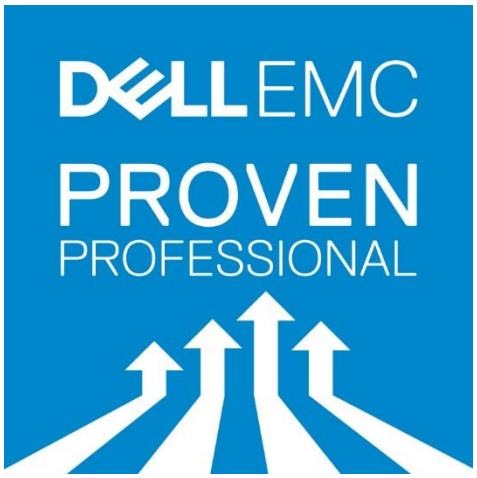

DELL EMC NETWORKING PROFESSIONAL EXAM STUDY GUIDE

EXAM CODE DNDNS-200

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Contents

Introduction

This Study Guide provides an overview of each topic on the Dell EMC Networking Professional certification exam and a list of technical resources for detailed information about each topic. Candidates should use the resources for further study and exam preparation.

Information about Dell EMC Networking Professional certifications, exams, and classes is available on the Dell EMC Certification Page and at http://www.Dell.com/certification.

Dell EMC Networking Professional Certification Preparation

Recommended training courses are listed in the Exam Description available on the Dell EMC Certification Page. Links to online practice tests are also provided on this page.

Class dates and additional course details are available at www.LearnDell.com

Who should take the exam

Candidates for the Dell EMC Networking Professional Exam should have a minimum of one year(s) of experience deploying and/or managing Dell Networking Hardware (N,S,C, and Z series) with additional industry experience of one to three years. Additionally, candidates should have the following knowledge, skills or experience:

- Configuration and troubleshooting network technologies
- Knowledge of Dell deployment process and tools
- Ability to perform typical deployment and/or cutover and integration

The exam covers installation, configuration, validation and troubleshooting Dell EMC Networking products. IT professionals and system administrators are required to pass the exam for certification.

Exam description

A detailed exam description is available on the Dell EMC Certification Page.

Purpose of this study guide

This Study Guide provides an overview of each topic on the Dell EMC Networking Professional Exam and a list of resources for detailed information about each topic. Candidates should use the resources for further study and exam preparation.

The intent of this Study Guide is to assist candidates with preparing for the exam by providing information and resources about topics as they relate to a Dell EMC Networking deployment. This Study Guide is not intended to give candidates all the information needed to pass the exam, as their experience in the field is expected to complement the Study Guide and product-related resources.

Finding the resources referenced in this guide

Resources and references for each topic are available either in the Service & Support section on the Dell Force10 portal at http://force10networks.com/. If a resource is not found on the portal, check the Support website at http://www.dell.com/support. On the Dell Support website, select **View products >Servers, Storage, & Networking > Dell Networking**. Log in to the sites before you attempt to access a resource; otherwise, a page error may be returned.

Note: Dell TechCenter is another resource you can consult for additional information. Dell TechCenter is an IT community where Dell customers and Dell employees share knowledge, best practices, and information about Dell products and installations.

Exam sections and topics

Pre Site and On Site

Network deployment or cutover plans, equipment and infrastructure to support deployment or cutover configurations.

Network deployment

Before going on site a deployment engineer should analyze the network deployment plan to determine whether sufficient information has been provided to successfully execute the proposed network deployment.

The plan should include: L2 and L3 protocols to be used as well as relevant configuration for those protocols, a list of all equipment to be used, and end goals of the project. The deployment engineer must confirm that the planned hardware and deployment plan will be able to meet the project's stated goals.

Resources

- Energy Smart Solution Advisor (ESSA)
- Partner Document Library
- Dell Networking Optics and Cables Connectivity Guide
- Expansion Modules for Dell Networking Switches v2.3
- Expansion Modules for Dell Networking Switches version 2.3
- Additional Resources

Cutover plans

Before going onsite, a deployment engineer should analyze the network cutover plan to determine whether sufficient information has been provided to successfully execute the cutover from an existing infrastructure to the proposed post-deployment network.

