The SNIA Ethernet Storage Forum (ESF) focuses on educating end-users about Ethernet-connected storage networking technologies.
Housekeeping

- Presentation with live Q&A at the end
- Questions submitted via web tool will be answered verbally
- Unanswered questions will be placed on www.sniaesfblog.org
- Request complete the 10 second feedback form
Today’s Panel

- Jason Blosil, SNIA–ESF Chair
- Gary Gumanow, SNIA–ESF Board of Directors
- David Fair, SNIA–ESF Board of Directors
SNIA Webinar Agenda

- Trends driving new networking requirements
- Technologies enhancing 10GbE
  - New server platforms
  - I/O virtualization
  - Network flexibility (cabling and DCB)
- 10GbE market adoption
- Future of 1GbE / Fast Ethernet
- Where do we go from here
Top Storage Trends

Cloud Services
SSD Flash
End-To-End Management
Mobile Delivery of Content
Converging Architecture
Drivers of 10GbE

Economic Drivers

Increased Use of Virtual Resources for Real Work Loads!

Technical Drivers

Competitive Advantage
Economic Drivers – 10GbE
It’s about $/Gb

Hardware
- 1GbE
  - Adapter – sub $100 / port
  - Switch – sub $75/ port
- 10GbE
  - Adapter – sub $300 / port ($30 / Gb)
  - Switch – sub $500 / port ($50 / Gb)

Green Initiatives
- Data center avoidance
- Data center efficiency

10GbE offers 10x the bandwidth at 5x the price
OR
a 50% reduction in $ / Gb of bandwidth
Cloud Services

Private Cloud: behind the firewall of an enterprise, closed to public
Public Cloud: accessible via service providers for general purchase
Hybrid Cloud: private clouds linked to public clouds

Workloads moving increasingly to virtualized cloud infrastructure
Disruption of Flash Technology

- Relatively small differences between HDD types
- Flash is a game changer
- Balancing cost and performance is key
- Flash performance relocates performance bottlenecks
SSD versus 15k rpm FC, 4KB random reads

Sequential I/O throughput per drive
**End-to-End Flash Categories**

### Host-side Flash Software
- Software only, may be tied to particular flash hardware

### Flash as DAS / Cache
- Flash hardware, stores persistent data
- May be combined with software to form cache

### Flash-based VSA
- Software

### Flash in Controller
- Flash hardware and software
- “Behind wire”

### Pure Flash in Array
- All flash

### Network-based Flash
- Flash Hardware and software
- “Bump in the wire”

### Hybrid Flash / HDD Array
- Mixed flash / HDD
Vote #1
New server platforms coming to market as of March 2012 let Ethernet accomplish more than ever

- Bandwidth per port doubles with PCI Express® 3.0
- Integrating PCIe3 onto the processor itself reduces latency
- What Intel calls “Direct Data I/O” changes the I/O paradigm for servers
  - The Ethernet controller talks directly with the processor’s last-level cache
  - No longer is Ethernet traffic forced to detour through main memory on ingress and egress

This new server platform has the I/O headroom to run up to 250 Gbps of Ethernet I/O per processor
  - More than a factor of three more headroom than any preceding server platform
Flexible LOM Encourages Upgrades To 10GbE

- Similar to blade mezzanine cards, flexible LOM cards can be configured by OEMs at the time of order
- OEMs each have their own names for this form factor

“Classic” LOM

10GBASE-T LAN-on-Motherboard (LOM)

“Flexible” LOM

Custom PCI Express 10GBASE-T Converged Network Adapter

PCI Express® NIC

Standard PCI Express 10GBASE-T Converged Network Adapter
Remote Direct Memory Access (RDMA) is a technology that allows an application to transfer data directly to/from the data space of another application while bypassing the OS kernel.

- Permits low latency data transfers with low packet jitter, low CPU utilization, and traffic segregated into prioritized classes.

Two RDMA-over-Ethernet technologies being deployed today over 10GbE, iWARP (internet Wide-Area RDMA Protocol) and RoCE (RDMA over Converged Ethernet).

High-performance computing (HPC) workloads written to the Open Fabrics Alliance stack for InfiniBand can run on a 10GbE network supporting either iWARP or RoCE.

Windows Server 2012 will take advantage of RDMA capabilities to support network Microsoft’s file system called “SMB Direct 3.0.”
Ethernet Virtualization For 10GbE Overview

- Multiple approaches to “carving up” 10GbE ports and assigning the slices to virtual machines have emerged
  - Demand queuing
  - PCI-SIG® Single-Root I/O Virtualization (SR-IOV)
  - OEM-driven NIC partitioning: Dell’s NPAR, HP’s Flex-10, IBM’s vNIC
  - OEM-driven network virtualization: Cisco’s FEX

- Demand queuing is supported by Microsoft and VMware
- SR-IOV is supported in Linux Xen and KVM
  - Microsoft has committed to SR-IOV support in 2012
  - VMware is showing it in their ESX 5.1 beta

