Dell EMC XC Series Networking Deployment and Best Practices Guide v1.1

Using Dell EMC Networking S-Series and Z-Series Switches with XC Series Hyper-Converged Appliances

Dell EMC Networking Infrastructure Solutions
November 2017
Revisions

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Executive summary

Dell EMC XC Series hyper-converged appliances enable both large and small IT organizations to efficiently consolidate and run virtualized workloads on a single system. These hyper-converged appliances push the scale of virtualization to new limits. Robust networks are required that can handle the higher utilization demand of network bandwidth. These networks must be able to continuously deliver high performance and be able to scale equally with the highly scalable hyper-converged systems as demand dictates.

This document provides best practices and details on how to deploy a network for the Dell EMC XC Series. The goals of this document are to:

- Assist administrators in selecting the best hardware and topology for their XC Series network
- Deliver step-by-step instructions on cabling, configuring, and deploying the XC Series network
- Provide best practices that ensure networking availability and scale
- Provide examples of automating network configurations using Ansible playbooks
- Show cabling diagram examples for various networking topologies

**Note:** XC Series cluster deployments, except for the Dell ECM™ XC430 Xpress, are installed by Dell Services. Contact your Dell Services representative before using this document to configure your network.
1 Introduction

Dell EMC XC Series hyper-converged appliances consolidate compute and storage into a single chassis. XC Series appliances install quickly, integrate easily into any data center, and can be deployed for multiple virtualized workloads including desktop virtualization, database, and private cloud projects. With XC Series appliances, your enterprise can:

- Grow incrementally with pay as you grow, scale-out expansion
- Increase capacity and performance one appliance at a time
- Meet future needs without over-provisioning
- Reduce IT infrastructure costs including maintenance, facilities, power, software licensing, and server hardware
- Be built upon the administrator’s choice of hypervisor: VMware® ESXi, Nutanix AHV, or Microsoft® Hyper-V®

Note: See Appendix G for a glossary of terms, including acronyms, used in this guide.

Figure 1  Dell EMC™ XC Series hyper-converged appliances


Note: XC Series cluster deployments, except for the Dell EMC™ XC430 Xpress, are installed by Dell Services. Contact your Dell Services representative before using this document to configure your network.
1.1 Network topologies for XC Series

It is important to select a network configuration that meets your specific requirements. Figure 2 and Figure 3 show the high-level topologies that may be used. More details, including instructions on implementing each scenario, are included further in this guide.

A dual switch top-of-rack (ToR) topology allows each XC Series appliance to connect to two switches which are configured as Virtual Link Trunking (VLT) peers. VLT allows link aggregation group (LAG) terminations on two separate switches and supports a loop-free topology. The two switches are kept synchronized via an interswitch link called the VLT interconnect, or VLTi. This is the common ToR topology for a single rack environment and prevents a complete network failure in the event that one switch fails. A single-switch ToR topology also works but should only be used in an academic environment or non-production test beds, due to the single point of failure. Downstream connections from the VLT pair to the XC Series appliances are always layer 2. Upstream connections from the VLT pair may be layer 2 or layer 3.

![Diagram of XC Series clusters in a ToR network](image)

Both illustrations in Figure 2 show three XC Series appliances in an XC Series cluster, and six network connections, shown as green lines. There are two network connections between each XC Series appliance and the network. Both topologies use the bandwidth of dual NICs (active-active) to allow for redundancy at the link layer, but only the network represented in the left diagram (using 2 ToR switches) allows for redundancy at the switch layer.

Multiple racks, or clusters, can be connected with a leaf-spine topology as shown in Figure 3. Due to increasing east-west traffic within the data center, such as server-server, server-storage, and so on, an alternative to the traditional access-aggregation-core network model is becoming more widely used. This architecture is known as a Clos or leaf-spine network and is designed to minimize the number of hops between hosts.

Each ToR dual switch (leaf) pair is connected to a higher layer set of switches (spine) that allows each rack to forward east-west traffic between the racks. This provides the best possible redundancy and scaling of the network. The connections between VLT switch pairs (leafs) going to spine switches can be layer 2 (switched) or layer 3 (routed).
Dell EMC provides specific recommendations below for each switch role played in the ToR and leaf-spine topologies.

1.2 Dell EMC Networking S4048-ON switch

The Dell EMC Networking S4048-ON is a 1RU (rack unit) high-density 10/40GbE switch with 48 dual-speed, 1/10GbE SFP+ (S4048T-ON with 10GBaseT) ports and six 40GbE (QSFP+) uplinks, offering 1.44 Tbps capacity. This deployment guide provides steps to add a single XC Series cluster to two S4048-ON, ToR switches. This switch may also be used as a leaf switch in a leaf-spine topology.

**Figure 3** Multiple XC Series clusters in a leaf-spine network

**Figure 4** Dell EMC Networking S4048-ON front view

**Figure 5** Dell EMC Networking S4048-ON rear view showing management ports
1.3 Dell EMC Networking S6010-ON switch
The Dell EMC Networking S6010-ON is a 1RU layer 2/3 switch with 32 ports supporting 10/40GbE, and offering 2.56 Tbps capacity. Two S6010-ON switches are used as upstream spine switches in one example in this deployment guide.

![S6010-ON Dell EMC Networking front view](image)

Figure 6  S6010-ON Dell EMC Networking front view

1.4 Dell EMC Networking Z9100-ON switch
The Dell EMC Networking Z9100-ON is a 1RU layer 2/3 switch with 32 ports supporting 10/25/40/50/100GbE. The Z9100-ON is a fixed switch purpose-built for applications in high-performance data center and computing environments offering 6.4 Tbps capacity. Two Z9100-ON switches are used as upstream spine switches in one example in this deployment guide.

![Dell EMC Networking Z9100-ON front view](image)

Figure 7  Dell EMC Networking Z9100-ON front view

1.5 Dell EMC Networking S3048-ON switch
The Dell EMC Networking S3048-ON is a 1RU Layer 2/3 switch with 48 1000BASE-T ports. One S3048-ON switch is used for out-of-band (OOB) management traffic in this deployment guide.

![Dell EMC Networking S3048-ON front view](image)

Figure 8  Dell EMC Networking S3048-ON front view

1.6 Dell EMC XC Series hyper-converged appliances
Dell EMC XC Series hyper-converged appliances start with the proven Dell EMC PowerEdge server platform and incorporates the advanced software technologies that power leading scalable and cloud infrastructures. Backed by Dell EMC global service and support, these 1RU and 2RU appliances are preconfigured for specific virtualized workloads, and are designed to maintain data availability in case of appliance and disk failures.

There are several XC Series configurations available to support various workloads. The examples in this guide use the Dell EMC Networking XC630-10 shown here:
The following table lists the Dell EMC XC Series hyper-converged appliances and example workloads:

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Workload examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>XC630-10</td>
<td>Compute/performance-intensive VDI, test &amp; development, private cloud, server virtualization</td>
</tr>
<tr>
<td>XC730-16G</td>
<td>VDI for graphics intensive workloads and knowledge workers with image-based apps</td>
</tr>
<tr>
<td>XC730xd-24</td>
<td>Performance-intensive SQL and Oracle OLTP</td>
</tr>
<tr>
<td>XC430-4</td>
<td>Balanced compute and storage for smaller scale virtualized environments</td>
</tr>
<tr>
<td>XC730xd-12</td>
<td>Storage-heavy Microsoft Exchange, SharePoint, data warehouse, big data</td>
</tr>
<tr>
<td>XC6320-6</td>
<td>High density compute and storage environments, service providers, private cloud</td>
</tr>
<tr>
<td>XC730xd-12C</td>
<td>Storage capacity appliance for cluster with any supported hypervisor. Does not run workload VMs or virtual desktops. AHV only.</td>
</tr>
</tbody>
</table>

For the latest list of available XC Series appliances and technical specifications, visit [Dell EMC XC Series Hyperconverged Appliances](#).
2. XC Series network configuration flowchart

This flowchart illustrates the high-level process used in deploying the network necessary for an XC Series cluster based on selected hypervisor.

Order Dell EMC switches and XC appliances

Configure switch ports going to XC appliances for install environment

Use Foundation App to discover XC Appliances and create cluster for Xpress setup.
Non-Xpress configurations are performed by Dell Services.

Install hardware (XC appliances and switches) into rack
Plug in all cables

Configure VLT (between dual ToR switches)

Configure management network

Set switches to factory defaults

Cluster build
- attended install ~30 min.
- unattended ~1-2 hrs.

Which hypervisor is being used?

