

Fault Tolerance Configuration with a Dell Networking R1-2210 10GbE Switch Module in a VRTX Chassis

How to deploy a Dell PowerEdge VRTX chassis with a Dell PowerEdge M830 blade server and an R1-2210 10GbE Switch Module in a redundant configuration

Dell Engineering
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Revisions

Date	Description	Authors
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December 2014	Initial release	Ed Blazek, Curtis Branch, Michael Matthews

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1 Introduction

In today's business environment, the need for high speed and reliable access to network resources is more important than ever. Business can be lost and user productivity can plummet because of network congestion or network downtime. If these issues become chronic, they can drastically affect the business's bottom line.

A 10GbE Switch Module (R1-2210) installed in a Dell PowerEdge VRTX chassis with dual Dell PowerEdge M830 blade servers and configured with fault tolerant networking paths can provide the speed and reliability today's businesses demand. In addition to redundancy, the R1-2210 switch module also provides a 10GB path from the PowerEdge VRTX to the Local Area Network (LAN).

This guide provides the details necessary to deploy redundant configurations using the Dell R1-2210 switch module. The first configuration deploys a VRTX chassis with dual Dell PowerEdge M830 blade servers and an R1-2210 10GbE Switch Module. This redundant configuration includes a pair of stacked Dell Networking N3048 switches. The second configuration deploys a VRTX chassis with dual Dell PowerEdge M830 blade servers and an R1-2210 10GbE Switch Module. This deployment includes a QLogic BCM57810 Dual-port 10GbE PCIe adapter with a pair of stacked Dell Networking N3048 switches.

1.1 Audience

Dell Networking Solutions Engineering (DNSE) intends this guide for network administrators and/or network engineers. These individuals should have a thorough working knowledge of network connectivity, IP addressing and Command Line Interface (CLI) switch configuration. They must also understand and have experience using Link Aggregation (LAG), port channels and Virtual LANs (VLANs). In addition, the audience must have the appropriate permissions to configure the switches and change the server's network settings.

1.2 Objectives

In scope

This deployment guide illustrates two configuration scenarios that utilize one or more of the following components:

- Dell PowerEdge VRTX chassis
- Dell PowerEdge M830 servers
- Dell Networking N3048 switches
- Dell Networking 10GbE R1-2210 switch modules
- QLogic BCM57810S Dual-port 10GbE network daughter cards (NDC)
- QLogic BCM57810 Dual-port 10GbE PCIe adapters

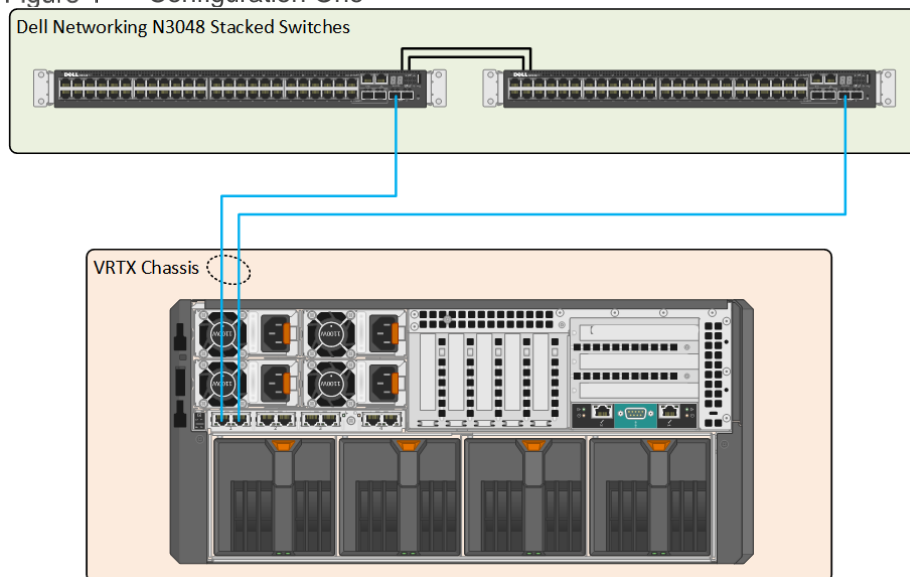
Refer to section 2.1, Hardware components, for details on these components. The following information covers the objectives of each configuration scenario.

Configuration One:

Redundancy using Dell PowerEdge M830 and the R1-2210 switch module

The objective of Configuration One is to use the R1-2210 switch module to provide all I/O connectivity to the VRTX chassis. For redundancy to the VRTX chassis, the configuration stacks Dell Networking N3048 switches.

Figure 1 Configuration One

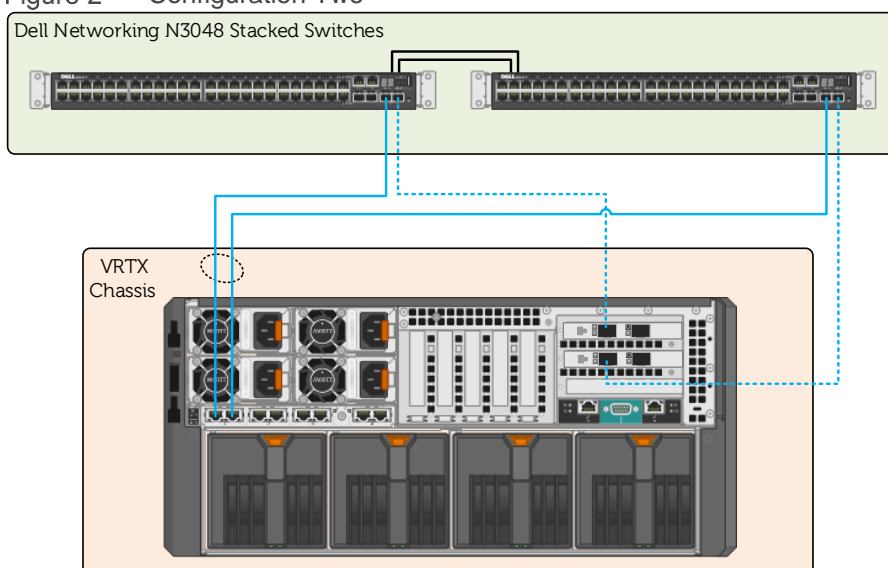


Configuration Two:

Added Redundancy for the R1-2210 switch module

The objective of Configuration Two is to increase the redundancy of Configuration One. The addition of two QLogic BCM57810 dual-port 10GbE PCIe adapters in the VRTX chassis accomplishes this. Each adapter maps to one of the M830 servers and links to the N3048 stack.

Figure 2 Configuration Two



Out of Scope

This guide does not cover the initial VRTX setup or connecting the VRTX to your environment. This guide also does not cover advanced configuration of the operating system (OS), including configuration of advanced fault tolerance or clustering from within the OS. The only exception is NIC teaming.

Click this link to go to the [Dell PowerEdge VRTX Manuals](#) page. Locate configuration information not found in this guide in the I/O Module Information section.

2 Component overview

2.1 Hardware components

This section provides an overview of the hardware components this deployment guide discusses. This solution is based on a Dell PowerEdge VRTX chassis containing two Dell PowerEdge M830 servers, a Dell Networking R1-2210 10GbE Switch Module and two Dell Networking N3048 switches. Refer to Table 1 through Table 4 for details on these components.

Table 1 VRTX chassis

Component	Description//Firmware Version
PowerEdge VRTX chassis	
Chassis Management Controller (CMC)	2.11.200
Chassis Infrastructure Firmware	2.21.a00
PCIe Devices Two QLogic BCM57810 10GbE PCIe adapters	8.07.25

Table 2 PowerEdge M830 server

Component	Description//Firmware Version
Dell PowerEdge M830	
Memory	64 GB DDR-3
Processors	Four - Intel Xeon E5-4650 2.1Ghz
Operating System	Microsoft Windows Server 2012 R2 Version 6.3 (Build 9600)
Sever BIOS	1.4.3
Integrated Dell Remote Access Controller (iDRAC)	2.30.30.30
Lifecycle Controller (LC)	2.30.30.30
OS Driver Pack	16.03.00
Complex programmable logic device (CPLD)	1.0.2
QLogic BCM57810S Dual-port 10GbE	8.07.25
QLogic BCM57810S Dual-port 10GbE - Driver	7.13.54.0
RAID Controller	25.4.0.0017
RAID Controller - Driver	6.603.07.00

Table 3 Dell Networking R1-2210 switch module

Component	Description//Firmware Version
R1-2210 Switch Module	2.0.0.58

Table 4 Dell Networking N3048 switch

Component	Description//Firmware Version
Dell Networking N3048 Switch	6.3.0.6
Modules	Dell Dual-port 10 Gigabit SFP+

2.2 Dell PowerEdge VRTX chassis

Figure 3 shows the Dell PowerEdge VRTX chassis. The VRTX chassis reduces the complexity of deployments in remote and branch offices by consolidating servers, storage, and networking in a 5U chassis. The VRTX chassis supports a maximum of four half-height or two full-height blade servers. It includes an internally shared storage infrastructure using an SAS-based PowerEdge RAID Controller (PERC) with 1GB cache. An internal Ethernet switch provides external connectivity to the client network. The unique configuration of the VRTX eliminates the need for external storage arrays and fabrics for connectivity to computer nodes. For more information about the Dell PowerEdge VRTX, visit [Dell PowerEdge VRTX Shared Infrastructure Platform](#)

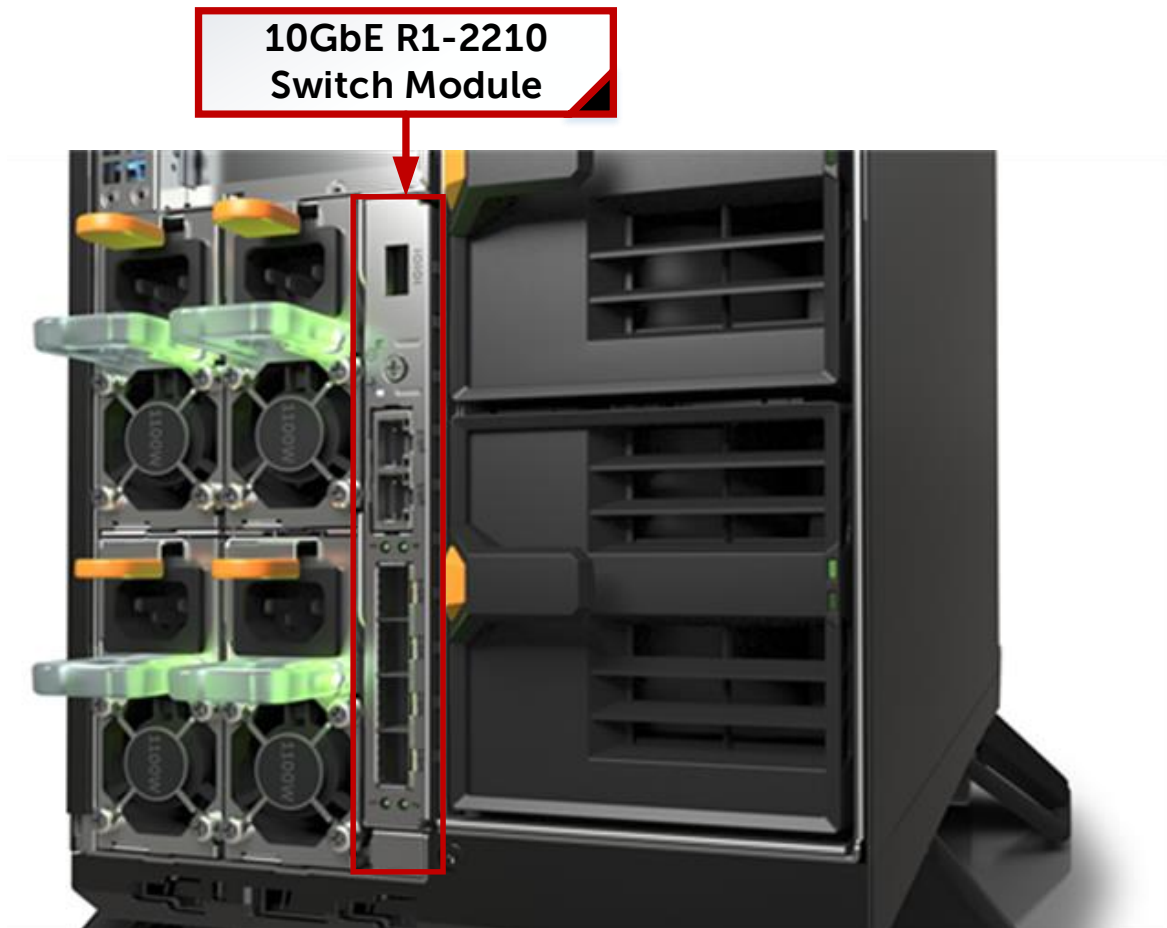
Figure 3 Dell PowerEdge VRTX chassis



2.2.1 Dell PowerEdge VRTX 10GbE R1-2210 switch module

Figure 4 shows a single R1-2210 switch module, which you can implement for all I/O. This allows a maximum signal consolidation without forcing bifurcation of the Ethernet fabric. The R1-2210 accepts up to 16 lanes from Fabric A and output of up to four lanes to the external ports. This switch is the only VRTX Fabric A device that supports the full four-lane count from Fabric A. For more information on VRTX Fabrics, refer to [Dell PowerEdge VRTX Fabrics Port Mapping and Connectivity](#) section. When equipped with two M830 servers and dual-port NDCs, the PowerEdge VRTX can take advantage of eight internal ports (four per M830). For more information about the PowerEdge VRTX 10GbE R1-2210 switch module, visit [Product Support for PowerEdge VRTX](#).

