NETAPP WHITE PAPER

Fabric Convergence with Lossless Ethernet and Fibre Channel over Ethernet

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1 INTRODUCTION

The I/O characteristics of the Fibre Channel protocol have enabled it to become the de facto block storage protocol for implementing storage area networks (SANs) in enterprise data centers. The challenge resulting from the pervasive success of Fibre Channel is the need to run separate physical networks, or SANs, to carry that traffic from the host to storage.

SANs deliver the following well-understood value propositions:

- Storage consolidation
- Centralized storage management
- High performance
- High reliability
- Rapid reconfiguration

2 FIBRE CHANNEL OVER ETHERNET

Fibre Channel over Ethernet (FCoE) transports Fibre Channel frames over an Ethernet fabric and enables data centers to increase application performance while reducing cost, power, and manageability tasks by converging storage, networking, and clustering data to a single fabric.

The key benefits of FCoE are:

- High-performance storage access over lossless 10 Gigabit Ethernet fabrics
- Transparent access to storage devices using existing SAN management methods
- Retention of enterprise-proven Fibre Channel drivers and management tools
- Lower capital, energy, and cooling costs with fewer adapters, cables, and switches (in conjunction with the lossless Ethernet capabilities of Data Center Bridging [DCB])
- Lower management overhead by maintaining a single fabric
- Increased application availability by simplifying the network and server configuration

Figure 1) FCoE is the encapsulation of Fibre Channel into Ethernet.

FCoE is an evolution of Fibre Channel that uses Fibre Channel's network, service, and protocol layers to carry data packets over Ethernet physical and data link layers. Using Fibre Channel's upper layers simplifies FCoE deployment by allowing the use of enterprise-proven Fibre Channel software stacks, management tools, and trained administrators. Most importantly, mission-critical applications do not need to change to benefit from the performance and cost benefits of FCoE.

3 LOSSLESS ETHERNET USING DCB

As a protocol, Fibre Channel uses specific semantics to guarantee delivery of data and that storage traffic is delivered reliably and in a timely manner. In order to provide the service level guarantees required by storage traffic and allow for network convergence, Ethernet requires enhancements to its quality of service and bandwidth allocation mechanisms.

Those enhancements are being delivered in DCB, also known as converged enhanced Ethernet (CEE), a collection of IEEE standards that provide quality of service and bandwidth guarantees that allow for the deployment of a converged network where all applications can be run over a single physical infrastructure. DCB-capable products will enable lossless Ethernet fabrics by using priority-based flow control (PFC) to pause traffic based on priority levels. This allows virtual lanes to be created within an Ethernet link, with each virtual lane assigned a priority level. During periods of heavy congestion, lower priority traffic can be paused, while allowing high-priority and latency-sensitive tasks such as data storage to continue.

