, select **Pools**.
- Click the **+** icon. In the **Create Pool** dialog box, enter a **Name** then click **Next**.
- Select appropriate storage tiers and RAID configuration for the pool. Click **Next**.
- Under **Select Amount of Storage**, select the number of drives section. The total number of drives and the total capacity will be displayed next to **Totals**. Click **Next**.
- The **Capability Profile Name** section is optional. Click **Next**.
- Review selections on the **Summary** page and click **Finish** to create the pool. Once the **Overall status** shows 100%, click **Close**.
- The pool is displayed on the **STORAGE > Pools** page as shown in Figure 13.

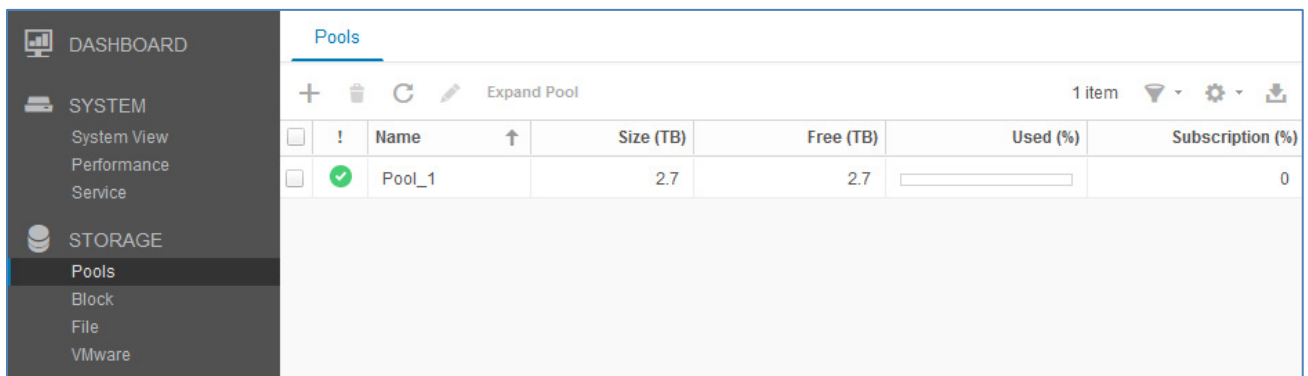


Figure 13 Storage pool created

B.2.2 Add ESXi hosts

- In the Unisphere left pane under **ACCESS**, select **VMware**.
- On the **vCenters** tab, click the **+** icon to open the **Add vCenter** dialog box.
- Enter the **Network Name or Address** of the vCenter server. Enter the vCenter **User Name** and **Password** and click **Find**.

4. A list of discovered ESXi hosts is displayed. Select the applicable hosts and click **Next**.
5. A VMware API for Storage Awareness (**VASA**) **Provider** is not used in this example. Click **Next**.
6. On the **Summary** page, review the ESXi Hosts to be added. Click **Finish**.
7. When the Overall status shows 100% Completed, click Close.
8. The vCenter server is displayed as shown in Figure 14.

