Configuring a Dell EqualLogic SAN Infrastructure with Virtual Link Trunking (VLT)

A Dell Reference Architecture

A Dell Reference Architecture

Revisions

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Acknowledgements

Feedback

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Executive summary

Virtual Link Trunking (VLT) is a networking technology that enables Dell Networking (and Force 10) Ethernet switches to aggregate multiple physical switches to appear as a single logical unit. This white paper:

- Describes use cases and benefits of using VLT with Dell EqualLogic iSCSI storage
- Demonstrates possible performance gains when using VLT versus traditional uplinks
- Provides best practices for configuring VLT with Dell EqualLogic SANs

1 Introduction

Virtual Link Trunking (VLT) is a Layer 2 networking protocol technology that enables Dell Networking (or Force 10) switches to aggregate multiple physical links across separate physical switches or chassis, yet appear as a single logical link. Unlike a traditional static Link Aggregation Group (LAG), a VLT link can connect across multiple physical switches, therefore providing higher bandwidth, load balancing and redundancy for those links.

VLT provides a loop-free network so that spanning tree is no longer required, except as a precautionary step prior to the establishment of the VLT. While spanning tree would typically disable or block redundant links to prevent a loop, VLT allows load balancing across parallel links resulting in an increase of available uplink bandwidth to the core switches.

EqualLogic iSCSI SANs can directly benefit from using VLT because of its ability to use all of the available bandwidth while still maintaining the redundancy required to provide a resilient storage area network.

1.1 Audience

This technical white paper is intended for storage administrators, network administrators, SAN system designers, storage consultants, or anyone tasked with configuring a SAN infrastructure for EqualLogic PS Series storage. It is assumed that readers have experience in designing and/or administering a shared storage solution. Also, there are some assumptions made in terms of familiarity with all current Ethernet standards as defined by the Institute of Electrical and Electronic Engineers (IEEE) as well as TCP/IP and iSCSI standards as defined by the Internet Engineering Task Force (IETF).

1.2 Terminology

The following terms will be used throughout this document.

DCB: Data Center Bridging is a set of enhancements made to the IEEE 802.1 bridge specifications for supporting multiple protocols and applications in the same data center switching fabric. It is made up of several IEEE standards including Enhanced Transmission Selection (ETS), Priority-based Flow Control (PFC), Data Center Bridging Exchange (DCBX), and application Type-Length-Value (TLV). For more information, see http://en.community.dell.com/techcenter/storage/w/wiki/4396.data-center-bridging-standards-behavioral-requirements-and-configuration-guidelines-by-sis.aspx

Hop count: Typically refers to the number of switches a packet must flow through on the way to its destination.

LACP: The Link Aggregation Control Protocol is defined in IEEE 802.3ad (and later 802.1ax) and provides additional functionality for creating and controlling Link Aggregation Groups (LAGs).

MPIO: Multi-Path I/O typically refers to a host-based software layer that manages multiple paths for load balancing and redundancy in a storage environment.

VLT: Virtual Link Trunking is the combined port channel between an attached device and the VLT peer switches.

VLTi: The Virtual Link Trunking Interconnect is a link between VLT peers or the switches that are participating in a VLT domain. It is used to synchronize the states between the peer switches.

1.3   Objective

There are many possibilities for configuring various topologies of storage networks. This white paper discusses a few typical topologies that are found when deploying Dell EqualLogic iSCSI SANs with Dell Networking (Force10) switches. This document also provides best practice guidance and design considerations for deploying EqualLogic iSCSI SANs within an Ethernet switching infrastructure that utilizes Dell Networking VLT.

2 Technical Overview

The following sections provide an overview of the SAN infrastructure components and technologies used in developing this white paper.

2.1 Dell EqualLogic iSCSI storage

Dell EqualLogic PS Series arrays provide a storage solution that delivers the benefits of consolidated networked storage in a self-managing iSCSI storage area network (SAN) that is affordable and easy to use, regardless of scale. Built on an advanced, peer storage architecture, EqualLogic storage simplifies the deployment and administration of consolidated storage environments, enabling:

- Perpetual self-optimization with automated load balancing across disks, RAID sets, connections, cache and controllers
- Efficient enterprise scalability for both performance and capacity without fork-lift upgrades
- Powerful, intelligent and simplified management
- Improved productivity and streamlined IT infrastructure through unified block and file storage capabilities

2.2 Dell Networking Ethernet switches

The Dell Networking S-Series S4810 and Force10 M-series (MXL) are ultra-low-latency 10GbE/40GbE switches that are optimized for high speed datacenter applications including iSCSI SAN.   The S4810 is a single rack unit (1U) top of rack (ToR) switch while the MXL is designed to integrate within the Dell PowerEdge M1000e blade chassis.

Both the S-series and M-series run the Force10 operating system (FTOS), making them simple to manage and monitor. Advanced features such as VLT and DCB allow for the creation of a flexible and reliable network infrastructure for critical datacenter applications.

2.3 Virtual Link Trunking

VLT is a feature provided in Dell Networking and Dell Force10 datacenter switches. It provides Layer 2 multipath capability, enabling multiple parallel paths between nodes and load-balancing traffic where alternative paths exist. When VLT is enabled, the total available bandwidth of all redundant connections between devices can be utilized.

VLT offers the following benefits:

- Allows a single device to use a LAG across two upstream devices.
- Eliminates STP-blocked ports.
- Provides a loop-free topology.
- Uses all available uplink bandwidth.
- Provides fast convergence if either the link or a device fails.
- Optimized forwarding with virtual router redundancy protocol (VRRP).
- Provides link-level resiliency.
- Assures high availability.

VLT presents a single logical Layer 2 domain from the perspective of an attached device that has a virtual link trunk terminating on two other devices (switches or chassis) in the VLT domain. However, the two VLT devices have independent management and control planes. The VLTi is used to synchronize peer switches participating in the VLT domain.

A separate backup link maintains heartbeat messages across an out-of-band (OOB) management network. The backup link ensures that node failure conditions are correctly detected and are not confused with failures of the VLT interconnect. VLT ensures that local traffic on a chassis does not traverse the VLTi and takes the shortest path to the destination via directly attached links.

2.4   Use cases for VLT technology

One of the most compelling use cases for VLT is using Dell Networking MXL fabric switches in the Dell PowerEdge M1000e blade chassis. When the MXL switches are uplinked to a set of top of rack, or core switches without using VLT, spanning tree may block or disable one or more of the uplinks to prevent a loop. While this does the job of preventing a loop, it also reduces the available uplink bandwidth and sometimes cutting the performance by 50% or more.

VLT allows for simultaneous uplinks which enable a redundant, load balanced topology capable of supporting higher bandwidth needs for applications such as iSCSI SANs or converged network infrastructures utilizing DCB. Networking fabrics that utilize core/aggregation/edge or spine/leaf topologies may also benefit from using VLT for connectivity between switches.

While VLT is capable of supporting host-based connections across VLT peer devices, this is not generally useful (or supported) for Dell EqualLogic iSCSI SAN connected hosts or arrays. Dell recommends using MPIO and when possible, the Dell EqualLogic Host Integration Tool (HIT) kit, for all hosts connected to EqualLogic iSCSI SANs.

This paper is focused on topologies that use more than two switches. A VLTi can be configured with as few as two switches. However, in the case of two switches being used for a dedicated and isolated SAN, there is really no added functionality available versus using a traditional LAG connection between the switch pair. For only two switches, a traditional LAG provides sufficient connectivity.

