

Unified Storage Networking

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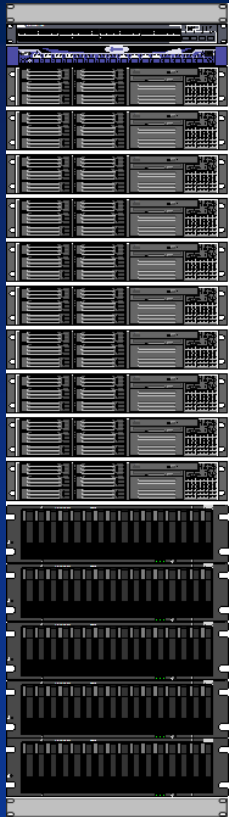
Demartek Company Overview

- Industry analysis with on-site test lab
- Lab includes servers, networking and storage infrastructure
 - Fibre Channel: 4 & 8 Gbps
 - Ethernet: 1 & 10 Gbps (with FCoE)
 - Servers: 8+ cores, up to 96GB RAM
 - Virtualization: ESX, Hyper-V, Xen
- We prefer to run real-world applications to test servers and storage solutions
 - Currently testing various SSD and FCoE implementations
- Web: www.demartek.com

Agenda

- The Problem
- Buzzwords and Acronyms
- Key protocols and standards
- Technologies available now
- Advantages and disadvantages
- Effect on currently installed storage networks
- Demartek lab test results
- Futures, Commentary, Roadmaps

The Problem: Too Many Parts



48-port Ethernet switch
32-port FC switch

10 rack servers
(2U each)

Disk array, 5 shelves
(3U each)

- Rack Servers (each)
 - 4 NIC ports (1Gb)
 - 2 FC ports (4Gb)
- Disk Array
 - 2 NIC ports (1Gb)
 - 4 FC ports (4Gb)
- Totals?
 - Cables & switch ports
 - Adapter cards
 - Maximum bandwidth

The Solution: Converged Network

Combine lossless features of Fibre Channel
with ubiquity of Ethernet

- Within a rack (short-term)
- Entire infrastructure (long-term)

New Buzzwords & Acronyms

- Converged Network: combined LAN and SAN network
- Data Center Bridging (DCB)
 - CEE: Converged Enhanced Ethernet
 - DCE: Data Center Ethernet (Cisco trademark)
 - EEDC: Enhanced Ethernet for Data Center
- FCoE: Fibre Channel over Ethernet
 - FCoCEE: FC over CEE
- CNA: Converged Network Adapter

How Can This Work?

- Enhance Ethernet so that it properly handles storage traffic
- Data Center Bridging (DCB)
 - A collection of architectural Ethernet extensions designed to improve Ethernet networking and management in the data center
- FCoE is the first major application for DCB

Data Center Bridging (DCB)

- Traffic Differentiation
 - Can distinguish LAN, SAN and IPC traffic
- Lossless Fabric
 - Required for SAN traffic
- Optimal Bridging
 - Allows shortest path bridging within data center
- Configuration Management
 - Works with existing systems

Key Protocols and Standards

- Ethernet
 - IEEE 802.1 DCB Task Group
 - 802.1Qau Congestion Notification (CN)
 - 802.1Qaz Enhanced Transmission Selection (ETS)
 - 802.1Qbb Priority-based Flow Control (PFC)
 - IETF TRILL – Multipathing alternative
 - Technical working groups are making progress
- Fibre Channel (FC)
 - INCITS T11: FC-BB-5 (“FCoE”)
 - Approved June 2009

Fibre Channel over Ethernet

- FCoE places the FC protocol on a new physical link
 - Uses Lossless Ethernet (DCB) physical links
 - Protocol and behavior is the same as traditional FC
- FCoE fabrics must be built with FCoE/DCB switches
 - Interoperate with traditional FC fabrics
 - Support all FC advanced features
 - Operate identically on FCoE and FC fabrics

Switch Technology Available

- DCB/FCoE switches
 - Blade Networks Virtual Fabric 10G Switch & RackSwitch G8124
 - Brocade 8000 FCoE switch, FCOE10-24 blade for DCX Backbone
 - Cisco Nexus 5000 series switches, 4000 blades
 - Others are expected
- Contain technology for:
 - 10Gb Enhanced Ethernet (lossless)
 - Optional: 4 or 8Gb Fibre Channel
 - Support for FCoE traffic
 - Support for iSCSI traffic

Adapter Technology Available

- Converged Network Adapters (CNA)
 - Brocade 1007/1010/1020
 - Emulex OCe10102, OCe11102
 - QLogic QLE8x00 series (8100, 8200 etc.)
 - Mellanox 10GBase-T adapter (w/FCoE firmware)
- 10GbE NICs
 - Intel X520
- Chipsets/Controllers
 - Available from Broadcom, Emulex, Intel, QLogic
- These adapters require PCI-Express slots
 - Newer adapters work best with PCIe 2.0 or higher