Figure 4 Dell PowerEdge VRTX 10GbE R1-2210 switch module



2.2.2 Dell PowerEdge M830

Figure 5 shows the blade server selected for this solution, the best-in-class Dell PowerEdge M830 Server. This full-height blade server is a feature-rich, quad-processor platform that offers a blend of density, performance, efficiency and scalability. The M830 offers remarkable computational density, scaling up to 72 cores, 4 Intel Xeon processors and up to 3TB of DDR4 memory. All this comes in an extremely compact, full-height blade form factor. For more information about Dell PowerEdge M830 server, visit [Product Support for PowerEdge M830](#)

Figure 5 Dell PowerEdge M830 blade server



2.2.3 QLogic BCM57810S dual-port 10GbE network daughter card

Figure 6 shows a dual-port 10GbE NDC. Each PowerEdge M830 supports two dual-port 10GbE NDCs. Currently, Broadcom, Intel and QLogic each provide NDCs for the PowerEdge M830. In this deployment guide, each of the PowerEdge M830 servers houses two QLogic BCM57810S Dual-port, 10GbE NDCs.

Figure 6 QLogic BCM57810S dual-port 10GbE NDC



2.2.4 QLogic BCM57810 dual-port 10GbE PCIe adapter

Figure 7 shows a full-height, dual-port 10GbE PCIe adapter card. The PowerEdge VRTX chassis supports up to three full-height, full-length PCIe cards and five half-height, low-profile PCIe cards. Install Network Adapters to provide network access through Fabric B or C. The configuration this document uses has two QLogic BCM57810 full-height, dual-port, 10GbE PCIe adapters.

Figure 7 QLogic BCM57810 dual-port, 10GbE PCIe adapter



2.3 Dell Networking N3048 N-Series switches

Figure 8 shows the Dell Networking N3048 1/10GbE switch, which is optimized for lowering operational costs while improving manageability at branch offices. Dell EMC recommends the N3048 to compliment the Dell PowerEdge VRTX. The N3048 switch's Layer 3 capabilities help eliminate network bottlenecks while reducing management devices at the remote office. The high-density N3048 design provides 48 1GbE access ports with two 10GbE uplinks and four 10GbE uplinks with the optional, hot swappable, dual 10GbE module. Use Dell Networking OS stacking technology and high-speed, built-in stacking ports to stack up to 12 N3048 switches for creating a single logical switch. The N3048 offers the following features and options:

N3048 Features:

- Forty-six (10/100/1000) BaseT ports
- Two SFP ports
- Two 10GbE SFP+ ports

N3048 Options:

- Redundant PSUs
- One slot for 10GbE uplink (1000BaseT or SFP+)
- Two built-in stacking ports

Note: While the configurations outlined in this document use a pair of Dell Networking N3048 switches, any pair of N3000 Series switches can be utilized. For more information about the Dell Networking N-3000 series switches, visit: <http://www.dell.com/us/business/p/networking-n3000-series/pd>

Figure 8 Dell Networking N3048 switch

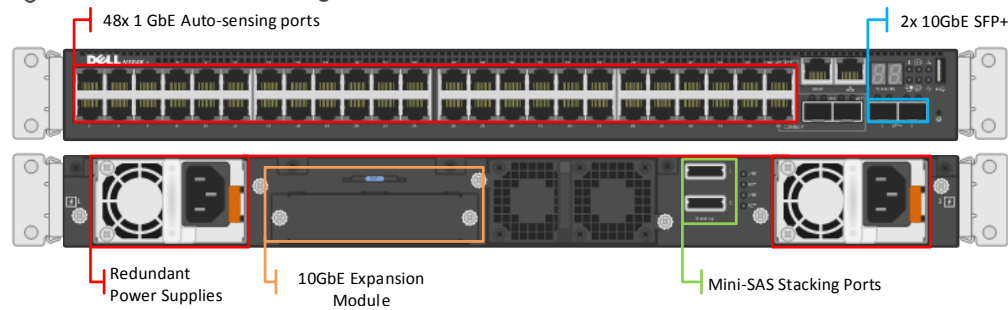


Figure 9 shows the SFP+ module designed for high-speed uplink data transmissions. You can install a Dell SFP+, dual-port, 10GbE module in the 10GbE expansion module at the back of the N3048 switch. It provides two SFP+ ports that support SFP+ 10GbE optical transceivers.

Figure 9 Dell SFP+ dual-port 10GbE module



2.4 Network topology

In the scenarios this deployment guide presents, the VRTX chassis contains an R1-2210 switch module and two PowerEdge M830 servers. Each of the servers has two QLogic BCM57810S 10GbE NDCs installed. For Environment B, the VRTX chassis adds two QLogic BCM57810 PCIe adapters.

Dell PowerEdge VRTX Fabrics Port Mapping and Connectivity

The PowerEdge VRTX chassis offers three separate fabrics (A, B and C). Fabric A refers to the Ethernet connectivity provided to the M830 servers by the 10GbE R1-2210 switch module installed in the VRTX chassis. Fabrics B and C refer to the PCIe connection between the Fabric B and C slots and the QLogic BCM57810 dual-port 10GbE PCIe adapter installed in the chassis.

The PowerEdge VRTX has eight PCIe slots at the back of the chassis. Five of the slots support low-profile cards and three slots support full-height cards. Each PCIe slot is associated with either Fabric B or C in the chassis and can be mapped to servers via the CMC. A PCIe slot in Fabric B connects to Fabric B of the server to which it is mapped. A PCIe slot in Fabric C connects to Fabric C of the server to which it is mapped. The PCIe slots are dedicated to one server at a time in the VRTX chassis and cannot be shared. Table 5 below shows characteristics of the PowerEdge VRTX PCIe slots:

Table 5 Dell PowerEdge VRTX PCIe Slots Overview

PCIe Expansion Slot #	Associated Fabric (B or C)	Supported Card Size
1	C	Full Height, Full Length
2	C	Full Height, Full Length
3	B	Full Height, Full Length
4	C	Low-Profile
5	C	Low-Profile
6	B	Low-Profile
7	B	Low-Profile
8	B	Low-Profile

Figure 10 shows the Fabric A mapping and connections used in Configuration One.

Figure 10 Configuration One - Fabric A mapping and connections

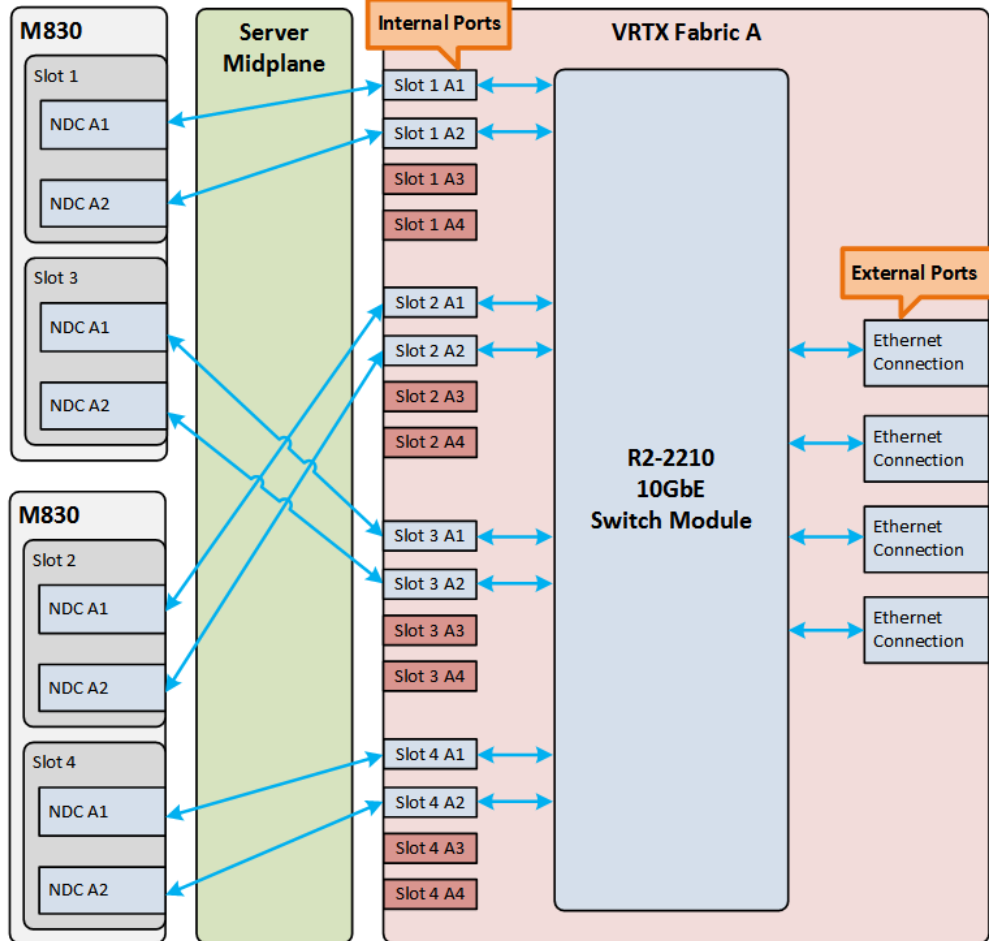
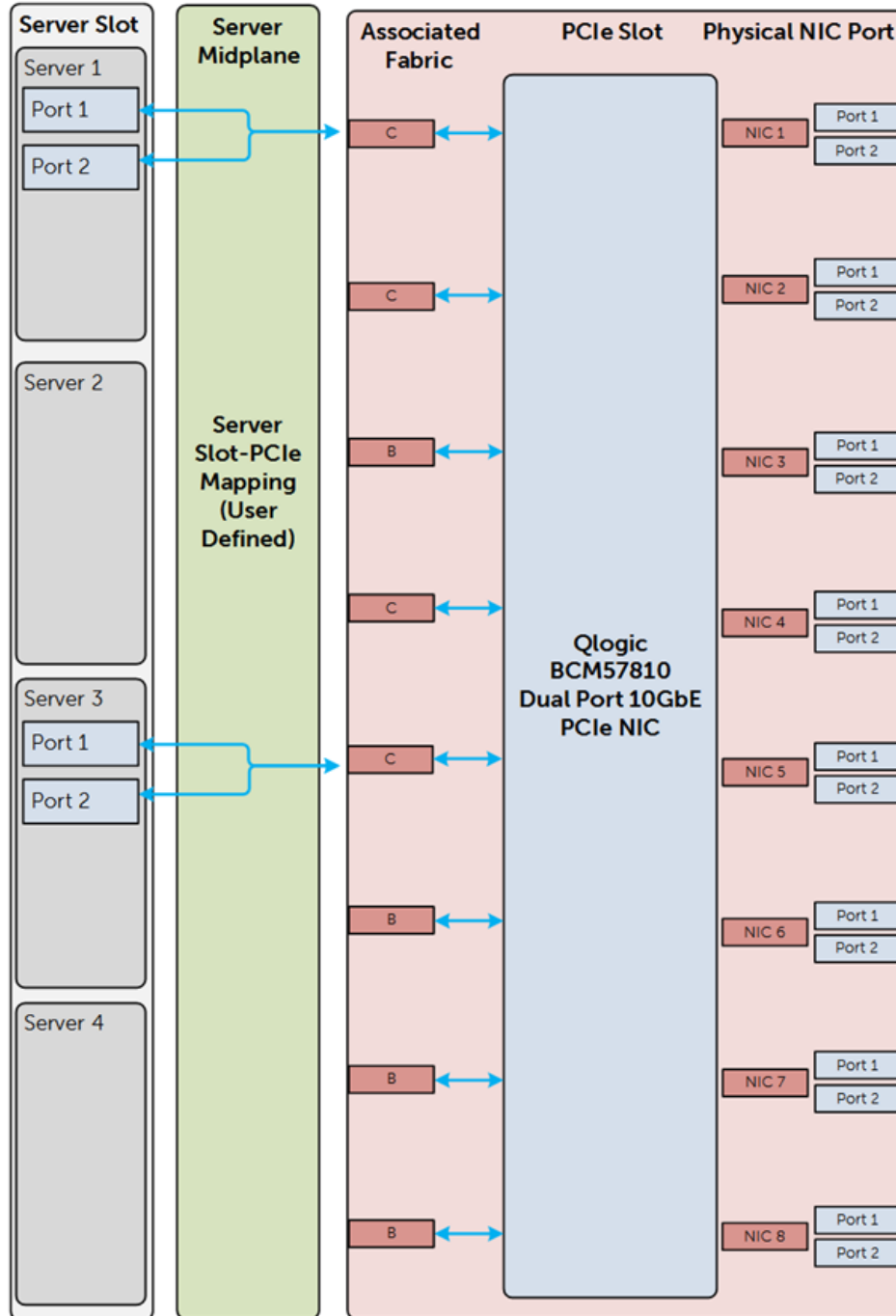


Figure 11 shows the Fabric C mapping and connections used in Configuration Two.

