

# Dell EMC Networking OS10 Enterprise Edition Deployment Guide with Cisco ACI

## Abstract

This document provides steps for the configuration and deployment of Dell EMC Networking switches running Dell EMC OS10 Enterprise Edition, into a Cisco ACI environment.

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## Revisions

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# 1 Introduction

Dell EMC Networking is committed to providing customers with modern data center networking technology to be the foundation for digital transformation. Customers can choose from a wide range of industry-standard network applications, operating systems, and hardware platforms to realize cost savings and improvement in service agility.

This document provides an example for the deployment of a pair of top-of-rack (ToR) Dell EMC Networking switches into an existing Cisco Application Centric Infrastructure (ACI) environment. The example details how Layer 2 domains can be extended into and out of an ACI fabric with Dell EMC Networking switches in a way that provides high throughput and failure tolerance. The example shows how devices that are connected to Dell EMC Networking switches can be integrated with the ACI fabric to communicate with and access ACI resources.



Figure 1 Dell EMC Networking S5248F-ON switch

The deployment example includes instructions to configure a pair of Dell EMC S5248F-ON switches. The example demonstrates connectivity to a pair of Cisco Nexus C93180YC-EX switches in ACI mode.

Table 1 outlines what this document is and is not.

Table 1 Dell EMC Networking OS10EE Deployment Guide with Cisco ACI

This guide is	This guide is not/does not
A reference for basic configuration of a top-of-rack (ToR) pair of switches using OS10EE	A guide for all features of OS10EE-based switches
An example of one way to add ToR switches to an existing Cisco ACI environment	A guide for adding Cisco ACI to a complete leaf-spine deployment

## 1.1 Typographical conventions

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

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

## 1.2 Attachments

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

## 2 Hardware overview

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

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**Note:** While the steps in this document were validated using the specified Dell EMC Networking switches and operating systems, they may be used for other Dell EMC Networking switch models using the same networking operating system version or later assuming the switch has the available port numbers, speeds, and types. The two switch models in this section are detailed based on being the most commonly deployed ToR switches in the current portfolio.

---

### 2.1 Dell EMC Networking S5248F-ON

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

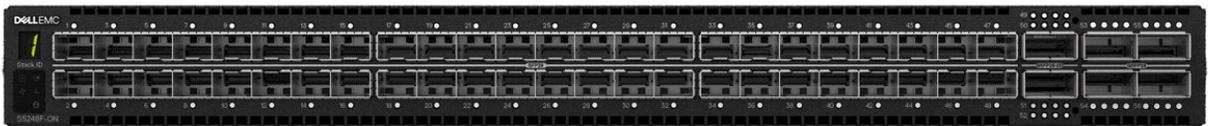


Figure 2 Dell EMC Networking S5248F-ON switch

### 2.2 Dell EMC Networking S4148F-ON

The Dell EMC Networking S4148F-ON is a 1-RU switch with forty-eight 10GbE SFP+ ports, two 40GbE QSFP+ ports, and four 100GbE QSFP28 ports. The high-performance S4148F-ON switch is an optimal choice for ToR environments requiring connectivity for 10GbE compute and storage.



Figure 3 Dell EMC Networking S4148F-ON switch

### 2.3 Dell EMC Networking S3048-ON

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



Figure 4 Dell EMC Networking S3048-ON

## 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 are used as Cisco ACI leaf switches in the demonstrated environment in this guide.

## 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 the demonstrated environment in this guide.

## 2.6 Supported Dell EMC switches

The switch models highlighted in blue in Table 2, have been validated in the lab environment that is detailed in section 0. All Dell EMC Networking switches that run the OS10EE operating system can be used in a similar deployment with Cisco ACI. Tested and supported features in the Cisco ACI environment include VLT and Layer 2 operation.

Table 2 Supported Dell EMC Networking switches

Dell EMC Networking Switch	OS10EE, version 10.4.0R3 and later
S5248F-ON	Supported, validated version 10.4.2
S4148F-ON	Supported
S5048F-ON	Supported
S5148F-ON	Supported
S5296F-ON	Supported
S5232F-ON	Supported
S6010-ON	Supported
S6100-ON	Supported
S4048-ON	Supported
S4048T-ON	Supported
S4112F-ON	Supported, validated version 10.4.2
S4112T-ON	Supported
S4128F-ON	Supported
S4128T-ON	Supported
S4148T-ON	Supported
S4148FE	Supported
S4148U	Supported, validated version 10.4.2
S4248FB-ON	Supported
S4248FBL-ON	Supported

---

**Note:** Dell EMC provides this supported list as is, without express or implied warranties of any kind. This list is for informational purposes only and may contain typographical and technical inaccuracies. Dell EMC is not liable for any damages that arise out of or in connection with the use of the information provided in this list. Table 2 includes only switches that are commonly deployed as ToR switches. All switch models that run OS10EE deployed in a VLT topology in Layer 2 operation can be considered. Some switches contain features, such as Fibre Channel, that have not been validated to work with Cisco API and is out of the scope of this document.

---

### 3 Cisco Application Centric Infrastructure (ACI)

Cisco ACI is an application focused, software-defined networking solution utilizing both software and traditional switching hardware. The solution is an overlay on Cisco's high-performance switches, operating in an ACI mode managed by a controller. The Cisco Application Policy Infrastructure Controller (APIC) is a central management appliance that handles policy, visibility, security, and overall network control for the ACI environment.

Cisco ACI provides the following features within the ACI domain:

- Multi-tenant security
- Microsegmentation
- Application specific policy management
- Network availability and QoS
- Network automation

## 4 Dell EMC ToR switches with Cisco ACI environment overview

The example that is shown in this paper covers deploying S5248F-ON switches connected to a Cisco ACI environment. By integrating the ToR switch pair into an ACI environment, compute resources within the rack can use ACI gateways and access ACI resources.

The validated Cisco ACI environment includes a pair of Nexus C93180YC-EX switches as leaf switches as shown in Figure 5. The C93180YC-EX leaf switch pair are connected to a single Nexus C9336-PQ spine using 40GbE uplinks (not shown).

