Deployment of Dell[™] M-Series blade switches in a Cisco[®] Catalyst[®] Network





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TABLE OF CONTENTS

Table of contents	. 2
Summary	. 3
Features of Simple Switch Mode	. 4
Sample scenarios	. 4
Testing scenarios Scenario 1: Plug and play using the Dell PowerConnect M802 switch for blade deployment into an existing network Scenario 2: Configuring VLANs on the internal ports of the De PowerConnect M8024 switch Scenario 3: Configuring multiple VLANs per internal port to connect to a server NIC with tagging enabled Scenario 4: Configuring multiple Port Aggregation Groups an dedicating specific Uplinks Scenario 5: Adding VLANs in a multi-AG configuration Scenario 6: Setting up a fully meshed topology with LAG failover	5 24 6 ell 7 8 id 10 11 12 13
Scenario 8: Establishing access with VSS enabled across the Cisco Catalyst 6504-E switches	14
Appendix $A = Detailed scenario methodology$	16
Scenario 1: Plug and play using the Dell PowerConnect M802 switch for blade deployment into an existing network Scenario 2: Configuring VLANs on the internal ports of the De PowerConnect M8024 switch Scenario 3: Configuring multiple VLANs per internal port to	10 24 16 ell 17
connect to a server NIC with tagging enabled	20
Scenario 4: Configuring multiple Port Aggregation Groups an dedicating specific Uplinks	id 23
Scenario 5: Adding VLANs in a multi-AG configuration	27
Scenario 6: Setting up a fully meshed topology	33
failover Scenario 8: Establishing access with VSS enabled across the	35
Cisco Catalyst 6504-E switches	38
Appendix B – Network switch configuration information	45
About Principled Technologies	46

SUMMARY

Adding a Dell[™] PowerConnect[™] M8024 switch or a Dell M8024 LAN Module with a Dell PowerEdge[™] M1000e modular blade enclosure to an existing network using a Cisco[®] infrastructure is a straightforward process. The addition of Simple Switch Mode on the Dell M8024 family of switches further simplifies the process, allowing integration into a Cisco 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) in 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 to integrate with each scenario with minimal interaction from our technicians.



Figure 1: The Dell PowerConnect M8024 switch. NOTE: We tested with the Dell PowerConnect M8024 sv



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 design its integration into the existing environment.

The primary advantages of deploying SSM are as follows:

- Port Aggregation is easy to configure. Simply group internal ports and associate with external ports, assign VLANs (if required), and it's ready to go.
- SSM automatically configures multiple external ports into an LACP trunk group.
- By using Aggregator Groups, the feature 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 Simple Switch Mode on a Dell PowerConnect M8024 switch, perform the following steps:

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

NOTE: Dell M8024 LAN Modules are always in Simple Switch Mode,

so you do not need to do these steps.

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:

 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.

- 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.
- 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.)
- 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 the Guide give detailed, step-by-step information on how to do the deployment and provide detailed configuration information on the hardware we used.

TESTING SCENARIOS

Our testing 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 Simple Switch Mode 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 our 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 Cisco Catalyst 6504-E switch ports. Dell's plug-and-play features with Simple Switch Mode allow for quick integration of Dell blade switch into a network. We provide detailed instructions in <u>Appendix A</u>.

- 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.
- Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch. The Dell PowerConnect M8024 switch will automatically create a Link Aggregation Group (LAG) and establish network connectivity for 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 2 illustrates the completed configuration for Scenario 1.



Dell PowerConnect M8024 switch

Cisco Catalyst 6504-E switch

Figure 2: 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 those VLANs in the external Cisco Catalyst network. VLANs allow for traffic isolation and for granular quality of service (QoS) control over simple subnetting, and Dell switches with Simple Switch Mode enabled offer quick and easy VLAN configuration. We provide detailed instructions in <u>Appendix A</u>.

- 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 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 3 illustrates the completed configuration for Scenario 2.



Cisco Catalyst 6504-E switch



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, which is useful for management of VMs. We provide detailed instructions in <u>Appendix A</u>.

- 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 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 VM communications so that you can tag them to various VLANs.

Figure 4 illustrates the completed configuration for Scenario 3.



Cisco Catalyst 6504-E switch

Figure 4: 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.

- 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 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 LAG, including those external ports that are part of that group. This applies to the blade servers in Group 2 as well.

Figure 5 illustrates the completed configuration for Scenario 4.



Cisco Catalyst 6504-E switch

Figure 5: Graphic representation of Scenario 4.

Dell PowerConnect M8024 switch

Scenario 5: Adding VLANs in a multi-AG 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 <u>Appendix A</u>.

- 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).
- 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 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 6 illustrates the completed configuration for Scenario 5.