3 Test Configurations and methodology

This section discusses the tested topologies and the test methodology used for testing conducted in Dell labs. This section also discusses the configuration of the host servers, network, and storage used for these tests. An I/O workload test utility was run to demonstrate how a VLT uplink provided a better solution for utilizing maximum available bandwidth over a LAG. Finally, DCB was enabled on the VLT configuration to enable convergence of LAN and SAN traffic on the same set of switches.

3.1 EqualLogic storage

Four Dell EqualLogic PS6110XV array members were configured in a single pool within a single management group. This allowed the volumes to be evenly distributed across all members of the pool. Eight 100 GB volumes were created and four volumes were assigned to each host server. The active controller ports for each controller were balanced across the switches. Since each PS6110XV has a single active 10GbE port, the active port for two controllers was on the first switch, and two ports were active on the other switch.

3.2 PowerEdge blade servers

Each test used two PowerEdge M620 blade servers in the PowerEdge M1000e blade chassis to generate storage I/O. Each server was running Windows 2008 R2 SP1. For both the LAG and VLT topologies, a pair of Broadcom 57810s network ports were configured for connectivity to the iSCSI SAN. A pair of Dell Networking MXL switches was installed in Fabric B of the M1000e blade chassis. A Dell PowerConnect M6220 was in Fabric slot A1 to provide client connectivity to the M620 servers.

The EqualLogic HIT kit was installed to configure MPIO and the Microsoft iSCSI software initiator was used to establish a connection to the iSCSI volumes. Four volumes were presented to each host.

When DCB was enabled on the VLT configuration, the Broadcom 57810 adapters were configured to provide both Ethernet and iSCSI offload (iSOE) modes. The Broadcom Advanced Control Suite (BACS) was used to configure the iSCSI function, a team was created across the Ethernet (LAN) function and an additional IP address was assigned.

3.3 LAG topology

For the LAG topology, a pair of 10GbE ports were uplinked from each MXL blade switch to the ToR S4810 switches. The pair of S4810 switches was interconnected using two of the built-in 40GbE ports configured as a LACP LAG.

Ethernet ports on the blade servers connect via the chassis mid-plane, directly to internal ports on the MXL blade switches. Controller ports on the EqualLogic array members were connected directly to the ToR S4810 switches using Direct Attach Copper (DAC) twin-ax cabling.

In this topology, spanning tree was enabled and as a result, some links were blocked to prevent a loop. A lower spanning-tree cost (100) was configured on the LAG between the two S4810 switches to ensure

that it was never blocked. EqualLogic SANs require a single Layer-2 (L2) network and the connection between the two switches is important so that the array members can always communicate properly for group membership and advanced functionality such as load balancing and capacity balancing across members.

One of the uplinks from each of the MXL switches was configured with a slightly higher cost (1000) and the remaining link used the default cost of 2000. This allowed us to choose the link that would be disabled when spanning tree converged across the fabric. However, because one of the uplinks from each MXL was blocked by spanning tree, the overall uplink bandwidth was reduced by 50%.

While the built-in 40GbE ports could have easily been used for uplinks too, 10GbE ports were chosen simply to make it easier to visualize the effect that spanning-tree had on the overall network. Using the 40GbE ports would have simply required more servers and storage to generate the required I/O to utilize the additional bandwidth, but the outcome is the same.
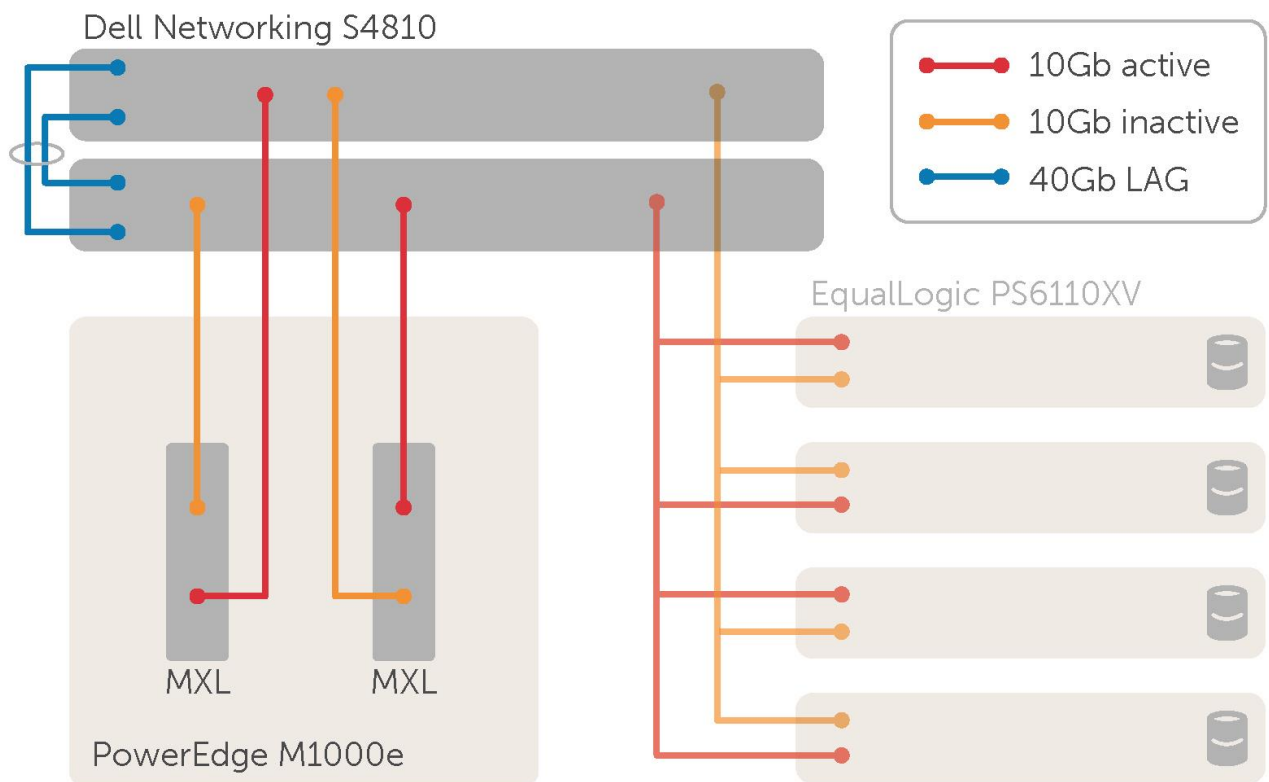
Figure 1   LAG topology

3.4   VLT topology

For the VLT topology, a pair of 10GbE ports was again uplinked from each MXL blade switch to the ToR S4810 switches. The pair of S4810 switches was interconnected using two of the built-in 40GbE ports configured as a VLTi.   The OOB management ports on the S4810 served as our VLTi backup link.

As in the LAG configuration, the blade servers connect via the 10Gbase-KR chassis mid-plane, directly to internal ports on the MXL blade switches. Controller ports on the EqualLogic array members were connected directly to the ToR S4810 switches using DAC twin-ax cabling.

In this topology, spanning tree is enabled only to prevent a loop at switch startup, before the VLT is established. Once the VLT is in place, all uplinks from the MXL to the S4810 switches remain active and no ports are blocked.

