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SUMMARY

Adding a Dell™ PowerConnect™ M8024 switch or a Dell M8024 LAN Module with a Dell PowerEdge™ M1000e modular blade enclosure to an existing Cisco® network infrastructure is a straightforward process. The addition of Simple Switch Mode on the Dell M8024 family of switches simplifies the process, allowing integration into the network with minimal effort.

This Principled Technologies (PT) Guide explains the deployment process for the Dell PowerEdge M1000e modular blade enclosure with a Dell PowerConnect M8024 switch (see Figure 1) into an existing Cisco network. We tested two Dell PowerConnect M8024 switches in a variety of different network deployment scenarios with two Cisco Catalyst 6504-E switches, and discovered that Simple Switch Mode is capable of automatically configuring the Dell PowerConnect M8024 switches with minimal interaction from our technicians.



Figure 1: The Dell PowerConnect M8024 switch.



NOTE: We tested with the Dell PowerConnect M8024 switches, but all of our steps should apply to the Dell M8024 LAN Module, as well.

Features of Simple Switch Mode

Simple Switch Mode, or SSM, allows server administrators, or anyone with very limited expertise in configuring Ethernet switches, the ability to deploy a loop-free switching solution without having to

configure the spanning tree protocol (STP) or implement a complex design in order integrate the switch into the existing environment.

The primary advantages of deploying SSM include:

- Port Aggregation is easy to configure. Simply group internal ports and associate them with external ports, assign VLANs (if desired), and it's ready to go.
- SSM automatically configures multiple external ports into a link aggregation control protocol (LACP) trunk group.
- By automatically using Aggregator Groups, SSM provides loop-free operation without using STP.
- Port Aggregation is completely interoperable. Dynamic (via Link Aggregation Control Protocol (LACP)) and static link aggregation is supported on the external ports.

To enable SSM on a Dell PowerConnect M8024 switch, perform the following steps:

1. Log into the switch.
2. Select System → Operational Mode → Operational Mode Configuration.
3. In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 2).

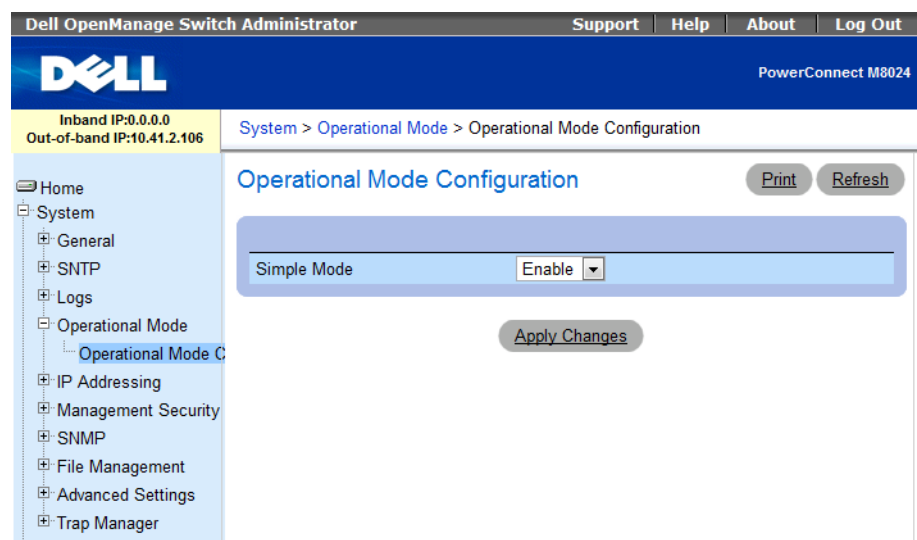
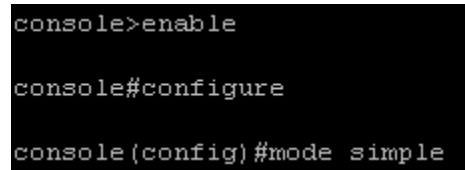


Figure 2: Simple Mode configuration on the Dell PowerConnect M8024 switch.

SSM can also be enabled in the Dell command-line interface by typing the following commands (see Figure 3):

```
enable
configure
mode simple
```



```
console>enable
console#configure
console(config)#mode simple
```

Figure 3: Simple Mode configuration on the Dell PowerConnect M8024 switch.



NOTE: Dell M8024 LAN Modules are always in Simple Switch Mode, so these steps are not necessary on those devices.

Sample scenarios

In the sections that follow, we discuss some of the new features of the hardware and software, give an overview of the deployment process, and present the following eight sample scenarios:

1. Plug and play using the Dell PowerConnect M8024 switch for blade deployment into an existing network after configuring Link Aggregation Control Protocol (LACP) on Cisco Catalyst 6504-E switch ports.
2. Configuring VLANs on internal ports of the Dell PowerConnect M8024 switch, while configuring the Cisco Catalyst 6504-E switch to extend those VLANs in an external Catalyst network.
3. Configuring Multiple VLANs per internal port to connect to the server NIC with Tag enabled. (An example of this would be supporting virtual machines (VMs) in the server scenario.)
4. Configuring multiple port aggregation groups (mapping aggregate groups to group-specific attached blade servers) and dedicating specific uplinks to carry that traffic to the Cisco network.
5. Adding VLANs in a multi-aggregate group configuration.
6. Setting up a meshed topology for redundancy.
7. Setting up a topology with Link Aggregation Group (LAG) failover.
8. Establishing access with VSS enabled across two Cisco Catalyst 6504-E switches.

The appendices to this Guide give detailed, step-by-step information on the deployment and provide detailed configuration information on the hardware we used.

TESTING SCENARIOS

Our testing scenarios included establishing connections and utilizing sample features and functions of the Dell PowerConnect M8024 switch with the goal of showing the ease of deployment of the Dell PowerConnect M8024 switch and accompanying Dell hardware in a Cisco Catalyst environment. The Dell blade switch operated in SSM as a port aggregator. We began each scenario with a fresh test bed, which included a Dell PowerEdge M710 blade server in the Dell PowerEdge M1000e modular blade enclosure connected with Dell PowerConnect M8024 switches. We include a network diagram showing the general configuration of the switches in our test bed for each scenario.

Scenario 1: Plug and play using the Dell PowerConnect M8024 switch for blade deployment into an existing network

In this section, we provide an overview of the plug-and-play process with the Dell PowerConnect M8024 switch, after configuring Link Aggregation Control Protocol (LACP) on the Cisco Catalyst 6504-E switch ports. Dell's plug-and-play features with SSM allow for quick integration of Dell blade switch into a network. We provide detailed instructions in [Appendix A](#).

1. On the Cisco Catalyst 6504-E switch, set up a four-port port channel with LACP using the ports that will be connected to Dell PowerConnect M8024 switch.
2. Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch.

The Dell PowerConnect M8024 switch will automatically create a LAG and connect the blade servers into the existing network.



NOTE: Because the Dell PowerConnect M8024 switch forms the LAG as you cable up the ports, cabling will not create loops, removing the need for STP.

Figure 4 illustrates the completed configuration for Scenario 1.

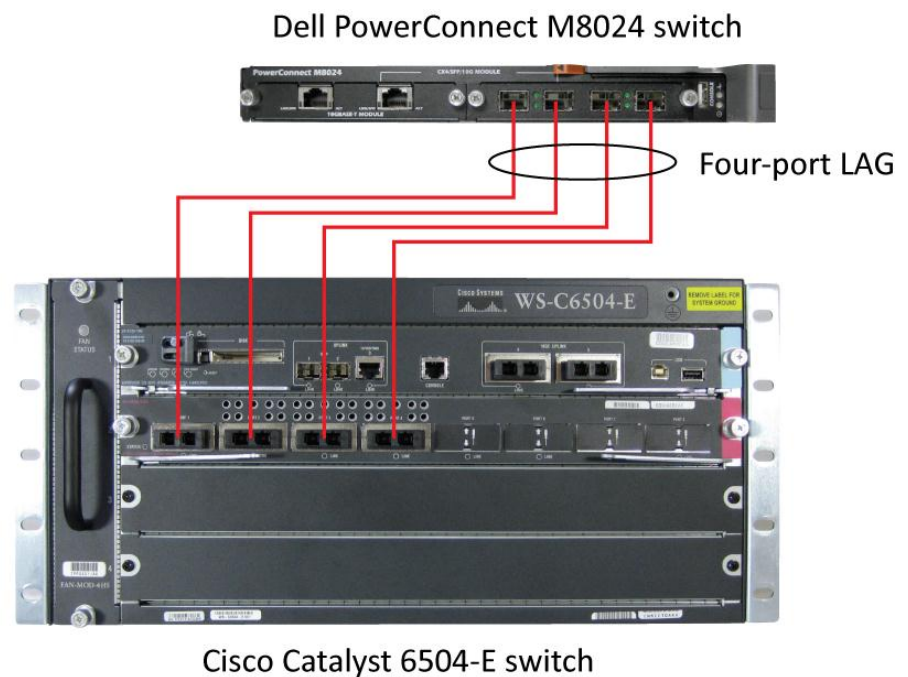


Figure 4: Graphic representation of Scenario 1.

Scenario 2: Configuring VLANs on the internal ports of the Dell PowerConnect M8024 switch

In this section, we provide an overview of configuring the VLANs on the internal ports of the Dell PowerConnect M8024 switch, while configuring those on the Cisco Catalyst 6504-E switch to extend the VLANs in the external Cisco Catalyst network. VLANs allow for traffic isolation and for granular Quality of Service (QoS) control over simple

subnetting. Dell switches with SSM enabled offer quick and easy VLAN configuration. We provide detailed instructions in [Appendix A](#).

1. On the Dell PowerConnect M8024 switch, enter the Internal Port VLAN configuration screen, select a port, and change the default Untagged VLAN (we changed port 1/xg1 to VLAN 101).
2. On the Cisco Catalyst 6504-E switch, create a four-port port channel group with LACP and trunking (VLAN tagging) enabled.
3. Allow VLAN 101 through the new port channel.
4. Connect the cables from the ports of the port channel group to the Dell PowerConnect M8024 Switch.

The Dell PowerConnect M8024 switch will automatically make a four-port LAG with VLAN tagging enabled and tag all communications from the designated internal port as VLAN 101.

Figure 5 illustrates the completed configuration for Scenario 2.

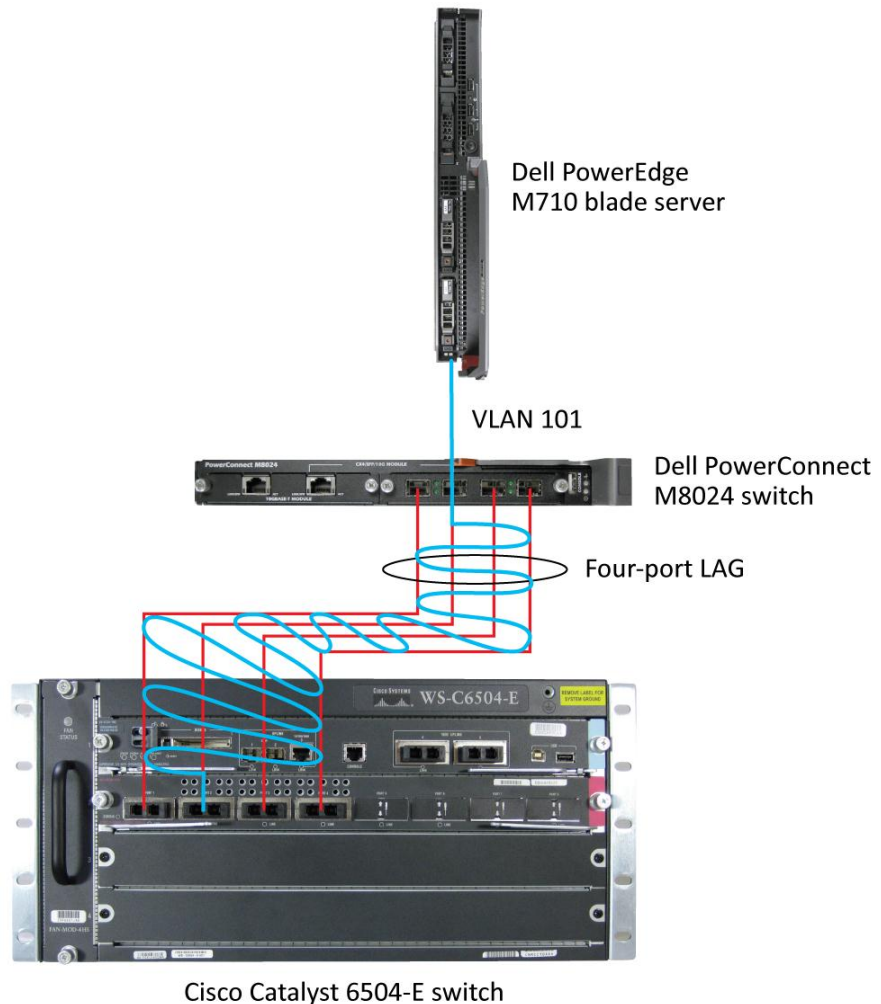


Figure 5: Graphic representation of Scenario 2.