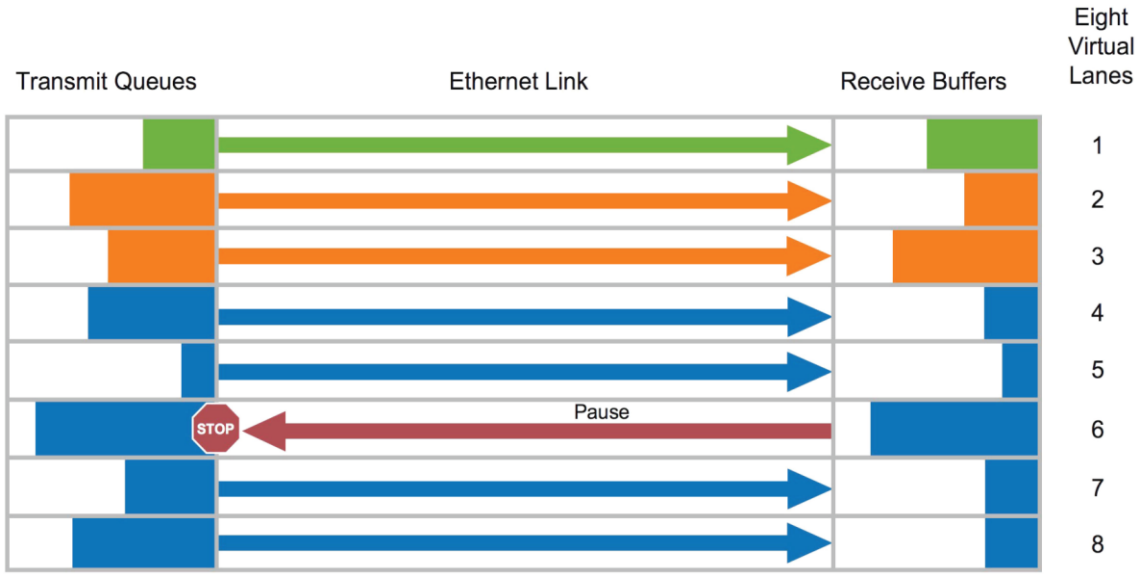

Figure 2) Priority flow control allows up to eight prioritized virtual lanes per Ethernet link.

FABRIC CONVERGENCE

DCB Ethernet and FCoE make it possible to converge enterprise storage, networking, management, and clustering data onto a single fabric that is simple to manage and offers high performance.

Pervasive use of Ethernet in enterprises of all sizes enables reduced component complexity and the ability to leverage common skills associated with client networks. And moving to Ethernet as a physical transport allows FCoE to follow a very robust roadmap with 10Gb per second bandwidth today and plans for 40Gb per second and 100Gb per second in the near future.

4 ETHERNET DRIVES ECONOMIC BENEFITS

POWER SAVINGS

By eliminating the need for multiple host I/O cards (host bus adapters/network interface cards [NICs]) and separate physical networks (FC SAN and Ethernet) for connecting those hosts together and converging to a single Ethernet network, users can recognize significant savings in power consumption across the data center. In addition, a converged network allows for reduction of the number of host adapters in each server and the number of switches and cables required to build out a data center infrastructure.

ADDITIONAL COST SAVINGS

Additional cost savings can be expected by converging storage and networking onto Ethernet fabrics. Not only are energy, management, and maintenance costs reduced, but also the cost of Ethernet adapters, cables, and switches is lower than with Fibre Channel due to the higher volumes and ultracompetitive market forces.

5 ROLLING OUT FCOE INTO THE DATA CENTER

The first FCoE products introduced to the market are generally focused at the server and the network switch as a means of connecting newly deployed servers to an existing FC SAN infrastructure. Converged network adapters (CNAs) provide server LAN and SAN connectivity over Ethernet and, when combined with FCoE switches that connect FCoE-capable initiators (server side) to existing Fibre Channel SANs, enable you to consolidate server interconnectivity to a single Ethernet fabric.

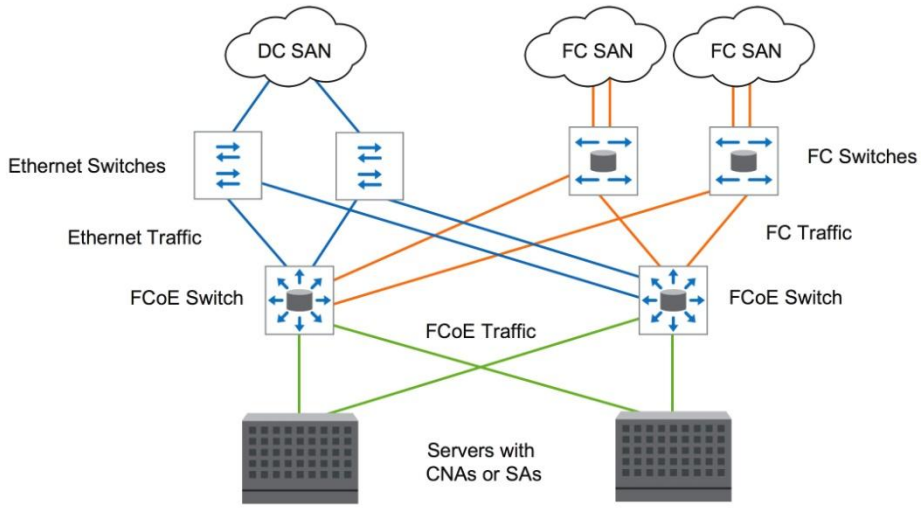

Figure 3) FCoE access switches and CNAs or server adapters (SAs) with FCoE initiators simplify the network topology.