Cisco Catalyst 6504-E switches

Figure 6: 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 while spanning tree protocol (STP) is enabled on an existing network. STP allows for redundant connections in switches without creating loops, and the Dell PowerConnect M8024 switches can automatically integrate themselves into an STP network. The Dell PowerConnect M8024 in Simple Switch Mode uses LAGs to prevent loops, but allows Cisco Catalyst switches to handle STP states. We provide detailed instructions in <u>Appendix A</u>.

- 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.
- Connect the cables between all switches. The Dell PowerConnect M8024 switches will automatically integrate into the Cisco spanning tree network.

Figure 7 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 7: 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 8 illustrates the new logical network created in the event of a cable failure.



Dell PowerConnect M8024 switches 1 & 2

Figure 8: 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. Simple Switch Mode 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.

- 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 channel groups with LACP enabled.
- 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 9 illustrates the completed configuration for Scenario 7.



Cisco Catalyst 6504-E switch

Figure 9: 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 <u>Appendix A</u>.

- 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).
- On the each Cisco Catalyst 6504-E switch, set up the VSS domain and keepalive ports, and create the PortChannel for the downstream switch (the Dell PowerConnect M8024 switch).
- **3.** Cable the two Cisco Catalyst 6504-E switches together using the peer links 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 10 illustrates the completed configuration for Scenario 8.



Figure 10: Graphic representation of Scenario 8.

APPENDIX A – DETAILED SCENARIO METHODOLOGY

In this appendix, we provide detailed descriptions of the test scenarios we followed and screenshots for each step, as appropriate. In each scenario, we assume that the associated switches are at factory default configurations. 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

On the Dell PowerConnect M8024 switch GUI

- **1.** Log into the switch.
- Select System→Operational Mode→Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 11).

Dell OpenManage Switc	h Administrator	Support Help	About Log Out
DØLL			PowerConnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Ope	erational Mode Configuration	
➡ Home ⊡ Svstem	Operational Mode Confi	guration	Print Refresh
General SNTP	Simple Mode	Enable 💌	
[⊕] Logs			
Operational Mode Operational Mode C		Apply Changes	
 Management Security SNMP 			
[.] File Management			
 Advanced Settings 			
Figure 11: Simple N	lode configuration on the	e Dell PowerConnec	t M8024 switch.

On the Dell PowerConnect M8024 switch CLI

1. Log into the switch.

2. Type the following commands into the switch (see Figure 12):

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

Figure 12: 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 13):

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

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

Figure 13: Configuring a port channel on the Cisco Catalyst 6504-E switch.

 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

On the Dell PowerConnect M8024 switch GUI

- **1.** Log into the switch.
- 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

Deployment of Dell M-Series blade switches in a Cisco Catalyst network

(see Figure 14). The switch will reset after this and you will need to log in again.

Dell OpenManage Swite	h Administrator Support Help	About	Log Out
D¢LL		PowerC	onnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
Home	Operational Mode Configuration	Print	Refresh
General SNTP	Simple Mode		
⊞ Logs			
Operational Mode Operational Mode C	Apply Changes		
[⊕] IP Addressing			
Management Security SNMP			

Figure 14: Simple Mode configuration on the Dell PowerConnect M8024 switch.

- Select Switching → Port Aggregator → Internal Port VLAN Configuration.
- In the Internal-Port drop-down menu, select a port (we chose 1/xg1). (See Figure 15.)

	Dell OpenManage Switcl	h Administrator		Support Help	About Log Out			
	D¢LL				PowerConnect M8024			
	Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port Aggregator > Internal Port VLAN Configuration						
6	⊐ Home ⊞System	Internal Port VLAN	Configuration	Pri	int <u>Refresh</u>			
B	Switching							
	Network Security	Group Id	1 💌					
		Group Default VLAN	4022					
	Port Aggregator	Internal-Port	1/xg1 💌					
	Global Configuration	Untagged-VLAN	4022	(1 to 4021)/The Defa	ult Vlan of the Group			
	Port Configuration Port Configuration S Group Configuration Internal Port VLAN I Internal Port VLAN I Port Channel Summ	Tagged-VLANs	1 • 2 = 3 3 4 5 5 6 7 •					
2	Group VLAN MAC Statistics/RMON		Apply Char	nges				

Figure 15: Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

6. In the Untagged-VLAN textbox, write a VLAN (we chose 101), and left-click Apply Changes (see Figure 16.)

Dell OpenManage Swite	h Administrator		Support Help About Log Out
D¢LL			PowerConnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port Aggregate	or > Internal Port VLAN Co	onfiguration
⊒ Home ⊒ System	Internal Port VLAN	Configuration	Print Refresh
⊐ Switching			
Network Security	Group Id	1 💌	
[⊞] Ports	Group Default VLAN	4022	
Port Aggregator	Internal-Port	1/xg1 💌	
Global Configuration	Untagged-VLAN	101	(1 to 4021)/The Default Vlan of the Group
Port Configuration		1 🔺	
Port Configuration S		2 🗉	
Group Configuration	Tagged VI ANs	3	
Internal Port VLAN	Tagged-VLAIVS	5	
Internal Port VLAN		6	
Port Channel Summ		7 -	
Group VLAN MAC			
Statistics/RMON		Apply Cha	anges
4 III			