Scenario 3: Configuring multiple VLANs per internal port to connect to a server NIC with tagging enabled

In this section, we provide an overview of configuring multiple VLANs per internal port to connect to a server NIC with VLAN tagging enabled. This is useful for management of VMs. We provide detailed instructions in [Appendix A](#).

1. On the Dell PowerConnect M8024 switch, enter the Internal Port VLAN configuration screen, select a port, and add several tagged VLANs (we changed port 1/xg1 to include VLANs 101-104).
2. On the Cisco Catalyst 6504-E switches, create a four-port port channel group with LACP and Trunking (VLAN tagging) enabled.
3. Allow VLANs 101-104 through the new port channel.

4. Connect the cables from the ports of the port channel group to the Dell PowerConnect M8024 switch.

The Dell PowerConnect M8024 switch will automatically make a four-port LAG with VLAN tagging enabled. From now on, you can modify communications by tagging them to various VLANs.

Figure 6 illustrates the completed configuration for Scenario 3.

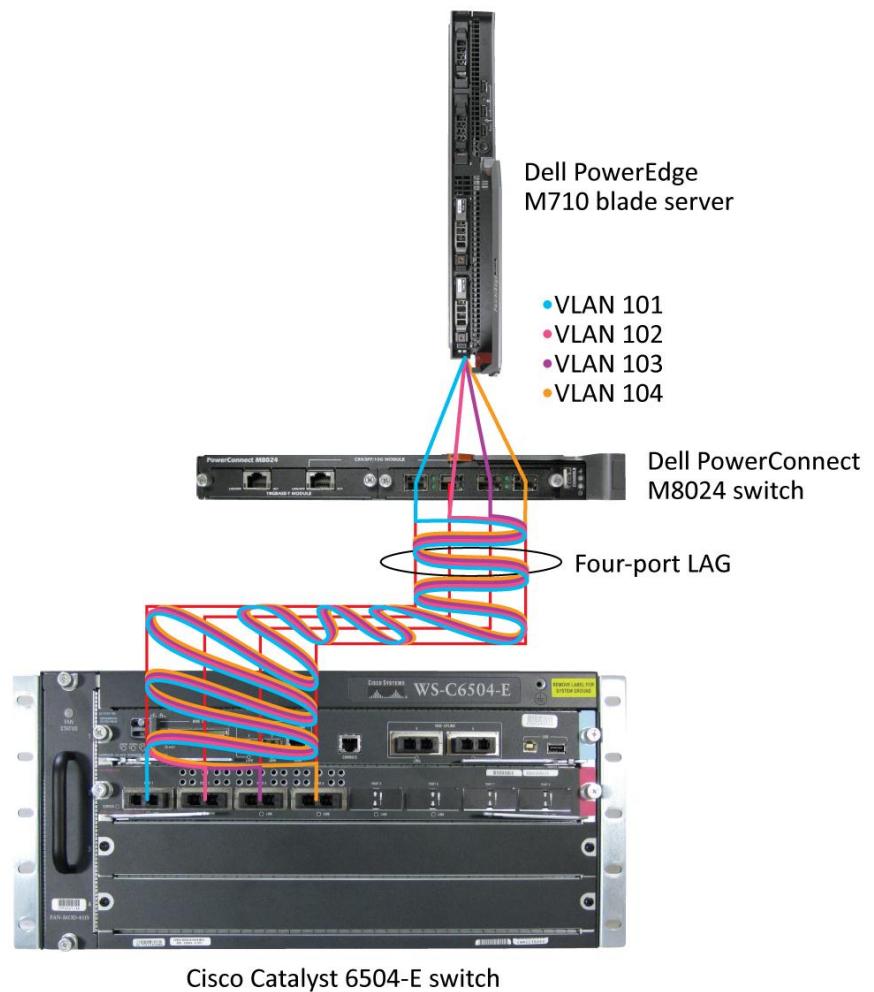


Figure 6: Graphic representation of Scenario 3.

Scenario 4: Configuring multiple Port Aggregation Groups and dedicating specific Uplinks

In this section, we provide an overview of configuring multiple Port Aggregation Groups (AGs to group specific attached blade servers) and dedicating specific uplinks to carry that traffic to the Cisco

Catalyst network. Doing this allows us to physically separate traffic for easier administration. We provide detailed instructions in [Appendix A](#).

1. On the Dell PowerConnect M8024 switch, enter the Port Configuration screen, and change the group ID of the ports you desire to Group 2 (we changed ports 1/xg9-1/xg16 and ports 1/xg23-1/xg24 to Group 2).
2. On the Cisco Catalyst 6504-E switch, create two two-port port channel groups with LACP enabled.
3. Connect the cables.

The Dell PowerConnect M8024 switch will automatically make two two-port LAGs, separating the traffic from between the two groups created earlier. The traffic from the blade servers that are connected to internal ports belonging to Group 1 will use their appropriate LAG, including those external ports that are part of that group. This applies to the blade servers in Group 2 as well.

Figure 7 illustrates the completed configuration for Scenario 4.

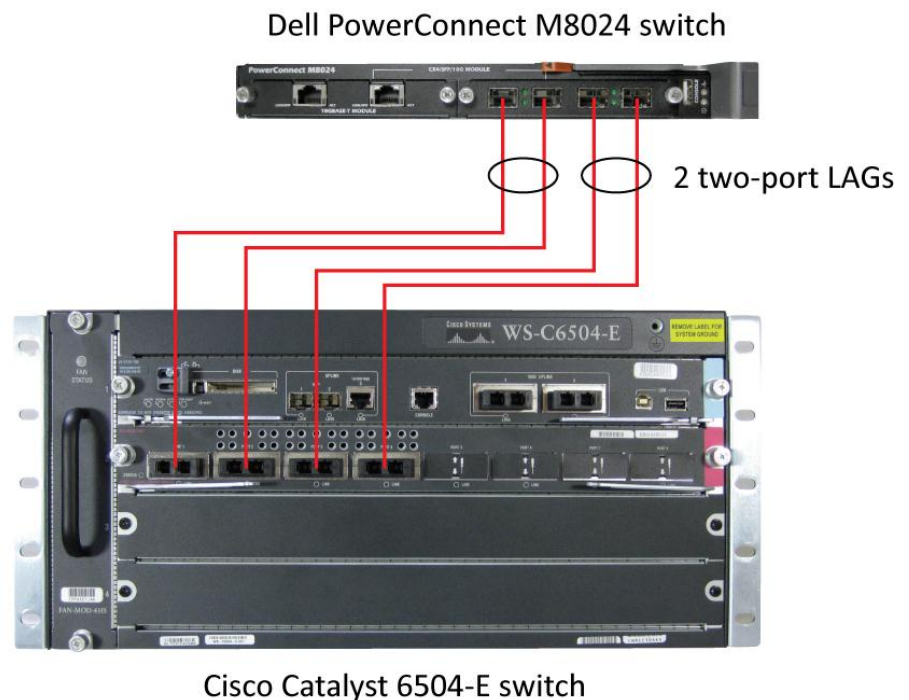


Figure 7: Graphic representation of Scenario 4.

Scenario 5: Adding VLANs in a multi-aggregate group configuration

In this section, we provide an overview of adding VLANs in a multi-AG configuration, which combine the advantages of virtual network administration with physical network separation. We provide detailed instructions in [Appendix A](#).

1. On the Dell PowerConnect M8024 switch, enter the Port Configuration screen, and change the group ID of ports to Group 2 (we changed ports 1/xg9-1/xg16 and ports 1/xg23-1/xg24 to Group 2).
2. Enter the Internal Port VLAN configuration screen, select a port, and add several tagged VLANs (we changed port 1/xg1 to include VLANs 101-102 and port 1/xg9 to include VLANs 103-104).
3. On the Cisco Catalyst 6504-E switches, create two two-port port channel groups with LACP enabled. Make sure that the two port channels include the VLANs you configured earlier (we configured VLANs 101-102 for the first port channel and VLANs 103-104 for the second port channel).
4. Connect the cables.

The Dell PowerConnect M8024 switch will automatically make two two-port LAGs, separating the traffic from between the two groups created earlier, while allowing for further segregation through VLANs.

Figure 8 illustrates the completed configuration for Scenario 5.

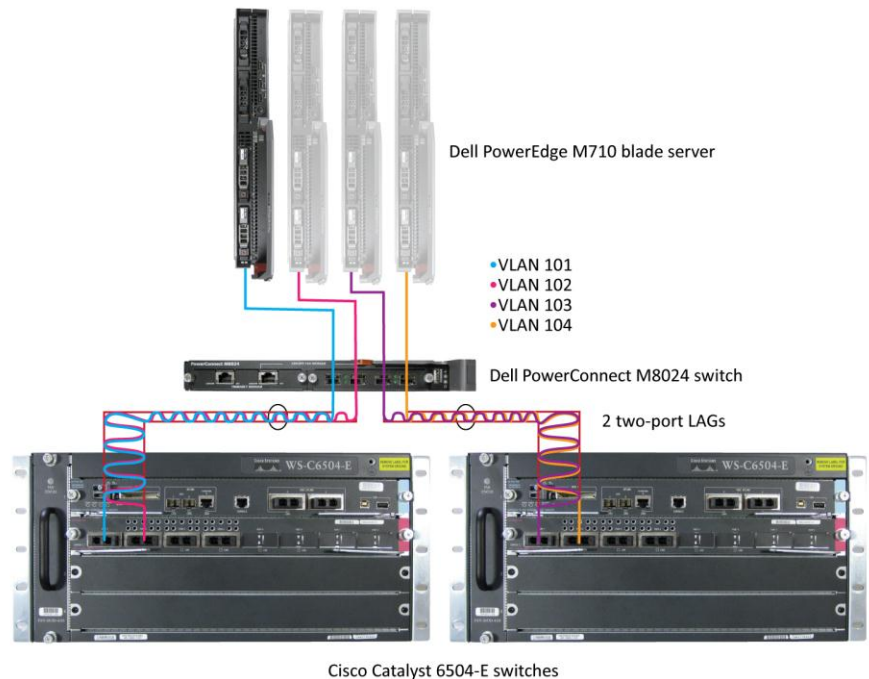


Figure 8: Graphic representation of Scenario 5.

Scenario 6: Setting up a fully meshed topology

In this section, we provide an overview of setting up a fully meshed topology. For our scenario, STP is already enabled on the existing network. STP allows for redundant connections in switches without creating loops. Dell PowerConnect M8024 switches can automatically integrate themselves into an STP network. The Dell PowerConnect M8024 in SSM uses LAGs to prevent loops, but allows Cisco Catalyst switches to handle STP states. We provide detailed instructions in [Appendix A](#).

1. On the first Cisco Catalyst 6504-E switch, set the spanning tree priority so that it is the root.
2. On the second Cisco Catalyst 6504-E switch, set the spanning tree priority so the tree will default to it as the secondary root in the event of failure.
3. Connect the cables between all switches.

The Dell PowerConnect M8024 switches will automatically integrate into the Cisco spanning tree network.