Figure 11 Configuration Two - Fabric C mapping and connections

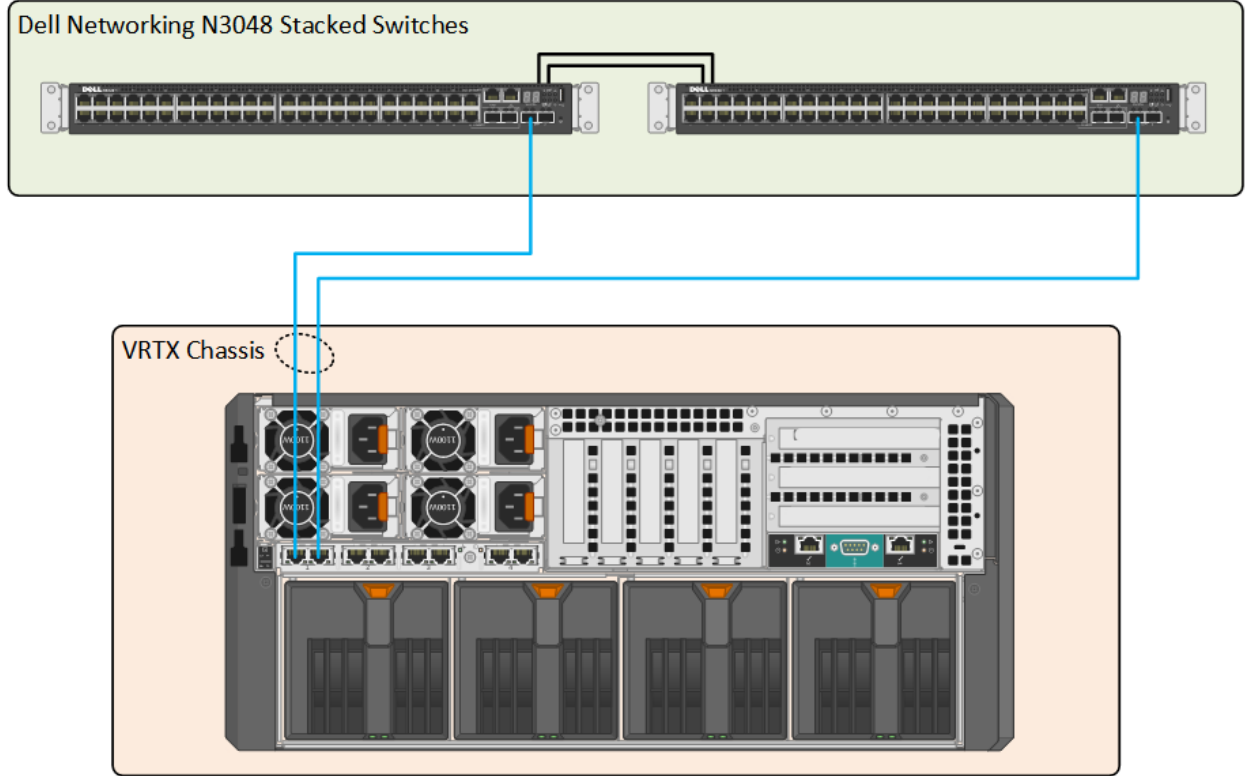


3 Configuration One

The first solution uses the R1-2210 switch module to provide all I/O connectivity. The configuration also stacks Dell Networking N3048 switches to provide redundancy for the PowerEdge M830 server. Figure 12 shows the physical topology of Configuration One.

Note: A drawback of Configuration One is the single-point-of-failure presented by the IOM. Configuration Two addresses this issue.

Figure 12 Configuration one - physical topology



3.1 Server roles and VLANS

This environment includes a specific, assigned role using a separate network for each PowerEdge M830 switch. As a best practice, create separate VLAN IDs to isolate these two distinct networks. Employees at the branch office use VLAN 20 for communication with the file server, mail server and so on. VLAN 30 hosts data accessed from a less secure network, such as the internet. Table 6 summarizes these VLANs and presents example network ranges and subnets. Actual addresses depend on your network.

Table 6 VLANS

VLAN ID	VLAN Name	IP Network	Subnet Mask	Purpose
20	Employee_Traffic	192.168.20.0	255.255.255.0	Internal Traffic
30	DMZ_Traffic	192.168.30.0	255.255.255.0	Public Traffic

3.2 Dell Networking N3048 switch configuration

This section presents the procedures for resetting N3048 switches to their factory defaults and then for stacking and setting the time on the switches. Set the time on the switch, create VLANs on the stacked units and assign IP addresses to both VLANs. Finally, create a port channel consisting of two 10 Gigabit ports to connect the N3048 stack to the R1-2210 switch.

3.2.1 Reset N3048 switch to factory defaults

Administrators must clear the two Dell Networking N3048 switches of all previous configurations before stacking. To clear the switches, reset each of the switches to factory defaults

To reset the Dell Networking N3048 switch to factory defaults, do the following:

1. Reload the switch and select **Option 2** in the **Dell Networking Boot Options** prompt during the switch startup.
2. Select **Option 10** in the **Boot Main Menu** prompt to restore the configuration to factory defaults.
3. Select option 9 to reboot the switch, as Figure 13 shows.

Figure 13 Commands to restore the N3048 to factory defaults

```
Console# reload
.
.
Dell Networking Boot Options
=====

Select a menu option within 3 seconds or the Operational Code will start
automatically...

1 - Start Operational Code
2 - Display Boot Menu

Select (1, 2)# 2

Boot Main Menu
=====

    1 - Start Operational Code
    2 - Select Baud Rate
    3 - Retrieve Logs
    4 - Load New Operational Code
    5 - Display Operational Code Details
    9 - Reboot
   10 - Restore Configuration to Factory Defaults
   11 - Activate Backup Image
   12 - Start Password Recovery

Enter Choice# 10

Are sure you want to Erase Current Configuration? (Y/N): y
Erasing Current Configuration...done.
```

```

Boot Main Menu
=====

 1 - Start Operational Code
 2 - Select Baud Rate
 3 - Retrieve Logs
 4 - Load New Operational Code
 5 - Display Operational Code Details
 9 - Reboot
10 - Restore Configuration to Factory Defaults
11 - Activate Backup Image
12 - Start Password Recovery

Enter Choice# 9

Rebooting...

syncing filesystems....This may take a few moments
Rebooting system!
The system is going down NOW!
Sent SIGTERM to all processes
Sent SIGKILL to all processes
Requesting system reboot

```

3.2.2 N3048 switch stacking

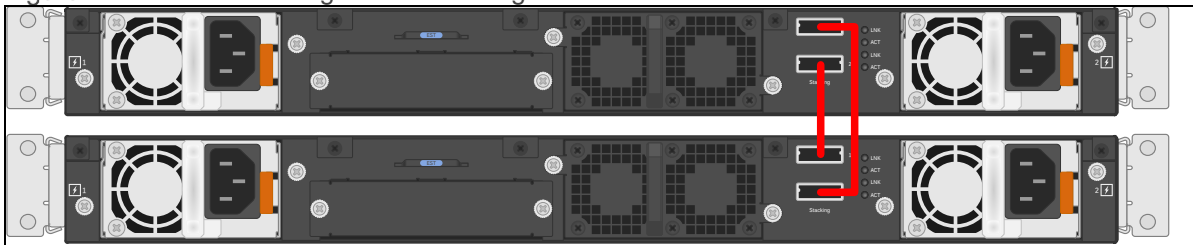
This environment uses a pair of N3048 stacked switches to provide redundancy at the top of the distribution layer.

To stack the switches, connect them as Figure 14 shows using the mini-SAS stacking cables.

To designate the master switch, allow the switch to boot up completely before powering up the second switch. After the switches have booted, the master switch serves as the management point for the stacked units. For additional information on stacking the N3048 switches, refer to the [Dell Networking N2000, N3000 and N4000 Series Switches User's Configuration Guide](#).

Note: You can only access and configure the master switch in the stack. You can access other stack members, but you cannot configure them.

Figure 14 Dell Networking N3048 stacking



After you can administratively access the switches, and enter the **show switch** and **show switch stack-ports** commands to verify the stacking configuration. Figure 15 shows the output of the show switch commands:

Figure 15 Commands to verify stacking configurations

Console# show switch						
SW	Management Status	Standby Status	Preconfig Model ID	Plugged-in Model ID	Switch Status	Code Version
1	Mgmt Sw		N3048	N3048	OK	6.3.0.6
2	Stack Mbr	Oper Stby	N3048	OK		6.3.0.6
console# show switch stack-ports						
Interface	Configured Stack Mode	Running Stack Mode	Link Status	Link Speed (Gb/s)	Admin Status	
Tw1/0/1	Stack	Stack	Link Up	21	Enabled	
Tw1/0/2	Stack	Stack	Link Up	21	Enabled	
Tw2/0/1	Stack	Stack	Link Up	21	Enabled	
Tw2/0/2	Stack	Stack	Link Up	21	Enabled	

3.2.3 N3048 CLI configuration

3.2.3.1 Set system time on the N3048 switch

To make troubleshooting (that is. reviewing the log files) easier in the event the configuration does not work properly, set the system time before configuring the switch. To set the system time, enter the commands that Figure 16 shows:

Figure 16 Commands to set system time

```

console>enable
console#configure
console(config)#clock set 11:44:00
console(config)#clock set 05/14/2016
console(config)#end
console#show clock
.11:44:16 CDT may 14 2016
No time source
console#copy running-config startup-config

```

3.2.3.2 VLAN configuration

This scenario uses two VLANs: 20 and 30. To create these VLANs, enter the commands that Figure 17 shows:

Figure 17 Commands to configure VLANs

```
console>enable
console#configure
console(config)#vlan 20
console(config-vlan20)#name Employee_Traffic
console(config-vlan20)#exit
console(config)#vlan 30
console(config-vlan30)#name DMZ_Traffic
console(config-vlan30)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters Configuration mode, creates VLANs 20 and 30, exits Configuration mode and saves the running configuration.

3.2.3.3 Port group configuration

To connect the N3048 stack to the R1-2210 switch module requires a port channel. To configure the port channel, enter the commands that Figure 18 shows:

Figure 18 Commands to configure port channels

```
console>enable
console#configure
console(config)#interface port-channel 1
console(config-if-Po1)#description "LAG from VRTX Te0/1-2"
console(config-if-Po1)#switchport mode trunk
console(config-if-Po1)#switchport trunk allowed vlan 20,30
console(config-if-Po1)#end
console# copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters Configuration mode, selects port channel 1 for configuration, assigns a description and sets the port channel as a trunk. This limits the VLANs to the ones created earlier (20 and 30). These commands exit configuration mode and save the running configuration.

Next, assign two 10GbE ports to the port channel group, as Figure 19 shows:

Figure 19 Commands to assign ports to port channel groups

```
console>enable
console#configure
console(config)#interface tengigabitethernet1/0/1
console(config-if-Te1/0/1)#channel-group 1 mode active
console(config-if-Te1/0/1)#exit
console(config)#interface tengigabitethernet2/0/1
console(config-if-Te2/0/1)#channel-group 1 mode active
console(config-if-Te2/0/1)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters Configuration mode, selects Ethernet TenGigabitEthernet port 1/0/1, assigns it to port channel 1 and exits port configuration. It then selects Ethernet TenGigabitEthernet port 2/0/1 and assigns it to port channel 1, exits Configuration mode and saves the running configuration.

3.2.4 N3048 validation

Verify the configuration by entering the **show interfaces port-channel** and **show vlan** commands, as Figure 20 shows:

Figure 20 Commands to verify the configuration

```
console#show interfaces port-channel
```

Channel	Ports	Ch-Type	Hash Type	Min-links	Local Prf
Po1	Active: Te1/0/1, Te2/0/1	Dynamic	7	1	Disabled
Po2	No Configured Ports	Static	7	1	Disabled
Po3	No Configured Ports	Static	7	1	Disabled
Po4	No Configured Ports	Static	7	1	Disabled
Po5	No Configured Ports	Static	7	1	Disabled

```
console#show vlan
```

VLAN	Name	Ports	Type
1	default	Po2-128, Gi1/0/1-48, Te1/0/2, Te1/1/1-2, Gi2/0/1-48, Te2/0/2, Te2/1/1-2	Default
20	Employee_Traffic	Po1	Static
30	DMZ_Traffic	Po1	Static