Figure 16: 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 17):

```
enable
       configure
       port-aggregator group 1
       lacp auto
       vlan add 101
       end
       config
       port-aggregator lag-failover
onsole#configure
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#lacp_auto
console(config-portAggr-group-1)#vlan add 101
console(config-portAggr-group-1)#end
console#config
console(config)#port-aggregator lag-failover
Warning! Please ensure that lacp mode is 'auto' for all groups.
 set the lacp auto mode.
```

Figure 17: 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 18):

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



Figure 18: Configuring a port channel with Trunking on the Cisco Catalyst 6504-E switch.

 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

On the Dell PowerConnect M8024 switch GUI

- **1.** Log into the switch.
- Select System→Operational Mode→Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu and left-click Apply Changes (see Figure 19). The switch will reset after this and you will need to log in again.

Dell OpenManage Swite	ch Administrator Support Help	About Log Ou	ut
D¢LL		PowerConnect M8	024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
Home	Operational Mode Configuration	Print Refresh	
E General	Simple Mode Enable 💌		
 Logs □ Operational Mode 	Apply Changes		
Management Security SNMP			
Advanced Settings			
nap manager			

Figure 19: Simple Mode configuration on the Dell PowerConnect M8024 switch.

- Select Switching → Port Aggregator → Internal Port VLAN Configuration.
- In the Internal-Port drop-down menu, select a port (we chose 1/xg1). (See Figure 20.)

	Dell OpenManage Swi	tch	Administrator			Support	Help	About	Log Out	
	D¢LL							Powe	rConnect M8024	
	Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106		Switching > Port Aggregator > Internal Port VLAN Configuration							
() 	■ Home Svstem		Internal Port VLAN		onfiguration			<u>Print</u>	Refresh	
Ę	Switching									
	Network Security		Group Id		1 💌					
	[⊕] Ports		Group Default VLAN	4	4022					
	Port Aggregator		Internal-Port		1/xg1 💌					
	Global Configurati	DIT	Untagged-VLAN		4022	(1 to 402	21)/The De	efault Vlan	of the Group	
	Port Configuration				1 🔺					
	Port Configuration	S			2 =					
	Group Configuration	ori	Tagged-VLANs		4					
	Internal Port VLA	1			5					
	Internal Port VLA	1:			6					
	Port Channel Sun	nrr								
	Group VLAN MAC	÷				_				
+	Statistics/RMON	Þ			Apply Chan	<u>ges</u>				

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

6. In the Tagged-VLANs box, select your VLANs (we chose 101-104), and left-click Apply Changes (see Figure 21).

	Dell OpenManage Switc	h Administrator		Support	Help About	Log Out		
	DØLL				Power	Connect M8024		
	Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port Aggregator > Internal Port VLAN Configuration						
G	■ Home	Internal Port VLAN	Configuration		Print	Refresh		
E	Switching							
	Network Security	Group Id	1 -					
	[⊕] Ports	Group Default VLAN	4022					
	Port Aggregator	Internal-Port	1/xg1 💌					
	Global Configuration	Untagged-VLAN	4022	(1 to 4021)/The Default Vlan	of the Group		
	Port Configuration		101 🔺					
	Port Configuration S		102 E					
	Group Configuration	Tagged-VLANs	103					
	Internal Port VLAN	-aggoa to ato	105					
	Internal Port VLAN		106					
	Port Channel Sumr		107 🔻					
	Group VLAN MAC							
E	Statistics/RMON		Apply Cha	nges				
	۰ III ا							

Figure 21: Selecting tagged VLANs 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 22):

```
enable
configure
port-aggregator group 1
lacp auto
vlan add 101-104
end
configure
port-aggregator lag-failover
```

console#configure

```
console(config)#port-aggregator group 1
console(config-portAggr-group-1)#lacp auto
console(config-portAggr-group-1)#vlan add 101-104
console(config-portAggr-group-1)#end
console#configure
console(config)#port-aggregator lag-failover
Warning! Please ensure that lacp mode is 'auto' for all groups.
Use 'lacp auto' to
o set the lacp auto mode.
```

Figure 22: 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 23):

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

outer#config t

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

Figure 23: Configuring a port channel with Trunking and multiple VLANs on the Cisco Catalyst 6504-E switch.

 Connect cables from the Cisco Catalyst 6504-E switch to the Dell PowerConnect M8024 switch. From this point onward, any VMs configured with VLAN tagging will be encapsulated with appropriate VLAN tags.

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

On the Dell PowerConnect M8024 switch GUI

- **1.** Log into the switch.
- Select System→Operational Mode→Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu and left-click Apply Changes (see Figure 24). The switch will reset after this and you will need to log in again.