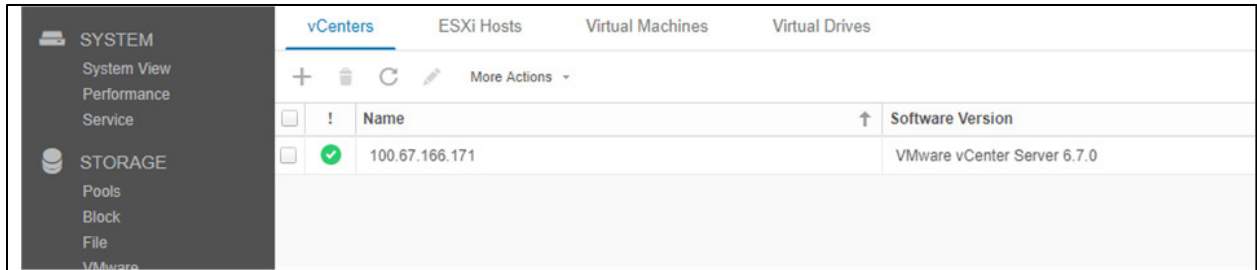


Figure 14 vCenter server added to Unisphere

9. The list of added ESXi hosts is displayed on the **ESXi Hosts** tab, as shown in Figure 15.

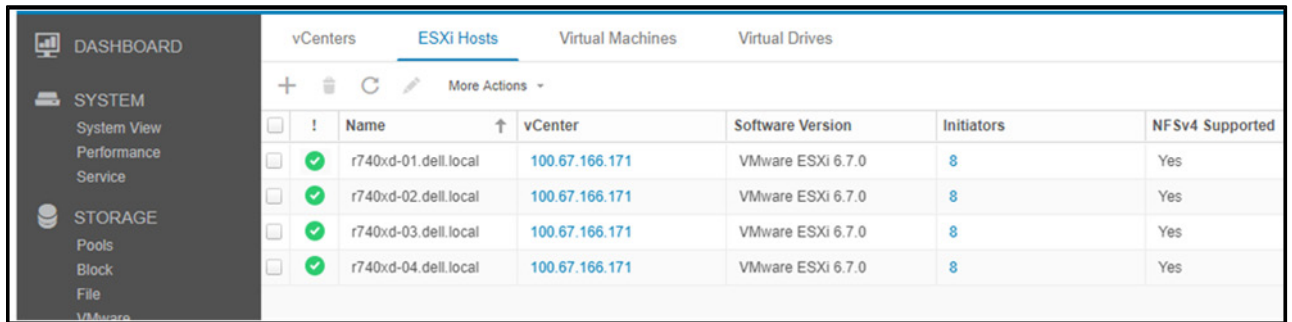


Figure 15 ESXi Hosts added to Unisphere

Note: Extra hosts may be added as needed on the **ESXi Hosts** tab. Click the **+** icon, enter the credentials for the vCenter Server or ESXi host, and follow the prompts.

B.2.3 Create LUNs and configure host access

1. In the Unisphere left pane under **STORAGE**, select **Block**.
2. On the **LUNs** tab, click the **+** icon to open the **Create LUNs** dialog box.
3. On the **Configure LUN(s)** page, select the **Number of LUNs**. Provide a **Name** and select the **Storage Pool**. Modify the **Size** as required and click **Next**.
4. On the **Access** page, click the **+** icon and select host(s) to be granted access to the LUN. Click **OK > Next**.
5. On the **Snapshot** page, leave settings at their defaults and click **Next**.
6. On the **Replication** page, leave settings at their defaults and click **Next**.
7. On the **Summary** page, review the details and click **Finish** to create the LUN.
8. On the **Results** page, click Close when Overall status shows 100% Completed.

The newly created LUN is now visible on the **LUNs** tab as shown in Figure 16. In this example, a LUN named FC-80GB that is 80GB in size has been created.

LUNs							
Consistency Groups							
iSCSI Interfaces							
1 item							
		Name	Size (GB)	Allocated (%)	Pool	Thin Clone Base	
<input type="checkbox"/>	!	FC-80GB	80.0	<input type="text"/>	Pool_1	-	

Figure 16 LUN created

Create extra LUNs and grant access (map) to hosts as needed.

Note: To modify host access at any time, check the box next to the LUN to select it. Click the icon, and select the Host Access tab.

B.3 VMware preparation

B.3.1 VMware ESXi download and installation

Install VMware ESXi 6.7 U1 or later, on each PowerEdge server. Dell EMC recommends using the latest Dell EMC customized ESXi .iso image available on support.dell.com. The correct drivers for the PowerEdge server hardware are built into this image. This image is used to install ESXi using CD/DVD, a USB flash drive, or by mounting the .iso image through the PowerEdge server's iDRAC interface.

Each ESXi host has one 1GbE BASE-T interface connected to the OOB management network for communication with the vCenter Server.