Figure 9 illustrates the completed configuration for Scenario 6 and the network created via STP. The first Cisco Catalyst 6504-E switch will act as the root switch in the tree and block the redundant ports.

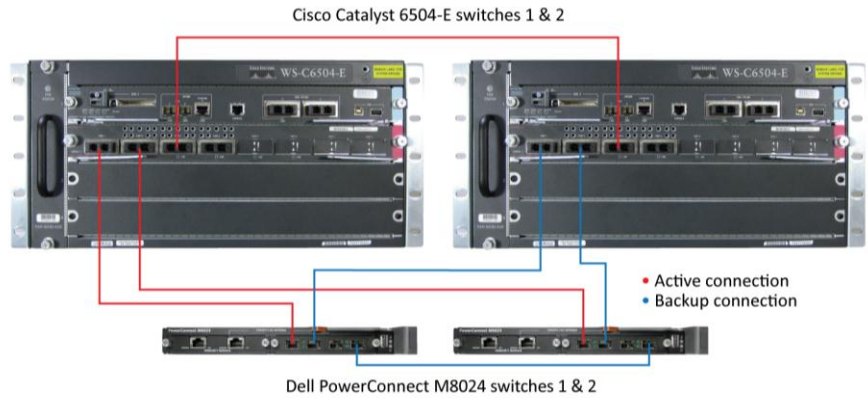


Figure 9: Graphic representation of Scenario 6.

In the event of a cable failure, the root switch will enable the appropriate ports to maintain connections with all other switches.

Figure 10 illustrates the new logical network created in the event of a cable failure.

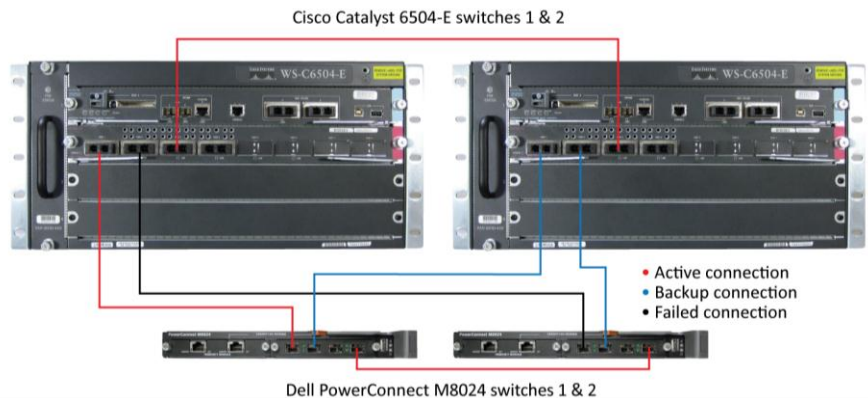


Figure 10: Graphic representation of the modified logical network after a cable failure.

Scenario 7: Setting up a straight-through topology with LAG failover

In this section, we provide an overview of setting up a straight-through topology with LAG failover. SSM LAG failover allows Dell switches to automatically change from the primary to the backup LAG

in the event of a port failure, reducing potential downtime. We provide detailed instructions in [Appendix A](#).

1. On the Dell PowerConnect M8024 switch, enter the Port Configuration screen, and change the Lag Role of ports to Secondary (we changed ports 1/xg23-1/xg24 to Secondary).
2. On the Cisco Catalyst 6504-E switches, create two two-port port channel groups with LACP enabled.
3. Connect the cables.

The Dell PowerConnect M8024 switch will automatically make a two-port LAG with a secondary backup LAG that it will failover to in the event of a cable or port failure.

Figure 11 illustrates the completed configuration for Scenario 7.

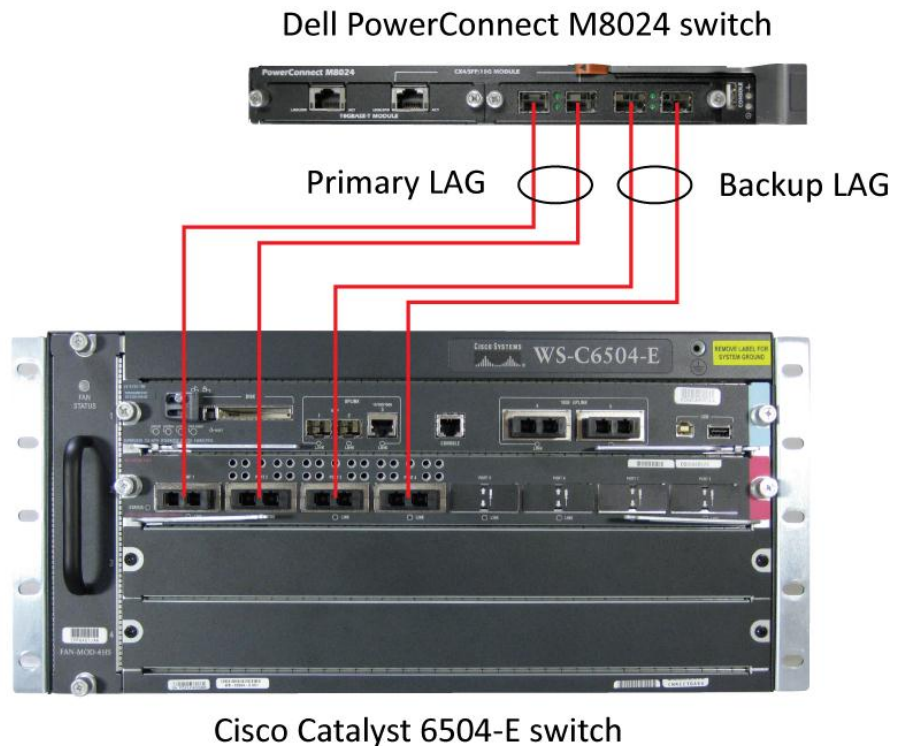


Figure 11: Graphic representation of Scenario 7.

Scenario 8: Establishing access with VSS enabled across the Cisco Catalyst 6504-E switches

In this section, we provide an overview of establishing access with VSS enabled across Cisco Catalyst 6504-E switches. VSS, or Virtual

Switching System, is a Cisco technology that allows multiple switches to be administered from one switch and present themselves as one switch, combining link aggregation with switch redundancy. This allows for multiple-port link aggregation across switches. In our example scenario, each Dell PowerConnect M8024 switch maintains a 4-port link aggregation with the Cisco switches, 2 ports in each switch. We provide detailed instructions in [Appendix A](#).

1. On each Dell PowerConnect M8024 switch, enter the Internal Port VLAN configuration screen, select a port, and change the default Untagged VLAN (we changed ports 1/xg1 and 1/xg8 to VLAN 101).
2. On the each Cisco Catalyst 6504-E switch, set up the VSS domain and virtual switch link (VSL) ports, and create the multichassis port channel for the downstream switch (the Dell PowerConnect M8024 switch).
3. Cable the two Cisco Catalyst 6504-E switches together using the VSLs you configured.
4. Cable the Cisco Catalyst 6504-E switches to the Dell PowerConnect M8024 switch.

The Dell PowerConnect M8024 switch will automatically make a LAG with the Cisco Catalyst 6504-E switches and treat the two switches as one.

Figure 12 illustrates the completed configuration for Scenario 8.

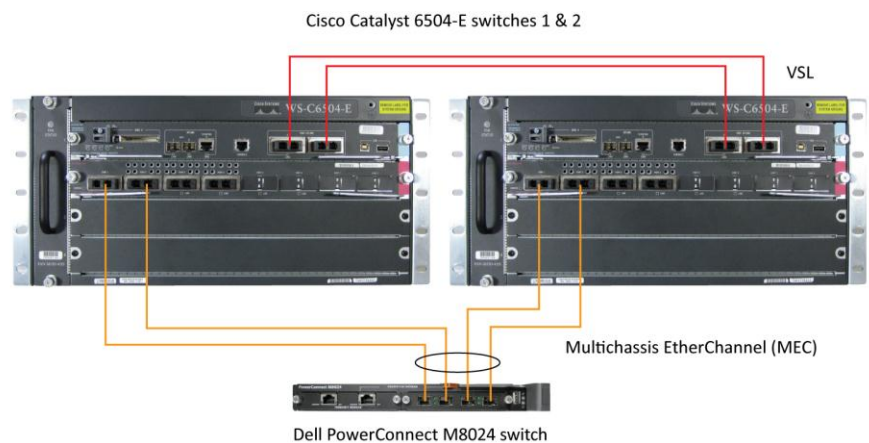


Figure 12: Graphic representation of Scenario 8.

APPENDIX A – DETAILED SCENARIO METHODOLOGY

In this appendix, we provide a list of components you need to reproduce the scenarios, a description of how we cabled the switches, detailed descriptions of the test scenarios, and screenshots for the steps, as appropriate. In each scenario, we assume that the associated switches are using factory default settings. For convenience, we've included steps for both the Dell graphical user interface and the command line interface. The Cisco Catalyst 6504-E graphical user interface for Cisco IOS 12.2 is basically a Web version of the Cisco command-line interface, so our Cisco CLI instructions should work fine for the GUI, as well.

Scenario 1: Plug and play using the Dell PowerConnect M8024 switch for blade deployment into an existing network

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	1
Cisco Catalyst 6504-E switch	1
LC-SC multimode fiber optic patch cable	4

Figure 13: Materials needed to reproduce Scenario 1.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	6504-E te 2/1
M8024 Ethernet 1/xg22	6504-E te 2/2
M8024 Ethernet 1/xg23	6504-E te 2/3
M8024 Ethernet 1/xg24	6504-E te 2/4

Figure 14: Cable connections for Scenario 1.

On the Dell PowerConnect M8024 switch GUI

If the switch is already in Simple Mode, no further configuration is necessary.

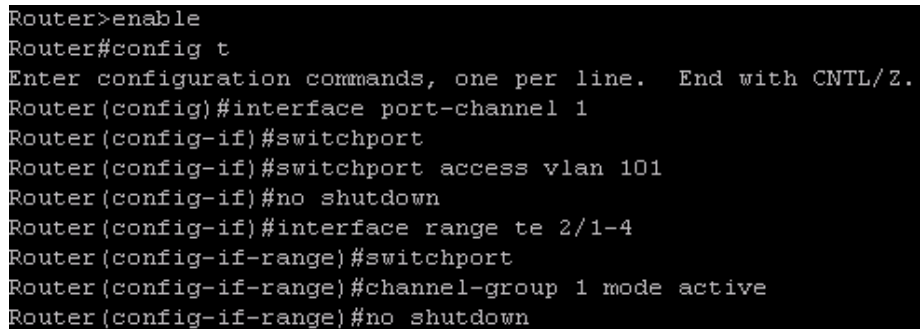
On the Dell PowerConnect M8024 switch CLI

If the switch is already in Simple Mode, no further configuration is necessary.

On the Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 15):

```
enable
config t
interface port-channel 1
switchport
switchport access vlan 101
no shutdown
interface range te 2/1-4
switchport
channel-group 1 mode active
no shutdown
```



```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface port-channel 1
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
Router(config-if)#no shutdown
Router(config-if)#interface range te 2/1-4
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 1 mode active
Router(config-if-range)#no shutdown
```

Figure 15: Configuring a port channel on the Cisco Catalyst 6504-E switch.

3. Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch.

Scenario 2: Configuring VLANs on the internal ports of the Dell PowerConnect M8024 switch

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	1
Cisco Catalyst 6504-E switch	1
LC-SC multimode fiber optic patch cable	4

Figure 16: Materials needed to reproduce Scenario 2.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	6504-E te 2/1
M8024 Ethernet 1/xg22	6504-E te 2/2
M8024 Ethernet 1/xg23	6504-E te 2/3
M8024 Ethernet 1/xg24	6504-E te 2/4

Figure 17: Cable connections for Scenario 2.

On the Dell PowerConnect M8024 switch GUI

1. Log into the switch.
2. Select Switching → Port Aggregator → Internal Port VLAN Configuration.
3. In the Internal-Port drop-down menu, select a port (we chose 1/xg1). (See Figure 18.)