Dell OpenManage Swite	ch Administrator Support Help	About	Log Out
D¢LL		PowerCo	onnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
➡ Home	Operational Mode Configuration	Print	Refresh
General SNTP	Simple Mode Enable 💌		
Operational Mode	Apply Changes		
 IP Addressing • Management Security 			
SNMP File Management			
terrap Manager			

Figure 24: Simple Mode configuration on the Dell PowerConnect M8024 switch.

 Select Switching→Port Aggregator→ Port Configuration (see Figure 25).

D	ell OpenManage Switc	h Administrator					Support	Help A	bout Lo	g Out
	D¢LL								PowerConnec	t M8024
0	Inband IP:0.0.0.0 ut-of-band IP:10.41.2.106	Switching > Port	Aggregator :	Port Configuration						
	Home System Switching ⋑ Network Security ⋑ Ports ⋑ Port Aggregator	Port Configu	uration		1.	Pr	int	<u>Refresh</u>		
	Global Configuration									_
	Port Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
	Port Configuration S	1/xg1	1				1/xg17	1	Primary	•
	Group Configuration	1/xg2	1				1/xg18	1	Primary	•
	Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	•
	Port Channel Sumr	1/xg4	1				1/xg20	1	Primary	-
	Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	•
÷٠	Statistics/RMON	1/xg6	1				1/xg22	1	Primary	-
		1/xg7	1				1/xg23	1	Primary	•
		1/xg8	1				1/xg24	1	Primary	•
		1/xg9	1							
		1/xg10	1							
		1/xg11	1							
		1/xg12	1							
		1/xg13	1							
		1/xg14	1							
		1/xg15	1							
		1/xg16	1							

Figure 25: 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 26.)

Dell OpenManage Swit	ch Administrator					Support	Help /	About Lo	g Out
DØLL								PowerConnec	ct M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port	Aggregator	> Port Configuration						
Home System Switching P Network Security P Ports Port Aggregator	Port Configu	uration		1.	Pr	int	Refresh		
Global Configuration			F			5			
Port Configuration	S 1/vo1	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
Group Configuratio	1/xg1	1				1/xg18	1	Primary	
Internal Port VLAN	1/xg2	1				1/xg10	1	Primany	
Internal Port VLAN	1/xg3	1				1/2020	1	Primany	
Port Channel Sum	1/xq5	1				1/xg21	1	Primany	
Statistics/RMON	1/xg5	1				1/xg21	1	Primary	
	1/xq7	1				1/xg23	1	Primary	-
	1/xq8	1				1/xg24	1	Primary	-
	1/xq9	2				inge i		, mary	
	1/xq10	2							
	1/xq11	2							
	1/xq12	2							
	1/xq13	2							
	1/xg14	2							
	1/xq15	2							
	1/xg16	2							

Figure 26: Assigning Group 2 to internal ports on the Dell PowerConnect M8024 switch.

6. 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 27).

Del	l OpenManage Switc	h Administrator					Support	Help /	About Lo	g Out
	Xell								PowerConnec	ct M8024
Out-	Inband IP:0.0.0.0 of-band IP:10.41.2.106	Switching > Port	Aggregator :	> Port Configuration						
■ Ho Sy Sv	ome rstem vitching Network Security Ports	Port Configu	uration		1 💌	Pr	int	Refresh		
B	Port Aggregator									
	Port Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
	Port Configuration S	1/xg1	1				1/xg17	1	Primary	-
	Group Configuration	1/xg2	1				1/xg18	1	Primary	•
	Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	•
	Port Channel Summ	1/xg4	1				1/xg20	1	Primary	-
	Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	-
⊞ St	atistics/RMON	1/xg6	1				1/xg22	1	Primary	•
		1/xg7	1				1/xg23	2	Primary	-
		1/xg8	1				1/xg24	2	Primary	-
		1/xg9	2							
		1/xg10	2							
		1/xg11	2							
		1/xg12	2							
		1/xg13	2							
		1/xg14	2							
		1/xg15	2							
		1/xg16	2							



On the Dell PowerConnect M8024 switch CLI

- **1.** Log into the switch.
- 2. Type the following commands into the switch (see Figure 28):

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

Figure 28: 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 29):

```
config t
interface port-channel 1
switchport
switchport access vlan 101
interface port-channel 2
switchport
switchport access vlan 102
```

```
Router#config t
Enter configuration commands, one per line. End with CNTL/2.
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
Router(config-if)#interface port-channel 2
Router(config-if)#switchport
Router(config-if)#switchport
Router(config-if)#switchport access vlan 102
```

Figure 29: Configuring the port channels on the Cisco Catalyst 6504-E switch.

3. Type the following commands into the switch to add the port channels to the ports (see Figure 30):

```
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/2.
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)#no shutdown
Router(config-if-range)#no shutdown
Router(config-if-range)#no shutdown
```

Figure 30: 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

On the Dell PowerConnect M8024 switch GUI

- **1.** Log into the switch.
- Select System→Operational Mode→Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 31). The switch will reset after this and you will need to log in again.