To the nodes in the Fibre Channel SAN, the FCoE initiators appear to be directly connected and can be managed and maintained with the same tools. For environments with large Fibre Channel investments, FCoE provides an ideal way to transition from one physical protocol to Ethernet without having to engage in extensive training.

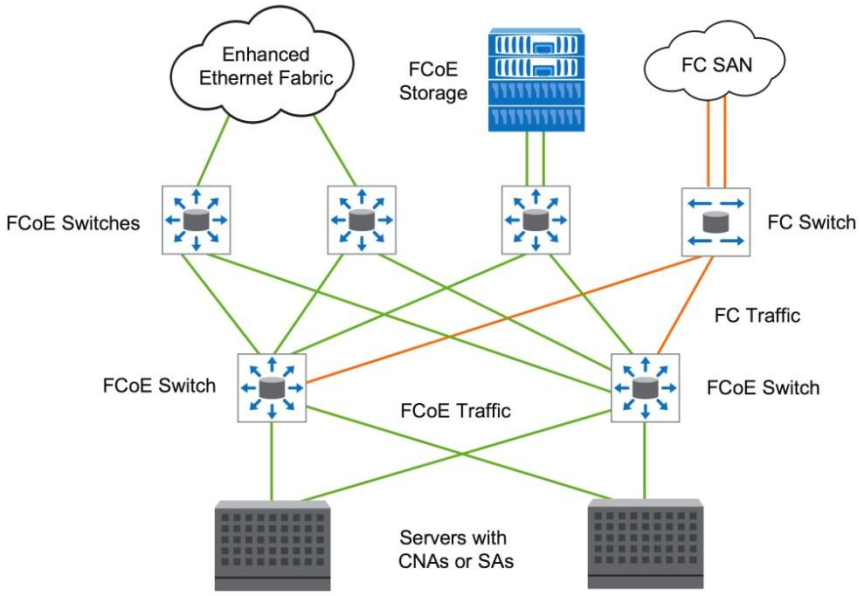

Figure 4) A fully converged network architecture with end-to-end FCoE.

As DCB becomes more popular, its value will extend further into the data center with storage systems supporting native FCoE. Unified storage arrays with native FCoE as well as iSCSI and NFS/CIFS enable a fully converged 10GbE fabric and offer significant value over disparate storage systems with limited or dedicated protocol support.

6 CONCLUSION

As the functionality of Ethernet continues to increase, its value as a data network continues to expand. The next generation of Ethernet includes enhancements delivered with DCB that are ideally suited for storage networks. FCoE will begin to see penetration into data centers in 2009 as the standard is ratified and new and exciting products are made available in quantity. And as FCoE continues to expand its presence, enterprises will see increased opportunity to reduce cost and improve manageability and service levels by converging all network traffic onto a common technology, Ethernet.

ABOUT BLADE NETWORKS

BLADE Network Technologies is the leading supplier of Gigabit and 10G Ethernet network infrastructure solutions that reside in blade servers and "scale-out" server and storage racks. BLADE's new "virtual, cooler and easier" RackSwitch family demonstrates the promise of "Rackonomics"- a revolutionary approach for scaling out data center networks to drive down total cost of ownership. The company's customers include over half of the Fortune 500 across 26 industry segments, and an installed base of over 200,000 network switches representing more than 1,000,000 servers and over 5 million switch ports. For more information, visit www.bladenetwork.net.

ABOUT NETAPP

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