```
console#
```

Note: Irrelevant information has been removed from the output of the show commands in Figure 20 to highlight the configuration performed in this guide.

3.3 Dell Networking R1-2210 switch module configuration

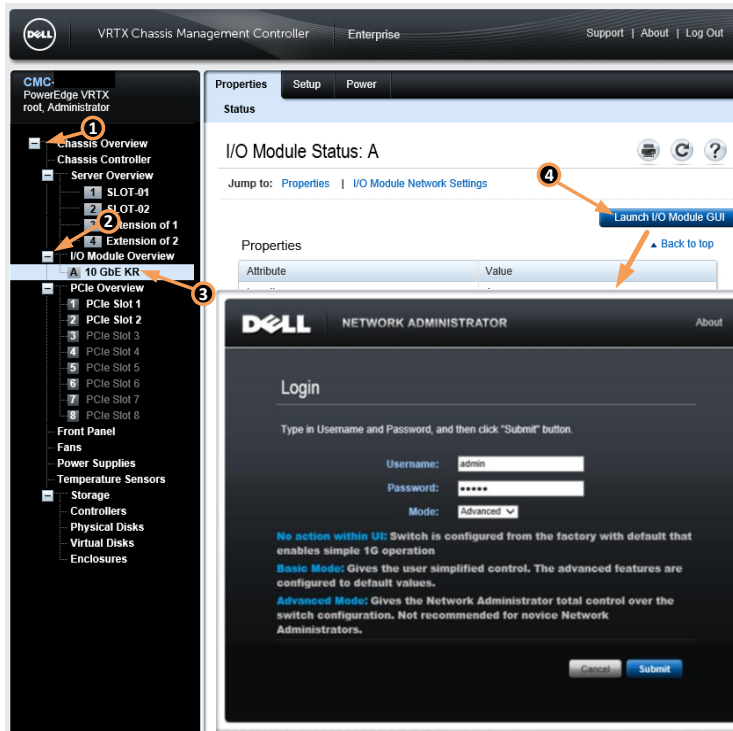
3.3.1 R1-2210 switch module management settings

You can manage the R1-2210 switch module in multiple ways. Examples in this document manage the R1-2210 switch by accessing it through Telnet and validate the configurations using the Dell VRTX CMC I/O Module GUI.

To launch the I/O module GUI, perform the following steps in the Dell VRTX CMC, as Figure 21 shows:

1. Expand the **Chassis Overview**.
2. Expand the **I/O Module Overview**.
3. Click the switch module.
The **I/O Module Status** window opens.
4. Click **Launch I/O Module GUI** button.
The Login Screen for the I/O Module GUI opens.

Figure 21 Launching the I/O Module GUI



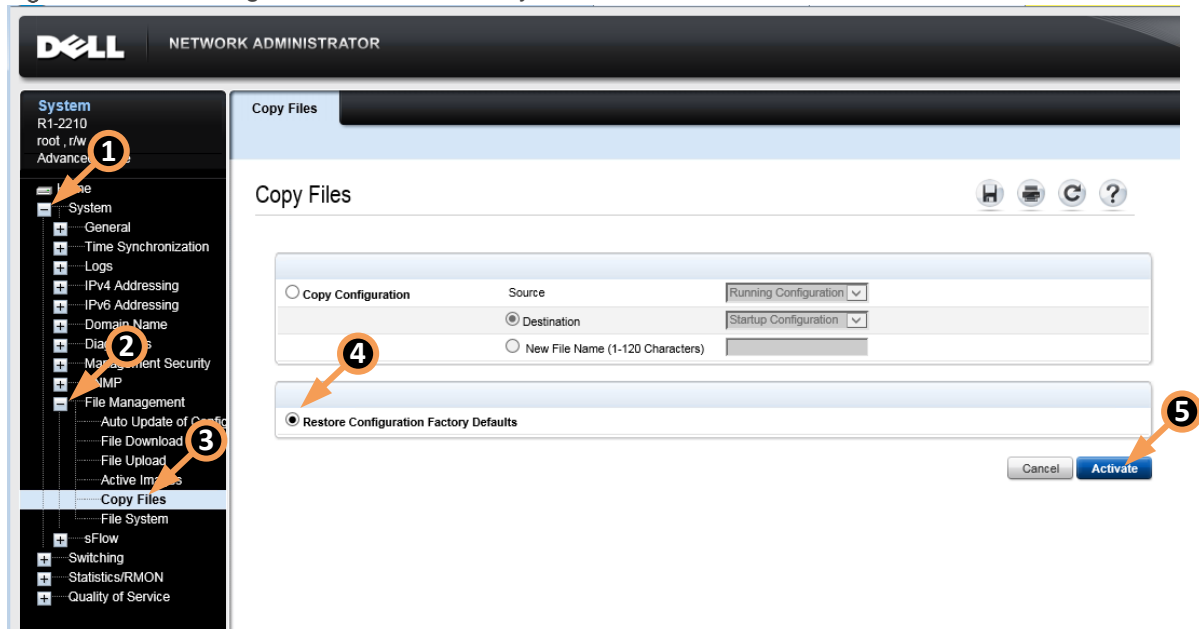
Note: This guide does not cover the configuration of the VRTX CMC. For CMC configuration information, refer to the [Chassis Management Controller Version for Dell PowerEdge VRTX User's Guide](#).

3.3.2 Reset R1-2210 Switch Module to Factory Defaults

You must reset the R1-2210 switch module to factory defaults before completing any configuration. To do this, perform the following steps in the R1-2210 I/O Module GUI, as Figure 22 shows:

1. Expand **System**.
2. Expand **File Management**.
3. Click **Copy Files**.
4. Select the **Restore Configuration to Factory Defaults** radio button.
5. Click the **Activate** button.

Figure 22 Resetting the R1-2210 to factory defaults



3.3.3 R1-2210 switch module CLI configuration

3.3.3.1 Set system time on the R1-2210 switch module

To make troubleshooting (that is, reviewing the log files) easier in the event the configuration does not work properly, set the system time before configuring the switch. To set the system time, enter the commands that Figure 23 shows:

Figure 23 Commands to set system time

```
console#clock set 11:44:00 14 may 2016
console#show clock
.11:44:16 CDT may 14 2016
No time source
```

3.3.3.2 VLAN configuration

Create VLAN 20 and 30 by entering the commands that Figure 24 shows:

Figure 24 Commands to create VLANs

```
console#configure
console(config)#vlan 20 name Employee_Traffic
console(config)#vlan 30 name DMZ_Traffic
console(config)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters into Configuration mode, creates VLANs 20 and 30, exits Configuration mode and saves the running configuration.

3.3.3.3 External-facing port group configuration

Enter the commands that Figure 25 shows to create and assign ports to port channel 1 for communication between the R1-2210 and the N3048 stack. Turn on Link Aggregation Control Protocol (LACP) with the **mode auto** option.

Figure 25 Commands to create and assign ports

```
console#configure
console(config)#interface port-channel 1
console(config-if)#description "LAG to N3048 stack"
console(config-if)#switchport mode trunk
console(config-if)#switchport trunk allowed vlan add 20,30
console(config-if)#exit
console#interface range tengigabitethernet0/1-2
console(config-if-range)#channel-group 1 mode auto
console(config-if-range)#end
console#copy running-config startup-config
```

3.3.3.4 Internal-facing port group configuration

You must create two additional port groups. These LAGs serve the M830 servers and allow redundancy between the two NDCs installed in each M830. Table 7 summarizes the LAG and the R1-2210's internal ports.

Table 7 R1-2210 – LAG and Internal Ports

	LAG Members		VLAN
M830 Slot-1	Slot 1 A1	Slot 3 A1	20
M830 Slot-2	Slot 2 A1	Slot 4 A1	30

3.3.3.5 Employee traffic LAG

This LAG handles all internal, employee-related traffic at the branch office and resides on the PowerEdge M830 in Slot 1/3 of the VRTX chassis. Enter the commands that Figure 26 shows to create the LAG:

Figure 26 Commands to create the LAG

```
console#configure
console(config)#interface Port-channel 2
console(config-if)#description Employee_VLAN
console(config-if)#switchport access vlan 20
console(config-if)#exit
console(config)#interface range TengigabitEthernet1/1, te3/1
console(config-if-range)#channel-group 2 mode auto
console(config-if-range)#end
console#copy running-config startup-config
```

This sequence first puts the switch in Executive mode. It then enters Configuration mode, selects port channel two for configuration and sets a description. Next, it sets the port to tag incoming packets with VLAN 20 and exits configuration for port channel 2. Then, after selection of an Ethernet range for two internal ports on the R1-2210, these two ports receive assignment to port channel 2 using LACP. The sequence completes by exiting Configuration mode and saving the running configuration.

3.3.3.6 DMZ traffic LAG

This LAG handles traffic coming from the Internet to the DMZ. A web server, public-facing file server or any sever role that needs to be in a traditional DMZ can use this LAG. Enter the commands that Figure 27 shows to create the LAG:

Figure 27 Commands to create a DMZ traffic LAG

```
console#configure
console(config)#interface Port-channel 3
console(config-if)#description DMZ_VLAN
console(config-if)#switchport access vlan 30
console(config-if)#exit
console(config)#interface range TengigabitEthernet2/1, te4/1
console(config-if-range)#channel-group 3 mode auto
console(config-if-range)#end
console#copy running-config startup-config
```

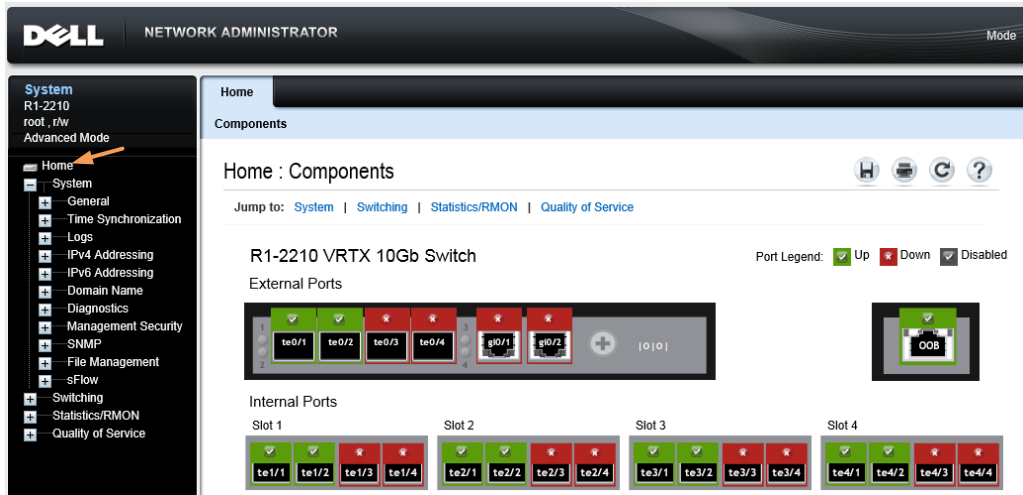
This sequence first puts the switch in Executive mode. It then enters into Configuration mode, selects port channel three for configuration and sets a description. Next, it sets the port to tag incoming packets with VLAN 30 and exits configuration for port channel 3. Then, after selection of an Ethernet range for two internal ports on the R1-2210, these two ports receive assignment to port channel 3 using LACP. The sequence completes by exiting Configuration mode and saving the running configuration.

3.3.4 R1-2210 switch module validation

Physical Port Status Verification

Verify the physical port's status by logging into the I/O Module GUI and selecting the **Home** option in the left pane, as Figure 28 shows:

Figure 28 Physical port status verification

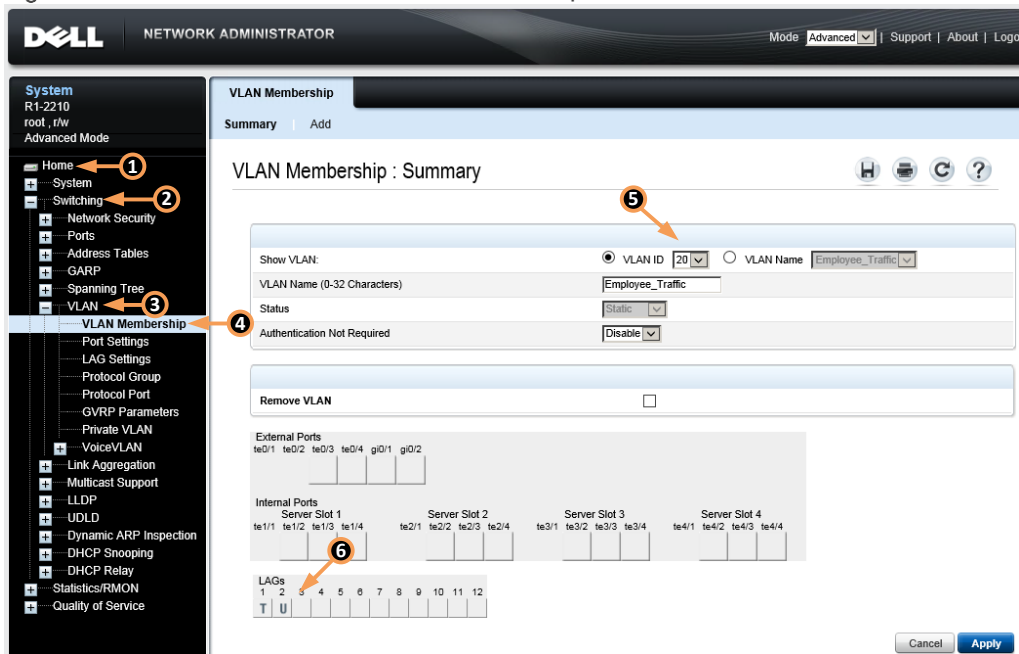


VLAN Verification

Ensure that the port groups you just created are added to the correct VLANs by performing the following steps, as Figure 29 shows:

1. Click **Home**.
4. Expand **Switching**.
5. Expand **VLAN**.
6. Select **VLAN Membership**.
The **VLAN Membership** page opens.
7. Select the **VLAN ID** from the drop-down box.
8. The **LAGs** display.

Figure 29 I/O module GUI – VLAN membership

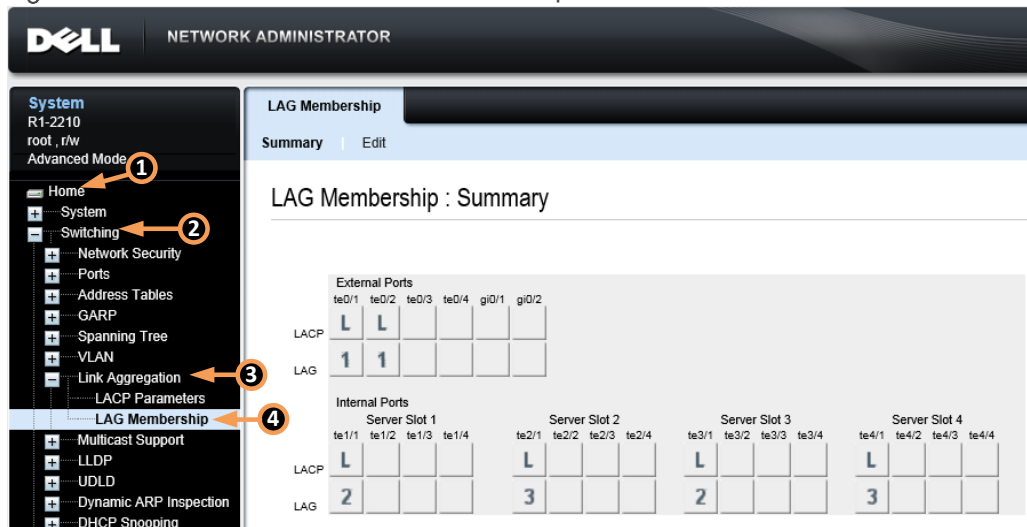


LAG membership verification

Verify port membership by performing following steps, as Figure 30 shows:

1. Click **Home**.
 2. Expand **Switching**.
 3. Expand **Link Aggregation**
 4. Select **LAG Membership**.
- The **LAG Membership: Summary** page opens.

Figure 30 I/O module GUI – LAG membership



3.4 Windows 2012 NIC teaming configuration using LACP

This section covers NIC teaming in Windows 2012. NIC teaming binds multiple network interfaces on a computer to provide traffic failover, which prevents connectivity loss in the event of a network component failure. It also provides bandwidth aggregation. Windows 2012 and Windows 2012 R2 natively support NIC teaming.

