Dell EMC PowerEdge MX SmartFabric Deployment Guide

Abstract

This document provides steps for configuring and deploying PowerEdge MX networking switches in SmartFabric mode. Deployment examples include Dell EMC Networking, Cisco Nexus, and Cisco ACI environments.

November 2018

Revisions

Date	Description
November 2018	Added Scenario 3 – Cisco ACI environment, added MX5108n switch as an option for deployment scenarios
September 2018	Initial release

Table of contents

1 Introduction

The new Dell EMC PowerEdge MX, a unified, high-performance data center infrastructure, provides the agility, resiliency, and efficiency to optimize a wide variety of traditional and new, emerging data center workloads and applications. With its kinetic architecture and agile management, PowerEdge MX dynamically configures compute, storage and fabric, increases team effectiveness and accelerates operations. Its responsive design delivers the innovation and longevity customers of all sizes need for their IT and digital business transformations.

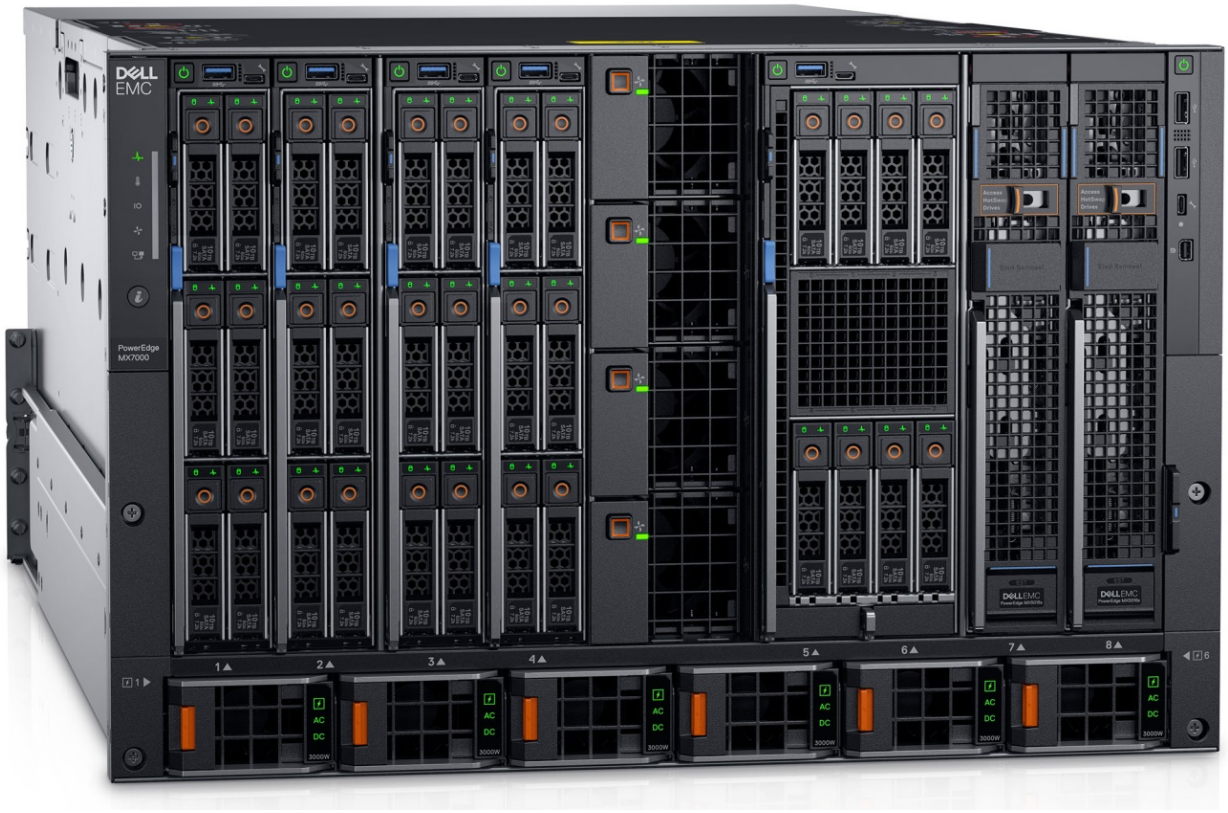


Figure 1 Dell EMC PowerEdge MX7000 chassis

This document provides examples for deployment of two PowerEdge MX7000 chassis and the setup and configuration of the new switch operating mode, SmartFabric. This guide also demonstrates connectivity with different leaf switch options, including:

- Dell EMC Networking Z9100-ON
- Cisco Nexus 3232C
- Cisco Nexus C93180YC-EX in Application Centric Infrastructure (ACI) mode

Table 1 outlines what this document is and is not. Also, this deployment guide assumes a basic understanding of the PowerEdge MX platform.

Table 1 Dell EMC PowerEdge MX SmartFabric Deployment Guide - is/is not

This guide is	This guide is not / does not
A reference for the most used features of SmartFabric operating mode	A guide for all features of the MX7000 platform
A secondary reference to the Release Notes	Take precedence over the Release Notes

Note: For a general overview of PowerEdge MX networking concepts, see the *Dell EMC PowerEdge MX Network Architecture Guide*.

1.1 Typographical conventions

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

`Monospace Text`	CLI examples
`Underlined Monospace Text`	CLI examples that wrap the page
`Italic Monospace Text`	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 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, 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 B contains a complete listing of hardware and software validated for this guide.

Note: While the steps in this document were validated using the specified Dell EMC Networking switches and operating system(s), they may be leveraged for other Dell EMC Networking switch models utilizing the same networking OS version or later assuming the switch has the available port numbers, speeds, and types.

2.1 Dell EMC PowerEdge MX7000 chassis

The PowerEdge MX7000 chassis has one of three control panel options for administration, up to six hot-pluggable, redundant, 3000-watt power supplies and up eight compute and storage sleds. Figure 2 shows the front of the chassis and the following installed components:

- One touchscreen LCD panel (optional)
- Two Dell EMC PowerEdge MX740c sleds in slots one and two
- Six blank inserts in slots three through eight

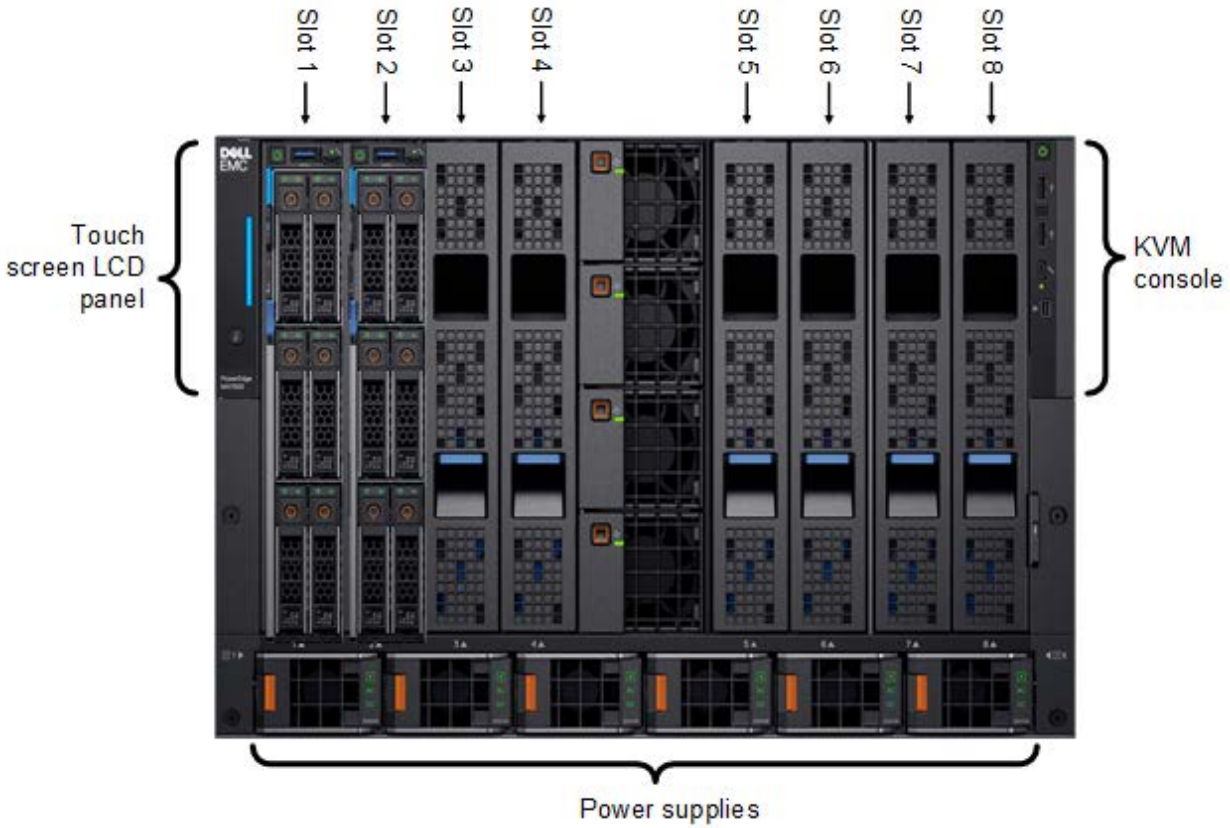


Figure 2 Dell EMC PowerEdge MX7000–front

The MX7000 includes three I/O fabrics. Fabrics A and B for Ethernet I/O Module (IOM) connectivity, and Fabric C for SAS and Fibre Channel (FC) connectivity. Each Fabric provides two slots for redundancy.

Figure 3 shows the back of the PowerEdge MX7000 chassis configured with the following:

- One Dell EMC Networking MX9116n Fabric Switching Engine (FSE) shown in fabric slot A1
- One Dell EMC Networking MX7116n Fabric Expander Module (FEM) shown in fabric slot A2
- Two Dell EMC PowerEdge MX9002m modules installed in management slots MM1 and MM2

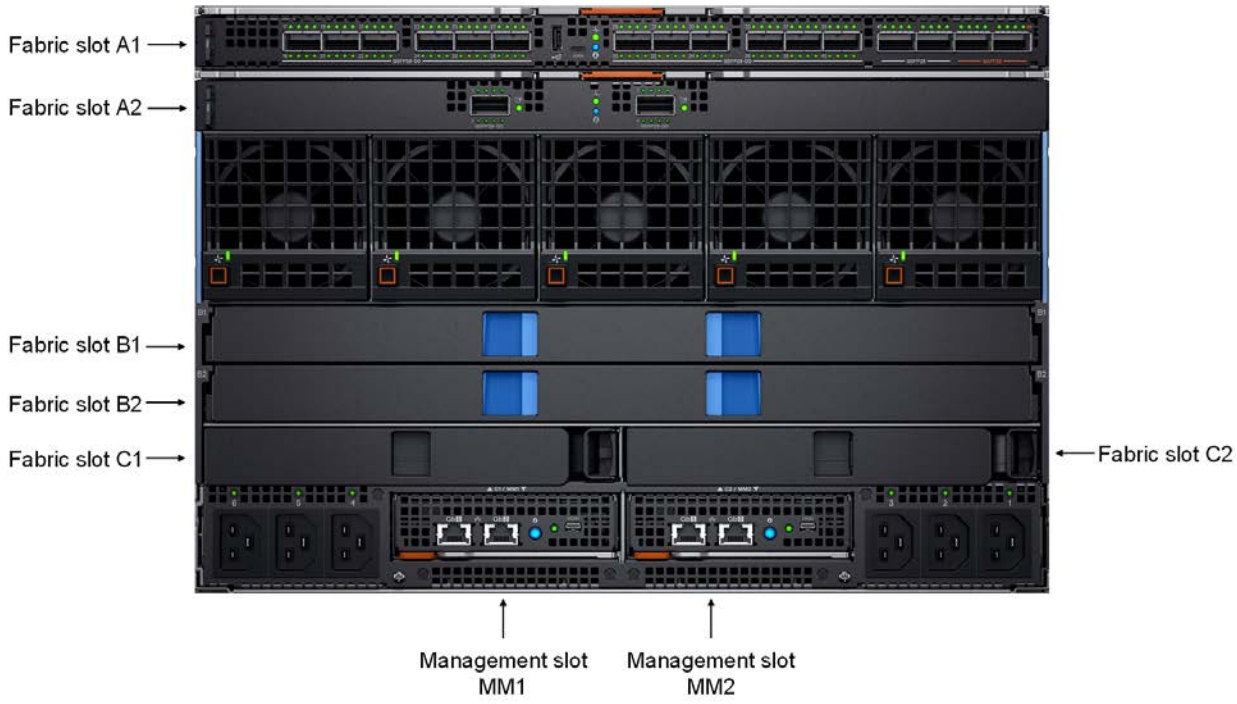


Figure 3 Dell EMC PowerEdge MX7000–back

Note: Two PowerEdge MX7000 chassis with the hardware shown in Figure 2 and Figure 3 are used in this guide. Compute sled models and quantities vary in the examples.

2.1.1 Dell EMC PowerEdge MX740c compute sled

The PowerEdge MX740c is a two-socket, full-height, single-width sled with impressive performance and scalability. It is ideal for dense virtualization environments and can serve as a foundation for collaborative workloads. An MX7000 chassis supports up to eight MX740c sleds.

PowerEdge MX740c key features include:

- Single-width slot design
- Two CPU sockets
- 24 DIMM slots of DDR4 memory
- Boot options include BOSS-S1 or IDSDM
- Up to six SAS/SATA SSD/HDD and NVMe PCIe SSDs
- Two PCIe mezzanine card slots for connecting to network Fabric A and B
- One PCIe mini-mezzanine card slot for connecting to storage Fabric C
- iDRAC9 with Lifecycle Controller

Figure 4 Dell EMC PowerEdge MX740c sled with six 2.5-inch SAS drives

2.1.2 Dell EMC PowerEdge MX840c compute sled

The PowerEdge MX840c, a powerful four-socket, full-height, double-width sled features dense compute and memory capacity and a highly expandable storage subsystem. It is the ultimate scale-up server that excels at running a wide range of database applications, substantial virtualization, and software-defined storage environments. An MX7000 chassis supports up to four MX840c sleds.

PowerEdge MX840c key features include:

- Dual-width slot design
- Four CPU sockets
- 48 DIMM slots of DDR4 memory
- Boot options include BOSS-S1 or IDSDM
- Up to eight SAS/SATA SSD/HDD and NVMe PCIe SSDs
- Four PCIe mezzanine card slots for connecting to network Fabric A and B
- Two PCIe mini-mezzanine card slots for connecting to storage Fabric C
- iDRAC9 with Lifecycle Controller

Figure 5 Dell EMC PowerEdge MX840c sled with eight 2.5-inch SAS drives

2.1.3 Dell EMC PowerEdge MX9002m module

The Dell EMC MX9002m module controls overall chassis power, cooling, and hosts the OpenManage Enterprise Modular (OME-M) console. Two external Ethernet ports are provided to allow management connectivity and to connect additional MX7000 chassis in a single logical chassis. An MX7000 supports two MX9002m modules for redundancy. Figure 6 shows a single MX9002m module and its components.

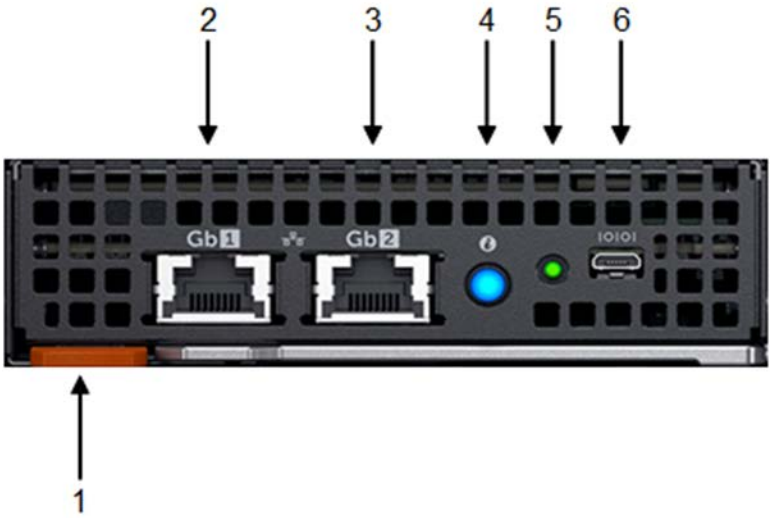


Figure 6 Dell EMC PowerEdge MX9002m module

The following MX9002m module components are labeled in Figure 6.

1. Handle release
2. Gigabit Ethernet port 1 (Gb1)
3. Gigabit Ethernet port 2 (Gb2)
4. ID button and health status LED
5. Power status LED
6. Micro-B USB console port

Note: In this document, two MX9002m modules are used in each MX7000 chassis.

2.1.4 Dell EMC Networking MX9116n Fabric Switching Engine

The Dell EMC Networking MX9116n Fabric Switching Engine (FSE) is a scalable, high-performance, low latency 25GbE switch purpose-built for the PowerEdge MX platform. The MX9116n FSE provides enhanced capabilities and cost-effectiveness for the enterprise, mid-market, Tier2 cloud, and NFV service providers with demanding compute and storage traffic environments.

In addition to 16 internal 25GbE ports, the MX9116n FSE provides the following external interfaces:

- Two 100GbE QSFP28 ports
- Two 100GbE/100GFC QSFP28 unified ports
- Twelve 200GbE QSFP28-Double Density (DD) ports

The two 100GbE QSFP28 ports provide Ethernet uplink connectivity. The two QSFP28 unified ports support SAN connectivity supporting both NPIV Proxy Gateway (NPG) and direct attach FC capabilities.

The QSFP28-DD ports provide capacity for additional uplinks, Virtual Link Trunking interconnect (VLTi) links, and connections to rack servers at 10GbE or 25GbE using breakout cables. Also, the QSFP28-DD ports provide fabric expansion connections for up to nine additional MX7000 chassis leveraging the MX7116n Fabric Expander Module in Fabric A and B. See Appendix A.5 for QSFP28-DD connector information.

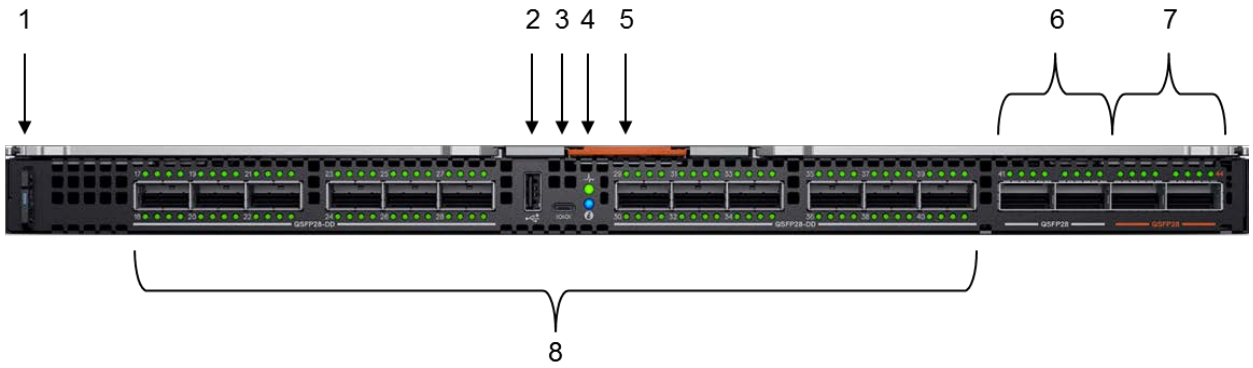


Figure 7 Dell EMC Networking MX9116n FSE

The following MX9116n FSE components are labeled in Figure 7:

1. Express service tag
2. Storage USB port
3. Micro-B USB console port
4. Power and indicator LEDs
5. Module insertion/removal latch
6. Two QSFP28 ports
7. Two QSFP28 unified ports
8. Twelve QSFP28-DD ports

Note: In this document, two MX9116n FSEs are used–one in each MX7000 chassis.

2.1.5 Dell EMC Networking MX7116n Fabric Expander Module

The Dell EMC Networking MX7116n Fabric Expander Module (FEM) acts as an Ethernet repeater, taking signals from attached compute sleds and repeating them to the associated lanes on the external QSFP28-DD ports. The MX7116n FEM provides eight internal 25GbE connections to the chassis and two external QSFP28-DD interfaces.

There is no operating system or switching ASIC on the MX7116n FEM, so it never requires an upgrade. There is also no management or user interface, making the MX7116n FEM maintenance-free.

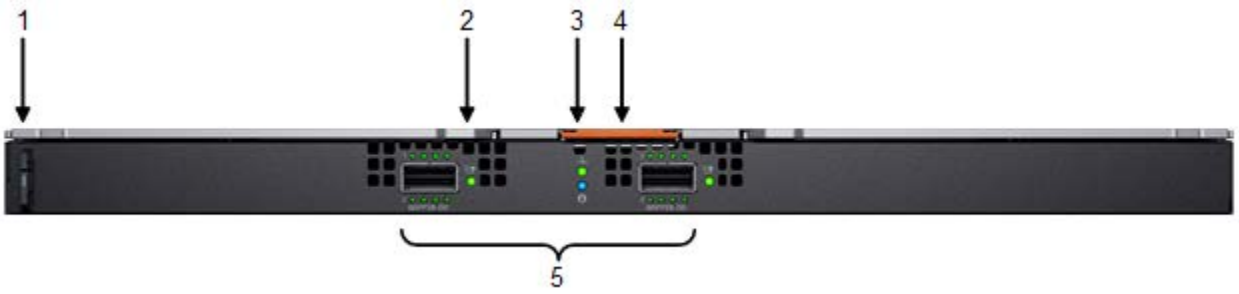


Figure 8 Dell EMC Networking MX7116n FEM

The following MX7116n FEM components are labeled in Figure 8:

1. Express service tag
2. Supported optic LED
3. Power and indicator LEDs
4. Module insertion/removal latch
5. Two 200GbE QSFP28-DD fabric expander ports

Note: In this document, two MX7116n FEMs are used–one in each MX7000 chassis.

2.1.6 Dell EMC Networking MX5108n Ethernet switch

The Dell EMC Networking MX5108n Ethernet switch is targeted at smaller PowerEdge MX7000 deployments using one or two chassis. While not a scalable switch, it still provides high-performance and low latency with a non-blocking switching architecture. The MX5108n provides line-rate 25GbE layer 2 and layer 3 forwarding capacity to all connected servers with no oversubscription.

In addition to eight internal 25GbE ports, the MX5108n provides the following external interfaces:

- One 40GbE QSFP+ port
- Two 100GbE QSFP28 ports
- Four 10gbE BASE-T ports

The ports can be used to provide a combination of network uplink, VLTi, or FCoE (FSB) connectivity. The MX5108n does not support NPG or direct attach FC capabilities.

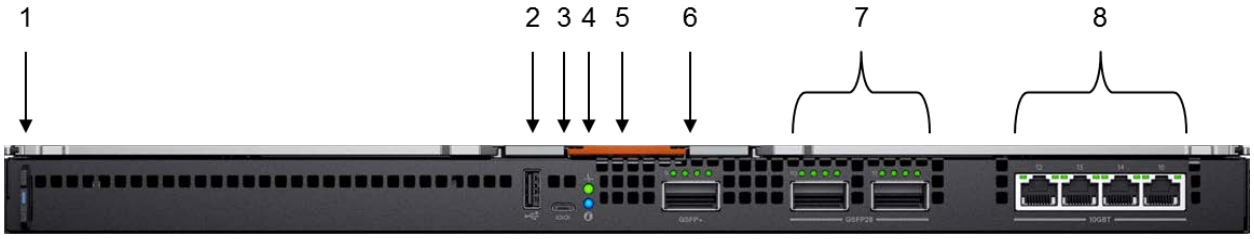


Figure 9 Dell EMC Networking MX5108n

The following MX5108n components are labeled in Figure 9:

1. Luggage Tag
2. Storage USB Port
3. Micro-B USB console port
4. Power and indicator LEDs
5. Module insertion/removal latch
6. One QSFP+ port
7. Two QSFP28 ports
8. Four 10GbE BASE-T ports

Note: While the examples in this guide are specific to the MX9116n FSE and MX7116n FEM, the use of two MX5108n switches in a single chassis is supported for the solutions shown. Cabling options for the MX5108n will differ from the MX9116n/MX7116n as shown in the Dell EMC PowerEdge MX IO Guide.

2.2 Rack-mounted networking switches

This section covers the rack-mounted networking switches used in the examples in this guide.

2.2.1 Dell EMC Networking S3048-ON

The Dell EMC Networking S3048-ON is a 1-Rack Unit (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 10 Dell EMC Networking S3048-ON

2.2.2 Dell EMC Networking Z9100-ON

The Dell EMC Networking Z9100-ON is a 1-RU multilayer switch with thirty-two QSFP28 ports supporting 10/25/40/50/100GbE and two 10GbE SFP+ ports. A pair of Z9100-ON switches is used as leaf switches in Scenario 1 in this guide.

Figure 11 Dell EMC Networking Z9100-ON

2.2.3 Cisco Nexus 3232C

The Cisco Nexus 3232C is a 1-RU fixed form-factor 100GbE switch with thirty-two QSFP28 ports supporting 10/25/40/50/100GbE. A pair of Cisco Nexus 3232C switches is used as leaf switches in Scenario 2 in this guide.

2.2.4 Cisco Nexus C93180YC-EX

The Cisco Nexus C93180YC-EX switch is a 1-RU switch with forty-eight 1/10/25GbE ports and six 40/100GbE ports. A pair of Cisco Nexus C93180YC-EX switches is used as Cisco ACI leaf switches in Scenario 3 in this guide.

2.2.5 Cisco Nexus C9336-PQ

The Cisco Nexus C9336-PQ switch is a 2-RU switch with thirty-six 40GbE QSFP+ ports. One Cisco Nexus C9336-PQ switch is used as a Cisco ACI spine switch in Scenario 3 in this guide.

3 PowerEdge MX7000 chassis fabrics

The PowerEdge MX7000 chassis includes two I/O fabrics, fabric A and fabric B. The vertically aligned compute sleds in slots one through eight connect to the horizontally aligned IOMs in slots A1, A2, B1, and B2. This orthogonal connection method results in a midplane-free design and allows the adoption of new I/O technologies without the burden of having to upgrade the midplane.

The MX740c supports two mezzanine cards, and the MX840c supports four mezzanine cards. Each mezzanine card connects to a pair of IOMs installed in the corresponding fabric slots as shown in Figure 12. For example, port one of mezzanine card A1 connects to fabric slot A1, containing an MX9116n FSE for example (not shown). Port two of mezzanine card A1 connects to fabric slot A2, containing an MX7116n FEM for example (not shown).