The plan should include relevant information such as existing: Spanning Tree, routing protocols, uplink cable types, subnets, and other networking equipment's make and model that will be connected to the new deployment. The cutover plan should also provide a plan for interoperating the planned protocols and hardware with that existing environment.

Equipment and infrastructure to support deployment or cutover configurations

Before going onsite, a deployment engineer and customer should confirm that there is sufficient space available in the rack to accommodate the switches. Power must be available in the rack, and the rack must be wired for connectivity to the management network and all networks that carry user data from the newly deployed Networking equipment to the existing infrastructure.

Rack space and infrastructure must meet the requirements of the N, S, C or Z-Series switches used. Examples of these requirements are cooling, safety, weight, power delivery systems, and electrical overload protection. Racks, rails, rail pins, mounting screws, cables, and assembly tools are needed for a safe and secure installation.

Resources

- Energy Smart Solution Advisor (ESSA)
- Partner Document Library
- Dell Networking Optics and Cables Connectivity Guide
- Expansion Modules for Dell Networking Switches v2.3
- Expansion Modules for Dell Networking Switches version 2.3
- Additional Resources

Physical Installation

Inventory, component placement, switch hardware and cabling, power-on procedure.

Inventory

Once onsite, a Deployment engineer must confirm that all equipment present first matches what was called for in the deployment plan, and second is actually what is needed to integrate a new deployment with the existing infrastructure.

The provided inventory will support the L2 and L3 protocols and capacity requirements called out in the Deployment plan. The Deployment engineer must now also confirm that the relevant existing environment matches expectations set during pre-deployment planning.

Resources

- Partner Document Library
- Dell Networking Optics and Cables Connectivity Guide
- Dell Force10 Hadoop Network
- Network Switch Configuration Guides for EqualLogic SANs
- Expansion Modules for Dell Networking Switches version 2.3
- Additional Resources

Component placement

Proper component placement is crucial to a good heat and power management plan, which can make or break a network deployment. Airflow must be properly planned so that equipment is not drawing in air from a hot aisle. Sufficient power must be available and reachable by the equipment when racked.

Prior to deploying a network, a Deployment engineer should verify, not just that enough rack space is available, but that the additional power and heat dissipation requirements for the equipment to be deployed are in place. Without these foundations, a successful deployment is not possible.

Resources

- Partner Document Library
- Additional Resources

Switch hardware and cabling

The Deployment engineer should verify that the cables selected for both data and power meet the needs of the customer. While it is easy to be sure that all the data cables between new equipment are the correct type, it can often be confusing when choosing correct cables to mate with an existing patch panel or directly connecting to other Networking equipment. Likewise, power cables must not only be chosen for compatibility with the power supply of a given switch, but with the form factor of the PDU outlet. Finally, cable length can be an issue. If plans have changed for which rack will be used for a deployment, or which part of a rack to use, the ordered cables might no longer be the correct length.

Candidates should recognize data transceiver and cable types, as well as common power cable NEMA standards.

Resources

- Dell Networking Optics and Cables Connectivity Guide
- Partner Document Library
- Link connectivity for DAC (Twinax) cables on Force10 switches.
- How to Manage the QSFP Ports on a Force10 S4810 Switch
- How to Manage QSFP Ports on a N4000 Series Switch
- Additional Resources

Power-on procedure

Whether stacking switches or operating them as standalone units, the N, S, C, and Z Series switches provide diagnostic codes and information through both LEDs and serial console access. These indicators tell a Deployment engineer the status of power, the boot up process, and stacking.

Candidates should be able to determine, based on provided information, the state of a switch from these diagnostic indicators.

Resources

- How to stack N4000 series switches
- How to Automatically Synchronize Firmware when Adding an N-Series Switch to a Stack
- Additional Resources

Configure

Firmware upgrade process, control and management plane protocols, switch parameters, VLANs, Spanning Tree protocols, basic dynamic routing protocols, LACP, ACLs, static routing, and/or multicast, VLT/MLAG, switch stacking concepts.