10GbE ports were again chosen simply to make it easier to demonstrate the effect that the use of VLT had on the overall network. Using the built-in 40GbE ports would provide additional bandwidth for all uplinks.
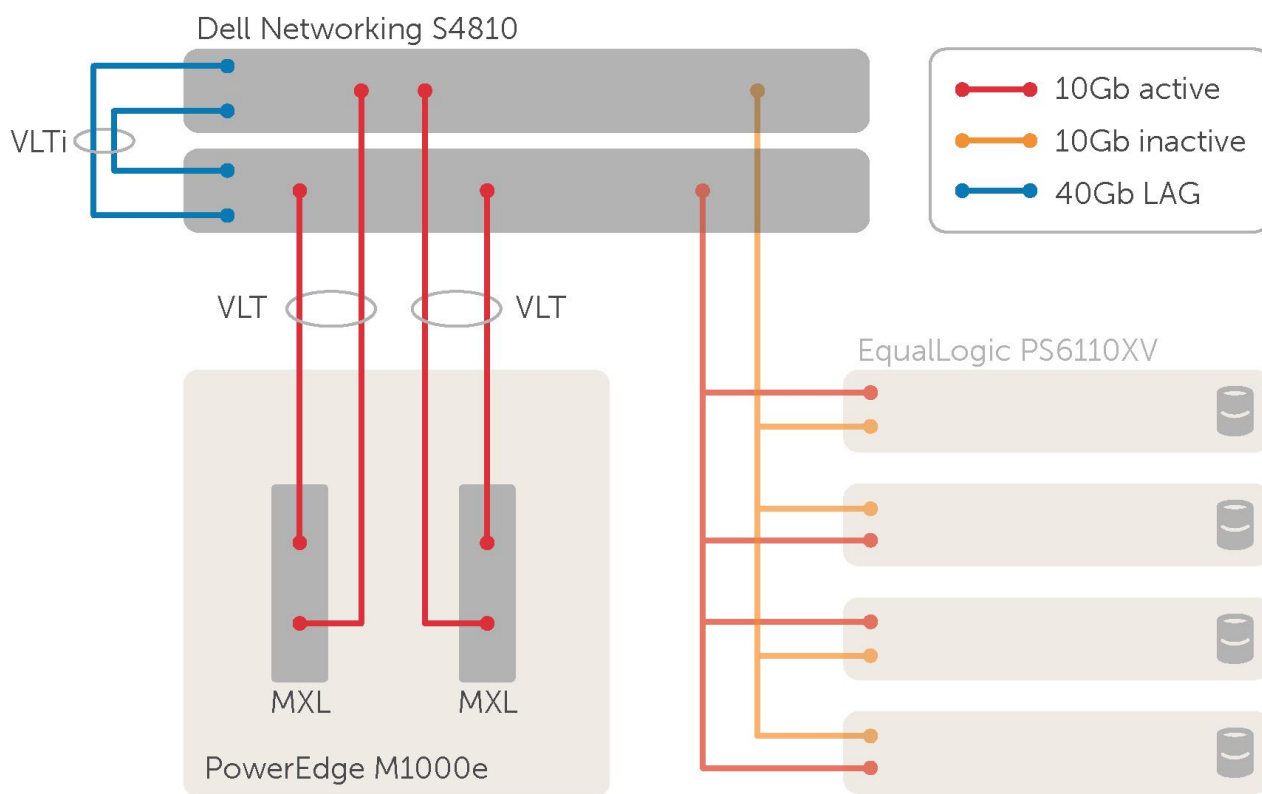
Figure 2   VLT topology

3.5 VLT topology with DCB enabled

Additionally, a configuration with DCB enabled was created, as shown in Figure 3. When DCB is enabled, the network is able to support both LAN and SAN traffic together and allows for prioritization of iSCSI traffic, creating a near-lossless fabric for the SAN. This is important to ensure that applications that are dependent on storage response times continue to provide acceptable performance levels even if network congestion occurs.

The topology for this test was similar to the previous VLT configuration, except that the 40GbE QSFP ports, available on the MXL and S4810 switches, were used for the uplink VLTs. This allowed for much more uplink bandwidth than the previous configurations so a separate workload test was not run for this configuration.

The MXL blade switches were configured in willing mode by setting the QSFP uplink port role to auto-upstream. This allows the MXL switches to receive the configuration settings from the S4810 ToR switches.   All ports on the MXL switches that faced end devices (in this case the blade hosts) were set to auto-downstream. This forced them to propagate the ETS and PFC configuration settings from the switch to the CNAs in the host servers. The Broadcom 57810 CNAs in each blade server were then also set in willing mode (the default) so they accepted the DCB configuration from the switch.

This type of configuration allowed the ToR S4810 switches to function as the authoritative source for the DCB configuration. Any changes made on the S4810 switches would now propagate, via DCBX, to other switches and to host or storage end-devices which simplifies configuration changes.
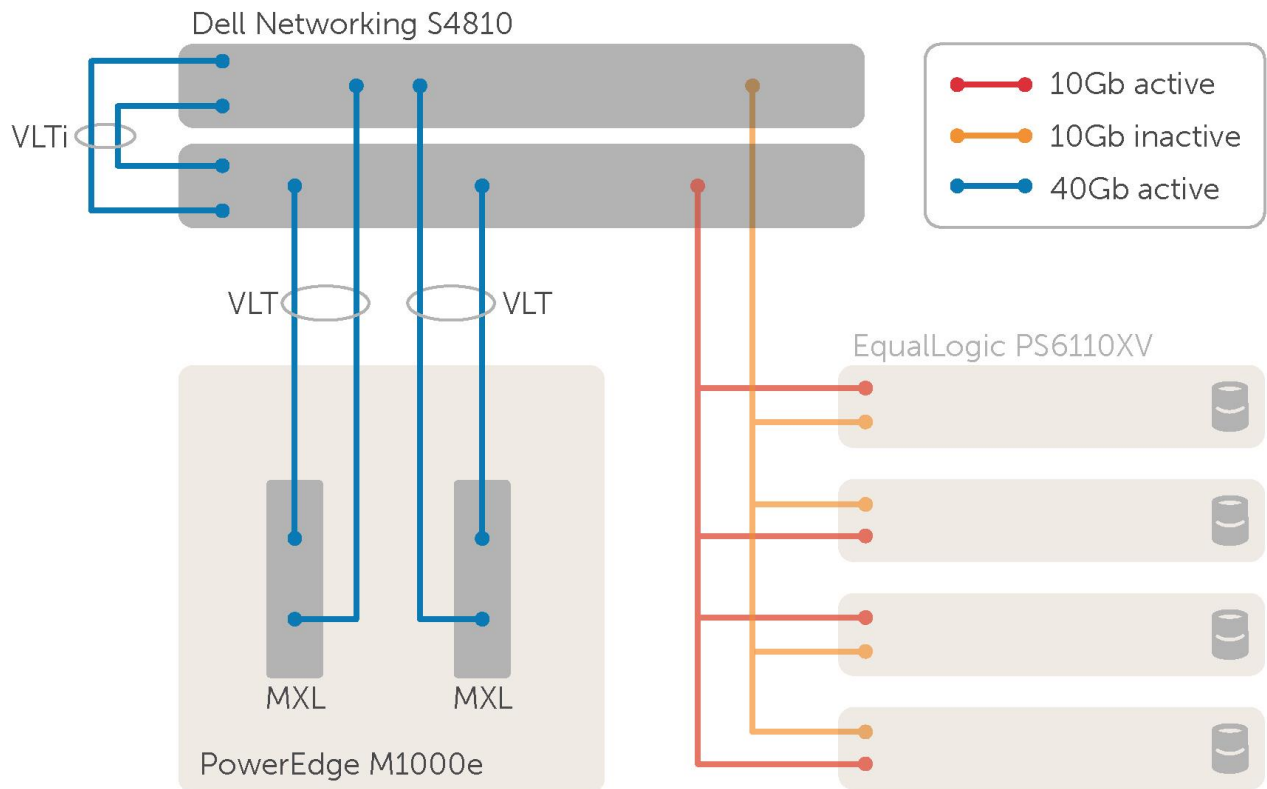
Figure 3   VLT topology with DCB enabled