Adapter Technology Available

- Offload characteristics
 - CNAs: FC & FCoE supported in hardware
 - 10GbE NICs: FC & FCoE supported by software
 - Ethernet: Similar to good server-class NIC
- Connectors
 - Copper: CX4 and SFP+ (10GBASE-CR)
 - Optical: SFP+ (10GBASE-SR)
- Future: 10GBASE-T (RJ45, Cat 6 and 7)
 - Some concerns about bit error rate (BER) and power consumption

Advantages & Disadvantages

- Advantages
 - Reduced number of cables
 - Reduced number of adapters
 - Reduced number of switches (over the long term)
 - Retain existing management software
- Disadvantages
 - Possible single points-of-failure
 - Single adapter
 - Single switch
 - Organizational issues

Organizational Issues

- In typical large shops today, networking and storage are separate departments
 - Networking: Dynamic (more changes)
 - Storage: Stable (fewer changes)
- Other areas of convergence
 - Consider voicemail & email
- Those that learn networking and storage will be in the best position

Effect on Current Storage Networks

Can use and coexist with existing storage networks

- Converged switches can pass FC traffic to existing FC SAN switches or to FC targets
- Existing storage management software should work with FCoE technology

Expected Deployment Phases

Expecting a slow, deliberate process

- 2008 – 2009
 - Early adopters, top-of-rack-switch, connects to existing storage networks
- 2010 – 2011
 - Core networking support and wider adoption of FCoE adapters, some FCoE storage targets
- 2011+
 - More native FCoE storage targets

Demartek Lab Test Results

- Past Testing:
 - Conducted FCoE “First Look” in May 2008
 - Participated in FCoE “Test Drive” in June 2008
 - NetApp native FCoE storage in January 2010
 - IBM/QLogic FCoE-to-FC storage in May 2010
 - Evaluation of Emulex OneCommand in Aug. 2010
 - Evaluation of Intel X520 FCoE/iSCSI in Sep. 2010
- Current Testing:
 - Testing with various adapters, switches and storage in the Demartek lab in 2011

FCoE General Comments

- Storage infrastructure changes slowly
- Should be considered in long-term planning, new equipment acquisitions and data center build-outs
- Standards
 - FCoE (FC-BB-5) is now a standard within the T11 committee
 - INCITS 462-2010 has been approved as a standard, available for purchase in July 2010

Roadmaps

- FC: 16-Gbps by 2011
 - SAN interface has a future
 - Disk drive interface approaching end-of-life
- Ethernet: 40 & 100 Gbps specifications (IEEE 802.3ba) ratified in June 2010
- FCoE will follow Ethernet roadmap
- Infiniband: 10, 20, 40 Gbps now, expecting 80 & higher

Future Technology Outlook

- Higher-speed adapters will require servers with PCI-Express 2.0 (or higher) slots
- Vendors are scrambling for LAN-on-Motherboard (LOM) design wins
 - Expect to see 10GbE available on server motherboards beginning in late 2010 or early 2011
 - Look for possible 10GbE + FCoE on server motherboards in the future
 - Expect to see both copper and optical connections available directly on server motherboards

Future Technology Outlook

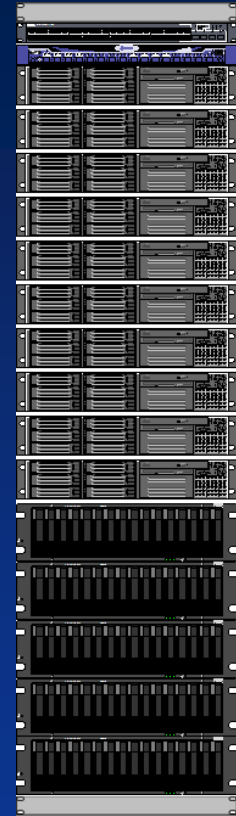
- As interface speeds increase, expect increased usage of fiber-optic cables and connectors for most interfaces
 - At higher Gigabit speeds, copper cables and interconnects become too “noisy” except for short distances

Cabling

- Single-mode fiber (SMF)
 - 9 μm (microns), very-long distance, yellow
- Multi-mode fiber (MMF)
 - 62.5 μm or 50 μm , medium distance
 - Orange: OM1 (62.5 μm), OM2 (50 μm)
 - Aqua: OM3 and OM4 (both 50 μm)
 - 10GbE is best with OM3 or OM4
 - OM3 and OM4 also will support 40GbE & 100GbE
- Cable deployments change very slowly, so choose 10GbE cabling wisely

Before and After

- Compare parts list with DCB & FCoE
 - Cables & switch ports
 - Adapter cards
 - Maximum bandwidth
- What can be eliminated?



Demartek FCoE Resources

- Demartek has compiled a free comparison reference guide of FCoE and the other storage networking interfaces, which is updated periodically and includes roadmap information. This also includes cable distances and speeds.
www.demartek.com/Demartek_Interface_Comparison.html
- Demartek FCoE Zone
 - <http://www.demartek.com/FCoE.html>

Free Monthly Newsletter

- Demartek publishes a free monthly newsletter highlighting recent reports, articles and commentary. Look for the newsletter sign-up at <http://www.demartek.com>.

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