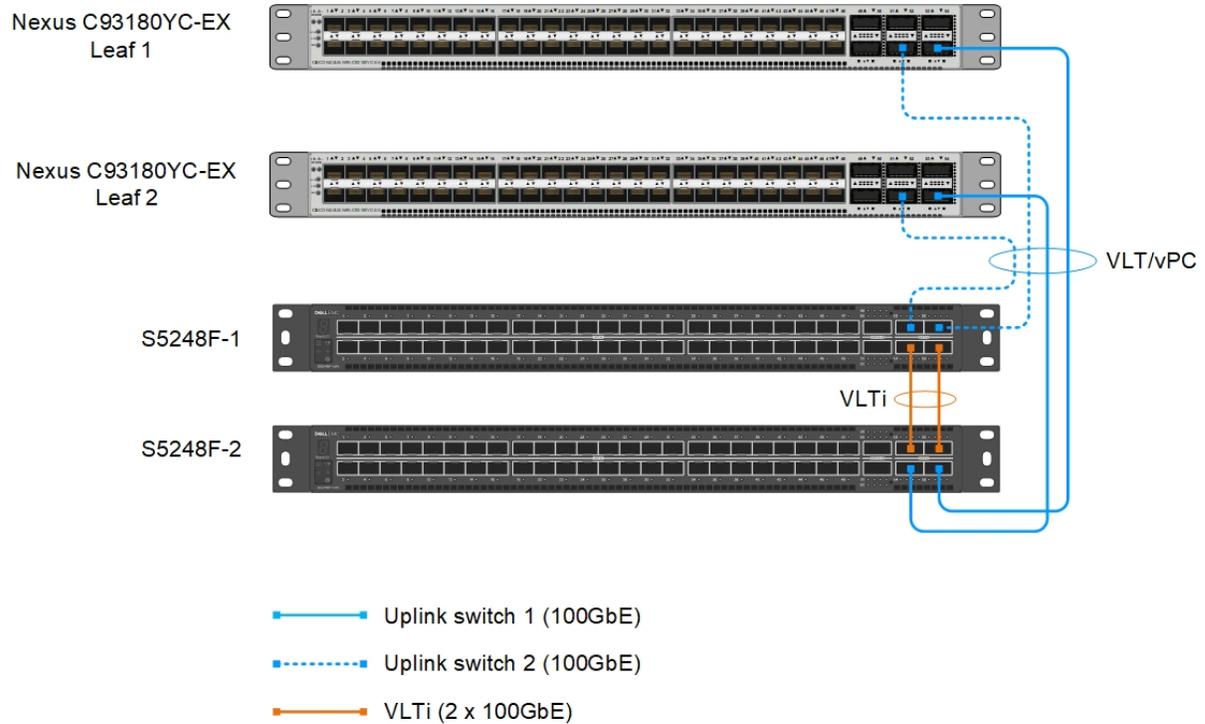


Figure 5 Dell EMC Networking switches connected to Cisco ACI leaf switches

Connections from S5248F-ON switches to the C93180YC-EX leaf pair are 100 GbE. These connections are shown in blue in Figure 5.

**Note:** The wiring diagram in Figure 5 is drawn to show the types of connections in a carefully arranged fashion for clarity. The port numbers and connection locations may differ in the actual deployment. No physical peer link is used between the Cisco ACI leaf switches. See the Cisco ACI documentation for more information.

## 4.1 Validated environment

In this example, two S5248F-ON switches are joined to an existing Cisco ACI environment. The rack contains two S5248F-ON and four PowerEdge R730xd servers.

The connections between the ACI environment and the S5248F-ON switches consist of double-sided multi-chassis link aggregation group (MLAG). The double-sided MLAG connection consists of a vPC on the Cisco ACI side and a VLT port channel on the S5248F-ON side.

All of the devices in the validated environment that are covered in this chapter, are connected as shown in Figure 6.

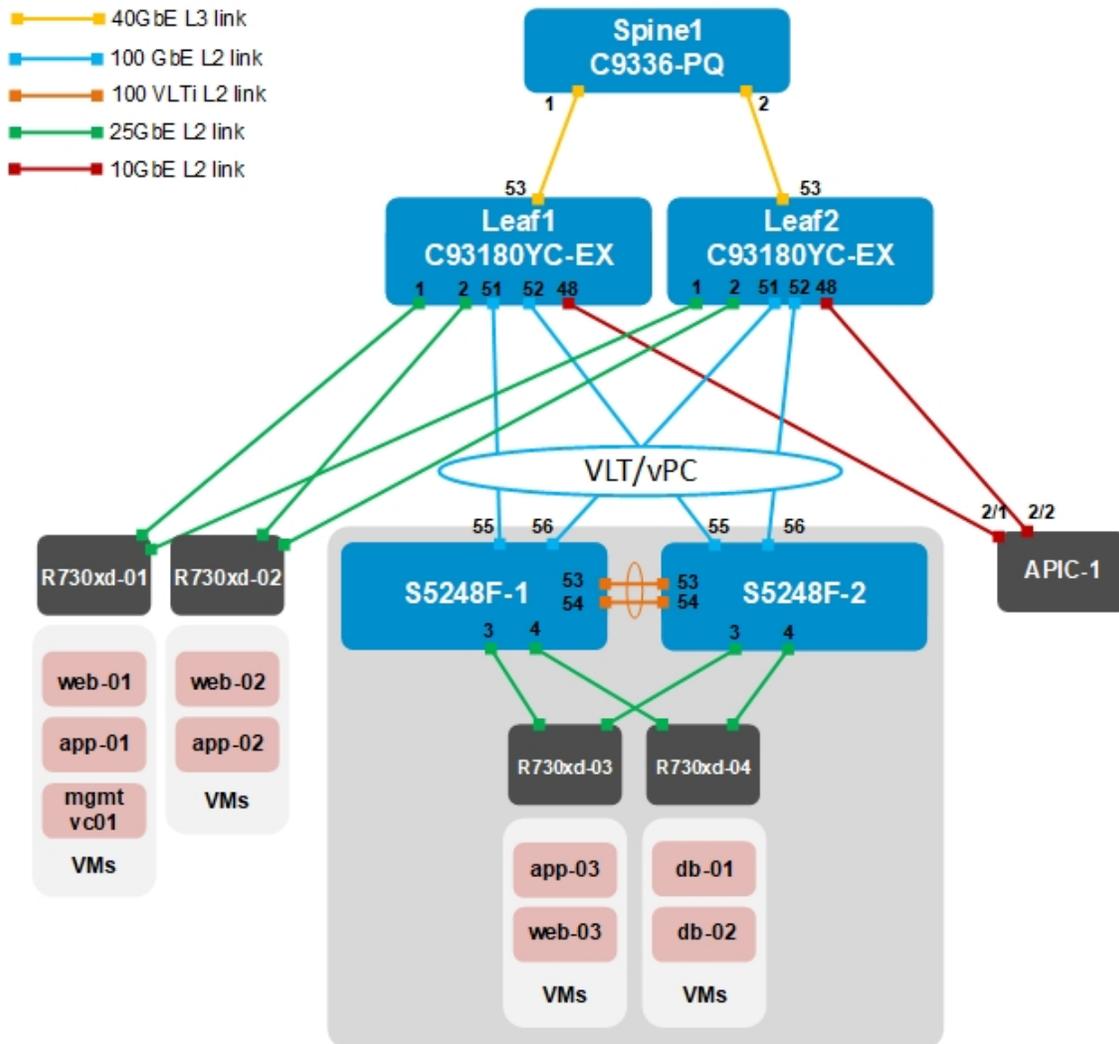


Figure 6 Validated Dell EMC ToR and ACI environment

**Note:** No physical 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 Dell EMC PowerEdge R730xd rack servers 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.

The existing Cisco ACI environment has two PowerEdge R730xd rack servers that are directly connected to the ACI leaf switches. These rack servers are in a VMware vSphere cluster, with a vCenter VM named mgmtvc01 on R730xd-01 as shown in Figure 6.

Integrating the S5248F-ON switches into the Cisco ACI environment enables the four PowerEdge R730xd servers in the rack to join the existing VMware vSphere cluster. This enables all hosts and VMs to communicate using the relevant networks.

The in-band test environment uses the five networks that are shown in Table 3.

Table 3 In-band networks used

VLAN ID	VLAN name	Description	Network address	Gateway address
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 vSphere 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 4.

Table 4 VM IP addresses

VM name	VLAN name	IP address
mgmtvc01	ESXi_Mgmt	100.67.163.171
web01-web03	web	172.16.14.1-3
app01-app03	app	172.16.15.1-3
db01-db02	db	172.16.16.1-2

## 5 OOB Management network

Network topological designs are not complete without a layer for management traffic. The OOB management network is a separate network for management traffic only. Administrators use the OOB management network to configure, manage, and monitor devices such as servers and switches. Payload traffic that is initiated by network end users does not traverse the OOB management network. Switches used for management are 1GbE. Figure 7 demonstrates how the Dell EMC Networking S3048-ON switch may be used for this purpose.