Firmware Upgrade Process

Dell Networking equipment ships from the factory with preloaded firmware. At the time of a deployment, the factory-loaded firmware may be out-of-date. Not all versions of firmware are

supported on every switch. Checking for updates then updating to the appropriate firmware is a requirement during deployment to ensure that the deployed firmware is supported and functioning properly for the customer's environment. Instructions on how to update the firmware for all Dell Networking switches come packaged with the firmware download.

Candidates should be familiar with the firmware update process for both DNOS 6 and DNOS 9, including methods of transferring the firmware to the switch, and update process.

Resources

- www.Dell.com/support
- www.force10networks.com
- How to Automatically Synchronize Firmware when Adding an N-Series Switch to a Stack
- Additional Resources

Control and management plane protocols

Control plane protocols

Control plane traffic is traffic generated by the switch or router, and destined to another switch or router that is generally directly attached. Control plane traffic shares information between networking devices for different purposes, depending on the protocol in question. Here are a few examples:

- ISDP
- CDP
- LLDP
- Spanning Tree (more on this in a later section)
- UDLD

Resources

- Additional Resources

Management plan protocols

Networking equipment can be managed directly or remotely by many methods. Choosing the right one or ones will depend on the security requirements of the customer, and the preference of the deployment engineer and customer. Depending on the series, and how it is configured the switch could be managed by:

- Serial
- HTTP
- HTTPS
- TELNET
- SSH
- SNMP (various versions)
- And more…

Candidates should be able to describe the different management methods enablement and use, as well as their benefits and limitations.

Resources

- How to configure N-Series for SNTP (Simple Network Time Protocol)
- Enable HTTPS/SSH and disable HTTP/Telnet for switch management on PowerConnect 7000 and N series switches
- How to set a username and password for Web, Telnet access on PowerConnect and N series switches
- How to configure Radius or TACACS authentication for switch management on N series switches
- How to set a management IP address on Dell Networking Force10 Switches
- How to set up management access for the N2000, N3000, and N4000 series switches
- Additional Resources

Switch parameters

While everything in this guide could refer to switch parameters, here we will take it to mean CLI navigation, user privileges, and many common configurations not specified in other sections of this guide. Some examples are provided below:

- User privileges
- CLI navigation
- DHCP relay/ IP helper
- MTU
- RSPAN

Candidates should be able to recognize and, or, provide correct CLI syntax for the N, S, C, and Z Series for a given management or networking protocol.

Resources

- How to perform interface range commands on 7000, 8000, 8100, M6220, M6348, M8024-K N2000, N3000 and N4000 series switches
- How to save and back up your configuration on Dell PowerConnect, Force10, and N series switches
- How to configure MTU (Maximum Transmission Unit) for Jumbo Frames on Dell Networking Force10 switches
- How to Manage the QSFP Ports on a Force10 S4810 Switch
- Dell Networking Force10 Bare Metal Provisioning (JumpStart)
- How to set a management IP address on Dell Networking Force10 Switches
- How to manage Network Time Protocol on Dell Networking Force10 Switches
- How to Manually Set Time and Date on Dell Networking Force10 Switches
- Grep and Advanced Grep in FTOS
- How to perform interface range commands on Force10 Switches
- Additional Resources

VLANs

VLANs (Virtual Local Area Networks) are a widely implemented IEEE technology that may split up a switch into multiple broadcast domains, and extend those separated broadcast domains across multiple switches with the use of 802.1Q tagging. The CLI syntax for creating and assigning VLANs is quite different for switches running DNOS 6 and DNOS 9.

Deployment engineers are expected to configure and demonstrate understanding of VLAN implementation on the N, S, C, and Z Series switches as well as understand techniques for interoperation between these lines and with other Networking vendors.