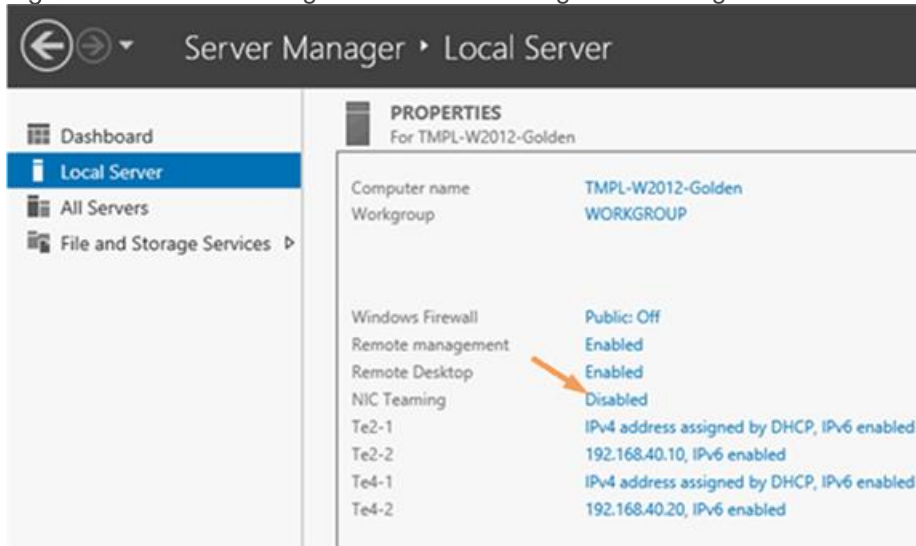
In this environment, LACP explicitly uses the NIC teaming mode to match the configuration already performed on the R1-2210 Switch module. For further details on other NIC teaming options, refer to the [NIC Teaming Overview](#) page on Microsoft's [TechNet](#) site.

Note: The following steps rename the NICs to associate them with the R1-2210 switch module ports.

3.4.1 Enable NIC teaming

Enable NIC teaming in Windows 2012 and 2012 R2 by clicking **Disabled** next to **NIC Teaming** in the Server Manager window, as Figure 31 shows:

Figure 31 Server Manager window – Enabling NIC teaming

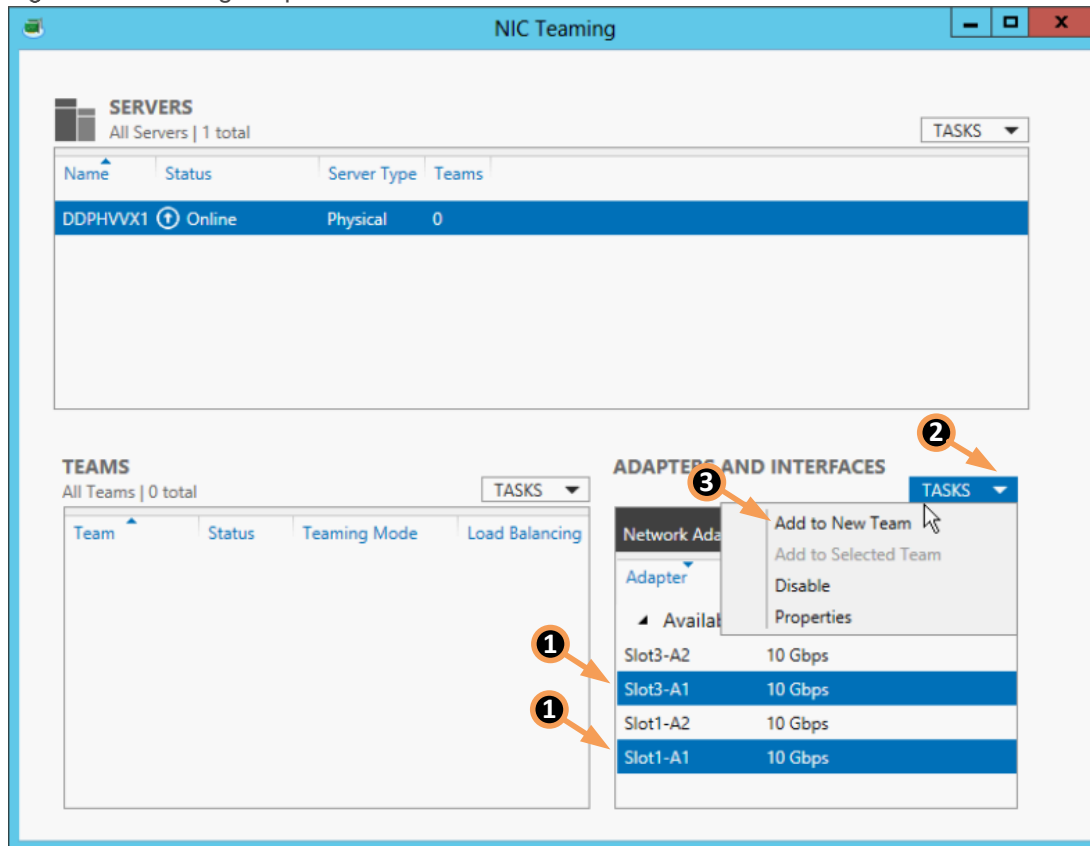


3.4.2 Adding adapters to NIC team

To create a new NIC team, perform the following steps, as Figure 32 shows:

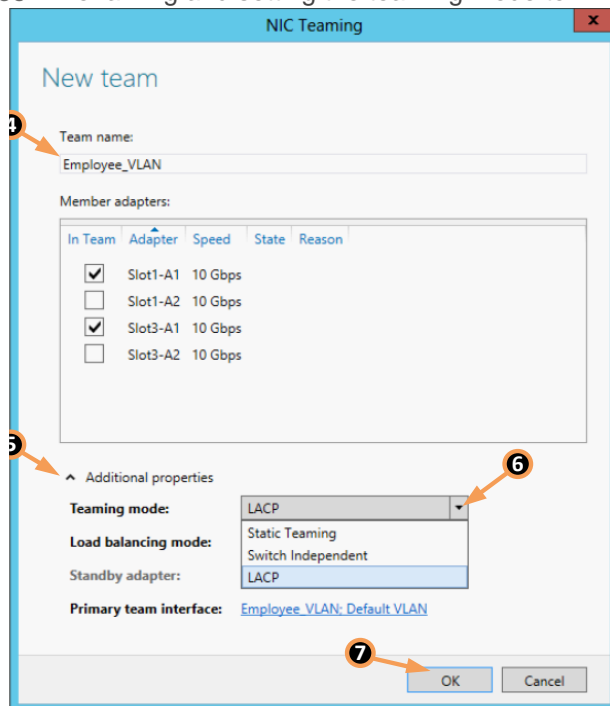
1. **Ctrl+Click** each adapter that you want to add to the team.
2. Click **TASKS**.
3. Select **Add to new Team**.

Figure 32 Adding adapters to new team



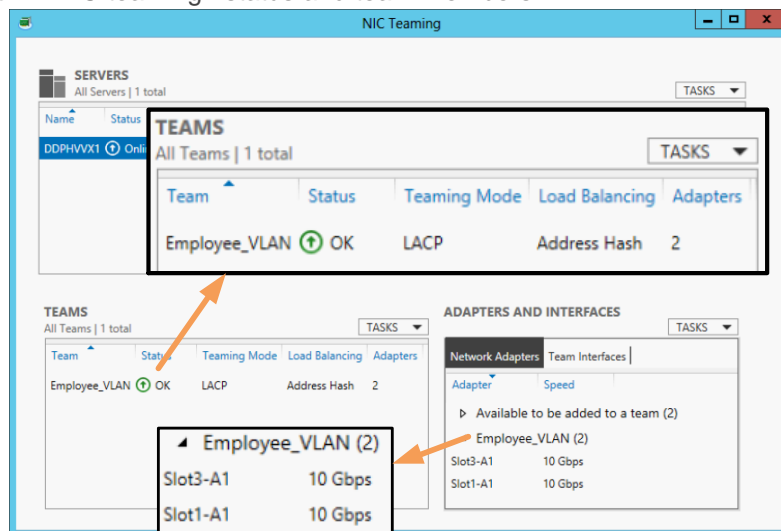
4. Enter the new team's name in the **Team Name** field, as Figure 33 shows.
5. Expand **Additional properties**.
6. Use the drop down box to change the Teaming Mode to **LACP**.
7. Click **OK**.

Figure 33 Renaming and setting the teaming mode to LACP



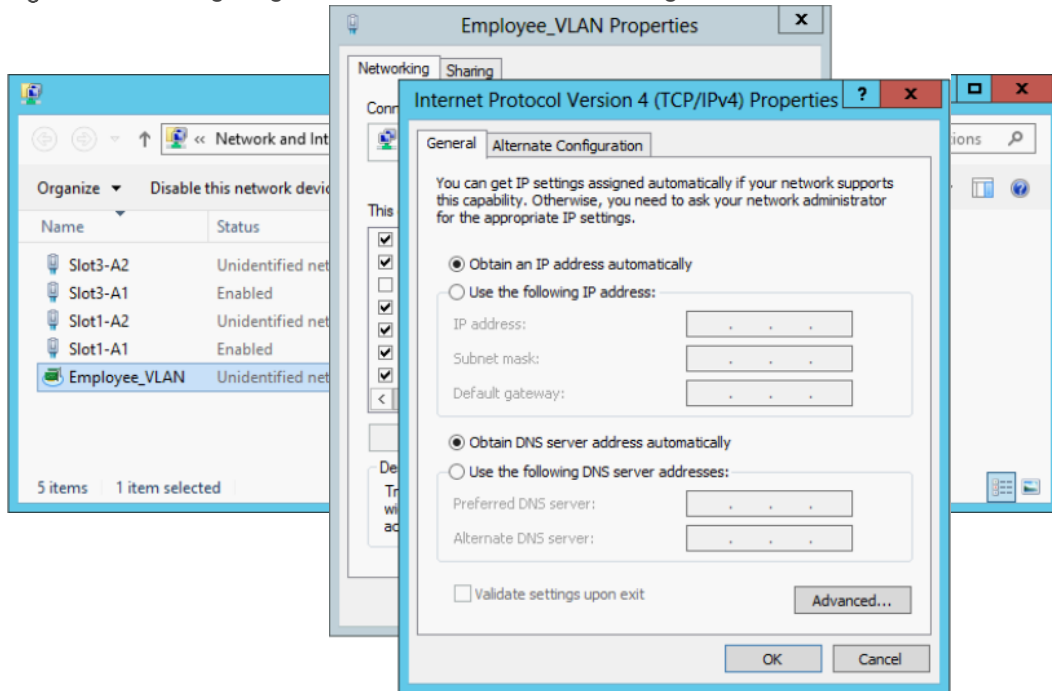
As Figure 34 shows, the new team name displays in the **TEAMS** section of the NIC Teaming page. This listing also shows the status of the LACP team (status should be **OK**). Identify the adapters the team uses by expanding the team in the **ADAPTERS AND INTERFACES** section.

Figure 34 NIC teaming –status and team members



At this point, you can configure the NIC team like any other network adapter. Assign the IP address, subnet mask and default gateway using the familiar Windows GUI, as Figure 35 shows:

Figure 35 Configuring the LACP team's network settings



Enable NIC teaming on the second Dell M830

To enable teaming on the second Dell M830, repeat the preceding section on the Dell M830 in Slot 2 using the information provided in Table 8:

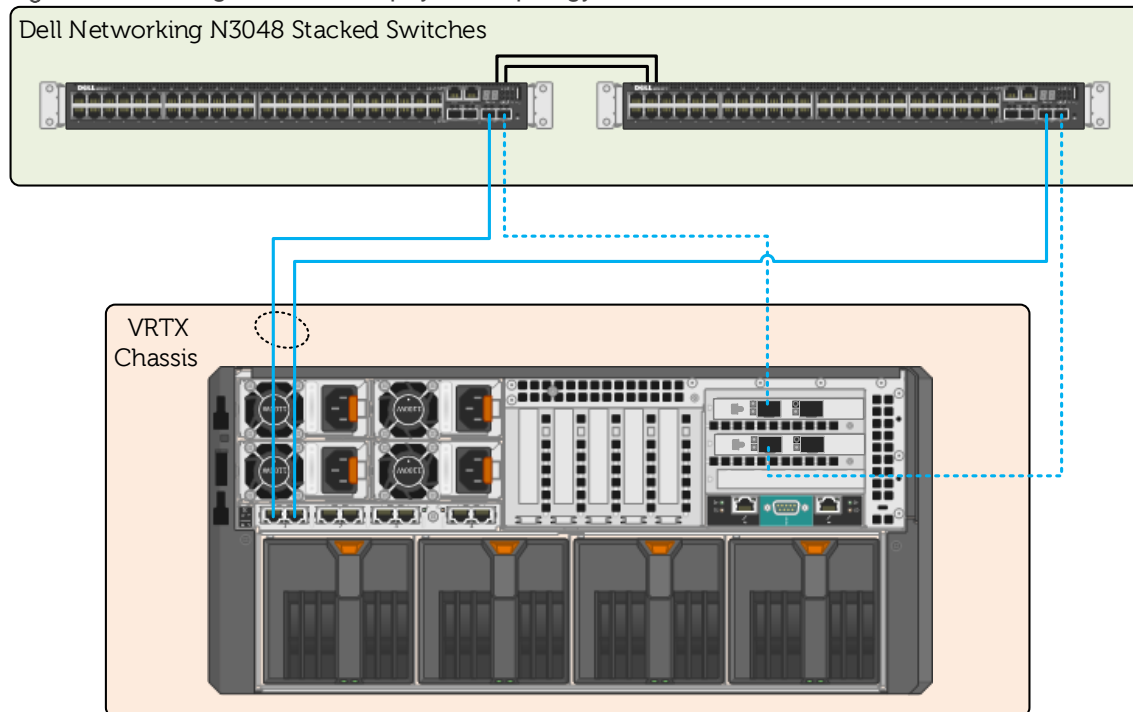
Table 8 Teaming Information for the Dell M830 in Slot 2

Team Name	Adapter #1	Adapter #2
DMZ_VLAN	Slot2-A1	Slot4-A1

4 Configuration Two

Configuration Two adds redundancy between the servers and N3048 switches by adding PCIe NICs to the PowerEdge VRTX chassis. With Configuration one as a starting point, Configuration Two installs two QLogic BCM57810 dual-port 10GbE PCIe adapters in the VRTX chassis. Each adapter maps to a M830 server and links the PCIe adapters to the second integrated SFP+ port on the front of the N3048 stack. Figure 36 shows the physical topology of Configuration Two.

