This is the Introduction to Network Technology section of the training. Now that you have an introductory understanding of compute technology, we’ll switch gears and talk about the network technology found in Dell EMC converged and hyper-converged products.

Like the previous sections, you can choose how to proceed. To launch this training, click the Training button.

To attempt to by-pass the training, click assessment. Remember, if you do not pass you must complete the training before attempting the assessment again.
Let's look at the learning objectives for this section.

Upon completion of this training you will be able to explain the function of the network technology within Dell EMC converged and hyper-converged infrastructure products.

Distinguish between the purpose and technologies used in local area networks (LANs) and storage area networks (SANs) in these converged and hyper-converged infrastructure products.

List and explain the purpose of each of the network technology components used in Dell EMC products.

And, you will be able to describe the connectivity of network components in Dell EMC converged and hyper-converged infrastructure products.

Click next and we'll get started!
But let's begin with a little more trivia. What we now call the “Internet” began as early as the 1950’s as a US government network used for military purposes. Homes were not networked, and there was no web based commercial activity back then. Can you guess when the Internet was first legally available for commercial traffic?
Network Trivia

The start of what we know of today as the “Internet” began as early as the 1950’s as a US government network used for military purposes.

When was the Internet first legally available for commercial traffic?

Click on an answer below to continue.

- 1965
- 1975
- 1985
- 1995
- 2005

The correct answer is 1995…Hard to believe that the Internet as we know it today is less than 20 years old!

Source: “Retiring the NSFNET Backbone Service: Chroning the End of an Era”, Susan P. Harris and Elise Gerich, ConnaXions, Vol. 10, No. 4, April 1996.
Let's get started! In this section, you will learn about the function of network technology in Dell EMC converged and hyper-converged infrastructure products.
The network is a critical part of Dell EMC converged and hyper-converged systems. It provides connectivity between components inside and outside of the system, which enables the exchange of data and information between components. Click on and review the content of each tab to learn more about these basic network concepts.
Network Purpose:

Network technology provides connectivity inside and outside of the converged or hyper-converged infrastructure systems. Inside, it provides connectivity and communications between components. Including for example, between compute and storage devices. Inside each system is a local area network or LAN. Today, LAN networks are commonly found in businesses, schools, and homes to carry general network and Internet traffic. These systems also have storage area networks or SANs. These are different networks in that they are dedicated specifically to carrying storage related network traffic.

Outside the system, networking provides connectivity between the Dell EMC system and the customer’s site network which handles other organization networking and communication needs.

In addition to providing connectivity and moving network traffic, networks simplify data protection and migration tasks. The ability to move data over the network for these purposes creates significant data center management efficiencies.
Each device on a network must speak a language the network understands. Standards setting organizations define the network standards, called protocols, which are divided into sections referred to as network layers. Some sections define physical attributes like performance requirements of cabling or network switches. Other layers define processes by which data is packaged and transported across a network. Sometimes protocols defined by multiple standards setting organizations are combined to achieve specific network capabilities. As mentioned previously, the network types found in Dell EMC systems are SANs and LANs.

SANs use Fibre Channel network standards and on the physical network layer they utilize the Fibre Channel Protocol or FCP. LANs are Ethernet networks which utilizes the Internet Protocol (IP) on the physical network layer.

There are many network protocols used in Dell EMC systems, but an important one to know is the Small Computer System Interface or SCSI protocol. Here’s why it is important. All Dell EMC converged infrastructure systems use block level storage which you’ll learn more about later. Block level storage is one way that data is stored on Vblock and VxBlock systems and it requires the SCSI protocol as one of its network layer standards.

Recall that converged infrastructure servers have no storage and their operating system files are accessed on storage drives across a network. These servers access their operating system files over a SAN using the SCSI.
When a server is turned on it boots its operating system from files accessed via block level storage over the SAN Network.
More details about Fibre Channel and Ethernet standards are available by clicking the link at the bottom of this screen.
Storage Area Networks (SANs):

A storage area network, or SAN, utilizes the Fibre Channel network standard. As you know by now, a SAN is dedicated to storage related network communications between host computers and storage devices. SANs allow multiple servers of different types and platforms to access the same storage drives. They utilize a special network switch called a SAN switch which also supports the Fibre Channel standard.