ESXi
AHV
Hyper-V

Use vCenter to configure interface teaming, load balancing and failover

Use Server Manager to configure interface teaming, load balancing, and failover

Use CVM to configure interface teaming, load balancing, and failover

Configure ToR switches to enable redundant ports going to XC appliances

Use Prism (cluster management tool) to configure NTP services

Network configuration steps

XC cluster creation (Dell Services or XC Xpress)

Figure 11   Network deployment for XC Series cluster
Deploying the XC Series cluster is performed in three stages. The first and third stages are related to the network. The initial network is created in step one. The cluster is built in step two. The last step configures the final production network. The stages are depicted in the flowchart in chapter 2. This guide walks the user through all networking steps. The reader is directed to the XC Series cluster documentation for completing step 2.

The information in this guide is helpful in ensuring your network devices are ready to connect XC Series appliances for clustering. The following key points should be followed throughout this guide and when using the Foundation applet for cluster creation:

- The 10GbE Intel NIC ports in the XC Series appliance require either Twinax or Intel SFP+. Connecting a different vendor’s SFP to the 10GbE Intel NICs will not work. See Appendix B for more information.
- Load balancing/NIC teaming is disabled for host appliances during initial building of cluster. The instructions provided enables load balancing/NIC teaming to be used after the cluster is built.
- When moving the hypervisor used from ESXi to AHV, or AHV to ESXi, load balancing/NIC teaming must be disabled on the XC Series host. They may be re-enabled once the conversion is complete.
- Layer 2 networking is required for implementing and using an XC Series cluster. Layer 3 should not be used for connectivity between XC Series appliances and ToR/Leaf switches.
- Dell EMC recommends using dual ToR switches in a VLT configuration as shown in Figure 13, when running XC Series clusters in a production environment.
- When creating the cluster, the following static IP addresses for each host, or XC Series appliance, are required:
  - A static IP address for the hypervisor host
  - A static IP address for the Control VM (CVM)
  - A static IP address for the iDRAC
  - CVM and hypervisor hosts are required to be on the same IP subnet and VLAN
  - Gateway, DNS, and NTP addresses should be available
- The use of IP network 192.168.5.0 is forbidden as it causes hosts to fail. This private network is designated for internal communication between the hypervisor and CVM.
- Dell EMC recommends that all of the switch ports enable default VLAN access for deployment. If default VLAN access is not permitted, refer to the Nutanix Field Installation Guide for assigning a VLAN tag during deployment.
- IPv6 is used for XC Series appliance discovery and cluster creation. Dell EMC Networking switches pass IPv6 at Layer 2 by default. No modifications to switch configurations are required.
- Use the spanning-tree rstp edge-port command on each ToR/leaf-switch interface connecting to an XC Series appliance to put them into an immediate forwarding stateable.

Note: Dell EMC recommends enabling Spanning Tree on all ToR/leaf switches and using edge-port on the ports connected to the XC Series servers. By default, Dell EMC Networking switches have Spanning Tree disabled globally.

Table 2 lists the IP addresses used in the example configurations in the guide:
Information contained in the bullet list and table above, along with the installation and setup guides, should be referenced when creating or modifying a cluster.

**Initial switch settings**

The configuration commands for the examples in this guide assume that the switches start at their factory default settings. Use the commands for your corresponding OS to reset Dell EMC Networking switches used in this guide to factory defaults.

**Note:** It is recommended that all switches mentioned in this guide be reset to factory defaults in advance of configuring any of the example network topologies.

```
OS9# delete startup-config.bak
OS9# restore factory-defaults stack-unit unit# clear-all
```

Proceed with factory settings? Confirm [yes/no]: yes

```
***********************************************************************
* WARNING - Restoring factory defaults will delete the existing       *
* startup-config and resets all persistent settings (stacking,       *
* fanout, etc.) and boot environment variables (boot config, console *
* baud rate, management interface settings, etc.)                   *
* After restoration the unit(s) will be power-cycled immediately.    *
* Proceed with caution !                                            *
***********************************************************************
```

**Note:** Copies of the configuration files validated in creating this document are attached. Click the paperclip icon on the left to view or download local copies of these configuration files.
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. It is used by administrators to configure, manage, and monitor devices such as servers and switches. Payload traffic initiated by the network end-users does not traverse the OOB management network. Switches used for management are generally 1GbE. Figure 12 demonstrates how the Dell EMC Networking S3048-ON is a good switch for this purpose:

![Diagram of management network example for multiple racks]

Figure 12  Management network example for multiple racks

Figure 13 uses dotted lines to show all management network cables coming into a single S3048-ON management switch. Notice there is one cable from the management switch to each device on the network to be managed. The cables running to the S4048-ON switches are connected to the OOB management ports on the back of the switches. Cables running to the XC Series hosts are connected to the iDRAC ports. The management switch can also be connected to other management switches upstream. Finally, the vCenter and the

**Note:** Foundation applet are shown in suitable placements for this example topology. This is the most efficient location for these systems during appliance discovery and cluster creation. These systems should not be plugged into the management switch.
Configure management IP addresses
Each switch that is to be managed through the management switch - over the network, requires an IP address on the OOB port. For example, the OOB port for the Dell EMC Networking S4048-ON is managementethernet 1/1.

Note: For this and other switches running OS9, enter the following commands, replacing the IP address with an available one for your network. Substitute the example default gateway (next hop) address of 192.168.1.1 with the one for your network.

```
OS9#configure
OS9(config)#interface managementethernet 1/1
OS9(config-if-ma-1/1)#ip address 192.168.1.10/24
OS9(config-if-ma-1/1)#no shutdown
OS9(config)#management route 0.0.0.0/0 192.168.1.1
```
Each headless appliance that is to be managed through the management switch will need an IP address on the iDRAC port. For the XC Series appliances in Figure 13, a keyboard, mouse, and monitor will need to be used to access the I/O ports to set the iDRAC IP address. Once set, the XC Series is accessed and managed through a web user interface. See the user guides that accompany the XC Series and your particular switch for more information on how to set up and use management ports for these devices.
5  Example 1: Dual Dell EMC Networking S4048-ON ToR switches and OS9 (for AHV and Hyper-V)

In the dual switch ToR topology, two switches are configured as VLT peers. All appliance hosts connect to both switches using a single NIC port connecting to each switch. This recommended topology for networking within a rack or cluster, protects against a single switch failure. Network redundancy is established at both the link and switch levels. Up to 48 hosts can be connected to this dual switch network while providing complete redundancy at each level.

![Diagram of Dual Dell EMC Networking S4048-ON ToR switches and OS9](image)

**Figure 14  Dual switch ToR**

By default the XC Series appliance has uplink interfaces in active/passive mode. Upstream switch architectures that are capable of having active/active uplink interfaces, such as VLT, can be leveraged for additional network throughput. This example configuration puts the appliance interfaces into active/active mode using LACP port channels. Only one switch is used for cluster creation. Once the cluster is created, the switch is transitioned to normal operating mode, joining the second switch for VLT peer redundancy.

