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Agenda

❖ A Brief History
  ❖ Fibre Channel
  ❖ iSCSI

❖ Similarities and Differences

❖ Is one better than the other? Challenge Topics
  ❖ Performance, manageability, security, cost, etc.
  ❖ The future
What is Fibre Channel?

- Block storage network technology
  - Upper level protocols (SCSI, FICON, NVMe, etc.)
  - Protocol mapping (FCP, FC-SB, FC-NVMe, etc.)
  - Lower/signaling protocols and Physical network
- Standardized by ANSI/INCITS T11
  - First standardized 1994
  - First available 1997
- “Fibre Channel” usually means SCSI on FCP over FC
5-Layer Model

2x wire speed every ~4 years (4/8/16/32 Gb/s, etc.)

<table>
<thead>
<tr>
<th>ULPs</th>
<th>SCSI</th>
<th>FICON</th>
<th>NVMe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping FC-4</td>
<td>FCP-4</td>
<td>FC-SB</td>
<td>FC-NVMe</td>
</tr>
<tr>
<td>Services FC-3</td>
<td>FC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signaling FC-2</td>
<td>FC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission FC-1</td>
<td>FC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical FC-0</td>
<td>FC</td>
<td></td>
<td></td>
</tr>
</tbody>
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Fibre Channel

- FC: Purpose-Built for Storage
  - Optimized out of the box
    - Fire it up and Forget it
- Uses Different Adapters & Switches
  - Dedicated Network with one job to do – storage
  - Familiar configurations and topologies
    - Point to Point or Switched Fabric
Fibre Channel

- **FC: Purpose-built for Storage**
  - Centrally Managed (in the network/switch)
  - Lossless in-order delivery
  - Reusable protocol
    - SCSI (traditional LUNs)
    - FICON (Mainframe block storage)
    - NVMe (Namespaces)
    - Even Aircraft (FC-AE/FC-AV)
Fibre Channel

- **Reliability**
  - Strong CRC
  - Fewer retransmissions

- **Redundancy**
  - Built using duplicate SANs
  - Simplifies network protocol
  - Complexity in Host S/W and Storage device
    - Not in the network
Fibre Channel

FC Services

- Zoning
  - Manual zoning
  - Peer zoning (automatic)

- Name Server
  - Registration / Discovery
  - Notifications of network state changes

- Security
  - FC-SP-2 authentication
  - FC-FS-4 encryption
Fibre Channel

- **Speeds and Feeds**
  - 1G / 2G / 4G / 8G / 16G / 32G / 64GFC / 128GFC (x4)

- **Futures**
  - In Development: 256GFC (x4) / 128GFC (x1)
  - Roadmap: 256GFC (TBD), 512GFC (TBD) / 1TFC (TBD)
  - FC-NVMe runs NVMe protocol over existing FC networks
Agenda Revisited

- A Brief History
  - Fibre Channel
  - iSCSI
- Similarities and Differences
- Is one better than the other? Challenge Topics
  - Performance, manageability, security, cost, etc.
  - The future
What is iSCSI?

- Block storage network technology
  - SCSI protocol running (usually) on TCP/IP
  - Can run on RDMA: InfiniBand, iWARP, RoCE
  - Almost always over Ethernet

- Standardized by IETF
  - RFCs 3721, 3722, 4018, 4056, 7143, etc.
  - First available in 2003/2005/2006 (Windows/Linux/VMware)

- “iSCSI” usually means SCSI on TCP/IP over Ethernet
iSCSI Network Model

- OSI 7-layer model
- Was 10x wire speed every ~5 years
  - 10Mb, 100Mb, 1/10/100GbE
  - Now 2x every 3-4 years (200/400GbE)
- Ethernet supports NVMe-oF
  - But not over iSCSI

<table>
<thead>
<tr>
<th>L7</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6</td>
<td>SCSI</td>
</tr>
<tr>
<td>L5</td>
<td>iSCSI</td>
</tr>
<tr>
<td></td>
<td>iSER</td>
</tr>
<tr>
<td></td>
<td>iWARP</td>
</tr>
<tr>
<td></td>
<td>iSER RoCE</td>
</tr>
<tr>
<td>L4</td>
<td>TCP</td>
</tr>
<tr>
<td></td>
<td>UDP</td>
</tr>
<tr>
<td>L3</td>
<td>IP (Network)</td>
</tr>
<tr>
<td>L2</td>
<td>Ethernet (Link)</td>
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<tr>
<td>L1</td>
<td>Ethernet (Physical)</td>
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</tbody>
</table>
iSCSI

- iSCSI: Protocol is purpose-built for storage
  - Underlying Ethernet network is all-purpose
  - iSCSI just works out of the box
    - But discovery requires configuration
    - Optimization or tuning required for best performance

- Can have dedicated or shared network
  - Shared network for lower cost, maximum flexibility
  - Dedicated storage network for highest performance
iSCSI

➤ Management
   ✷ Mostly distributed (in clients and targets)

➤ Transport can be configured as lossless or lossy

➤ Underlying network is reusable
   ✷ Other storage protocols: NFS, SMB, NVMe-oF
   ✷ Object storage or scale-out filesystems
   ✷ Compute traffic or hyperconverged infrastructure
iSCSI

- **Reliability**
  - iSCSI digest (CRC)
  - Ethernet CRC, RoCE/InfiniBand CRC, TCP/IP checksums