Because a SAN is dedicated to communication between hosts and storage arrays, it can more efficiently deal with storage network traffic than can a LAN that must also accommodate other non-storage related traffic.
Local Area Networks (LANs):

A LAN uses the Ethernet network standard and the IP protocol. Think of it as a general-purpose network used to handle a variety of network needs like sending emails, collaborating with project teams, and printing a file to a network printer. It provides networking for basic communication between computers, printers, network switches, shared storage drives, and other network devices.

Data in a file level storage configuration can be shared by multiple applications and systems. To accomplish this, the network must use a protocol that enables multiple applications to share the same data and files on specific storage drives. Common Internet File System (or CIFS) is the standard use in Windows environments, and Network File System (or NFS) in Linux environments. Later in the storage section you will learn more about file level storage.

Block level storage can also be accessed over a LAN using the Internet Small Computer System Interface (or iSCSI) which is a modified version of the SCSI standard used in Fibre Channel networks. You will learn later that this protocol is used to provide access to block level storage in a Vblock System model that does not have a SAN.
Vblock System Network Components

Now you know a little more about LAN and SAN networks, so let’s turn our attention to the specific network components found in converged and hyper-converged infrastructure products.
Network Components

Dell EMC converged and hyper-converged infrastructure products utilize various network components. The four that we'll discuss here include Cisco LAN switches, Cisco SAN switches, Cisco Unified Network Switches, and the Cisco Nexus 1000V virtual switch. Let's talk about each of these one at a time.
Cisco LAN Switch:

All Dell EMC converged and hyper-converged products contain LAN switches that are responsible for managing Ethernet network communications, both within these systems as well as outside the system to connect to company networks.

When data is sent through a LAN, a LAN switch receives data from the sending device, identifies the destination device, and then delivers that data to the device for which it is intended. For example, if a user wants to print a page of a document, instructions are sent from the computer into the network. The LAN switch receives the message and forwards it directly to the appropriate printer where the page is printed.

In Dell EMC converged infrastructure systems, the LAN switch provides Ethernet connectivity between the compute and storage layers, as well as to the site network. In hyper-converged products, it provides connectivity between servers and to the site network.

Each switch comes with a number of physical ports. Ports can be added using an expansion module to increase the network’s capacity. It is important to understand that not all the physical ports that come with a switch or expansion module are automatically licensed. For example, a switch will come with multiple ports, but with licenses to use only some of them. Licenses can be purchased to activate the unlicensed ports at any time. All the ports on a switch or expansion module can be used only if licenses for each port have been purchased.
A SAN switch performs pretty much the same tasks as a LAN switch, it just does so on a SAN, not a LAN. As you learned earlier, a storage area network (SAN) is dedicated to communications between computer hosts and a storage arrays. Because it does not share capacity with other types of network traffic, storage related communications can happen more efficiently on a SAN. A SAN switch directs the flow of data between hosts and storage arrays. Both the SAN and SAN switches work using the Fibre Channel network protocol.

As mentioned earlier for Vblock and VxBlock converged infrastructure systems, SAN and SAN switches support booting of compute servers over the network. When one of these servers is turned on, it communicates with storage drives over the SAN to retrieve and boot the server's operating system. Each Vblock and VxBlock System contain two SAN switches.
Unified Network Switch:  

Instead of separate LAN and SAN switches, older converged infrastructure systems, that have been discontinued, may contain Cisco Unified Switches. A unified switch eliminates the need for separate LAN and SAN switches. It can perform the switching tasks associated with both Ethernet and Fibre Channel networks. There are a couple of factors that can influence the decision to use unified switches: First, the maximum number of network ports on unified switches may not be sufficient for a customer’s connectivity needs.

Generally speaking, a network with separate LAN and SAN switches will have a great number of network ports for traffic to flow through. Think of the ports on a network switch as driving lanes on a highway. More lanes mean the road can accommodate more traffic with fewer slowdowns. The number of network ports effects the capacity of a network to carry traffic. The more switches and switch ports contained in a network, the greater the traffic volume the network can handle.