5.1 Configure dual Dell EMC Networking S4048-ON ToR switches

Use the steps below to configure dual Dell EMC Networking S4048-ON switches connecting four XC Series hosts using switch ports 1 through 4 on each switch. Only switch S4048-ON #1 is used for the cluster installation.
<table>
<thead>
<tr>
<th>Dell S4048-ON 1</th>
<th>Dell S4048-ON 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set the management configuration</strong></td>
<td><strong>Set the management configuration</strong></td>
</tr>
<tr>
<td>Dell#configure</td>
<td>Dell#configure</td>
</tr>
<tr>
<td>Dell(conf)#interface managementethernet 1/1</td>
<td>Dell(conf)#interface managementethernet 1/1</td>
</tr>
<tr>
<td>Dell(conf-if-ma-1/1)#ip address 100.67.183.29/24</td>
<td>Dell(conf-if-ma-1/1)#ip address 100.67.183.30/24</td>
</tr>
<tr>
<td>Dell(conf-if-ma-1/1)#no shutdown</td>
<td>Dell(conf-if-ma-1/1)#no shutdown</td>
</tr>
<tr>
<td>Dell(conf-if-ma-1/1)#exit</td>
<td>Dell(conf-if-ma-1/1)#exit</td>
</tr>
<tr>
<td>Dell(conf)#management route 0.0.0.0/0 100.67.183.254</td>
<td>Dell(conf)#management route 0.0.0.0/0 100.67.183.254</td>
</tr>
<tr>
<td><strong>Set port channel for VLTi Interswitch peer links</strong></td>
<td><strong>Set port channel for VLTi Interswitch peer links</strong></td>
</tr>
<tr>
<td>Dell(conf)#interface range fortyGigE 1/53</td>
<td>Dell(conf)#interface range fortyGigE 1/53</td>
</tr>
<tr>
<td>Dell(conf)#interface range fortyGigE 1/53-1/54</td>
<td>Dell(conf)#interface range fortyGigE 1/53-1/54</td>
</tr>
<tr>
<td>Dell(conf-if-range-fo-1/53-1/54)#no shutdown</td>
<td>Dell(conf-if-range-fo-1/53-1/54)#no shutdown</td>
</tr>
<tr>
<td>Dell(conf-if-range-fo-1/53-1/54)#exit</td>
<td>Dell(conf-if-range-fo-1/53-1/54)#exit</td>
</tr>
<tr>
<td><strong>Set VLT</strong></td>
<td><strong>Set VLT</strong></td>
</tr>
<tr>
<td>Dell(conf)#vlt domain 1</td>
<td>Dell(conf)#vlt domain 1</td>
</tr>
<tr>
<td>Dell(conf-vlt-domain)#peer-link port-channel 100</td>
<td>Dell(conf-vlt-domain)#peer-link port-channel 100</td>
</tr>
<tr>
<td>Dell(conf-vlt-domain)#back-up destination 100.67.183.30</td>
<td>Dell(conf-vlt-domain)#back-up destination 100.67.183.29</td>
</tr>
<tr>
<td>Dell(conf-vlt-domain)#Unit-id 0</td>
<td>Dell(conf-vlt-domain)#Unit-id 1</td>
</tr>
<tr>
<td>Dell(conf-vlt-domain)#exit</td>
<td>Dell(conf-vlt-domain)#exit</td>
</tr>
<tr>
<td><strong>Configure cluster-facing ports</strong></td>
<td><strong>Configure cluster-facing ports</strong></td>
</tr>
<tr>
<td>Dell#configure</td>
<td>Dell#configure</td>
</tr>
<tr>
<td>Dell(conf)#interface range te 1/1-1/4</td>
<td>Dell(conf)#interface range te 1/1-1/4</td>
</tr>
<tr>
<td>Dell(conf-if-range-te-1/1-1/4)#description XC nodes port 0</td>
<td>Dell(conf-if-range-te-1/1-1/4)#description XC nodes port 1</td>
</tr>
<tr>
<td>Dell(conf-if-range-te-1/1-1/4)#no ip address</td>
<td>Dell(conf-if-range-te-1/1-1/4)#no ip address</td>
</tr>
<tr>
<td>Dell(conf-if-range-te-1/1-1/4)#portmode hybrid</td>
<td>Dell(conf-if-range-te-1/1-1/4)#shutdown</td>
</tr>
<tr>
<td>Dell(conf-if-range-te-1/1-1/4)#switchport</td>
<td>Dell(conf-if-range-te-1/1-1/4)#exit</td>
</tr>
<tr>
<td>Dell(conf-if-range-te-1/1-1/4)#no shutdown</td>
<td>Dell(conf)#interface te 1/1</td>
</tr>
<tr>
<td>Dell(conf-if-range-te-1/1-1/4)#exit</td>
<td>Dell(conf)#interface te 1/1</td>
</tr>
</tbody>
</table>

**Note:** Use the `show vlt brief` command to verify the VLT configuration.
Configure spanning tree and port channels

Dell#configure
Dell(conf)#protocol spanning-tree rstp
Dell(conf-rstp)#no disable
Dell(conf-rstp)#exit
Dell(conf)#interface port-channel 1
Dell(conf-if-po-1)#portmode hybrid
Dell(conf-if-po-1)#switchport
Dell(conf-if-po-1)#spanning-tree rstp edge-port
Dell(conf-if-po-1)#vlt-peer-lag port-channel 1
Dell(conf-if-po-1)#no shutdown
Dell(conf-if-po-1)#exit

Dell(conf-if-te-1/1)#port-channel-protocol lacp
Dell(conf-if-te-1/1-lacp)#port-channel 1
Dell(conf-if-te-1/1-lacp)#exit
Dell(conf-if-te-1/1)#exit

Dell(conf)#interface te 1/2
Dell(conf-if-te-1/2)#port-channel-protocol lacp
Dell(conf-if-te-1/2-lacp)#port-channel 2
Dell(conf-if-te-1/2-lacp)#exit
Dell(conf-if-te-1/2)#exit

Dell(conf)#interface te 1/3
Dell(conf-if-te-1/3)#port-channel-protocol lacp
Dell(conf-if-te-1/3-lacp)#port-channel 3
Dell(conf-if-te-1/3-lacp)#exit
Dell(conf-if-te-1/3)#exit

Dell(conf)#interface te 1/4
Dell(conf-if-te-1/4)#port-channel-protocol lacp
Dell(conf-if-te-1/4-lacp)#port-channel 4
Dell(conf-if-te-1/4-lacp)#exit
Dell(conf-if-te-1/4)#exit

Note: Ports on the redundant switch to the XC Series appliances must be shutdown to continue. You will be prompted to bring them back up as the last step in Chapter 6.
Dell(conf)#interface port-channel 2
Dell(conf-if-po-2)#portmode hybrid
Dell(conf-if-po-2)#switchport
Dell(conf-if-po-2)#spanning-tree rstp edge-port
Dell(conf-if-po-2)#vlt-peer-lag port-channel 2
Dell(conf-if-po-2)#no shutdown
Dell(conf-if-po-2)#exit

Dell(conf)#interface port-channel 3
Dell(conf-if-po-3)#portmode hybrid
Dell(conf-if-po-3)#switchport
Dell(conf-if-po-3)#spanning-tree rstp edge-port
Dell(conf-if-po-3)#vlt-peer-lag port-channel 3
Dell(conf-if-po-3)#no shutdown
Dell(conf-if-po-3)#exit

Dell(conf)#interface port-channel 4
Dell(conf-if-po-4)#portmode hybrid
Dell(conf-if-po-4)#switchport
Dell(conf-if-po-4)#spanning-tree rstp edge-port
Dell(conf-if-po-4)#vlt-peer-lag port-channel 4
Dell(conf-if-po-4)#no shutdown
Dell(conf-if-po-4)#exit

Save the configuration

Dell#write

Dell(conf)#interface port-channel 2
Dell(conf-if-po-2)#portmode hybrid
Dell(conf-if-po-2)#switchport
Dell(conf-if-po-2)#spanning-tree rstp edge-port
Dell(conf-if-po-2)#vlt-peer-lag port-channel 2
Dell(conf-if-po-2)#no shutdown
Dell(conf-if-po-2)#exit

Dell(conf)#interface port-channel 3
Dell(conf-if-po-3)#portmode hybrid
Dell(conf-if-po-3)#switchport
Dell(conf-if-po-3)#spanning-tree rstp edge-port
Dell(conf-if-po-3)#vlt-peer-lag port-channel 3
Dell(conf-if-po-3)#no shutdown
Dell(conf-if-po-3)#exit

Dell(conf)#interface port-channel 4
Dell(conf-if-po-4)#portmode hybrid
Dell(conf-if-po-4)#switchport
Dell(conf-if-po-4)#spanning-tree rstp edge-port
Dell(conf-if-po-4)#vlt-peer-lag port-channel 4
Dell(conf-if-po-4)#no shutdown
Dell(conf-if-po-4)#exit

Save the configuration

Dell#write

5.2 Create an XC Series cluster

**Note:** XC Series cluster deployments, except for the XC430 Xpress, are installed by Dell Services.

The network is ready to deploy the XC Series appliances into an XC Series cluster. Before creating the XC Series cluster, the Installer/Foundation applet systems should have proper placement on the network. One recommended setup is shown in Figure 13 on page 14.

If deploying Xpress, use the documentation that comes with your XC430 appliances.
The Foundation applet generally used for the XC430 Xpress may also be used for appliance discovery and creation of other XC Series clusters. To obtain the applet, sign in to the Nutanix portal: https://portal.nutanix.com and select Downloads > Foundation. A Nutanix account is required.

The process of discovering XC Series appliances and building the cluster usually takes 1-3 hours. Most of this time will be unattended while the cluster is being built. Once the cluster is created, use the steps below to complete the network configuration.

5.3 Hypervisor configuration

Below are the instructions to configure the hypervisor network stack. Skip to the section that applies to the hypervisor selected during cluster installation:

- 5.3.1 AHV
- 5.3.2 Hyper-V

5.3.1 AHV

The AHV Networking Nutanix Best Practices guide provides advanced illustrations on how to configure the network with the Dell EMC XC630-10 appliance.