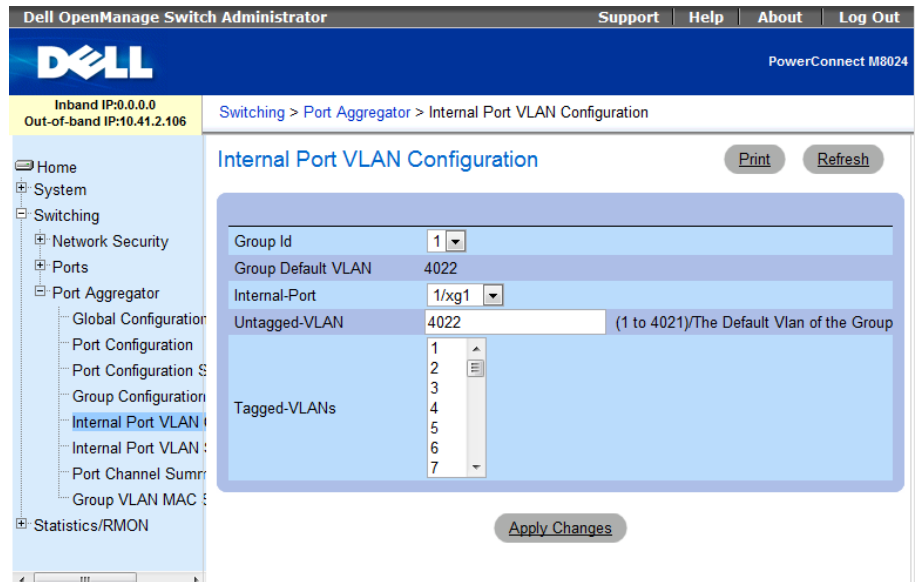


Figure 18: Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

4. In the Untagged-VLAN textbox, enter a VLAN number (we chose 101), and left-click Apply Changes (see Figure 19.)

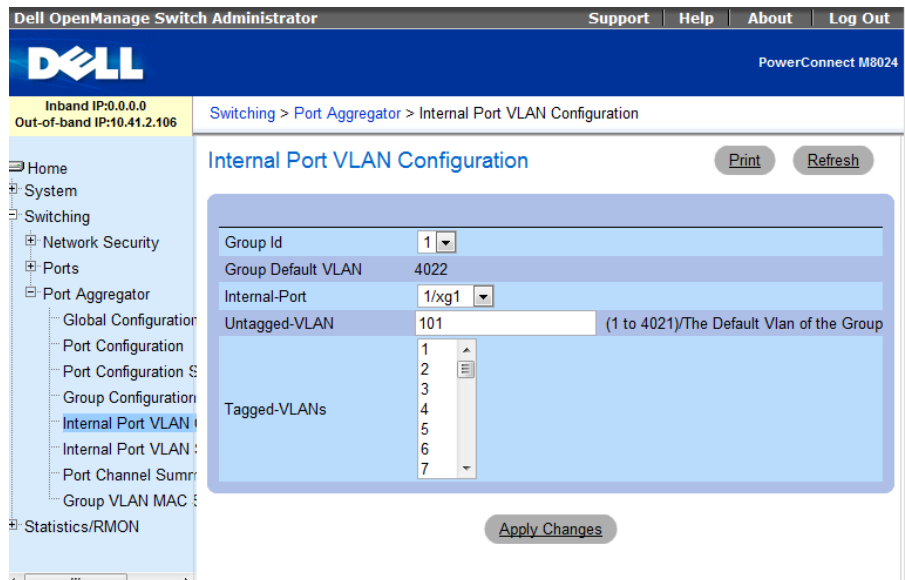
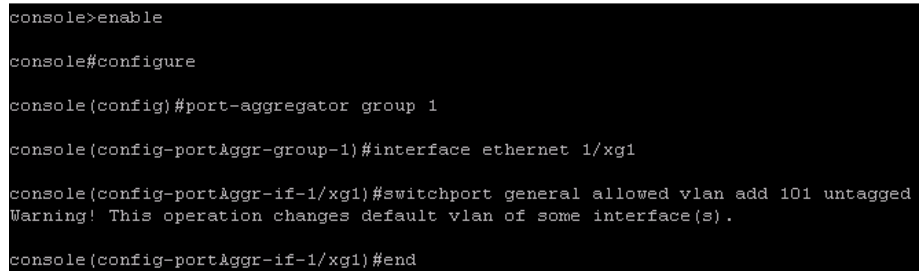


Figure 19: Selecting a VLAN in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

On the Dell PowerConnect M8024 switch CLI

1. Log into the switch.
2. Type the following commands into the switch (see Figure 20):

```
enable
configure
port-aggregator group 1
interface ethernet 1/xg1
switchport general allowed vlan add 101
untagged
end
```



```
console>enable
console#configure
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#interface ethernet 1/xg1
console(config-portAggr-if-1/xg1)#switchport general allowed vlan add 101 untagged
Warning! This operation changes default vlan of some interface(s).
console(config-portAggr-if-1/xg1)#end
```

Figure 20: Selecting a VLAN in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

On the Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 21):

```
enable
config t
interface port-channel 1
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 101
switchport mode trunk
no shutdown
interface range te 2/1-4
switchport
channel-group 1 mode active
no shutdown
```

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface port-channel 1
Router(config-if)#switchport
Router(config-if)#switchport trunk encapsulation dot1q
Router(config-if)#switchport trunk allowed vlan 101
Router(config-if)#switchport mode trunk
Router(config-if)#no shutdown
Router(config-if)#interface range te 2/1-4
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 1 mode active
Router(config-if-range)#no shutdown

```

Figure 21: Configuring a port channel with Trunking on the Cisco Catalyst 6504-E switch.

3. Connect the cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch.

Scenario 3: Configuring multiple VLANs per internal port to connect to a server NIC with tagging enabled

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	1
Cisco Catalyst 6504-E switch	1
LC-SC multimode fiber optic patch cable	4

Figure 22: Materials needed to reproduce Scenario 3.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	6504-E te 2/1
M8024 Ethernet 1/xg22	6504-E te 2/2
M8024 Ethernet 1/xg23	6504-E te 2/3
M8024 Ethernet 1/xg24	6504-E te 2/4

Figure 23: Cable connections for Scenario 3.

On the Dell PowerConnect M8024 switch GUI

1. Log into the switch.
2. Select Switching → Port Aggregator → Internal Port VLAN Configuration.
3. In the Internal-Port drop-down menu, select a port (we chose 1/xg1). (See Figure 24.)

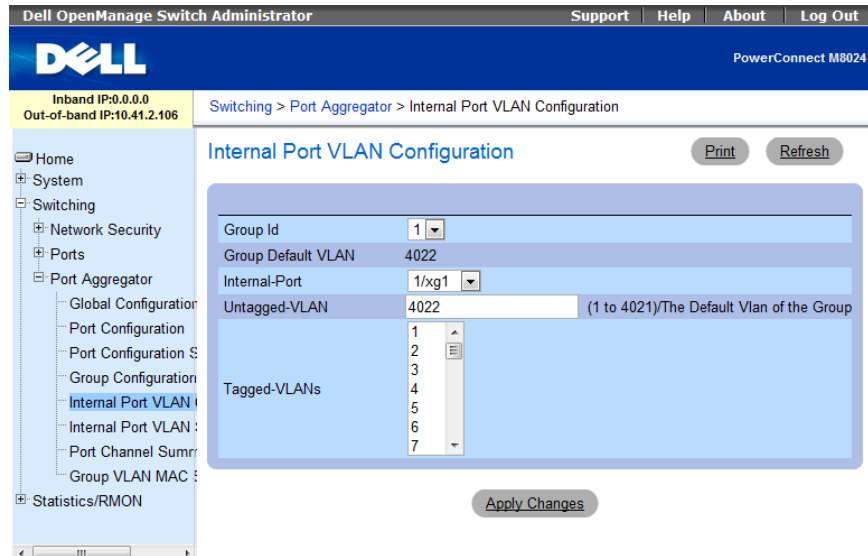


Figure 24: Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

- In the Tagged-VLANs box, select your VLANs (we chose 101-104), and left-click Apply Changes (see Figure 25).

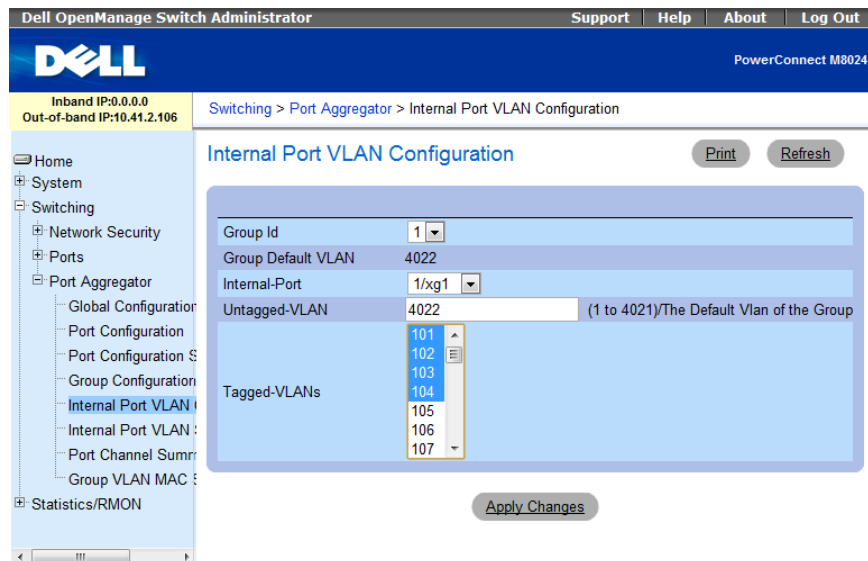


Figure 25: Selecting tagged VLANs in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

On the Dell PowerConnect M8024 switch CLI

- Log into the switch.
- Type the following commands into the switch (see Figure 26):

```
enable
configure
port-aggregator group 1
interface ethernet 1/xg1
```

```
switchport general allowed vlan add
  101-104
end
```

```
console>enable
console#configure
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#interface ethernet 1/xg1
console(config-portAggr-if-1/xg1)#switchport general allowed vlan add 101-104
console(config-portAggr-if-1/xg1)#end
```

Figure 26: Configuring LACP with multiple VLANs on the Dell M8024.

On the Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 27):

```
enable
config t
interface port-channel 1
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 101-104
switchport mode trunk
no shutdown
interface range te 2/1-4
switchport
channel-group 1 mode active
no shutdown
```

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface port-channel 1
Router(config-if)#switchport
Router(config-if)#switchport trunk encapsulation dot1q
Router(config-if)#switchport trunk allowed vlan 101-104
Router(config-if)#switchport mode trunk
Router(config-if)#no shutdown
Router(config-if)#interface range te 2/1-4
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 1 mode active
Router(config-if-range)#no shutdown
```

Figure 27: Configuring a port channel with trunking and multiple VLANs on the Cisco Catalyst 6504-E switch.

3. Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch.

From this point onward, any machines configured with VLAN tagging will be encapsulated with appropriate VLAN tags.

Scenario 4: Configuring multiple Port Aggregation Groups and dedicating specific Uplinks

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	1
Cisco Catalyst 6504-E switch	1
LC-SC multimode fiber optic patch cable	4

Figure 28: Materials needed to reproduce Scenario 4.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	6504-E te 2/1
M8024 Ethernet 1/xg22	6504-E te 2/2
M8024 Ethernet 1/xg23	6504-E te 2/3
M8024 Ethernet 1/xg24	6504-E te 2/4

Figure 29: Cable connections for Scenario 4.