Dell OpenManage Swite	ch Administrator Support Help	About	Log Out
D¢LL		PowerCo	onnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
➡ Home ➡ System ➡ General ➡ SNTP	Operational Mode Configuration	Print	<u>Refresh</u>
Coperational Mode Coperational Mode Coperational Mode COPERATION	Apply Changes		

Figure 31: Simple Mode configuration on the Dell PowerConnect M8024 switch.

 Select Switching→Port Aggregator→Port Configuration (see Figure 32).

Dell	OpenManage Swite	h Administrator					Support	Help /	About Lo	g Out
	XELL								PowerConnec	ct M8024
Out-	Inband IP:0.0.0.0 of-band IP:10.41.2.106	Switching > Port	Aggregator :	> Port Configuration						
■ Ho ● Sy ● Sw	ome stem ritching Network Security	Port Configu	iration		1.	Pr	int	<u>Refresh</u>		
Ē	Ports Port Aggregator									
	Global Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
	Port Configuration S	1/xg1	1				1/xg17	1	Primary	-
	Group Configuration	1/xg2	1				1/xg18	1	Primary	-
	Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	-
	Port Channel Sumr	1/xg4	1				1/xg20	1	Primary	-
	Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	-
🗄 Sta	atistics/RMON	1/xg6	1				1/xg22	1	Primary	-
		1/xg7	1				1/xg23	1	Primary	-
		1/xg8	1				1/xg24	1	Primary	-
		1/xg9	1							
		1/xg10	1							
		1/xg11	1							
		1/xg12	1							
		1/xg13	1							
		1/xg14	1							
		1/xg15	1							
		1/xg16	1							

Figure 32: 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 33.)

Dell OpenManage Switc	h Administrator					Support	Help /	About Lo	g Out
D¢LL								PowerConner	t M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port	Aggregator	> Port Configuration						
Home System Switching Network Security Ports	Port Configu	iration		1.	Pr	int (Refresh		
Port Aggregator									
Port Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
Port Configuration S	1/xg1	1				1/xg17	1	Primary	•
Group Configuration	1/xg2	1				1/xg18	1	Primary	-
Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	•
Port Channel Summ	1/xg4	1				1/xg20	1	Primary	-
Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	•
Statistics/RMON	1/xg6	1				1/xg22	1	Primary	•
	1/xg7	1				1/xg23	1	Primary	•
	1/xg8	1				1/xg24	1	Primary	-
	1/xg9	2							
	1/xg10	2							
	1/xg11	2							
	1/xg12	2							
	1/xg13	2							
	1/xg14	2							
	1/xg15	2							
	1/xg16	2							

Figure 33: Assigning Group 2 to internal ports on the Dell PowerConnect M8024 switch.

6. 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 34).

Dell OpenManage Switc	h Administrator					Support	Help /	About Lo	g Out
DØLL								PowerConnec	ct M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port	Aggregator	Port Configuration						
Home System Switching Witching Network Security	Port Configu	iration		1	Pr	int	<u>Refresh</u>		
Port Aggregator									
Port Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
Port Configuration S	1/xg1	1				1/xg17	1	Primary	-
Group Configuration	1/xg2	1				1/xg18	1	Primary	-
Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	•
Port Channel Summ	1/xg4	1				1/xg20	1	Primary	-
Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	-
Statistics/RMON	1/xg6	1				1/xg22	1	Primary	-
	1/xg7	1				1/xg23	2	Primary	-
	1/xg8	1				1/xg24	2	Primary	-
	1/xg9	2							
	1/xg10	2							
	1/xg11	2							
	1/xg12	2							
	1/xg13	2							
	1/xg14	2							
	1/xg15	2							
	1/xg16	2							

Figure 34: Assigning Group 2 to external ports on the Dell PowerConnect M8024 switch.

7. Select Switching → Port Aggregator → Internal Port VLAN Configuration (see Figure 35).

Dell OpenManage Switch	h Administrator		Support He	lp About Log Out
D¢LL				PowerConnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port Aggregate	or > Internal Port VLAN Cor	nfiguration	
⊐ Home ∄-System	Internal Port VLAN	Configuration		Print Refresh
⊐ Switching				
Network Security	Group Id	1 💌		
[⊕] Ports	Group Default VLAN	4022		
Port Aggregator	Internal-Port	1/xg1 💌		
Global Configuration	Untagged-VLAN	4022	(1 to 4021)/The	e Default Vlan of the Group
Port Configuration		1 🔺		
Port Configuration S		2 🗉		
Group Configuration		3		
Internal Port VLAN	Tagged-VE/IVS	5		
Internal Port VLAN		6		
Port Channel Summ		7 -		
Group VLAN MAC				
∃ Statistics/RMON		Apply Char	nges	

Figure 35: Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

- In the Internal Port drop-down menu, select a port (we chose 1/xg1).
- 9. In the Tagged-VLANs box, select your VLANs (we chose 101-102), and left-click Apply Changes (see Figure 36).