B.3.2 Install and configure VMware vCenter Server 6.7 U1

For information about the installation and configuration of vCenter Server, see [vSphere Installation and Setup](#). In this deployment, the vCenter Server is located on a separate host within the data center.

B.3.3 Add ESXi hosts to vCenter Server

The vSphere Web Client is a service running on vCenter Server. In the vSphere Web Client, a data center object named **Datacenter** is created for this deployment, and the two ESXi are added to it.

A cluster that is named Management is created and added to the data center object, and the four R740xd hosts are added to the cluster. When complete, the vSphere Web Client **Hosts and Clusters** tab in the **Navigator** pane is displayed as shown in Figure 17.

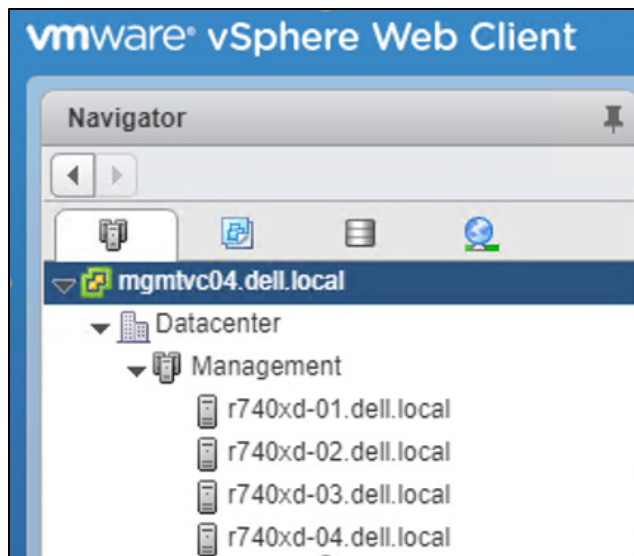



Figure 17 Datacenter and cluster that is created with ESXi hosts

B.3.4 Configure storage on ESXi hosts

The example LUN created on the storage array is used to create a datastore on an ESXi host. The datastore is used to create a virtual disk on a virtual machine (VM) residing on the ESXi host. This process may be repeated as needed for extra LUNs, hosts, and VMs.

B.3.5 Rescan storage

1. In the vSphere Web Client, go to **Home > Hosts and Clusters**.
2. In the **Navigator** pane, select an ESXi host with LUN access that is configured on the FC storage array.
3. In the center pane, select **Configure > Storage Adapters**.
4. Select host's first FC adapter, vmhba4 in this example, and click the  icon to rescan storage.
5. The LUN on the storage array mapped to this host is displayed under **Adapter Details** on the **Devices** tab as shown in Figure 18.