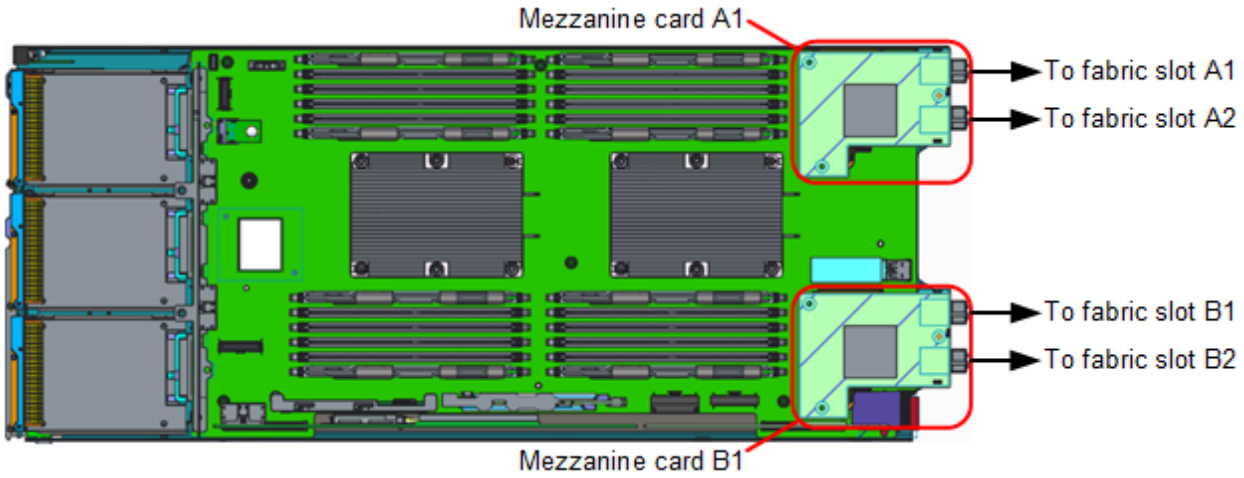


Figure 12 Dell EMC PowerEdge MX740c mezzanine cards

Table 2 shows the port mapping for fabric A. The MX9116n FSE in slot A1 maps dual-port mezzanine cards to odd-numbered ports. The MX7116n FEM, connected to the MX9116n FSE, maps to virtual ports with each port representing a compute sled attached to the MX7116n FEM.

Table 2 Port mapping example for fabric A

MX7000 slot	MX9116n FSE ports	MX7116n FEM virtual ports
1	Ethernet 1/1/1	Ethernet 1/71/1
2	Ethernet 1/1/3	Ethernet 1/71/2
3	Ethernet 1/1/5	Ethernet 1/71/3
4	Ethernet 1/1/7	Ethernet 1/71/4
5	Ethernet 1/1/9	Ethernet 1/71/5
6	Ethernet 1/1/11	Ethernet 1/71/6
7	Ethernet 1/1/13	Ethernet 1/71/7
8	Ethernet 1/1/15	Ethernet 1/71/8

Note: In this document, only Fabric A is used.

4 PowerEdge MX IOM overview

4.1 OS10 Enterprise Edition

The Dell EMC Networking MX9116n FSE and MX5108n support Dell EMC Networking OS10 Enterprise Edition (OS10EE). OS10EE is a network operating system supporting multiple architectures and environments.

The following additional OS10EE CLI commands are available for the MX9116n FSE to assist with MX7116n FEM management:

- `show switch-operating-mode` – displays the current operating mode of a supported switch
- `show port-group` – displays the current port-group configuration on the switch
- `show discovered-expanders` – displays the MX7116n FEMs attached to the MX9116n FSEs
- `show unit-provision` – displays the unit ID and service tag of the MX7116n FEM attached to an MX9116n FSE
- `port-group` – configures a group of front-panel unified ports or QSFP28-DD port

Note: For more information, see the *OS10 Enterprise Edition User Guide for PowerEdge MX I/O Modules* on the Support for Dell EMC Networking MX9116n - Manuals and documents web page.

4.2 Operating Modes

The Dell EMC Networking MX9116n FSE and MX5108n operate in one of two modes:

1. **Full Switch Mode** – Enabled by default, all switch-specific OS10EE capabilities are available
2. **SmartFabric Mode** – Switches operate as layer 2 I/O aggregation devices and are managed through the Open Manage Enterprise Modular console

Table 3 outlines the differences between the two operating modes. The differences between operating modes apply to both the MX9116n FSE and the MX5108n.

Table 3 IOM operating mode differences

Full Switch mode	SmartFabric mode

Configuration changes are persistent during power cycle events.	Only the configuration changes made using the OS10 commands below are persistent across power cycle events. All other CLI configuration commands are disabled.
	
	`clock`
	`hostname`
	`interface`
	`ip nameserver`
	`logging`
	`management route`
	`ntp`
	`snmp-server`
	`username`
	`spanning-tree`
	`vlan`

Full Switch mode	SmartFabric mode
All switch interfaces are assigned to VLAN 1 by default and are in the same Layer 2 bridge domain.	Layer 2 bridging is disabled by default. Interfaces must join a bridge domain (VLAN) before being able to forward frames.
All configurations changes are saved in the running configuration by default. To display the current configuration, use the `show running-configuration` command.	Verify configuration changes using feature-specific show commands, such as `show interface` and `show vlan`, instead of `show running-configuration`.

4.3 SmartFabric mode details

A SmartFabric is a logical entity that consists of a collection of physical resources, such as servers and switches, and logical resources such as networks, templates, and uplinks. The OpenManage Enterprise Modular console provides a method to manage these resources as a single unit and supports most switch configuration settings. SmartFabric mode supports all OS10EE `show` commands and the following subset of CLI configuration commands:

- `clock` – Configure clock parameters
- `end` – Exit to the EXEC mode
- `exit` – Exit from the current mode
- `help` – Display available commands
- `hostname` – Set the system hostname
- `interface` – Configure or select an interface
- `ip nameserver` – Configure nameserver
- `logging` – Configure system logging
- `management route` – Configure the IPV4/IPv6 management route
- `no` – Delete or disable commands in configuration mode
- `ntp` – Configure the network time protocol
- `snmp-server` – Configure the SNMP server
- `username` – Create or modify user credentials
- spanning-tree commands:
  - `disable` – Disable spanning tree globally
  - `mac-flush-timer` – Set the time used to flush MAC address entries
  - `mode` – Enable a spanning-tree mode, such as RSTP or MST
  - `mst` – Configure multiple spanning-tree (MST) mode
  - `rstp` – Configure rapid spanning-tree protocol (RSTP) mode
  - `vlan` – Configure spanning-tree on a VLAN range

Note: For Spanning Tree Protocol recommendations, see Appendix A.4.

5 Scalable Fabric Architecture overview

A new concept with the PowerEdge MX platform is the Scalable Fabric Architecture. A Scalable Fabric spans multiple chassis and allows them to behave like a single chassis from a networking perspective.

A Scalable Fabric consists of two main components, a pair of MX9116n FSEs in the first two chassis and additional pairs of MX7116n FEMs in the remaining chassis. Each MX7116n FEM connects to the MX9116n FSE corresponding to its fabric and slot. All IOMs participating in the fabric are configured in either Full Switch or SmartFabric mode.

Figure 13 shows three (expandable to ten) MX7000 chassis in a single Scalable Fabric Architecture. The first two chassis each contain one MX9116n FSE and one MX7116n FEM. Chassis 3-10 each contain two MX7116n FEMs. All connections in the figure use QSFP28-DD connections.

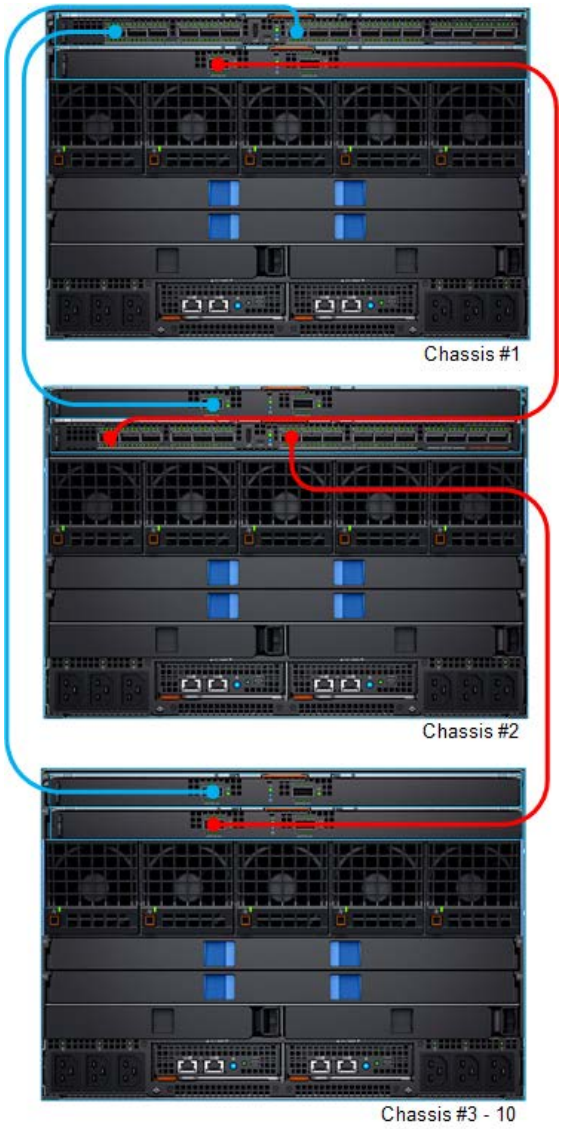


Figure 13 Scalable Fabric example using Fabric A

In this document, a Scalable Fabric Architecture is deployed across two PowerEdge MX7000 chassis. Both MX9116n FSEs operate in SmartFabric mode. This section provides an overview of the management network and the Scalable Fabric Architecture used in this document.

5.1 OOB Management network

Figure 14 shows a Dell EMC Networking S3048-ON used as an OOB management switch. Management ports from the leaf switches and the MX9002 modules connect to the S3048-ON as shown. Management ports on other equipment in the rack (not shown), such as PowerEdge server iDRACs, are also connected to the S3048-ON. Not shown is the S3048-ON connecting to the management network core.

Note: Shown for the leaf switch layer is a pair of Dell EMC Networking Z9100-ON switches. If using Cisco Nexus switches, management network configuration is identical.

For the S3048-ON management switch, all ports used are in Layer 2 mode and are in the default VLAN. Spanning Tree Protocol (STP) is enabled as a precaution against loops. Additional configuration is not required.

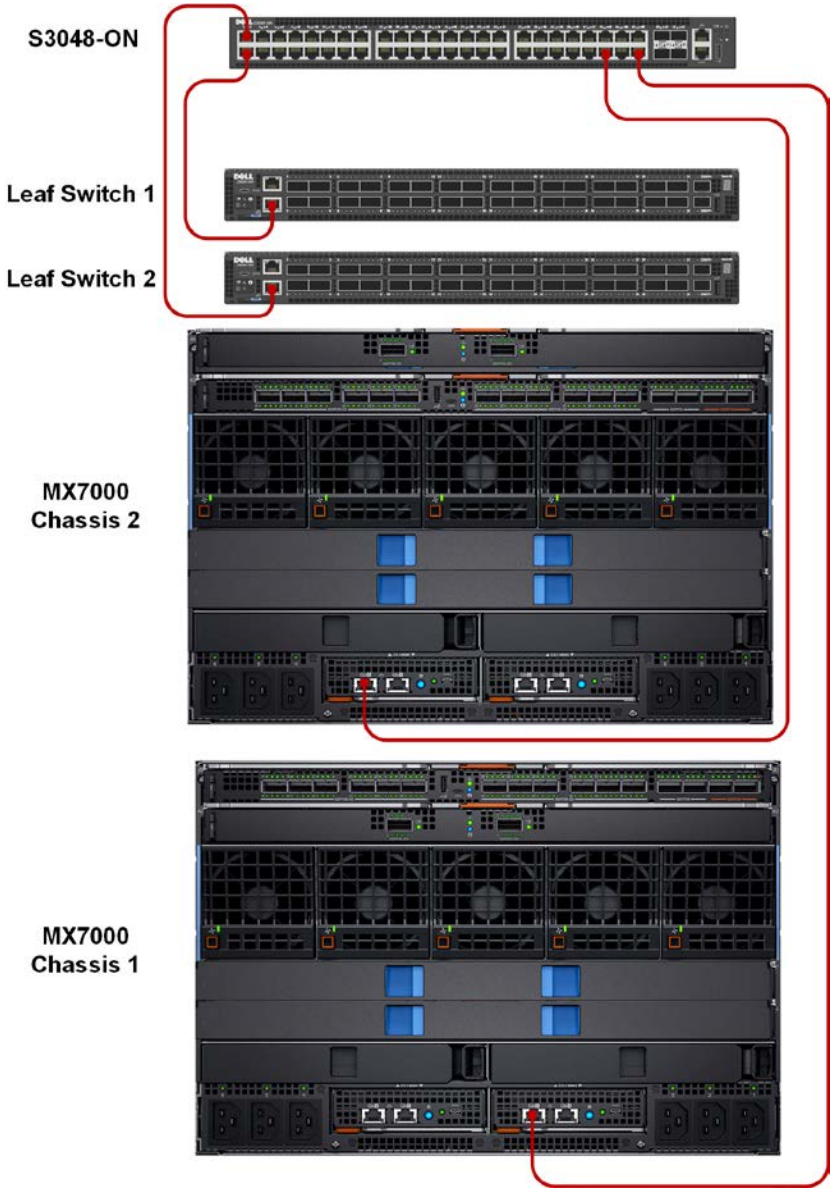


Figure 14 Management network

Note: MX9002 module daisy chain cabling is shown in section 6.1.

5.2 Scalable Fabric Architecture network

Figure 15 shows the Scalable Fabric Architecture network and how each of the MX9116n FSEs connect to a pair of leaf switches using QSFP28 cables. The MX9116n FSEs interconnect through a pair of QSFP28-DD ports. MX7116n FEMs connect to the MX9116n FSE in the other chassis as shown.

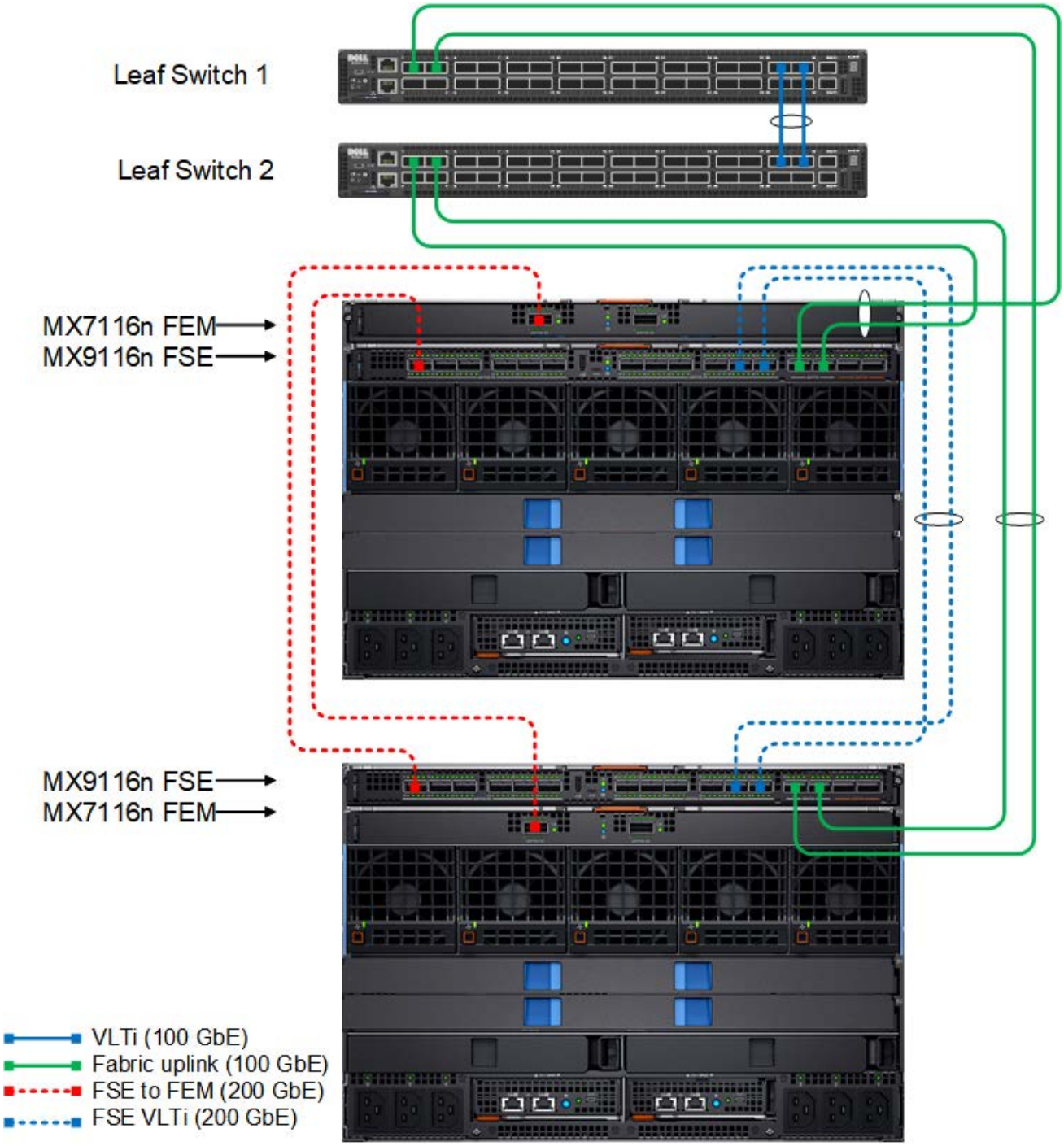


Figure 15 Scalable Fabric Architecture topology

Note: For more information on QSFP28-DD connectors, see Appendix A.5.

6 OpenManage Enterprise Modular console

The PowerEdge MX9002m module hosts the OpenManage Enterprise Modular (OME-M) console. OME-M is the latest addition to the Dell OpenManage Enterprise suite of tools and provides a centralized management interface for the PowerEdge MX platform. OME-M console features include:

- End-to-end lifecycle management for servers, storage, and networking
- A touch LCD for initial setup and error notification
- Leverages iDRAC9 intelligent automation and security features
- Manages one or multiple chassis from a single web or REST API leveraging multi-chassis management (MCM) groups
- OpenManage Mobile for configuration and troubleshooting including wireless server vKVM
- Creation and deployment of SmartFabric topologies

6.1 PowerEdge MX9002m module cabling

Multiple PowerEdge MX9002m modules are grouped to form domains called MCM groups. A single MCM group can include up to 10 chassis, where one is the lead and the remaining chassis are members. The OpenManage Enterprise Modular console supports a daisy chain topology using the redundant 1GbE ports on the MX9002m module.

An MCM group includes the following features:

- Provides the rollup health status of the OME-M chassis group
- Automatically propagates lead chassis settings to member chassis

In addition to the two MX7000s each having a single connection to the S3048-ON management switch, additional inter-chassis cabling is shown in Figure 16. These additional 1GbE cables provide redundancy to all available MMs in both chassis. Table 4 lists each Mx90002 module and its associated connections.

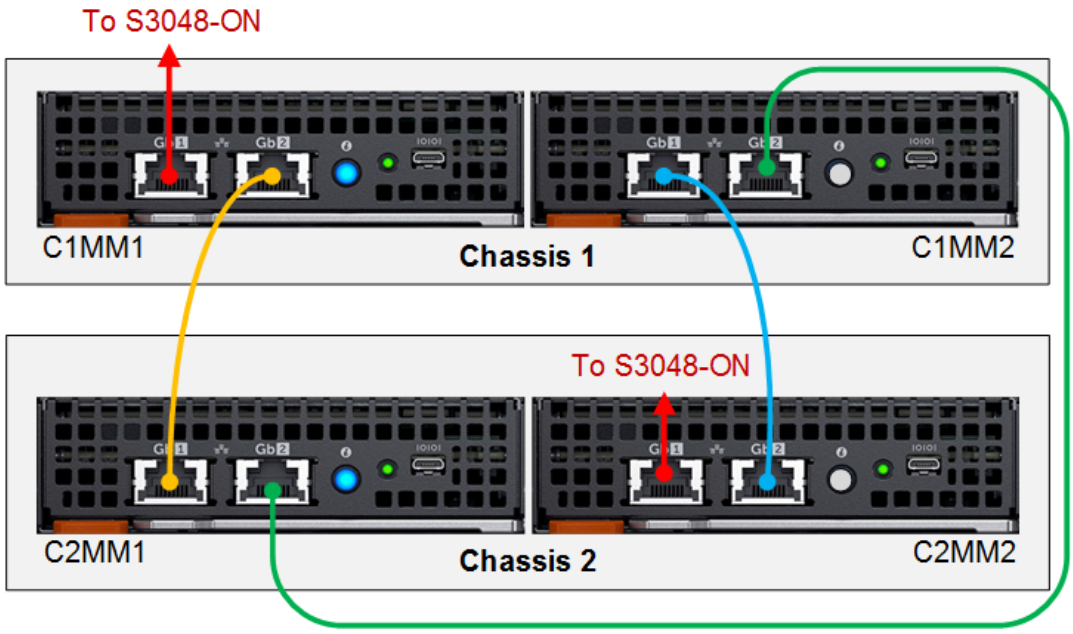


Figure 16 Dell EMC PowerEdge MX9002m module daisy chain cabling

Table 4 Dell EMC PowerEdge MX9002m module daisy chain cabling

C*x*MM*x*	Port Gb1	Port Gb2
C1MM1	To S3048-ON	C2MM1 Port Gb1
C2MM1	C1MM1 Port Gb2	C1MM2 Port Gb2
C1MM2	C2MM2 Port Gb2	C2MM1 Port Gb2
C2MM2	To S3048-ON	C1MM2 Port Gb1

6.2 PowerEdge MX7000 initial deployment

Initial configuration may be done through the LCD touchscreen. If DHCP is not used, perform the following steps to assign a static IP address and gateway to each chassis:

1. Activate the LCD touchscreen by tapping the screen lightly. The **Select Language** screen appears.
2. Select the desired language, such as **English**.
3. Select **Main Menu**, and then **Save**.
4. Select **Settings > Network Settings > Edit > IPv4 > Static IP**.
5. Select **Yes** to change the IP settings from DHCP to Static.
6. Provide the following:
   a. IP address
   b. Subnet mask
   c. Default gateway
7. Select **Save**.

Repeat steps 1 through 7 for each chassis.

On first logging into the OME-M console, the **Chassis Deployment Wizard** displayed. In this document, only MCM group definition settings are initially configured. All settings are optional and can be completed later by selecting **Overview > Configure** > **Initial Configuration** on the chassis page.

To complete the **Chassis Deployment Wizard,** complete the following steps:

1. In the **Chassis Deployment Wizard** window, click **Group Definition** in the left pane.
2. In the **Group Definition** pane, select the **Create Group** checkbox and complete the following:
   a. In the **Group Name** box, enter a name**,** for example, **Group1**.
   b. Optionally, enter a description in the **Group Description** box.
   c. Next to **Onboarding Permissions**, select **Automatic**.
   d. Select the **All** checkbox under **Propagate Configuration to Members**.
   e. Under **Available Chassis**, select the second MX7000 chassis and click **Add Chassis**.
   f. Under **Current Members**, confirm that the selected chassis is listed.
   g. Click **Next**.
3. On the **Summary** page, confirm the icon is displayed next to **Group Definition Settings** under **Progress Status**.
4. Click **Submit**.

After the window closes, click the **Home** button on the navigation pane. The group appears in the upper left corner of the page with all participating chassis members. It may take an additional few minutes for the secondary chassis to be added. When complete, both chassis should appear on the **Home** page with the status icon as shown in Figure 17.

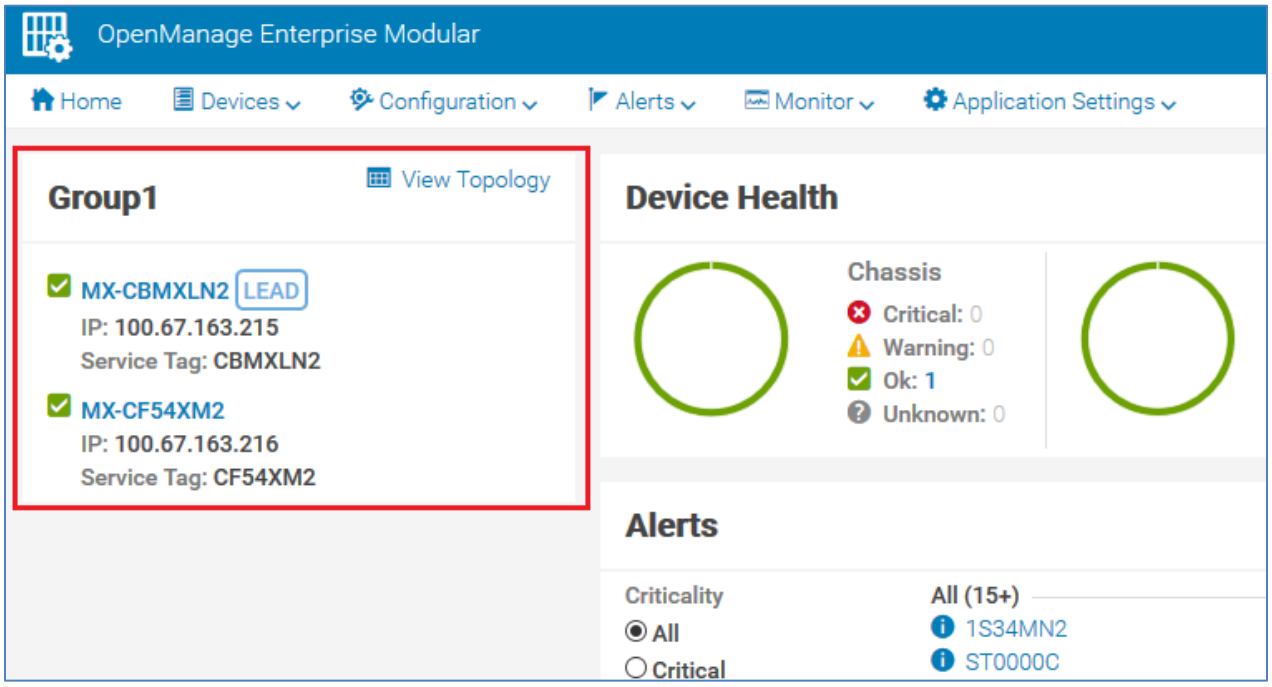


Figure 17 Healthy MCM group

6.3 PowerEdge MX7000 component management

All switches running OS10EE form a redundant management cluster that provides a single REST API endpoint to OME-M to manage all switches in a chassis or across all chassis in an MCM group. Figure 18 shows the PowerEdge MX networking IOMs in the MCM group. This page is accessed by selecting **Devices > I/O Modules.**

Each IOM can be configured directly from the OME-M console. Administrative tasks include:

- Viewing IOM-specific alerts
- Power cycling the IOM
- Configuring device management information
- Configuring port breakout modes
- Updating IOM firmware

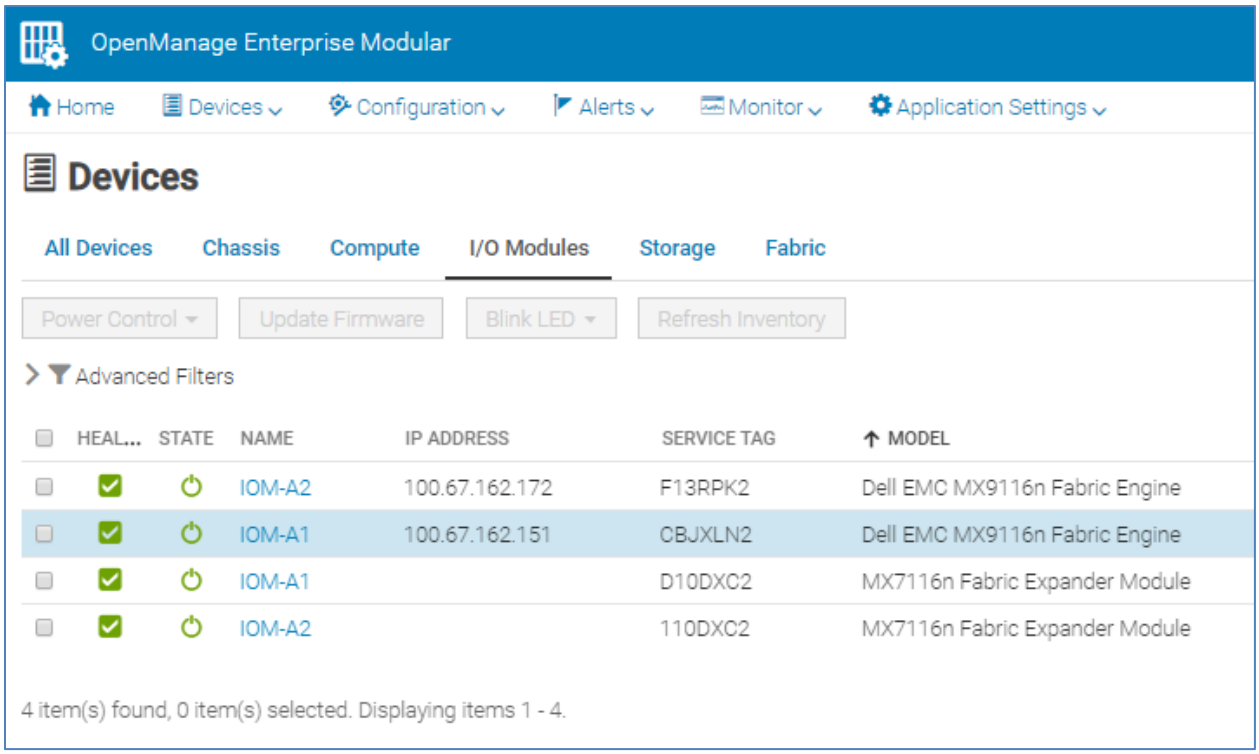


Figure 18 OME-M console – I/O Modules page

IOMs are configured to receive their management IP address via DHCP by default. To optionally configure static IP addresses and hostnames on the MX9116n IOMs, do the following:

1. Open the OME-M console.
2. From the navigation menu, click **Devices > I/O Modules.**
3. Click **IOM-A1** for the first MX9116n.
4. On the **IOM-A1** page, click the **Settings** tab and expand **Network**.
5. Under IPv4 settings, uncheck the **Enable DHCP** box and specify a valid **IP Address, Subnet Mask**, and **Gateway.**
6. Click **Apply.**
7. Expand Management and enter a Host Name, for example, **MX9116n-1**.
8. Click Apply.

