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

- **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

48-port Ethernet switch
32-port FC switch
10 rack servers (2U each)
Disk array, 5 shelves (3U each)

Santa Clara, CA USA
February 2011
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
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
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
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
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
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
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 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
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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