



Using MLAG in Dell Networks

A deployment guide for Dell Networking switches (version 1.1)

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Revisions

Date	Description	Author
March, 2014	1.1 includes limitation of partner switches, added clarification of types of ports that can be used in peer-links, and changes to topologies supported in new appendix.	Victor Teeter
January, 2014	1.0 Initial Release	Victor Teeter

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Executive Summary

Multi-switch Link Aggregation or MLAG is a feature that allows two Dell Networking switches to act as a single switch, provides multiple paths across the network with benefits like:

- Failover in cases of failed cables or switches
- Increased bandwidth of up to double the bandwidth of a single switch
- Elimination of port blocking as well as reconvergence delays of spanning tree

An MLAG domain is created by connecting a Dell Networking switch to another Dell Networking switch through Peer-Link ports to create MLAG peers (the two connected switches). Other switches directly connected to the MLAG peers are unaware that they are connecting to two switches. Two switches appear as a single switch on the network.

All links in the MLAG can carry data traffic across many physically diverse topologies. In the case of a link or switch failure, traffic continues to flow with minimal disruption. MLAG optimizes availability and bandwidth between attached devices in Dell's Datacenter and Campus networking solutions.

The following Dell Networking N-series switches support MLAG and may be used in building the configurations in this white paper:

N2024

N2024P

N2048

N2048P

N3024

N3024P

N3024F

N3048

N3048P

N4032

N4032F

N4064

N4064F



1 Introduction

MLAGs provide an active-active split aggregation deployment across two switches acting as one. MLAG creates a more resilient network with higher bandwidth capabilities. This white paper discusses MLAGs, how and when they are used, caveats to look out for, and instructions on how to implement MLAG into your network.

Figure 1 below shows two very basic examples of MLAG domains. In both examples, peer switches are linked together with a special LAG (one or more cables as denoted by the red line in the pictures below), called a Peer-Link. Any non-management port on the switch can be used in the Peer-Link. With the Peer-Link configured, the two switches appear as a single switch to partner switches upstream and downstream. Each partner switch contains MLAGs that are simply LAGs (link aggregation groups) whose cables are split between the two peers. Primary and secondary peer roles are chosen automatically by the program when MLAG is enabled.

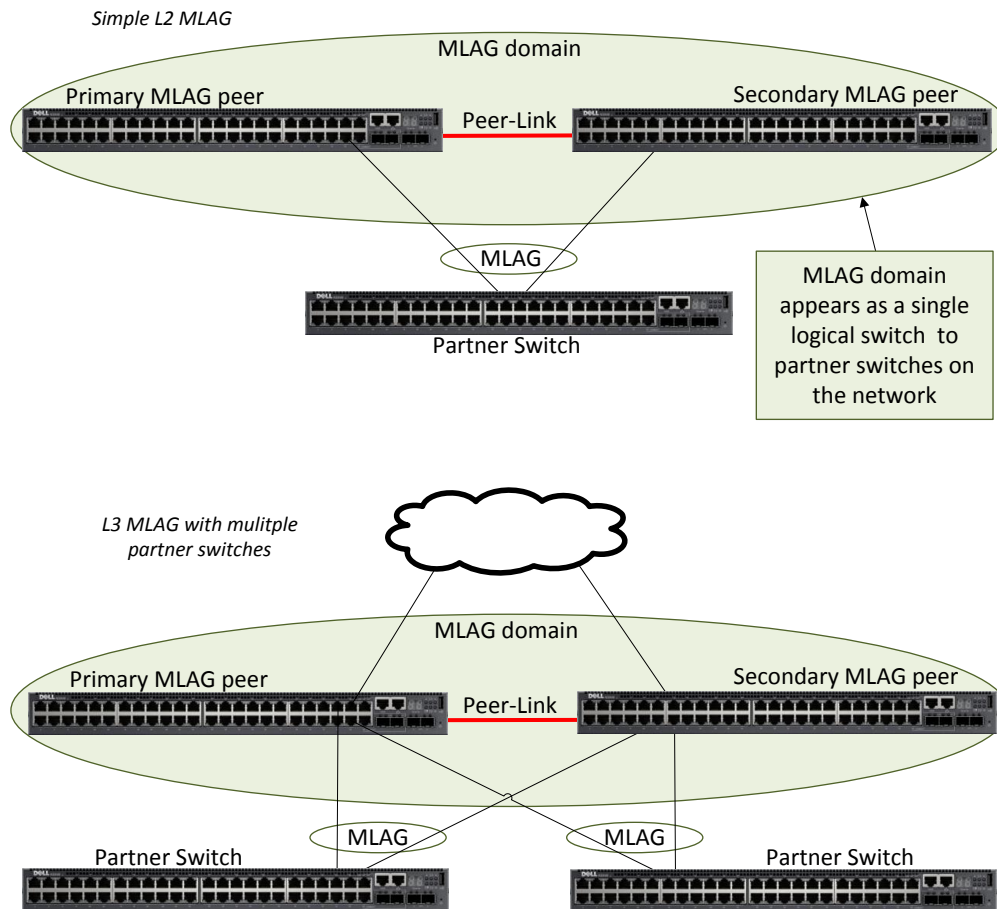


Figure 1 Two examples of a single-tier MLAG topology



2 Caveats for Enabling MLAG

There are a few limitations in implementing MLAGs:

- Two identical switch models are required to create MLAG peers. This means an N2048 can only be peered with another N2048, an N3024 with another N3024, and so on.
- Peer devices must use the same expansion module type if ports from the expansion module are to be part of the MLAG interface.
- Neither of the two switches used as MLAG peers may be stacked with other switches.
- MLAG status using the `show vpc brief` command is only run from the primary MLAG peer when both the primary and secondary peer information is required.