Figure 36 Configuration Two - physical topology



Note: With the exception of the QLogic BCM57810 PCIe adapters, Configuration Two uses identical hardware components to those in Configuration One.

4.1 Server roles and VLANs

In this environment, each PowerEdge M830 receives a specific role and uses a separate network. As a best practice, create separate VLAN IDs to isolate these two distinct networks; employees at the branch office use VLAN 20 for communication with file server, mail server, and so on. VLAN 30 hosts data accessed from a less secure network, such as the internet. Table 9 summarizes these VLANs. The network ranges and subnets in the following tables serve as examples; the actual values depend on your network.

Table 9 VLANs

VLAN ID	VLAN Name	IP Network	Subnet Mask	Purpose
20	Employee_Traffic	192.168.20.0	255.255.255.0	Internal Traffic
30	DMZ_Traffic	192.168.30.0	255.255.255.0	Public Traffic

4.2 Dell Networking N3048 switch configuration

This section provides procedures for resetting to factory defaults and stacking N3048 switches, setting system time and creating VLANs on the stacked units. This section also provides the procedure for assigning IP addresses to both VLANs and creating port channels for connecting the N3048 stack to the switch. (The port channels consist of two 10 Gigabit ports.) The final procedure connects two links from two 10 Gigabit ports to the QLogic BCM57810 Dual-port PCIe adapters in the VRTX chassis.

4.2.1 Reset the N3048 switch to factory defaults

To stack two N3048 switches requires clearing them of all previous configurations. To clear the switches, reset each switch to factory defaults.

To reset the Dell Networking N3048 switch to factory defaults, reload the switch and select **Option 2** at the **Dell Networking Boot Options** prompt during switch startup. Select **Option 10** at the **Boot Main Menu** prompt to restore the configuration to factory defaults. Figure 37 shows these steps:

Figure 37 Command to reset the Dell Networking N3048 to factory defaults

```
Console#reload
.
.
Dell Networking Boot Options
=====

Select a menu option within 3 seconds or the Operational Code will start
automatically...

1 - Start Operational Code
2 - Display Boot Menu

Select (1, 2)# 2

Boot Main Menu
=====

    1 - Start Operational Code
    2 - Select Baud Rate
    3 - Retrieve Logs
    4 - Load New Operational Code
    5 - Display Operational Code Details
    9 - Reboot
   10 - Restore Configuration to Factory Defaults
   11 - Activate Backup Image
   12 - Start Password Recovery

Enter Choice# 10

Are sure you want to Erase Current Configuration? (Y/N): y
Erasing Current Configuration...done.

Boot Main Menu
=====

    1 - Start Operational Code
    2 - Select Baud Rate
    3 - Retrieve Logs
    4 - Load New Operational Code
    5 - Display Operational Code Details
    9 - Reboot
   10 - Restore Configuration to Factory Defaults
   11 - Activate Backup Image
   12 - Start Password Recovery

Enter Choice# 9

Rebooting...

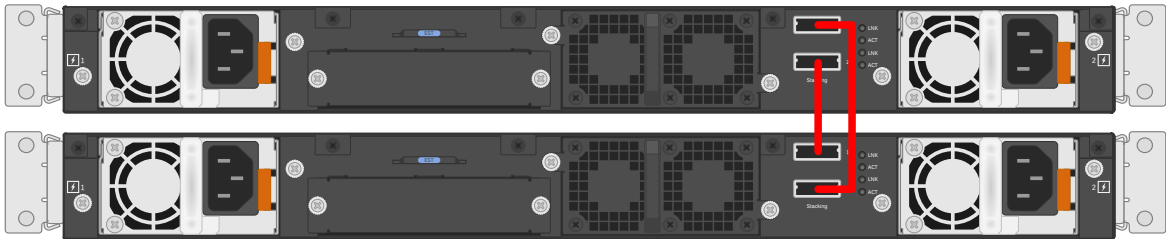
syncing filesystems....This may take a few moments
Rebooting system!
The system is going down NOW!
Sent SIGTERM to all processes
Sent SIGKILL to all processes

Requesting system reboot
```

4.2.2 Stack N3048s

This environment uses a pair of N3048 stacked switches to provide redundancy at the distribution layer. To stack the switches, connect them using the mini-SAS stacking cables, as Figure 38 shows:

Figure 38 Dell Networking N3048 stacking



To designate the master switch, allow the first switch to boot up completely before powering up the second switch. After the switches have booted, the master switch provides the management point for the stacked units. For additional information on stacking the N3048 switches, refer to the [Dell Networking N-Series User Guide](#).

Note: You can only access and configure a stack’s master switch. You can access, but not directly configure, other stack members. All configuration comes through the master switch.

When you can administratively access the switches, enter the `show switch` and `show switch stack-ports` commands to verify the stacking configuration. Figure 39 shows the output of the `show switch` commands.

Figure 39 Show switch and show switch stack-ports commands output

console#show switch						
SW	Management Status	Standby Status	Preconfig Model ID	Plugged-in Model ID	Switch Status	Code Version
1	Mgmt Sw		N3048	N3048	OK	6.3.0.6
2	Stack Mbr	Oper Stby	N3048	N3048	OK	6.3.0.6
console#show switch stack-ports						
Interface	Configured Stack Mode	Running Stack Mode	Link Status	Link Speed (Gb/s)	Admin Status	
Tw1/0/1	Stack	Stack	Link Up	21	Enabled	
Tw1/0/2	Stack	Stack	Link Up	21	Enabled	
Tw2/0/1	Stack	Stack	Link Up	21	Enabled	
Tw2/0/2	Stack	Stack	Link Up	21	Enabled	

4.2.3 N3048 CLI configuration

4.2.3.1 Set system time on the N3048 switch

Set system time before configuring the N3048 switch. This helps with troubleshooting (that is, reviewing log files) in the event the configuration does not work properly. To set the system time, enter the commands Figure 40 shows:

Figure 40 Commands to set system time

```
console>enable
console#configure
console(config)#clock set 11:44:00
console(config)#clock set 05/14/2016
console(config)#end
console#show clock
.11:44:16 CDT may 14 2016
No time source
console#copy running-config startup-config
```

4.2.3.2 VLAN configuration

This scenario uses two VLANs: 20 and 30. To create these VLANs, enter the commands Figure 41 shows:

Figure 41 Commands for VLAN configuration

```
console>enable
console#configure
console(config)#vlan 20
console(config-vlan20)#name Employee_Traffic
console(config-vlan20)#exit
console(config)#vlan 30
console(config-vlan30)#name DMZ_Traffic
console(config-vlan30)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters into Configuration mode, creates VLAN 20 and 30, exits Configuration mode and saves the running configuration.

4.2.3.3 Port group configuration

To connect the N3048 stack to the R1-2210 switch module requires a port channel. To configure the port channel, enter the commands Figure 42 shows:

Figure 42 Commands for port configuration

```
console>enable
console#configure
console(config)#interface port-channel 1
console(config-if-Po1)#description "LAG from VRTX Te0/1-2"
console(config-if-Po1)#switchport mode trunk
console(config-if-Po1)#switchport trunk allowed vlan 20,30
console(config-if-Po1)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters Configuration mode, selects port channel 1 for configuration, assigns a description and sets the port channel as a trunk. Then, the VLANs are limited to the ones created earlier (20 and 30). The sequence completes by exiting Configuration mode and saving the running configuration.

The next procedure assigns two 10GbE ports to the port channel group, as Figure 43 shows:

Figure 43 Commands for port group configuration

```
console>enable
console#configure
console(config)#interface tengigabitethernet1/0/1
console(config-if-Te1/0/1)#channel-group 1 mode active
console(config-if-Te1/0/1)#exit
console(config)#interface tengigabitethernet2/0/1
console(config-if-Te2/0/1)#channel-group 1 mode active
console(config-if-Te2/0/1)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters Configuration mode, selects Ethernet TenGigabitEthernet port 1/0/1, assigns it to port channel 1 and exits port configuration. Then, it selects Ethernet TenGigabitEthernet port 2/0/1 and assigns it to port channel 1. The sequence completes by exiting Configuration mode and saving the running configuration.

4.2.3.4 PCIe NICs connected port configuration

To provide additional redundancy in this solution, set the second integrated SFP+ ports on N3048 stack members to switchport mode access. Also, assign each port to the respective VLAN used in the M830. Save the configuration by entering the commands that Figure 44 shows:

Figure 44 Commands to configure PCIe NICs connected ports

```
console>enable
console#configure
console(config)#interface te1/0/2
console(config-if-Te1/0/2)#switchport mode access
console(config-if-Te1/0/2)#switchport access vlan 20
console(config-if-Te1/0/2)#exit
console(config)#interface te2/0/2
console(config-if-Te2/0/2)#switchport mode access
console(config-if-Te2/0/2)#switchport access vlan 30
console(config-if-Te2/0/2)#end
console#copy running-config startup-config
```

4.2.4 N3048 validation

Verify the configuration by entering the `show interfaces port-channel` and `show vlan` commands, as Figure 45 shows:

Figure 45 Commands to validate N3048 configuration

```
console#show interfaces port-channel
```

Channel	Ports	Ch-Type	Hash	Type	Min-links	Local	Prf
Pol	Active: Te1/0/1, Te2/0/1	Dynamic	7		1		Disabled