Resources

- How to use General Switchport Mode on Dell Networking PowerConnect Switches
- How to create a VLAN on Dell Networking Force10 Switches
- How to configure interfaces in Layer 2 mode on Dell Networking Force10 Switches
- Additional Resources

Spanning Tree protocols

Spanning Tree protocols provide for the elimination of logical loops within L2 networks. This often crucial technology may be implemented as part of a complex Networking topology that defines the flow of traffic.

Deployment engineers are expected to configure and demonstrate understanding of all supported Spanning Tree technologies for switches running DNOS 6 or 9. The candidate should further understand how these different Spanning Tree technologies interoperate when multiple technologies are implemented in the same environment.

Resources

- How to enable Rapid Spanning Tree (RSTP) on Dell Networking Force10 switches
- How to manage Multiple Spanning Tree (MSTP) on Dell Networking Force10 DataCenter Switches
- How to manage Per-VLAN Spanning Tree Plus (PVST+) on Dell Networking Force10 Switches
- How to manage Rapid Spanning Tree (RSTP) Thru Command Line on Dell Networking PowerConnect Switches
- How to enable Rapid Per-VLAN Spanning Tree (Rapid-PVST) or Per-VLAN Spanning tree (PVST) for the N-Series switches
- PVST on Force10 switch blocks untagged VLAN or puts port into err-disable when connected to Cisco or other third party switches
- Additional Resources

Dynamic routing protocols

Dynamic Routing protocols allow for routers (and L3 switches) to dynamically share routing information between themselves. Multiple routing protocols are supported across the DNOS 6 and 9 platforms. The different routing protocols have advantages and disadvantages. Depending on the existing Routing environment, and what is called for in a new installation, different routing protocols may be required.

Candidates should be familiar with the routing protocols particular to N, S, C, and Z Series switches, as well as be able to configure and describe their functionality and redistribution.

Resources

- Additional Resources

LAG (Link Aggregation Group)

Link Aggregation Groups allow multiple physical interfaces to be bound into a single logical interface that allows for increased bandwidth while maintaining link redundancy. Dell Networking switches fully support the IEEE standard (802.3ad) for link aggregation. These standards based LAGs allow for full interoperability with any other standards based Networking devices.

Candidates should be familiar with IEEE LAGs available and their configuration on Dell Networking switches.

Resources

- How to create Link Aggregation Groups (LAGs) on Dell Networking PowerConnect Switches
- How to create Link Aggregation Groups (LAGs) on Dell Networking Force10 Switches
- Additional Resources

Access Control List (ACL)

Access Control Lists offer stateless traffic filtering on either ingress or egress traffic passing through an interface. This filtering allows a deployment engineer to prevent undesired traffic of a specific source, destination, protocol, or application from passing on some or all of the network.

Candidates should be familiar with ACL concepts and applications, as well as the relevant CLI syntax for switches running DNOS 6 and 9.

Resources

- N-series and ACL Hardware Limitation
- Additional Resources

Static Routing

Static routes allow a deployment engineer to statically set the next hop router for a specific destination network. Static routes also allow for minimal overhead in a non-redundant routing environment, or subset of a larger environment.

Candidates should be familiar with concepts and CLI syntax for Static Routing on switches running DNOS 6 and 9.

Resources

- How to configure an IP Address on Dell Networking Force10 Switches
- Additional Resources

Multicast L2 and L3

Multicast traffic allows a source to transmit traffic to a select group of recipients who join the group, without transmitting to everyone on a broadcast domain, or all broadcast domains. To accomplish this filtering by group a deployment engineer must implement L2 multicast

technologies like IGMP (Internet Group Management Protocol), and for routing that traffic an L3 technology like PIM (Protocol Independent Multicast) routing. PIM requires an underlying IP routing infrastructure.

Candidates should be familiar with multicast traffic flow and L2 and L3 mechanisms and CLI syntax such as: IGMP snooping and querier as well as PIM.

Resources

- Understanding IGMP Snooping
- L2 Multicast Traffic is Flooded in the VLAN with no Receivers
- Additional Resources

VLT/MLAG

Link Aggregation Groups allow multiple physical interfaces to be bound into a single logical interface which allows for increased total link bandwidth while maintaining link redundancy. DNOS 6 and 9 both include implementations beyond the IEEE 802.3ad standard. MLAG for N-Series and VLT for S,C,Z-Series allow for not just link, but switch redundancy that traditional Link Aggregation can't offer without having to rely on stacking switches.