3.6   Block I/O performance testing

To generate block I/O for testing of the iSCSI storage bandwidth, vdbench was used. Vdbench is an open-source I/O workload generation tool and is available for download on SourceForge.net. Vdbench requires a Java runtime environment (JRE), so the JRE for Windows was installed. Vdbench was also selected for its ability to be controlled by a script or parameter file.

Large block I/O is typical of applications like streaming and backup and utilizes more of the available bandwidth. A parameter file was configured to generate 100% sequential reads with a 256K block size to raw volumes. To ensure that any potential bottleneck was shifted to the network infrastructure, Vdbench was configured so that all reads were contained within the cache of the local storage array members.

The same vdbench parameter file was used for both the LAG and VLT topologies. Each test was run for 10 minutes. Furthermore, the test was run against each topology three times and then the results were averaged.

4 Results and analysis

This section discusses the results of the tests conducted for the purpose of this white paper.

Note: The performance data in this paper is not intended to express maximum performance or benchmark results. Actual workload, host to array port ratios, and other factors may also affect performance.

4.1 LAG and spanning tree effects

For this test, a single LACP port-channel (LAG) was created between the S4810 switches. Since each MXL switch had one 10GbE port uplinked to each of the S4810 switches, there were no additional LAGs or port-channels needed.   As mentioned in Section 3, this configuration resulted in two of the 10GbE uplinks being blocked by spanning tree, and reduced the aggregate uplink bandwidth by 50%. Running a command to display the spanning-tree status on the first blade switch returned the following output.

```
#show spanning-tree rstp brief
Executing IEEE compatible Spanning Tree Protocol
Root ID    Priority 0, Address 0001.e88b.49f4
Root Bridge hello time 2, max age 20, forward delay 15
Bridge ID    Priority 32768, Address d067.e5ac.a9d4
------------------
Interface                                                        Bpdu
 Name      Role   PortID   Prio Cost   Sts         Cost   Link-type Edge Filter
---------- ------ -------- ---- ------- ----------- ------- --------- ---- ------
Te 0/1     Desg   128.130  128  2000    FWD         1100   P2P       Yes  No
Te 0/2     Desg   128.131  128  2000    FWD         1100   P2P       Yes  No
-------------------
Te 0/43    Altr   128.172  128  2000    BLK         1100   P2P       No   No
Te 0/44    Root   128.173  128  1000    FWD         1100   P2P       No   No
```

Note: Some content was removed from the above output to make it easier to read.

Notice that port 43 shows a state of **BLK** which indicates spanning tree has temporarily disabled it. Port 43 was chosen because it has a higher cost assigned.   Blocking one of the two 10GbE uplinks reduces the total uplink bandwidth for this path by 50%.

The output from the second blade switch is similar, except that the status of ports 43 and 44 are reversed due to the order in which the cables were connected. Again spanning tree has blocked the port with the highest cost, cutting the total bandwidth in half.

While an alternative topology, such as the one shown in Figure 4 is possible, VLT has advantages. The configuration shown in Figure 4 was not tested for this white paper. It has two uplink ports connected from each MXL LAG connected to a single S4810 switch. If one of the S4810 ToR switches failed or was taken offline, an entire iSCSI storage path would be lost for all hosts. A topology using VLT uplinks would maintain both storage paths in the same failure scenario.

An additional LAG can be added between the MXL switches to allow a path to the remaining ToR switch. However, adding the LAG between the MXL switches would cause spanning-tree to block one link. Assigning a higher cost to this LAG would ensure that it was blocked by default and only active in the event of a failure in one of the other LAGs. An additional LAG consumes more ports, in this case two 40GbE ports, which adds to the cost of the solution. A VLT topology can offer better redundancy without requiring the additional LAG.

MPIO is used to manage multiple paths between the hosts and storage. In a failure scenario, this topology would also force approximately 50% of the packets to flow across the LAG between the MXL switches (assuming the path to a ToR switch was unavailable). Packets that traversed this path would then encounter a third switch hop compared to the VLT topology that was tested. Additional switch hops can increase the overall latency for a solution. Furthermore, it is recommended to keep the active LAG between a pair of redundant switches as close to the storage controller ports as possible to minimize switch hops for inter-array communication.
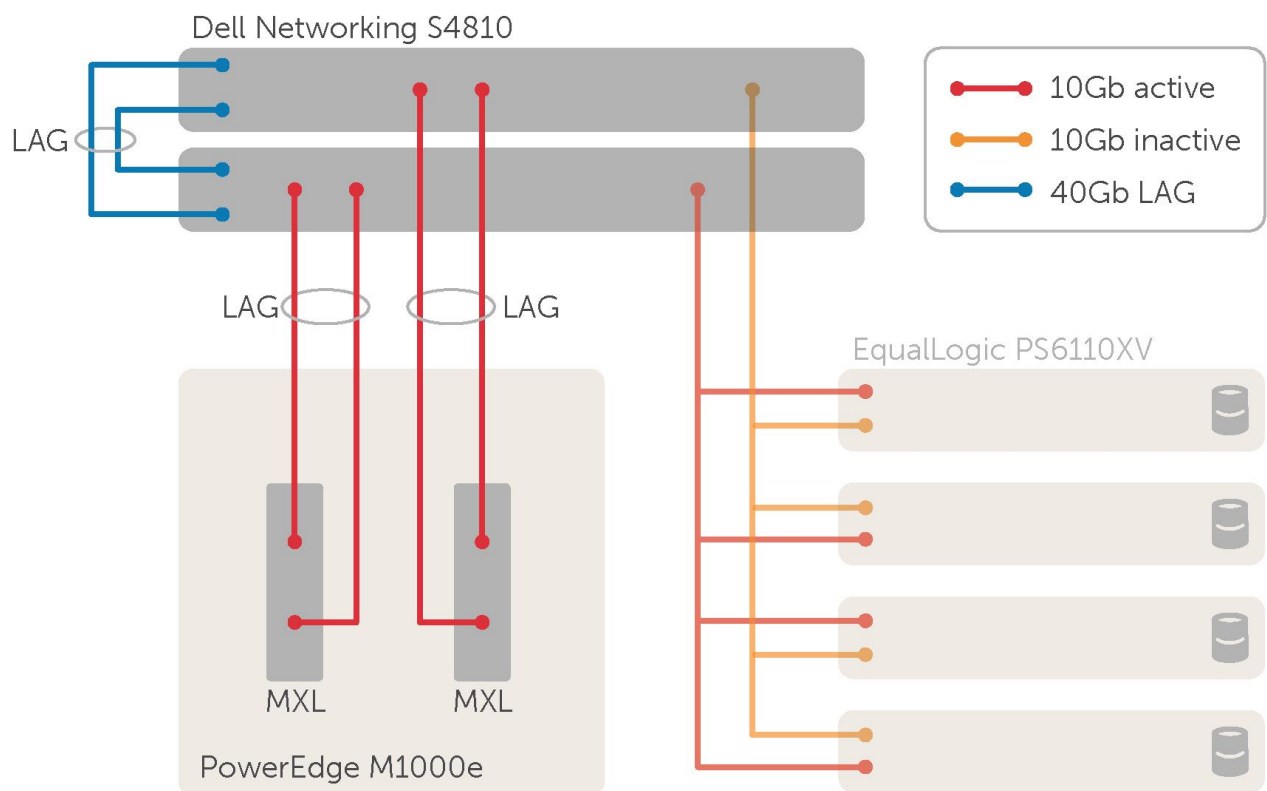
Figure 4   Alternate LAG topology (not recommended)