```
console#show vlan
```

VLAN	Name	Ports	Type
20	Employee_Traffic	Pol,Te1/0/2	Static
30	DMZ_Traffic	Pol,Te2/0/2	Static

Note: Irrelevant information has been removed from the output of the show commands (Figure 45) to highlight the configuration performed in this guide.

4.3 Dell Networking R1-2210 switch module configuration

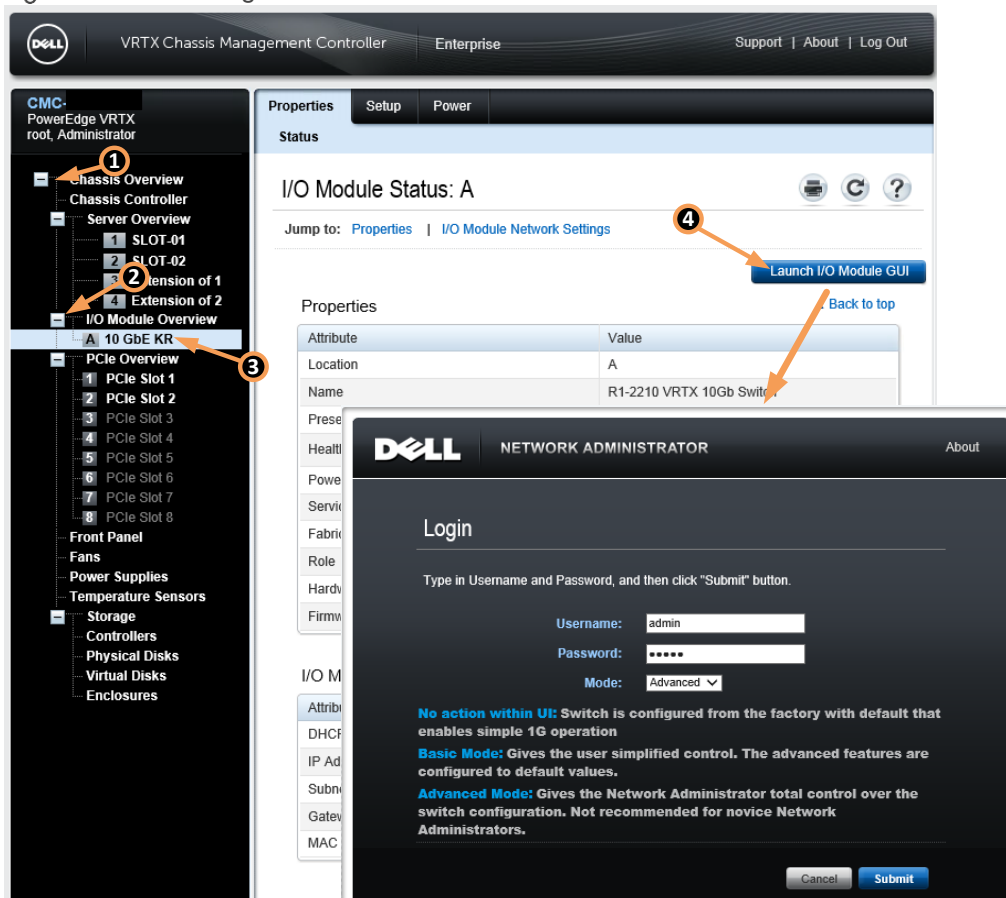
4.3.1 R1-2210 switch module management settings

You can manage the R1-2210 switch module in multiple ways. This document describes managing the switch through Telnet and validating the configurations using the Dell VRTX CMC I/O Module GUI.

To launch the I/O module GUI, perform the following steps in the Dell VRTX CMC, as Figure 46 shows:

1. Expand the **Chassis Overview**.
2. Expand the **I/O Module Overview**.
3. Click the switch module.
The **I/O Module Status** window opens.
4. Click **Launch I/O Module GUI** button.
The Login Screen for the I/O Module GUI opens.

Figure 46 Launching the I/O Module GUI



Note: This guide does not cover the configuration of the VRTX CMC. For CMC configuration information, refer to the [Chassis Management Controller Version 2.1 for Dell PowerEdge VRTX User's Guide](#).

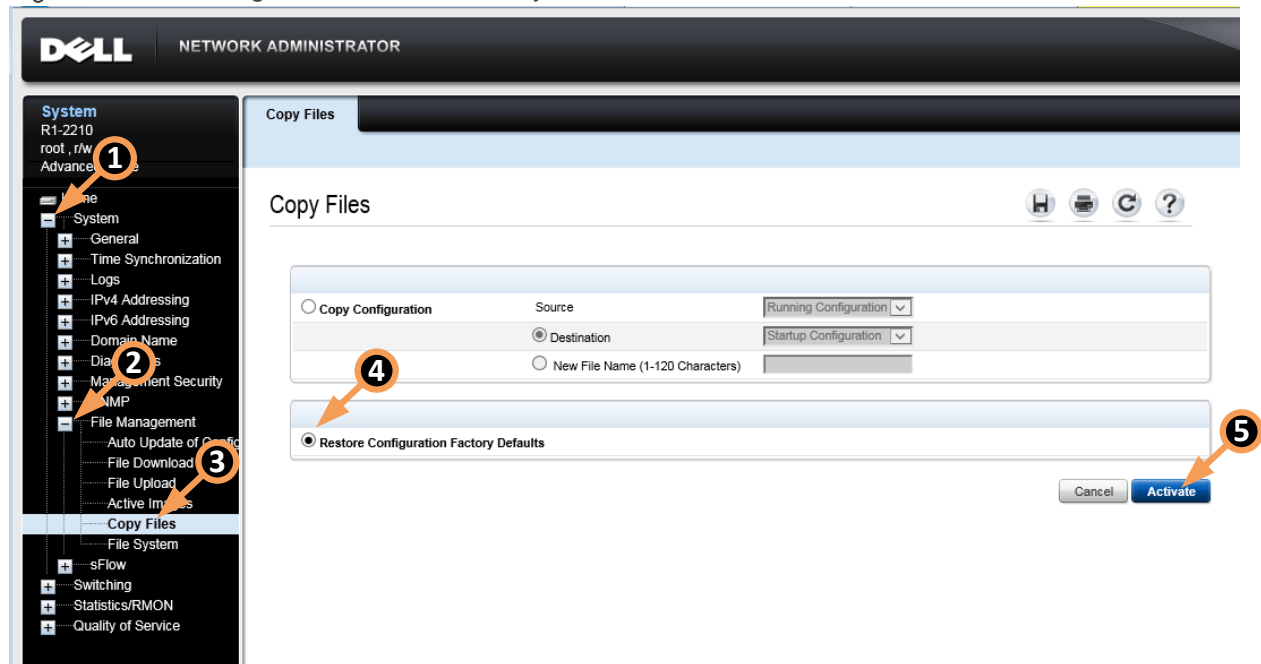
4.3.2 Reset R1-2210 switch module to factory defaults

You must reset the R1-2210 switch module to its factory defaults before completing any configuration. Perform the following steps in the R1-2210 I/O module GUI to do that, as in Figure 47 and the following steps:

1. Expand **System**.
2. Expand **File Management**.
3. Click **Copy Files**.

4. Select the **Restore Configuration to Factory Defaults** radio button.
5. Click the **Activate** button

Figure 47 Resetting the R1-2210 to Factory Defaults



4.3.3 R1-2210 switch module CLI configuration

4.3.3.1 Set system time on the R1-2210 switch

Set system time before configuring the switch to help with troubleshooting (that is, reviewing log files) in the event the configuration does not work properly. Figure 48 shows the commands for setting system time:

Figure 48 Commands to set system time

```
console>enable
console#configure
console(config)#clock set 11:44:00 14 may 2016
console(config)#end
console#show clock
.11:44:16 CDT may 14 2016
No time source
```

4.3.3.2 VLAN configuration

Create VLAN 20 and 30 by entering the commands that Figure 49 shows:

Figure 49 Commands to configure VLANs

```
console>enable
console(config)#vlan 20 name Employee_Traffic
console(config)#vlan 30 name DMZ_Traffic
```

```
console(config)#end
console#copy running-config startup-config
```

This sequence puts the switch in Executive mode, enters into Configuration mode, creates VLAN 20 and 30, exits Configuration mode and saves the running configuration.

4.3.3.3 External-facing port group configuration

Use the following commands to create and assign ports to port channel 1 (used between the R1-2210 and the N3048 stack). Turn on LACP using the **mode auto** option, as Figure 50 shows:

Figure 50 Commands to configure external-facing port groups

```
console>enable
console#configure
console(config)#interface port-channel 1
console(config-if)#description "LAG to N3048 stack"
console(config-if)#switchport mode trunk
console(config-if)#switchport trunk allowed add vlan 20,30
console(config-if)#exit
console#interface range tengigabitethernet0/1-2
console(config-if-range)#channel-group 1 mode auto
console(config-if-range)#end
console#copy running-config startup-config
```

4.3.3.4 Internal-facing port settings

This configuration sets the internal-facing R1-2210 switch module ports to access ports. This matches the NIC teaming *Switch Independent* mode. NIC teaming configuration in section 4.5 uses this mode.

4.3.3.5 PowerEdge M830 in VRTX slot 1 and 3

The following commands tag all traffic as VLAN 20 (Employee Traffic) for the PowerEdge M830 occupying Slots 1 and 3, as Figure 51 shows:

Figure 51 Commands to tag traffic as VLAN 20 (Employee Traffic)

```
console>enable
console#configure
console(config)#interface tengigabitethernet1/1
console(config-if)#switchport mode access
console(config-if)#switchport access vlan 20
console(config-if)#exit
console(config)#interface tengigabitethernet3/1
console(config-if)#switchport mode access
console(config-if)#switchport access vlan 20
console(config-if)#end
console#copy running-config startup-config
```

4.3.3.6 PowerEdge M830 in VRTX slot 2 and 4

The following commands tag all traffic as VLAN 30 (DMZ Traffic) for the PowerEdge M830 occupying Slots 2 and 4, as Figure 52 shows:

Figure 52 Commands to tag traffic as VLAN 30 (DMZ Traffic)

```
console>enable
console#configure
console(config)#interface tengigabitethernet2/1
console(config-if)#switchport mode access
console(config-if)#switchport access vlan 30
console(config-if)#exit
console(config)#interface tengigabitethernet4/1
console(config-if)#switchport mode access
console(config-if)#switchport access vlan 30
console(config-if)#end
console#copy running-config startup-config
```

4.3.4 R1-2210 switch module validation

Validate proper configuration of the MLAG port channel and its inclusion of both te0/1 and te0/2 by entering `show int Port-Channel`, as Figure 53 shows:

Note: The bold text in Figure 53 shows the Port Group and the participating ports.

Figure 53 Command to validate MLAG port channel configuration

```
console#show int Port-Channel

Load balancing: src-dst-mac.

Gathering information...
Channel  Ports
-----  -----
Pol1      Active: te0/1-2

console#show vlan
Created by: D-Default, S-Static, G-GVRP, R-Radius Assigned VLAN, V-Voice VLAN