Dell OpenManage Swite	ch Administrator		S	upport	Help	About	Log Out
DØLL						Power	Connect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port A	ggregator > Inte	ernal Port VLA	N Configur	ation		
➡ Home	Internal Port \	/LAN Cont	figuration			<u>Print</u>	Refresh
Switching							
• Network Security	Group Id	1 💌					
	Group Default	4022					
Port Aggregator	Internal-Port	1/xa1 💌					
Global Configuration	Untagged-VLAN	4022		(1 to 402	1)/The De	fault Vlan	of the Group
Port Configuration		100		(.,		
Port Configuration S	5	101 🔳					
Group Configuration		102					
Internal Port VLAN	i lagged-viz-livs	103					
Port Channel Sumr		105					
Group VI AN MAC		106 🔻					
Statistics/RMON			Apply Cha	inges			
۰ III ا							

Figure 36: Selecting VLANs for the first port in Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

10. Repeat Step 9, applying VLANs 103-104 to port 1/xg9, (see Figure 37).

Dell OpenManage Swite	h Administrator		Support H	elp About Log Out
DØLL				PowerConnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port Ag	ggregator > Internal Port \	/LAN Configuration	ก
➡ Home ➡ System	Internal Port \	/LAN Configuratio	n	Print Refresh
Switching	Group Id	2 -		
Ports Port Aggregator	Group Default VLAN	4023		
Global Configuration	Untagged-VLAN	4023	(1 to 4021)/T	he Default Vlan of the Group
- Port Configuration - Port Configuration - Group Configuration - Internal Port VLAN + - Internal Port VLAN + - Port Channel Summ - Group VLAN MAC +	Tagged-VLANs	100 ▲ 101 Ⅲ 102 103 104 105 106 ▼		
Statistics/RMON		Apply	<u>Changes</u>	

Figure 37: 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 38):

```
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
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#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)#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 38: Moving ports from aggregate group 1 to aggregate group 2.

On the Cisco Catalyst 6504-E switches

1. Log into the switch.

6504-1 (config-if-range)#

2. Type the following commands into your first Cisco Catalyst 6504-E switch (see Figure 39):

```
config t
interface port-channel 1
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 101-102
switchport mode trunk
interface range te 2/1-2
switchport
channel-group 1 mode active
no shutdown
```

```
6504-1#config t
Enter configuration commands, one per line. End with CNTL/2.
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)#switchport mode trunk
6504-1 (config-if)#interface range te 2/1-2
6504-1 (config-if-range)#switchport
6504-1 (config-if-range)#switchport
```

Figure 39: Configuring a port channel with Trunking and multiple VLANs on the first Cisco Catalyst 6504-E switch.

3. Type the following commands into your second Cisco Catalyst 6504-E switch (see Figure 40):

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



Figure 40: Configuring a port channel with Trunking and multiple VLANs on the second Cisco Catalyst 6504-E switch.

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

Scenario 6: Setting up a fully meshed topology

On the Dell PowerConnect M8024 switches GUIs

- 1. Log into Switch 1.
- Select System→Operational Mode→Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 41).

Dell OpenManage Swite	h Administrator Support Help	About	Log Out
D¢LL		PowerC	onnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
Home	Operational Mode Configuration	Print	Refresh
General	Simple Made		
E Logs			
Operational Mode	Apply Changes		
Management Security			
File Management			
Advanced Settings Tran Manager			

Figure 41: Simple Mode configuration on the Dell PowerConnect M8024 switch.

- 4. Log into Switch 2.
- Select System→Operational Mode→Operational Mode Configuration.

6. In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 42).

Dell OpenManage Swite	h Administrator	Support	Help	About	Log Out
D¢LL				PowerCo	onnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.107	System > Operational Mode > Op	erational Mode Configu	ration		
➡ Home	Operational Mode Confi	guration		Print	Refresh
General	Simple Made	Enable -			
⊞ Logs	Simple Mode				
Operational Mode		Apply Changes			
Operational Mode C					
 Advanced Settings 					

Figure 42: Simple Mode configuration on the second 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 43):