Repeat steps 3-7 for the second MX9116n, **IOM-A2.**

7 Scenario 1 - SmartFabric deployment while connected to Z9100-ON switches

Figure 19 shows the production topology using a pair of Z9100-ONs as leaf switches. This section walks through configuring the Z9100-ONs as well as creating a SmartFabric and the corresponding uplinks.

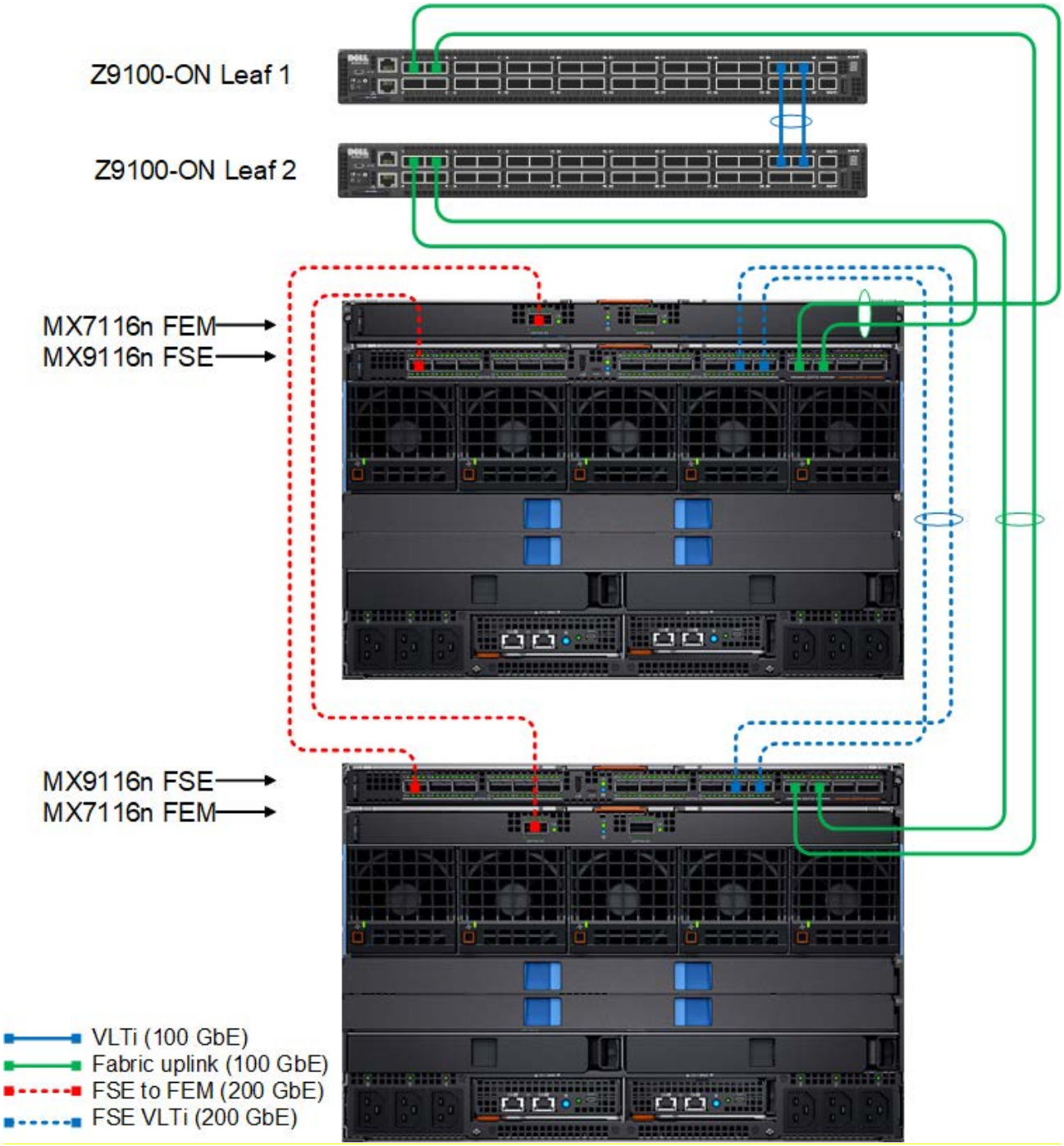


Figure 19 SmartFabric with Z9100-ON leaf switches

Note: See Appendix A.5 for more information on QSFP28-DD cables.

7.1 Dell EMC Networking Z9100-ON leaf switch configuration

The following section outlines the configuration commands issued to the Dell EMC Networking Z9100-ON leaf switches. The switches start at their factory default settings per Appendix A.2.

1. Use the following commands to set the hostname, and to configure the OOB management interface and default gateway.

Z9100-ON Leaf 1	Z9100-ON Leaf 2
configure terminal hostname Z9100-Leaf1 interface mgmt 1/1/1 no ip address dhcp no shutdown ip address 100.67.162.35/24 management route 0.0.0.0/0 100.67.162.254	configure terminal hostname Z9100-Leaf2 interface mgmt 1/1/1 no ip address dhcp no shutdown ip address 100.67.162.34/24 management route 0.0.0.0/0 100.67.162.254

2. Configure the VLT on each spine switch using the following commands. VLT configuration involves setting a discovery interface range and discovering the VLT peer in the VLTi.

Z9100-ON Leaf 1	Z9100-ON Leaf 2
interface range ethernet1/1/29- 1/1/31 description VLTi no shutdown no switchport vlt-domain 1 backup destination 100.67.162.34 discovery-interface ethernet1/1/29-1/1/31	interface range ethernet1/1/29- 1/1/31 description VLTi no shutdown no switchport vlt-domain 1 backup destination 100.67.169.35 discovery-interface ethernet1/1/29-1/1/31

3. Configure the required VLANs on each switch.

Z9100-ON Leaf 1	Z9100-ON Leaf 2
interface vlan10 description “Company A General Purpose” no shutdown	interface vlan10 description “Company A General Purpose” no shutdown

4. Configure the port channels that connect to the downstream MX9116n FSEs. Then, exit configuration mode and save the configuration.

Z9100-ON Leaf 1	Z9100-ON Leaf 2
interface port-channel1 description "To MX Chassis" no shutdown switchport mode trunk switchport trunk allowed vlan10 vlt-port-channel 1 interface ethernet1/1/1 description "To MX Chassis-1" no shutdown no switchport channel-group 1 mode active interface ethernet1/1/3 description "To MX Chassis-2" no shutdown no switchport channel-group 1 mode active end write memory	interface port-channel1 description "To MX Chassis" no shutdown switchport mode trunk switchport trunk allowed vlan10 vlt-port-channel 1 interface ethernet1/1/1 description "To MX Chassis-1" no shutdown no switchport channel-group 1 mode active interface ethernet1/1/3 description "To MX Chassis-2" no shutdown no switchport channel-group 1 mode active end write memory

7.2 Deploy a SmartFabric

SmartFabric deployment consists of four broad steps all completed using the OME-M console:

1. Create the VLANs to be used in the fabric.
2. Select switches and create the fabric based on the physical topology desired.
3. Create uplinks from the fabric to the existing network and assign VLANs to those uplinks.
4. Deploy the appropriate server templates to the compute sleds.

7.2.1 Define VLANs

To define VLANs using the OME-M console, perform the following steps:

1. Open the OME-M console.
2. From the navigation menu, click **Configuration** > **Networks**.
3. In the **Network** pane, click **Define**.
4. In the **Define Network** window, complete the following:
    a. Enter **VLAN0010** in the **Name** box.
    b. Optionally, enter a description in the **Description** box.
    c. Enter **10** in the **VLAN ID** box.
    d. From the **Network Type** list, select **General Purpose (Bronze)**.
    e. Click **Finish**.

Note: For information on **Network Types**, see Appendix A.6.

In a SmartFabric deployment , there is not a default VLAN, such as VLAN 1. The default VLAN must be created for any untagged traffic to cross the fabric. Figure 20 shows the two VLANs after being created using the steps above.

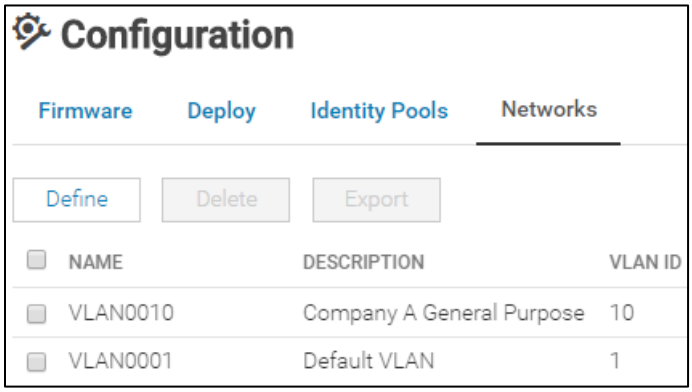


Figure 20 Defined VLAN list

7.2.2 Create the SmartFabric

To create a SmartFabric using the OME-M console, perform the following steps:

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. In the **Fabric** pane, click **Add Fabric**.
4. In the **Create Fabric** window, complete the following:
    a. Enter **SmartFabric** in the **Name** box.
    b. Optionally, enter a description in the **Description** box.

c. Click **Next**.
d. From the **Design Type** list, select **2x MX9116n Fabric Switching Engine in different chassis**.
e. From the **Chassis-X** list, select the first MX7000 chassis.
f. From the **Switch-A** list, select **Slot-IOM-A1**.
g. From the **Chassis-Y** list, select the second MX7000 chassis to join the fabric.
h. From the **Switch-B** list, select **Slot-IOM-A2**.
i. Click **Next**.
j. On the **Summary** page, verify the proposed configuration and click **Finish**.

Note: From the **Summary** window a list of the physical cabling requirements can be printed.

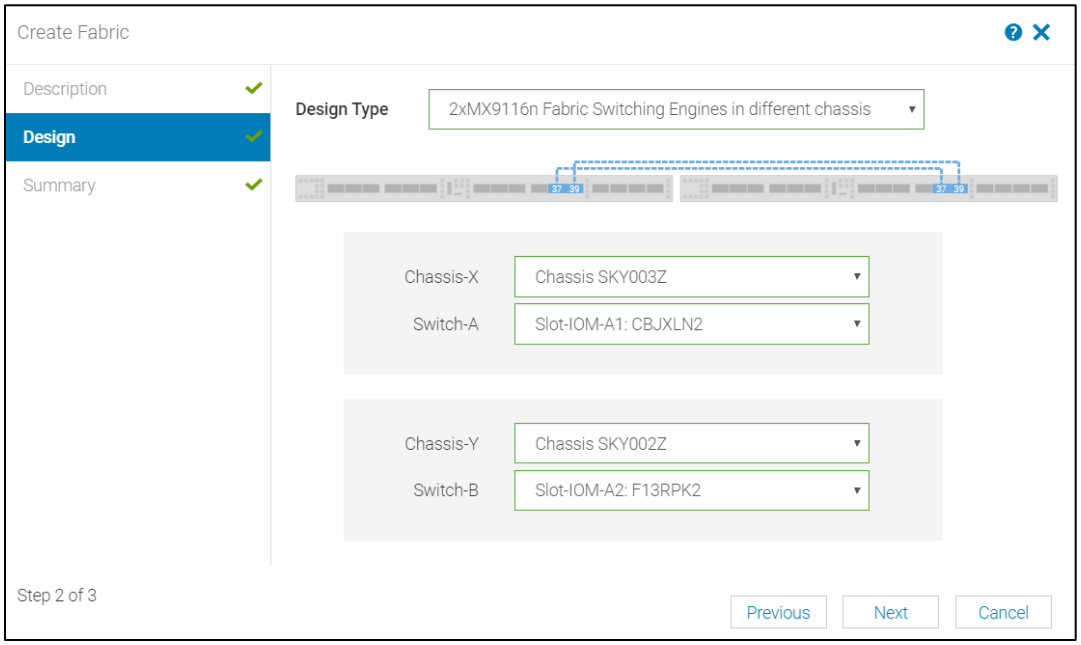


Figure 21 SmartFabric deployment design window

At this point, the SmartFabric deploys. This process can take several minutes to complete. During this time all related switches reload, and the operating mode changes from the default mode, Full Switch, to SmartFabric mode.

Note: Any configuration not completed by the OME-M console is lost when switching between IOM operating modes.

Figure 22 shows the new SmartFabric object and some basic statistics.

Figure 22 SmartFabric post-deployment without defined uplinks

7.2.3 Define uplinks

After initial deployment, the new fabric shows **Uplink Count** as 'zero' and shows a warning (). The lack of a fabric uplink results in a failed health check (). To create uplinks, follow these steps:

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. Click on the fabric name, **SmartFabric**.
4. In the Fabric Details pane, click **Uplinks**.
5. Click on the **Add Uplinks** button.
6. In the **Add Uplink** window complete the following:
    a. Enter **Uplink01** in the **Name** box.
    b. Optionally, enter a description in the **Description** box.
    c. From the **Uplink Type** list, select **Ethernet**.
    d. Click **Next**.
    e. From the **Switch Ports** list, select **ethernet 1/1/41** and **ethernet 1/1/42** for both MX9116n FSEs.
    f. From the **Tagged Networks** list, select **VLAN0010**.
    g. From the Untagged Network list, select **VLAN0001**.
    h. Click **Finish**.

At this point, SmartFabric creates the uplink object and the status for the fabric changes to OK ().

7.2.4 Server templates

A server template contains the parameters extracted from a server and allows these parameters to be quickly applied to multiple compute sleds. The templates contain settings for the following categories:

- Local access configuration
- Location configuration
- Power configuration
- Chassis network configuration
- Slot configuration
- Setup configuration

Additionally, server templates also allow an administrator to associate VLANs to compute sleds.

7.2.4.1 Create a server template

To create a server template, follow these steps:

1. Open the OME-M console.
2. From the navigation menu, click **Configuration** > **Deploy**.
3. From the center pane, click Create Template > From Reference Device.
4. In the **Create Template** window, complete the following:
   a. Enter M740c with Intel mezzanine in the Template Name box.
   b. Optionally, enter a description in the **Description** box.
   c. Click **Next**.
   d. In the Device Selection pane, click Select Device.
   e. In the **Select Devices** window, choose **Sled-**1 from **Chassis-1**.
   f. In the **Select Devices** window, click **Finish**.
   g. From the **Elements to Clone** list, select the following options:
      i. iDRAC
      ii. System
      iii. NIC
   h. Click **Finish**.

Note: Both **iDRAC** and **NIC** settings need to be captured to enable virtual identities. For additional information about virtual identities, see Appendix A.7.

A job starts, and the new server template displays on the list. When complete, the status displays as **Completed successfully**. Next, associate the VLANs created previously with the template.

7.2.4.2 Associate server template with a VLAN

After successfully creating a new template, associate the template with a network:

1. From the **Deploy** pane, select the **R740c with Intel mezzanine** server template.
2. From the **Deploy** pane, click **Edit Network**.
3. In the **Edit Network** window, complete the following:
   a. Optionally, from the **Identity Pool** list, choose **Ethernet ID Pool**. (see Appendix A.7).
   b. For both ports, from the **Untagged Network** list, select **VLAN0001**.
   c. For both ports, from the **Tagged Network** list, choose **VLAN0010**.
   d. Click **Finish**.

Figure 23 shows the associated networks for the server template.

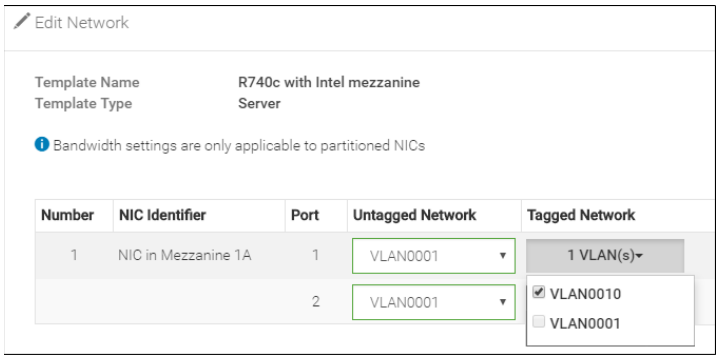


Figure 23 Server template network settings

7.2.4.3 Deploy a server template

To deploy the server template, complete the following steps:

1. From the **Deploy** pane, select the **R740c with Intel mezzanine** server template.
2. From the **Deploy** pane, click **Deploy Template**.
3. In the **Deploy Template** window, complete the following:
   a. Click the **Select** button to choose which slots or compute sleds to deploy the template to.
   b. Select the Do not forcefully reboot the host OS.
   c. Click **Next**.
   d. Choose **Run Now**
   e. Click **Finish**.

The interfaces on the MX9116n FSE are updated automatically. SmartFabric configures each interface with an untagged VLAN and any tagged VLANs. Additionally, SmartFabric deploys associated QoS settings. See Appendix A.6 for more information.

7.3 Verify configuration

This section covers the validation of the SmartFabric and the Z9100-ON leaf switches.

7.3.1 PowerEdge MX7000 validation

This section covers validation specific to the Dell EMC PowerEdge MX7000.

7.3.1.1 Show the MCM group topology

The OME-M console can be used to show the physical cabling of thee SmartFabric.

1. Open the OME-M console.
2. In the left pane click **View Topology**.
3. Click the lead chassis and then click **Show Wiring**.
4. The  icons can be clicked to show cabling.

Figure 24 shows the current wiring of the SmartFabric.

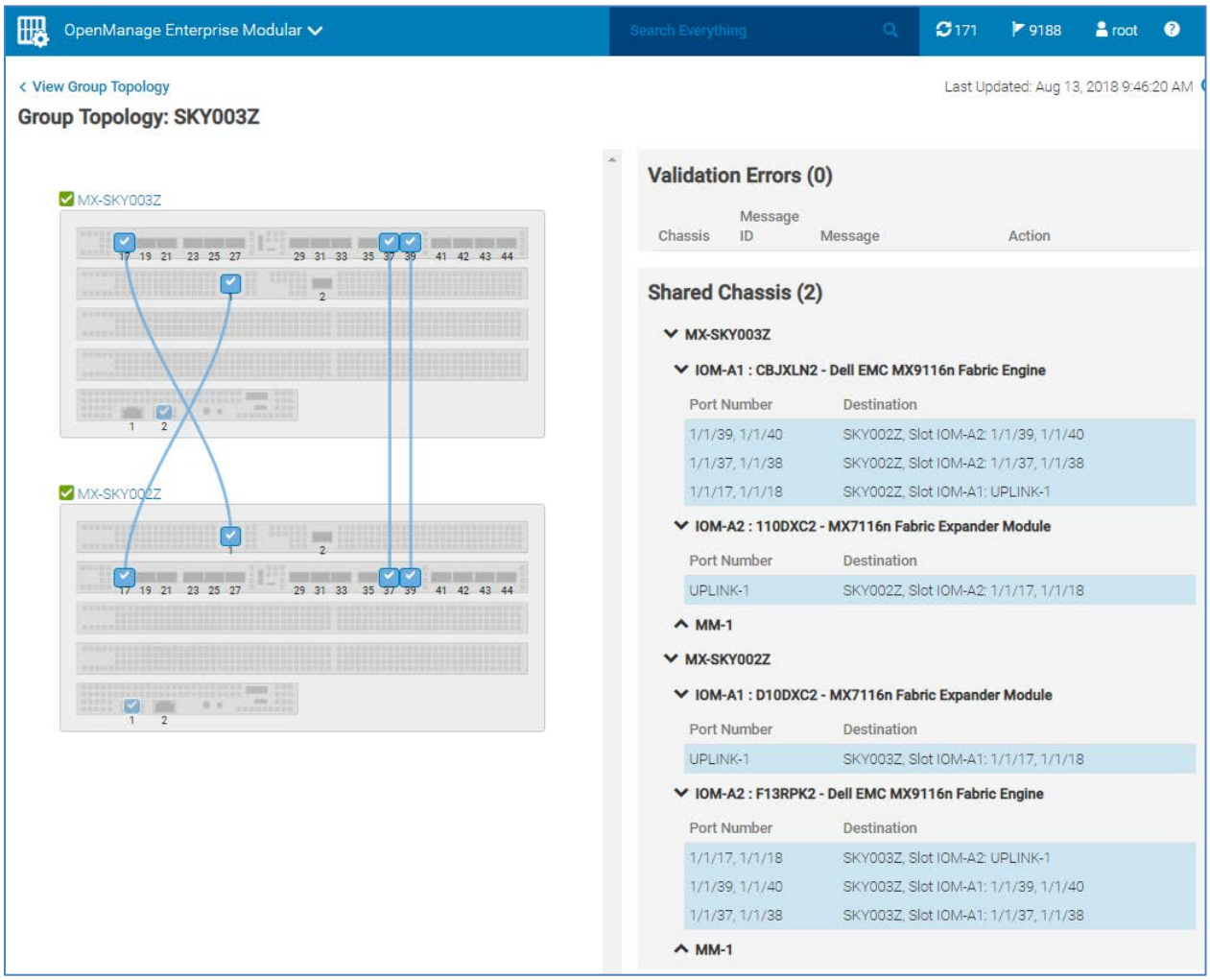


Figure 24 SmartFabric cabling

7.3.1.2 Show the SmartFabric status

The OME-M console can be used to show the overall health of the SmartFabric.

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. Select **SmartFabric1** to expand the details of the fabric.

Figure 25 shows the details of the fabric.

Figure 25 Fabric status details

The **Overview** tab shows the current inventory, including switches, servers, and interconnects between the MX9116n FSEs in the fabric. Figure 26 shows the SmartFabric switch in a healthy state. Figure 27 shows the participating servers in a healthy state.

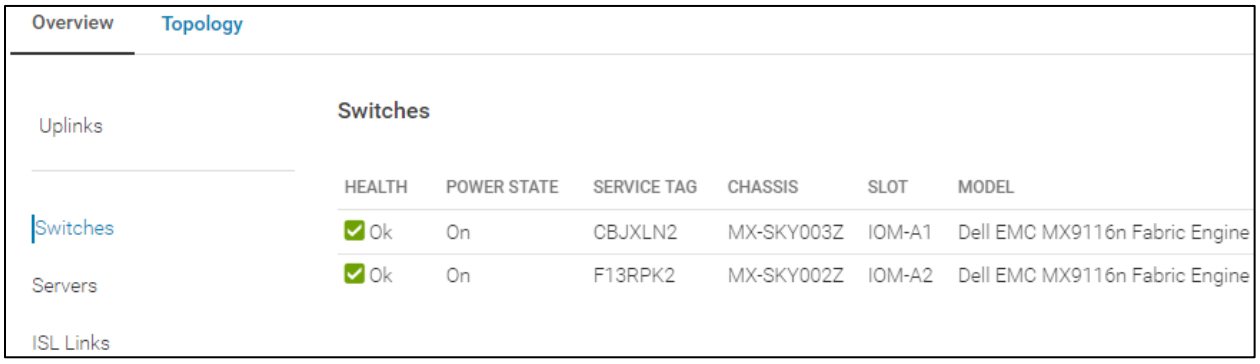


Figure 26 SmartFabric switch inventory

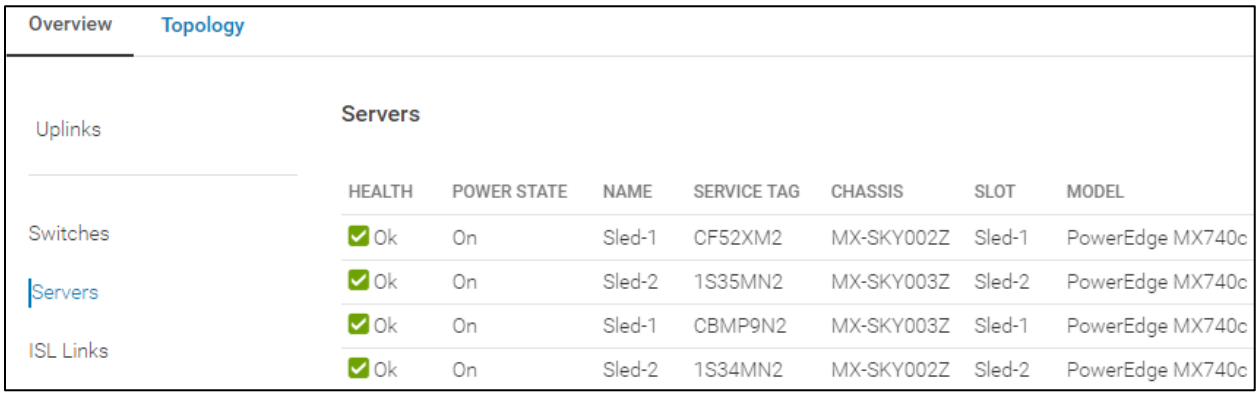


Figure 27 SmartFabric server inventory

Figure 28 shown the **Topology** tab and the VLTi automatically created by SmartFabric mode.

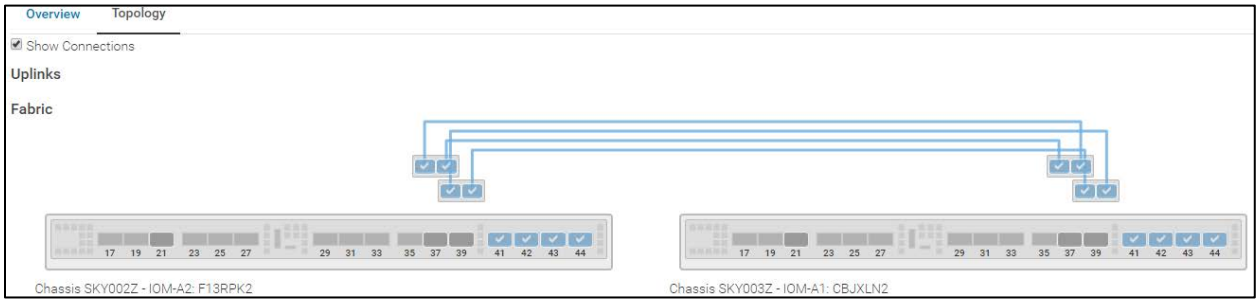


Figure 28 SmartFabric overview fabric diagram

Figure 29 displays the wiring diagram table from the **Topology** tab.