See the switch User Guide for additional [information](#).

Note: Run the `show vpc brief` command only from the Primary MLAG peer. This provides information on both peer switches.

2.1 Consistency of MLAG Peers

As mentioned in the section above, the two switches to be used as MLAG peers must be identical models, as well as any expansion module that is used in the MLAG peer-link setup. There are also six areas in the software configuration that must be given special attention to ensure they contain identical information prior to enabling the MLAG. These areas are reflected in Figure 2.

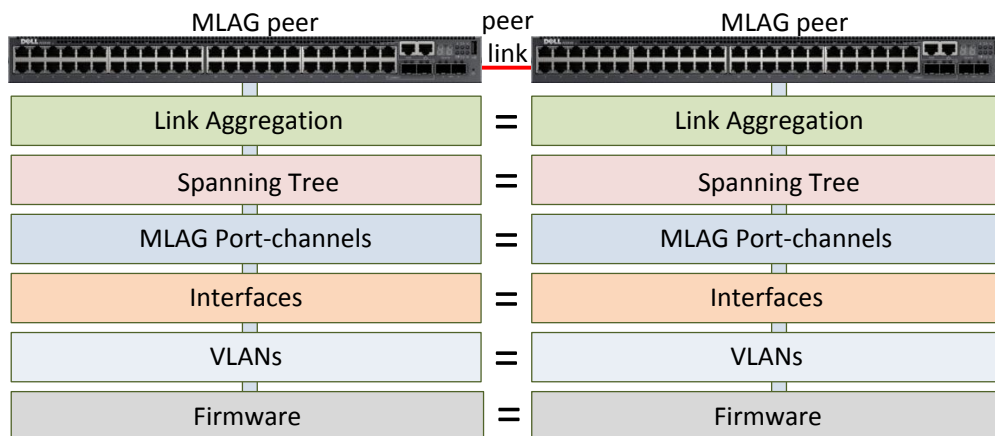


Figure 2 Consistent MLAG peer configurations



Change any settings mentioned below on both the MLAG peers when required. Enable MLAG only after the above settings are configured on the two peer switches.

It is also recommended for MLAG to be temporarily disabled in order to make subsequent changes to the above settings.

Note: Be sure to schedule down time if making changes that impact traffic or cause data loss.

Note: Failure to make these areas identical may cause sporadic traffic issues on the network which are difficult to troubleshoot.

Option category	Settings that need to match on both MLAG peers
<i>Link Aggregation</i>	Hashing mode Minimum links Static/dynamic LAG LACP parameters <ul style="list-style-type: none"> ○ Actor parameters ○ Admin key ○ Collector max-delay ○ Partner parameters
<i>Spanning Tree</i>	Bpdufilter Bpduflood Auto-edge TCN-guard Cost Edgeport Root guard Loop guard STP Version STP MST VLAN configuration STP MST instance configuration (instance ID, port priority, port cost/mode)
<i>MLAG Port-channels</i>	Port-channel mode Link speed Duplex mode MTU Bandwidth VLAN configuration
<i>Interfaces</i>	PFC configuration CoS queue assignments
<i>VLANs</i>	MLAG VLANs must be configured on both MLAG peers, and connect to two partner LAGs.
<i>Firmware</i>	Both peers require the same firmware version to operate correctly.
<i>Misc.</i>	FDB entry aging timers Static MAC entries ACL configuration

Table 1 Specific configuration options to be equal among MLAG peers



3 Supported Topologies

MLAG topologies contain several options. They can be a single layer (only one pair of MLAG peer switches) or two layers (two pair of MLAG peer switches). The peer-link between peers can have anywhere from 1 to 8 active interfaces to create the link. With these and other variables, there are dozens of ways to setup an MLAG. Table 2 lists all supported topology options.

Topological parameter	Supported options
# of MLAG domains per switch	1
# of peer switches per MLAG domain	2
# of interfaces per MLAG	2 to 8
# of interfaces per Peer-Link	1 to 8
# of MLAGs connecting to MLAG domain	Limited only by number of ports available
# of layers	1 or 2

Table 2 Parameters for an MLAG topology

Figure 3 shows just a few examples of MLAG topologies that can be built using the MLAG feature. The red lines show the peer-links between the primary and secondary peer switches.