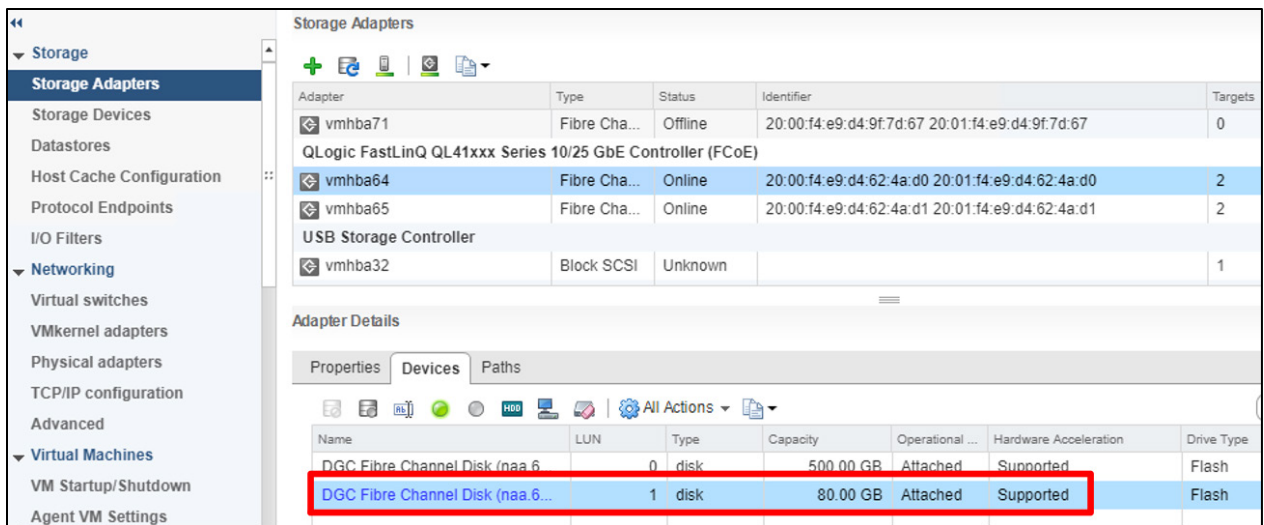


Figure 18 LUN visible to ESXi host

- Repeat for host's second adapter, vmhba5 in this example. The LUN information on the **Adapter Details > Devices** tab is identical to the first adapter.
- Select the first storage adapter, for example, vmhba4, and then select the **Adapter Details > Paths** tab as shown in Figure 19. The target, LUN number, for example, LUN 0, and the path status are shown. The target field includes the two active storage WWPNs connected to vmhba4. The status field is marked either **Active** or **Active (I/O)** for each path.

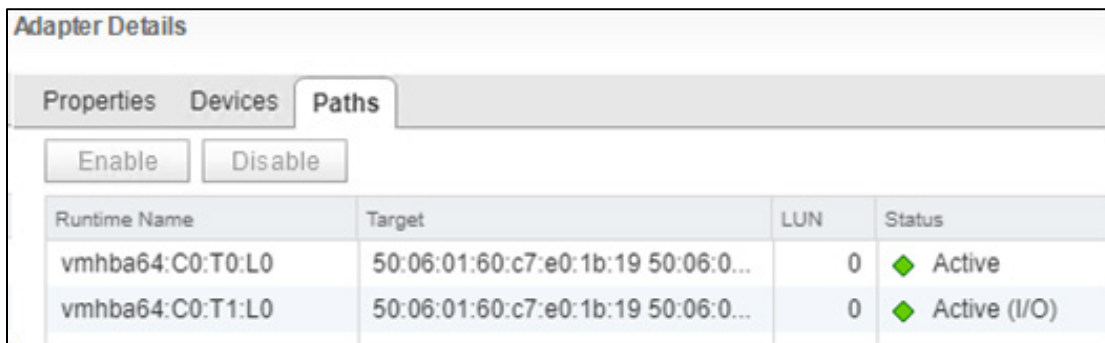


Figure 19 Adapter Details - Paths tab

The **Paths** tab includes similar information for the host's second storage adapter.

B.3.6 Create a datastore

A datastore that uses the Unity LUN is created on the ESXi host.

To create the datastore:

- In the vSphere Web Client, go to **Home > Hosts and Clusters**.
- In the **Navigator** pane, right-click the ESXi host and select **Storage > New Datastore**.
- In the **New Datastore** window, leave the **Type** set to **VMFS** and click **Next**.
- The **Name and device selection** page appears as shown in Figure 20. In this example, the 80GB LUN mapped to this host is displayed in the list of devices.