Wiring Diagram

Chassis SKY002Z

IOM-A2: F13RPK2 - Dell EMC MX9116n Fabric Engine

PORT NUMBER	OPERATIONAL STATUS	PORT CONFIGURATION	PORT ROLE	UPLINK NAME	DESTINATION
ethernet1/1/37	Up	NoBreakout	ISL		SKY003Z, Slot IOM-A1: ethernet1/1/37
ethernet1/1/39	Up	NoBreakout	ISL		SKY003Z, Slot IOM-A1: ethernet1/1/39
ethernet1/1/40	Up	NoBreakout	ISL		SKY003Z, Slot IOM-A1: ethernet1/1/40
ethernet1/1/38	Up	NoBreakout	ISL		SKY003Z, Slot IOM-A1: ethernet1/1/38

Chassis SKY003Z

IOM-A1: CBJXLN2 - Dell EMC MX9116n Fabric Engine

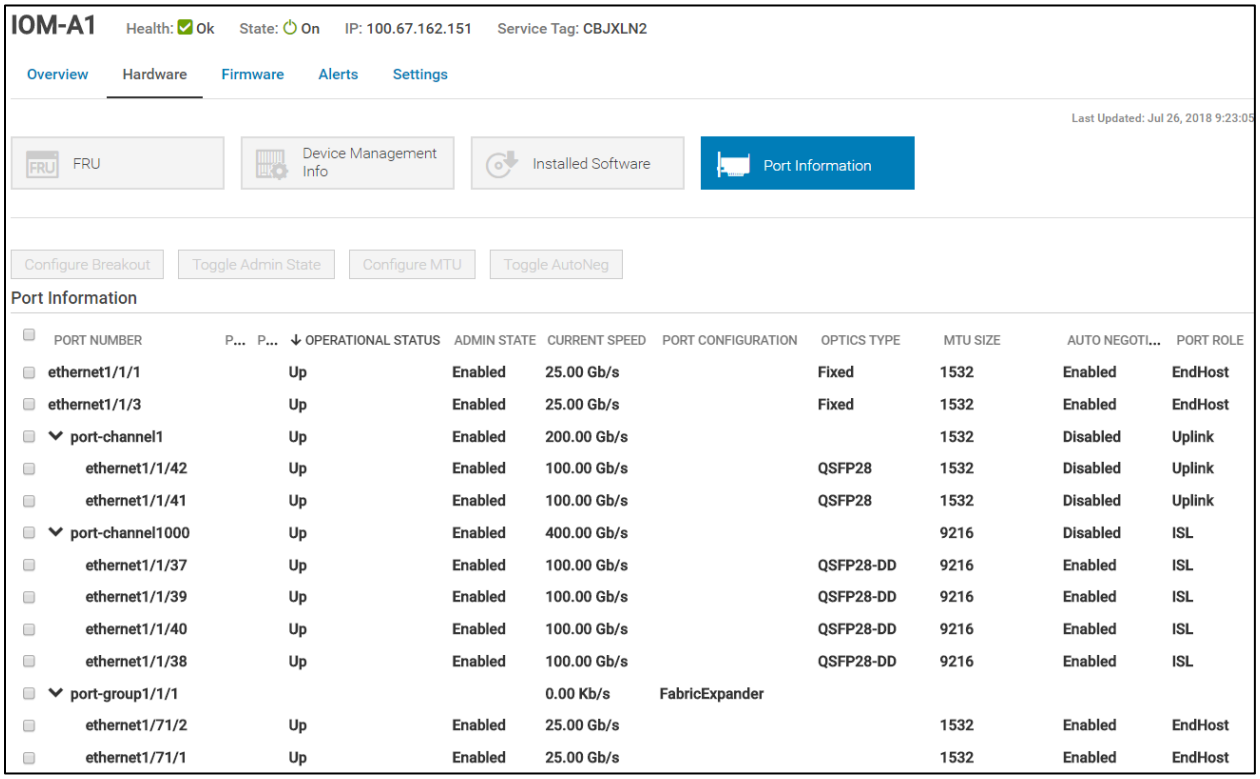
Figure 29 SmartFabric topology wiring diagram table

7.3.1.3 Show port status

The OME-M console can be used to show MX9116n FSE port status.

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **I/O Modules**.
3. Select an IOM and click the **View Details** button to the right of the inventory screen. The **IOM overview** for that device, displays.
4. From the **IOM Overview**, click **Hardware**.
5. Click to select the **Port Information** tab.

Figure 30 shows ethernet 1/1/1, 1/1/3, 1/71/1, and 1/72/1 in the correct operational status (Up). These interfaces correspond to the MX740c compute sleds in slots 1 and 2 in both chassis. The figure also shows the VLT connection (port channel 1000) and the uplinks (port channel 1) to the Z9100-ON leaf switches.



PORT NUMBER	P...	P...	OPERATIONAL STATUS	ADMIN STATE	CURRENT SPEED	PORT CONFIGURATION	OPTICS TYPE	MTU SIZE	AUTO NEGOTI...	PORT ROLE
ethernet1/1/1			Up	Enabled	25.00 Gb/s		Fixed	1532	Enabled	EndHost
ethernet1/1/3			Up	Enabled	25.00 Gb/s		Fixed	1532	Enabled	EndHost
port-channel1			Up	Enabled	200.00 Gb/s			1532	Disabled	Uplink
ethernet1/1/42			Up	Enabled	100.00 Gb/s		QSFP28	1532	Disabled	Uplink
ethernet1/1/41			Up	Enabled	100.00 Gb/s		QSFP28	1532	Disabled	Uplink
port-channel1000			Up	Enabled	400.00 Gb/s			9216	Disabled	ISL
ethernet1/1/37			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
ethernet1/1/39			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
ethernet1/1/40			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
ethernet1/1/38			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
port-group1/1/1					0.00 Kb/s	FabricExpander				
ethernet1/71/2			Up	Enabled	25.00 Gb/s			1532	Enabled	EndHost
ethernet1/71/1			Up	Enabled	25.00 Gb/s			1532	Enabled	EndHost

Figure 30 IOM Port Information

7.3.1.4 show switch-operating-mode

Use the `show switch-operating-mode` command to display the current operating mode:

```
C140A1# show switch-operating-mode

Switch-Operating-Mode : Smart Fabric Mode
```

7.3.1.5 show discovered-expanders

The `show discovered-expanders` command is only available on the MX9116n FSE and displays the MX7116n FEMs service tag attached to the MX9116n FSEs and the associated port-group and virtual slot.

```
C140A1# show discovered-expanders
Service   Model    Type  Chassis      Chassis-slot Port-group Virtual
tag                      service-tag                          Slot-Id
-------------------------------------------------------------------------
D10DXC2   MX7116n  1     SKY002Z      A1           1/1/1      71
          FEM
```

7.3.1.6 show unit-provision

The `show unit-provision` command is only available on the MX9116n FSE and displays the unit ID and the provision and discovered name of the MX7116n FEM attached to the MX9116n FSE.

C140A1# **show unit-provision**

```
Node ID | Unit ID | Provision Name | Discovered Name | State |
---------+---------+--------------------------------+-------|
 1       | 71      | D10DXC2        | D10DXC2         | up    |
```

7.3.1.7 show lldp neighbors

The `show lldp neighbors` command shows information about LLDP neighbors. `Ethernet1/1/1`, `ethernet 1/1/3`, and `ethernet 1/1/71-1/1/72` represent the two MX740c sleds. The first entry is the iDRAC for the compute sled. The iDRAC uses connectivity to the mezzanine card to advertise LLDP information. The second entry is the mezzanine card itself.

`Ethernet 1/71/1` and `ethernet 1/71/2` represent the MX740c compute sleds connected to the MX7116n FEM in the other chassis.

Ethernet range `ethernet1/1/37-1/1/40` are the VLTi interfaces for the SmartFabric. Last, `ethernet1/1/41-1/1/42` are the links in a port channel connected to the Z9100-ON leaf switches.

```
C140A1# show lldp neighbors
Loc PortID     Rem Host Name    Rem Port Id                  Rem Chassis Id
-------------------------------------------------------------------------
ethernet1/1/1   iDRAC-CBMP9N2   CBMP9N2 NIC.Mezzanine.1A-1-1 d0:94:66:2a:07:2f
ethernet1/1/1   Not Advertised  24:6e:96:9c:e3:50            24:6e:96:9c:e3:50
ethernet1/1/3   iDRAC-1S35MN2   1S35MN2 NIC.Mezzanine.1A-1-1 d0:94:66:29:fa:f4
ethernet1/1/3   Not Advertised  24:6e:96:9c:e5:48            24:6e:96:9c:e5:48
ethernet1/1/37  C160A2          ethernet1/1/37               20:04:0f:00:a1:9e
ethernet1/1/38  C160A2          ethernet1/1/38               20:04:0f:00:a1:9e
ethernet1/1/39  C160A2          ethernet1/1/39               20:04:0f:00:a1:9e
ethernet1/1/40  C160A2          ethernet1/1/40               20:04:0f:00:a1:9e
ethernet1/1/41  Z9100-Leaf1     ethernet1/1/3                4c:76:25:e8:f2:c0
ethernet1/1/42  Z9100-Leaf2     ethernet1/1/3                4c:76:25:e8:e8:40
ethernet1/71/1  Not Advertised  24:6e:96:9c:e5:d8            24:6e:96:9c:e5:d8
ethernet1/71/1  iDRAC-CF52XM2   CF52XM2 NIC.Mezzanine.1A-1-1 d0:94:66:29:fe:b4
ethernet1/71/2  Not Advertised  24:6e:96:9c:e5:da            24:6e:96:9c:e5:da
ethernet1/71/2  iDRAC-1S34MN2   1S34MN2 NIC.Mezzanine.1A-1-1 d0:94:66:29:ff:27
```

7.3.1.8 show qos system

The `show qos system` command displays the QoS configuration applied to the system. The command is useful to verify the service policy created manually or automatically by a SmartFabric deployment.

```
C140A1# show qos system
 Service-policy (input): PM_VLAN
 ETS Mode : off
```

7.3.1.9 show policy-map

Using the service policy from `show qos system`, the `show policy-map type qos PM_VLAN` command displays QoS policy details including associated class maps, for example, `CM10`, and QoS queue settings, `qos-group 2`.

```
C140A1# show policy-map type qos PM_VLAN
 Service-policy (qos) input: PM_VLAN
   Class-map (qos): CM10
     set qos-group 2
```

7.3.1.10 show class-map

The command `show class-map` displays details for all the configured class-maps. For example, the association between `CM10` and `VLAN 10` is shown.

```
C140A1# show class-map
 Class-map (application): class-iscsi
 Class-map (qos): class-trust
 Class-map (qos): CM10(match-any)
   Match: mac vlan 10
 Class-map (qos): CM2(match-any
```

7.3.2 Z9100-ON validation

This section contains validation commands for the Dell EMC Networking Z9100-ON leaf switches.

7.3.2.1 show vlt

The `show vlt` command validates the VLT configuration status when the VLTi Link Status is up. The role of one switch in the VLT pair is primary, and its peer switch (not shown) is assigned the secondary role.

```
Z9100-Leaf1# show vlt 1
Domain ID                  : 1
Unit ID                    : 1
Role                       : primary
Version                    : 1.0
Local System MAC address   : 4c:76:25:e8:f2:c0
VLT MAC address            : 4c:76:25:e8:f2:c0
IP address                 : fda5:74c8:b79e:1::1
Delay-Restore timer        : 90 seconds
Peer-Routing               : Disabled
Peer-Routing-Timeout timer : 0 seconds
VLTi Link Status
    port-channel1000       : up
```

```
VLT Peer Unit ID    System MAC Address    Status    IP Address
Version
--------------------------------------------------------------------------------
  2                 4c:76:25:e8:e8:40      up       fda5:74c8:b79e:1::2     1.0
```

7.3.2.2 show lldp neighbors

The `show lldp neighbors` command provides information about connected devices. In this case, `ethernet1/1/1` and `ethernet1/1/3` connect to the two MX9116n FSEs, `C160A2` and `C140A1`. The remaining links, `ethernet1/1/29` and `ethernet 1/1/31`, represent the VLTi connection.

```
Z9100-Leaf1# show lldp neighbors
Loc PortID         Rem Host Name  Rem Port Id     Rem Chassis Id
-------------------------------------------------------------
ethernet1/1/1      C160A2         ethernet1/1/41  20:04:0f:00:a1:9e
ethernet1/1/3      C140A1         ethernet1/1/41  20:04:0f:00:cd:1e
ethernet1/1/29     Z9100-Leaf2    ethernet1/1/29  4c:76:25:e8:e8:40
ethernet1/1/31     Z9100-Leaf2    ethernet1/1/31  4c:76:25:e8:e8:40
```

7.3.2.3 show spanning-tree brief

The `show spanning-tree brief` command validates that STP is enabled on the leaf switches. All interfaces are forwarding (`FWD`), as shown in the `Sts` column.

```
Z9100-Leaf1# show spanning-tree brief
Spanning tree enabled protocol rapid-pvst

VLAN 1
Executing IEEE compatible Spanning Tree Protocol
Root ID    Priority 32768, Address 2004.0f00.a19e
Root Bridge hello time 2, max age 20, forward delay 15
Bridge ID    Priority 32769, Address 4c76.25e8.f2c0
Configured hello time 2, max age 20, forward delay 15
Flush Interval 200 centi-sec, Flush Invocations 432
Flush Indication threshold 0 (MAC flush optimization is disabled)
Interface                                          Designated
Name              PortID    Prio  Cost  Sts Cost  Bridge ID    PortID
--------------------------------------------------------------------------------
port-channel1     128.2517  128   50    FWD 0     32768        2004.0f00

Interface
Name           Role    PortID   Prio Cost  Sts   Cost  Link-type  Edge
--------------------------------------------------------------------------------
port-channel1  Root    128.2517 128  50    FWD   0     AUTO       No
```

```
VLAN 10
Executing IEEE compatible Spanning Tree Protocol
Root ID    Priority 32778, Address 4c76.25e8.e840
Root Bridge hello time 2, max age 20, forward delay 15
Bridge ID    Priority 32778, Address 4c76.25e8.f2c0
Configured hello time 2, max age 20, forward delay 15
Flush Interval 200 centi-sec, Flush Invocations 5
Flush Indication threshold 0 (MAC flush optimization is disabled)
Interface                                                          Designated
Interface                                        Designated
Name              PortID    Prio  Cost  Sts Cost  Bridge ID    PortID
-------------------------------------------------------------------------------
port-channel1     128.2517  128   50    FWD 1     32768        2004.0f00
Interface
Name           Role    PortID   Prio Cost  Sts   Cost  Link-type  Edge
-------------------------------------------------------------------------------
port-channel1  Root    128.2517 128  50    FWD   1     AUTO       No
```

8 Scenario 2 - SmartFabric deployment while connected to Cisco Nexus 3232C leaf switches

Figure 31 shows the production topology using a pair of Cisco Nexus 3232C as leaf switches. This section configures the Cisco Nexus 3232Cs and creating a SmartFabric with the corresponding uplinks.

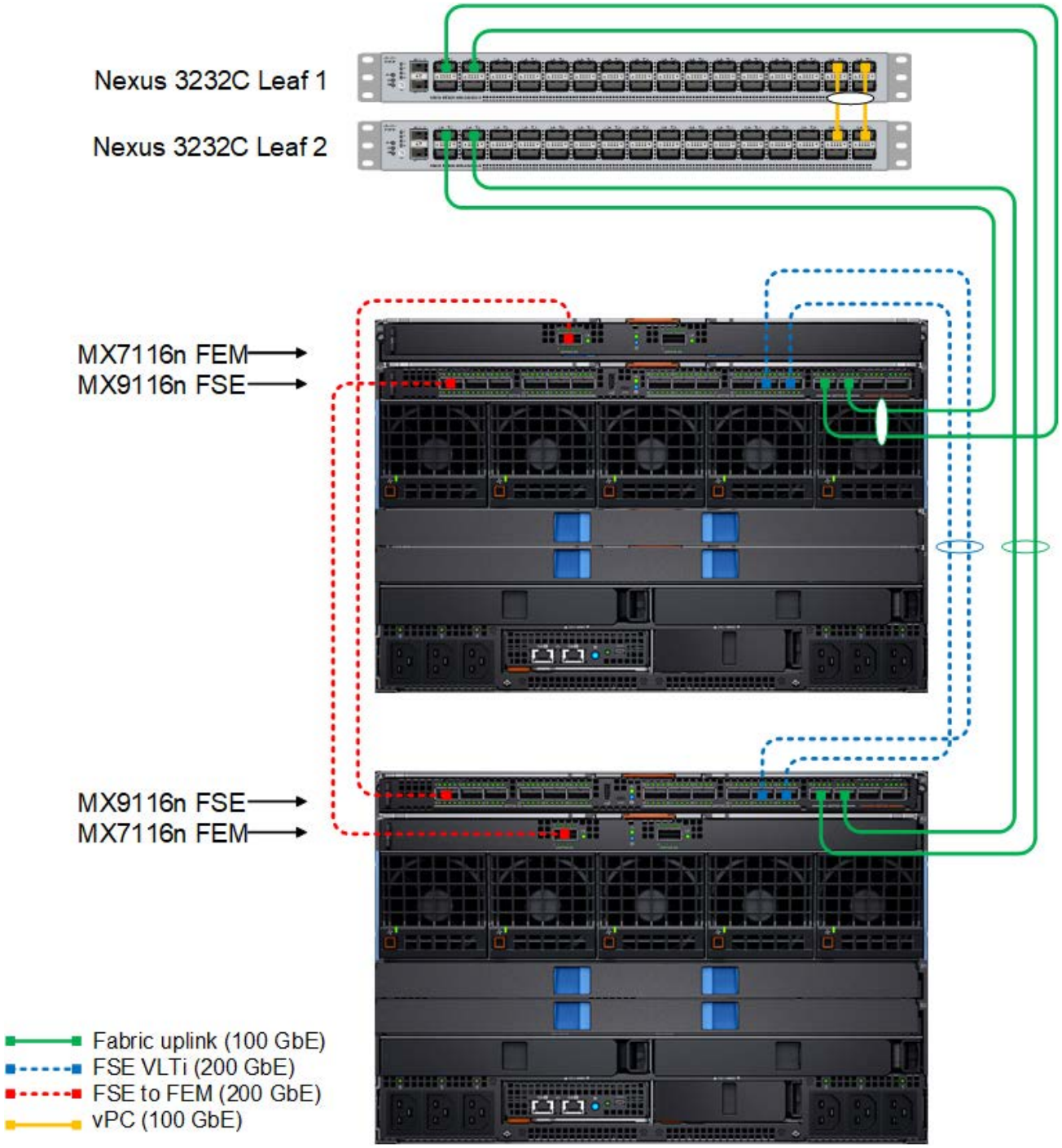


Figure 31 SmartFabric with Cisco Nexus 3232C leaf switches

Note: See Appendix A.5 for more information on QSFP28-DD cables.

8.1 Cisco Nexus 3232C leaf switch configuration

The following section outlines the configuration commands issued to the Cisco Nexus 3232C leaf switches. The switches start at their factory default settings, as described in Appendix A.3.

1. Enter the following commands to set the hostname, enable required features, and enable RPVST spanning tree mode. Configure the management interface and default gateway.

Cisco Nexus 3232C Leaf 1	Cisco Nexus 3232C Leaf 2

`configure terminal`
 	
`hostname 3232C-Leaf1`
 	
`feature vpc`
`feature lldp`
`feature lacp`
 	
`spanning-tree mode rapid-pvst`
 	
`interface mgmt0`
` vrf member management`
` ip address 100.67.162.201/24`
 	
`vrf context management`
` ip route 0.0.0.0/0 100.67.162.254`
	`configure terminal`
	
	`hostname 3232C-Leaf2`
	
	`feature vpc`
	`feature lldp`
	`feature lacp`
	
	`spanning-tree mode rapid-pvst`
	
	`interface mgmt0`
	` vrf member management`
	` ip address 100.67.162.200/24`
	
	`vrf context management`
	` ip route 0.0.0.0/0 100.67.162.254`

2. Enter the following commands to create a virtual port channel (vPC) domain and assign the keepalive destination to the peer switch management IP. Then create a port channel for the vPC peer link and assign the appropriate switchport interfaces.

Cisco Nexus 3232C Leaf 1	Cisco Nexus 3232C Leaf 2

`vpc domain 255`
` peer-keepalive destination 100.67.162.200`
 	
`interface port-channel255`
`  switchport`
`  switchport mode trunk`
`  vpc peer-link`
 	
`interface Ethernet1/29`
`  description vPC Interconnect`
`  switchport`
`  switchport mode trunk`
`  channel-group 255 mode active`
`  no shutdown`
 	
`interface Ethernet1/31`
`  description vPC Interconnect`
`  switchport`
`  switchport mode trunk`
`  channel-group 255 mode active`
`  no shutdown`
	`vpc domain 255`
	` peer-keepalive destination 100.67.162.201`
	
	`interface port-channel255`
	`  switchport`
	`  switchport mode trunk`
	`  vpc peer-link`
	
	`interface Ethernet1/29`
	`  description vPC Interconnect`
	`  switchport`
	`  switchport mode trunk`
	`  channel-group 255 mode active`
	`  no shutdown`
	
	`interface Ethernet1/31`
	`  description vPC Interconnect`
	`  switchport`
	`  switchport mode trunk`
	`  channel-group 255 mode active`
	`  no shutdown`

3. Enter the following commands to configure the port channels to connect to the downstream MX9116n FSEs. Then, exit configuration mode and save the configuration.

Cisco Nexus 3232C Leaf 1	Cisco Nexus 3232C Leaf 2
interface port-channel1 description To MX Chassis switchport switchport mode trunk switchport trunk allowed vlan 1,10 vpc 255 interface Ethernet1/1 description To MX Chassis 1 switchport switchport mode trunk switchport trunk allowed vlan 1,10 channel-group 1 mode active no shutdown interface Ethernet1/3 description To MX Chassis 2 switchport switchport mode trunk switchport trunk allowed vlan 1,10 channel-group 1 mode active no shutdown end copy running-configuration startup-configuration	interface port-channel1 description To MX Chassis switchport switchport mode trunk switchport trunk allowed vlan 1,10 vpc 255 interface Ethernet1/1 description To MX Chassis 1 switchport switchport mode trunk switchport trunk allowed vlan 1,10 channel-group 1 mode active no shutdown interface Ethernet1/3 description To MX Chassis 2 switchport switchport mode trunk switchport trunk allowed vlan 1,10 channel-group 1 mode active no shutdown end copy running-configuration startup-configuration

8.2 Create a SmartFabric

See Section 7.2 for the steps to create a SmartFabric for the environment.

8.3 Verify configuration

This section covers the validation of the Cisco Nexus 3232C leaf switches. For information about the MX9116n FSE validation commands, see Section 7.3.1.

8.3.1 show vpc

The `show vpc` command validates the vPC configuration status. The peer adjacency should be `OK`, with the peer show as `alive`. The end of the command shows which VLANs are active across the vPC.

```
NX3232C-Leaf1# show vpc
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                     : 255
Peer status                       : peer adjacency formed ok
vPC keep-alive status             : peer is alive
Configuration consistency status  : success
```

```
Per-vlan consistency status       : success
Type-2 inconsistency reason       : Consistency Check Not Performed
vPC role                          : secondary, operational primary
Number of vPCs configured         : 1
Peer Gateway                      : Disabled
Dual-active excluded VLANs        : -
Graceful Consistency Check        : Enabled
Auto-recovery status              : Disabled
Delay-restore status              : Timer is off.(timeout = 30s)
Delay-restore SVI status          : Timer is off.(timeout = 10s)

vPC Peer-link status
---------------------------------------------------------------------
id   Port   Status Active vlans
--   ----   ------ --------------------------------------------------
1    Po255  up     1,10

vPC status
----------------------------------------------------------------------------
id   Port   Status Consistency Reason                     Active vlans
--   ----   ------ ----------- ------                     ------------
255  Po1    up     success     success                    1,10
```

8.3.2 show vpc consistency-parameters

The `show vpc consistency-parameters` command displays the configured values on all interfaces in the vPC. The displayed configurations are only those configurations that limit the vPC peer link and vPC from coming up.

```
NX3232C-Leaf1# show vpc consistency-parameters vpc 255

    Legend:
        Type 1 : vPC will be suspended in case of mismatch

Name                        Type  Local Value            Peer Value
-------------               ----  ---------------------- -----------------------
STP Port Type               1     Normal Port            Normal Port
STP Port Guard              1     Default                Default
STP MST Simulate PVST       1     Default                Default
lag-id                      1     [(1000,                [(1000,
                                  20-4-f-0-cd-1e, 1, 0,  20-4-f-0-cd-1e, 1, 0,
                                  0), (7f9b,             0), (7f9b,
                                  0-23-4-ee-be-ff, 80ff, 0-23-4-ee-be-ff, 80ff,
                                   0, 0)]                 0, 0)]
mode                        1     active                 active
delayed-lacp                1     disabled               disabled
Speed                       1     100 Gb/s               100 Gb/s
Duplex                      1     full                   full
Port Mode                   1     trunk                  trunk
Native Vlan                 1     1                      1
MTU                         1     1500                   1500
```

```
Dot1q Tunnel                1     no                    no
Switchport Isolated         1     0                     0
vPC card type               1     N9K TOR               N9K TOR
Allowed VLANs               -     1,10                  1,10
Local suspended VLANs       -     -                     -
```

8.3.3 show lldp neighbors

The `show lldp neighbors` command provides information about lldp neighbors. In this case `Eth1/1` and `Eth1/3` are connected to the two MX9116n FSEs, `C160A2` and `C140A1`. The remaining links, `Eth1/29` and `Eth1/31`, represent the VLTi connection.

```
NX3232C-Leaf1(config)# show lldp neighbors
Capability codes:
  (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
  (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
Device ID               Local Intf      Hold-time  Capability  Port ID
S3048-ON                mgmt0           120        PBR         ethernet1/1/45
C160A2                  Eth1/1          120        PBR         ethernet1/1/41
C140A1                  Eth1/3          120        PBR         ethernet1/1/41
NX3232C-Leaf2           Eth1/29         120        BR          Ethernet1/29
NX3232C-Leaf2           Eth1/31         120        BR          Ethernet1/31
Total entries displayed: 5
```

8.3.4 show spanning-tree summary

The `show spanning-tree summary` command validates that STP is enabled on the leaf switches. All interfaces are shown as forwarding.

```
NX3232C-Leaf1# show spanning-tree summary
Switch is in rapid-pvst mode
Root bridge for: VLAN0010
Port Type Default                        is disable
Edge Port [PortFast] BPDU Guard Default  is disabled
Edge Port [PortFast] BPDU Filter Default is disabled
Bridge Assurance                         is enabled
Loopguard Default                        is disabled
Pathcost method used                     is short
STP-Lite                                 is disabled

Name                   Blocking Listening Learning Forwarding STP Active
---------------------- -------- --------- -------- ---------- ----------
VLAN0001                     0         0        0          2          2
VLAN0010                     0         0        0          2          2
---------------------- -------- --------- -------- ---------- ----------
2 vlans                      0         0        0          4          4
```

9 Scenario 3 - SmartFabric deployment while connected to Cisco ACI leaf switches

This chapter covers deploying a PowerEdge MX SmartFabric connected to a Cisco ACI environment. By integrating PowerEdge MX into an ACI environment, compute resources in the MX environment can use ACI gateways and access ACI resources.