The following example provides the steps for setting up the “Scenario 2: 2x 10 Gb and 2x 1 Gb Separated” design described in section 5.1 of the guide. The default configuration of the virtual switch has uplinks to the switch as active-backup. Use the following procedure to change the adapters to balance-tcp:

1. From the iDRAC virtual console, open an SSH connection to the local cluster controller.
2. Use the following commands to configure virtual switches and uplinks.
   a. Verify current config:

   CVM:10.1.1.124:$ allssh manage_ovs --bridge_name br0 show_uplinks

   b. Temporarily disable rebalance interval:

   CVM:10.1.1.124:$ hostssh "ovs-vsctl set port br0-up other_config:bond-rebalanceinterval=0"

   c. Add a new bridge for 1G interfaces:

   CVM:10.1.1.124:$ hostssh "ovs-vsctl add-br br1"

   d. Update the br0 bond to include only 10 Gb interfaces:

   CVM:10.1.1.124:$ allssh manage_ovs --bridge_name br0 --innterfaces 10g update_uplinks

   e. Update the br1 bond to include only 1G interfaces:
3. Change the load balance mode from active-backup to balance-slb on 10G links.
   a. Set 10G interface to LACP and bond mode to balance-tcp fallback to active-backup on LACP failure:
      
      ```
      CVM:10.1.1.124:$ hostssh "ovs-vsctl set port br0-up other_config:lacp-fallback-ab=true"
      CVM:10.1.1.124:$ hostssh "ovs-vsctl set port br0-up lACP=active"
      CVM:10.1.1.124:$ hostssh "ovs-vsctl set port br0-up bond_mode=balance-tcp"
      ```
   
   b. Set 10G interface bond interval:
      
      ```
      CVM:10.1.1.124:$ hostssh "ovs-vsctl set port br0-up other_config:bond-rebalanceinterval=60000"
      ```

4. Transition switches to operating mode by enabling switch redundancy.

Return to the ToR switch(es) to enable the redundant ports that are connecting to the XC Series hosts.

Run the following commands on the redundant switch (S4048-ON #2) of the VLT pair to enable the redundant ports:

```
S4048-ON #2

Dell#configure
Dell(conf)#interface range te 1/1-1/4
Dell(conf-if-range-te-1/1-1/4)#no shutdown
Dell(conf-if-range-te-1/1-1/4)#exit
```

Run the following commands on the install switch (S4048-ON #1) of the VLT pair to enable the redundant ports for this scenario:

```
S4048-ON #1

Dell#configure
Dell(conf)#interface range te 1/1-1/4
Dell(conf-if-range-te-1/1-1/4)#shutdown
Dell(conf-if-range-te-1/1-1/4)#no switchport
Dell(conf-if-range-te-1/1-1/4)#no portmode hybrid
Dell(conf-if-range-te-1/1-1/4)#description XC nodes port 0
Dell(conf-if-range-te-1/1-1/4)#exit
Dell(conf)#interface te 1/1
Dell(conf-if-te-1/1)#no ip address
```
5. Show 10G interface config:

CVM:10.1.1.124:~$ hostssh "ovs-appctl bond/show br0-up"
CVM:10.1.1.124:~$ hostssh "ovs-appctl lacp/show br0-up"

6. Skip to chapter 7 to set up NTP on the cluster and complete the deployment.

5.3.2 Hyper-V

After the cluster has been installed and added to active directory domain, use the steps below to configure load balancing and failover (LBFO) and complete the setup of the Hyper-V cluster.

**Note:** Prism is the cluster management tool used after the cluster is created to add the cluster to the active directory domain. Consult your XC Series Server documentation for more information.

1. Run the following commands on the redundant switch (S4048-ON #2) of the VLT pair to enable the redundant ports:
2. Open Server Manager using iDRAC or RDP, and select **NIC Teaming**. For this procedure, we used iDRAC.

*Note: The default password is nutanix/4u.*

3. In **NIC Teaming** select **NetAdapterTeam**.
4. Either NIC1 or NIC2 will show Active, and the other will show Disconnected, depending on your cabling configuration. Expand the **Additional properties** section and from the **Teaming mode** drop-down, select **LACP**.

---

**Note:** Alternativity, PowerShell commandlets may be used to set teaming mode. See page 26 for more information.
5. Repeat the GUI commands above on all of the nodes in the cluster.

**Note:** Proceed to step 6 after the commands above have been repeated on all of the nodes.

6. Run the following commands on the install switch (S4048-ON #1) of a VLT pair to enable the redundant ports for this scenario. This transitions the install switch to operating mode.

```
S4048-ON #1

Dell#configure
dell(conf)#interface range te 1/1-1/4
dell(conf-if-range-te-1/1-1/4)#shutdown
dell(conf-if-range-te-1/1-1/4)#no switchport
dell(conf-if-range-te-1/1-1/4)#no portmode hybrid
dell(conf-if-range-te-1/1-1/4)#description XC nodes port 0
dell(conf-if-range-te-1/1-1/4)#exit
dell(conf)#interface te 1/1
dell(conf-if-te-1/1)#no ip address
dell(conf-if-te-1/1)#port-channel-protocol lacp
dell(conf-if-te-1/1-lacp)#port-channel 1 mode active
dell(conf-if-te-1/1-lacp)#exit
dell(conf-if-te-1/1)#exit

dell(conf)#interface te 1/2
dell(conf-if-te-1/2)#no ip address
dell(conf-if-te-1/2)#port-channel-protocol lacp
dell(conf-if-te-1/2-lacp)#port-channel 2 mode active
dell(conf-if-te-1/2-lacp)#exit
dell(conf-if-te-1/2)#exit

dell(conf)#interface te 1/3
dell(conf-if-te-1/3)#no ip address
dell(conf-if-te-1/3)#port-channel-protocol lacp
dell(conf-if-te-1/3-lacp)#port-channel 3 mode active
dell(conf-if-te-1/3-lacp)#exit
dell(conf-if-te-1/3)#exit

dell(conf)#interface te 1/4
dell(conf-if-te-1/4)#no ip address
dell(conf-if-te-1/4)#port-channel-protocol lacp
dell(conf-if-te-1/4-lacp)#port-channel 4 mode active
dell(conf-if-te-1/4-lacp)#exit
dell(conf-if-te-1/4)#exit

dell(conf)#interface range te 1/1-1/4
dell(conf-if-range-te-1/1-1/4)#no shutdown
```

7. Member adapters should now be Active on all member NICs as shown below.
8. Skip to chapter 7 to set up NTP on the cluster and complete the deployment.

5.3.3 Alternative method to set teaming mode on appliances using PowerShell

A PowerShell method may be used in place of steps 2 through 5 in the GUI above. Use the PowerShell commandlets below to set teaming mode on all servers.

1. Create connections:

   ```powershell
   PS C:\> $allnodes = New-CimSession -ComputerName "NODE-1", "NODE-2", "NODE-3", "NODE-4" -name "nodes"
   ```

   Where NODE-X is the host name.

2. Set LACP teaming mode:
PS C:\> Set-NetLbfoTeam -Name NetAdapterTeam -CimSession $allnodes -TeamingMode LACP

3. Use the following command to verify LACP is enabled on the team:
PS C:\> Get-NetLbfoTeam -Name NetAdapterTeam -CimSession $allnodes

4. Close connections to nodes:
PS C:\> Remove-CimSession -name nodes

**Note:** PowerShell commandlets may also be used to set teaming mode on the Hyper-V cluster using IP addresses. See Appendix F for more information.

5. Go back and perform steps 6 step 7 starting on page 25. These steps will enable the redundant switch ports for this scenario and validate the configuration.
Example 2: Dual Dell EMC Networking S4048-ON ToR switches and OS9 (for ESXi)

The network topology used here is the same as chapter 5, but the order of commands for configuring the network and hypervisor is different. Two switches are configured as VLT peers. All appliance hosts connect to both switches using a single NIC port connecting to each switch. This is the recommended topology for networking within a rack or cluster because it protects against a single switch failure. Network redundancy is established at both the link and switch levels. Up to 48 hosts may be connected to this dual switch network while providing complete redundancy at each level.

Figure 15  Dual switch ToR using Dell EMC Networking S4048-ON with OS9

By default the XC Series appliance will have uplink interfaces in active/passive mode. Upstream switch architectures that are capable of having active/active uplink interfaces, like VLT, can be leveraged for additional network throughput. The example configurations provided in this document put these interfaces into active/active mode using a static port channel.