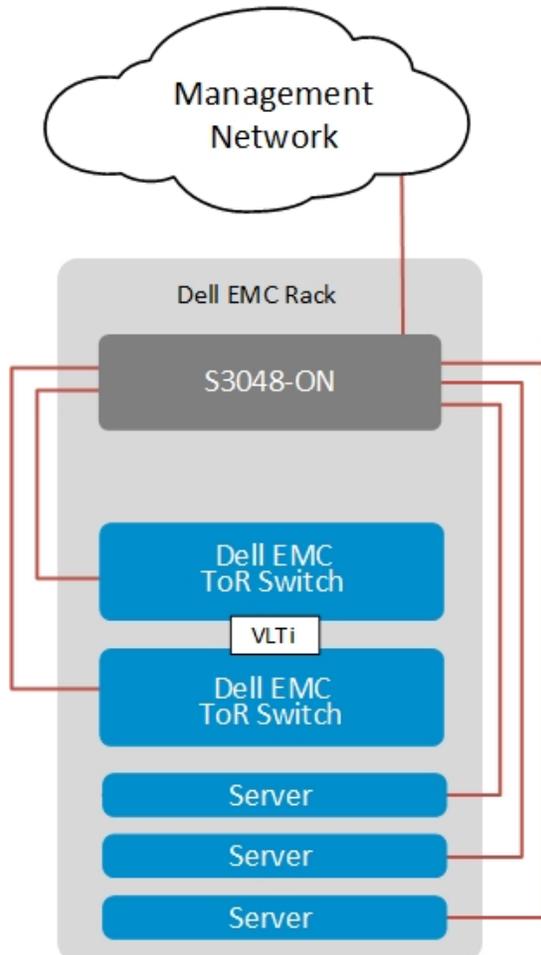


Figure 7 Management network example for a single rack

Figure 7 shows an OOB management network for a single rack. More racks can be added to the same management network. A Dell EMC Networking S3048-ON may be used to manage up to 48 devices on the network, typically enough for a single rack of equipment. The switch may then be connected to other adjacent management switches, or upstream to a management core.

Figure 8 shows how the OOB management network was configured for the demonstrated environment, alongside the connections used for in-band production traffic. There are two OOB management connections for each server: one that is used for ESXi management and one that is used for providing connectivity to the server iDRAC. The production in-band uplinks to the ACI environment are not shown.

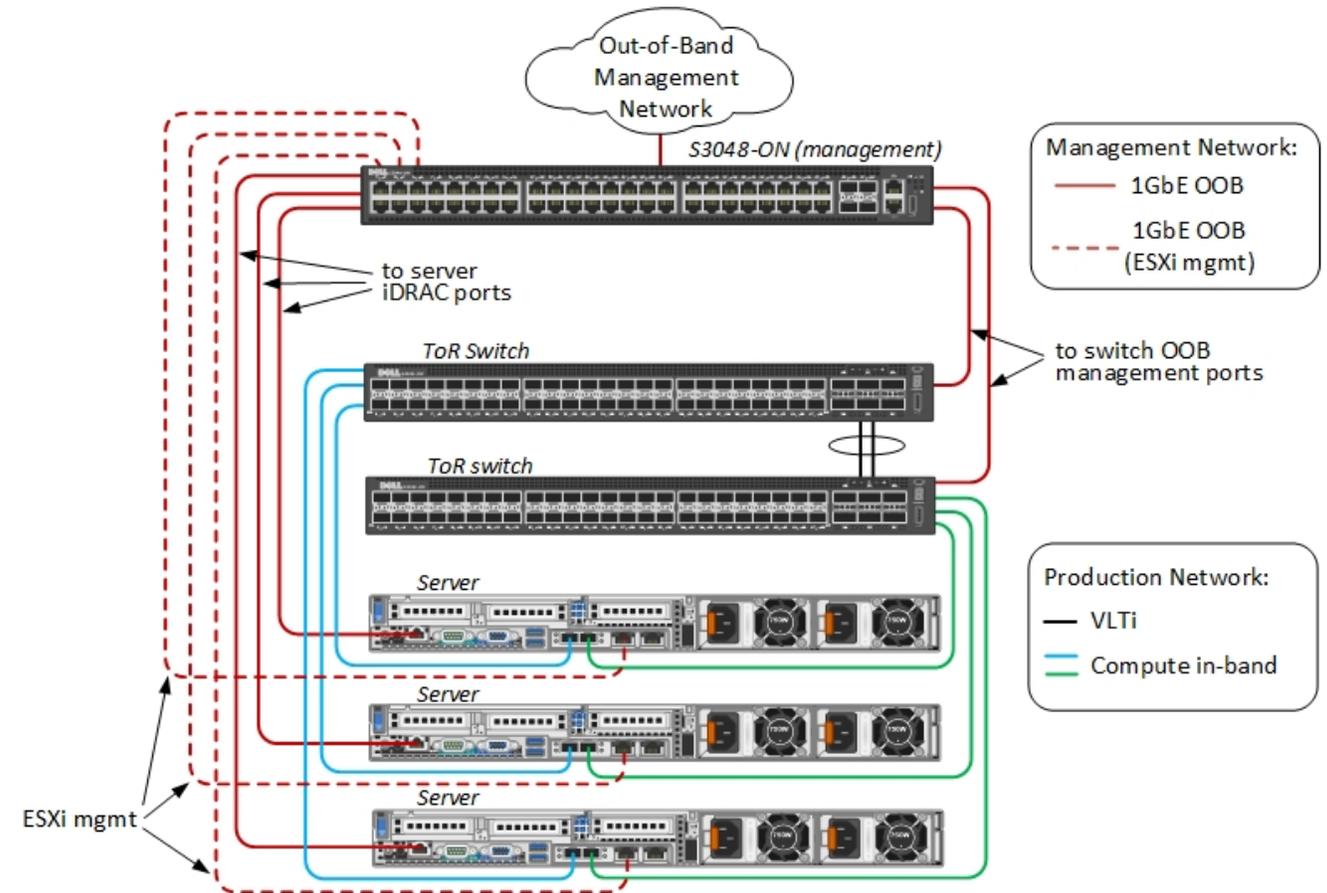


Figure 8 OOB management network cabling alongside in-band production network

## 6 Cisco APIC configuration

The Cisco APIC configuration includes the ports that are connected to the R730xd rack servers and the vPC that connects to the S5248F-ON VLT port channel. Included are the configuration of the ACI fabric interfaces, switches, and application-level elements such as ACI endpoint groups (EPGs) and bridge domains.

The networks that are used in the validated environment are shown in Table 5, along with the corresponding bridge domain, and application EPG names used in APIC configuration.

Table 5 Validated environment network information

VLAN ID	VLAN name	Gateway IP address/mask	Bridge domain name	Application EPG name
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.