The Cisco ACI environment validated includes a pair of Nexus C93180YC-EX switches as leaf switches as shown in Figure 32. Both C93180YC-EX leafs are connected to a single Nexus C9336-PQ spine using 40GbE uplinks (not shown).

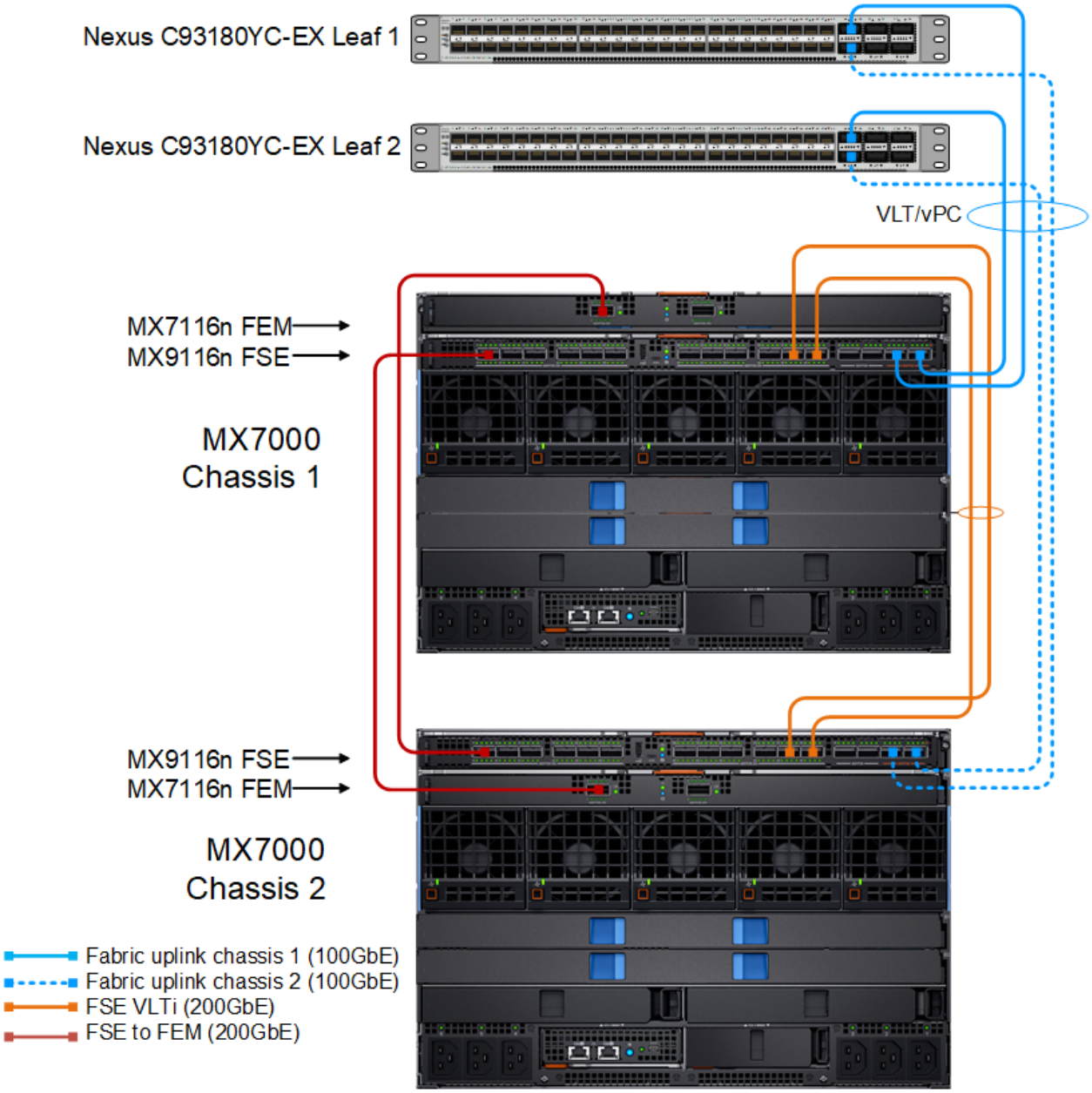


Figure 32 Smart Fabric connected to Cisco ACI leaf switches

Connections from MX9116n FSE switches to C93180YC-EX leafs are 100GbE. These connections are shown in blue in Figure 32.

9.1 Validated environment

In this scenario, two MX7000 chassis are joined to an existing Cisco ACI environment. The MX chassis environment consists of two MX9116n FSEs, two MX7116n FEMs, and four MX compute sleds.

The connections between the ACI environment and the MX chassis are made using a double-sided multi-chassis link aggregation group (MLAG). The MLAG is called a vPC on the Cisco ACI side and a VLT on the PowerEdge MX side.

All devices in the validated environment covered in this chapter are connected as shown in Figure 33.

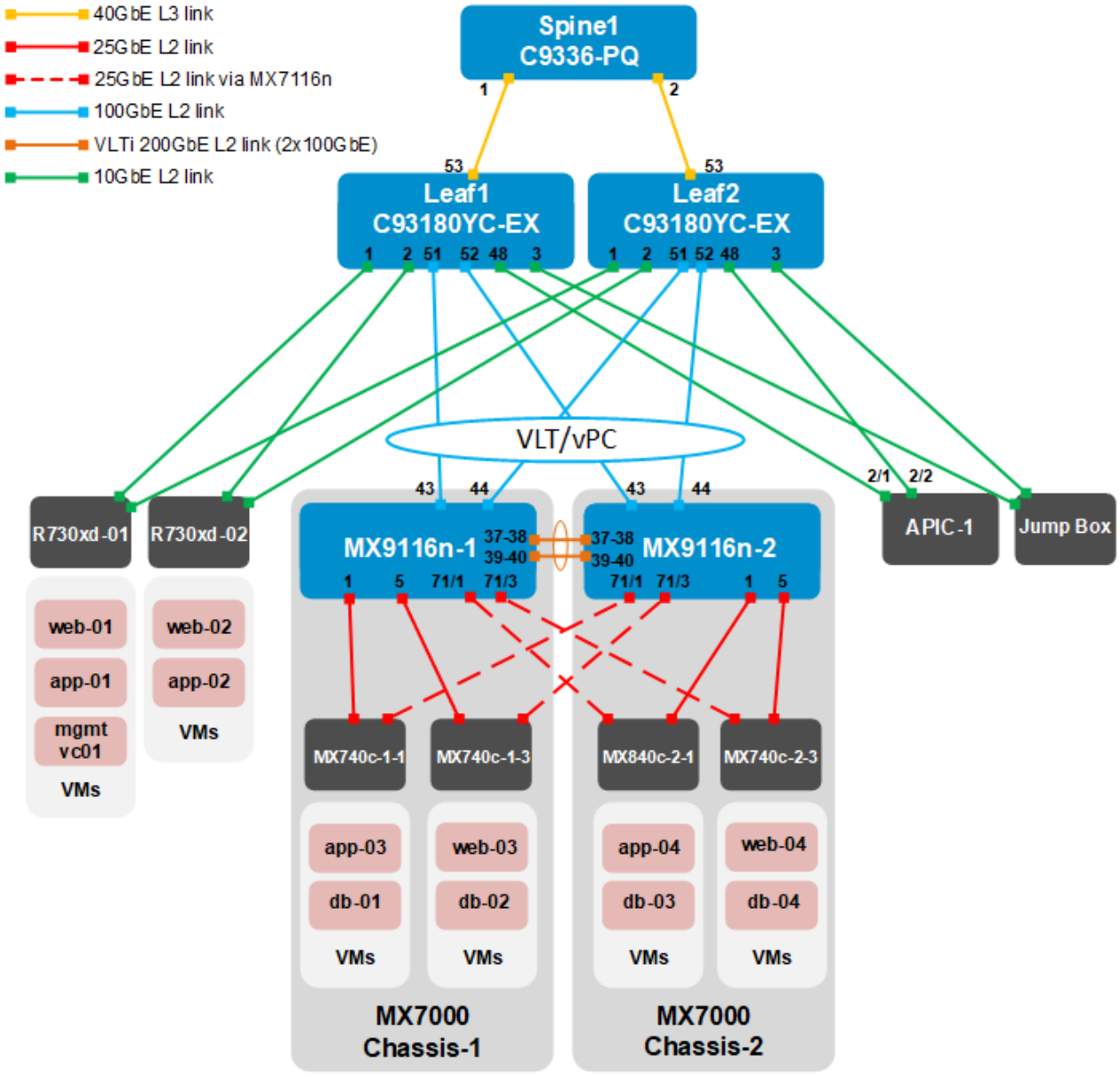


Figure 33 Validated SmartFabric and ACI environment

Note: The MX7116n FEMs are not shown in Figure 33. The MX740c/MX840c compute sled connections to the M9116n FSE in the opposite chassis, which are made using the MX7116n FEM in the local chassis, are shown using dashed red lines. The compute sled connections to the MX9116n FSE in the local chassis are shown using solid red lines.

Note: No peer link is used between the Cisco ACI leaf switches. See the Cisco ACI documentation for more information. Cisco recommends a minimum of three Application Policy Infrastructure Controllers (APICs) in a production environment. For this validation effort, a single APIC, named APIC-1, is used.

All PowerEdge R730xd rack servers and MX compute sleds in this example are running VMware ESXi 6.7.0. VMs named “web,” “app,” and “db” on the ESXi hosts are running Ubuntu Linux guest operating systems. An optional jump box (shown in Figure 33), accessible over the OOB management network, is added to assist with vCenter configuration.

The existing Cisco ACI environment has two PowerEdge R730xd rack servers directly connected to the ACI leafs. These rack servers are in a VMware vSphere cluster, with a vCenter VM named mgmtvc01 located on R730xd-01 as shown in Figure 33.

Integrating the MX environment into the Cisco ACI environment enables the four MX compute sleds in the two chassis to join the existing VMware vSphere cluster. This allows all hosts and VMs to communicate using the relevant networks.

The environment uses the six networks shown in Table 5.

Table 5 Networks used

VLAN ID	VLAN name	Description	Network address	Gateway address
1611	ESXi_Mgmt	ESXi host in-band management	172.16.11.0/24	172.16.11.254
1612	vMotion	VM migration	172.16.12.0/24	172.16.12.254
1613	vSAN	Storage	172.16.13.0/24	172.16.13.254
1614	web	VM data network	172.16.14.0/24	172.16.14.254
1615	app	VM data network	172.16.15.0/24	172.16.15.254
1616	db	VM data network	172.16.16.0/24	172.16.16.254

Note: While the VMware vMotion and vSAN networks are configured in this example, their use is out of scope for this guide.

VMs in the validated environment use the IP addresses shown in Table 6.

Table 6 VM IP addresses

VM Name(s)	VLAN name	IP address(es)
mgmtvc01	ESXi_Mgmt	172.16.11.171
web01-web04	web	172.16.14.1-4
app01-app04	app	172.16.15.1-4
db01-db04	db	172.16.16.1-4

9.2 Cisco APIC configuration

The Cisco APIC configuration includes the ports connected to the R730xd rack servers (and jump box, if used) and the vPC that connects to the MX9116n VLT port channel. This includes configuration of the ACI fabric interfaces, switches, and application-level elements such as ACI endpoint groups (EPGs) and bridge domains.

The networks used in the validated environment are shown in Table 7, along with the corresponding bridge domain, and application EPG names used in APIC configuration.

Table 7 Validated environment network information

VLAN ID	VLAN name	Gateway IP address/mask	Bridge domain name	Application EPG name
1611	ESXi_Mgmt	172.16.11.254/24	ESXiMgmtBD1	ESXiMgmtEPG1
1612	vMotion	172.16.12.254/24	vMotionBD1	vMotionEPG1
1613	vSAN	172.16.13.254/24	vSANBD1	vSANEPG1
1614	web	172.16.14.254/24	webBD1	webEPG1
1615	app	172.16.15.254/24	appBD1	appEPG1
1616	db	172.16.16.254/24	dbBD1	dbEPG1

In this deployment, EPGs are extended outside of the ACI fabric by mapping EPGs to external VLANs. This is so when a frame tagged with, VLAN 1611 for example, enters the ACI fabric, ACI knows that it belongs to the ESXi Management EPG and treats it accordingly.

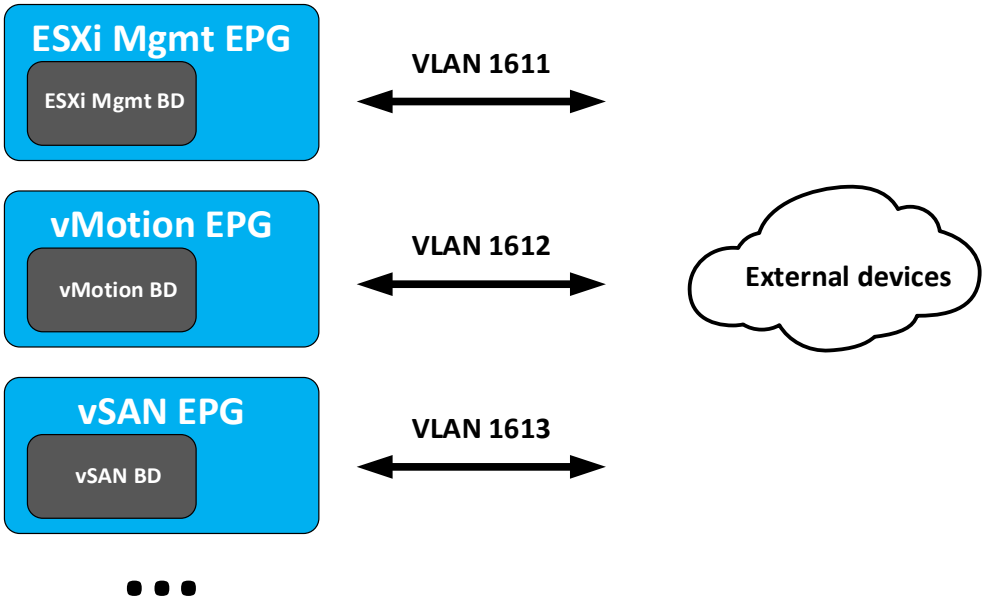


Figure 34 Bridge domains are associated with EPGs, which are mapped to external VLANs.

APIC configuration steps used in the validated environment are provided in the attachment named **Scenario 3 – APIC config steps.pdf**. See the Cisco ACI documentation for detailed APIC configuration instructions.

9.3 Deploy a SmartFabric

9.3.1 Define VLANs

The VLAN settings used during SmartFabric deployment for this environment are shown in Table 8.

Table 8 SmartFabric VLAN settings

VLAN ID	VLAN Name	Description	Network Type (QoS)	Tagged/Untagged
1611	ESXi_Mgmt	ESXi host in-band management	Hypervisor Management	Tagged
1612	vMotion	VM migration	VM migration	Tagged
1613	vSAN	Storage	Storage – Data Replication	Tagged
1614	web	VM data network	General Purpose (Silver)	Tagged
1615	app	VM data network	General Purpose (Silver)	Tagged
1616	db	VM data network	General Purpose (Silver)	Tagged

VLANs for the SmartFabric are defined using the OME-M console as follows:

1. Open the OME-M console.
2. From the navigation menu, click **Configuration** > **Networks**.
3. In the **Network** pane, click **Define**.
4. In the **Define Network** window, complete the following:
   a. Enter the first VLAN name, for example, **ESXi_Mgmt,** in the **Name** box.
   b. Optionally, enter a **Description**.
   c. Enter the **VLAN ID**, for example, **1611**.
   d. Select the Network Type, for example, Hypervisor Management.

Note: For information about network type and QoS group settings, see Appendix A.6.

   e. Click **Finish**.
5. Repeat steps 3 and 4 for each VLAN.

The configured VLANs for this example are shown in Figure 35.

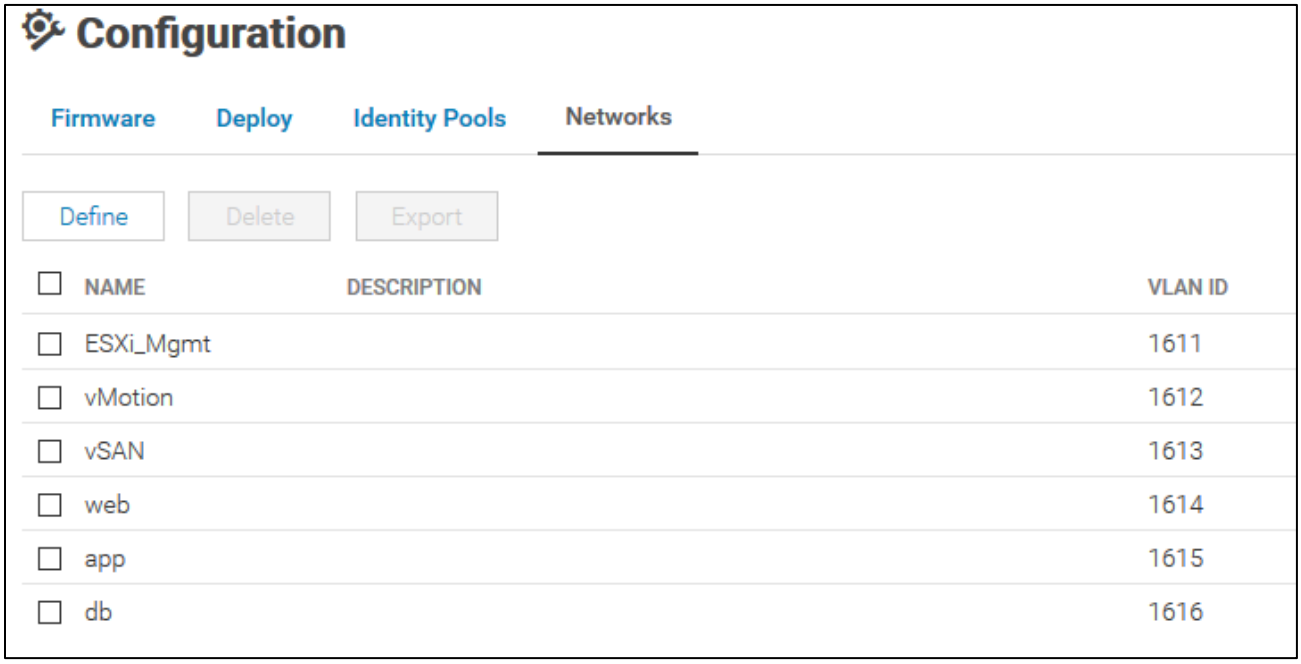


Figure 35 Defined VLANs

9.3.2 Create the SmartFabric

To create a SmartFabric using the OME-M console, perform the following steps:

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. In the **Fabric** pane, click **Add Fabric**.
4. In the **Create Fabric** window, complete the following:
    a. Enter a **Name**, for example, **SmartFabric1.**
    b. Optionally, enter a **Description**.
    c. Click **Next**.
    d. From the **Design Type** list, select **2x MX9116n Fabric Switching Engines in different chassis**.

e. From the **Chassis-X** list, select the first MX7000 chassis.
f. From the **Switch-A** list, select **Slot-IOM-A1**.
g. From the **Chassis-Y** list, select the second MX7000 chassis to join the fabric.
h. From the **Switch-B** list, select **Slot-IOM-A2**.

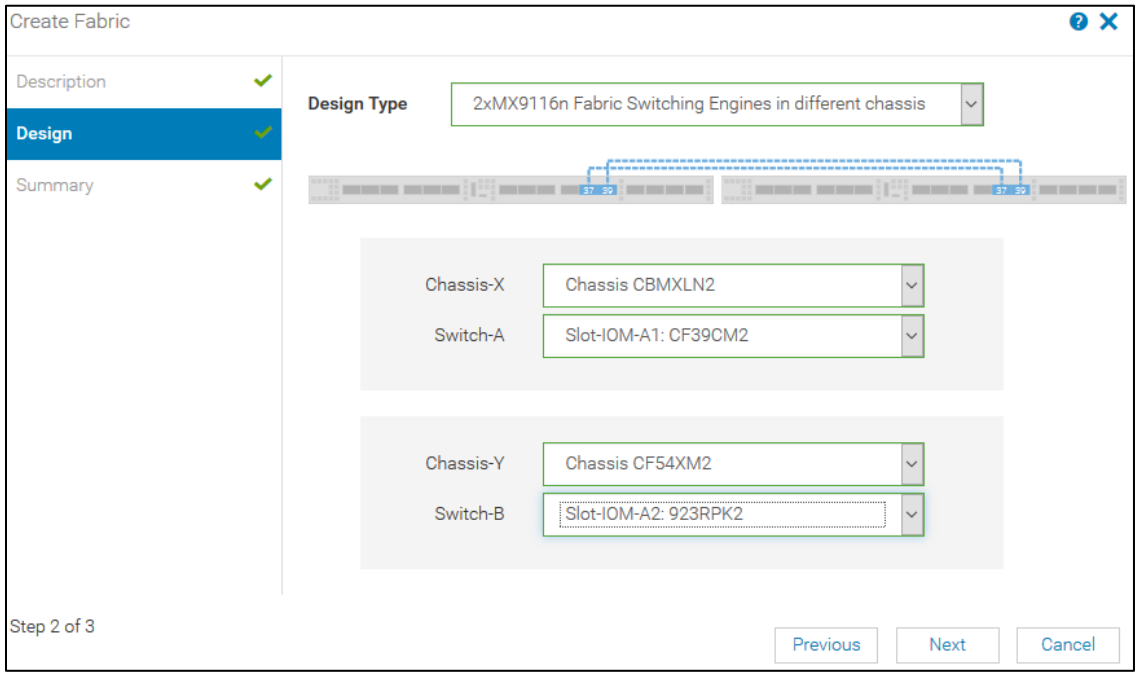


Figure 36 SmartFabric deployment design window

i. Click **Next**.
j. On the **Summary** page, verify the proposed configuration and click **Finish**.

The SmartFabric deploys. This process takes several minutes to complete. During this time, all related IOMs reload, the operating mode of the IOMs changes from their default, Full Switch, to SmartFabric, and the SmartFabric is created.

Figure 37 shows the new SmartFabric object.

Figure 37 SmartFabric after deployment before uplinks are created

Note: After creation, the SmartFabric shows the **Uplink Count** is 0 and the ⚠ icon. The **Health** column displays the ⊗ icon until uplinks are defined in the next section.

9.3.3 Define uplinks

To define the uplinks from the MX9116n FSEs to the Cisco ACI leafs, follow these steps:

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. Click the fabric name, for example, **SmartFabric1**.
4. In the left pane on the **Fabric Details** page, click **Uplinks**.
5. Click the **Add Uplink** button. In the **Add Uplink** window complete the following:
   a. Enter a **Name**, for example, **VLT01.**
   b. Optionally, enter a description in the **Description** box.
   c. From the **Uplink Type** list, select **Ethernet**.
   d. Click **Next**.
   e. From the **Switch Ports** list, select the ports used in the uplink to the ACI leaf switches. In this example, **ethernet 1/1/43 and 1/1/44** are used on both MX9116n FSEs.

Note: Click the service tag of each MX9116n to expand their ports for selection as shown in Figure 38.

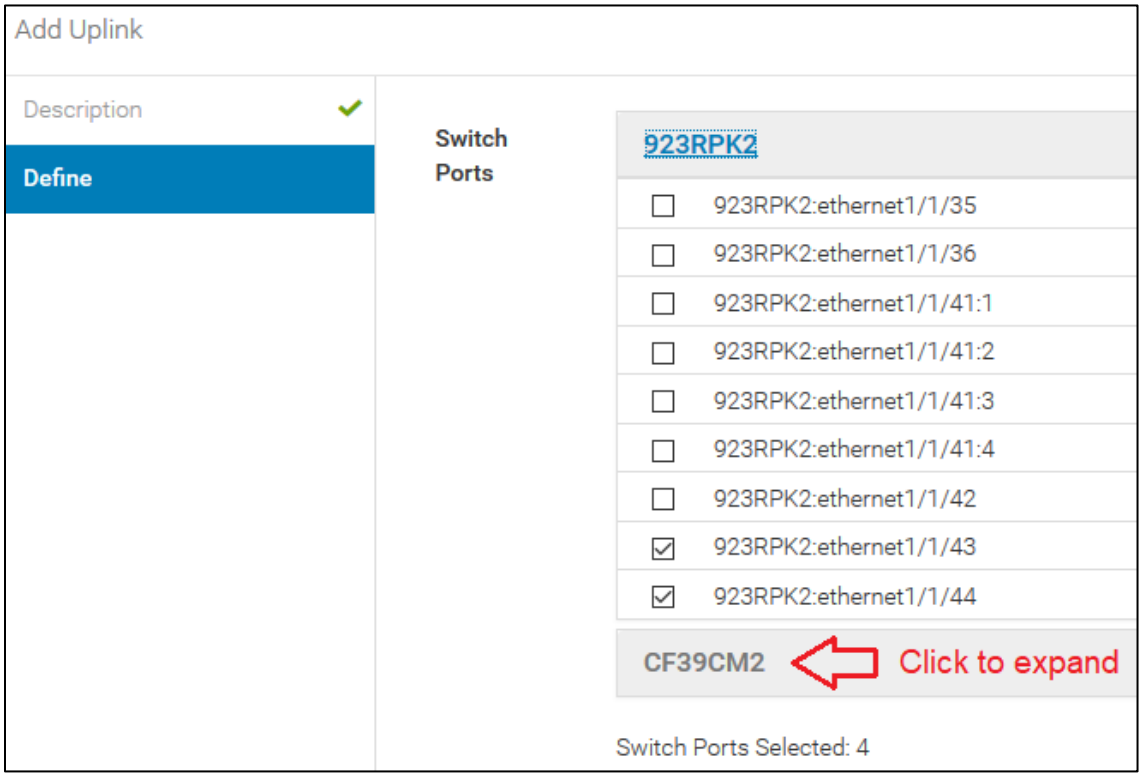


Figure 38 Click switch service tag to view ports

f. Under **Tagged Networks**, select the checkbox next to each VLAN that the uplink will be tagged. The uplink is a tagged member of all six VLANs in this example as shown in Figure 39.
g. If the uplink will be an untagged member of a VLAN, select the VLAN from the drop-down list next to **Untagged Network**. In this example, this is left at **None.**

Note: If the uplink is an untagged member of a VLAN, see the Cisco ACI documentation for setting the corresponding EPG to access (untagged) mode in ACI.

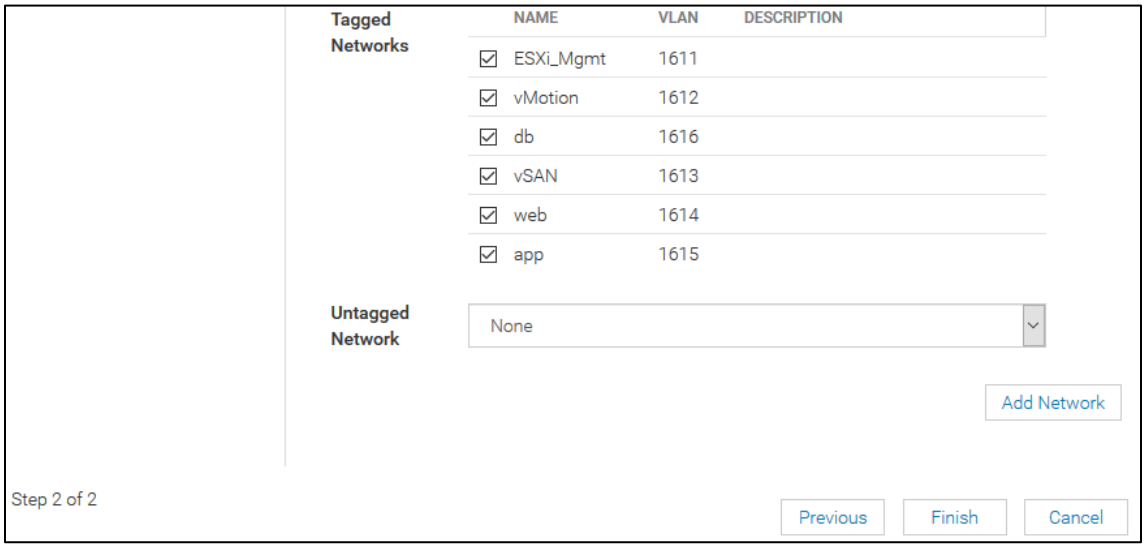


Figure 39 Tagged and untagged networks selected

h. Click **Finish**.