6.1 Configure dual switch Dell EMC Networking S4048-ON ToR

Use the steps below to configure the single Dell EMC Networking S4048-ON connecting four XC host appliances using switch ports 1 through 8.
### Set management configuration

```bash
Dell#configure
Dell(conf)#interface managementethernet 1/1
Dell(conf-if-ma-1/1)#ip address 100.67.183.29/24
Dell(conf-if-ma-1/1)#no shutdown
Dell(conf-if-ma-1/1)#exit
Dell(conf)#management route 0.0.0.0/0 100.67.183.254
```

### Set port channel for VLTi

```bash
Dell(conf)#interface port-channel 100
Dell(conf-if-po-100)#Channel-member fortyGigE 1/53,1/54
Dell(conf-if-po-100)#no shutdown
Dell(conf-if-po-100)#exit
Dell(conf)#interface range fortyGigE 1/53-1/54
Dell(conf-if-range-fo-1/53-1/54)#no shutdown
Dell(conf-if-range-fo-1/53-1/54)#exit
```

### Set VLT

```bash
Dell(conf)#vlt domain 1
Dell(conf-vlt-domain)#peer-link port-channel 100
Dell(conf-vlt-domain)#back-up destination 100.67.183.30
Dell(conf-vlt-domain)#Unit-id 0
Dell(conf-vlt-domain)#exit
```

**Note:** Use the `show vlt brief` command to verify the configuration.

### Configure cluster facing ports

```bash
Dell#configure
Dell(conf)#interface range te 1/1-1/4
Dell(conf-if-range-te-1/1-1/4)#description XC nodes port 0
Dell(conf-if-range-te-1/1-1/4)#no ip address
Dell(conf-if-range-te-1/1-1/4)#shutdown
```
Configure spanning tree and port channels

Dell#configure
Dell(conf)#protocol spanning-tree rstp
Dell(conf-rstp)#no disable
Dell(conf-rstp)#exit
Dell(conf)#interface port-channel 1
Dell(conf-if-po-1)#portmode hybrid
Dell(conf-if-po-1)#switchport
Dell(conf-if-po-1)#spanning-tree rstp edge-port
Dell(conf-if-po-1)#channel-member
TenGigabitEthernet 1/1
Dell(conf-if-po-1)#vlt-peer-lag port-channel 1
Dell(conf-if-po-1)#no shutdown
Dell(conf-if-po-1)#exit

Dell(conf)#interface port-channel 2
Dell(conf-if-po-2)#portmode hybrid
Dell(conf-if-po-2)#switchport
Dell(conf-if-po-2)#spanning-tree rstp edge-port
Dell(conf-if-po-2)#channel-member
TenGigabitEthernet 1/2
Dell(conf-if-po-2)#vlt-peer-lag port-channel 2
Dell(conf-if-po-2)#no shutdown
Dell(conf-if-po-2)#exit

Dell(conf)#interface port-channel 3
Dell(conf-if-po-3)#portmode hybrid
Dell(conf-if-po-3)#switchport
Dell(conf-if-po-3)#spanning-tree rstp edge-port
Dell(conf-if-po-3)#channel-member
TenGigabitEthernet 1/3
Dell(conf-if-po-3)#vlt-peer-lag port-channel 3
Dell(conf-if-po-3)#no shutdown
Dell(conf-if-po-3)#exit

Dell(conf)#interface port-channel 4
Dell(conf-if-po-4)#portmode hybrid

Note: Ports on the redundant switch to the XC Series appliances must be shutdown to continue. You will be prompted to bring them back up as the last step in Chapter 6.
6.2 Create an XC Series cluster

**Note:** XC Series cluster deployments, except for the XC430 Xpress, are installed by Dell Services.

The network is ready to deploy the XC Series appliances into an XC Series cluster. Before creating the XC Series cluster, the Installer/Foundation applet systems should have proper placement on the network. One recommended setup is shown in Figure 13 on page 14.

If deploying Xpress, use the documentation that comes with your XC430 appliances.

**Note:** The Foundation applet generally used for the XC430 Xpress may also be used for appliance discovery and creation of other XC Series clusters. To obtain the applet, sign in to the Nutanix portal: [https://portal.nutanix.com](https://portal.nutanix.com) and select **Downloads > Foundation.** A Nutanix account is required.

The process of discovering XC Series appliances and building the cluster usually takes 1-3 hours. Most of this time will be unattended while the cluster is being built. Once the cluster is created, use the steps below to complete the network setup.

6.3 ESXi - Configure vSwitch0 and management port group

**Note:** This ESXi example is using a standard switch which supports static LAG only. For LACP, a VMware distributed switch (vDS) is required. Consult your VMware documentation for information on using a vDS, including products licensed for it’s use.

The default configuration of the virtual switch has uplinks to the switch as active-standby. Use the following procedure to change the adapters to active-active:

1. Open the **VMware vCenter Home** page and select **Hosts and Clusters.**
2. Select one of the newly added XC Series appliances.
3. Select the Manage tab > Networking > Virtual switches > vSwitch0.
4. Open the Manage Physical Network Adapters for the vSwitch0 virtual switch. The default configuration is shown in Figure 17 (based on an XC630 appliance with two 10GbE and two 1GbE ports).
5. Select and remove the 1GbE adapters, vmnic2 and vmnic3, using the red X button.
6. Click OK.
7. Open Vswitch0 Edit Settings page (Figure 18).
8. Select **Teaming and Failover** from the left navigation menu.
9. Select the standby adapter **vnic** and move to active adapters using the up arrow.
10. Select **Route based on IP hash** using the **load balancing** pull down menu.
11. Verify your screen reflects the settings shown in Figure 18.
12. Click **OK**.
13. Select **Management Network** and edit settings page as shown in Figure 19.
14. Select **Teaming and failover** from the left navigation menu.
15. Verify that the **Load balancing Override** is not selected. Uncheck this option if necessary.
16. Ensure that the **Failover order Override** is not selected. Uncheck this option if necessary.
17. Verify that your settings reflect the settings shown in Figure 19.
18. Click OK.
19. Repeat steps 1 through 18 for all XC Series appliances.

**Note:** Repeat steps above for all XC Series appliances before continuing to the next step.

20. Run the following commands on the redundant switch (S4048-ON #2) of a VLT pair to enable the redundant ports for this scenario:

```
S4048-ON #2

Dell#configure
Dell(config)#interface range te 1/1-1/4
Dell(config-if-range-te-1/1-1/4)#no shutdown
Dell(config-if-range-te-1/1-1/4)#exit
```

21. Skip to chapter 7 to set up NTP on the cluster and complete the deployment.

**Note:** The *Dell XC Series Appliances – Reference Architecture for VMware ESXi Cluster* demonstrates how the Dell XC630-10 appliance functions with mixed workloads when configured as a VMware vSphere cluster. Additionally, it provides best practices and a configuration guide for setting up the solution to run VMware vSphere in the datacenter of a medium-sized business.
7 Network Time Protocol (NTP)

An XC Series cluster will not function correctly if a time discrepancy exists that is greater than five minutes. Dell EMC recommends syncing to three to five external Stratum One time sources to ensure accurate times on the hypervisor and the Controller VM (CVM) on all XC Series clusters. This allows for:

- Accurate timestamps necessary for backup software to determine the files to back up
- Efficient troubleshooting of the network
- Prevention of disaster recovery snapshots from expiring too quickly or too late
- Timely and accurate graphs generated by network monitoring software, such as those found in Prism

Once a cluster is built, the Prism cluster management tool may be used using the default ID and password of admin/admin. Perform the following steps to configure the cluster to add NTP services.

1. Open Prism, and click the “gear” icon.
2. From the Gear menu, select NTP Servers.
3. In the NTP Servers dialog box, type the appliance IP address or fully qualified host name.
4. Click Add. The name or address is displayed in the HOST NAME OR IP ADDRESS list below the NTP Server field.

Note: To remove an NTP entry, go to the Servers list and click the delete (x) icon for that appliance. Click OK.

The Dell XC Series cluster is configured and ready to use.

Note: Copies of the configuration files validated in creating this document are attached. Click the paperclip icon on the left to view or download local copies of these configuration files.
8 Leaf-spine topologies

In the leaf-spine topology, each ToR dual switch pair, or leaf, is connected to a higher layer set of switches, or spine, that allows each rack to forward east-west traffic between the racks. This provides the best possible redundancy and scaling of the network. ToR switches are considered to be “leafs” when they connect to spine switches.

As a best practice, each new rack contains two leaf switches. Configure these two switches as VLT peers so downstream devices see them as a single logical device. Only Layer 2 is supported on VLT peer leaf’s switch ports that are connected to the cluster appliances. Upstream connections from VLT pairs going to spine switches can be Layer 2 (switched) or Layer 3 (routed).