Unified switches usually have fewer ports and therefore cannot support as much network traffic. Which is a reason why they are not offered in current Vblock and VxBlock systems. The combination of LAN and SAN switches offer a greater maximum number of ports than configurations using unified switches.
Cisco Virtual Switch:

The Cisco Nexus 1000V series switch is software not hardware like the LAN, SAN, and unified switches. It is designed for a virtualized environment. You’ll learn more about virtualization soon. But for now, what you need to know is that virtualization is a means of using the resources of a system (like CPU, memory, and storage) and assigns them to virtual machines. A virtual machine is not a physical computer, but it can perform like a real computer running an operating system and applications. In Dell EMC Systems, many virtual machines can be created as servers running specific applications. This can be a difficult concept to get your arms around right now, but you’ll learn much more about it later.

For now, understand that the Cisco Nexus 1000V virtual switch software plays the same role in a virtual network, that a LAN, SAN, and unified switch does in a physical network. Specifically, a virtual switch controls communications between virtual machines on a virtual network, and between a virtual network and a physical network.

Cisco Nexus 1000V switches are standard components in all Vblock and VxBlock System configurations. You’ll learn lots more about virtualization soon!
The last topic for this section addresses network connectivity. Here, you will learn how the components of the network provide connectivity both inside and outside of a Dell EMC converged and hyper-converged infrastructure systems.
You’ve already learned about the connectivity related to Dell EMC converged and hyper-converged infrastructure compute components. We’ll build on that here and focus now is on the connectivity of the network components.

Remember that network components provide connectivity inside and outside of the converged and hyper-converged infrastructure system. Inside it connects the internal components including compute and storage technologies. Outside it provides connectivity to a customer’s site network.
Vblock and VxBlock Systems can come with two Cisco LAN switches. In systems with blade servers, each LAN switch is connected to both Fabric Interconnects. This provides redundancy, if one switch breaks down, the other can manage the connectivity needs from all the blade servers.

As you learned, LAN switches are responsible for providing Ethernet connectivity so the site network can access compute components. The compute Fabric Interconnects are connected directly to the LAN switch which then connects to the site network. The LAN switch also provides connectivity between the site network and storage so that file level storage can be accessed from users and computers outside of the Vblock or System. Later in the next section, you'll will learn more specifically about how connectivity is made to storage components.

Vblock and VxBlock Systems can also have two SAN switches. Remember that a SAN utilizes the Fibre Channel standard and the SCSI protocol to provide access to block level storage. These SAN switches manage data traffic between the compute servers and storage drives. The SAN switch connects to the Fabric Interconnect on the compute side, and then directly to system storage.

Notice that unlike LAN switches, each SAN switch connects to a single Fabric Interconnect. Redundancy is handled differently on the SAN side you will learn more about this later.
In a unified network configuration, there is no need for LAN switches. And there are no SAN switches either. These are replaced by two unified network switches. The unified switches will manage both LAN Ethernet network connectivity and SAN Fibre Channel network connectivity.
You learned earlier that some Vblock systems, that have recently been discontinued, do not have Cisco UCS blade components. These systems contain no blade servers, blade chassis, or fabric interconnects. Instead, they are engineered with Cisco UCS rack-mounted servers. In these Vblock Systems, the rack-mount servers are connected directly to the network switches. Notice that each server is connected to both network switches for redundancy.

Although these have been discontinued, you should understand how they are configured and work, in case you need to discuss them.
Hyper-Converged Infrastructure

The network components in VxRack Systems consists of two LAN switches, which are also referred to as system interconnect network switches. These switches have a couple of roles in VxRack systems. First, they provide connectivity between servers so data can travel between servers and their storage drives. You’ll realize that this is an important feature when later in this training we discuss virtualization and the pooling of resources across these servers. Note that each server is connected to both switches. The second role of these switches is to provide connectivity or an uplink to the customer’s network.

Remember, that VxRail Appliances do not come with network switches. These systems are connected to customer provided and managed network switches.
Congratulations! You’ve finished this section of the training. In this section, you learned about the function of the network technology in Dell EMC converged and hyper-converged infrastructure products. You learned about the differences between LANs and SANs. You also learned about the network components found in Dell EMC products. And finally, you learned about network connectivity in these converged and hyper-converged infrastructure products.

Now you’re ready for the network portion of the assessment. Click next to get started!