The Future of Storage Area Network

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Agenda

• Core-to-Edge SAN
• Emerging Trends & Technologies
• Highly Scalable and Available SAN Design
• Multi-protocol SAN with MAN & WAN
• SAN Security
• Scaling SAN with internetworking
McDATA’s Core to Edge SAN

- Best in class core-to-edge open standard-based solutions
  - Director & switch family with ultra high availability & scalability
  - Leader in high bandwidth, availability, scalability, and manageability
  - Multi-protocol and intelligent SAN for distance, IP SAN, QoS, and value-adds
  - Investment protection

- Management and application software
  - High availability, ease of use, operation, and performance optimization

- World class system integration, interoperability, & solutions provider
Emerging Trends

To mention a few:

• Before 1997, there was virtually no SAN.
• In 2002, SAN deployment:
  > 98% of Large Enterprises
  < 12% of Small Enterprises
  (Gartner)
• Cost per gigabyte of disk has declined by 35-45% annually
• Growth in information storage, backup, replication, and business continuance
  – Content Addressable Storage
• Utility computing & storage services ?
• New interconnect market trends
  – Serial ATA & Serial Attach SCSI (SAS)
  – iSCSI
  – Higher speed FC: 4Gb/s (?), 10Gb/s
  – More intelligence in SAN
• SAN Management is both an Inhibitor and an Opportunity

A lot of talk, not much revenue ??
Emerging Technologies

• SAN
  – Direct-Attached → Network-Attached
  – Large SAN fabric → 100s of nodes towards 1000s of nodes
  – Higher bandwidth & speed
    → Trunking, Tb/s switching, 10 Gb/s, 4 Gb/s...
  – Convergence of SAN and NAS
  – Secured SAN

• Mission-critical needs
  – High availability
    → Cost of downtime becomes more critical
  – Interoperability
    → Users and vendors must work harder to achieve
  – Manageability
    → Ease of use and lower TCO

• New SAN technologies
  – Multi-protocol – iSCSI, InfiniBand?
  – Storage & fabric virtualization
  – System area network
    → InfiniBand?
    → RDMA schemes:
      • Virtual Interface (VI), Socket Direct Protocol (SDP), Storage Remote Protocol (SRP),
        Direct Access File System (DAFS),...

• Grid computing → Changes to SAN?
High Availability is a key requirement

<table>
<thead>
<tr>
<th><strong>Nondisruptive Code Load and Activation Test</strong></th>
<th><strong>DUT</strong></th>
<th><strong>Total Downtime (sec)</strong></th>
<th><strong>Total Time to Upload Code (min:sec)</strong></th>
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</thead>
<tbody>
<tr>
<td>– Spirent Test Traffic Was Started</td>
<td>Intrepid 6064</td>
<td>0.0</td>
<td>Less than 5:00</td>
</tr>
<tr>
<td>– Upgrade Firmware on DUT</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>– Verify New Firmware Was Operational &amp; Measured Traffic Downtime</td>
<td>Product-X</td>
<td>22.0</td>
<td>More than 15:00</td>
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<thead>
<tr>
<th><strong>Cold Re-Boot Test</strong></th>
<th><strong>DUT</strong></th>
<th><strong>Total Down Time (min:sec)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>– Spirent Test Traffic Was Started</td>
<td>Intrepid 6064</td>
<td>1:56.7</td>
</tr>
<tr>
<td>– Power Was Applied to the DUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– The Time It Took DUT to Forward Frame Was Measured</td>
<td>Product-X</td>
<td>10:11.7</td>
</tr>
</tbody>
</table>

Based on McDATA-Sponsored Independent Test Results
Scalable, Extensible, Modular, High Availability Design

- Blade approach extends & protects customer’s investment in McDATA directors
- Blade approach does not burden the cost of storage virtualization to every port in the director
10 G FC