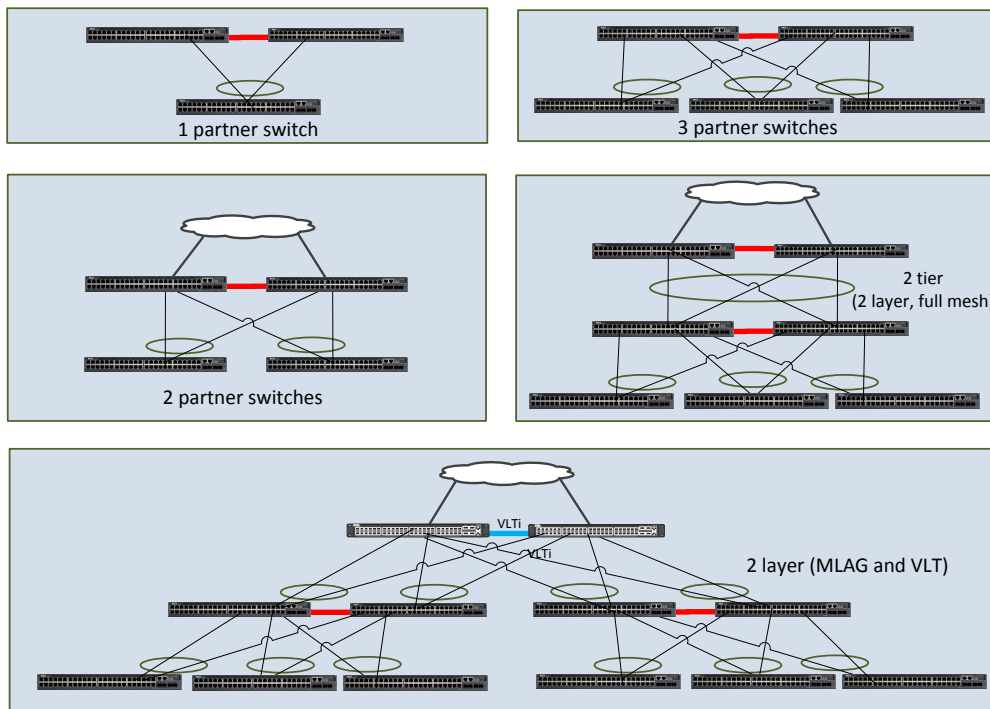


Figure 3 Examples of MLAG topologies



4 Single-Tier Example

This example shows the configuration of the two MLAG peers with two MLAG partners. The default spanning tree configuration is used and spanning tree is disabled on the peer link.

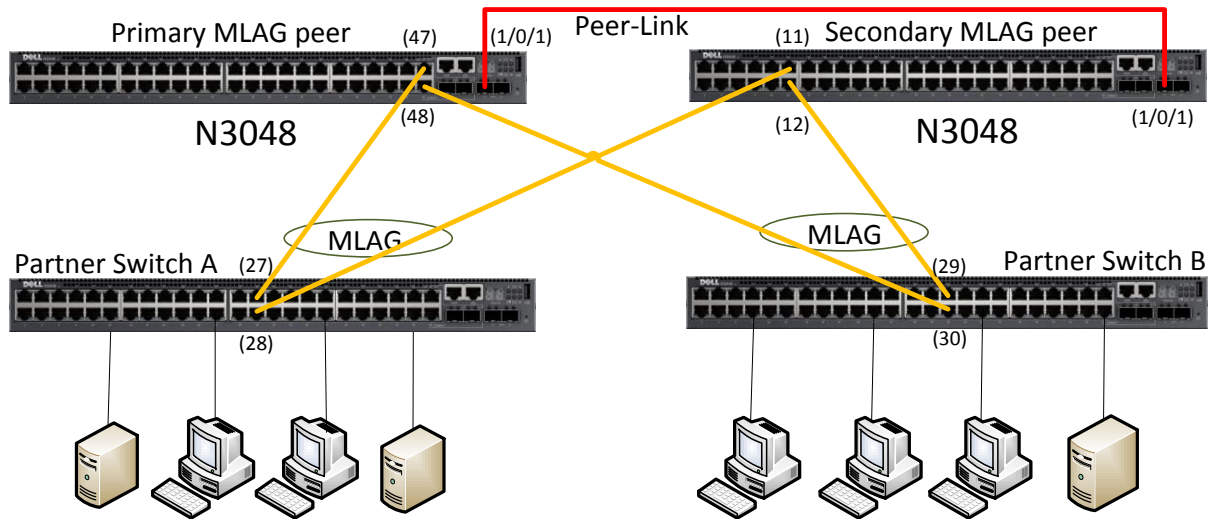


Figure 4 Single tier MLAG topology

To configure the two MLAG peers in the basic configuration, follow the steps below:

1. Enter the following commands on both peer switches before enabling MLAG (using the **feature vpc** command) on each one. Each column below contains commands that can be cut and pasted into a CLI session.