4.2   VLT and spanning tree effects

For the VLT configuration, three port-channels (1, 10, and 20) were created on the pair of S4810 switches. Port-channel 1 was designated for the VLTi and consisted of two 40GbE ports on each of the switches.

Port-channels 10 and 20 were created to connect to the uplinks coming from the MXL switches. These port-channels each consisted of one uplink from each of the two MXL switches.
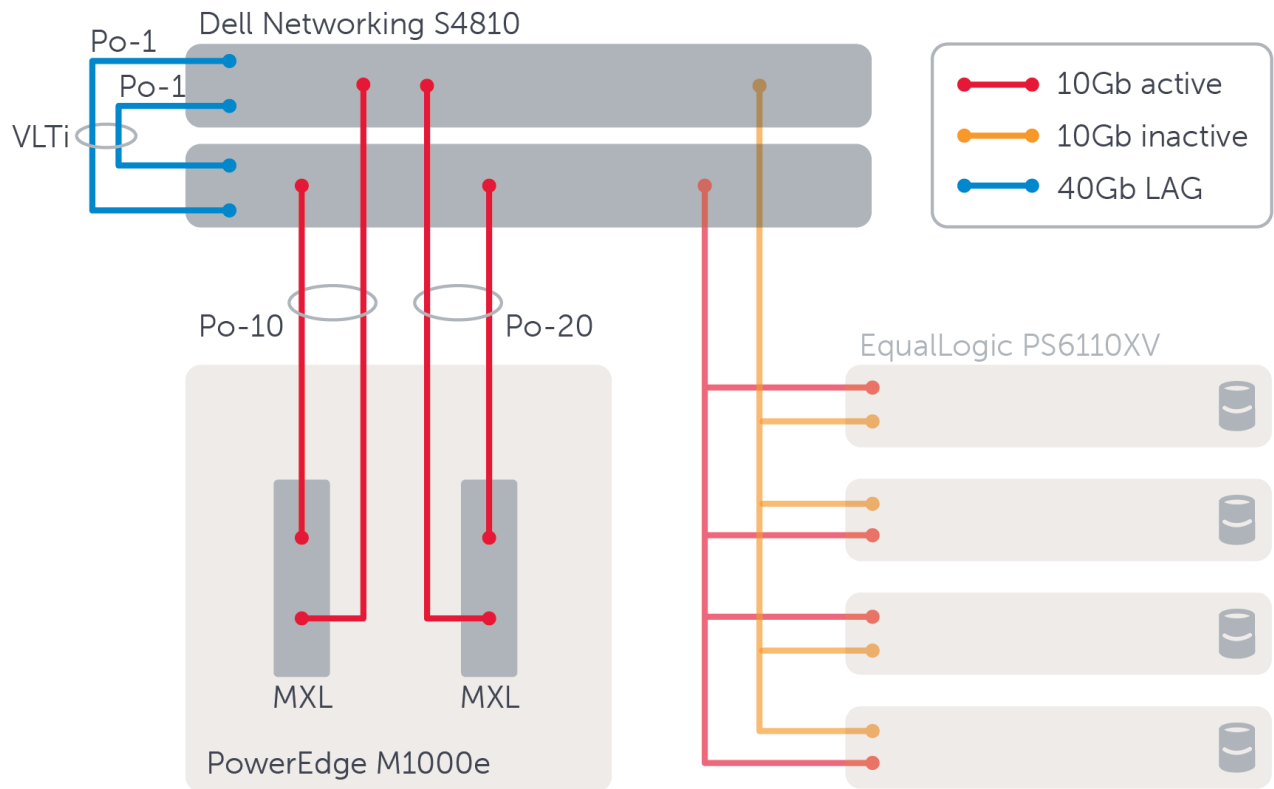
Figure 5   VLT topology with port-channel labels

Each MXL switch had a separate port-channel. On the first MXL switch, port-channel 10 was created and contained 10GbE ports 43 and 44. These ports were split across the two VLT peers (the S4810 switches). The configuration for the port-channel was:

```
interface TenGigabitEthernet 0/43
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown

interface TenGigabitEthernet 0/44
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown

interface Port-channel 10
 no ip address
```

```
    mtu 12000
    switchport
    vlt-peer-lag port-channel 10
    no shutdown
```

The second MXL switch was configured similarly, except that ports 43 and 44 were configured as port-channel 20.

Once the VLT was enabled, spanning tree did not block any of the uplinks. Running a command to display the spanning tree status on the first blade switch shows the following:

```
#show spanning-tree rstp brief
Executing IEEE compatible Spanning Tree Protocol
Root ID    Priority 0, Address 0001.e88b.49f4
Root Bridge hello time 2, max age 20, forward delay 15
Bridge ID    Priority 32768, Address d067.e5ac.a9d4
Interface                                                            Bpdu
 Name       Role   PortID   Prio Cost    Sts          Cost    Link-type Edge Filter
---------- ------ -------- ---- ------- ----------- ------- --------- ---- ------
Po 10      Root   128.11   128  1800    FWD          1800    (vlt) P2P No   No
Te 0/1     Desg   128.130  128  2000    FWD          1800    P2P       Yes  No
Te 0/2     Desg   128.131  128  2000    FWD          1800    P2P       Yes  No
```

Note: Some content was removed from the above output to make it easier to read.

4.3   Performance Comparison of LAG vs. VLT

With the LAG topology, SAN I/O bandwidth performance testing clearly shows that there is more available bandwidth with the VLT configuration, and as a result, the VLT test configuration was able to achieve a higher throughput as shown in Figure 6.