```
enable
configure
mode simple
```



Figure 43: Simple Mode configuration on the Dell PowerConnect M8024 switch.

On the Cisco Catalyst 6504-E switches

- **1.** Log into the switch.
- 2. Type the following commands into the first Cisco Catalyst 6504-E switch (see Figure 44):

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

6504-1#config t
Enter configuration commands, one per line. End with CNTL/Z.
6504-1(config)#spanning-tree vlan 1-4094 priority O
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
6504-1(config-if-range)#

Figure 44: Configuring spanning tree priority on the first Cisco Catalyst 6504-E switch.

3. Type the following commands into the second Cisco Catalyst 6504-E switch (see Figure 45):

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

6504-2#config t
Enter configuration commands, one per line. End with CNTL/2,
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
6504-2(config-if-range)#

Figure 45: Configuring spanning tree priority on the second Cisco Catalyst 6504-E switch.

4. Connect the cables from the Cisco Catalyst 6504-E switches to each other and to the Dell PowerConnect M8024 switches. The switches will deliberate amongst themselves and create a spanning tree with the first Cisco switch as the root.

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

On the Dell PowerConnect M8024 switch

- **1.** Log into the switch.
- Select System → Operational Mode → Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 46). The switch will reset after this and you will need to log in again.

Dell OpenManage Swite	ch Administrator Support Help	About	Log Out
D¢LL		PowerCo	onnect M8024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
⊟ Home	Operational Mode Configuration	Print	Refresh
General SNTP	Simple Mode Enable 💌		
Operational Mode	Apply Changes		
 IP Addressing • Management Security 			
SNMP File Management			
ter Advanced Settings ⊡ Trap Manager			

Figure 46: Simple Mode configuration on the Dell PowerConnect M8024 switch.

 Select Switching → Port Aggregator → Port Configuration (see Figure 47).

Del	OpenManage Switc	h Administrator					Support	Help /	About Lo	g Out
	Xell								PowerConnec	ct M8024
Out-	Inband IP:0.0.0.0 of-band IP:10.41.2.106	Switching > Por	t Aggregator :	> Port Configuration						
⊒ Ho ⊡Sy ⊡Sv	ome stem ritching	Port Config	uration			Pr	int	Refresh		
÷	Network Security	Unit			1 💌					
	Ports Dort Aggregator									
	Global Configuration									
	Port Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
	Port Configuration S	1/xg1	1				1/xg17	1	Primary	-
	Group Configuration	1/xg2	1				1/xg18	1	Primary	•
	Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	-
	Port Channel Summ	1/xg4	1				1/xg20	1	Primary	•
	Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	-
St	atistics/RMON	1/xg6	1				1/xg22	1	Primary	•
		1/xg7	1				1/xg23	1	Primary	-
		1/xg8	1				1/xg24	1	Primary	-
		1/xg9	1							
		1/xg10	1							
		1/xg11	1							
		1/xg12	1							
		1/xg13	1							
		1/xg14	1							
		1/xg15	1							
		1/xg16	1							

Figure 47: The Port Configuration screen on the Dell PowerConnect M8024 switch.

5. 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 48).

Del	l OpenManage Switc	h Administrator					Support	Help Al	bout Log O	ut
) (LL								PowerConnect M8	024
Out	Inband IP:0.0.0.0 of-band IP:10.41.2.106	Switching > Port	Aggregator	> Port Configuration						
■ H ■ Sy ■ Sv ■	ome /stem vitching Network Security Ports	Port Configu	iration		1	Pr	int	<u>Refresh</u>		
	Port Aggregator									
	Port Configuration	Internal Ports	Group Id	External 1G Ports	Group Id	Lag Role	External 10G Ports	Group Id	Lag Role	
	Port Configuration S	1/xg1	1				1/xg17	1	Primary	•
	Group Configuration	1/xg2	1				1/xg18	1	Primary	-
	Internal Port VLAN	1/xg3	1				1/xg19	1	Primary	-
	Port Channel Summ	1/xg4	1				1/xg20	1	Primary	-
	Group VLAN MAC	1/xg5	1				1/xg21	1	Primary	-
± St	atistics/RMON	1/xg6	1				1/xg22	1	Primary	-
		1/xg7	1				1/xg23	1	Secondary •	-
		1/xg8	1				1/xg24	1	Secondary -	-
		1/xg9	1							
		1/xg10	1							
		1/xg11	1							
		1/xg12	1							
		1/xg13	1							
		1/xg14	1							
		1/xg15	1							
		1/xg16	1							

Figure 48: 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 49):

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

console#config

```
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 49: Simple Mode configuration on the Dell PowerConnect M8024 switch.

On the Cisco Catalyst 6504-E switch

- **1.** Log into the switch.
- 2. Assuming that you configured the Dell PowerConnect M8024 with three different groups, type the following commands into the switch (see Figure 50):

```
config t
interface port-channel 1
switchport
switchport access vlan 101
interface port-channel 2
switchport
switchport access vlan 101
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/2.
Router(config)#interface port-channel 1
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
Router(config)#interface port-channel 2
Router(config-if)#switchport
Router(config-if)#switchport access vlan 101
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
Router(config-if-range)#
```

Figure 50: Configuring two port channels on the Cisco Catalyst 6504-E switch.

 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

On the Dell PowerConnect M8024 switch

- **1.** Log into the switch.
- Select System→Operational Mode→Operational Mode Configuration.
- In the Operational Mode Configuration screen, select Enable in the Simple Mode drop-down menu, and left-click Apply Changes (see Figure 51). The switch will reset after this and you will need to log in again.