Primary MLAG Peer (N3048)	Secondary MLAG Peer N3048)	Description of commands
<pre>configure vlan 30 exit</pre>	<pre>configure vlan 30 exit</pre>	<p>← Create a VLAN for MLAG and all partner traffic</p>
<pre>interface port-channel 1 description "MLAG-Peer-Link" spanning-tree disable switchport mode trunk vpc peer-link exit</pre>	<pre>interface port-channel 1 description "MLAG-Peer-Link" spanning-tree disable switchport mode trunk vpc peer-link exit</pre>	<p>← Configure the port channel for the peer link - must be trunk mode</p>
<pre>interface tengigabitethernet 1/0/1 channel-group 1 mode active description "MLAG-Peer-Link" exit</pre>	<pre>interface tengigabitethernet 1/0/1 channel-group 1 mode active description "MLAG-Peer-Link" exit</pre>	<p>← Identify and configure the peer link interface</p>
<pre>interface port-channel 30 switchport mode trunk</pre>	<pre>interface port-channel 30 switchport mode trunk</pre>	<p>← Create a LAG for partner switch A to pass traffic</p>



Primary MLAG Peer (N3048)	Secondary MLAG Peer N3048)	Description of commands
switchport trunk native vlan 30 vpc 30 exit	switchport trunk native vlan 30 vpc 30 exit	← Must use a native VLAN ← Assign a unique id for partner switch A
interface port-channel 40 switchport mode trunk switchport trunk native vlan 30 vpc 40 exit	interface port-channel 40 switchport mode trunk switchport trunk native vlan 30 vpc 40 exit	← Create a LAG (port-channel) for partner switch B to pass traffic ← Assign a unique id for partner switch B
interface gigabitethernet 1/0/47 channel-group 30 mode active description "MLAG-Partner-link" exit	interface gigabitethernet 1/0/11 channel-group 30 mode active description "MLAG-Partner-Link" exit	← Assign interfaces to connect to partner A LAG (channel-group)
interface gigabitethernet 1/0/48 channel-group 40 mode active description "MLAG-Partner-Link" exit	interface gigabitethernet 1/0/12 channel-group 40 mode active description "MLAG-Partner-Link" exit	← Assign interfaces to connect to partner B LAG (channel-group)
interface range gi1/0/xx-yy switchport mode access switchport access vlan 30 exit	interface range gi1/0/xx-yy switchport mode access switchport access vlan 30 exit	← Assign additional ports to the VLAN only for hosts that will be using the MLAG
feature vpc vpc domain 1 peer-keepalive enable exit	feature vpc vpc domain 1 peer-keepalive enable exit	← Enable the MLAG

Partner Switch A	Partner Switch B	Description of commands
configure vlan 30 exit	configure vlan 30 exit	← create same VLAN on partners
interface port-channel 1 switchport mode trunk switchport trunk native vlan 30 exit	interface port-channel 1 switchport mode trunk switchport trunk native vlan 30 exit	← configure the port channel trunk for the partner link
interface gi1/0/27 channel-group 1 mode active exit	interface gi1/0/29 channel-group 1 mode active exit	← Assign interfaces to MLAG (channel-group)
interface gi1/0/28 channel-group 1 mode active exit	interface gi1/0/30 channel-group 1 mode active exit	← Assign interfaces to MLAG (channel-group)
interface range gi1/0/xx-yy switchport mode access switchport access vlan 30 exit	interface range gi1/0/xx-yy switchport mode access switchport access vlan 30 exit	← Assign additional ports to the VLAN only for hosts that will be using the MLAG



Note: Interfaces used to connect each peer to the partner switch LAG do not need to match on each peer. For instance, in the example above, one partner LAG interface connects to 1/0/47 on the primary peer while the other interface connects to 1/0/11 on the secondary peer.

2. Connect all cables as shown in Figure 4.
3. Run the **show vpc brief** command on either of the two MLAG peers to see which peer is the primary MLAG peer.
4. Run the **show vpc brief** command again from the primary switch to display all information for both peers.

Note: The partner switches must be configured with MLAGs and connected to the MLAG peers, or the "Number of VPCs operational" in the **show vpc brief** command shows 0.

Primary MLAG Peer	Secondary MLAG Peer
<pre> show vpc brief VPC admin status..... Enabled Keep-alive admin status..... Enabled VPC operational status..... Enabled Self role..... Primary Peer role..... Secondary Peer detection admin status..... Disabled Peer-Link details ----- Interface..... Po1 Peer-link admin status..... Enabled Peer-link STP admin status..... Disabled Configured VLANs..... 1,30 Egress tagged VLANs..... 30 VPC Details ----- Number of VPCs configured..... 2 Number of VPCs operational..... 2 VPC id# 30 ----- Interface..... Po30 Configured VLANs..... 1,30 VPC interface state..... Active Local Members Status ----- Gi1/0/47 Up Peer Members Status ----- Gi1/0/11 Up VPC id# 40 </pre>	<pre> show vpc brief VPC admin status..... Enabled Keep-alive admin status..... Enabled VPC operational status..... Enabled Self role..... Secondary Peer role..... Primary Peer detection admin status..... Disabled Peer-Link details ----- Interface..... Po1 Peer-link admin status..... Enabled Peer-link STP admin status..... Disabled Configured VLANs..... 1,30 Egress tagged VLANs..... 30 VPC Details ----- Number of VPCs configured..... 2 Number of VPCs operational..... 2 VPC id# 30 ----- Interface..... Po30 Configured VLANs..... 1,30 VPC interface state..... Active Local Members Status ----- Gi1/0/11 Up Peer Members Status ----- < * run command from Primary for this information > VPC id# 40 </pre>



Primary MLAG Peer		Secondary MLAG Peer	
-----		-----	
Interface.....	Po40	Interface.....	Po40
Configured VLANs.....	1,30	Configured VLANs.....	1,30
VPC interface state.....	Active	VPC interface state.....	Active
Local Members	Status	Local Members	Status
-----		-----	
Gi1/0/48	Up	Gi1/0/12	Up
Peer Members	Status	Peer Members	Status
-----		-----	
Gi1/0/12	Up	< * run command from Primary for this information >	

Note: Running the **show vpc brief** command on the primary shows the complete status of both peer switches. Running the **show vpc brief** command on the secondary only shows the status of the secondary.