- Users have multiple and increasing choices for Ethernet virtualization of 10GbE ports
Vote #2
What would you estimate is the average number of virtual machines per physical x86 server in your environment today? How do you expect this to change over the next 24 months? (Percent of respondents, N=463)

<table>
<thead>
<tr>
<th>Today</th>
<th>24 months from now</th>
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<tr>
<td>&lt;5</td>
<td>8%</td>
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<tr>
<td>5-10</td>
<td>24%</td>
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<td>23%</td>
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<td>&gt;25</td>
<td>3%</td>
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<tr>
<td>Don’t Know</td>
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**Server Virtualization Impact on the Network**
- It has created more network traffic in the data center (30%)
- 10GbE & 16Gb FC
- 40Gb

Source: 2011 Enterprise Strategy Group
Leverage existing infrastructure – Flexibility Network media options

- **SFP+ Optical or Twin-Ax**
  - iSCSI adapter with SFP cage
  - Twinaxial Cable with SFP+ modules on ends
  - Supports 5-7m distances
    - Top of Rack

- **Optical versions available supporting 100m or more**

- **10GBASE-T**
  - Backwards compatible with Gigabit Ethernet
  - Uses Cat6/Cat6A/Cat7 unshielded twisted pair cabling with RJ-45 connectors
  - Supports 100m distances
    - Top of Rack, End of Row (EOR)

Expensive

- Optical
  - Expensive optical transceivers

- Twin-Ax
  - Expensive Cables

Less Expensive

- CAT6A
  - Less Expensive Cabling
  - Newer Switches
What is Data Center Bridging?

- **Enhancements to Ethernet**
  - Provided enhanced QoS support to Ethernet
  - 10GbE Technology today...

- **What constitutes DCB Standards?**
  - PFC aka Priority based Flow Control (802.1Qbb)
  - ETS aka Enhanced Transmission Selection (802.1Qaz)
  - QCN aka Congestion Notification (802.1Qau)
  - DCBX aka Data Center Bridging capability eXchange

  - **LLDP vs. DCBX**
    - LLDP: Primarily a link level information exchange protocol
    - DCBX: Neighbors can configure parameters based on info exchange and state machine
Data Center Bridging Capabilities eXchange Protocol (DCBX)
  - Supports centralized configuration of DCB and related protocols
  - Initiated by endpoints (hosts/storage) configure themselves

Enhanced Transmission Selection (ETS)
  - Provides priority groups with bandwidth controls

Priority Flow Control (PFC)
  - Enable lossless Ethernet operation to provide deterministic performance

What’s needed
  - HBA or Converged Network Adapter supporting DCB
  - 10G Ethernet Switch supporting DCB
  - 10G Storage Array supporting Ethernet storage over DCB
DCB Components

IEEE DCB

802.1Qbb
(Per-Priority Flow Control)

HALT an individual stream, but NOT all of them!

Allocate bandwidth based upon predetermined classes of traffic

IEEE DCB

802.1Qaz
(Enhanced Transmission Selection)

IEEE DCB

802.1Qau
(Congestion Management)

End-to-End Communication between end-points. Tells the end-point to BACK OFF!
Ethernet Storage Forum

DCB & 10GbE

- Enables convergence of LAN and SAN traffic
  - DCB enables mixed traffic
- Deterministic performance in converged, mixed traffic environment
  - Lossless Ethernet using Priority Flow Control enables support
- Ease of use
  - Centralized configuration via switch with DCBX support
    - Hosts, storage announce capabilities
    - Switch enables PFC, Jumbo-frames, other parameters via DCBX
- Easy server integration
  - Integrated LOM & Modular servers with DCB capabilities
Ethernet Unifies the Data Center

Solve All Your Use Cases

- Increased asset and storage utilization
- Simplified storage and data management
- Improved flexibility and business agility
- Reduced costs through consolidation
- Improved storage and network efficiencies

File and Block

- Small/ Medium Business
- Data Centers, Remote Offices
- Traditional FC Data Centers

- CIFS
- NFS
- iSCSI
- FCoE

- 1GbE /10GbE
- 10Gb Ethernet with DCB
10GbE Adoption

Datacenter Switch Shipments

Ports in Millions

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Future of 1GbE / Fast Ethernet

Data Center
- Management networks for storage, servers, switches, etc.
- Low demand storage applications such as print servers, basic file services, and active directories
- Low demand or medium demand block storage, such as iSCSI storage for email applications

Outside of the data center
- Voice over IP (each desk requires wired connection)
- Video surveillance
- Virtual desktops (VDI)
- And general client networking
- Consumer
Data intensive applications are relentlessly driving the need for higher-speed connectivity

- Cloud computing, mobile networking, high-speed consumer broadband

10GbE adoption is paving the way for 40G interfaces in the aggregation layer and 100G uplinks at the core layer

40GbE is the next logical step in the evolution of the data network

- Forecasters expect 40GbE to begin significant edge server deployment in 2015-16
Vote #3
Questions?

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Full Q&A session from this Webcast will be posted on the SNIA-ESF Blog