LAG vs VLT bandwidth (MB/sec)
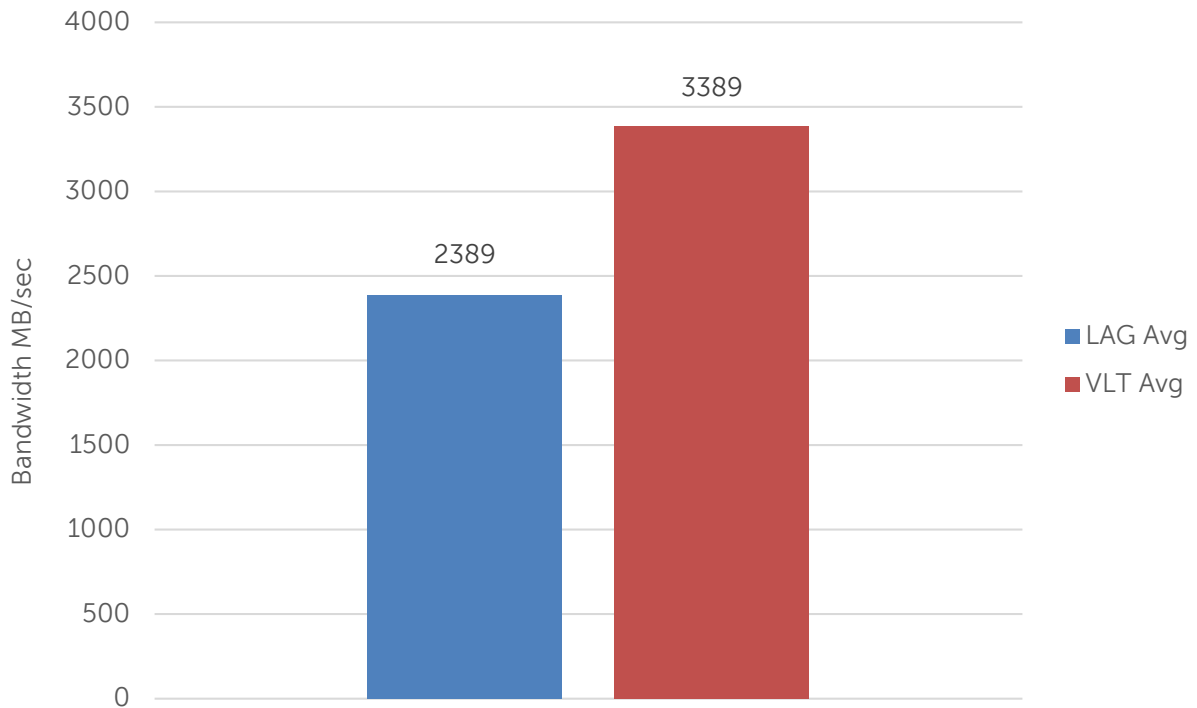
Figure 6   LAG versus VLT bandwidth comparison

4.4   VLT with DCB and spanning tree effects

As observed with the non-DCB VLT configuration, spanning tree was no longer active and blocking links once the VLT was established.

```
sw62#show spanning-tree rstp brief
Executing IEEE compatible Spanning Tree Protocol
Root ID    Priority 0, Address 0001.e88b.49f4
Root Bridge hello time 2, max age 20, forward delay 15
Bridge ID    Priority 32768, Address d067.e5ac.a9d4
Configured hello time 2, max age 20, forward delay 15
Bpdu filter disabled globally

Interface                                      Designated
 Name       PortID   Prio Cost    Sts         Cost    Bridge ID            PortID
---------- -------- ---- ------- ----------- ------- -------------------- --------
Po 10      128.11   128  600     FWD(vlt)    600     0    0001.e88b.49f4 128.21
Te 0/1     128.130  128  2000    FWD         600     32768 d067.e5ac.a9d4 128.130
Te 0/2     128.131  128  2000    FWD         600     32768 d067.e5ac.a9d4 128.131
```

Note: Some content was removed from the above output to make it easier to read.

4.5 Confirming DCB settings

The following command was used to confirm that DCB was properly propagating from the ToR S4810 switches to the MXL blade switches.

```
#sh int ets summary
Interface fortyGigE 0/33
Max Supported TC is 4
Number of Traffic Classes is 8
Admin mode is on

Admin Parameters :
------------------
Admin is enabled

PG-grp      Priority#        Bandwidth       TSA
-------------------------------------------------
0           0,1,2,3,4,5,6,7  100%            ETS
1                            -               -
2                            -               -
3                            -               -
4                            -               -
5                            -               -
6                            -               -
7                            -               -
15                           -               -

Remote Parameters :
-------------------
Remote is enabled.

PG-grp      Priority#        Bandwidth       TSA
-------------------------------------------------
0           0,1,2,3,5,6,7    50 %            ETS
1           4                50 %            ETS
2                            -               -
3                            -               -
4                            -               -
5                            -               -
6                            -               -
7                            -               -
15                           -               -

Remote Willing Status is disabled
Local Parameters :
------------------
Local is enabled

PG-grp      Priority#        Bandwidth       TSA
-------------------------------------------------
0           0,1,2,3,5,6,7    50 %            ETS
1           4                50 %            ETS
2                            -               -
3                            -               -
4                            -               -
5                            -               -
6                            -               -
7                            -               -
15                           -               -
```

```
Oper status is recommended
ETS DCBX Oper status is Up
State Machine Type is Feature
Conf TLV Tx Status is enabled
```

Note – some content was removed from the above output to make it easier to read.

This command will actually show the configuration for all ports, however only port 0/33, one of the QSFP uplinks, is shown. The local parameters show that the ETS configuration has been accepted from the ToR S4810 switch and is active on the MXL switch. Similar commands can be used to verify settings for PFC.

5 Best practice recommendations

The following best practices for deploying VLT in an EqualLogic iSCSI SAN infrastructure are recommended by Dell.

- For topologies of more than two switches, such as the examples provided in this white paper, Dell recommends using a VLT configuration to allow the aggregate bandwidth of all redundant uplinks to be used simultaneously.
- For a dedicated and isolated SAN infrastructure consisting of only two switches, Dell recommends using a LAG connection between switches. The LAG configuration is simpler and can still provide sufficient bandwidth and the required redundancy.
- Optimal performance may require balancing the active ports of the storage members across switches depending on the model of EqualLogic storage. For example, with four PS6110XV arrays, placing two active controller ports on each ToR switch will balance the network bandwidth requirement across the switches.
- For VLT-enabled topologies, it is still recommended to configure rapid spanning tree to prevent loops while a switch is joining a VLT domain (such as after a switch reload).
- When converging LAN and SAN traffic on the same switch fabric, DCB should be enabled on switches and all host iSCSI initiators (EqualLogic PS arrays with 10GbE controller ports are always automatically enabled for DCB).
- For host or storage facing connections, MPIO should be used to manage redundancy and load-balancing across multiple paths. VLT should not be used for connectivity to storage controller ports or hosts ports configured as iSCSI initiators.
- To help reduce latency in the storage network, minimize switch hop counts where possible.
- If a LAG is used between a redundant pair of switches, the active LAG should be located closest to the storage controller ports to minimize the switch hop count for inter-array communication.
- Dell's *Switch Configuration Guide for EqualLogic SAN* series can be used to configure Dell supported switches with best practices for a dedicated 2 switch SAN and can also be used as a base, along with this white paper, for configuring larger SAN deployments using VLT. See: http://en.community.dell.com/techcenter/storage/w/wiki/4250.switch-configuration-guides-by-sis.aspx

6 Conclusion

When deploying Dell Networking or Force10 switches, EqualLogic iSCSI SAN deployments can benefit from the use of VLT in multi-switch SAN designs. By avoiding the blockage of switch-to-switch links due to spanning tree, available bandwidth can be utilized to its fullest potential. It may also lead to better performance than traditional switch designs with LAGs or separate uplinks.