Results of the command should be the same as shown above. All member ports must show "UP", and the "VPC interface state" must show "Active". The **show interface port-channel** is another helpful tool to let you know if the configured LAG ports are up and running. This command can be run on both the primary and secondary peers on a single layer MLAG topology. If correctly configured, the port(s) in the LAG are listed with an Active status. If there are any inactive ports, check for cabling or configuration issues.

Single-tier MLAG Peer						
show interface port-channel 40						
Channel	Ports	Ch-Type	Hash	Type	Min-links	Local Prf

Po40	Active: Gi1/0/48	Dynamic	7	1	Disabled	
Hash Algorithm Type						
1 - Source MAC, VLAN, EtherType, source module and port Id						
2 - Destination MAC, VLAN, EtherType, source module and port Id						
3 - Source IP and source TCP/UDP port						
4 - Destination IP and destination TCP/UDP port						
5 - Source/Destination MAC, VLAN, EtherType, source MODID/port						
6 - Source/Destination IP and source/destination TCP/UDP port						
7 - Enhanced hashing mode						



5 Two-Tier Example

Figure 5 shows a logical topology for a 2-tier fully meshed MLAG, offering full redundancy across all four MLAG peers. Six Dell N3024s are used for the example, however the same principals apply and the same commands can be used on the N2000 and N4000 series switches.

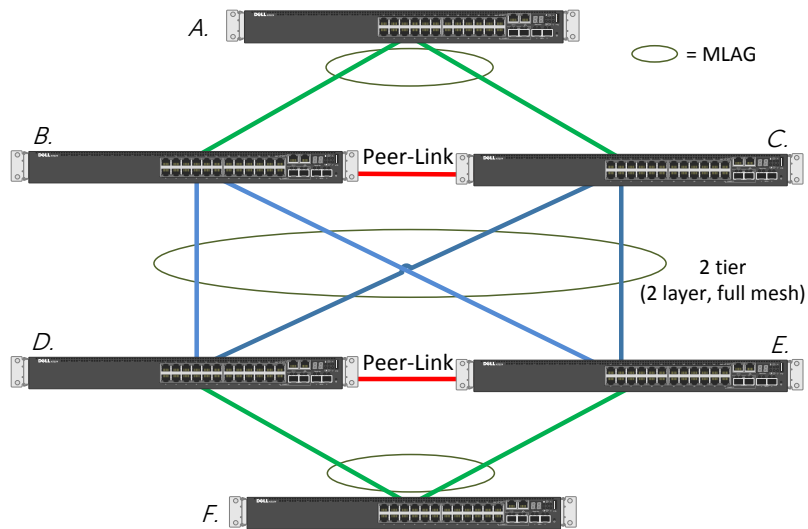


Figure 5 Logical topology of a 2-tier full mesh configuration

Figure 6 shows the physical layout of the same topology as it might appear in a rack, including cabling and attached hosts that need to communicate across the MLAG. The same color scheme is used for the cables in Figure 6 that was used to show logical connections in Figure 5.