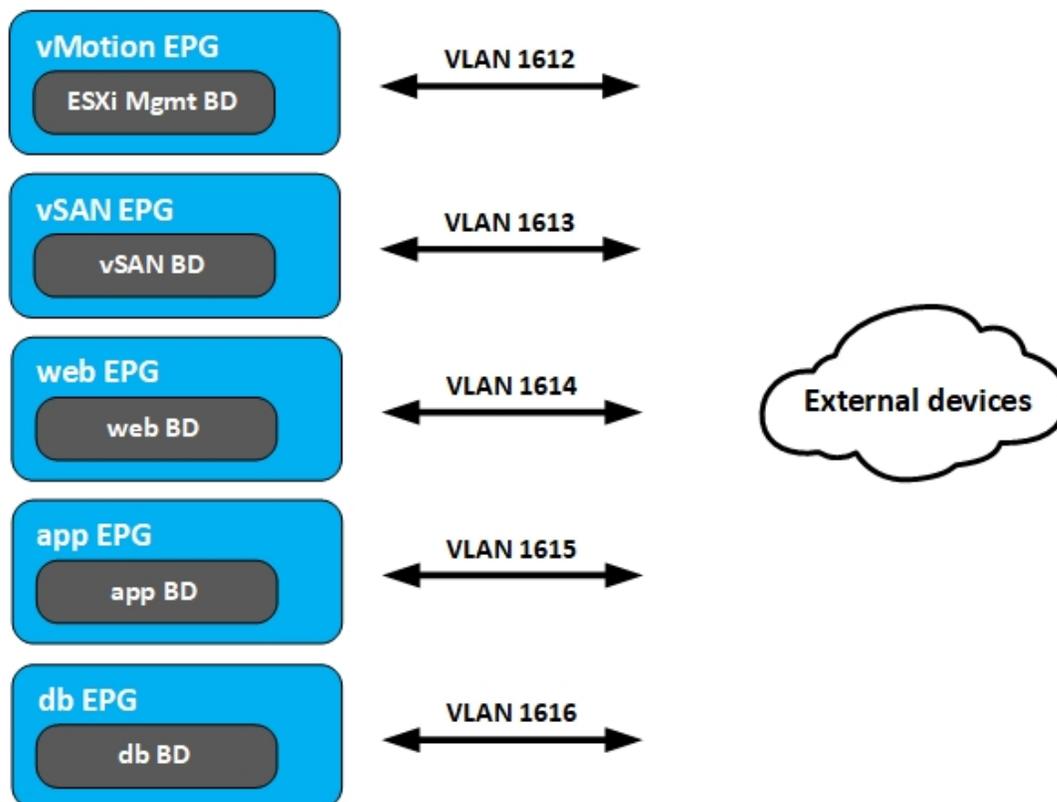


Figure 9 Bridge domains are associated with EPGs, which are mapped to external VLANs.

APIC configuration steps that are used in the validated environment are provided in the attachment titled **OS10EE Deployment Guide - Cisco APIC configuration steps**. See the Cisco ACI documentation for detailed APIC configuration instructions.

---

**Note:** In this environment, the 100 GbE ports on the ACI leaf switches are used as downlinks to the S5248F-ON switches. By default, the 100 GbE switch ports are designated for fabric connections, such as connections to ACI spine switches. To use these 100 GbE switch ports for connecting to devices outside of the ACI fabric, they must be configured as downlinks. Refer to Cisco documentation for more information.

---

## 7 Configure S5248F-ON switches

The following section outlines the configuration commands that are issued to the Dell EMC Networking S5248F-ON ToR switches.

### 7.1 OOB management configuration

The OOB port for the *Dell EMC Networking S5248F-ON* is `mgmt 1/1/1`. The following commands show how to configure this OOB port when using OS10EE. The switches start at their factory default settings as described in [Appendix A.1](#).

---

**Note:** The S5248F-ON CLI is accessible through the console port or by using SSH. The default username and password are both `admin`.

---

Table 6 OOB management configuration

S5248F-1	S5248F-2
<pre>configure terminal hostname S5248F-1 interface mgmt 1/1/1   no ip address dhcp   no shutdown   ip address 100.67.166.33/24 management route 0.0.0.0/0 100.67.166.254</pre>	<pre>configure terminal hostname S5248F-2 interface mgmt 1/1/1   no ip address dhcp   no shutdown   ip address 100.67.166.32/24 management route 0.0.0.0/0 100.67.166.254</pre>

---

**Note:** The configuration for the S3048-ON management switch is not shown. The configuration and deployment of the overall management network is not within the scope of this document.

---

### 7.2 VLT configuration

In this example, configure VLT between the two Dell EMC S5248F-ON switches. VLT synchronizes Layer 2 and ARP table information between the switches and enables a single port channel to be connected to the switch pair as if they are a single switch.

1. Set up VLT on S5248F-1 using the commands in the first column of Table 7 (recommended port values are shown).
2. Configure S5248F-2 using the commands in column 2 provided in Table 7.

Table 7 VLT configuration

S5248F-1	S5248F-2
<pre>interface range ethernet 1/1/53-1/1/54 description VLTi no shutdown no switchport  vlt-domain 127 backup destination 100.67.166.32 discovery-interface ethernet 1/1/53- 1/1/54</pre>	<pre>interface range ethernet 1/1/53-1/1/54 description VLTi no shutdown no switchport  vlt-domain 127 backup destination 100.67.166.33 discovery-interface ethernet 1/1/53- 1/1/54</pre>

## 7.3 Configure the VLANs

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

Table 8 VLAN settings

VLAN ID	VLAN name	Description	Tagged/Untagged
1612	vMotion	VM migration	Tagged
1613	vSAN	Storage	Tagged
1614	web	VM data network	Tagged
1615	app	VM data network	Tagged
1616	db	VM data network	Tagged

Table 9 VLAN configuration

S5248F-1	S5248F-2
<pre>interface vlan 1612 description vMotion no shutdown  interface vlan 1613 description vSAN no shutdown  interface vlan 1614 description web no shutdown  interface vlan 1615 description app no shutdown  interface vlan 1616 description db no shutdown</pre>	<pre>interface vlan 1612 description vMotion no shutdown  interface vlan 1613 description vSAN no shutdown  interface vlan 1614 description web no shutdown  interface vlan 1615 description app no shutdown  interface vlan 1616 description db no shutdown</pre>

## 7.4 Server-facing configuration

Configure the server-facing interfaces with the following steps.

Table 10 Server-facing configuration

S5248F-1	S5248F-2
<pre>interface ethernet 1/1/3 description "R730xd-03 p1" no shutdown switchport mode trunk switchport access vlan 1 switchport trunk allowed vlan 1612-1616 spanning-tree port type edge  interface ethernet 1/1/4 description "R730xd-04 p1" no shutdown switchport mode trunk switchport access vlan 1 switchport trunk allowed vlan 1612-1616 spanning-tree port type edge</pre>	<pre>interface ethernet 1/1/3 description "R730xd-03 p2" no shutdown switchport mode trunk switchport access vlan 1 switchport trunk allowed vlan 1612-1616 spanning-tree port type edge  interface ethernet 1/1/4 description "R730xd-04 p2" no shutdown switchport mode trunk switchport access vlan 1 switchport trunk allowed vlan 1612-1616 spanning-tree port type edge</pre>

## 7.5 Switch pair uplink configuration

Configure the VLT port channel and interfaces connecting to the ACI leaf switches. Configure and enable uplink failure detection (UFD).

Table 11 Uplink configuration

S5248F-1	S5248F-2
<pre>interface port-channel 100 description "ACI connection" no shutdown switchport mode trunk switchport access vlan 1 switchport trunk allowed vlan 1612-1616 vlt-port-channel 100  interface ethernet 1/1/55 description "ACI connection leaf 1 eth 1/1" no shutdown channel-group 100 mode active no switchport  interface ethernet 1/1/56 description "ACI connection leaf 2 eth 1/1" no shutdown channel-group 100 mode active no switchport  uplink-state-group 1 enable downstream ethernet1/1/3-1/1/4 upstream port-channel 100</pre>	<pre>interface port-channel 100 description "ACI connection" no shutdown switchport mode trunk switchport access vlan 1 switchport trunk allowed vlan 1612-1616 vlt-port-channel 100  interface ethernet 1/1/55 description "ACI connection leaf 1 eth 1/2" no shutdown channel-group 100 mode active no switchport  interface ethernet 1/1/56 description "ACI connection leaf 2 eth 1/2" no shutdown channel-group 100 mode active no switchport  uplink-state-group 1 enable downstream ethernet1/1/3-1/1/4 upstream port-channel 100</pre>

**Note:** UFD is a feature that disables downlink interfaces due to uplink interface failures. Configuration of UFD is a best practice to prevent downstream resources from sending traffic to a switch with failed uplinks.