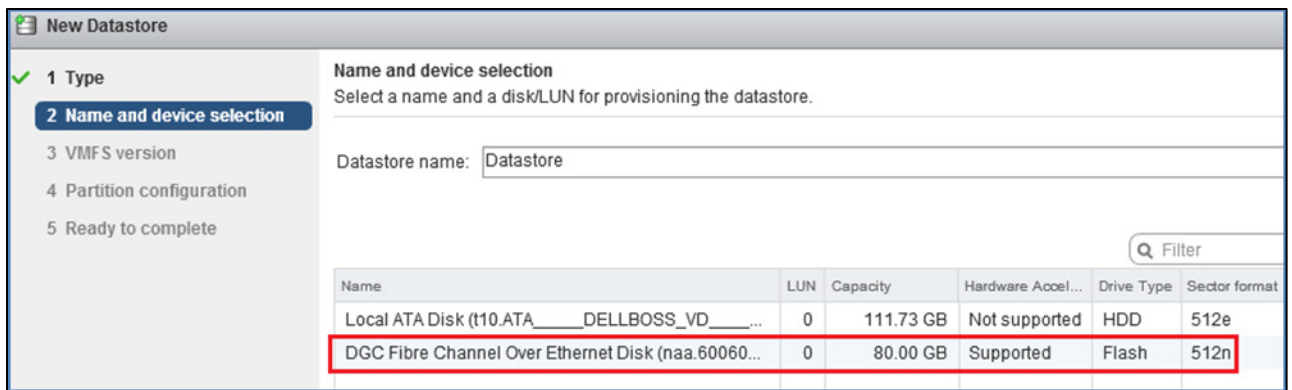


Figure 20 Name and device selection page

5. Provide a **Datastore name**, for example, **Unity 80GB LUN**, select the LUN in the list, and click **Next**.
6. Select the **VMFS version**. For this guide, it is left at its default setting, **VMFS 5**. Click **Next**.
7. Leave the **Partition configuration** at its default settings and click **Next > Finish** to create the datastore.

The datastore is now accessible by selecting the host in the **Navigator** pane. Select the **Configure** tab > **Storage > Datastores** as shown in Figure 21.

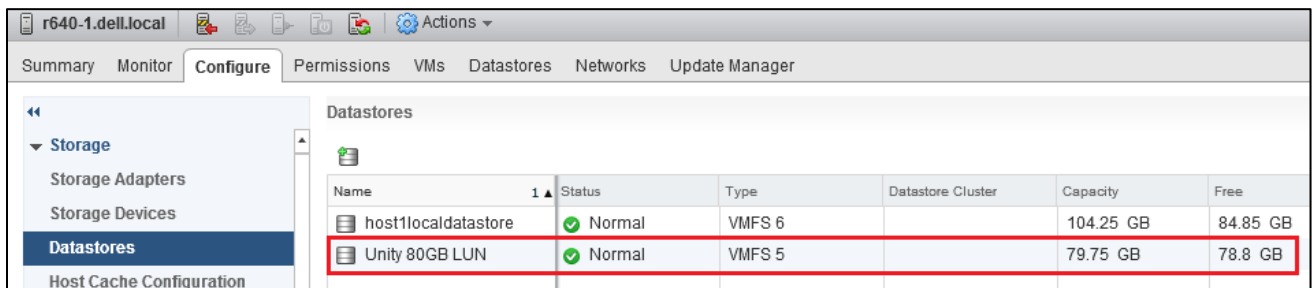


Figure 21 Datastore configured

The datastore is also accessible by going to **Home > Storage**. It is listed under the **Datacenter** object in the **Navigator** pane.

B.3.7 Create a virtual disk

In this example, the ESXi host with the datastore configured in the previous section contains a VM named **VM1** that is running a Windows Server guest operating system.

Note: Virtual machine guest operating system deployment steps are not included in this document. For instructions, see the VMware vSphere 6.7 Documentation. Guest operating systems can be any supported by ESXi 6.7. VMs should be deployed before proceeding with this section.

To create a virtual disk on VM1 using the datastore:

1. Go to Home > Hosts and Clusters.
2. In the **Navigator** pane, right click on **VM1** and select **Edit Settings**.
3. Next to **New Device**, select **New Hard Disk** and click **Add**.

4. Click the ▶ icon next to **New Hard Disk** to view the configuration options.
5. Next to **Location**, click **Browse** then select the previously configured datastore, such as, Unity 80GB LUN, and click **OK**. The screen looks similar to Figure 22.