SmartFabric creates the uplink object. If the connected Cisco ACI vPC is configured correctly, as shown in the attachment **Scenario 3 – APIC config steps.pdf**, the uplink comes up and the status for the fabric changes to Ok on the **Devices > Fabric** page as shown in Figure 40.

Figure 40 SmartFabric status after uplink is created

9.3.4 Server templates

A server template contains the parameters that are extracted from a compute sled and enables these parameters to be quickly applied to multiple compute sleds. The templates contain settings for the following categories:

- Local access configuration
- Location configuration
- Power configuration
- Chassis network configuration
- Slot configuration
- Setup configuration

Also, server templates enable an administrator to associate VLANs to compute sleds.

9.3.4.1 Create server templates

A server template should be created for each unique server and NIC combination used in the MX7000 chassis group. If all servers are identical, only one template needs to be created. For the hardware used in this example, three templates are created:

- MX740c with QLogic QL41232HMKR NIC
- MX740c with Intel XXV710 NIC
- MX840c with QLogic QL41232HMKR NIC

To create a server template, follow these steps:

1. Open the OME-M console.
2. From the navigation menu, click **Configuration** > **Deploy**.
3. Click **Create Template > From Reference Device**.
4. In the **Create Template** window, complete the following:
   a. Enter a name such as MX740c with QLogic QL41232HMKR NIC in the Template Name box.
   b. Optionally, enter a description in the **Description** box.
   c. Click **Next**.
   d. On the Device Selection page, click Select Device.
   e. In the **Select Devices** window, choose an appropriate sled for the template, for example, **Sled-1** from **Chassis-1** and click **Finish**.
   f. In the **Elements to Clone** list, select the following options:
      i. iDRAC
      ii. System
      iii. NIC
   g. Click **Finish**.

Note: Capture both iDRAC and NIC settings to enable virtual identities. For additional information about virtual identities, see **Appendix A.7**.

A job starts, and the new server template displays in the list. When done, the status changes to **Completed**.

Repeat steps 3 and 4 above if more templates need to be created. The templates created for this example are shown in Figure 41.

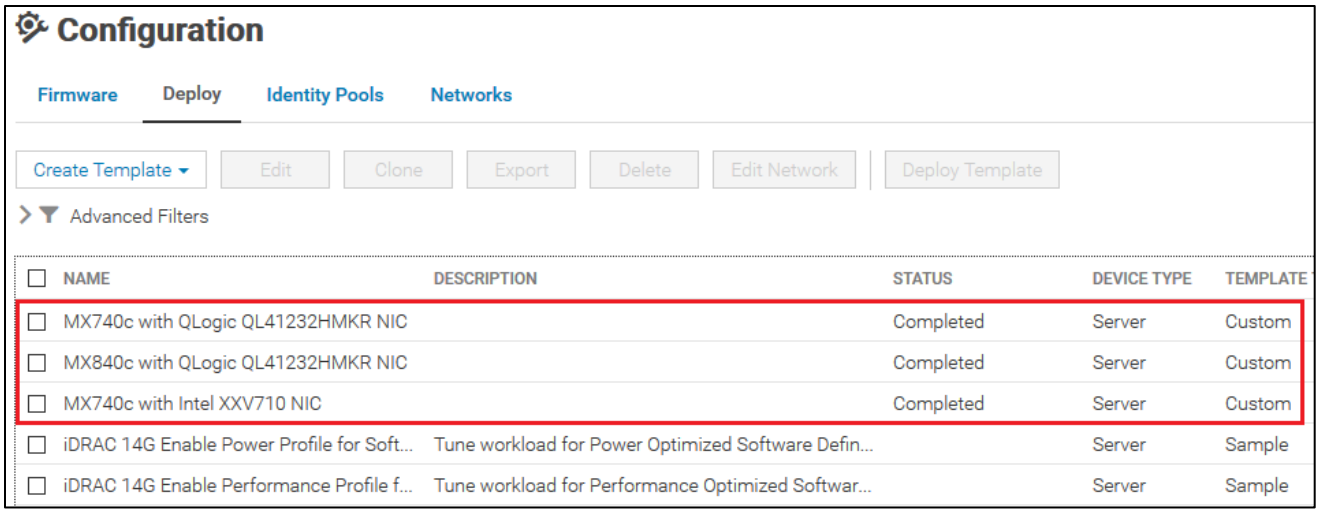


Figure 41 Server templates created

9.3.4.2 Add VLANs to the server templates

After successfully creating server templates, associate each template with VLANs as follows:

1. On the **Configuration > Deploy** page, select a server template previously created such as **MX740c with QLogic QL41232HMKR NIC.**
2. Click the **Edit Network** button.
3. In the **Edit Network** window, complete the following:
   a. For both ports, if they will be untagged members of a VLAN, select the VLAN from the drop-down box under **Untagged Network.** No ports are untagged in this example.
   b. For both ports, select the VLANs they are tagged members of in the drop-down box under **Tagged Network.** Both ports are tagged members of all six VLANs in this example as shown in Figure 42.

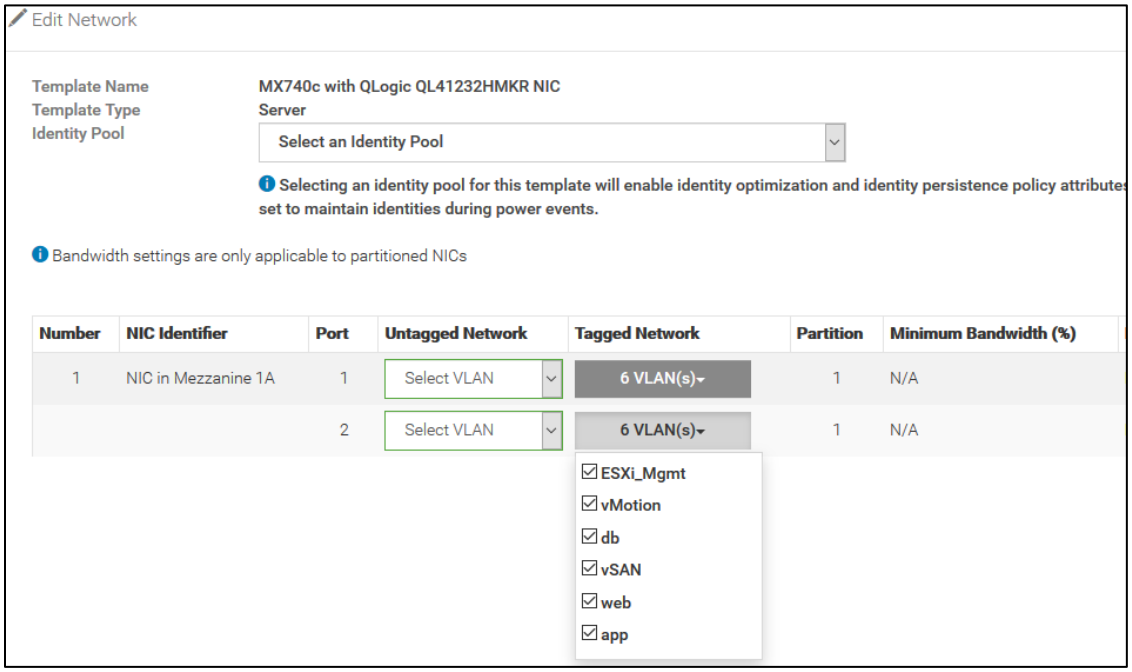


Figure 42 VLANs added to server template

c. Click **Finish**.

9.3.4.3 Deploy the server templates

To deploy the server templates, complete the following steps:

1. On the **Configuration > Deploy** page, select a server template such as **MX740c with QLogic QL41232HMKR NIC.**
2. Click the **Deploy Template** button. Click **Yes** if prompted to use the physical identities.
3. In the **Deploy Template** window, complete the following:
   a. Click the **Select** button to choose which sleds to deploy the template. After sleds are selected, click **Finish.**
   b. Under Host OS Reboot Options, select the Do not forcefully reboot the host OS checkbox.
   c. Click **Next**.
   d. Optionally, configure the iDRAC Management IP settings for each sled. In this example, it is kept at **Don't Change IP settings**. Click **Next.**
   e. Choose **Run Now** > **Finish.** Read the "deploying template" warning and click **Yes** to confirm.

Repeat the steps above using applicable templates for any remaining sleds.

SmartFabric configures each MX9116n FSE interface with the VLAN settings automatically per the template. This enables hosts in the MX Chassis to access the networks configured.

SmartFabric also deploys the associated QoS settings based on the network type assigned to each VLAN. For more information on QoS settings, see Appendix A.6.

9.4 vCenter configuration overview

The existing ACI environment has two PowerEdge R730xd rack servers connected to the ACI leafs. The rack servers are in a vSphere cluster named **Management**.

After the SmartFabric is deployed, MX compute sleds can communicate with the rack servers and the vCenter, mgmtvc01. The MX compute sleds are joined to the vSphere cluster by an administrator as shown in Figure 43.

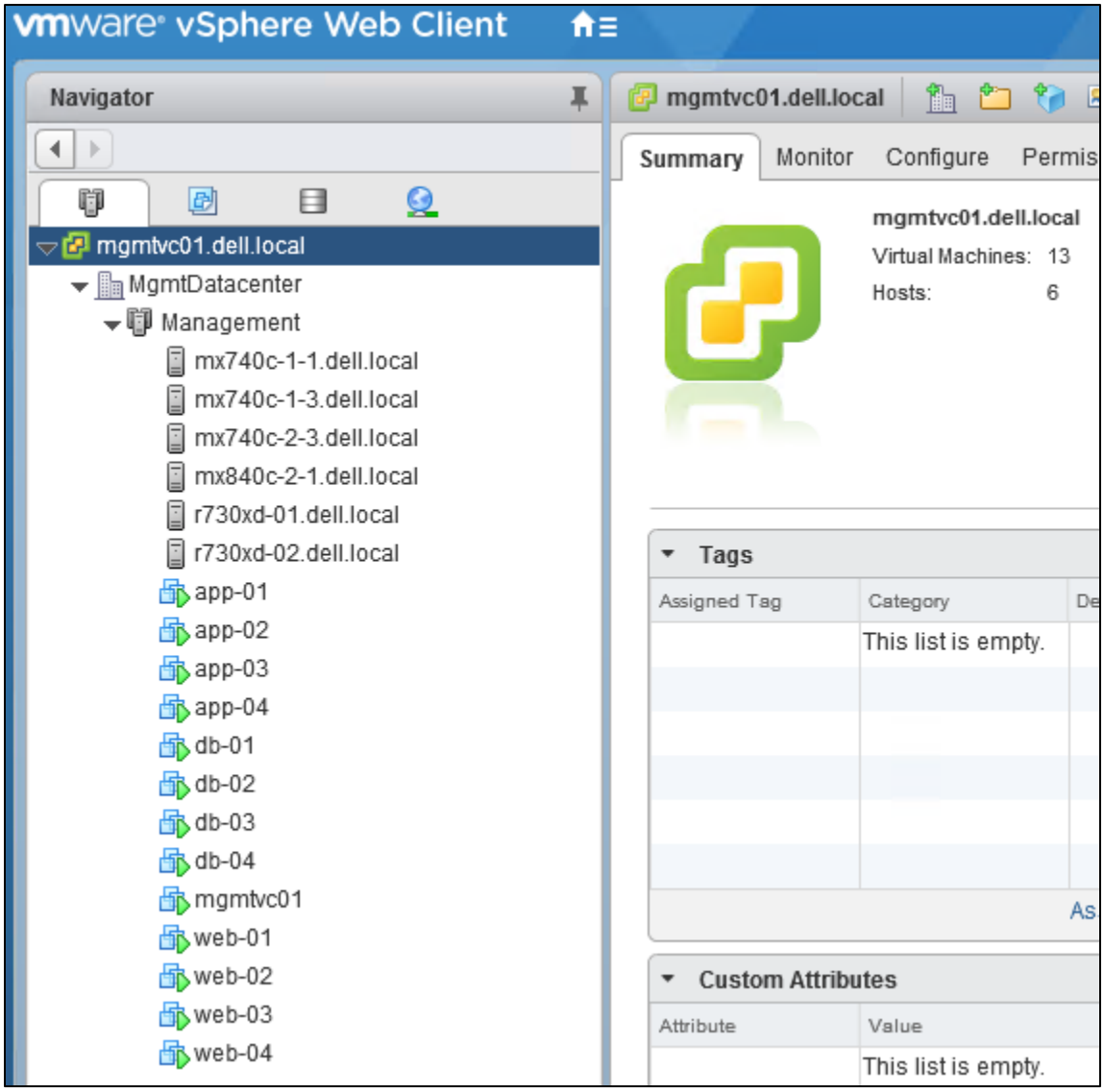


Figure 43 Hosts and VMs used in the validated environment in a single vSphere cluster

Note: The VM locations in the topology are shown in Figure 33 at the beginning of this chapter.

A VDS named **VDS-Mgmt**, along with six distributed port groups, one for each VLAN, are used as shown in Figure 44.

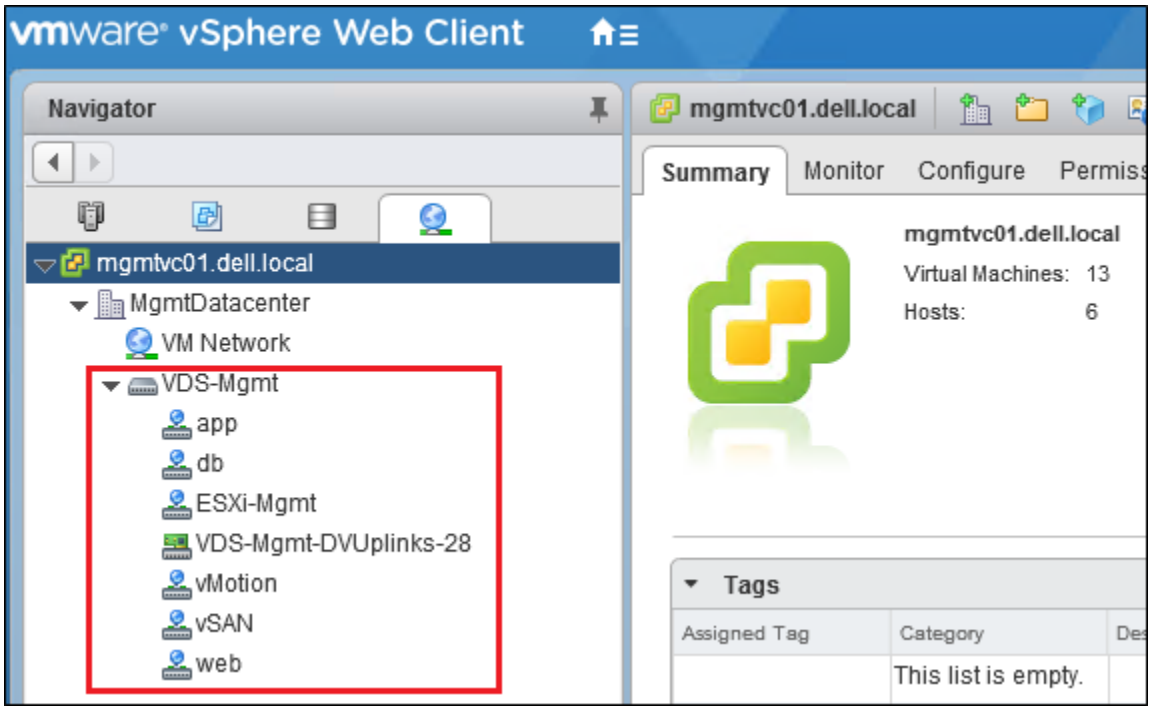


Figure 44 VDS and port groups used in the validated environment

Note: For each port group in the VDS in this example, both uplinks are active and the load balancing method used is **Route based on physical NIC load** as recommended in VMware Validated Design Documentation. Detailed vCenter configuration is beyond the scope of this document.

Note: Cisco ACI supports VMware vCenter VDS integration where the APIC learns ESXi host locations using LLDP. With intermediate switches between ESXi hosts and ACI leaf switches, this is not possible without an LLDP relay mechanism. This feature is planned for a future OS10EE release.

9.5 Verify configuration

This section covers methods to verify the SmartFabric and ACI environment is configured properly.

9.5.1 Validation using the OME-M Console

9.5.1.1 Show the MCM group topology

The OME-M console can be used to show the physical cabling of the SmartFabric.

1. Open the OME-M console and click **Home.**
2. In the chassis group pane, click **View Topology**.
3. Click the lead chassis image and then click **Show Cabling**.
4. Click the icons to view cable connections as shown in Figure 45.

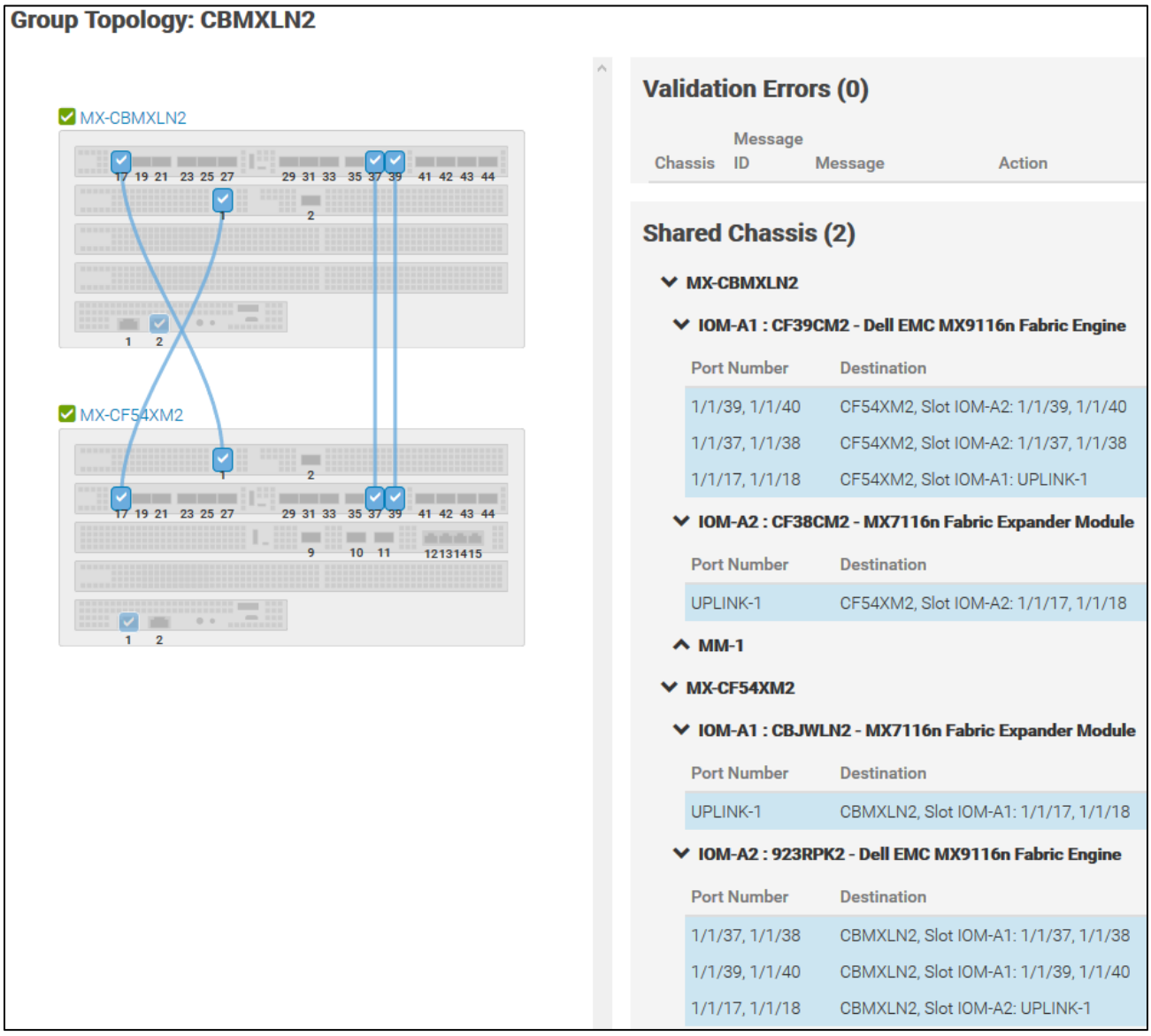


Figure 45 SmartFabric cabling

The Group Topology page shows the MX9116n and MX7116n connections and if any validation errors are present. On the MX9116n FSEs, ports 1/1/17-18 are used to connect to the MX7116n FEMs. Ports 1/1/37-40 are used for the VLTi.

9.5.1.2 Show the SmartFabric status

The overall health of the SmartFabric is viewed as follows:

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. Click the fabric name, for example, **SmartFabric1,** to expand the details of the fabric.

The overall status of the fabric is in the upper left corner of the page as shown in Figure 46.

Figure 46 Fabric status details

The left pane of the **Overview** tab lists **Uplinks**, **Switches**, **Servers**, and **ISL Links**. Click the **Switches** link to view the switch health status as shown in Figure 47.

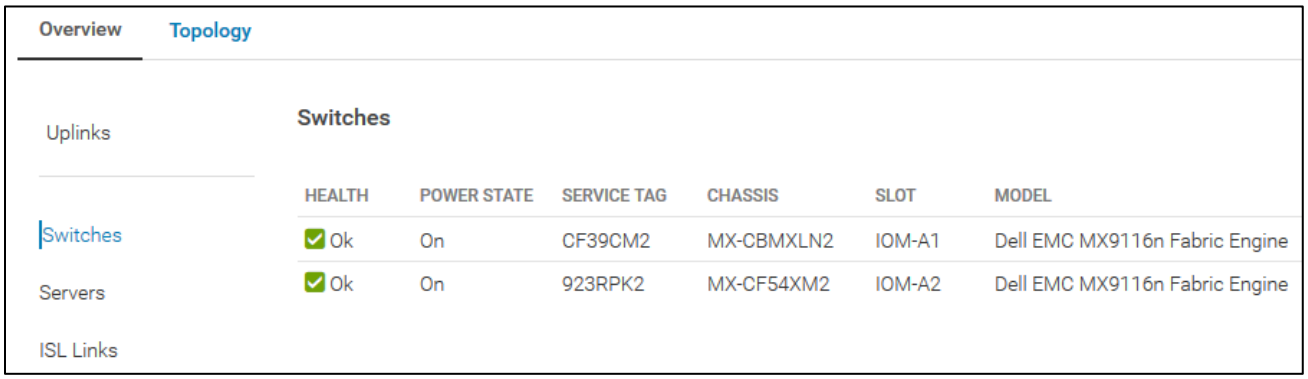


Figure 47 SmartFabric switch status

Click the **Servers** link to view the server health status as shown in Figure 48.

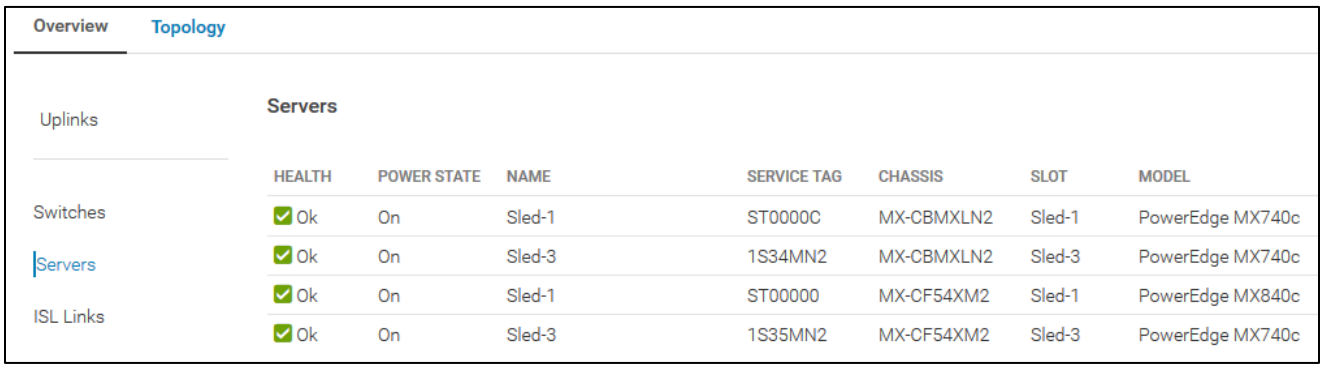


Figure 48 SmartFabric server status

Select the **Topology** tab to view uplinks and fabric connections.

Figure 49 shows the VLT port channel connection, **VLT01,** connected to the Cisco ACI vPC using ports 1/1/43-1/1/44 on each MX9116n. The VLTi connection between the two MX9116n FSEs is also shown.