On the Dell PowerConnect M8024 switch GUI

1. Log into the switch.
2. Select Switching → Port Aggregator → Port Configuration (see Figure 30).

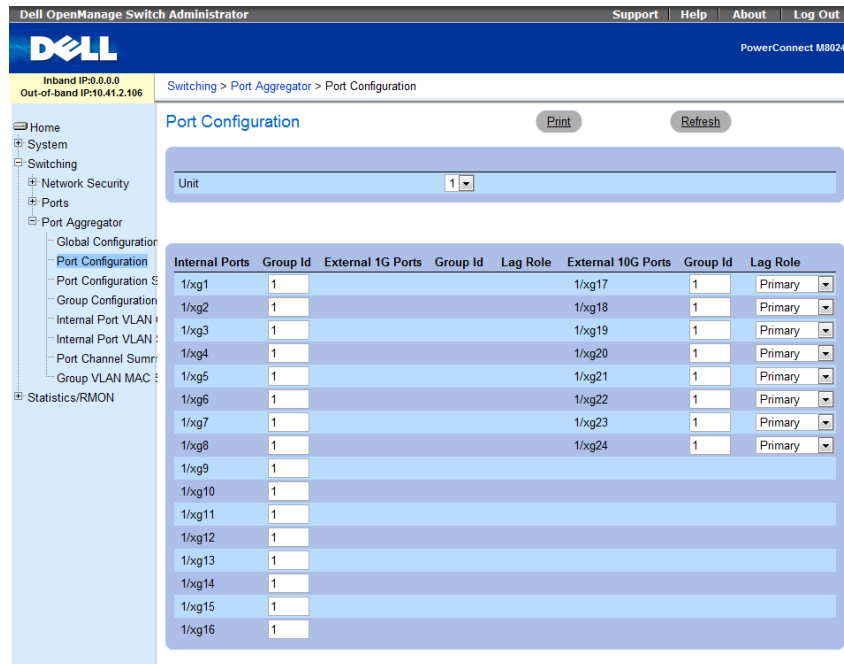


Figure 30: The Port Configuration screen on the Dell PowerConnect M8024 switch.

- In the Port Configuration screen, change the Group ID of the internal ports (we changed ports 9-16 to Group 2). (See Figure 31.)

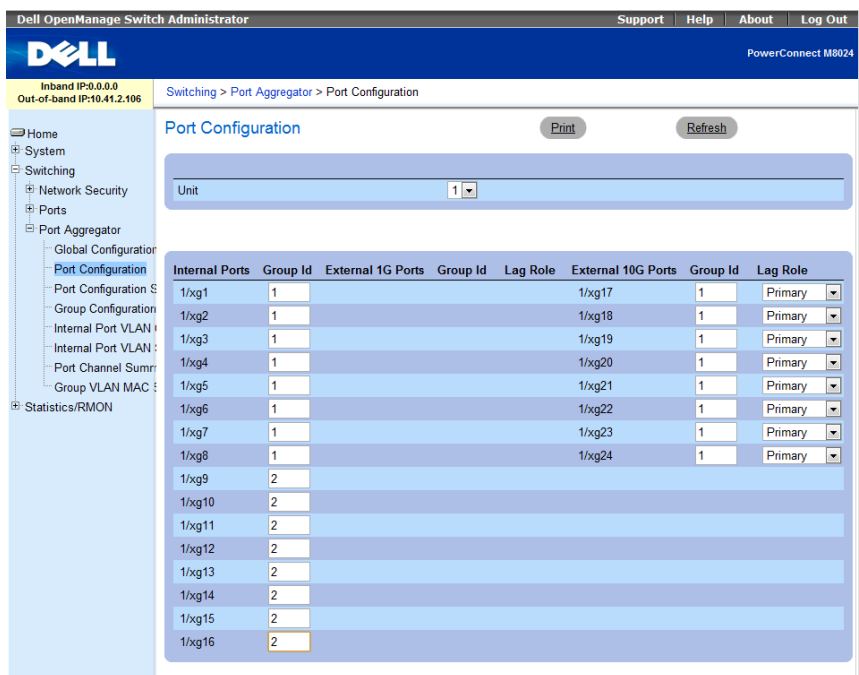


Figure 31: Assigning Group 2 to internal ports on the Dell PowerConnect M8024 switch.

- In the Port Configuration screen, change the Group ID of the external ports (we changed ports 23 and 24 to Group 2), and click Apply Changes (see Figure 32).

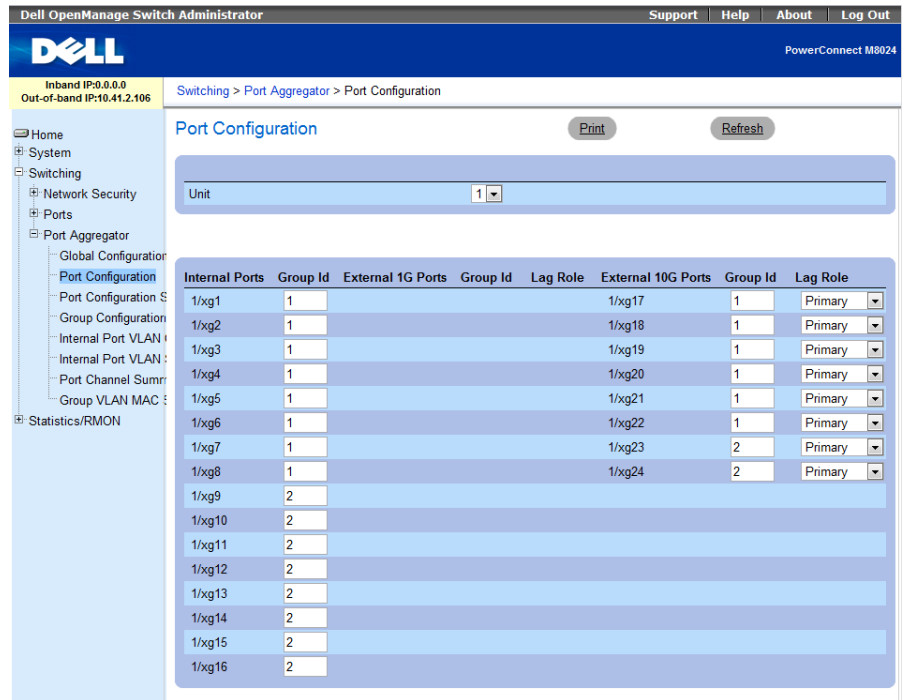


Figure 32: Assigning Group 2 to external ports on the Dell PowerConnect M8024 switch.

On the Dell PowerConnect M8024 switch CLI

1. Log into the switch.
2. Type the following commands into the switch (see Figure 33):

```
enable
configure
port-aggregator group 1
no add ethernet 1/xg9-1/xg16, 1/xg23-
1/xg24
exit
port-aggregator group 2
add ethernet 1/xg9-1/xg16, 1/xg23-1/xg24
end
```

```

console>enable
console#configure
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#no add ethernet 1/xg9-1/xg16,1/xg23-1/xg24
console(config-portAggr-group-1)#exit
console(config)#port-aggregator group 2
console(config-portAggr-group-2)#add ethernet 1/xg9-1/xg16,1/xg23-1/xg24
console(config-portAggr-group-2)#end

```

Figure 33: Moving ports from aggregate group 1 to aggregate group 2 on the Dell PowerConnect M8024 switch.

On the Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch to configure the port channels (see Figure 34):

```

enable
config t
interface port-channel 1
switchport
switchport access vlan 101
no shutdown
interface port-channel 2
switchport
switchport access vlan 102
no shutdown

```

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface port-channel 1
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
Router(config-if)#no shutdown
Router(config-if)#interface port-channel 2
Router(config-if)#switchport
Router(config-if)#switchport access vlan 102
Router(config-if)#no shutdown

```

Figure 34: Configuring the port channels on the Cisco Catalyst 6504-E switch.

3. Type the following commands while in privileged mode into the switch to add the port channels to the ports (see Figure 35):

```

config t
interface range te 2/1-2
switchport
channel-group 1 mode active

```

```

no shutdown
interface range te 2/3-4
switchport
channel-group 2 mode active
no shutdown

```