- 10 G FC initially critical to ISLs & server, then storage, later to IP Gateway & IB Gateway
  - Important to large fabric → Enables bandwidth in the core and uplinks
  - Simplify cable management – 6 x 2 G FC fibre pairs become 1 fibre pair
- Goals: Common cable and transceiver between 10 G E and 10 G FC
  → To leverage economy of scale and share one cable plant design

- McDATA’s focus – use of customers’ installed fiber cable infrastructure
  - Multimode:
    - 850nm → 300 M, & 1310nm → 10KM
  - Single Mode:
    - 850 → 300M, 1310nm → 10KM, 1550nm → 40KM or more
IP Storage Standards

• **iSCSI**
  – IP based *storage protocols* between IP servers and IP storage devices

• **FCIP**
  – IP based *tunneling protocols* for extending FC Inter-Switch Links (ISLs) between FC switches

• **iFCP**
  – IP based *Gateway to Gateway protocols* for interconnecting FC based servers to FC based storage devices
Multi-Protocol SAN

Building 1 – Data Center
Multi-Protocol SAN

Building 2
IP SAN

IP Network

Bldg 3: Department (or SME)

Connectivity Options:
- Ethernet
- FC

iSCSI Enabled Servers

GbE SAN Switch

iSCSI Storage

IP SAN Management

FC Servers

FC Storage

iSCSI Servers

GbE SAN Switch

IP Gateway Switch

IP Gateway Switch

Low-End iSCSI Servers

Directors with IP Module

iSCSI and FCIP

iSCSI Traffic

FCIP Traffic

IP SAN

FC Storage

iSCSI Storage

iSCSI Servers

iSCSI Servers

iSCSI Enabled Servers

GbE SAN Switch

iSCSI Traffic

IP Network
SAN-MAN HA Solution

Enterprise SAN

Long wave or DWDM

Customer Access Interface

Storage

SSP Site

WDM Ring

SSP Site Backbone

Carrier Grade
HA SAN SSP
Metro Backbone

Site Services:
A – Storage on Demand
B – Electronic Vaulting
C – Tape Backup

Host
DWDM Metro Switch
Intrepid 6064 Director
Sphereon 4500 Loop App.
Storage
Sphereon 4500 Fabric Switch
Scaling SAN over MAN/WAN

- Replication, mirroring, & snapshot work over Fibre Channel, IP, DWDM, and other WAN links
  - FC over DWDM is typically supported over 60-200 km
- Key design considerations
  - Round-trip delay determines throughput and synchronous vs. asynchronous applications
    - e.g., throughput decreases as round-trip delay increases (as shown in the figure)
  - Size of I/O
  - Applications requirements
  - FC configuration and FC fabric build and services over WAN/MAN
  - Management tools and visibility of the MAN/WAN infrastructure
NAS/SAN Convergence
→ Rich Media Website

FC SAN
IP
Network

Internet
Web Directors/Routers

Direct Access
SAN FS

IP Network
Web Streaming Servers
HTTP
IP Streaming
Security Threats Today

Theft of mission-critical information by an outside hacker – **Common fear**

90% of intrusions can be stopped by just applying available patches and updates

*Source: Gartner 2002 Security Conference*

The data center is locked, **but not secure**

*Source: Gartner 2002 Security Conference*

70% of security threats are from **INSIDERS**

*Source: Electric Crimes Task Force*
Leading with Standards-Based Security Solutions

SANtegrity
Zoning

Zone A  Zone B

SANtegrity Binding

SANtegrity Authentication
Scaling SANs – Today & Future

**TODAY**
- Large Fabric
  - 1000+ ports

**TOMORROW**
- Larger & Intelligent Fabric
  - 5000+ ports

**FUTURE**
- Internetworking Fabric
  - 50,000+ ports

Note: The exact number of ISLs between the core and edge switches depends on the fan-out requirements for the application. ES-3016s typically require 2 ISLs while ES-3032s usually have 4 ISLs per switch.
Thank You