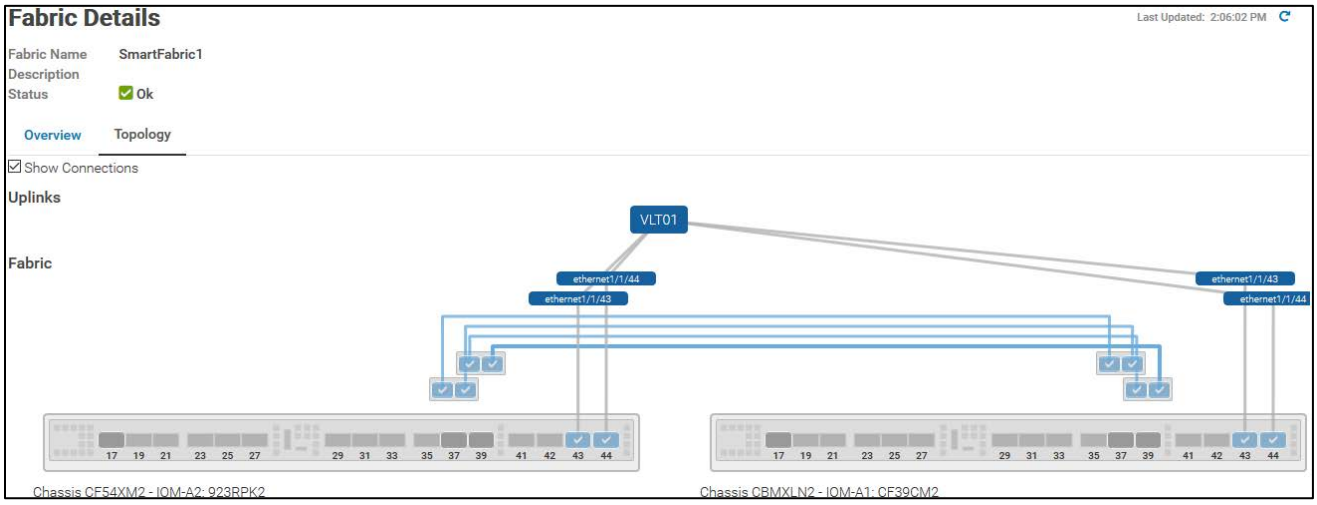
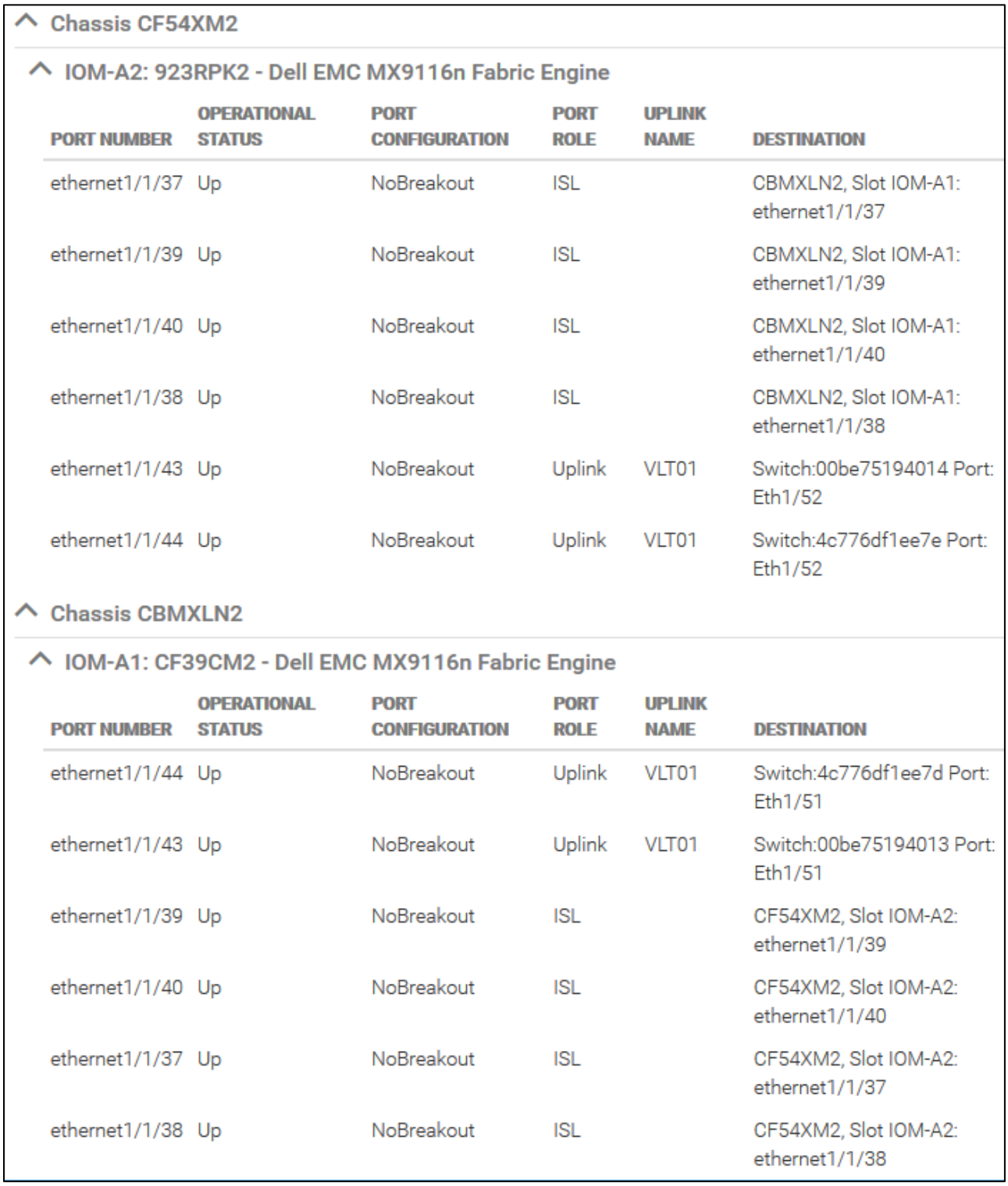


Figure 49 VLT01 uplink and VLTi connections

The connection details are shown in the table at the bottom of the **Topology** page as shown in Figure 50.



Chassis CF54XM2

IOM-A2: 923RPK2 - Dell EMC MX9116n Fabric Engine

PORT NUMBER	OPERATIONAL STATUS	PORT CONFIGURATION	PORT ROLE	UPLINK NAME	DESTINATION
ethernet1/1/37	Up	NoBreakout	ISL		CBMXLN2, Slot IOM-A1: ethernet1/1/37
ethernet1/1/39	Up	NoBreakout	ISL		CBMXLN2, Slot IOM-A1: ethernet1/1/39
ethernet1/1/40	Up	NoBreakout	ISL		CBMXLN2, Slot IOM-A1: ethernet1/1/40
ethernet1/1/38	Up	NoBreakout	ISL		CBMXLN2, Slot IOM-A1: ethernet1/1/38
ethernet1/1/43	Up	NoBreakout	Uplink	VLT01	Switch:00be75194014 Port: Eth1/52
ethernet1/1/44	Up	NoBreakout	Uplink	VLT01	Switch:4c776df1ee7e Port: Eth1/52

Chassis CBMXLN2

IOM-A1: CF39CM2 - Dell EMC MX9116n Fabric Engine

PORT NUMBER	OPERATIONAL STATUS	PORT CONFIGURATION	PORT ROLE	UPLINK NAME	DESTINATION
ethernet1/1/44	Up	NoBreakout	Uplink	VLT01	Switch:4c776df1ee7d Port: Eth1/51
ethernet1/1/43	Up	NoBreakout	Uplink	VLT01	Switch:00be75194013 Port: Eth1/51
ethernet1/1/39	Up	NoBreakout	ISL		CF54XM2, Slot IOM-A2: ethernet1/1/39
ethernet1/1/40	Up	NoBreakout	ISL		CF54XM2, Slot IOM-A2: ethernet1/1/40
ethernet1/1/37	Up	NoBreakout	ISL		CF54XM2, Slot IOM-A2: ethernet1/1/37
ethernet1/1/38	Up	NoBreakout	ISL		CF54XM2, Slot IOM-A2: ethernet1/1/38

Figure 50 SmartFabric topology connection details

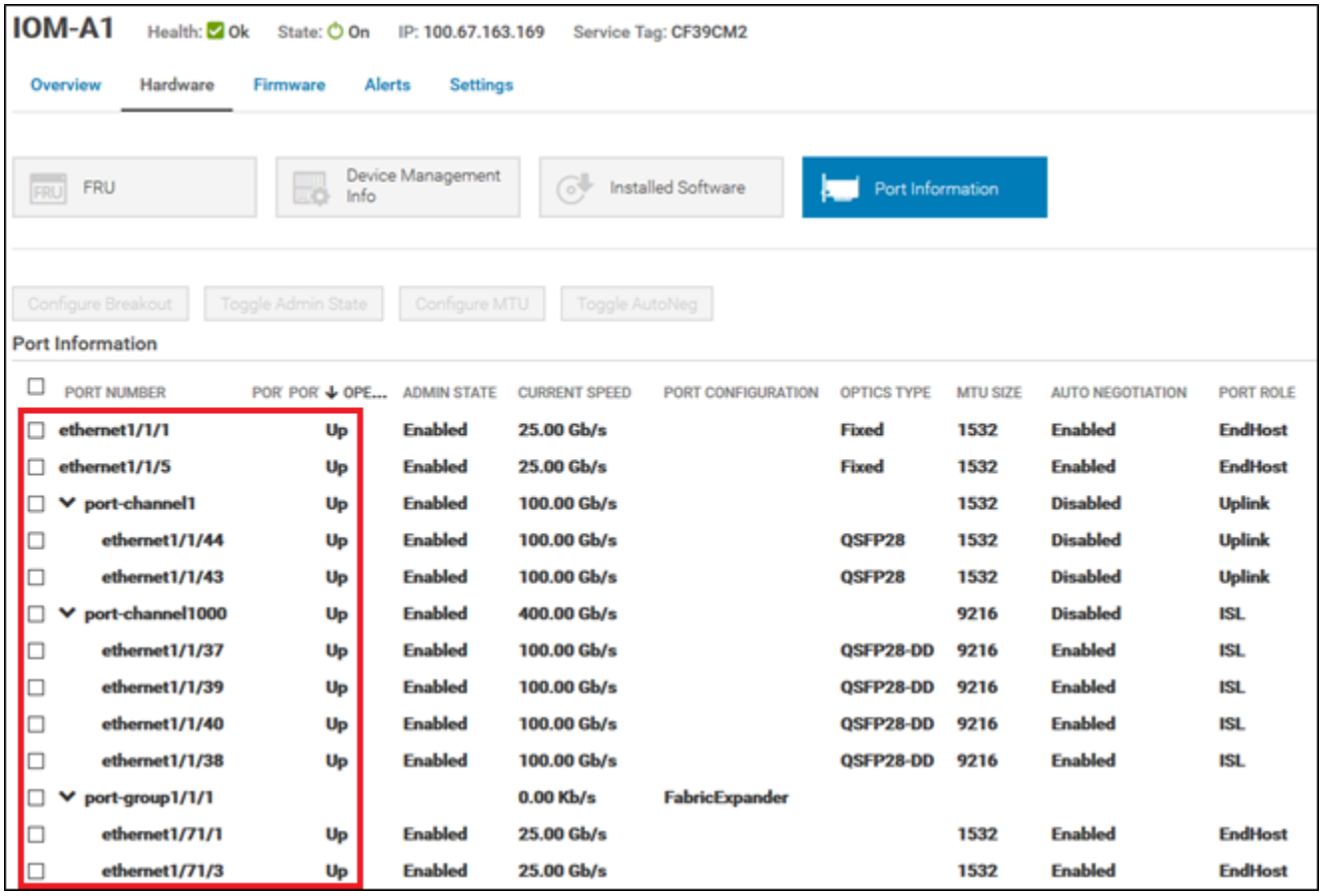
9.5.1.3 Show port status

The OME-M console can be used to show MX9116n FSE port status, toggle administrative states, configure breakouts, MTU settings, and auto-negotiation.

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **I/O Modules**.
3. Click an IOM name for the first MX9116n, for example, **IOM-A1**. The **IOM Overview** page for that device is displayed.
4. On the **IOM Overview** page, click **Hardware > Port Information**.

Figure 51 shows ports 1/1/1, 1/1/5, 1/71/1 and 1/71/3 are up. Ports 1/1/1 and 1/1/5 are connected to the compute sleds in the local chassis. Ports 1/71/1 and 1/71/3, in port group 1/1/1, are connected to the compute sleds in the opposite chassis via the MX7116n FEM.

The figure also shows the uplinks to the Cisco ACI leafs, using port channel 1, are up. It also shows the VLTi ports, using port channel 1000, are up.



PORT NUMBER	POR	POR	OPE...	ADMIN STATE	CURRENT SPEED	PORT CONFIGURATION	OPTICS TYPE	MTU SIZE	AUTO NEGOTIATION	PORT ROLE
ethernet1/1/1			Up	Enabled	25.00 Gb/s		Fixed	1532	Enabled	EndHost
ethernet1/1/5			Up	Enabled	25.00 Gb/s		Fixed	1532	Enabled	EndHost
port-channel1			Up	Enabled	100.00 Gb/s			1532	Disabled	Uplink
ethernet1/1/44			Up	Enabled	100.00 Gb/s		QSFP28	1532	Disabled	Uplink
ethernet1/1/43			Up	Enabled	100.00 Gb/s		QSFP28	1532	Disabled	Uplink
port-channel1000			Up	Enabled	400.00 Gb/s			9216	Disabled	ISL
ethernet1/1/37			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
ethernet1/1/39			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
ethernet1/1/40			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
ethernet1/1/38			Up	Enabled	100.00 Gb/s		QSFP28-DD	9216	Enabled	ISL
port-group1/1/1					0.00 Kb/s	FabricExpander				
ethernet1/71/1			Up	Enabled	25.00 Gb/s			1532	Enabled	EndHost
ethernet1/71/3			Up	Enabled	25.00 Gb/s			1532	Enabled	EndHost

Figure 51 IOM port information

9.5.2 Validation using the MX9116n CLI

The CLI commands shown in this section are available to help validate the configuration. The commands and output shown below are from the MX9116n in the first chassis. The CLI output from the MX9116n in the second chassis, not shown, is similar.

Note: The MX9116n CLI is accessible using SSH. The default username and password are both `admin`.

9.5.2.1 show switch-operating-mode

Use the **`show switch-operating-mode`** command to display the current operating mode.

```
MX9116n-1# show switch-operating-mode

Switch-Operating-Mode : Smart Fabric Mode
```

9.5.2.2 show discovered-expanders

The **`show discovered-expanders`** command is only available on the MX9116n FSE and displays the MX7116n FEMs service tag attached to the MX9116n FSEs and the associated port-group and virtual slot.

```
MX9116n-1# show discovered-expanders
Service   Model        Type  Chassis      Chassis-slot Port-group Virtual
tag                        service-tag                           Slot-Id
-------------------------------------------------------------------------
CBJWLN2   MX7116n FEM  1     CF54XM2      A1           1/1/1      71
```

9.5.2.3 show unit-provision

The **`show unit-provision`** command is only available on the MX9116n FSE. It displays the unit ID, name, and the state of each MX7116n FEM attached to the MX9116n FSE.

```
MX9116n-1# show unit-provision
Node ID | Unit ID | Provision Name | Discovered Name | State |
---------+---------+--------------------------------+-------|
 1       | 71      | CBJWLN2        | CBJWLN2         | up    |
```

(output truncated)

9.5.2.4 show vlt *domain-id*

The **show vlt *domain-id*** command validates the VLT configuration status. The role of one switch in the VLT pair is primary (not shown), and its peer switch is assigned the secondary role. The VLT domain ID of 255 is automatically configured in SmartFabric mode. The VLTi link Status and VLT Peer Status must both be up. SmartFabric automatically configures the VLTi as port channel 1000.

```
MX9116n-1# show vlt 255
Domain ID                  : 255
Unit ID                    : 1
Role                       : secondary
Version                    : 1.0
Local System MAC address   : 20:04:0f:00:b8:1e
VLT MAC address            : 20:04:0f:00:b8:1e
IP address                 : fda5:74c8:b79e:1::1
Delay-Restore timer        : 90 seconds
Peer-Routing               : Disabled
Peer-Routing-Timeout timer : 0 seconds
VLTi Link Status
    port-channel1000       : up

VLT Peer Unit ID    System MAC Address   Status  IP Address              Version
--------------------------------------------------------------------------------
  2                 20:04:0f:00:9d:1e    up      fda5:74c8:b79e:1::2     1.0
```

9.5.2.5 show vlt *domain-id* vlt-port-detail

The **show vlt *domain-id* vlt-port-detail** command shows the VLT port channel status for both VLT peers. The VLT in this example is connected to the Cisco ACI vPC. It is automatically configured in port channel 1, and it consists of two ports on each switch.

```
MX9116n-1# show vlt 255 vlt-port-detail
vlt-port-channel ID : 1
VLT Unit ID    Port-Channel      Status    Configured ports    Active ports
--------------------------------------------------------------------------------
* 1            port-channel1      up        2                   2
  2            port-channel1      up        2                   2
```

9.5.2.6 show interface port channel summary

The **show interface port-channel summary** command shows the LAG number (VLT port channel 1 in this example), the mode, status and ports used in the port channel.

```
MX9116n-1# show interface port-channel summary
LAG     Mode      Status    Uptime              Ports
1       L2-HYBRID up        00:29:20            Eth 1/1/43 (Up)
                                                Eth 1/1/44 (Up)
```

9.5.2.7 show lldp neighbors

The **show lldp neighbors** command shows information about directly connected devices. Ports 1/1/1, 1/1/5, 1/71/1, and 1/71/3 are connected to the four compute sleds.

Note: Ports 1/71/1 and 1/71/3 are the compute sleds connected to the MX7116n FEM in the other chassis.

Two instances appear for each port connected to a compute sled. One instance is the compute sled iDRAC. The iDRAC uses connectivity to the mezzanine card to advertise LLDP information. It includes the iDRAC name in the Rem Host Name column, the sled service tag and mezzanine card number-port-partition in the Rem Port ID column, and the iDRAC MAC address in the Rem Chassis Id column. The second instance is the mezzanine card itself and the MAC address of the mezzanine card port is shown.

Ports 1/1/37-1/1/40 are the VLTi interfaces for the SmartFabric. Ports 1/1/43-1/1/44 are the links in VLT port channel 1 connected to the Cisco ACI leaf switches.

```
MX9116n-1# show lldp neighbors
Loc PortID      Rem Host Name     Rem Port Id                  Rem Chassis Id
-------------------------------------------------------------------------------
ethernet1/1/1    Not Advertised   f4:e9:d4:f2:6f:26            f4:e9:d4:f2:6f:26
ethernet1/1/1    MX740c-1-1-idrac ST0000C NIC.Mezzanine.1A-1-1 d0:94:66:2d:b3:f4
ethernet1/1/5    Not Advertised   24:6e:96:9c:e5:da            24:6e:96:9c:e5:da
ethernet1/1/5    MX740c-1-3-idrac 1S34MN2 NIC.Mezzanine.1A-1-1 d0:94:66:29:ff:27
ethernet1/1/37   MX9116n-2        ethernet1/1/37               20:04:0f:00:9d:1e
ethernet1/1/38   MX9116n-2        ethernet1/1/38               20:04:0f:00:9d:1e
ethernet1/1/39   MX9116n-2        ethernet1/1/39               20:04:0f:00:9d:1e
ethernet1/1/40   MX9116n-2        ethernet1/1/40               20:04:0f:00:9d:1e
ethernet1/1/43   Leaf1            Eth1/51                      00:be:75:19:40:13
ethernet1/1/44   Leaf2            Eth1/51                      4c:77:6d:f1:ee:7d
ethernet1/71/1   Not Advertised   f4:e9:d4:f2:6f:da            f4:e9:d4:f2:6f:da
ethernet1/71/1   MX840c-2-1-idrac ST00000 NIC.Mezzanine.1A-1-1 d0:94:66:2d:b5:2c
ethernet1/71/3   Not Advertised   24:6e:96:9c:e5:48            24:6e:96:9c:e5:48
ethernet1/71/3   MX740c-2-3-idrac 1S35MN2 NIC.Mezzanine.1A-1-1 d0:94:66:29:fa:f4
```

9.5.2.8 show qos system

The **show qos system** command displays the QoS configuration applied to the system. The command is useful to verify the service policy created automatically by the SmartFabric deployment.

```
MX9116n-1# show qos system
 Service-policy (input): PM_VLAN
 ETS Mode : off
```

9.5.2.9 show policy-map

Using the service policy from `show qos system`, the s**how policy-map** command displays QoS policy details including class maps and QoS group settings. The QoS group values should match those configured for each VLAN. See Appendix A.6 for more information on QoS groups.

```
MX9116n-1# show policy-map
 Service-policy (application) input: policy-iscsi
 Service-policy (qos) input: PM_VLAN
   Class-map (qos): CM1611
     set qos-group 5
   Class-map (qos): CM1612
     set qos-group 5
   Class-map (qos): CM1613
     set qos-group 5
   Class-map (qos): CM1614
     set qos-group 3
   Class-map (qos): CM1615
     set qos-group 3
   Class-map (qos): CM1616
     set qos-group 3
```

9.5.2.10 show class-map

The command **show class-map** displays details for all the configured class maps. For example, the association between CM1611 and VLAN 1611 is shown.

```
MX9116n-1# show class-map
 Class-map (application): class-iscsi
 Class-map (qos): class-trust
 Class-map (qos): CM1611(match-any)
   Match: mac vlan 1611
 Class-map (qos): CM1612(match-any)
   Match: mac vlan 1612
 Class-map (qos): CM1613(match-any)
   Match: mac vlan 1613
 Class-map (qos): CM1614(match-any)
   Match: mac vlan 1614
 Class-map (qos): CM1615(match-any)
   Match: mac vlan 1615
 Class-map (qos): CM1616(match-any)
   Match: mac vlan 1616
```

9.5.3 Cisco ACI validation

9.5.3.1 Verify vPC configuration

Verify the vPC connection from the Cisco ACI fabric to the Dell MX SmartFabric VLT, shown in Figure 33, is up and properly configured to allow designated VLANs and EPGs. This is done as follows:

1. In the APIC GUI, go to **Fabric > Inventory > *Pod name* > *Leaf name* > Interfaces > vPC Interfaces** and drill down to the applicable port channel/vPC policy group as shown in Figure 52.

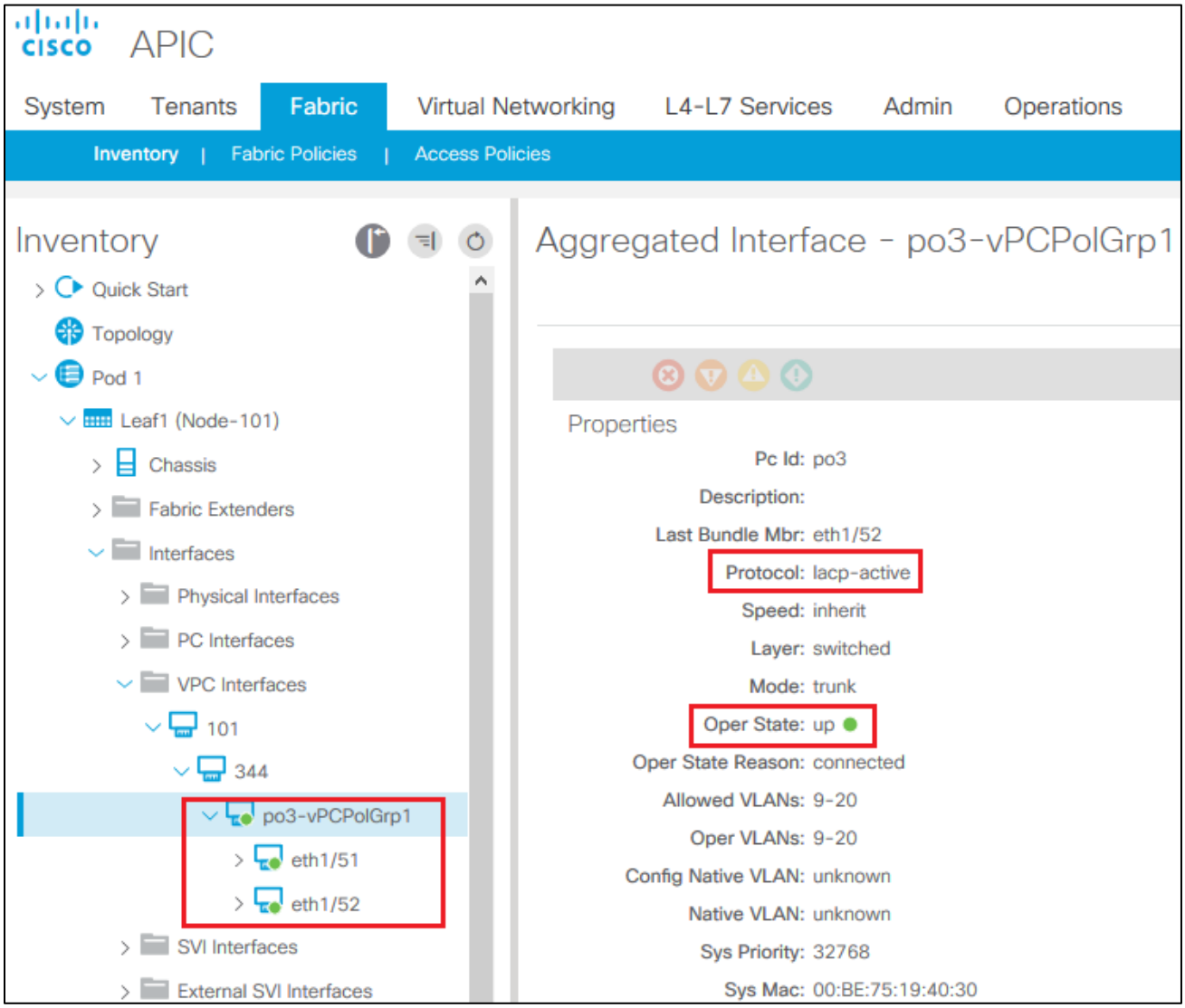


Figure 52 Cisco ACI vPC port channel and interfaces

2. Verify the port channel uses active LACP and is operationally up
3. Verify all leaf switch interfaces in the vPC, for example, eth1/51-52, are listed beneath the port channel and are also up.

4. With the port channel/vPC interface policy group selected in the left pane, click **VLANs** at the top of the right pane as shown in Figure 53.

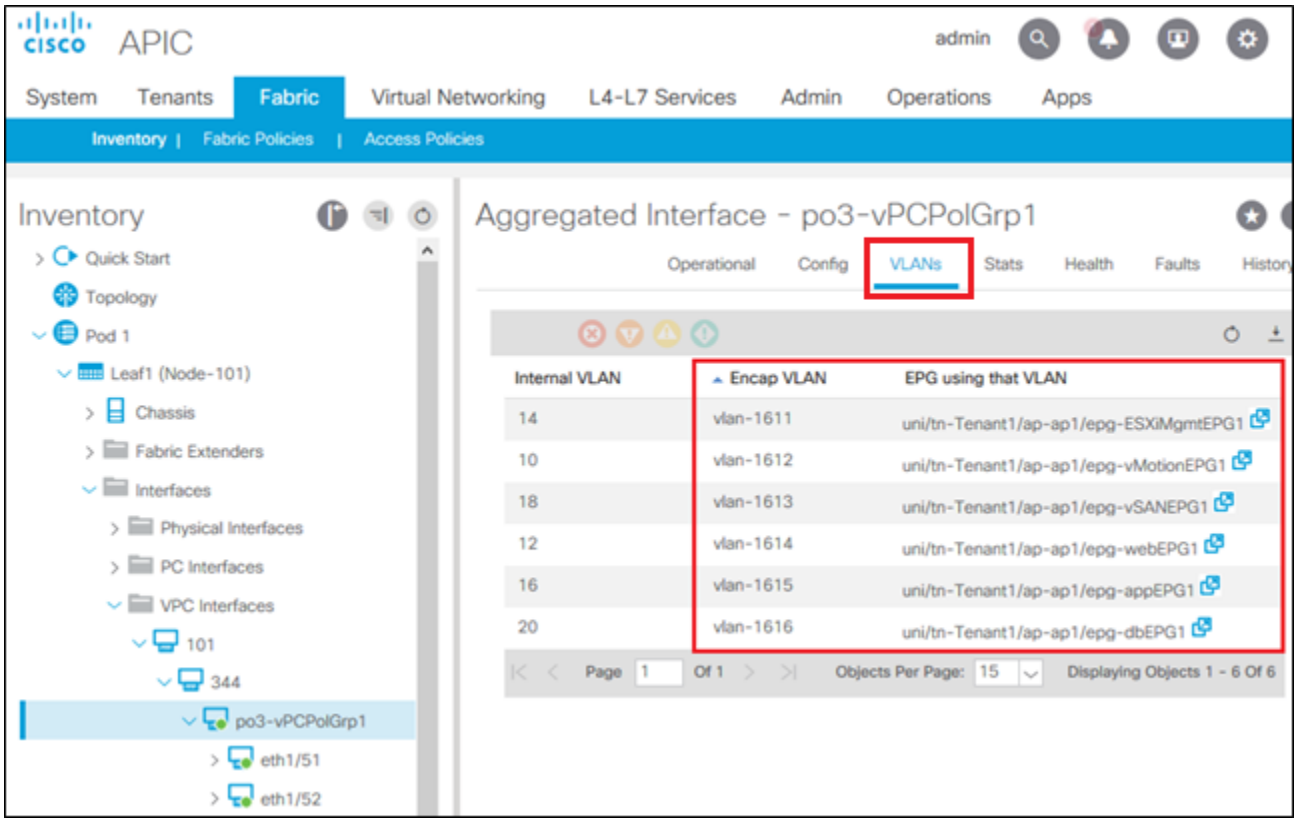


Figure 53 Cisco ACI vPC port channel VLANs and EPGs

5. Verify the port channel includes all required VLANs, and EPGs are mapped to the correct VLANs.

Repeat steps 1 through 5 for the remaining leaf switch.