A Test configuration details

Table 1 Tested components

Component	Sub-component	Description/Version
PowerEdge M1000e	CMC firmware	4.50
	PowerConnect M6220 firmware	5.1.2.3
	Dell Networking MXL FTOS	9.3.0.0
PowerEdge M620	BIOS	2.1.6
	iDRAC	1.51.51
	CPU	Intel E5-2650@2.00GHz
	RAM	128GB
	Operating system	Windows 2008 R2*
	EqualLogic HIT Kit	4.60
EqualLogic PS6110XV	Firmware	7.0.1
	Hard disk type	24 x 2.5" 146GB 15K
Dell Networking S4810	FTOS	9.3.0.0

* Recommended Windows updates applied as available at the time

B Detailed switch configuration

The following sections show portions of the show running-config from the tested switches. Some information that is not necessary to demonstrate the configuration was removed to make it easier to read.

B.1 Dell Networking S4810 #1 LAG

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
 bridge-priority 0
stack-unit 0 provision S4810
interface TenGigabitEthernet 0/0
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 no shutdown
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/3
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/4
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
```

```
-----------<snip>----------------
interface TenGigabitEthernet 0/46
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 no shutdown
interface TenGigabitEthernet 0/47
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp cost 1000
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/56
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 1 mode active
 no shutdown
interface fortyGigE 0/60
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 1 mode active
 no shutdown
interface ManagementEthernet 0/0
 ip address 192.168.2.35/24
 no shutdown
-----------<snip>----------------
interface Port-channel 1
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp cost 100
 no shutdown
interface Vlan 1
!untagged TenGigabitEthernet 0/0-47
!untagged Port-channel 1
management route 192.168.105.0/24 192.168.2.1
stack-unit 0 priority 1
ip ssh server enable
protocol lldp
-----------<snip>----------------
reload-type normal-reload
end
```

B.2   Dell Networking S4810 #2 LAG

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
 bridge-priority 0
```

```
stack-unit 0 provision S4810
interface TenGigabitEthernet 0/0
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 no shutdown
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/3
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/4
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/46
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp cost 1000
 no shutdown
interface TenGigabitEthernet 0/47
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/56
 no ip address
 mtu 12000
```

```
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 1 mode active
 no shutdown
interface fortyGigE 0/60
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 1 mode active
 no shutdown
interface ManagementEthernet 0/0
 ip address 192.168.2.36/24
 no shutdown
-----------<snip>----------------
interface Port-channel 1
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp cost 100
 no shutdown
interface Vlan 1
!untagged TenGigabitEthernet 0/0-47
!untagged Port-channel 1
management route 192.168.105.0/24 192.168.2.1
stack-unit 0 priority 1
ip ssh server enable
protocol lldp
-----------<snip>----------------
reload-type normal-reload
end
```

B.3   Dell Networking MXL #1 LAG

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
no iscsi enable
stack-unit 0 provision MXL-10/40GbE
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/43
 no ip address
```

```
 mtu 12000
 switchport
 flowcontrol rx on tx off
 no shutdown
interface TenGigabitEthernet 0/44
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp cost 1000
 no shutdown
-----------<snip>----------------
interface Vlan 1
 no ip address
!untagged TenGigabitEthernet 0/1-32,41-44
 no shutdown
-----------<snip>----------------
```

B.4   Dell Networking MXL #2 LAG

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
no iscsi enable
stack-unit 0 provision MXL-10/40GbE
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/43
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 no shutdown
interface TenGigabitEthernet 0/44
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp cost 1000
 no shutdown
-----------<snip>----------------
interface Vlan 1
```

```
 no ip address
!untagged TenGigabitEthernet 0/1-32,41-44
 no shutdown
-----------<snip>----------------
```

B.5   Dell Networking S4810 #1 VLT

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
 bridge-priority 0
vlt domain 1
 peer-link port-channel 1
 back-up destination 192.168.2.36
stack-unit 0 provision S4810
interface TenGigabitEthernet 0/0
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/3
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/46
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 20 mode active
 no shutdown
interface TenGigabitEthernet 0/47
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
```

```
  port-channel 10 mode active
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/56
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 no shutdown
interface fortyGigE 0/60
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 no shutdown
interface ManagementEthernet 0/0
 ip address 192.168.2.35/24
 no shutdown
-----------<snip>----------------
interface Port-channel 1
 no ip address
 mtu 12000
 channel-member fortyGigE 0/56,60
 no shutdown
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 10
 no shutdown
interface Port-channel 20
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 20
 no shutdown
interface Vlan 1
!untagged TenGigabitEthernet 0/0-45
!untagged Port-channel 1,10,20
-----------<snip>----------------
```

B.6 Dell Networking S4810 #2 VLT

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
 bridge-priority 0
vlt domain 1
 peer-link port-channel 1
 back-up destination 192.168.2.35
stack-unit 0 provision S4810
interface TenGigabitEthernet 0/0
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
  spanning-tree rstp edge-port
  no shutdown
```

```
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/3
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/46
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 20 mode active
 no shutdown
interface TenGigabitEthernet 0/47
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/56
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 no shutdown
interface fortyGigE 0/60
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 no shutdown
interface ManagementEthernet 0/0
 ip address 192.168.2.36/24
 no shutdown
-----------<snip>----------------
interface Port-channel 1
 no ip address
 mtu 12000
 channel-member fortyGigE 0/56,60
 no shutdown
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
```

```
 vlt-peer-lag port-channel 10
 no shutdown
interface Port-channel 20
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 20
 no shutdown
interface Vlan 1
!untagged TenGigabitEthernet 0/0-45
!untagged Port-channel 1,10,20
-----------<snip>----------------
```

B.7　Dell Networking MXL #1 VLT

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
no iscsi enable
stack-unit 0 provision MXL-10/40GbE
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/43
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown
interface TenGigabitEthernet 0/44
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown
-----------<snip>----------------
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 10
 no shutdown
```

```
interface Vlan 1
 no ip address
!untagged TenGigabitEthernet 0/1-32,41-42
!untagged Port-channel 10
 no shutdown
-----------<snip>----------------
```

B.8　Dell Networking MXL #2 VLT

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
no iscsi enable
stack-unit 0 provision MXL-10/40GbE
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 flowcontrol rx on tx off
 spanning-tree rstp edge-port
 no shutdown
-----------<snip>----------------
interface TenGigabitEthernet 0/43
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown
interface TenGigabitEthernet 0/44
 no ip address
 mtu 12000
 flowcontrol rx on tx off
 port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown
-----------<snip>----------------
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 10
 no shutdown
interface Vlan 1
 no ip address
!untagged TenGigabitEthernet 0/1-32,41-42
!untagged Port-channel 10
 no shutdown
-----------<snip>----------------
```

B.9 Dell Networking S4810 #1 VLT with DCB

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
 bridge-priority 0
vlt domain 1
 peer-link port-channel 1
 back-up destination 192.168.2.36
stack-unit 0 provision S4810
interface TenGigabitEthernet 0/0
 no ip address
 mtu 12000
 switchport
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 dcb-map converged
protocol lldp
   dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 dcb-map converged
protocol lldp
   dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
 dcb-map converged
protocol lldp
   dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/3
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
 dcb-map converged
protocol lldp
   dcbx port-role auto-downstream
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/48
 no ip address
 mtu 12000
```