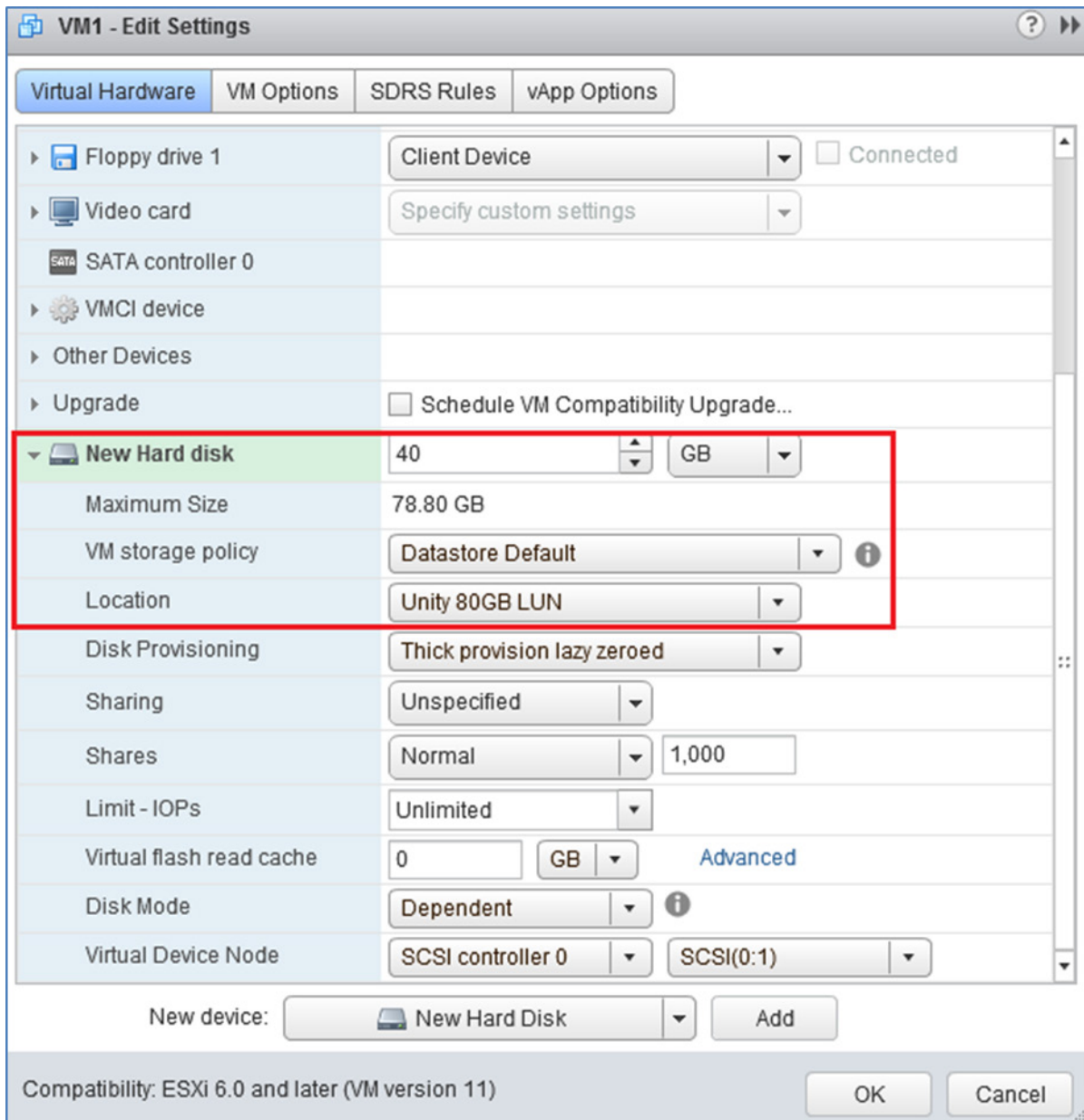


Figure 22 New hard disk configuration options

6. Next to **New Hard disk**, set the size in GB less than or equal to the **Maximum size** shown on the line below. The size is set to **40 GB** in this example.
7. Click **OK** to close the **Edit Settings** window and create the virtual disk.