## 8 vCenter configuration overview

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

After the Dell EMC Networking switches are deployed, servers in the Dell EMC ToR environment can communicate with the vCenter and other servers that are located in the ACI environment. The servers are joined to the vSphere cluster by an administrator as shown in Figure 10.

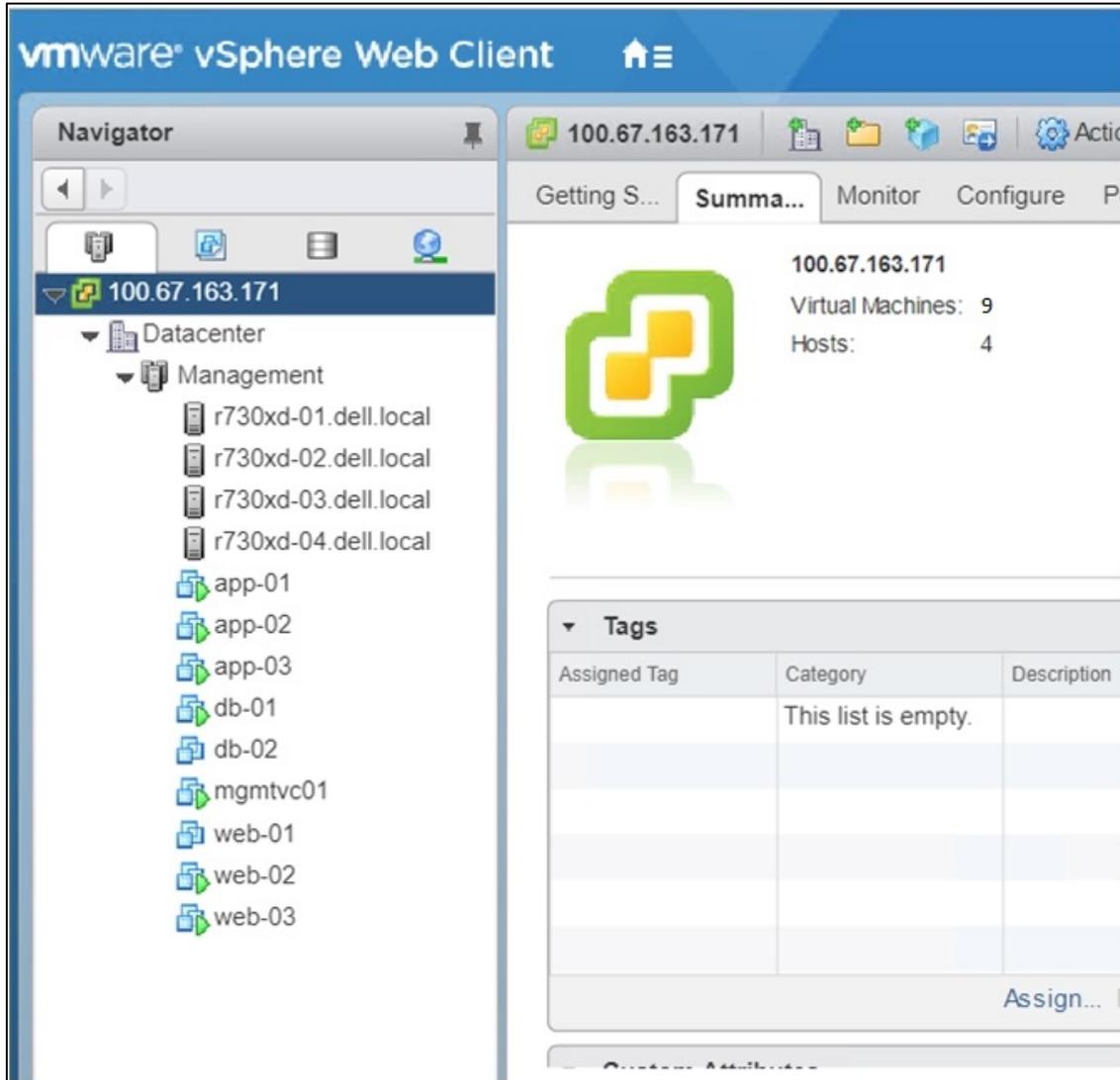


Figure 10 Hosts and VMs used in the validated environment in a single vSphere cluster

**Note:** The VM locations in the topology are shown in Figure 6 at the beginning of this chapter.

A VDS named **VDS-Mgmt**, along with five distributed port groups, one for each VLAN, are used as shown in Figure 11.

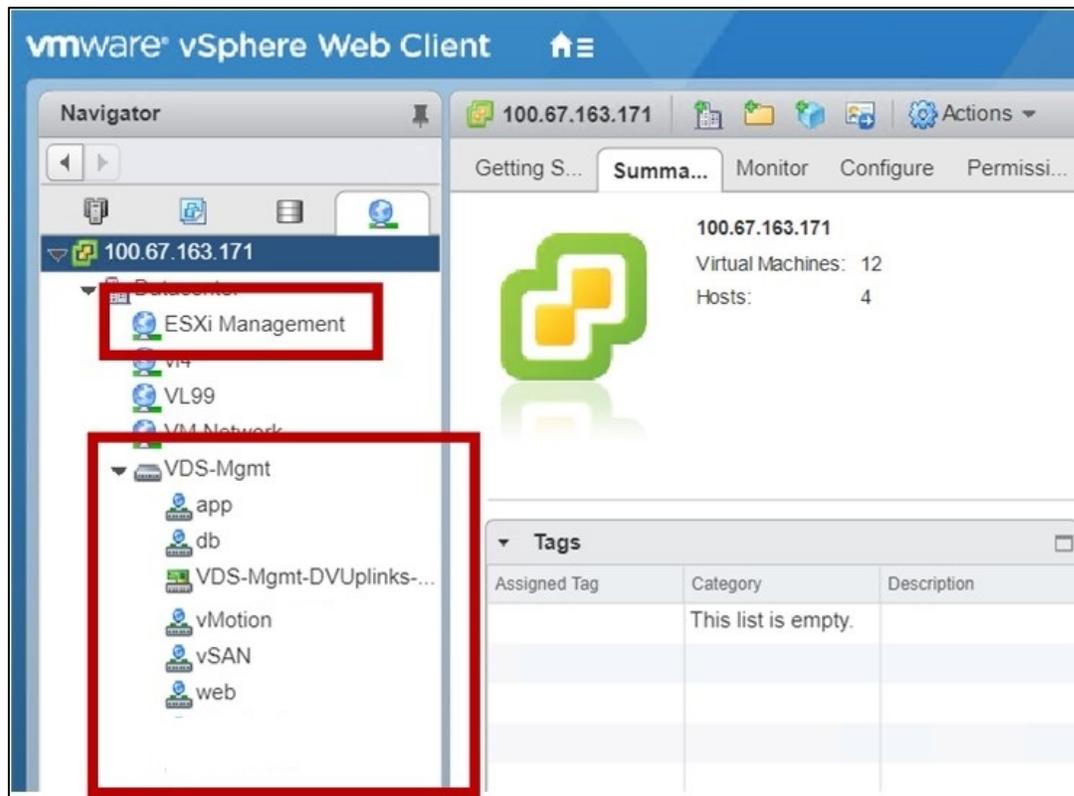


Figure 11 VDS and port groups that are used in the validated environment

---

**Note:** For each port group in the VDS in this example, both uplinks are active and the load balancing method that is used is **Route based on physical NIC load** as recommended in [VMware Validated Design Documentation](#).

A standard vSwitch (ESXi Management) is used for the default Management Network port group in this test environment and can be migrated to a distributed switch if preferred. Instructions on how to perform these operations are beyond the scope of this document.