Dell OpenManage Swite	ch Administrator Support Help	About Log Or	ut
D¢LL		PowerConnect M8	024
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	System > Operational Mode > Operational Mode Configuration		
Home	Operational Mode Configuration	Print Refresh	
E General	Simple Mode Enable 💌		
 Logs □ Operational Mode 	Apply Changes		
Management Security SNMP			
Advanced Settings			

Figure 51: Simple Mode configuration on the Dell PowerConnect M8024 switch.

- Select Switching → Port Aggregator → Internal Port VLAN Configuration.
- In the Internal-Port drop-down menu, select a port (we chose 1/xg1). (See Figure 52.)

(Dell OpenManage Switc	h Administrator		Support Help About Log Out		
	DØLL			PowerConnect M8024		
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106		Switching > Port Aggregator > Internal Port VLAN Configuration				
- 	●Home Svstem	Internal Port VLAN	I Configuration	Print Refresh		
-	Switching					
	Network Security	Group Id	1 💌			
		Group Default VLAN	4022			
	Port Aggregator	Internal-Port	1/xg1 💌			
	Global Configuration	Untagged-VLAN	4022	(1 to 4021)/The Default Vlan of the Group		
	Port Configuration		1 🔺			
	Port Configuration S		2 🗉			
	Group Configuration	Tagged-VI ANs	3			
	Internal Port VLAN	ruggou ver uto	5			
	Internal Port VLAN		6			
	Port Channel Summ		/ 🔻			
	Group VLAN MAC 5					
÷	"Statistics/RMON		Apply Ch	langes		

Figure 52: Internal Port VLAN Configuration on the Dell PowerConnect M8024 switch.

6. In the Untagged-VLAN textbox, write a VLAN (we chose 101), and left-click Apply Changes (see Figure 53).

ell OpenManage Switch Administrator Support Help About Log Out					
D¢LL			PowerConnect M8024		
Inband IP:0.0.0.0 Out-of-band IP:10.41.2.106	Switching > Port Aggregato	r > Internal Port VLAN Co	nfiguration		
■ Home ⊡ System	Internal Port VLAN	Configuration	Print Refresh		
Switching					
Network Security	Group Id	1 💌			
[⊕] Ports	Group Default VLAN	4022			
Port Aggregator	Internal-Port	1/xg1 💌			
Global Configuration	Untagged-VLAN	101	(1 to 4021)/The Default Vlan of the Group		
Port Configuration		1 🔺			
Port Configuration S	}	2 =			
Group Configuration	Tagged-VLANs	3			
Internal Port VLAN		5			
Internal Port VLAN		6			
Port Channel Sumr	r	/ •			
Group VLAN MAC					
Statistics/RMON		Apply Cha	nges		

Figure 53: 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 54):



Figure 54: 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 first Cisco Catalyst 6504-E switch (see Figure 55):

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



Figure 55: Initial configuration of VSS on the Cisco Catalyst 6504-E switch.

3. Type the following commands into the first Cisco Catalyst 6504-E switch (see Figure 56):

```
config t
        interface port-channel 10
       switch virtual link 1
       no shutdown
       exit
       switch virtual domain 100
       switch 1
       exit
       interface range te 1/4-5
       channel-group 10 mode on
       no shutdown
        end
        switch convert mode virtual
5504-1#config t
Enter configuration commands, one per line. End with CNTL/2.
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)#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 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 56: Configuring port channels for the VSL on the first Cisco Catalyst 6504-E switch.

4. Type the following commands into the second Cisco Catalyst 6504-E switch (see Figure 57):

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

6504-2#config t
Enter configuration commands, one per line. End with CNTL/2.
6504-2 (config)#redundancy
6504-2 (config-red)#mode sso
6504-2 (config-red)#exit
6504-2 (config-router)#si
6504-2 (config-router)#si
6504-2 (config-router)#si
6504-2 (config-router)#si
6504-2 (config-router)#si
```

Figure 57: Initial configuration of VSS on the second Cisco Catalyst 6504-E switch.

5. Type the following commands into the second Cisco Catalyst 6504-E switch (see Figure 58):

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



Figure 58: Configuring port channels for the VSL on the second Cisco Catalyst 6504-E switch.

 Type the following commands into the first Cisco Catalyst 6504-E switch (see Figure 59):

```
config t
interface port-channel 30
switchport
switchport access vlan 101
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
```



Figure 59: Configuring port channels and assigning ports to connect to the Dell PowerConnect M8024 switch.

 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 fourport LAG, with two ports connecting to each Cisco Catalyst 6504-E switch.

APPENDIX B – NETWORK SWITCH CONFIGURATION INFORMATION

Figure 60 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)SXI4a	
BIOS version	—	8.5(3)	

Figure 60: Detailed configuration information for the network switches.

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