B.3.8 Configure the virtual disk in Windows Server

The following example is applicable for VMs running Windows Server 2008, 2012, or 2016. See the operating system documentation to configure virtual disks on other supported guest operating systems.

1. Power on the VM and log in to the Windows Server guest operating system.
2. Within Windows Server, click **Server Manager, Tools, > Computer Management, Storage, then Disk Management**.

Note: If an **Initialize Disk** window displays, click **OK** to initialize now, or **Cancel** to initialize in step 5.

3. If the new disk is not present in the list, right click on **Disk Management** and select **Rescan Disks**.
4. The new hard disk displays in the list (**Disk 1** in Figure 23).

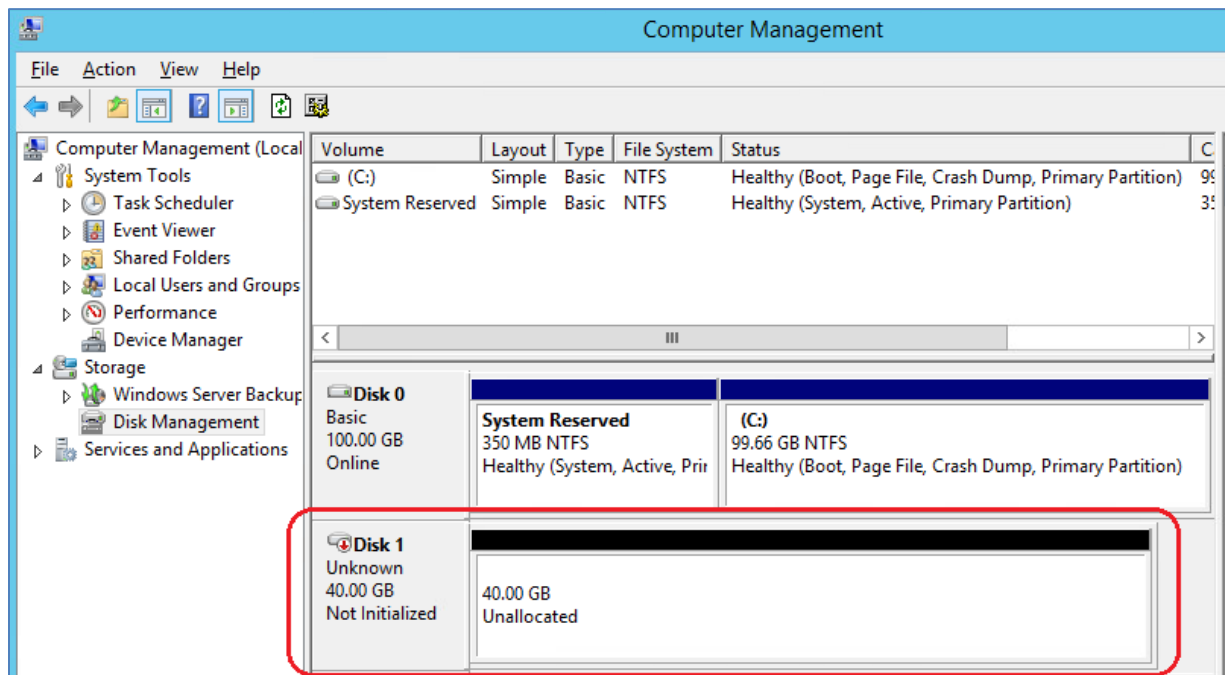


Figure 23 Windows Server Disk Management utility

5. If the disk is not initialized or if it is not online, right-click in the box containing the **Disk #**, for example, **Disk 1** and use the menu options to bring the disk online and initialize it.
6. Continue using the Disk Management application to format the disk.

C Technical resources

[Dell EMC Networking Guides](#)

[Dell EMC Networking Layer 3 Leaf-Spine Deployment and Best Practices with OS10EE](#)

[OS10 Enterprise Edition User Guide Release 10.4.2.0](#)

D Support and feedback

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