All XC Series appliances connect to both leaf switches with a single NIC port. Each leaf switch is then connected to each spine switch. The example scenario shown in Figure 20 has two spine and three VLT leaf pairs connected. The Dell EMC Networking S6010-ON or Dell EMC Networking Z9100-ON switches may be used for spines, and Dell EMC Networking S4048-ON switches are used for leafs. The Z9100-ON switches are shown as the spines in the following diagram:

![Diagram showing leaf-spine topology](image)

**Figure 20** Dell EMC leaf-spine topology using two spine switches

Figure 20 shows multiple racks, one cluster per rack, using a leaf-spine network. Refer to the Leaf-Spine Deployment and Best Practices Guide for steps on how to configure these networks. This and related Dell EMC Networking guides are available for download from Dell Techcenter at [http://en.community.dell.com/techcenter/networking/p/guides](http://en.community.dell.com/techcenter/networking/p/guides). The Leaf-Spine Deployment guide provides examples on setting up Layer 2, Layer 3 (OSPF), and Layer 3 (BGP) networks.
Brownfield networks
When deploying XC Series appliances and Dell EMC switch leafs into existing environments, it is often necessary to retrofit new equipment into the established network. Dell EMC customers that have Cisco or other non-Dell switches that are already implemented at the core, can still take advantage of the features provided by Dell EMC XC Series appliances and switches. The topology shown in Figure 21 demonstrates non-Dell switches at the spine layer attached to Dell EMC Networking switches at the leaf layer. This topology is almost identical to the one shown in Figure 20 but contains non-Dell EMC spine switches in a production environment. In the following example, an existing network is being expanded to include Dell EMC Networking switches at the ToR:

Figure 21  Leaf-spine topology using non-Dell spine switches

For this type of installation, there are a few changes that may be required on the leaf switches in order to interoperate with the spine switches from other manufacturers. See the Leaf-Spine Deployment and Best Practices Guide for steps on how to configure these networks. This and related Dell EMC Networking guides are available for download from Dell Techcenter at http://en.community.dell.com/techcenter/networking/p/guides.

Note: Deployment examples in the Leaf-Spine Deployment and Best Practices Guide include the Cisco Nexus 5600 and 7000 series switches used as spines. These spine switches are configured for interoperability with Dell EMC Networking switches at the leaf level.
Scaling the leaf-spine network
When deploying an XC Series cluster with VMware ESXi, it is uncommon to have more than 20 appliances in the cluster. The maximum number of XC Series appliances is 64 per cluster. Using a single VLT pair of Dell EMC Networking S4048-ON switches, this maximum is achieved by using four of the six 40GbE QSFP+ available on the S4048-ON. These ports need to use breakout cables to convert each QSFP+ port into four 10GbE ports. Two QSFP+ ports remain available for uplinks and VLT if needed.

Figure 22   Network scaling for XC Series clusters
When deploying multiple XC Series clusters within an autonomous network, a leaf-spine topology can be used as discussed in Chapter 8. Figure 22 shows the scalability of both leaf and spine layers.

The leaf-spine topology may be extended and is limited by the number of ports available in the spine switches used, with each leaf switch connected to each spine.
Ansible playbooks

Ansible is an optional tool that may be used to provision and manage Dell EMC Networking switches and enable rapid device deployment and network configuration changes. Ansible can also track running network device configurations against a known baseline for both Dell EMC and third-party operating systems. This allows organizations to reduce the time and effort required to design, provision and manage these networks. Visit www.ansible.com to learn more about the Ansible automation tool.

Sample Ansible modules are attached to demonstrate easy deployments for those who want to configure their network using the automation engine. Modules to provision dual switch ToR and Layer 3 leaf-spine, using BGP, topologies are included.

**Note:** More Ansible examples can be found in the document: [Ansible for Dell EMC Networking Switches](#).

**SSH requirement**

SSH access is required for Ansible scripting on the Dell EMC switches in this guide. Use the steps in the following link to configure each switch to allow for an SSH authentication login to run Ansible scripts: [RSA-SSH Authentication Password-Less Login](#).

**Ansible playbook for a dual switch ToR**

Sample scripts for a dual switch ToR topology like the one in Chapter 6 on page 28 are attached to this document and are ready to be deployed through Ansible. This playbook will configure both switches shown in Figure 23.

![Diagram](image)

**Figure 23  Ansible for dual switch ToR**

There are four Ansible files attached for the dual switch ToR topology, including the playbook, an inventory file, and a configuration file for each type of switch role - ToR-1, and ToR-2. These files allow the user to configure the dual switch (VLT), leaf pair for the ToR. The host variable and inventory files are required by
the playbook for the configuration deployment. These variable and inventory files should all reside in the same folder on the Unix host. Copy and modify these files as needed to automate the configuration of additional dual switch (VLT) leaf pairs onto the network.

**Note:** Attachments are found on the left by clicking the paperclip.

### Table 3  Ansible files for ToR

<table>
<thead>
<tr>
<th>Ansible file for XC dual switch ToR</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>XC_TOR_PB.yml</td>
<td>Ansible playbook (PB) file for dual switch ToR</td>
</tr>
<tr>
<td>XC_TOR_1.yml</td>
<td>Host variable file for the first ToR switch in VLT pair</td>
</tr>
<tr>
<td>XC_TOR_2.yml</td>
<td>Host variable file for the second ToR switch in VLT pair</td>
</tr>
<tr>
<td>XC_TOR_Inventory.yml</td>
<td>Inventory file for switches in this solution</td>
</tr>
</tbody>
</table>

The configuration files for each switch are also included as an attachment under the paperclip icon on the left. Table 4 shows the configuration files resulting from the application of the Ansible playbook for dual switch ToR.

### Table 4  Switch configurations after the Ansible playbook is applied

<table>
<thead>
<tr>
<th>Switch configuration file</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>XC_TOR-dual-switch1_cfg.txt</td>
<td>Configuration of the first ToR switch in VLT pair</td>
</tr>
<tr>
<td>XC_TOR-dual-switch2_cfg.txt</td>
<td>Configuration of the second ToR switch in VLT pair</td>
</tr>
</tbody>
</table>

For additional details about Dell EMC Networking modules, visit [https://galaxy.ansible.com/Dell-Networking](https://galaxy.ansible.com/Dell-Networking).

**Ansible Playbook for a leaf-spine using BGP**

Example scripts for a leaf-spine topology using BGP like the one shown in Figure 24, are attached to this document and are ready to be deployed through Ansible. This playbook demonstrates how to configure a spine and VLT leaf pair as shown in Figure 24, with a single Dell EMC Networking S6010-ON as the spine and dual Dell EMC Networking S4048-ON switches as leafs. The playbook can be expanded to configure multiple spines and leafs in any environment.
Figure 24 Ansible for leaf-spine using BGP

There are five Ansible files attached for the leaf-spine topology, including the playbook, an inventory file, and a configuration file for each type of switch role (spine, leaf-1, and leaf-2). The example shows an Ansible playbook for the configuration of one spine and a dual switch (VLT) leaf pair. The host variable and inventory files are required by the playbook for the configuration deployment and should all reside in the same folder on the Unix host. Copy and modify these files as needed to automate the configuration of additional leaf-spine switches onto the network.

Table 5 Ansible files for a leaf-spine

<table>
<thead>
<tr>
<th>Ansible file for XC leaf-spine for BGP</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>XC_BGP_LEAF-SPINE_PB.yml</td>
<td>Ansible playbook (PB) file</td>
</tr>
<tr>
<td>XC_SPINE1.yml</td>
<td>Host variable file for the spine switch</td>
</tr>
<tr>
<td>XC_LEAF1.yml</td>
<td>Host variable file for the first leaf in the VLT pair</td>
</tr>
<tr>
<td>XC_LEAF2.yml</td>
<td>Host variable file for the second leaf in the VLT pair</td>
</tr>
<tr>
<td>XC_LEAF-SPINE_Inventory.yml</td>
<td>Inventory file for switches in this solution</td>
</tr>
</tbody>
</table>

Table 6 shows the configuration files resulting from the application of the Ansible playbook for leaf-spine. The configuration files for each switch are included as an attachment under the paperclip icon on the left.
### Table 6  Switch configurations after the Ansible playbook is applied

<table>
<thead>
<tr>
<th>XC leaf-spine for BGP configurations</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>XC_Z9100-Spine1-BGP_cfg.TXT</td>
<td>Configuration of the spine switch</td>
</tr>
<tr>
<td>XC_S4048-Leaf1-BGP_cfg.TXT</td>
<td>Configuration of the first leaf switch</td>
</tr>
<tr>
<td>XC_S4048-Leaf1-BGP_cfg.TXT</td>
<td>Configuration of the second leaf switch</td>
</tr>
</tbody>
</table>

For additional details about Dell EMC Networking modules, visit [https://galaxy.ansible.com/Dell-Networking](https://galaxy.ansible.com/Dell-Networking).
**A Additional Resources**

Support.dell.com is focused on meeting your needs with proven services and support.

DellTechCenter.com contains community forums and blogs for Dell EMC customers to connect with other customers and Dell EMC employees to share knowledge, best practices and information about Dell EMC products and installations.