Candidates should be familiar with VLT/ MLAG technologies on switches running DNOS 6 and 9, as well as their limitations, capabilities, and interoperability.

Resources

- How to create Link Aggregation Groups (LAGs) on Dell Networking PowerConnect Switches
- Dell Networking N-Series MLAG v1.3
- How to set up Virtual Link Trunking (VLT) on Dell Networking Force10 Switches
- VLT failover testing recommendation
- Virtual Link Trunking overview
- Additional Resources

Stacking

Stacking allows multiple physical switches to operate as a single logical unit with combined management and control plane functionality. Often switches use dedicated stacking links for backplane communication, but some models may use Ethernet (user/ front side) ports in a special 'Stack' mode for this backplane communication. Stacked switches generally have very rigid hardware and firmware requirements for a unit to join a stack.

Candidates should be familiar with stacking technologies and the specific stacking methods, requirements, CLI syntax, used in the various N, S, C, and Z Series switches that allow stacking. They should also be familiar with the general benefits and drawbacks of stacking switches.

Resources

- How to Automatically Synchronize Firmware when Adding an N-Series Switch to a Stack
- How to create a Stack on a Dell Networking Force10 S4810 model Switch
- How to stack N2000 or N3000 switches
- How to stack N4000 series switches
- Additional Resources

Validation

Operational show commands and reachability tests, VLAN functionality, spanning tree protocol, routing protocols, CLI response, VLT/MLAG functionality and configuration.

Reachability tests

When validating a network it is important to confirm that relevant end nodes are able to communicate with each other through the newly deployed network. To that end a deployment engineer might use ICMP from the end nodes. And on the switch, debug, log commands, console output, and system logs, to determine that network traffic is taking the prescribed path through the network.

Given the output of ping/ traceroute tests, or the above CLI commands, candidates should be able to identify whether traffic has successfully traversed the correct path. Candidates should also be able to suggest the correct tool to verify reachability for a given situation.

Resources

- Additional Resources

VLAN verification

VLANs (Virtual Local Area Networks) are a widely implemented IEEE technology that may split up a switch into multiple broadcast domains, and extend those separated broadcast domains across multiple switches with the use of 802.1Q tagging. The CLI syntax for creating and assigning VLANs is quite different for switches running DNOS 6 and 9.

Candidates should be able to identify correctly configured VLANs and VLAN to port assignment on the N, S, C, and Z Series of switches.

Resources

- How to use General Switchport Mode on Dell Networking PowerConnect Switches
- How to create a VLAN on Dell Networking Force10 Switches
- How to configure interfaces in Layer 2 mode on Dell Networking Force10 Switches
- Additional Resources

Spanning Tree verification

Like most of Networking, Spanning Tree configuration depends on looking at the larger picture. A Deployment engineer must decide what role any one switch will have as part of that larger Spanning Tree environment. It is important to understand how different Spanning Tree

protocols will behave in a given situation, as a single switch may behave differently depending on the protocol chosen.

Candidates should be able to interpret Spanning Tree information given to them to determine how the Networking components will act.

Resources

- How to enable Rapid Spanning Tree (RSTP) on Dell Networking Force10 switches
- How to manage Multiple Spanning Tree (MSTP) on Dell Networking Force10 DataCenter Switches
- How to manage Per-VLAN Spanning Tree Plus (PVST+) on Dell Networking Force10 Switches
- How to manage Rapid Spanning Tree (RSTP) Thru Command Line on Dell Networking PowerConnect Switches
- How to enable Rapid Per-VLAN Spanning Tree (Rapid-PVST) or Per-VLAN Spanning tree (PVST) for the N-Series switches
- PVST on Force10 switch blocks untagged VLAN or puts port into err-disable when connected to Cisco or other third party switches
- Additional Resources

Routing protocols verification

BGP, OSPF, and RIP are Routing Protocols that share L3 network path information between routing devices, though each in their own way. This sharing of routing information between routers allows for the potential of a self-healing and redundant L3 network. It is possible for routers to run multiple routing protocols simultaneously, and so share information between more than one protocol.