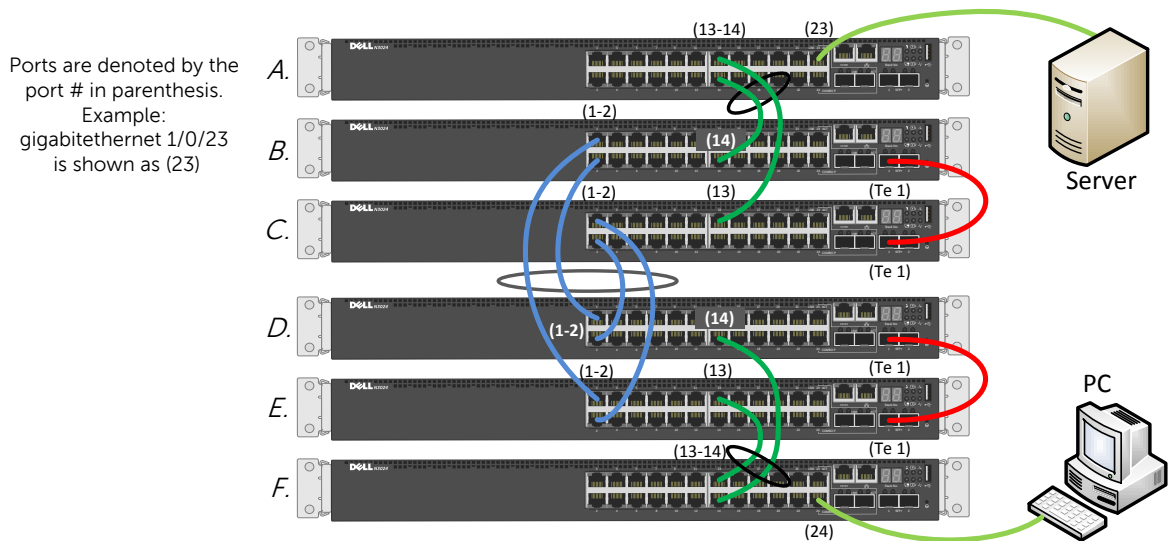


Figure 6 Physical cabling of a 2-tier full mesh configuration



In a full mesh, all eight ports joined together in the MLAG (four blue cables) are in the same port channel to achieve maximum redundancy.

To configure the 2-tier in a full mesh configuration, follow the steps below:

1. Enter the commands below for each corresponding switch in the topology.
2. Cable the configuration as shown.
3. Enable MLAG (using the **feature vpc** command) on each switch.

Similar commands are performed on all four MLAG peer switches. MLAG peers B and C are required to be consistent in their configurations following the guidelines set in *Consistency of MLAG peers*. MLAG peers D and E also follow the same requirements for consistency. Though MLAG partner switches A and F may have similar configurations in this particular scenario, they have no such consistency requirements to each other or to the peer switches.

Each column below contains commands that can be cut and pasted into a CLI session if using the same topology as described in this example. Command sections are color-coded to allow easier comparisons between the **BC** MLAG peers and the **DE** MLAG peers.

MLAG Peer B	MLAG Peer C	Description of commands
configure vlan 30 exit	configure vlan 30 exit	← Create a VLAN for MLAG and all partner traffic
interface port-channel 1 description "MLAG-Peer-Link" spanning-tree disable switchport mode trunk vpc peer-link exit	interface port-channel 1 description "MLAG-Peer-Link" spanning-tree disable switchport mode trunk vpc peer-link exit	← Configure the port channel for the BC peer link - must be trunk mode
interface tengigabitethernet 1/0/1 channel-group 1 mode active description "MLAG-Peer-Link" exit	interface tengigabitethernet 1/0/1 channel-group 1 mode active description "MLAG-Peer-Link" exit	← Identify and configure the BC peer link interfaces
interface port-channel 40 switchport mode trunk switchport trunk native vlan 30 vpc 40 exit	interface port-channel 40 switchport mode trunk switchport trunk native vlan 30 vpc 40 exit	← Create a LAG (port-channel) for partner switch DE to pass traffic ← Assign a unique id for partner switch DE
interface port-channel 50 switchport mode trunk switchport trunk native vlan 30 vpc 50 exit	interface port-channel 50 switchport mode trunk switchport trunk native vlan 30 vpc 50 exit	← Create a LAG (port-channel) for partner switch A to pass traffic ← Assign a unique id for partner switch A



MLAG Peer B	MLAG Peer C	Description of commands
interface gigabitethernet 1/0/1 channel-group 40 mode active description "MLAG-Partner-Link" exit	interface gigabitethernet 1/0/1 channel-group 40 mode active description "MLAG-Partner-Link" exit	← Assign interfaces to connect to partner E's half of full mesh LAG
interface gigabitethernet 1/0/2 channel-group 40 mode active description "MLAG-Partner-Link" exit	interface gigabitethernet 1/0/2 channel-group 40 mode active description "MLAG-Partner-Link" exit	← Assign interfaces to connect to partner D's half of full mesh LAG
interface gigabitethernet 1/0/14 channel-group 50 mode active switchport mode trunk switchport trunk allowed vlan 30 exit	interface gigabitethernet 1/0/13 channel-group 50 mode active switchport mode trunk switchport trunk allowed vlan 30 exit	← Assign interfaces to VLAN that will connect to partner A's LAG -put both 13 and 14 into same LAG 50
feature vpc vpc domain 1 peer-keepalive enable exit	feature vpc vpc domain 1 peer-keepalive enable exit	← Enable the MLAG

MLAG Peer D	MLAG Peer E	Description of commands
configure vlan 30 exit	configure vlan 30 exit	← Create a VLAN for MLAG and all partner traffic
interface port-channel 1 description "MLAG-Peer-Link" spanning-tree disable switchport mode trunk vpc peer-link exit	interface port-channel 1 description "MLAG-Peer-Link" spanning-tree disable switchport mode trunk vpc peer-link exit	← Configure the port channel for the DE peer link - must be trunk mode
interface tengigabitethernet 1/0/1 channel-group 1 mode active description "MLAG-Peer-Link" exit	interface tengigabitethernet 1/0/1 channel-group 1 mode active description "MLAG-Peer-Link" exit	← Identify and configure the DE peer link interfaces
interface port-channel 40 switchport mode trunk switchport trunk native vlan 30 vpc 40 exit	interface port-channel 40 switchport mode trunk switchport trunk native vlan 30 vpc 40 exit	← Create a LAG (port-channel) for partner switch BC to pass traffic ← Assign a unique id for partner switch BC
interface port-channel 60 switchport mode trunk switchport trunk native vlan 30 vpc 60 exit	interface port-channel 60 switchport mode trunk switchport trunk native vlan 30 vpc 60 exit	← Create a LAG (port-channel) for partner switch F to pass traffic ← Assign a unique id for partner switch F
interface gigabitethernet 1/0/1 channel-group 40 mode active	interface gigabitethernet 1/0/1 channel-group 40 mode active	← Assign interfaces to connect to partner B's half of full mesh