Other referenced or recommended Dell EMC publications:

- XC630 Series manuals
  [https://dell.com/xcseriesmanuals](https://dell.com/xcseriesmanuals)

- XC Series technical content library

- XC630 Series Support Matrix

- XC Series hardware specifications

- Nutanix bible (an authoritative reference for Nutanix)
  [http://www.nutanixbible.com](http://www.nutanixbible.com)

- Leaf-Spine Deployment and Best Practices Guide
  [http://en.community.dell.com/techcenter/networking/m/networking_files/20444291](http://en.community.dell.com/techcenter/networking/m/networking_files/20444291)

- Hyper-converged demonstration and test drive

- Nutanix Academy and training
  [http://my.nutanix.com](http://my.nutanix.com)

- Dell EMC Networking Whitepapers

- Dell EMC Networking S3048-ON User Guides

- Dell EMC Networking S4048-ON User Guides

- Dell EMC Networking S6010-ON User Guides

- Dell EMC Networking Z9100-ON User Guides
- XC Series Best Practices for Windows Server 2012 R2 with Hyper-V
  [http://en.community.dell.com/techcenter/extras/m/white_papers/20442739/download](http://en.community.dell.com/techcenter/extras/m/white_papers/20442739/download)

- Nutanix Networking Best Practices
  [http://go.nutanix.com/Microsoft-Window...-Best-Practices.html](http://go.nutanix.com/Microsoft-Window...-Best-Practices.html)

- Dell EMC Networking Supported Optics and Cables

- More Ansible examples for Dell EMC Networking Switches
  [http://en.community.dell.com/techcenter/networking/m/networking_files/2044376](http://en.community.dell.com/techcenter/networking/m/networking_files/2044376)
B  Supported network cards and cables

This section provides information about supported network cards and NICs for your XC Series appliance.

Intel-branded network daughter cards (NDCs) and network interface cards (NICs) specify the use of only Intel branded SFP+ optical modules for use with optical cables. When ordering a system with optics, the appropriate Intel branded SFP+ optical modules are included with your order. If you already have SFP+ optical modules, ensure they are the Intel branded modules before inserting into the NDC or NIC. Twinax network cables are also supported with the Intel X520 NDC and NIC. See Table 7 for a list of supported network cards and cables for the XC Series.

**Note:** The use of non-Intel branded SFP+ modules during deployment disables 10GbE ports. Contact Dell EMC Support to recover port functionality.

**Note:** Hot-plugging an unsupported SFP+ module causes the VMware ESXi host to fail and displays a purple diagnostic screen. Call Dell EMC Support to recover from this situation.

<table>
<thead>
<tr>
<th>Name</th>
<th>Firmware version</th>
<th>Supported cables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel X520 Dual 1GbE + Dual 10 GbE SFP+ (NDC)</td>
<td>16.0.24 or later</td>
<td>• Intel branded SFP+ modules only (10GbE)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Twinax Cable (10GbE)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Standard Category 6 Ethernet (1GbE)</td>
</tr>
<tr>
<td>Intel X540 Dual 1 GbE + Dual 10 GbE BaseT (NDC)</td>
<td>16.0.24 or later</td>
<td>• Standard Category 6 Ethernet (up to 10GbE)</td>
</tr>
<tr>
<td>Intel X520 Dual 10 GbE SFP+ (NIC)</td>
<td>16.0.24 or later</td>
<td>• Intel branded SFP+ modules only (10GbE)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Twinax Cable (10GbE)</td>
</tr>
<tr>
<td>Intel X540 Dual 10 GbE BaseT (NIC)</td>
<td>16.0.24 or later</td>
<td>• Standard Category 6 Ethernet (up to 10GbE)</td>
</tr>
</tbody>
</table>

For the latest information on XC Series support of network, disk drives, hypervisors, and other equipment and software, visit [http://en.community.dell.com/techcenter/storage/w/wiki/12132.xc630-series-support-matrix](http://en.community.dell.com/techcenter/storage/w/wiki/12132.xc630-series-support-matrix).


C Hardware and software versions used in this document

The examples in this document were validated using the following software versions

<table>
<thead>
<tr>
<th>Hardware/software</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell EMC Networking S3048-ON</td>
<td></td>
</tr>
<tr>
<td>Dell EMC Networking S4048-ON</td>
<td>DNOS 9.11.2.0 P0</td>
</tr>
<tr>
<td>Dell EMC Networking S6010-ON</td>
<td></td>
</tr>
<tr>
<td>Dell EMC Networking Z9100-ON</td>
<td></td>
</tr>
<tr>
<td>Dell EMC XC630 BIOS</td>
<td>2.3.4</td>
</tr>
<tr>
<td>Dell EMC XC630 iDRAC</td>
<td>2.41.40.40 (Build 07)</td>
</tr>
<tr>
<td>AOS</td>
<td>5.1.2</td>
</tr>
<tr>
<td>VMware ESXi</td>
<td>6.0</td>
</tr>
<tr>
<td>Hyper-V</td>
<td>Windows 2012 R2 Standard</td>
</tr>
<tr>
<td>AHV</td>
<td>20160925.84</td>
</tr>
</tbody>
</table>
Prism switch management for AHV hypervisors

When deploying an AHV hypervisor cluster, such as the Dell EMC Networking S4048-ON, users have the option to see the switches listed on the Virtual Networks screen in Prism. This is not a requirement and will not benefit or impede operations of the cluster. It only provides a topological graph of the network as shown in Figure 27. Follow the steps below with OS9 to configure this feature in Prism.

**Note:** Feature is only available for the AHV hypervisor (using OS9) on the Dell EMC Networking switch. No other hypervisors are supported.

After completing the configuration steps in Chapters 5 and 7 for setting up an AHV cluster and NTP, use the following commands to set up Prism switch management:

<table>
<thead>
<tr>
<th>S4048-ON #1</th>
<th>S4048-ON #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Configure VLAN</strong></td>
<td><strong>Configure VLAN</strong></td>
</tr>
<tr>
<td>Dell(conf)#interface vlan 1</td>
<td>Dell(conf)#interface vlan 1</td>
</tr>
<tr>
<td>Dell(conf-if-vl-1)#ip address 10.1.1.51/24</td>
<td>Dell(conf-if-vl-1)#ip address 10.1.1.52/24</td>
</tr>
<tr>
<td>Dell(conf-if-vl-1)#upagged Port-channel 1-4</td>
<td>Dell(conf-if-vl-1)#upagged Port-channel 1-4</td>
</tr>
<tr>
<td>Dell(conf-if-vl-1)#no shutdown</td>
<td>Dell(conf-if-vl-1)#no shutdown</td>
</tr>
<tr>
<td><strong>Configure SNMP</strong></td>
<td><strong>Configure SNMP</strong></td>
</tr>
<tr>
<td>Dell(conf)#snmp-server community public ro</td>
<td>Dell(conf)#snmp-server community public ro</td>
</tr>
<tr>
<td>Dell(conf)#snmp-server contact <a href="http://www.dell.com/support">http://www.dell.com/support</a></td>
<td>Dell(conf)#snmp-server contact <a href="http://www.dell.com/support">http://www.dell.com/support</a></td>
</tr>
<tr>
<td>Dell(conf)#snmp-server location Server Rack</td>
<td>Dell(conf)#snmp-server location Server Rack</td>
</tr>
</tbody>
</table>

**Note:** The default administrator ID and password for Prism is admin/admin.

1. From **Prism**, select gear icon dropdown.
2. Select **Network Switch**.
3. Click the **Add Switch Configuration** button as shown in Figure 25.
4. Enter the switch and host IP and SNMP details as shown in Figure 26.
1. Click **Save**.
2. Repeat the steps in this section to configure additional switches.

After all switches have been added, the **Virtual Networks** page looks similar to the one in Figure 27.
Figure 27  Virtual Networks shown in Prism
Single ToR switch (non-production environments)

**Note:** Use of a single top-of-rack (ToR) switch in a production environment is not recommended. For non-production environments such as evaluations, proof of concept, or academia, a single ToR switch is usually acceptable.

In a single ToR switch topology, all appliances connect to a single switch using both NIC ports. This topology has the advantages of lower cost, but does not protect against a switch failure. Network redundancy is only established at the link level. It is the minimum network requirement in order to deploy an XC Series cluster. This topology should only be used in an academic environment or a non-production test bed due to the single point of failure.

Any of the dual switch examples in this document may also be implemented with a single switch by simply configuring one switch instead of two. For example, a single Dell EMC Networking S4048-ON can support up to 24 appliances using 10GbE ports only, or 32 appliances if using four of the available six QSFP+ ports. Using QSFP+ ports for a 32-appliance topology would require four 4x10GbE breakout cables.