- **Redundancy**
  - Protocol: Link aggregation (LACP) or iSCSI multipathing
  - Physical: Duplicate Ethernet networks (optional)
iSCSI

- **iSCSI Services**
  - Zoning or isolation options
    - Physically separate network
    - ACLs (access control lists), VLANs (virtual LAN), VPN (virtual private network)
  - Internet Storage Name Service (iSNS)
  - Ethernet QoS and monitoring tools
  - Security
    - IPSEC for encryption
    - CHAP or RADIUS for authentication
iSCSI

❖ **Speeds and Feeds Today**
  • 1G / 2.5G / 5G / 10G / 25G / 40G / 50G / 100G

❖ **Futures**
  • Coming in 2018: 200GbE (4x50) and 400GbE (8x50)
  • In the plan: 800G, 1.6T, 3.2T (dates TBD)
  • NVMe-oF: Ethernet network also supports NVMe
Other Block Protocols

- **FCoE**
  - SCSI on FCP over lossless Ethernet
  - Often used for blade servers
- **SRP – SCSI RDMA Protocol**
  - Only runs on InfiniBand—usually for HPC customers
- **NVMe over Fabrics**
  - New kid on the (protocol) block
  - NVMe running over RDMA (Ethernet) or Fibre Channel
Important to Remember

Applications can use either FC or iSCSI
- Both deliver SCSI commands to LUNS
- Most OSes and Hypervisors support both

Most arrays support both FC and iSCSI
- Both protocols have initiator and target
- The optical cabling is often the same
Key Differences

- Underlying Network
- Adapter Offload Options
  - FC almost completely offloaded
  - iSCSI can be offloaded or S/W based
- Connection Management Model
- Security & Cost
  - We’ll explore shortly
Fibre Channel vs. iSCSI
Challenge Questions
Challenge Question #1 — Performance

➤ Which offers better performance?
   ✷ Bandwidth?
   ✷ Latency? Deterministic latency?

➤ Who is winning the speed race?
   ✷ Does it matter? Who needs that kind of speed anyway?
   ✷ What about distance?
   ✷ How can a server support 100/128/200 Gb/s?
   ✷ In reality, both use the same groups for their “speed” work

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Challenge Question #2 — Reliability & Manageability

❖ Which is More Reliable?

❖ Which is Easier to Manage?
  ➜ Setup and Expansion
  ➜ Monitoring
  ➜ Troubleshooting
Challenge Question #3 — Cost & Vendors

▷ What about price?
  ◆ Acquisition cost
  ◆ Operational cost

▷ Is it better to have 2 vendors or 6?
  ◆ Competition
  ◆ Innovation
  ◆ Interoperability
Challenge Question #4 — Security

Which is More Secure?
- Zoning vs. ACLs and VLANs
- How does iSCSI do LUN masking?
- How about encryption on the wire?

Should storage always use a separate network?
- Does a network “air gap” guarantee storage security?
Challenge Question #5 — Use Cases

What are the Best Applications for Each?
- Where is Fibre Channel used most?
- Where is iSCSI used most

Industry/Vertical Preferences
- Who prefers Fibre Channel?
- Who prefers iSCSI?
Challenge Question #6 — The Future

What Will Happen with NVMe and NVMe-oF?
- How will NVMe SSDs affect block storage networking?
- Will NVMe-oF replace one more than the other?

What about Hyperconverged Infrastructure?
- Does HCI make both FC and iSCSI SANs obsolete?
Fibre Channel Advantages

» Fast, Dedicated Hardware
  » Always lossless with credit-based flow control
  » HBA offloads; High-bandwidth switches

» Mature Ecosystem
  » Proven interoperability, Simple setup
  » Integration with storage and management software

» Storage Services
  » Name services, zoning, monitoring, diagnostics
iSCSI Advantages

- Ubiquity of Ethernet
  - Lower price alternatives, many vendors, popularity in the Cloud
  - Same network can support other storage/compute traffic

- Flexible Feature-vs.-cost Tradeoffs
  - Hardware acceleration: iSCSI offload, TOE, RDMA
  - Lossless, flow control, congestion management

- Higher Bandwidth, Lower Latency
  - 100GbE now, 200GbE soon
Decision time...

- How do you decide?
- Compare apples to apples
  - Don’t compare 1GE iSCSI to 32GFC
- Do you want an isolated dedicated storage network?
- Do you want a converged shared network?
- How big / complex is your environment?
- What is your inhouse expertise?
More Webcasts

❖ Next Live Webcast: Storage Performance Benchmarking: Workloads
  ✔️ February 14th 10:00 am PT
  ✔️ Register at: https://www.brighttalk.com/webcast/663/297859
❖ On-Demand “Everything You Wanted To Know About Storage But Were Too Proud To Ask” Series
  ✔️ https://www.snia.org/forums/esf/knowledge/webcasts-topics
❖ FCIA webcast: Fibre Channel Performance: Congestion, Slow Drain, and Over-Utilization, Oh My!
  ✔️ February 6th 10:00 am PT
  ✔️ Register at: https://www.brighttalk.com/webcast/14967/295141
❖ SNIA resources on iSCSI
  ✔️ Evolution of iSCSI: https://www.brighttalk.com/webcast/663/197361
  ✔️ Comparing iSCSI and NVMe-oF blog: http://sniaesfblog.org/?p=647
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- 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: [sniaesfblog.org](http://sniaesfblog.org)
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