9.5.3.2 Verify physical interface configuration

The physical, host-connected, interfaces in the validated environment are those connected directly to the PowerEdge R730xd servers (and the jump box, if used) as shown in Figure 33.

Verify the physical interfaces from the Cisco ACI fabric to the servers are up and properly configured to allow designated VLANs and EPGs. This is done as follows:

1. In the APIC GUI, go to **Fabric > Inventory > Pod 1 > *Leaf name* > Interfaces > Physical Interfaces** as shown in Figure 54.

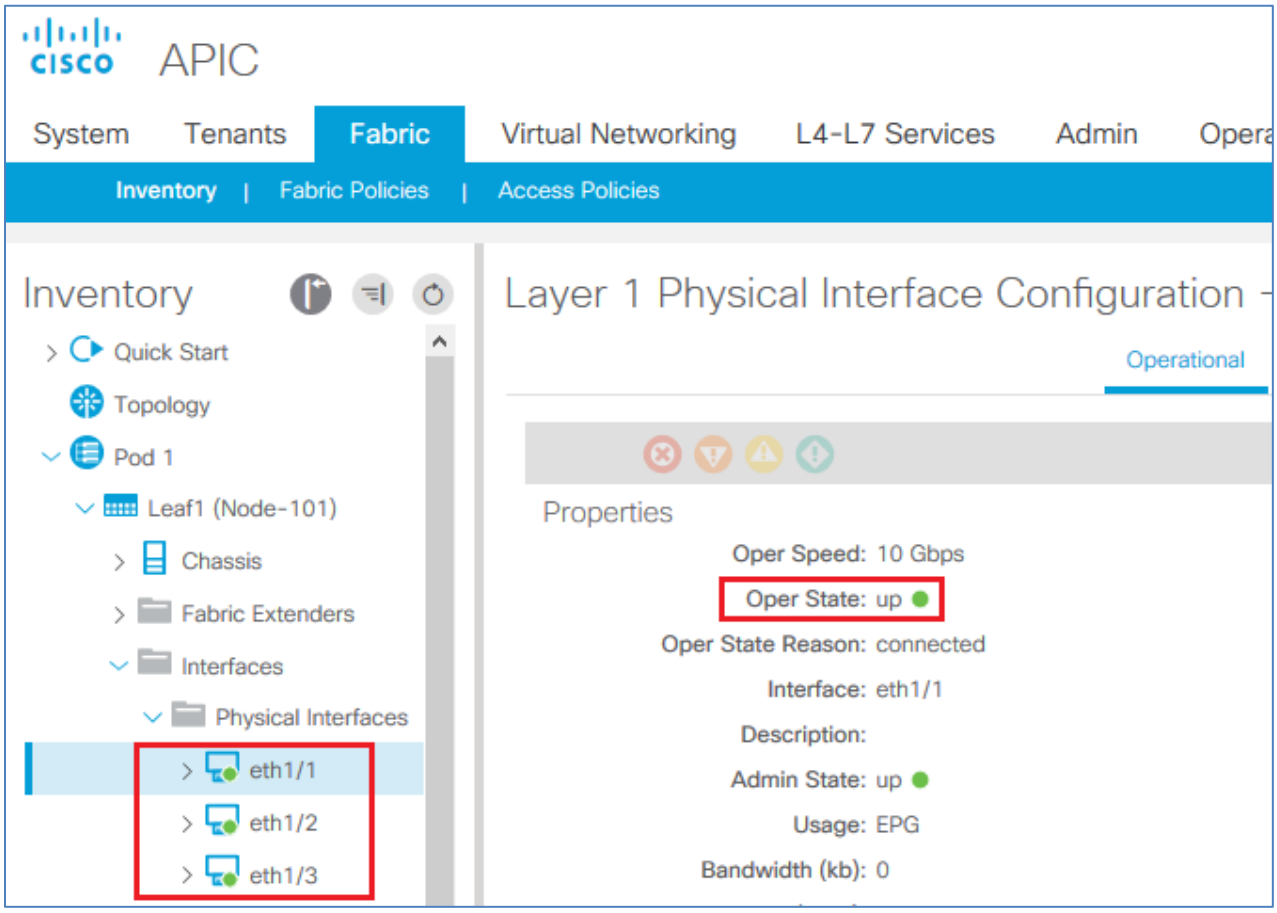


Figure 54 Cisco ACI physical interfaces

2. Verify all required interfaces, for example, eth1/1-3, are up.

3. With an interface selected in the left pane, click **VLANs** at the top of the right pane as shown in Figure 53.

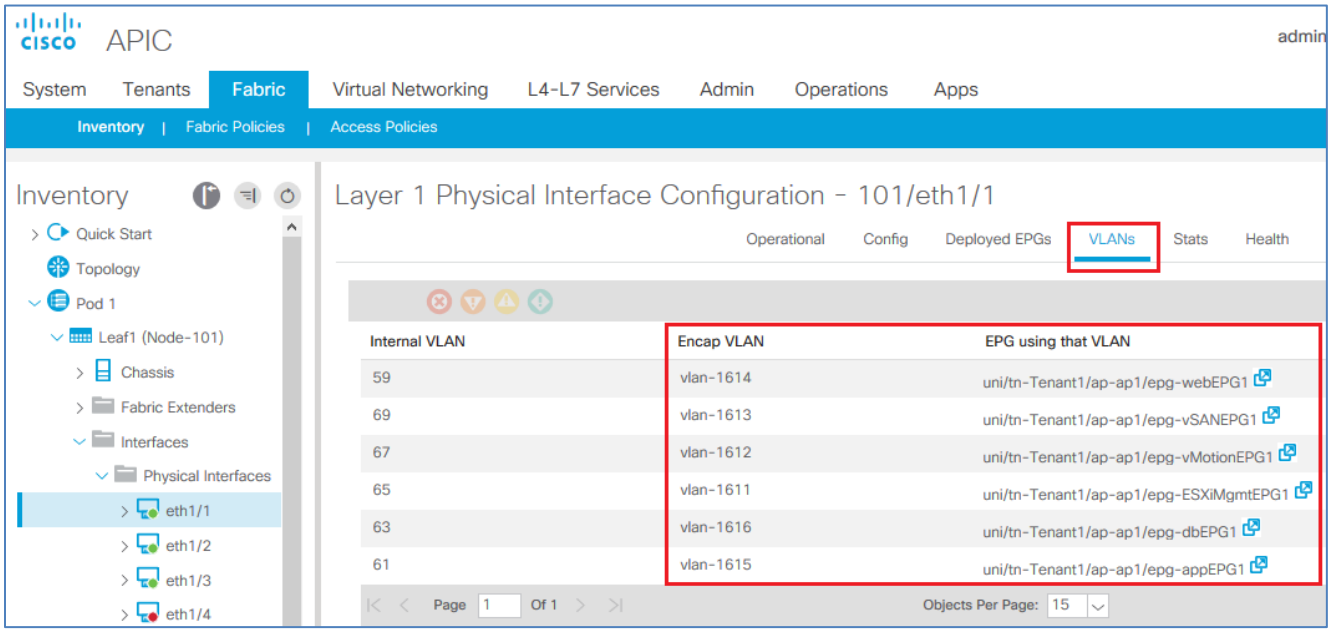


Figure 55 Cisco ACI interface VLANs and EPGs

4. Verify the interface includes all required VLANs and EPGs. Repeat for remaining interfaces as needed.

Repeat steps 1 through 4 for the remaining leaf switch.

9.5.3.3 Verify ACI is learning endpoints

To verify ACI is learning endpoints, do the following:

1. In the APIC GUI, go to **Tenants >** ***Tenant name*** **> Application Profiles >** ***Application Profile name*** **> Application EPGs >** select an ***Application EPG***.
2. Click **Operational** at the top of the right pane as shown in Figure 56.

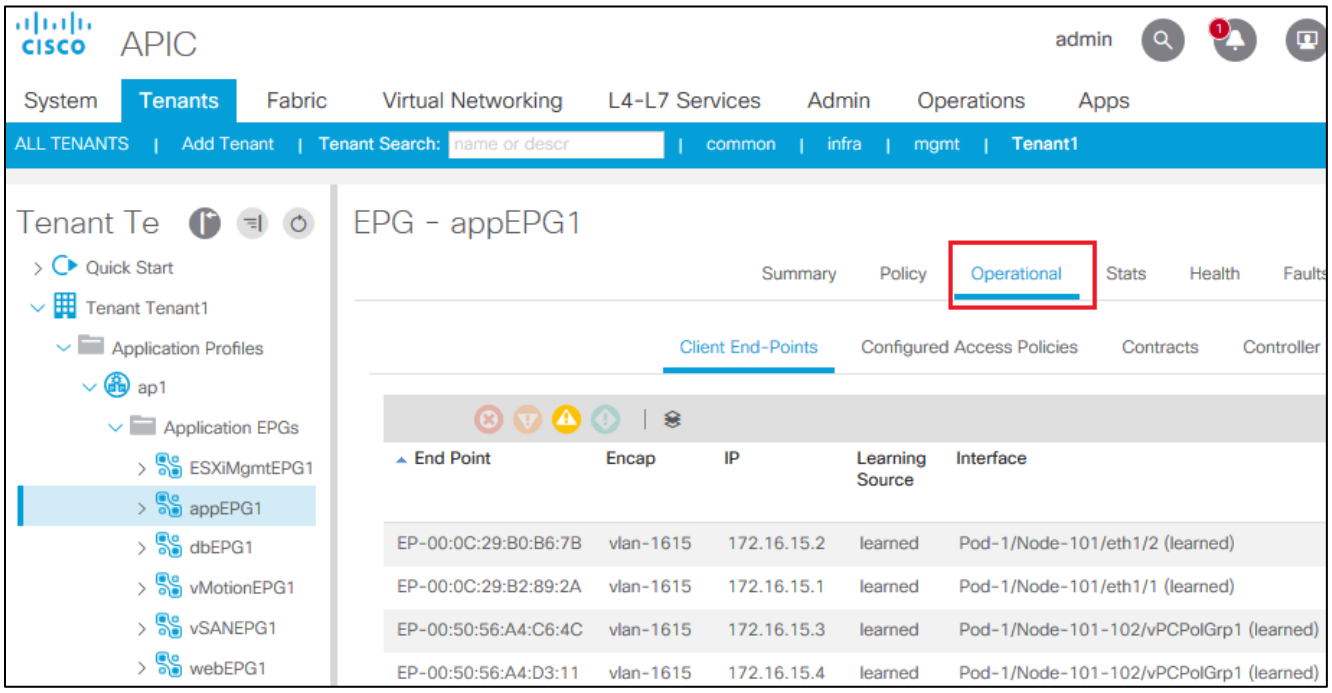


Figure 56 Cisco ACI endpoints in appEPG1

3. All learned endpoints for the selected EPG are displayed along with their VLAN, IP address, and interface.

Repeat the steps above for the remaining Application EPGs.

9.5.4 Verify connectivity between VMs

In ACI, by default, communication flows freely within EPGs, but not between EPGs. To enable inter-EPG communication, contracts are configured on the APIC. This example is configured for unrestricted inter-EPG communication as shown in steps 17 through 19 in the **Scenario 3 – APIC config steps.pdf** attachment.

Connectivity is verified by pinging between the VMs shown in Figure 33. Since inter-EPG communication is allowed using configured contracts, all VMs can ping all other VMs in the topology.

Figure 57 shows the VM named app-01, located in a rack server, successfully pinging the VMs named web-03 and db-04, which are located on MX compute sleds.

```
root@app-01:/#
root@app-01:/# ping web-03
PING web-03 (172.16.14.3) 56(84) bytes of data.
64 bytes from web-03 (172.16.14.3): icmp_seq=1 ttl=63 time=0.509 ms
64 bytes from web-03 (172.16.14.3): icmp_seq=2 ttl=63 time=0.468 ms
^C
--- web-03 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.468/0.488/0.509/0.030 ms
root@app-01:/# ping db-04
PING db-04 (172.16.16.4) 56(84) bytes of data.
64 bytes from db-04 (172.16.16.4): icmp_seq=1 ttl=62 time=0.621 ms
64 bytes from db-04 (172.16.16.4): icmp_seq=2 ttl=62 time=0.461 ms
64 bytes from db-04 (172.16.16.4): icmp_seq=3 ttl=62 time=0.550 ms
```

Figure 57 Verifying connectivity between VMs

A Additional information

A.1 Resetting PowerEdge MX7000 to factory defaults

This section covers resetting a PowerEdge MX7000 with IOMs in SmartFabric mode to factory defaults.

A.1.1 Remove the SmartFabric

To remove the SmartFabric using the OME-M console, perform the following steps:

1. Open the OME-M console.
2. From the navigation menu, click **Devices** > **Fabric**.
3. Select **SmartFabric**.
4. Click the **Delete** button.
5. In the delete fabric dialog box click **Yes**.

All participating switches reboot to Full Switch mode.

Note: Any configuration not completed by the OME-M console is lost when switching between IOM operating modes.

A.1.2 Remove the MCM group

To remove an MCM group using the OME-M console, perform the following steps:

1. Open the OME-M console.
2. In the MCM group pane, click the name of the lead chassis.
3. From the **Configure** menu, select **Delete Group**.
4. In the **Delete Group** dialog box, click **Confirm**.

At this point, the OME-M console removes the MCM group. To manage the chassis, use the individual IP addresses assigned to each.

A.1.3 Use RACADM to reset each chassis

To reset the chassis to factory default settings, perform the following steps:

1. Connect to the MX9002m IP address using SSH. The default username is `root,` and the default password is `calvin`.
2. In the RACADM shell, run the `racadm racresetcfg` command.
3. The factory reset process is initiated, and a status message displays.

Note: The process takes several minutes to complete.

4. Optionally, after the reset process is complete, use the LCD screen to reassign a static IP address. See Section 6.2 for more information.

A.2 Reset OS10EE switches to factory defaults

To reset OS10EE switches back to the factory default configuration, enter the following commands:

```
OS10# delete startup-configuration

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

System configuration has been modified. Save? [yes/no]:no

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

The switch reboots with default configuration settings.

A.3 Factory default Cisco Nexus 3232C

To reset the Cisco Nexus 3232C switches to the factory default configuration, enter the following commands:

```
3232C# write erase
Warning: This command will erase the startup-configuration.
Do you wish to proceed anyway? (y/n)  [n] y
```

After the next reboot the switch loads with default configuration settings.

A.4 Spanning Tree Protocol recommendations

By default, OS10EE uses Rapid per-VLAN Spanning Tree Plus (RPVST+) across all switching platforms including PowerEdge MX networking IOMs. OS10EE also supports RSTP and MST.

Caution should be taken when connecting an RPVST+ to an existing RSTP environment. RPVST+ creates a single topology per VLAN with the default VLAN, typically VLAN 1, for the Common Spanning Tree (CST) with RSTP.

For non-native VLANs, all Bridge Protocol Data Unit (BPDU) traffic is tagged and forwarded by the upstream, RSTP-enable switch, with the associated VLAN. These BPDUs use a protocol-specific multicast address. Any other RPVST+ tree attached to the RSTP tree might processes these packets accordingly leading to the potential of unexpected trees.

Note: When connecting to an existing environment that is not using RPVST+, Dell EMC Networking recommends changing to the existing spanning tree protocol before connecting an OS10EE switch.

In the example below, RSTP is enabled globally on an MX9116n FSE. MST configuration is similar.

```
C140A1(config)# spanning-tree mode rstp
C140A1 (config)# end
C140A1#show spanning-tree brief

Spanning tree enabled protocol rstp with force-version rstp
Executing IEEE compatible Spanning Tree Protocol
Root ID    Priority 0, Address 4c76.25e8.f2c0
```

```
Root Bridge hello time 2, max age 20, forward delay 15
Bridge ID    Priority 32768, Address 2004.0f00.cd1e
Configured hello time 2, max age 20, forward delay 15
Flush Interval 200 centi-sec, Flush Invocations 95
Flush Indication threshold 0 (MAC flush optimization is disabled)
```

A.5 QSFP28 double density connectors

Quad Small Form-Factor Pluggable 28 Double Density, or QSFP28-DD connectors, expand on the QSFP28 pluggable form factor. By doubling the number of available lanes from four to eight, with each lane operating at 25 Gbps, the result is 200 Gbps for each connection.

Note: A QSFP28-DD transceiver is not compatible with a QSFP28 port due to the specifications required to lengthen the PCB connector to allow for the additional four lanes. However, a QSFP28 transceiver can be inserted into a QSFP28-DD port.

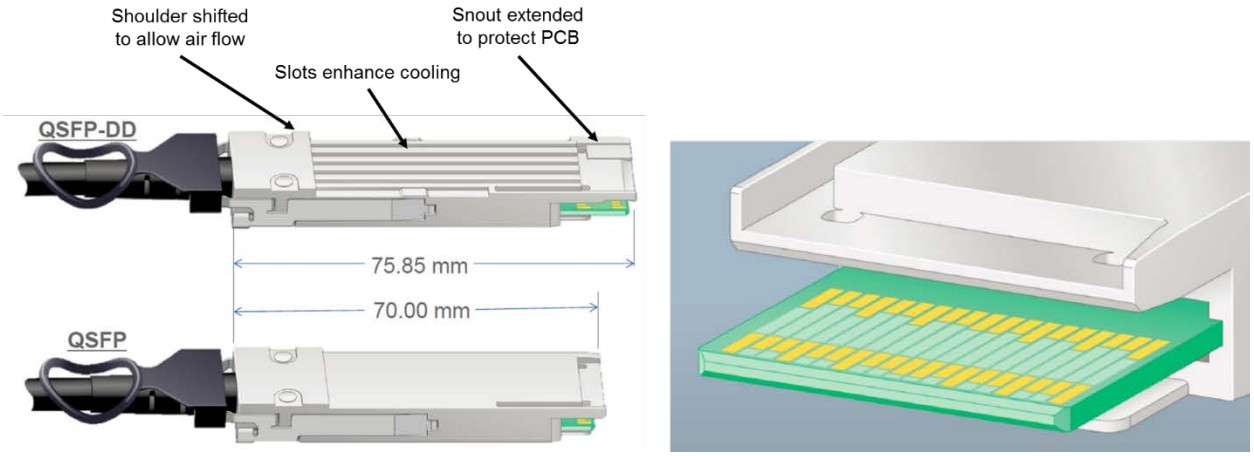


Figure 58 QSFP28-DD and QSFP28 physical interfaces

The MX9116n FSE supports direct attach cables (DAC), active optic cables (AOC), as well as multi-mode fiber (MMF) cables with supported Dell EMC Networking optics.

A.6 VLAN management and automated QoS

In addition to being able to assign VLANs to server profiles, SmartFabric automates QoS settings based on the Network Type specified. Figure 59 shows that when defining a VLAN, one of 11 options are pre-defined. Each of these options represents a queue.

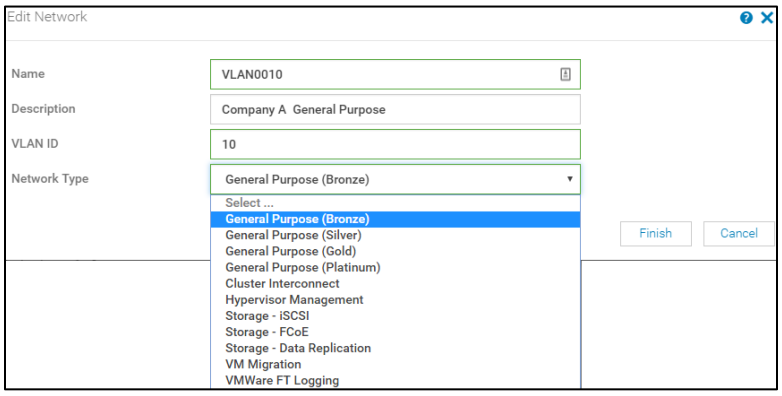


Figure 59 QoS options available in SmartFabric mode

Table 9 lists the network types and related settings. The QoS group is the numerical value for the queues available in SmartFabric mode. Available queues include 2 through 5. Queues 1, 6, and 7 are reserved.

Note: In SmartFabric mode, an administrator cannot change the default weights for the queues.

Table 9 Network types and default QoS settings

Network Type	Description	QoS Group
General Purpose (Bronze)	Used for low priority data traffic	2
General Purpose (Silver)	Used for standard/default priority data traffic	3
General Purpose (Gold)	Used for high priority data traffic	4
General Purpose (Platinum)	Used for extremely high priority data traffic	5
Cluster Interconnect	Used for cluster heartbeat VLANs	5
Hypervisor Management	Used for hypervisor management connections such as the ESXi management VLAN	5
Storage - iSCSI	Used for iSCSI VLANs	5
Storage - FCoE	Used for FCoE VLANs	5
Storage - Data Replication	Used for VLANs supporting storage data replication such as for VMware VSAN	5
VM Migration	Used for VLANs supporting vMotion and similar technologies	5
VMware FT Logging	Used for VLANs supporting VMware Fault Tolerance	5

When a VLAN-capable server template deploys, SmartFabric creates a class map. For example, class map `CM10`, matching all traffic associated with VLAN 10. Then a policy map, for example, `PM_VLAN`, sets this class map to the appropriate queue, as in `qos-group 2`.

A.7 Identity Pools

Identity Pools, or virtual identities, abstract the network identity for Ethernet, FCoE, iSCSI, or FC access. Virtual identities allow the assignment of a static MAC address or WWPN to a slot. This allows the replacement of a network device, like a mezzanine card, without causing any interruption to other applications relying on that hardware address.

Identity Pools are used in conjunction with server templates to automate network onboarding of compute sleds. To create an Ethernet ID pool, follow these steps:

1. Open the OME-M console.
2. From the navigation menu, click **Configuration** > **Identity Pools**.
3. Click **Create**.
4. In the **Create Identity Pool** window, complete the following:
    a. Enter Ethernet ID pool in the Pool Name box.
    b. Optionally, enter a description in the **Description** box.
    c. Click **Next**.
    d. Select the Include ethernet virtual MAC Addresses option.
    e. Enter the first address in the **Starting MAC Address** box.
    f. Enter 320 in the Number of Virtual MAC Identities box.
    g. Click **Finish**.

Note: The **starting MAC address** must be a locally administered unicast address.

B Validated components

B.1 Scenarios 1 and 2

The following tables include the hardware, software, and firmware used to configure and validate Scenario 1 and Scenario 2 in this document.

B.1.1 Dell EMC Networking switches

Table 10 Dell EMC Networking switches and OS versions – Scenarios 1 and 2

Qty	Item	Version
2	Dell EMC Networking Z9100-ON leaf switches	10.4.0E(R3)
1	Dell EMC Networking S3048-ON OOB management switch	10.4.0E(R3P2)

B.1.2 Dell EMC PowerEdge MX7000 chassis and components

Table 11 Dell EMC PowerEdge MX7000 chassis and components – Scenarios 1 and 2

Qty	Item	Version
2	Dell EMC PowerEdge MX7000 chassis	-
4	Dell EMC PowerEdge MX740c sled (2 per chassis)	-
4	Dell EMC PowerEdge M9002m modules (2 per chassis)	1.00
2	Dell EMC Networking MX9116n FSE (1 per chassis)	10.4.0E(R3)
2	Dell EMC Networking MX7116n FEM (1 per chassis)	-

Table 12 MX740c sled details – Scenarios 1 and 2

Qty per sled	Item	Firmware Version
1	Intel(R) Xeon(R) Silver 4114 CPU @ 2.20GHz	-
12	16GB DDR4 DIMMs (192GB total)	-
1	Boot Optimized Storage Solution (BOSS) Controller w/ 2x240GB SATA SSDs	2.6.13.2008
1	PERC H730P MX	25.5.3.0005
3	600GB SAS HDD	-
1	Intel(R) Ethernet 25G 2P XXV710 mezzanine card	18.5.17
-	BIOS	1.0.1
-	iDRAC with Lifecycle Controller	3.20.20.20

B.1.3 Cisco Nexus switches

Table 13 Nexus switches and OS versions – Scenarios 1 and 2

Qty	Item	Version
2	Cisco Nexus 3232C	7.0(3)I4(1)

B.2 Scenario 3

The following tables include the hardware, software, and firmware used to configure and validate Scenario 3 in this document.

B.2.1 Dell EMC Networking switches

Table 14 Dell EMC Networking Switches and OS versions – Scenario 3

Qty	Item	OS Version
1	Dell EMC Networking S3048-ON OOB management switch	10.4.1.2

B.2.2 Dell EMC PowerEdge MX7000 chassis and components

Table 15 Dell EMC PowerEdge MX7000 chassis and components – Scenario 3

Qty	Item	Version
2	Dell EMC PowerEdge MX7000 chassis	-
3	Dell EMC PowerEdge MX740c sled	-
1	Dell EMC PowerEdge MX840c sled	-
4	Dell EMC PowerEdge M9002m modules (2 per chassis)	1.00.01
2	Dell EMC Networking MX9116n FSE (1 per chassis)	10.4.0E(R3S)
2	Dell EMC Networking MX7116n FEM (1 per chassis)	-

Table 16 MX740c sled details – Scenario 3

Qty per sled	Item	Version
2	Intel(R) Xeon(R) Silver 4114 CPU @ 2.20GHz	-
12	16GB DDR4 DIMMs (192GB total)	-
1	Boot Optimized Storage Solution (BOSS) S1 Controller w/ 1x120GB SATA SSD	2.6.13.3011
1	PERC H730P MX	25.5.5.0005
2	600GB SAS HDD	-
1	Intel(R) Ethernet 2x25GbE XXV710 mezzanine card or QLogic 2x25GbE QL41232HMKR mezzanine card	18.5.17 (Intel) or 14.07.07 (QLogic)
-	BIOS	1.0.2
-	iDRAC with Lifecycle Controller	3.20.20.20
	VMware ESXi (Dell EMC Customized)	6.7.0 build 9484548 (A05)

Table 17 MX840c sled details – Scenario 3

Qty/sled	Item	Version
2	Intel(R) Xeon(R) Gold 5118 CPU @ 2.30GHz	-
2	32GB DDR4 DIMM	-
1	Boot Optimized Storage Solution (BOSS) S1 Controller w/ 1x120GB SATA SSD	2.6.13.3011
1	PERC H730P MX	25.5.5.0005
2	600GB SAS HDD	-
1	QLogic 2x25GbE QL41232HMKR mezzanine card	14.07.07
-	BIOS	1.0.2
-	iDRAC with Lifecycle Controller	3.20.20.20
	VMware ESXi (Dell EMC Customized)	6.7.0 build 9484548 (A05)

B.2.3 Cisco ACI components

Table 18 Cisco ACI components and OS versions – Scenario 3

Qty	Item	Version
1	Cisco APIC	3.2(3i)
1	Cisco Nexus C9336-PQ spine switch	n9000-13.2(3i)
2	Cisco Nexus C93180YC-EX leaf switches	n9000-13.2(3i)

C Technical resources

Dell EMC Networking Guides

Dell EMC PowerEdge MX IO Guide

Dell EMC PowerEdge MX Network Architecture Guide

Dell EMC PowerEdge MX SmartFabric Deployment Video

Dell EMC OpenManage Enterprise-Modular Edition User's Guide v1.00.01

OS10 Enterprise Edition User Guide for PowerEdge MX IO Modules Release 10.4.0E R3S

Manuals and documents for Dell EMC PowerEdge MX7000

Manuals and documents for Dell EMC Networking MX9116n

Manuals and documents for Dell EMC Networking S3048-ON

Manuals and documents for Dell EMC Networking Z9100-ON

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