---

**Note:** Cisco ACI supports VMware vCenter VDS integration where the APIC learns ESXi host locations using LLDP allowing automated configuration of host-connected switch ports. 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 Verify configuration

This section covers methods to verify the Dell EMC ToR and ACI environment is configured properly.

### 9.1 Validation using OS10EE CLI

The CLI commands that are shown in this section are available to help validate the configuration. The commands and output that are shown below are from an S5248F-ON switch. The CLI output from the second S5248F-ON, not shown, is similar.

---

**Note:** The S5248F-ON CLI is accessible using SSH. The default username and password are both `admin`.

---

#### 9.1.1 `show vlt [domain-id]` command

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 VLTi link Status and VLT Peer Status must both be up.

```
S5248F-1# show vlt 127
Domain ID           : 127
Unit ID            : 1
Role                : secondary
Version            : 2.0
Local System MAC address : 54:bf:64:be:f5:40
Role priority       : 32768
VLT MAC address     : 54:bf:64:ba:33:c0
IP address          : fda5:74c8:b79e:1::1
Delay-Restore timer : 90 seconds
Peer-Routing        : Enabled
Peer-Routing-Timeout timer : 0 seconds
VLTi Link Status
  port-channel1000 : up

VLT Peer Unit ID   System MAC Address   Status   IP Address
Version
-----
  2                 54:bf:64:ba:33:c0   up       fda5:74c8:b79e:1::2   2.0
```

## 9.1.2 show vlt [domain-id] vlt-port-detail command

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 100, and it consists of two ports on each switch.

```
S5248F-1# show vlt 127 vlt-port-detail
```

```
vlt-port-channel ID : 100
```

VLT Unit ID	Port-Channel	Status	Configured ports	Active ports
* 1	port-channel100	up	2	2
2	port-channel100	up	2	2

## 9.1.3 show interface port channel summary command

The `show interface port-channel summary` command shows the LAG number (VLT port channel 100 in this example), the mode, status, and ports used in the port channel.

```
S5248F-1# show interface port-channel summary
```

LAG	Mode	Status	Uptime	Ports
100	L2-HYBRID	up	03:47:13	Eth 1/1/55 (Up) Eth 1/1/56 (Up)

## 9.1.4 show lldp neighbors command

The `show lldp neighbors` command provides information about connected devices. In this case, ethernet1/1/55 and ethernet1/1/56 connect to the two Cisco ACI leaf switches. Ports ethernet1/1/3 and ethernet1/1/4 connect to servers within the Dell EMC rack. The remaining links, ethernet1/1/53 and ethernet 1/1/54, are the ports that are used for the VLTi.

```
S5248F-1# show lldp neighbors
```

Loc PortID	Rem Host Name	Rem Port Id	Rem Chassis Id
ethernet1/1/3	Not Advertised	24:8a:07:28:07:fa	24:8a:07:28:07:fc
ethernet1/1/4	Not Advertised	24:8a:07:3b:ec:e4	24:8a:07:3b:ec:e6
ethernet1/1/53	S5248F-2	ethernet1/1/54	54:bf:64:ba:33:c0
ethernet1/1/54	S5248F-2	ethernet1/1/53	54:bf:64:ba:33:c0
ethernet1/1/55	Leaf1	Eth1/51	00:be:75:19:40:13
ethernet1/1/56	Leaf2	Eth1/51	4c:77:6d:f1:ee:7d
mgmt1/1/1	OS10	ethernet1/1/5	64:00:6a:c6:f4:a0

## 9.1.5 show spanning-tree brief command

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.

```
S5248F-1# show spanning-tree brief
```

```
Spanning tree enabled protocol rstp with force-version rstp
```

```
Executing IEEE compatible Spanning Tree Protocol
```

```
Root ID Priority 4096, Address 54bf.64be.f540
```

```
Root Bridge hello time 2, max age 20, forward delay 15
```

```
Bridge ID Priority 4096, Address 54bf.64be.f540
```

```
We are the root
```

```
Configured hello time 2, max age 20, forward delay 15
```

```
Flush Interval 200 centi-sec, Flush Invocations 62
```

```
Flush Indication threshold 65535
```

Interface Name	PortID	Prio	Cost	Sts	Cost	Designated Bridge ID
----------------	--------	------	------	-----	------	----------------------

-----						
ethernet1/1/3	128.524	128	800	FWD	0	4096
54bf.64be.f540	128.524					
ethernet1/1/4	128.528	128	800	FWD	0	4096
54bf.64be.f540	128.528					
port-channel100	128.2616	128	50	FWD	0	4096
54bf.64be.f540	128.2616					

```
Interface
```

Name	Role	PortID	Prio	Cost	Sts	Cost
------	------	--------	------	------	-----	------

```
Link-type Edge
```

-----						
ethernet1/1/3	Desg	128.524	128	800	FWD	0
AUTO	Yes					
ethernet1/1/4	Desg	128.528	128	800	FWD	0
AUTO	Yes					
port-channel100	Desg	128.2616	128	50	FWD	0
AUTO	No					

## 9.1.6 show uplink state group command

The `show uplink-state-group` command provides information about the status of the uplink state group. A status of `Enabled,up` shows that Uplink Failure Detection (UFD) is operational.

```
S5248F-1# show uplink-state-group 1
```

```
Uplink State Group: 1, Status: Enabled,up
```

## 9.2 Cisco ACI validation

### 9.2.1 Verify vPC configuration

Verify the vPC connection from the Cisco ACI fabric to the S5248F-ON VLT, shown in Figure 6, is up and properly configured to enable 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 navigate to the applicable port channel/vPC policy group as shown in Figure 12.

