Use Cases for iSCSI and FCoE: Where Each Makes Sense

February 18, 2014
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SAN Market—Use Cases for iSCSI and FCoE: Where Each Makes Sense

Dell’ Oro Group Research
FC Switch and Adapter Port Shipments

Port Shipments in Millions

- 4 Gbps
- 8 Gbps
- >16 Gbps

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FCoE Enabled Switches 3Q13

Port Shipments in 000’s

- Modular
- Purpose Built
- Blade

Cisco
HP
Brocade
Others
FC and FCoE Switch Forecast

Port Shipments in 000's

<table>
<thead>
<tr>
<th>Year</th>
<th>FC Switches</th>
<th>FCoE Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
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<td>2011</td>
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<td>2016</td>
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<td>2017</td>
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</table>
L2+L3 10 Gbps Ethernet Switch
Bandwidth – Data Center

Switch Bandwidth in Gigabytes


iSCSI
Other
FCoE

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10 Gbps Ethernet Controller and Adapter Port Shipments

Port Shipments in Millions

FCoE Enabled Ports

10 Gbps Ethernet (Non-FCoE) Ports

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Server Market Adoption

Enterprises

Cloud and SP

Percent of Server Shipments (Bars)

Enterprise Server Shipments in Millions (Line)

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Jeff Asher, SNIA-ESF Member, Principal Architect - NetApp
Market Perceptions

- FCoE = Enterprise Grade
- iSCSI = Non-critical apps
- No real evidence to suggest differences in reliability given identical hardware (discussed more later)
FCoE/iSCSI Hardware

- FCoE hardware all supports iSCSI
  - FCoE requires CNA
  - iSCSI runs on any NIC
- Easy to run both simultaneously on same links and ports
- DCB is required for FCoE but benefits iSCSI
  - 10GbE gives iSCSI same bandwidth as FCoE
  - Jumbo frames reduce overhead
  - Lossless ethernet
- Storage system support
  - iSCSI targets are much more common
  - Most FCoE target systems also support iSCSI
Technical Details

- **Fibre Channel to FCoE**
  - Ratified in 2009
  - Seamlessly integrates with traditional Fibre Channel
  - Encapsulates SCSI at OSI Data Link layer
  - Data Center Bridging Enhancements
  - Always implemented in hardware

- **iSCSI**
  - Ratified in 2003
  - 1GbE to 10GbE
  - Encapsulates SCSI in IP Packets
  - More layers of encapsulation increase latency
  - Implemented in either software or hardware
## Protocol Stack Comparison

<table>
<thead>
<tr>
<th>iSCSI Protocol</th>
<th>TCP Stack</th>
<th>IP Stack</th>
<th>NIC H/W</th>
</tr>
</thead>
<tbody>
<tr>
<td>iSCSI S/W Initiator w/NIC</td>
<td>TCP/IP Offload Adapter</td>
<td>NIC H/W</td>
<td></td>
</tr>
<tr>
<td>TCP Stack</td>
<td>IP Stack</td>
<td>NIC H/W</td>
<td></td>
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<tr>
<td>iSCSI Offload Driver</td>
<td>NIC H/W</td>
<td></td>
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<td>Full iSCSI Offload Adapter</td>
<td>NIC H/W</td>
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<th>FC Protocol</th>
<th>FCoE Protocol</th>
<th>NIC H/W</th>
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<tr>
<td>Open FCoE Initiator</td>
<td>FCoE CNA</td>
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**BOLD - Hardware**
Decision Factors

- Topology Requirements
- Applications Requirements
- Performance Requirements
- Resource Utilization
- Skills and Support
Topology Requirements

- FCoE has more stringent topology requirements than iSCSI
  - DCB connectivity is required end-to-end
  - Initiator and target must be on same layer 2 segment
  - FCoE requires customer to pay more attention to interoperability

- Very few topology limitations for iSCSI
  - Initiator and target can be on different subnets
  - Non-DCB links in the path are supported

- An environment that takes advantage of iSCSI’s topology flexibility may encounter reduced performance.
  - May not meet storage and application vendor best practices
  - Layer 3 hops increase latency
In practice, an application can’t distinguish between iSCSI and FCoE

- Ability to identify the difference if important to the customer

Application vendor may specify protocol

- Protocol restrictions more common in healthcare and financial application environments
- Protocol choice driven by vendor qualifications
Performance Impacts

- FCoE outperforms iSCSI in most cases
  - Encapsulation
  - Hardware offloading
  - Frame size

- Wire performance delta is minimal
  - Software initiator vs hardware offload will impact server load, but minimally

- Most servers and storage systems are bottlenecks before protocols are a factor

- DCB offers more predictable latency over traditional IP networks, a benefit in mixed traffic environments
Resource Utilization

Two approaches to protocol handling
- Full offload – adapter handles protocol stack – lower CPU utilization
- Host-based – selective hardware acceleration levels – higher CPU utilization

Can make difference in acceptable application performance in edge cases on older servers
- OLTP databases
- Big Data applications
- Undersized Server

CPU utilization differences getting smaller everyday
IOPS and CPU Utilization for FCoE and iSCSI

Graph of data from Demartek Report

Intel® 10GbE Adapter Performance Evaluation for FCoE and iSCSI – September 2010
Availability of tools
- Most FC admin and troubleshooting tools work with FCoE
- IP network tools can troubleshoot iSCSI the same as other protocols
- Most iSCSI problems can be solved with “ping” command.

Availability of admins experienced in either
- iSCSI admins are generally easier to find
- FC network admins are less common than IP network admins, but transition to FCoE fairly easily
- Market forces drive salary and availability
Conclusion

Either protocol can satisfy most technical requirements.
- Extreme throughput requirements push towards FCoE.
- Extremely low latency tolerance push towards FCoE.
- Less than 800 Mbytes/sec per port = either will work
- Long distance requirements push towards iSCSI

Non-technical factors often drive the decision.
- Budget impacts
- Personnel availability
- Supportability in a particular environment
- Application support

Non Factors
- CPU Utilization – becoming less relevant over time (Moore’s law ramifications)
After This Webcast

- This webcast will be posted to the SNIA Ethernet Storage Forum (ESF) website and available on-demand
  - [http://www.snia.org/forums/esf/knowledge/webcasts](http://www.snia.org/forums/esf/knowledge/webcasts)

- A full Q&A from this webcast, including answers to questions we couldn't get to today, will be posted to the SNIA-ESF blog
  - [http://sniaesfblog.org/](http://sniaesfblog.org/)

- Follow and contribute to the SNIA-ESF blog thread on many storage-over-Ethernet topics, both hardware and protocols
  - [http://sniaesfblog.org/](http://sniaesfblog.org/)
QUESTIONS?
Conclusion

Thank You