MLAG Peer D	MLAG Peer E	Description of commands
description "MLAG-Partner-Link" exit	description "MLAG-Partner-Link" exit	<i>MLAG</i>
interface gigabitethernet 1/0/2 channel-group 40 mode active description "MLAG-Partner-Link" exit	interface gigabitethernet 1/0/2 channel-group 40 mode active description "MLAG-Partner-Link" exit	← Assign interfaces to connect to partner C's half of full mesh LAG
interface gigabitethernet 1/0/14 channel-group 60 mode active switchport mode trunk switchport trunk allowed vlan 30 description "MLAG-Partner-Link" exit	interface gigabitethernet 1/0/13 channel-group 60 mode active switchport mode trunk switchport trunk allowed vlan 30 description "MLAG-Partner-Link" exit	← Assign interfaces to VLAN that will connect to partner F's LAG -put both 13 and 14 into same LAG 60
feature vpc vpc domain 1 peer-keepalive enable exit	feature vpc vpc domain 1 peer-keepalive enable exit	← Enable the MLAG

Partner Switch A	Partner Switch F	Description of commands
configure vlan 30 exit	configure vlan 30 exit	← create same VLAN on partners
interface port-channel 1 switchport mode trunk exit	interface port-channel 1 switchport mode trunk exit	← configure the port channel trunks for the partner links
interface gi1/0/13 channel-group 1 mode active exit	interface gi1/0/13 channel-group 1 mode active exit	← Assign first interface to LAG (channel-group)
interface gi1/0/14 channel-group 1 mode active exit	interface gi1/0/14 channel-group 1 mode active exit	← Assign second interface to LAG (channel-group)
interface gi1/0/23 switchport mode access switchport access vlan 30 exit	interface gi1/0/24 switchport mode access switchport access vlan 30 exit	← Assign additional ports to the VLAN only for hosts that will be using the MLAG

Port 23 in switch A connects to the Server, and port 24 in switch F connects to the PC client.

Connect all cables as shown in Figure 6.

Run the **show vpc brief** command on either of the two MLAG peers to see which peer is the primary MLAG peer. Run the **show vpc brief** command again from the primary switch to display all information for both peers.



Note: Interfaces used to connect each peer to the partner switch LAG do not need to match on each peer. For instance, in the example above, one partner LAG interface connects to 1/0/47 on the primary peer while the other interface connects to 1/0/11 on the secondary peer.

Note: The partner switches must be configured with LAGs and connected to the MLAG peers, or the "Number of VPCs operational" in the **show vpc brief** command will show 0.

MLAG Peer B (Primary Peer)	MLAG Peer C (Secondary Peer)
<pre> show vpc brief VPC admin status..... Enabled Keep-alive admin status..... Enabled VPC operational status..... Enabled Self role..... Primary Peer role..... Secondary Peer detection admin status..... Disabled Peer-Link details ----- Interface..... Po1 Peer-link admin status..... Enabled Peer-link STP admin status..... Disabled Configured VLANs..... 1,30 Egress tagged VLANs..... 30 VPC Details ----- Number of VPCs configured..... 2 Number of VPCs operational..... 2 VPC id# 40 ----- Interface..... Po40 Configured VLANs..... 1,30 VPC interface state..... Active Local Members Status ----- Gi1/0/1 Up Gi1/0/2 Up Peer Members Status ----- Gi1/0/1 Up Gi1/0/2 Up VPC id# 50 ----- Interface..... Po50 Configured VLANs..... 1,30 VPC interface state..... Active </pre>	<pre> show vpc brief VPC admin status..... Enabled Keep-alive admin status..... Enabled VPC operational status..... Enabled Self role..... Secondary Peer role..... Primary Peer detection admin status..... Disabled Peer-Link details ----- Interface..... Po1 Peer-link admin status..... Enabled Peer-link STP admin status..... Disabled Configured VLANs..... 1,30 Egress tagged VLANs..... 30 VPC Details ----- Number of VPCs configured..... 2 Number of VPCs operational..... 2 VPC id# 40 ----- Interface..... Po40 Configured VLANs..... 1,30 VPC interface state..... Active Local Members Status ----- Gi1/0/1 Up Gi1/0/2 Up Peer Members Status ----- < * run command from Primary for this information > VPC id# 50 ----- Interface..... Po50 Configured VLANs..... 1,30 VPC interface state..... Active </pre>



Local Members	Status	Local Members	Status
-----	-----	-----	-----
Gi1/0/14	Up	Gi1/0/13	Up
Peer Members	Status	Peer Members	Status
-----	-----	-----	-----
Gi1/0/13	Up	< * run command from Primary for this information >	

Note: Running the `show vpc brief` command on the primary shows the complete status of both peer switches. Running the `show vpc brief` command on the secondary shows status of the secondary only.