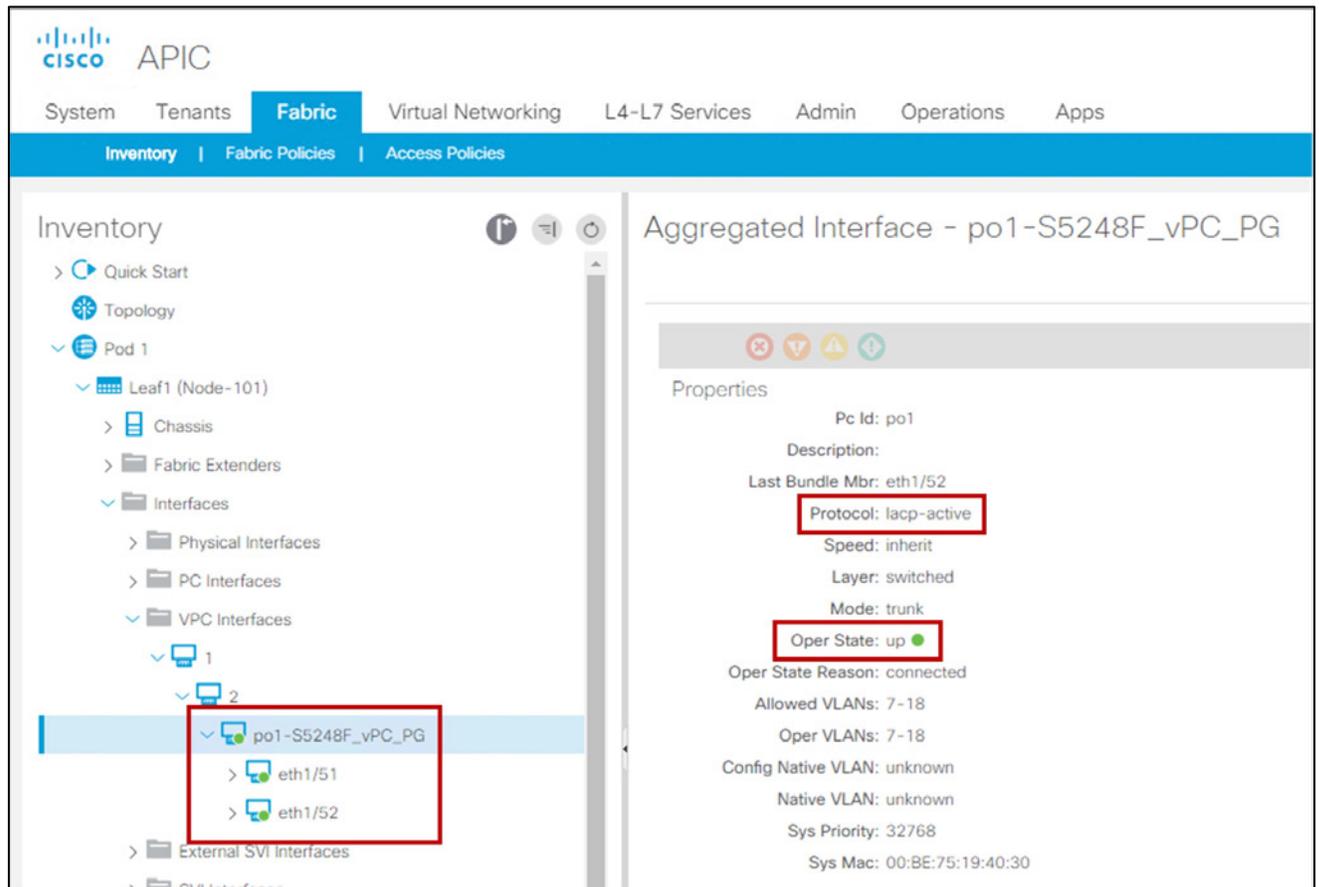


Figure 12 Cisco ACI vPC port channel and interfaces

2. Verify that 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.

- 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 13.

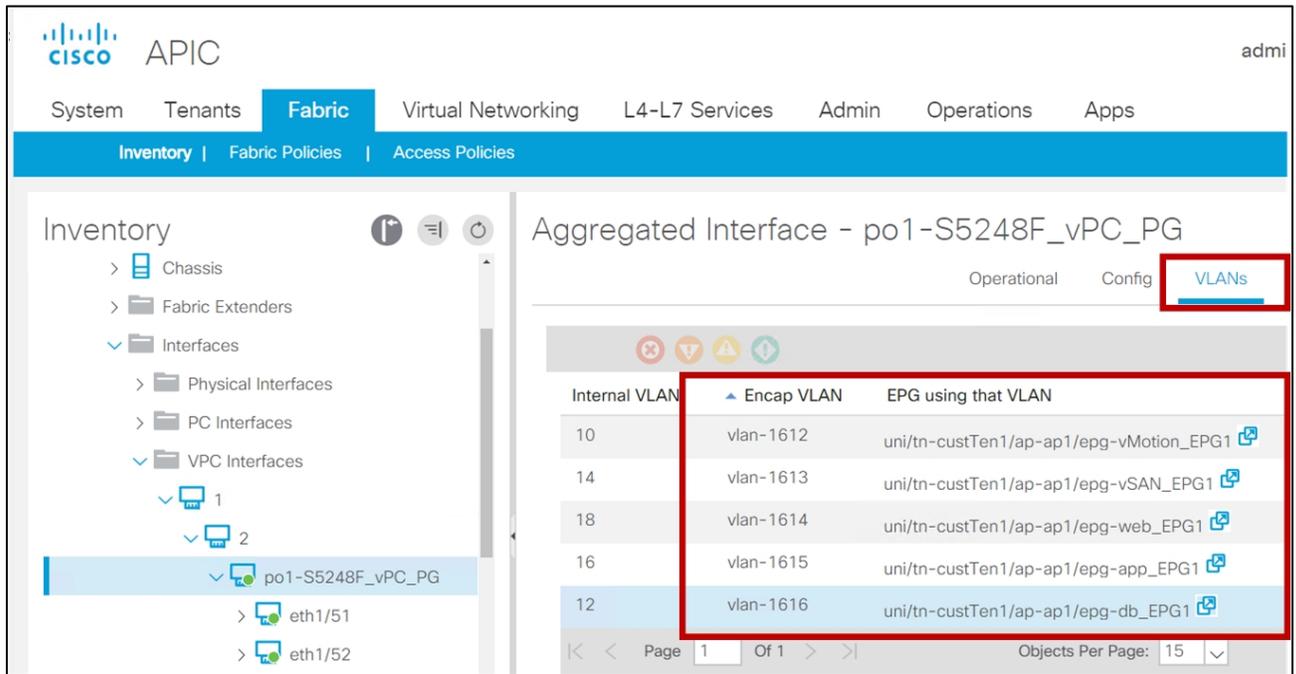


Figure 13 Cisco ACI vPC port channel VLANs and EPGs

- Verify that 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.

## 9.2.2 Verify physical interface configuration

The physical, host-connected, interfaces in the validated environment are those connected directly to the PowerEdge R730xd servers as shown in Figure 6.

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

1. In the APIC GUI, go to **Fabric > Inventory > Pod 1 > Leaf name > Interfaces > Physical Interfaces** as shown in Figure 14.

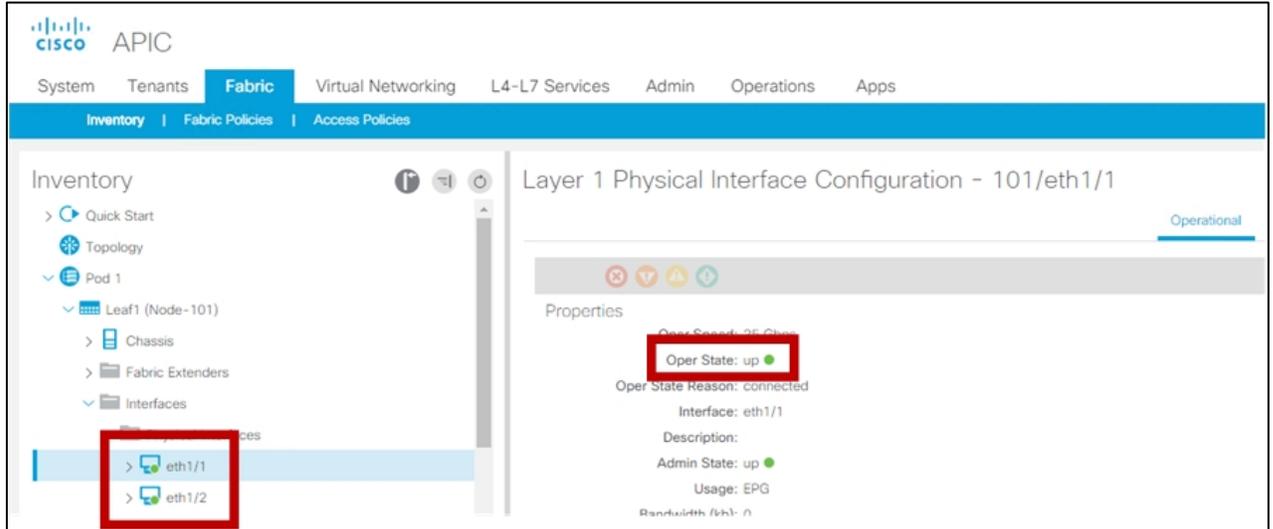


Figure 14 Cisco ACI physical interfaces

2. Verify all required interfaces, for example, eth1/1-2, are up.
3. With an interface selected in the left pane, click **VLANs** at the top of the right pane as shown in Figure 13.