Given the CLI output from N, S, C, or Z Series switches, a candidate should be able to interpret how these routing protocols are configured.

Resources

- How to Configure Virtual Router Redundancy Protocol (VRRP) on Dell Networking Force10 switches
- Additional Resources

Command Line Interface output

Like most enterprise Networking devices, the Dell Networking Series switches are primarily managed by Command Line Interface (CLI). DNOS 6 and 9 each have their own syntax of correct commands and required order of operations for completing a task. When that syntax or order of operations isn't followed the Networking equipment will respond to let a deployment engineer know that something isn't right.

Given the CLI output from an N, S, C, or Z Series switch, a candidate should be able to verify that a given protocol is operating correctly.

Resources

- Additional Resources

VLT/MLAG verification

MLAG for N-Series and VLT for S,C,Z Series are different technologies with the same goal at heart. They allow a single side of a Link Aggregation Group (LAG) to be split between two switches and present an industry standard LAG to the partner switch.

Candidates should be able to interpret CLI output to verify that an MLAG or VLT is fully functional.

Resources

- How to create Link Aggregation Groups (LAGs) on Dell Networking PowerConnect Switches
- Dell Networking N-Series MLAG v1.3
- Virtual Link Trunking overview
- How to set up Virtual Link Trunking (VLT) on Dell Networking Force10 Switches
- VLT failover testing recommendation
- Additional Resources

Troubleshooting

Troubleshooting steps, operational ping, show commands, reachability tests, and device indicators

Show command output

Like most enterprise Networking devices, the N, S, C, and Z Series are primarily managed by Command Line Interface (CLI). Show commands are commands that display the current status of configuration or protocols on a networking device.

Candidates should be able to interpret show command output to determine next steps for a given troubleshooting situation.

Resources

- Additional Resources

Reachability tests

- Ping and traceroute are two examples of ICMP protocol tools that can be used to troubleshoot network connectivity. It is also important to understand the source and destination of traffic, as well as what path is being tested.
- Candidates should understand how to use ping and traceroute on Dell Networking switches and understand the output when run from clients on the network. Candidates should understand the advantages of ICMP tools in troubleshooting a network.
- When testing reachability, ICMP is not the only test available to a Deployment engineer. LLDP, CDP, MAC address tables, Routing tables, are just some examples of indicators of communication between nodes in a network. Depending on what level of communication does occur between nodes will tell a Deployment engineer what a likely solution to the problem at hand may be.

Given a scenario, candidates should be able to interpret CLI output to determine next steps in troubleshooting a network, or determine a likely solution to a problem.

Resources

- Additional Resources

Device indicators

When troubleshooting hardware, both physical and CLI indicators may provide helpful information that will point a deployment engineer to a solution. Whether it is the color of an LED or the output of the "show inventory" command, a great deal can be determined about the current status of the hardware.

Given a scenario and device indicator, candidates should be able to determine next steps in troubleshooting hardware, or determine a likely solution to a problem.

Resources

- Expansion Modules for Dell Networking Switches v2.3
- How to Manage QSFP Ports on a N4000 Series Switch
- How to Manage QSFP Ports on a N4000 Series Switch
- Additional Resources

Additional Resources

Networking Reference Guides

Resources not specifically called out above are listed here. These guides cover a wide range of topics that would be applicable to all sections of the exam.

- Dell Networking N-Series CLI Reference Guide
- Dell Networking N-Series User Guide
- Dell Networking N-Series User Configuration Guide
- Dell Networking S4810P Manuals
- Dell Networking S4820T Manuals
- Dell Networking S5000 Manuals
- Dell Networking S6000 Manuals
- Dell Networking C Series Manuals
- Dell Networking Z9000 Manuals
- Dell Networking Z9500 Manuals

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