```
  dcb-map converged
port-channel-protocol LACP
  port-channel 20 mode active
protocol lldp
 no shutdown
interface fortyGigE 0/52
 no ip address
 mtu 12000
 dcb-map converged
port-channel-protocol LACP
  port-channel 10 mode active
 no shutdown
interface fortyGigE 0/56
 no ip address
 mtu 12000
 dcb-map converged
protocol lldp
 no shutdown
interface fortyGigE 0/60
 no ip address
 mtu 12000
 dcb-map converged
protocol lldp
 no shutdown
interface ManagementEthernet 0/0
 ip address 192.168.2.35/24
 no shutdown
-----------<snip>----------------
interface Port-channel 1
 no ip address
 mtu 12000
 channel-member fortyGigE 0/56,60
 no shutdown
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 10
 no shutdown
interface Port-channel 20
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 20
 no shutdown
interface Vlan 1
!untagged Port-channel 1
interface Vlan 335
 no ip address
 tagged TenGigabitEthernet 0/0-47
 tagged Port-channel 1,10,20
 no shutdown
interface Vlan 375
 no ip address
 tagged TenGigabitEthernet 0/0-47
 tagged Port-channel 1,10,20
 no shutdown
-----------<snip>----------------
dcb enable
dcb-map converged
```

```
 priority-group 0 bandwidth 50 pfc off
 priority-group 1 bandwidth 50 pfc on
 priority-pgid 0 0 0 0 1 0 0 0
protocol lldp
-----------<snip>----------------
```

B.10   Dell Networking S4810 #2 VLT with DCB

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
 bridge-priority 0
vlt domain 1
 peer-link port-channel 1
 back-up destination 192.168.2.35
stack-unit 0 provision S4810
interface TenGigabitEthernet 0/0
 no ip address
 mtu 12000
 switchport
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 dcb-map converged
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 spanning-tree mstp edge-port
 spanning-tree rstp edge-port
 spanning-tree 0 portfast
 spanning-tree pvst edge-port
 dcb-map converged
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
 dcb-map converged
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/3
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
 dcb-map converged
protocol lldp
```

```
  dcbx port-role auto-downstream
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/48
 no ip address
 mtu 12000
 dcb-map converged
port-channel-protocol LACP
  port-channel 10 mode active
protocol lldp
 no shutdown
interface fortyGigE 0/52
 no ip address
 mtu 12000
 dcb-map converged
port-channel-protocol LACP
  port-channel 20 mode active
 no shutdown
interface fortyGigE 0/56
 no ip address
 mtu 12000
 dcb-map converged
protocol lldp
 no shutdown
interface fortyGigE 0/60
 no ip address
 mtu 12000
 dcb-map converged
protocol lldp
 no shutdown
interface ManagementEthernet 0/0
 ip address 192.168.2.36/24
 no shutdown
-----------<snip>----------------
interface Port-channel 1
 no ip address
 mtu 12000
 channel-member fortyGigE 0/56,60
 no shutdown
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 10
 no shutdown
interface Port-channel 20
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 20
 no shutdown
interface Vlan 1
!untagged Port-channel 1
interface Vlan 335
 no ip address
 tagged TenGigabitEthernet 0/0-47
 tagged Port-channel 1,10,20
 no shutdown
interface Vlan 375
 no ip address
```

```
  tagged TenGigabitEthernet 0/0-47
  tagged Port-channel 1,10,20
  no shutdown
 ----------<snip>----------------
dcb enable
dcb-map converged
 priority-group 0 bandwidth 50 pfc off
 priority-group 1 bandwidth 50 pfc on
 priority-pgid 0 0 0 0 1 0 0 0
protocol lldp
 ----------<snip>----------------
```

B.11   Dell Networking MXL #1 VLT with DCB

```
Current Configuration ...
! Version 9.3(0.0)
----------<snip>----------------
protocol spanning-tree rstp
 no disable
no iscsi enable
stack-unit 0 provision MXL-10/40GbE
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
----------<snip>----------------
interface fortyGigE 0/33
 no ip address
 mtu 12000
port-channel-protocol LACP
  port-channel 10 mode active
protocol lldp
  no advertise dcbx-tlv ets-reco
  dcbx port-role auto-upstream
 no shutdown
interface fortyGigE 0/37
 no ip address
 mtu 12000
port-channel-protocol LACP
  port-channel 10 mode active
protocol lldp
  no advertise dcbx-tlv ets-reco
  dcbx port-role auto-upstream
 no shutdown
----------<snip>----------------
```

```
interface Port-channel 10
 no ip address
 mtu 12000
 switchport
 vlt-peer-lag port-channel 10
 no shutdown
interface Vlan 1
 no ip address
 no shutdown
interface Vlan 335
 no ip address
 tagged TenGigabitEthernet 0/1-32
 tagged Port-channel 10
 no shutdown
interface Vlan 375
 no ip address
 tagged TenGigabitEthernet 0/1-32
 tagged Port-channel 10
 no shutdown
-----------<snip>----------------
protocol lldp
```

B.12   Dell Networking MXL #2 VLT with DCB

```
Current Configuration ...
! Version 9.3(0.0)
-----------<snip>----------------
protocol spanning-tree rstp
 no disable
no iscsi enable
stack-unit 0 provision MXL-10/40GbE
interface TenGigabitEthernet 0/1
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
interface TenGigabitEthernet 0/2
 no ip address
 mtu 12000
 switchport
 spanning-tree rstp edge-port
protocol lldp
  dcbx port-role auto-downstream
 no shutdown
-----------<snip>----------------
interface fortyGigE 0/33
 no ip address
 mtu 12000
port-channel-protocol LACP
  port-channel 20 mode active
protocol lldp
  no advertise dcbx-tlv ets-reco
  dcbx port-role auto-upstream
 no shutdown
```

```
    interface fortyGigE 0/37
     no ip address
     mtu 12000
    port-channel-protocol LACP
      port-channel 20 mode active
    protocol lldp
      no advertise dcbx-tlv ets-reco
      dcbx port-role auto-upstream
     no shutdown
    -----------<snip>----------------
    interface Port-channel 20
     no ip address
     mtu 12000
     switchport
     vlt-peer-lag port-channel 20
     no shutdown
    interface Vlan 1
     no ip address
     no shutdown
    interface Vlan 335
     no ip address
     tagged TenGigabitEthernet 0/1-32
     tagged Port-channel 20
     no shutdown
    interface Vlan 375
     no ip address
     tagged TenGigabitEthernet 0/1-32
     tagged Port-channel 20
     no shutdown
    -----------<snip>----------------
    protocol lldp
```

C 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 EqualLogic Configuration Guide:
  http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/19852516/download.aspx

- Dell EqualLogic Compatibility Matrix
  http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/19856862.aspx

- Dell Switch Configuration Guides for EqualLogic SANs
  http://en.community.dell.com/techcenter/storage/w/wiki/4250.switch-configuration-guides-by-sis.aspx

- EqualLogic Best Practices for using Dell Force10 Leaf-Spine Architecture
  http://en.community.dell.com/techcenter/extras/m/white_papers/20348078.aspx

- Dell PowerEdge M1000e Blade and EqualLogic PS Series 10 GbE SAN Design Best Practices
  http://en.community.dell.com/techcenter/storage/w/wiki/4451.poweredge-m1000e-blade-and-equallogic-ps-series-san-design-best-practices-using-force10-switches-by-sis.aspx

- Dell Networking or Dell Force 10 Support Documentation
  http://www.force10networks.com/CSPortal20/KnowledgeBase/Documentation.aspx