```

Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface range te 2/1-2
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 1 mode active
Router(config-if-range)#no shutdown
Router(config-if-range)#interface range te 2/3-4
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 2 mode active
Router(config-if-range)#no shutdown
Router(config-if-range)#

```

Figure 35: Configuring the second port channel on the Cisco Catalyst 6504-E switch.

4. Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch. The Dell PowerConnect M8024 should automatically create two two-port LAGs, each configured with half of the internal ports.

Scenario 5: Adding VLANs in a multi-AG configuration

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	1
Cisco Catalyst 6504-E switch	2
LC-SC multimode fiber optic patch cable	4

Figure 36: Materials needed to reproduce Scenario 5.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	First 6504-E te 2/1
M8024 Ethernet 1/xg22	First 6504-E te 2/2
M8024 Ethernet 1/xg23	Second 6504-E te 2/1
M8024 Ethernet 1/xg24	Second 6504-E te 2/2

Figure 37: Cable connections for Scenario 5.

On the Dell PowerConnect M8024 switch GUI

1. Log into the switch.
2. Select Switching → Port Aggregator → Port Configuration (see Figure 38).

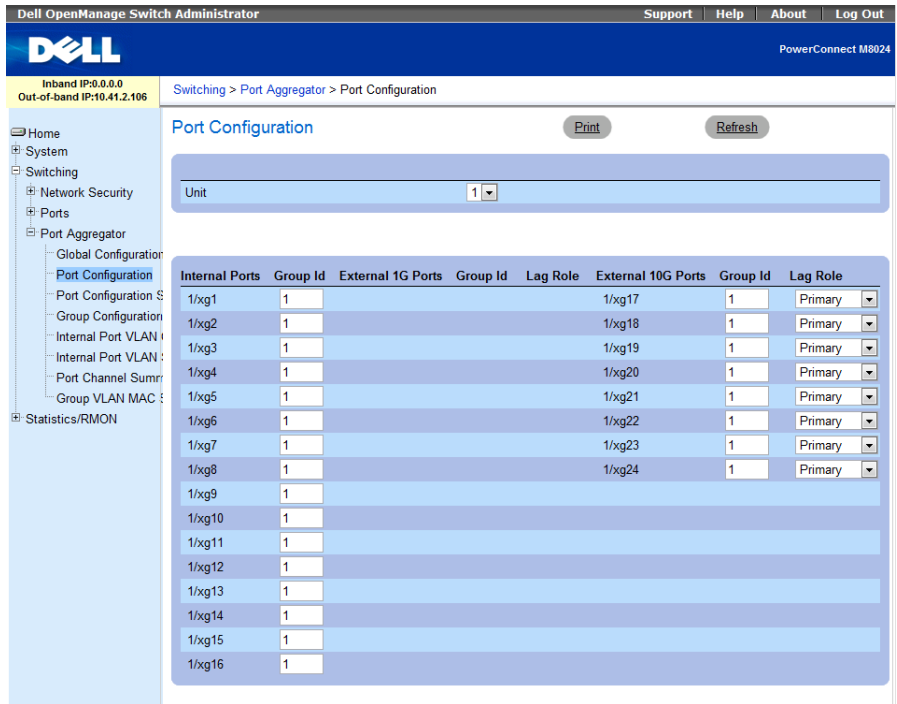


Figure 38: The Port Configuration screen on the Dell PowerConnect M8024 switch.

- In the Port Configuration screen, change the Group ID of the internal ports (we changed ports 9 through 16 to Group 2). (See Figure 39.)

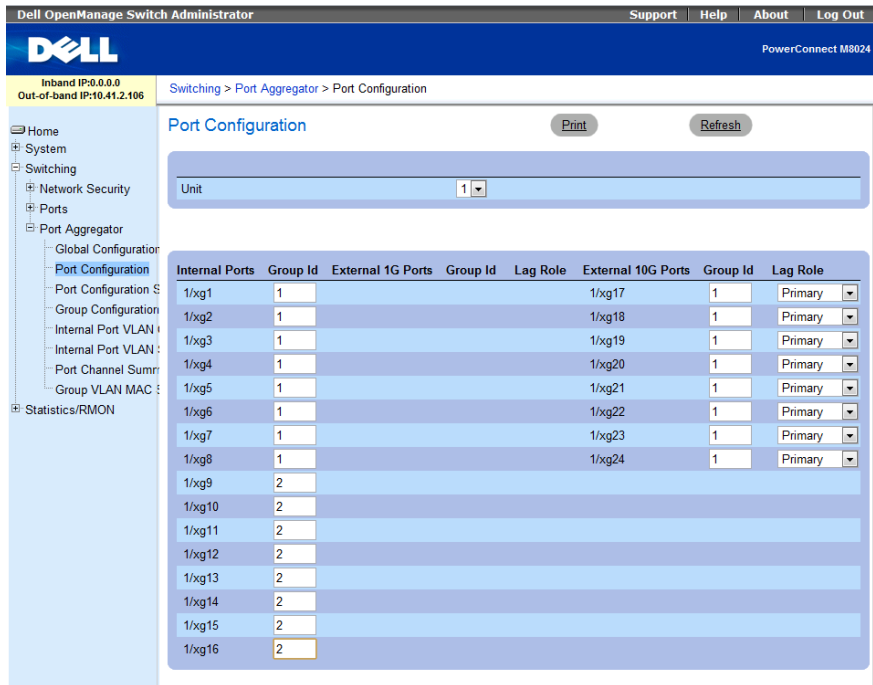


Figure 39: Assigning Group 2 to internal ports on the Dell PowerConnect M8024 switch.

- In the Port Configuration screen, change the Group ID of the external ports (we changed ports 23 and 24 to Group 2), and click Apply Changes (see Figure 40).

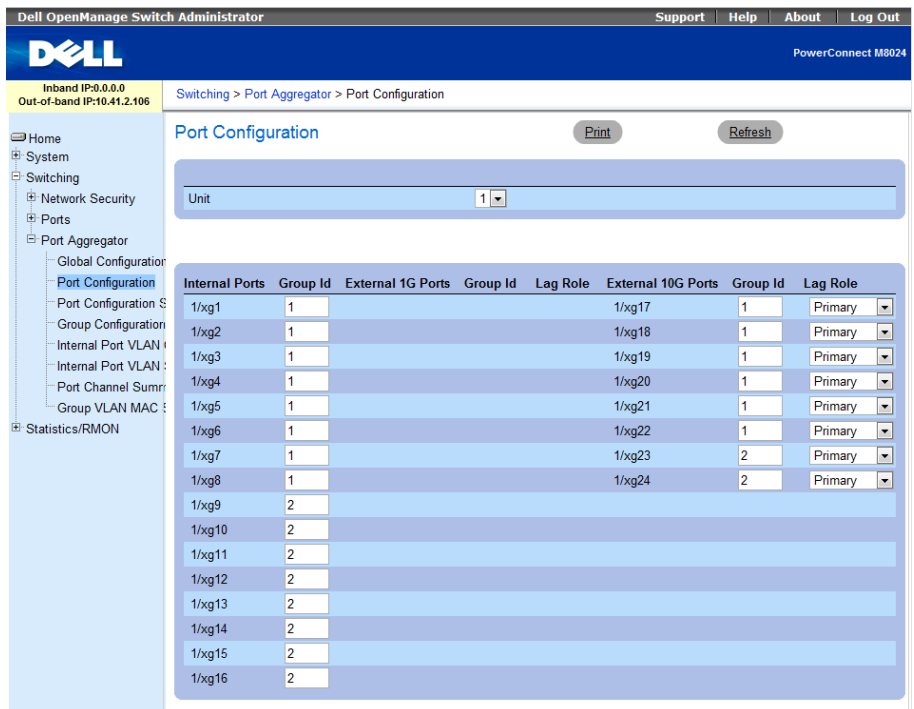


Figure 40: Assigning Group 2 to external ports on the Dell PowerConnect M8024 switch.

5. Select Switching → Port Aggregator → Internal Port VLAN Configuration (see Figure 41).

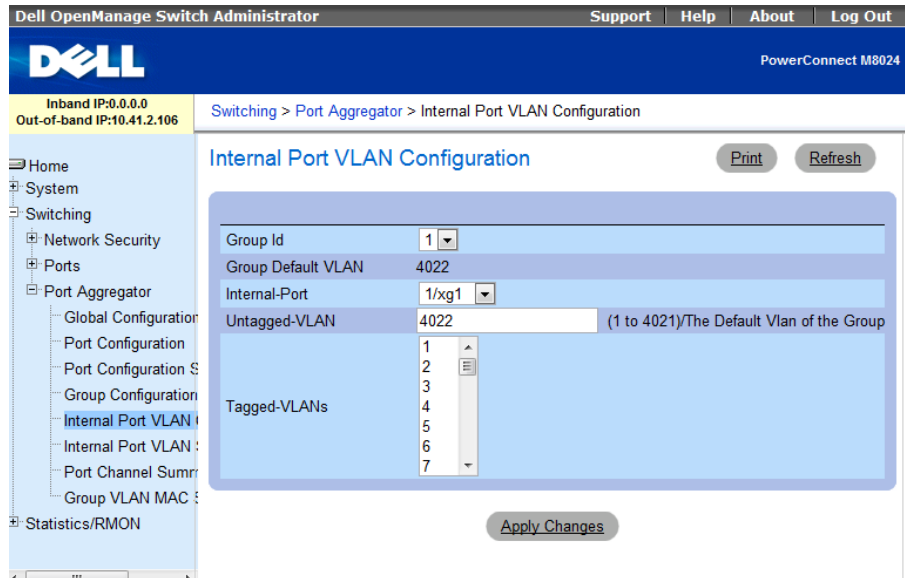


Figure 41: Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

6. In the Internal Port drop-down menu, select a port (we chose 1/xg1).
7. In the Tagged-VLANs box, select your VLANs (we chose 101-102), and left-click Apply Changes (see Figure 42).

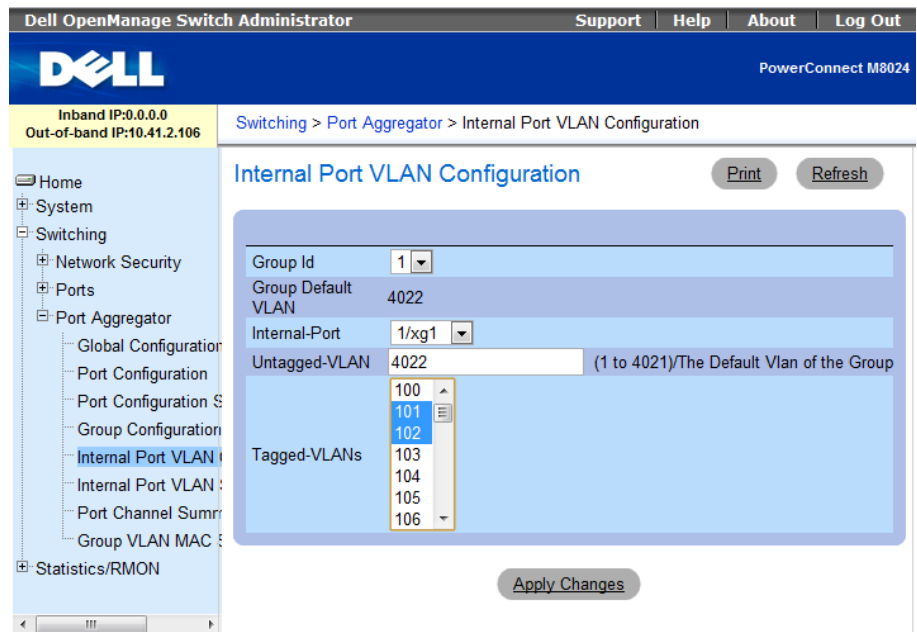


Figure 42: Selecting VLANs for the first port in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

8. In the Group Id box, select 2 from the dropdown menu (see Figure 43).

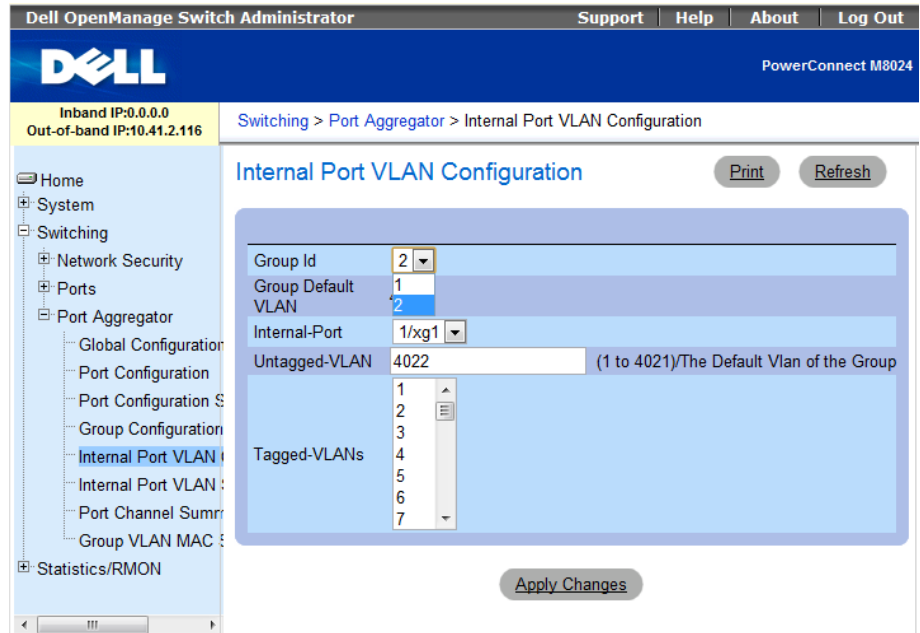


Figure 43: Selecting the Group Id in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

9. Repeat Step 7, applying VLANs 103-104 to port 1/xg9 (see Figure 44).

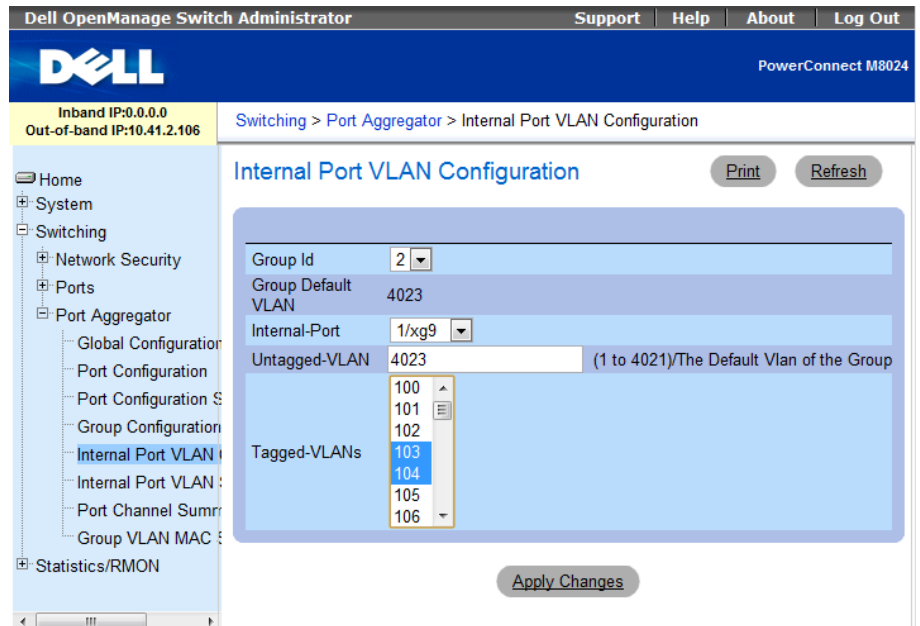


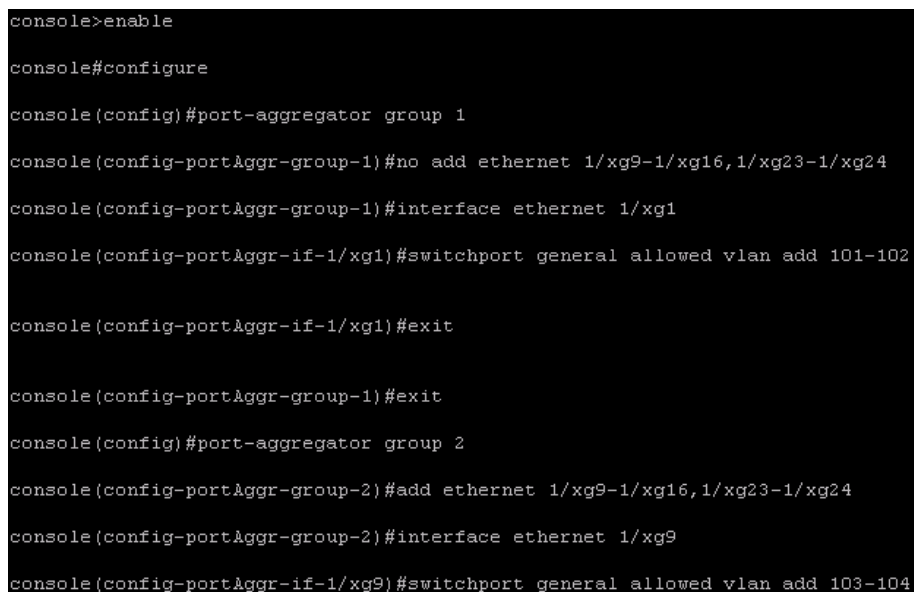
Figure 44: Selecting VLANs for the second port in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

On the Dell PowerConnect M8024 switch CLI

1. Log into the switch.

2. Type the following commands into the switch (see Figure 45):