Vlan      Name                Ports                Created by
-----  -
20  Employee_Traffic    te1/1,te3/1,Po1      S
30  DMZ_Traffic         te2/1,te4/1,Po1      S
```

4.4 QLogic PCIe adapter assignment

This environment includes two QLogic BCM57810 dual-port 10GbE PCIe adapters in the VRTX chassis. Their assignment to each PowerEdge M830 provides redundancy for the R1-2210 switch module. The CMC identifies the PCIe NICs and assigns them to a server in the VRTX chassis, as Figure 54 shows:

- 1. Expand **Chassis Overview**.
- 2. Click on **PCIe Overview**.
- 3. Select the **Setup** tab.
The **Mapping: PCIe Slots to Server Slots** page opens.
- 4. Use the drop-down menu under the **Action** column to assign the QLogic BCM57810 dual-port 10GbE PCIe adapter to a server.

Figure 54 Mapping: PCIe Slots to Server Slots

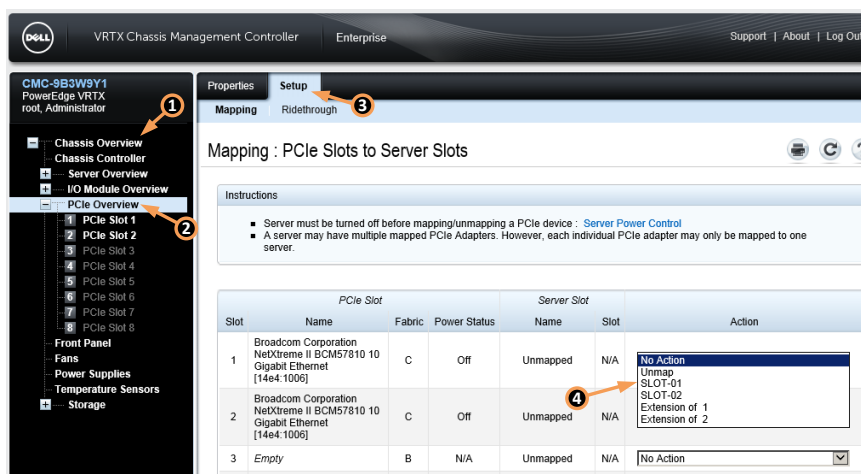


Figure 55 shows the PCIe-slot-to-server-slot configuration that this environment uses.

Figure 55 PCIe slot to server slot configuration

PCIe Slot				Server Slot		Action
Slot	Name	Fabric	Power Status	Name	Slot	
1	Broadcom Corporation NetXtreme II BCM57810 10 Gigabit Ethernet [14e4:1006]	C	Off	Unmapped	N/A	<input type="text" value="SLOT-01"/>
2	Broadcom Corporation NetXtreme II BCM57810 10 Gigabit Ethernet [14e4:1006]	C	Off	Unmapped	N/A	<input type="text" value="SLOT-02"/>
3	Empty	B	N/A	Unmapped	N/A	<input type="text" value="No Action"/>

4.5 Windows 2012 NIC teaming configuration using switch independent mode

This section covers NIC teaming in Windows 2012. Teaming allows multiple network interfaces on a computer to be bound together to provide traffic failover. This prevents connectivity loss in the event of a network component failure and provides bandwidth aggregation. Windows 2012 and Windows 2012 R2 supports NIC teaming natively.

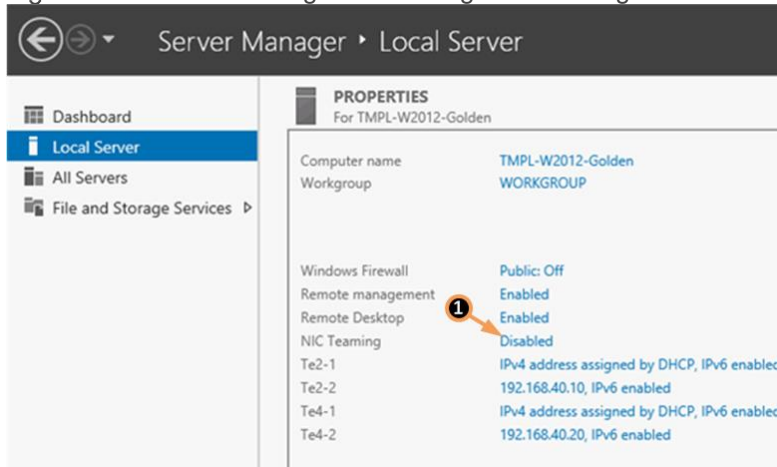
This environment uses the NIC teaming mode *switch independent* to match the configuration already performed on the R1-2210 switch module. For further details on other NIC teaming options, refer to the [NIC Teaming Overview](#) page on Microsoft's [TechNet](#) site.

Note: The following steps use NICs renamed to associate them with the R1-2210 switch module's internal ports.

4.5.1 Enabling NIC teaming

To enable NIC teaming in Windows 2012 and 2012 R2, click **Disabled** next to **NIC Teaming** in the Server Manager window, as Figure 56 shows:

Figure 56 Server manager – Enabling NIC teaming

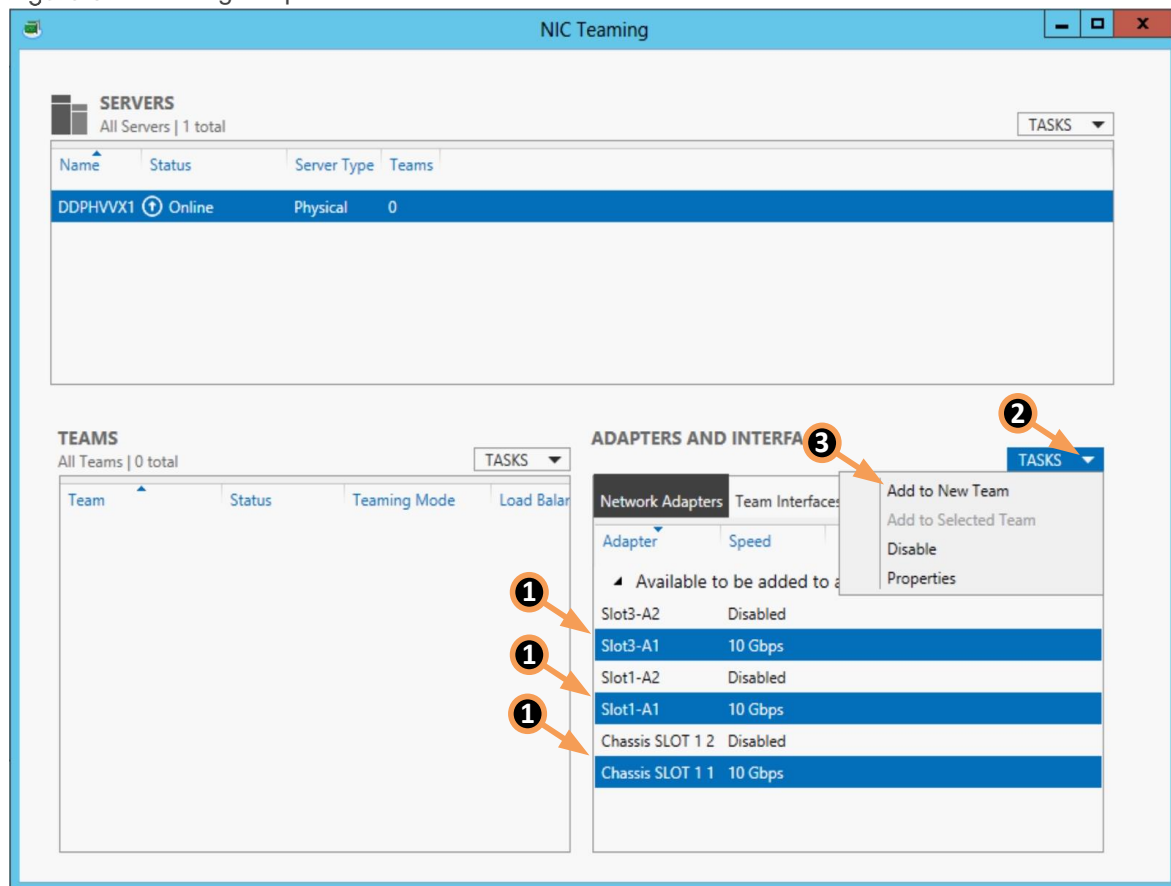


4.5.2 Adding adapters to NIC team

To create a new NIC team, perform the following steps, as Figure 57 shows:

1. **Ctrl+Click** each adapter that needs to be added to the team.
2. Click **TASKS**.
3. Select **Add to new Team**.

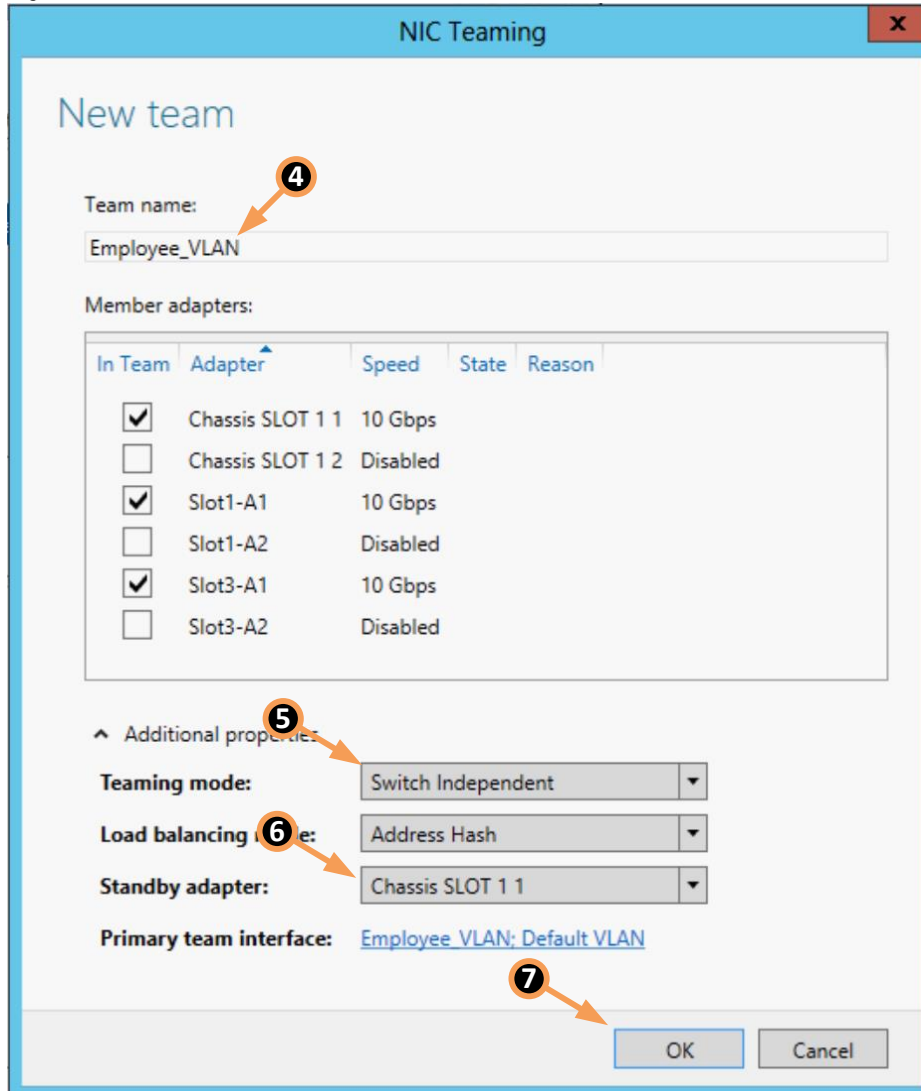
Figure 57 Adding adapters to new team



Provide the information for the new team requested in the following steps, as Figure 58 shows:

1. Enter the new team's name in the **Team Name** field.
2. Under Additional properties, change the Teaming Mode to **Switch Independent**.
3. Set the Standby adapter to **Chassis SLOT 1 1** (or the first NIC adapter of the assigned PCIe NIC).
4. Click **OK**.

Figure 58 Naming and setting the teaming mode to Switch Independent



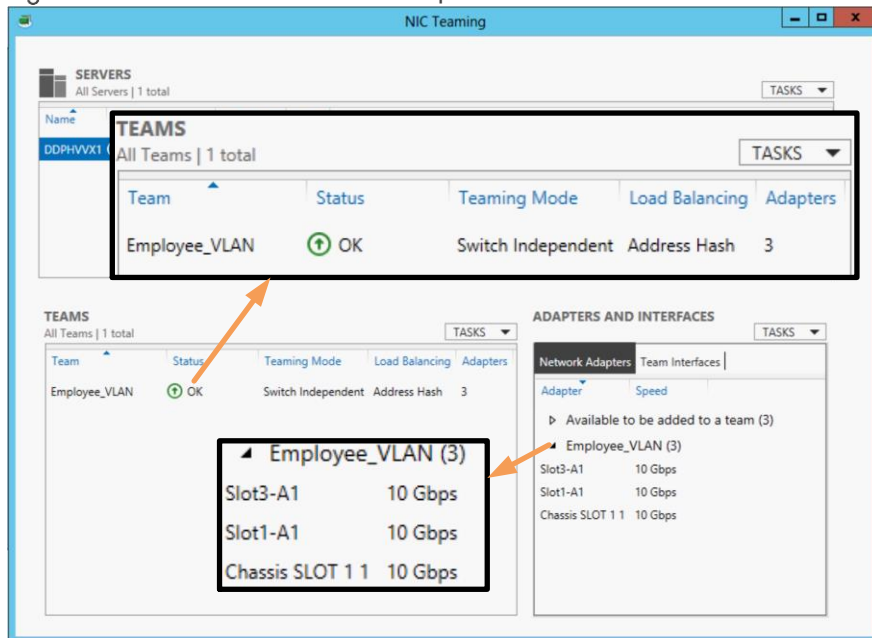
The image shows a 'NIC Teaming' dialog box with a 'New team' section. The 'Team name' field is set to 'Employee_VLAN' and is marked with a circled '4'. Below it, the 'Member adapters' table lists several adapters with checkboxes. The 'Additional properties' section is expanded, showing 'Teaming mode' set to 'Switch Independent' (marked with a circled '5'), 'Load balancing mode' set to 'Address Hash' (marked with a circled '6'), and 'Standby adapter' set to 'Chassis SLOT 1 1'. The 'Primary team interface' is 'Employee_VLAN: Default VLAN'. The 'OK' button is marked with a circled '7'.

In Team	Adapter	Speed	State	Reason
<input checked="" type="checkbox"/>	Chassis SLOT 1 1	10 Gbps		
<input type="checkbox"/>	Chassis SLOT 1 2	Disabled		
<input checked="" type="checkbox"/>	Slot1-A1	10 Gbps		
<input type="checkbox"/>	Slot1-A2	Disabled		
<input checked="" type="checkbox"/>	Slot3-A1	10 Gbps		
<input type="checkbox"/>	Slot3-A2	Disabled		

After you create the team, it displays in the **TEAMS** section of the NIC Teaming page, as Figure 59 shows:

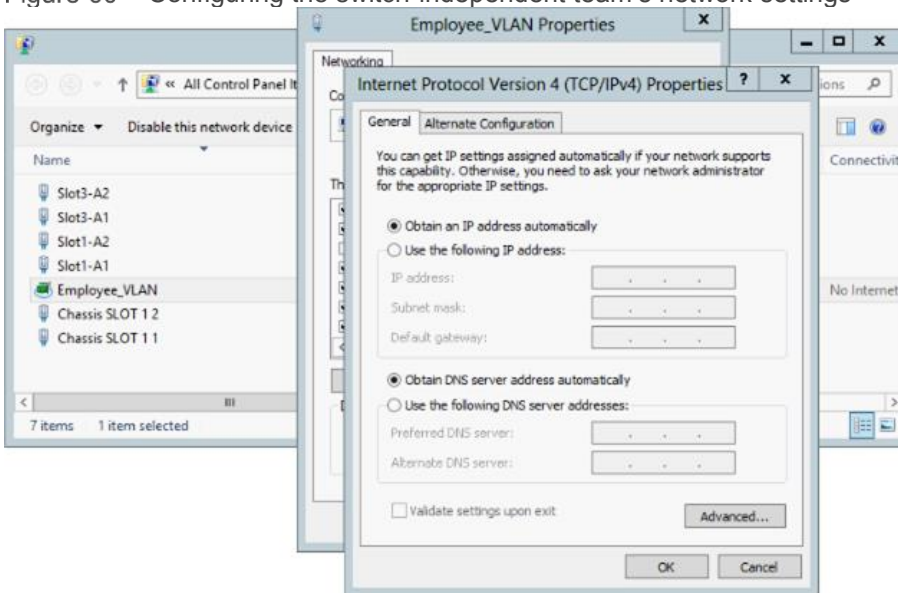
Note: This listing also shows the status of the LACP team (status should be **OK**). Identify the adapters that the team uses by expanding the team in the **ADAPTERS AND INTERFACES** section.

Figure 59 Status of the switch-independent team



At this point, configure the NIC team like any other network adapter. Assign the IP address, subnet mask and default gateway using the familiar Windows GUI, as Figure 60 shows:

Figure 60 Configuring the switch-independent team's network settings



Enable NIC teaming on the second Dell M830

To enable teaming on the second Dell M830, repeat the instructions from the preceding section on the Dell M830 in slot 2 using the information provided in Table 10:

Table 10 Teaming Information for the Dell M830 in slot 2

Team Name	Adapter #1	Adapter #2	Adapter #3
DMZ_VLAN	Slot2 A1	Slot4 A1	Chassis Slot 2 1

5 Conclusion

R1-2210 10GbE Switch Modules in PowerEdge VRTX chassis with dual PowerEdge M830 blade servers and redundant networking configuration provide abilities vital to business success today. This document illustrates two separate configurations leveraging multiple Dell EMC components that provide reliably available, high-speed computing infrastructure vital in today's ultra-competitive, technologically savvy business environment.

A Terminology

CLI (Command Line Interface) – CLI is the text-based telnet, SSH, or serial type interface that is used for entering commands into a device.

CMC (Chassis Management Controller) - A systems management component designed to manage one or more Dell PowerEdge systems containing blade servers.

Fabric (VRTX) - Three fabrics are available in a PowerEdge VRTX. Fabric A provides connectivity through the I/O module. Fabric B and C provide connectivity through the PCIe slots.

LACP (Link Aggregation Control Protocol) – LACP is a method to control the bundling of several physical ports together to form a single logical channel. LACP allows a network device to negotiate an automatic bundling of links by sending LACP packets to the peer (a directly connected device that also implements LACP).

LAG (Link Aggregated Group) - Aggregates ports or VLANs into a single virtual port or VLAN.

LAN (Local Area Network) - A network contained within a single room, building, campus or other limited geographical area.

NIC teaming- NIC Teaming allows multiple network adapters on a computer to be placed into a team to combine bandwidth or provide the ability for failover.

Port channels- Port channels combine multiple interfaces into one virtual interface. Port- channels provide increased bandwidth, redundancy and load balancing.

SSH (Secure Shell) - SSH is typically used to log into a remote machine and execute commands. SSH supports tunneling, forwarding TCP ports and X11 connections, it can also transfer files using the associated SSH file transfer (SFTP) or secure copy (SCP) protocols.

Switch Stack- A switch stack is a set of switches that behave and work together as a unified system.

Telnet (Terminal Emulation Protocol Network) - Telnet enables system users to log in and use resources on remote networks.

VLANs (Virtual Local Area Networks) - A VLAN is a switched network that is logically segmented on an organizational basis, by functions, project teams, or applications rather than on a physical or geographical basis.

B Additional Resources

- [Dell PowerEdge VRTX](#)
- [Dell PowerEdge VRTX Manuals](#)
- [Dell PowerEdge VRTX Networking](#)
- [Dell PowerEdge Family Manuals](#)
- [Dell Networking N3000 Series Switches](#)
- [Dell Networking N3000-Series Manuals](#)
- [Support.Dell.com](#)
- [DellTechCenter.com](#)
- [Remote and Branch Office Reference Architecture for VMware vSphere with Dell PowerEdge VRTX](#)

Support and Feedback

Contacting 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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