Results of the command should be the same as shown above. All member ports must show "UP", and the "VPC interface state" must show "Active". The `show interface port-channel` is another helpful tool to let you know if the configured LAGs are up and running. This command must also only be run on the primary peer when used in a two-tier topology. If correctly configured, ports in the primary LAG are listed with an "Active" status. Inactive ports are usually a sign of a cabling or configuration issue.

MLAG Primary Peers only: <i>B and D</i>					
show interface port-channel 40					
Channel	Ports	Ch-Type	Hash Type	Min-links	Local Prf

Po40	Active: Gi1/0/1, Gi1/0/2	Dynamic	7	1	Disabled
Hash Algorithm Type					
1 - Source MAC, VLAN, EtherType, source module and port Id					
2 - Destination MAC, VLAN, EtherType, source module and port Id					
3 - Source IP and source TCP/UDP port					
4 - Destination IP and destination TCP/UDP port					
5 - Source/Destination MAC, VLAN, EtherType, source MODID/port					
6 - Source/Destination IP and source/destination TCP/UDP port					
7 - Enhanced hashing mode					

Like the `show vpc brief` command, the `show interfaces port-channel` command must be run from the primary peer to receive information from both of the peer switches.



Appendix

A.1 Unsupported Configurations

Figure 7 shows examples of configurations that are *not supported*. The first topology shows an MLAG peer attempting to connect with a Dell VLTi peer. The second topology shows an MLAG peer attempting to connect with a Cisco vPC (or Cisco VSS) peer. Neither peer configurations shown in these scenarios are supported.

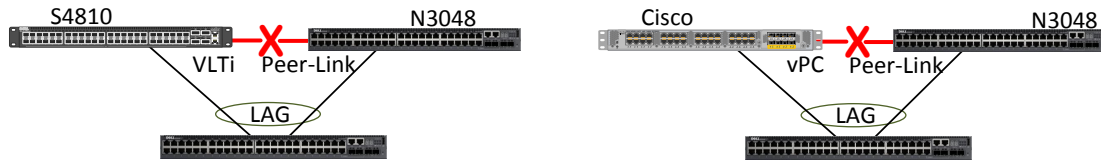


Figure 7 Unsupported peer configurations

A.2 Future support of MLAG with similar technologies

Figure 8 below shows MLAG peers on one layer and Dell VLT peers on the second layer, with a full-mesh LAG. Results from preliminary testing of this configuration have not shown any major issues. Official support for this configuration is planned for 2014.

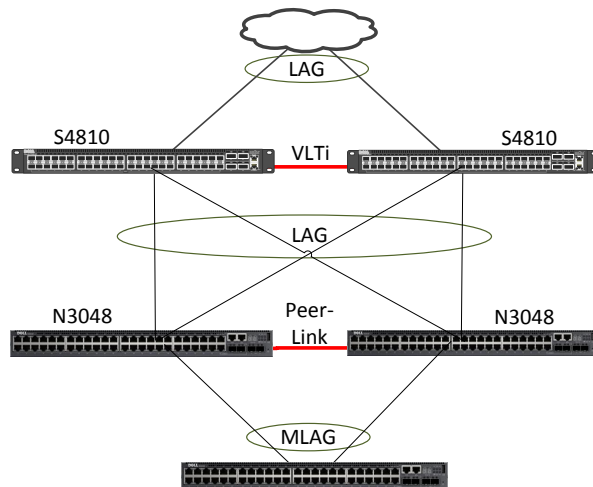


Figure 8 Mixed LAG configuration



VLT is a feature similar to MLAG, but is available on the FTOS-based Dell Networking switches like the S4810. Each peer pair must use the same multi-chassis lag feature. This will provide the network with the same resiliency and improved bandwidth as when using MLAG in a multi-tier MLAG-only environment.

A.3 Additional Resources

Support.dell.com is focused on meeting your needs with proven services and support.

DellTechCenter.com is an IT Community where you can connect with Dell Customers and Dell employees for the purpose of sharing knowledge, best practices, and information about Dell products and installations.

Referenced or recommended Dell publications:

- Dell Networking Support
 - <http://www.dell.com/support>
- Dell TechCenter (community forums and blogs for Dell customers)
 - <http://delltechcenter.com>
- Dell Networking Whitepapers
 - <http://en.community.dell.com/techcenter/networking/w/wiki/2580.networking-whitepapers.aspx>
- Dell Networking N2000/N3000/N4000 User Guides and Firmware downloads
 - http://www.dell.com/support/my-support/us/en/04#04/Products/ser_stor_net/networking?&_suid=1384718146004020619403219436666

A.4 Configuration details

This paper was compiled using the following components and versions.

Component	Description
Dell Networking firmware versions	D.9.29.2, 6.0.0.2, 6.0.0.4
Switch	Dell Networking N2000, N3000, and N4000 series



About Dell

Dell is a worldwide leader in data center and campus solutions which includes the manufacturing and distribution of servers, network switches, storage devices, personal computers, and related hardware and software. For more information on these and other products, please visit the Dell website at <http://www.dell.com>.