```
enable
configure
port-aggregator group 1
no add ethernet 1/xg9-1/xg16,1/xg23-1/xg24
interface ethernet 1/xg1
switchport general allowed vlan add 101-102
exit
exit
port-aggregator group 2
add ethernet 1/xg9-1/xg16,1/xg23-1/xg24
interface ethernet 1/xg9
switchport general allowed vlan add 103-104
```



```
console>enable
console#configure
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#no add ethernet 1/xg9-1/xg16,1/xg23-1/xg24
console(config-portAggr-group-1)#interface ethernet 1/xg1
console(config-portAggr-if-1/xg1)#switchport general allowed vlan add 101-102
console(config-portAggr-if-1/xg1)#exit
console(config-portAggr-group-1)#exit
console(config)#port-aggregator group 2
console(config-portAggr-group-2)#add ethernet 1/xg9-1/xg16,1/xg23-1/xg24
console(config-portAggr-group-2)#interface ethernet 1/xg9
console(config-portAggr-if-1/xg9)#switchport general allowed vlan add 103-104
```

Figure 45: Moving ports from aggregate group 1 to aggregate group 2.

On the Cisco Catalyst 6504-E switches

On the first Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 46):

```
enable
config t
interface port-channel 1
switchport
switchport trunk encapsulation dot1q
```

```
switchport trunk allowed vlan 101-102
switchport mode trunk
no shutdown
interface range te 2/1-2
switchport
channel-group 1 mode active
no shutdown
```

```
6504-1>enable
6504-1#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-1 (config)#interface port-channel 1
6504-1 (config-if)#switchport
6504-1 (config-if)#switchport trunk encapsulation dot1q
6504-1 (config-if)#switchport trunk allowed vlan 101-102
6504-1 (config-if)#switchport mode trunk
6504-1 (config-if)#no shutdown
6504-1 (config-if)#interface range te 2/1-2
6504-1 (config-if-range)#switchport
6504-1 (config-if-range)#channel-group 1 mode active
6504-1 (config-if-range)#no shutdown
```

Figure 46: Configuring a port channel with trunking and multiple VLANs on the first Cisco Catalyst 6504-E switch.

On the second Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands the switch (see Figure 47):

```
enable
config t
interface port-channel 1
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 103-104
switchport mode trunk
no shutdown
interface range te 2/1-2
switchport
channel-group 1 mode active
no shutdown
```

```

6504-2>enable
6504-2#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-2 (config)#interface port-channel 1
6504-2 (config-if)#switchport
6504-2 (config-if)#switchport trunk encapsulation dot1q
6504-2 (config-if)#switchport trunk allowed vlan 103-104
6504-2 (config-if)#switchport mode trunk
6504-2 (config-if)#no shutdown
6504-2 (config-if)#interface range te 2/1-2
6504-2 (config-if-range)#switchport
6504-2 (config-if-range)#channel-group 1 mode active
6504-2 (config-if-range)#no shutdown

```

Figure 47: Configuring a port channel with trunking and multiple VLANs on the second Cisco Catalyst 6504-E switch.

3. Connect cables from the Dell PowerConnect M8024 switch to the Cisco Catalyst 6504-E switches.

Scenario 6: Setting up a fully meshed topology

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	2
Cisco Catalyst 6504-E switch	2
LC-SC multimode fiber optic patch cable	4
LC-LC multimode fiber optic patch cable	1
SC-SC multimode fiber optic patch cable	1

Figure 48: Materials needed to reproduce Scenario 6.

Cable connections

Originating port	Connecting port
First M8024 Ethernet 1/xg21	First 6504-E te 2/1
First M8024 Ethernet 1/xg22	Second 6504-E te 2/1
First M8024 Ethernet 1/xg24	Second M8024 Ethernet 1/xg24
Second M8024 Ethernet 1/xg24	First 6504-E te 2/2
Second M8024 Ethernet 1/xg24	Second 6504-E te 2/2
First 6504-E te 2/3	Second 6504-E te 2/3

Figure 49: Cable connections for Scenario 6.

On the Dell PowerConnect M8024 switches GUIs

If the switch is already in Simple Mode, no further configuration is necessary.

On the Dell PowerConnect M8024 switch CLI

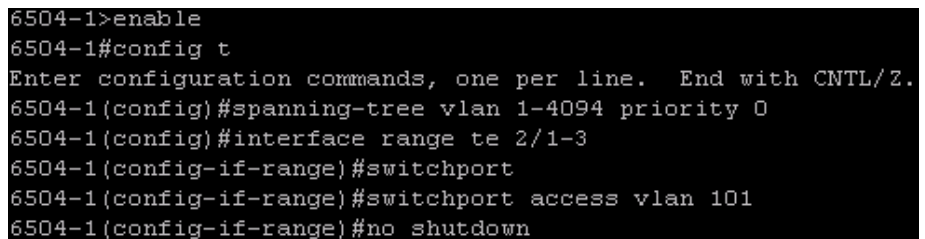
If the switch is already in Simple Mode, no further configuration is necessary.

On the Cisco Catalyst 6504-E switches

On the first Cisco Catalyst 6504-E

1. Log into the switch.
2. Type the following commands into the switch (see Figure 50):

```
enable
config t
spanning-tree vlan 1-4094 priority 0
interface range te 2/1-3
switchport
switchport access vlan 101
no shutdown
```

A screenshot of a terminal window showing the configuration of a Cisco Catalyst 6504-E switch. The text is as follows:

```
6504-1>enable
6504-1#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-1(config)#spanning-tree vlan 1-4094 priority 0
6504-1(config)#interface range te 2/1-3
6504-1(config-if-range)#switchport
6504-1(config-if-range)#switchport access vlan 101
6504-1(config-if-range)#no shutdown
```

Figure 50: Configuring spanning tree priority on the first Cisco Catalyst 6504-E switch.

On the second Cisco Catalyst 6504-E

1. Log into the switch.
2. Type the following commands into the switch (see Figure 51):

```
enable
config t
spanning-tree vlan 1-4094 priority 4096
interface range te 2/1-3
switchport
switchport access vlan 101
no shutdown
```

```

6504-2>enable
6504-2#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-2(config)#spanning-tree vlan 1-4094 priority 4096
6504-2(config)#interface range te 2/1-3
6504-2(config-if-range)#switchport
6504-2(config-if-range)#switchport access vlan 101
6504-2(config-if-range)#no shutdown

```

Figure 51: Configuring spanning tree priority on the second Cisco Catalyst 6504-E switch.

3. Connect the cables from the Cisco Catalyst 6504-E switches to each other and to the Dell PowerConnect M8024 switches.

The Dell switches will exchange configurations and create a spanning tree with the first Cisco switch as the root.

Scenario 7: Setting up a straight-through topology with LAG failover

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerConnect M8024 switch	1
Cisco Catalyst 6504-E switch	1
LC-SC multimode fiber optic patch cable	4

Figure 52: Materials needed to reproduce Scenario 7.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	6504-E te 2/1
M8024 Ethernet 1/xg22	6504-E te 2/2
M8024 Ethernet 1/xg23	6504-E te 2/3
M8024 Ethernet 1/xg24	6504-E te 2/4

Figure 53: Cable connections for Scenario 7.

On the Dell PowerConnect M8024 switch

1. Log into the switch.
2. Select Switching→Port Aggregator→Port Configuration (see Figure 54).

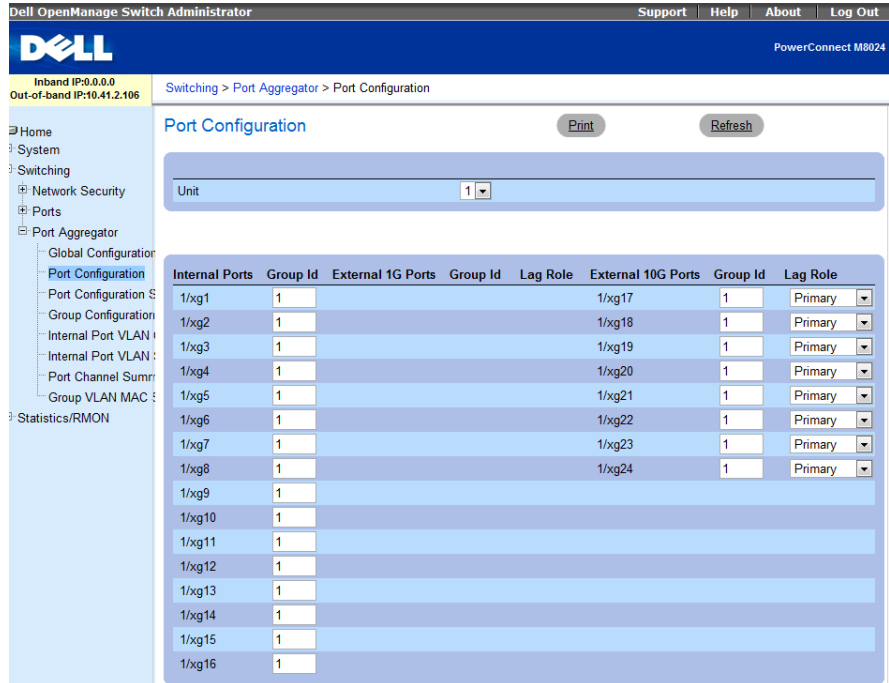


Figure 54: The Port Configuration screen on the Dell PowerConnect M8024 switch.

- In the Port Configuration screen, change the Lag Role of the external ports (we changed ports 23 and 24 to Secondary), and click Apply Changes (see Figure 55).

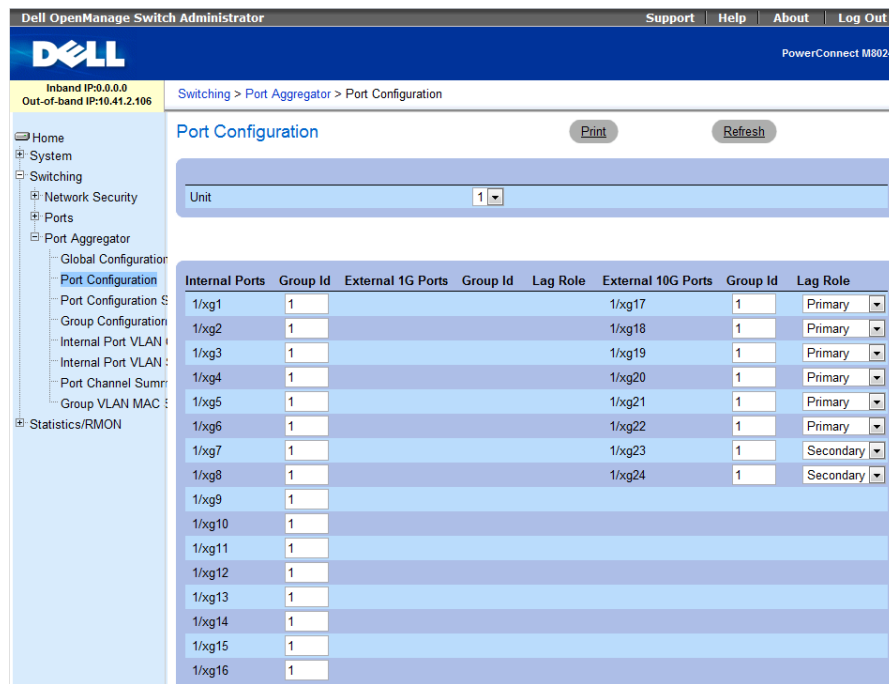
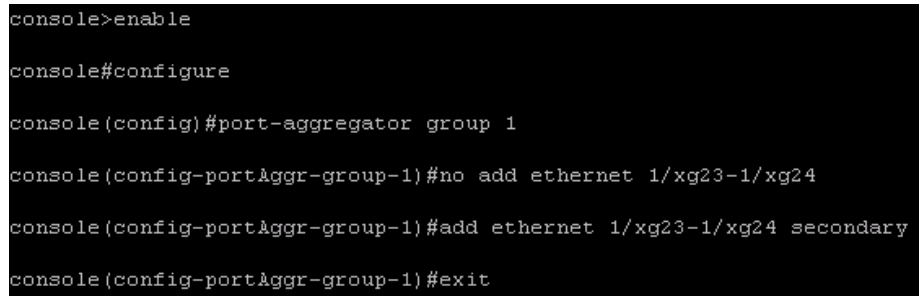


Figure 55: Assigning a Secondary LAG to external ports on the Dell PowerConnect M8024 switch.

On the Dell PowerConnect M8024 switch CLI

1. Log into the switch.
2. Type the following commands into the switch (see Figure 56):