![Diagram of Single switch top-of-rack (ToR)](image)

**Figure 28** Single switch top-of-rack (ToR)

**Example: Configure a single Dell EMC Networking S4048-ON ToR with OS9**

Use the following steps to configure a single Dell EMC Networking S4048-ON switch that connects XC Series hosts appliances. A serial or telnet connection is needed to make initial switch configuration. VLT is not required for single switch configuration but is included in this example configuration for future switching redundancy (recommended). This example configuration is for four XC Series appliances:
Set the management configuration

Dell#configure
Dell(conf)#interface managementethernet 1/1
Dell(conf-if-ma-1/1)#ip address 100.67.183.29/24
Dell(conf-if-ma-1/1)#no shutdown
Dell(conf-if-ma-1/1)#exit
Dell(conf)#management route 0.0.0.0/0 100.67.183.254

Set port channel for VLTi redundancy (for future use)

Dell(conf)#interface port-channel 100
Dell(conf-if-po-100)#Channel-member fortyGigE 1/53,1/54
Dell(conf-if-po-100)#no shutdown
Dell(conf-if-po-100)#exit
Dell(conf)#interface range fortyGigE 1/53-1/54
Dell(conf-if-range-fo-1/53-1/54)#no shutdown
Dell(conf-if-range-fo-1/53-1/54)#exit

Set up a VLT (for future use)

Dell(conf)#vlt domain 1
Dell(conf-vlt-domain)#peer-link port-channel 100
Dell(conf-vlt-domain)#back-up destination 100.67.183.30
Dell(conf-vlt-domain)#Unit-id 0
Dell(conf-vlt-domain)#exit

Note: Use the `show system` command to verify the VLT configuration.

Configure cluster facing ports

Dell#configure
Dell(conf)#interface range te 1/1-1/4
Dell(conf-if-range-te-1/1-1/4)#description XC nodes port 0
Dell(conf-if-range-te-1/1-1/4)#no ip address
Dell(conf-if-range-te-1/1-1/4)#no shutdown
Dell(conf-if-range-te-1/1-1/4)#exit

Dell#configure
Dell(conf)#interface range te 1/25-1/28
Dell(conf-if-range-te-1/25-1/28)#description XC nodes port 1
Dell(conf-if-range-te-1/25-1/28)#no ip address
Dell(conf-if-range-te-1/25-1/28)#shutdown
Dell(conf-if-range-te-1/25-1/28)#exit
Configure spanning tree and port channels

Dell#configure
Dell(conf)#protocol spanning-tree rstp
Dell(conf-rstp)#no disable
Dell(conf-rstp)#exit
Dell(conf)#interface port-channel 1
Dell(conf-if-po-1)#portmode hybrid
Dell(conf-if-po-1)#switchport
Dell(conf-if-po-1)#spanning-tree rstp edge-port
Dell(conf-if-po-1)#channel-member TenGigabitEthernet 1/1, 1/25
Dell(conf-if-po-1)#no shutdown
Dell(conf-if-po-1)#exit

Dell(conf)#interface port-channel 2
Dell(conf-if-po-2)#portmode hybrid
Dell(conf-if-po-2)#switchport
Dell(conf-if-po-2)#spanning-tree rstp edge-port
Dell(conf-if-po-2)#channel-member TenGigabitEthernet 1/2, 1/26
Dell(conf-if-po-2)#no shutdown
Dell(conf-if-po-2)#exit

Dell(conf)#interface port-channel 3
Dell(conf-if-po-3)#portmode hybrid
Dell(conf-if-po-3)#switchport
Dell(conf-if-po-3)#spanning-tree rstp edge-port
Dell(conf-if-po-3)#channel-member TenGigabitEthernet 1/3, 1/27
Dell(conf-if-po-3)#no shutdown
Dell(conf-if-po-3)#exit

Dell(conf)#interface port-channel 4
Dell(conf-if-po-4)#portmode hybrid
Dell(conf-if-po-4)#switchport
Dell(conf-if-po-4)#spanning-tree rstp edge-port
Dell(conf-if-po-4)#channel-member TenGigabitEthernet 1/4, 1/28
Dell(conf-if-po-4)#no shutdown
Dell(conf-if-po-4)#exit

Save the configuration

Dell#write

The switch is now configured to allow for the XC Series cluster to be created.
Using PowerShell to set Teaming Mode to LACP using IP addresses

Use the following PowerShell commandlets to set teaming mode on the Hyper-V cluster using IP addresses:

1. Allow connections to hosts IPs:

   ```powershell
   PS C:\> set-item wsman:localhost\client\trustedhosts -value *
   ```

2. Create connections to nodes using IP addresses:

   ```powershell
   PS C:\> $allnodes = New-CimSession -ComputerName "NODE-1","NODE-2","NODE-3","NODE-4" -credentail administrator -name "nodes"
   ```

   Where NODE-X is the host IP address.

   Enter password of nodes when prompted. (default is nutanix/4u)

3. Set LACP teaming mode:

   ```powershell
   PS C:\> Set-NetLbfoTeam -Name NetAdapterTeam -CimSession $allnodes -TeamingMode LACP
   ```

**Note:** Active Directory is not required when using the PowerShell commands in this appendix, nor is it required when using the GUI in Chapter 5. Active Directory may be required when using the CLI commands in Chapter 5.
### Glossary of Terms

**Acropolis Hypervisor (AHV)** - based on Linux KVM, used for deploying and serving virtual computers

**Ansible** – a tool for IT automation such as network deployments. Acquired by Red Hat® in 2015

**BaseT** – Ethernet cables for baseband transmissions using twisted pair copper wires

**Border Gateway Protocol (BGP)** – a standardized exterior gateway protocol used to route traffic across the Internet

**Command Line Interface (CLI)** – text-based interface for issuing commands to a device

**Control VM (CVM)** – runs Nutanix on each host appliance, executing I/O operations for hypervisors and VMs

**Cluster** – A collection of servers that communicate with each other to create high availability services to clients

**Direct Attached Cable (DAC)** – a high speed cable with built-in SFP connectors on each end

**Domain Name Server (DNS)** – a server used to maintain a directory of domain names for IP address translations

**Downstream** – data in and out of a network switch that flows toward and from end devices

**ESXi** – a hypervisor developed by VMware for deploying and serving virtual computers

**Gateway** – a network device (usually a router) that functions as an entrance to another network

**Hyper-converged** – an infrastructure integrating compute, storage, networking and virtualization into a single system

**Hyper-V** – a hypervisor developed by Microsoft for deploying and serving virtual computers

**Hypervisor** – software or hardware used to create and run virtual machines. AHV, ESXi, and Hyper-V are hypervisors

**Integrated Dell Remote Access Controller (iDRAC)** – an OOB management platform offered on some Dell servers

**Information Technology (IT)** – the broad subject of managing and processing information electronically

**Local Area Network (LAN)** – a network connecting computers within a limited area such as a building or house

**Layer 2 (L2)** – an OSI model layer pertaining to switching network packets based on MAC addresses

**Layer 3 (L3)** – an OSI model layer that uses IP routing tables to route packets between VLANs

**Out-of-band (OOB)** – a port on a switch, server or other networked device that allows management traffic only

**Link Aggregation (LAG)** – enables grouping Ethernet interfaces together to form a single logical interface

**Leaf** – a switch that connects to all spines in a leaf-spine network and provides network access to servers and storage

**Leaf-spine** – a two-layer network topology consisting of leaf switches and spine switches

**Network Interface Card (NIC)** – integrated into computers, it allows connections to networks with cables or wirelessly
Network Time Protocol (NTP) – used for clock synchronization between computers on a network
Open Shortest Path First (OSPF) – a link-state routing protocols typically used in single autonomous systems
Quad Small Form-factor Pluggable+ (QSFP+) – a transceiver used for 40 GbE data communications
Rack Unit (RU) – a unit of measurement equal to 44.45 mm (1.75 in) that describes the height of rackable devices
Small Form-factor Pluggable+ (SFP+) – a transceiver used for 10 GbE data communications
Spanning Tree – a network protocol that creates a loop-free network topology
Spine – a switch that connects to leafs in a leaf-spine network for east-west communications between leafs
Secure Shell (SSH) – a network protocol ensuring secure data transmission over a network
Terabytes Per Second (Tbps) – a data transmission rate equal to one trillion bytes per second
Telnet – a protocol that allows users to log into remote computers
Top-of-rack (ToR) – a switch that sits near or at the top of an IT rack typically used for connecting devices in the rack
Twinax – a name often used interchangeably with Direct Attached Cable (DAC), though other types of twinax exist
Upstream – data flow in and out of a network switch directed to and from the network core; opposite of downstream
Virtual LAN (VLAN) – any group of devices in the same broadcast domain, isolated within a Layer 2 network
Virtual Link Trunking (VLT) – a protocol that connects two physical switches into a single logical switch
Virtual Link Trunking interconnect (VLTi) – the cables and ports used to connect two switches to form a VLT
VMware – a subsidiary of Dell Technologies and leader in virtualization software
Contact Technical Support

Support Contact Information

Web: http://Support.Dell.com/
Telephone: USA: 1-800-945-3355

Feedback for this document

We encourage readers of this publication to provide feedback on the quality and usefulness of this deployment guide by sending an email to Dell_Networking_Solutions@Dell.com.

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