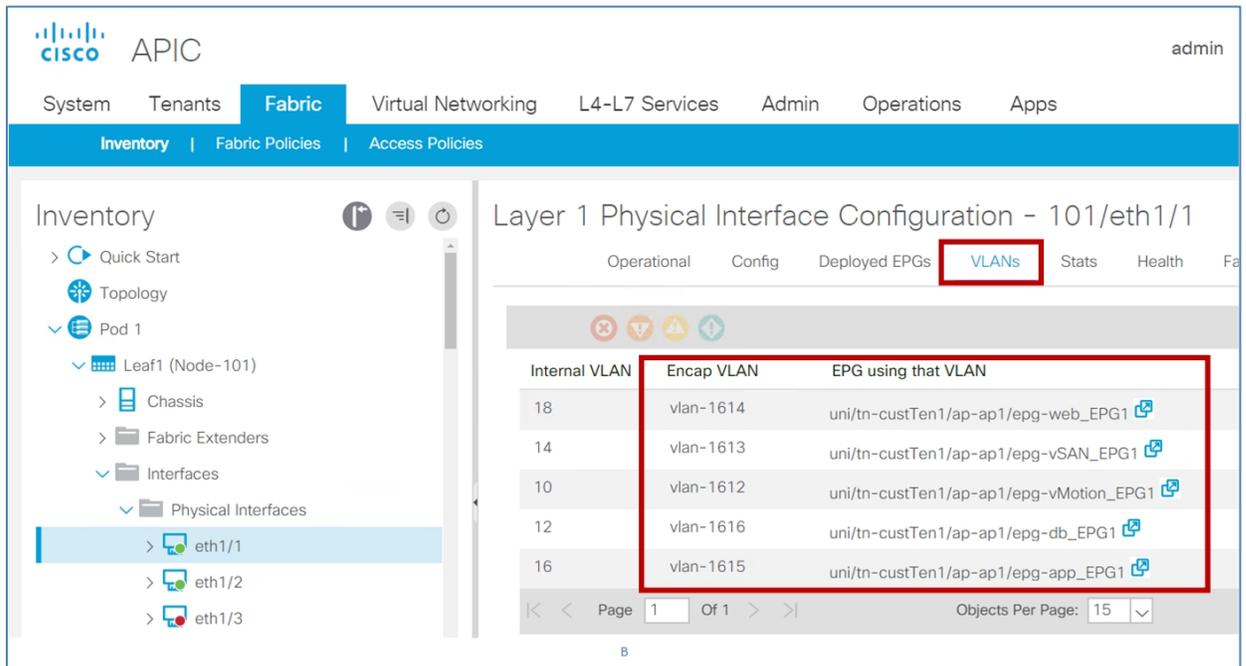


Figure 15 Cisco ACI interface VLANs and EPGs

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.

### 9.2.3 Verify ACI is learning endpoints

To verify that 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 16.

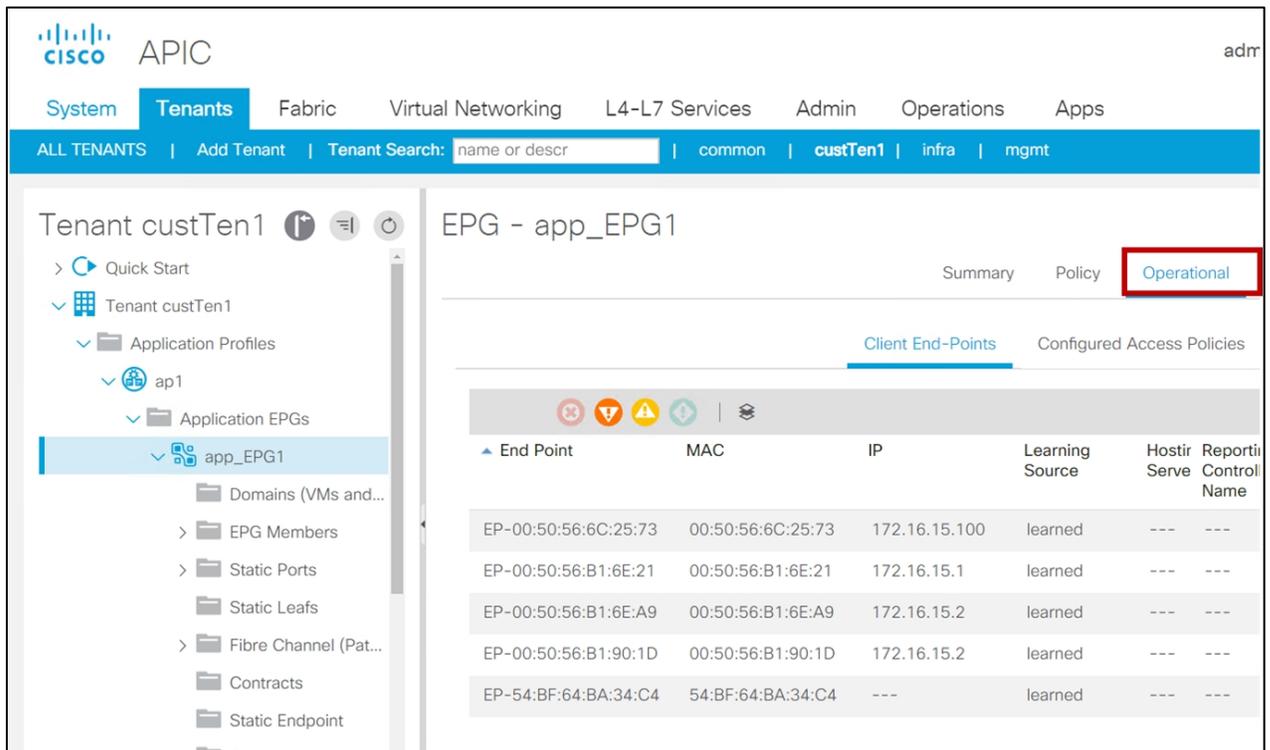


Figure 16 Cisco ACI endpoints in app EPG1

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

Repeat the steps in this section for the remaining Application EPGs.

## 9.3 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 attachment titled **OS10EE Deployment Guide - Cisco APIC configuration steps**.

Connectivity is verified by pinging between the VMs shown in Figure 6. Since inter-EPG communication is allowed using configured contracts, all VMs can ping all other VMs in the topology.

Figure 17 shows that the VM named app-01, located in a rack server, successfully pinging the VMs named web-03 and db-04, which are on the servers.

```
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 17 Verifying connectivity between VMs

## A Additional information

### A.1 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.2 Spanning Tree Protocol recommendations

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

Use caution 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-enabled switch, with the associated VLAN. These BPDUs use a protocol-specific multicast address. Any other RPVST+ tree that is attached to the RSTP tree might process 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. MST configuration is similar.

```
OS10(config)# spanning-tree mode rstp
```

```
OS10(config)# end
```

```
OS10#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)
```

## B Validated components

### B.1 Dell EMC Networking switches

Table 12 Dell EMC Networking switches and operating system versions

Qty	Item	Version
2	Dell EMC Networking S5248F-ON ToR switches	10.4.2
2	Dell EMC Networking S4148U-ON ToR switches	10.4.2
1	Dell EMC Networking S3048-ON OOB management switch	10.4.1.2

---

**Note:** Validation of the S4148U-ON switches was performed by replacing the S5248F-ON switches within the same test environment that is detailed within this document.

---

### B.2 Cisco ACI components

Table 13 Cisco ACI components and operating system versions

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](#)

[Manuals and documents for Dell EMC Networking S3048-ON](#)

[Manuals and documents for Dell EMC Networking S5248F-ON](#)

[Manuals and documents for Dell EMC Networking S4148U-ON](#)

[Manuals and documents for Dell EMC Networking S4112F-ON](#)

## D Support and feedback

### Contacting Technical Support

Support Contact Information

Web: <http://www.dell.com/support>

Telephone: USA: 1-800-945-3355

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