```
enable
configure
port-aggregator group 1
no add ethernet 1/xg23-1/xg24
add ethernet 1/xg23-1/xg24 secondary
exit
```



```
console>enable
console#configure
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#no add ethernet 1/xg23-1/xg24
console(config-portAggr-group-1)#add ethernet 1/xg23-1/xg24 secondary
console(config-portAggr-group-1)#exit
```

Figure 56: Simple Mode configuration on the Dell PowerConnect M8024 switch.

On the Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 57):

```
enable
config t
interface port-channel 1
switchport
switchport access vlan 101
no shutdown
interface port-channel 2
switchport
switchport access vlan 101
no shutdown
interface range te 2/1-2
switchport
channel-group 1 mode active
no shutdown
interface range te 2/3-4
switchport
channel-group 2 mode active
no shutdown
```

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface port-channel 1
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
Router(config-if)#no shutdown
Router(config-if)#interface port-channel 2
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
Router(config-if)#no shutdown
Router(config-if)#interface range te 2/1-2
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 1 mode active
Router(config-if-range)#no shutdown
Router(config-if-range)#interface range te 2/3-4
Router(config-if-range)#switchport
Router(config-if-range)#channel-group 2 mode active
Router(config-if-range)#no shutdown

```

Figure 57: Configuring two port channels on the Cisco Catalyst 6504-E switch.

3. Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch. The Dell PowerConnect M8024 should automatically create one two-port LAG with a two-port backup in case of cable or port failure.

Scenario 8: Establishing access with VSS enabled across the Cisco Catalyst 6504-E switches

Materials needed to reproduce this scenario

Item	Quantity needed
Dell PowerEdge M8024 switch	1
Cisco Catalyst 6504-E switch	2
LC-SC multimode fiber optic patch cables	4
SC-SC multimode fiber optic patch cables	2

Figure 58: Materials needed to reproduce Scenario 8.

Cable connections

Originating port	Connecting port
M8024 Ethernet 1/xg21	First 6504-E te 2/1
M8024 Ethernet 1/xg22	First 6504-E te 2/2
M8024 Ethernet 1/xg23	Second 6504-E te 2/1
M8024 Ethernet 1/xg24	Second 6504-E te 2/2
First 6504-E te 1/4	Second 6504-E te 1/4
First 6504-E te 1/5	Second 6504-E te 1/5

Figure 59: Cable connections for Scenario 8.

On the Dell PowerConnect M8024 switch

If the switch is already in Simple Mode, no further configuration is necessary.

On the Dell PowerConnect M8024 switch CLI

If the switch is already in Simple Mode, no further configuration is necessary.

On the Cisco Catalyst 6504-E switches:

Connect the two Cisco Catalyst 6504-E switches using the cabling information given above, then follow the steps below.



NOTE: At least one interface on each switch should be assigned an IP address and be active; otherwise the OSPF process mentioned later in the methodology may not start.

On the first Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 60):

```
enable
config t
redundancy
mode sso
exit
router ospf 101
nsf
end
```

```
6504-1>enable
6504-1#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-1(config)#redundancy
6504-1(config-red)#mode sso
6504-1(config-red)#exit
6504-1(config)#router ospf 101
6504-1(config-router)#nsf
6504-1(config-router)#end
```

Figure 60: Initial configuration of VSS on the Cisco Catalyst 6504-E switch.

3. Type the following commands into the switch (see Figure 61):

```
config t
switch virtual domain 100
```

```

switch 1
exit
interface port-channel 10
switch virtual link 1
no shutdown
exit
interface range te 1/4-5
channel-group 10 mode on
no shutdown
end
switch convert mode virtual

```

```

6504-1#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-1(config)#switch virtual domain 100
Domain ID 100 config will take effect only
after the exec command 'switch convert mode virtual' is issued
6504-1(config-vs-domain)#switch 1
6504-1(config-vs-domain)#exit
6504-1(config)#interface port-channel 10
6504-1(config-if)#switch virtual link 1
6504-1(config-if)#no shutdown
6504-1(config-if)#exit
6504-1(config)#interface range te 1/4-5
6504-1(config-if-range)#channel-group 10 mode on
6504-1(config-if-range)#no shutdown
6504-1(config-if-range)#end
6504-1#switch convert mode virtual

This command will convert all interface names
to naming convention "interface-type switch-number/slot/port",
save the running config to startup-config and
reload the switch.

NOTE: Make sure to configure one or more dual-active detection methods
once the conversion is complete and the switches have come up in VSS mode.

Do you want to proceed? [yes/no]: y
Converting interface names
Building configuration...

```

Figure 61: Configuring port channels for the VSL on the first Cisco Catalyst 6504-E switch.

On the second Cisco Catalyst 6504-E switch

- 1.** Log into the switch.
- 2.** Type the following commands into the switch (see Figure 62):

```

enable
config t
redundancy
mode sso
exit
router ospf 102
nsf
end

```

```

6504-2>enable
6504-2#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-2 (config)#redundancy
6504-2 (config-red)#mode sso
6504-2 (config-red)#exit
6504-2 (config)#router ospf 102
6504-2 (config-router)#nsf
6504-2 (config-router)#end

```

Figure 62: Initial configuration of VSS on the second Cisco Catalyst 6504-E switch.

3. Type the following commands into the switch (see Figure 63):

```

config t
switch virtual domain 100
switch 2
exit
interface port-channel 20
switch virtual link 2
no shutdown
exit
interface range te 1/4-5
channel-group 20 mode on
no shutdown
switch convert mode virtual

```

```

6504-2#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-2 (config)#switch virtual domain 100
Domain ID 100 config will take effect only
after the exec command 'switch convert mode virtual' is issued
6504-2 (config-vs-domain)#switch 2
6504-2 (config-vs-domain)#exit
6504-2 (config)#interface port-channel 20
6504-2 (config-if)#switch virtual link 2
6504-2 (config-if)#no shutdown
6504-2 (config-if)#exit
6504-2 (config)#interface range te 1/4-5
6504-2 (config-if-range)#channel-group 20 mode on
6504-2 (config-if-range)#no shutdown
6504-2 (config-if-range)#
*Feb 18 04:23:59.891: %VSLP-SW2_SP-5-RRP_MSG: Role change from Active to Standby and hence n
eed to reload
*Feb 18 04:23:59.891: %VSLP-SW2_SP-5-RRP_UNSAVED_CONFIG: Ignoring system reload since there
are unsaved configurations.
Please save the relevant configurations
*Feb 18 04:23:59.891: %VSLP-SW2_SP-5-RRP_MSG: Use 'redundancy reload shelf' to bring this sw
itch to its preferred STANDBY role
*Feb 18 04:23:59.895: %DUAL_ACTIVE-SW2_SP-1-RECOVERY: Dual-active condition detected: Starti
ng recovery-mode, all non-VSL and non-excluded interfaces have been shut down
6504-2#switch convert mode virtual

This command will convert all interface names
to naming convention "interface-type switch-number/slot/port",
save the running config to startup-config and
reload the switch.

NOTE: Make sure to configure one or more dual-active detection methods
once the conversion is complete and the switches have come up in VSS mode.

Do you want to proceed? [yes/no]: y
Converting interface names
Building configuration...

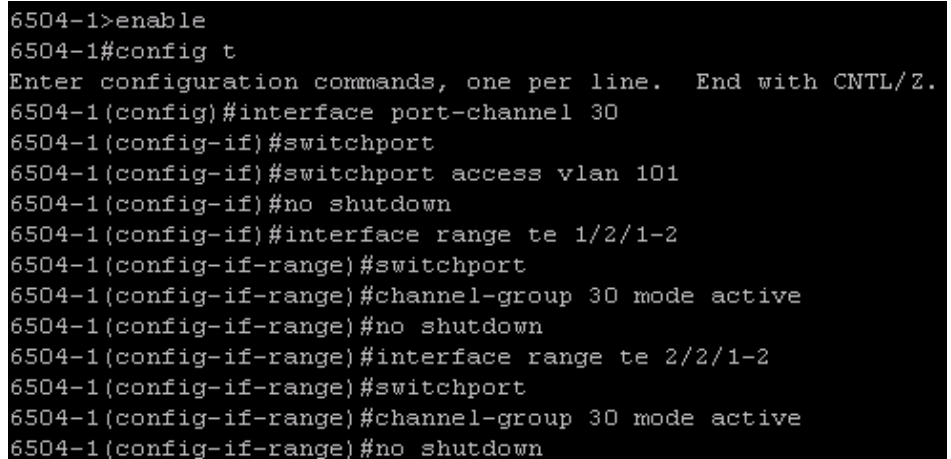
```

Figure 63: Configuring port channels for the VSL on the second Cisco Catalyst 6504-E switch.

On the first Cisco Catalyst 6504-E switch

1. Log into the switch.
2. Type the following commands into the switch (see Figure 64):

```
enable
config t
interface port-channel 30
switchport
switchport access vlan 101
no shutdown
interface range te 1/2/1-2
switchport
channel-group 30 mode active
no shutdown
interface range te 2/2/1-2
switchport
channel-group 30 mode active
no shutdown
```



```
6504-1>enable
6504-1#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-1(config)#interface port-channel 30
6504-1(config-if)#switchport
6504-1(config-if)#switchport access vlan 101
6504-1(config-if)#no shutdown
6504-1(config-if)#interface range te 1/2/1-2
6504-1(config-if-range)#switchport
6504-1(config-if-range)#channel-group 30 mode active
6504-1(config-if-range)#no shutdown
6504-1(config-if-range)#interface range te 2/2/1-2
6504-1(config-if-range)#switchport
6504-1(config-if-range)#channel-group 30 mode active
6504-1(config-if-range)#no shutdown
```

Figure 64: Configuring port channels and assigning ports to connect to the Dell PowerConnect M8024 switch.

3. Connect cables from the Cisco Catalyst 6504-E switches to the Dell PowerConnect M8024 switch according to the diagram shown in Scenario 8 of the Testing Scenarios section. The Dell PowerConnect M8024 switch should automatically create a four-port LAG, with two ports connecting to each Cisco Catalyst 6504-E switch.

APPENDIX B – NETWORK SWITCH CONFIGURATION INFORMATION

Figure 65 provides detailed configuration information for the network switches we used.

Network switch	Dell PowerConnect M8024	Cisco Catalyst 6504-E
Software version	3.1.3.12	12.2(33)SX14a
BIOS version	N/A	8.5(3)

Figure 65: Detailed configuration information for the network switches.

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