Server and Storage Consolidation with iSCSI Arrays

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Abstract

Server & Storage Consolidation with iSCSI

This session will appeal to IT managers, administrators and architects interested in best practices and deployment considerations of storage consolidation solutions available with iSCSI-based systems today.

This presentation, an update to a very popular SNIA Tutorial, outlines the benefits of networked storage, contrasting deployment models. After a summary of iSCSI-based SAN benefits, the presentation provides a detailed description of iSCSI SAN configurations, capabilities, options and best practices. As iSCSI has a natural affinity to virtualization, it also covers virtual server environments. Finally, the presentation describes typical deployment scenarios, and emerging developments, including higher speed Ethernet and FCoE.
Contents

✦ Storage Consolidation with iSCSI SANs
  ✦ Advantages of networked storage
  ✦ iSCSI SAN benefits

✦ iSCSI –based Storage Area Networks
  ✦ Host connectivity and security
  ✦ Boot from SAN
  ✦ High availability
  ✦ Quality of service
  ✦ iSCSI performance

✦ Deployments and Futures
  ✦ Typical array capabilities
  ✦ Server virtualization with iSCSI
  ✦ Typical deployment scenarios
  ✦ Emerging new capabilities

✦ Summary
Why Move to Networked Storage

- **Value of Storage Networking**
  - Improved reliability and reduced cost of backup
  - Improved scalability of storage capacity and performance
  - Simplified storage provisioning
  - Improved data availability

- **Top reasons for deploying a SAN**
  - Back-up
  - Storage consolidation
  - Satisfy on-going demands for additional capacity
  - Performance
  - Disaster recovery
  - New project or application deployment
Storage Technologies Compared

- **Direct Attached Storage**
  - Application Server
  - File System
  - RAID
  - SCSI, FCP

- **SAN Storage**
  - Application Server
  - File System
  - RAID
  - FCP

- **NAS Storage**
  - Application Server
  - File System
  - RAID
  - iSCSI

- **Server-based data management**
- **No resource sharing**
- **No data sharing**
- **Works with all apps**

- **Server-based data management**
- **Resource sharing**
- **No data sharing**
- **Works with all apps**

- **Storage-based data management**
- **Resource sharing**
- **Data sharing**
- **Works with qualified apps**
iSCSI SAN Benefits

- **Standard SAN storage**
  - Block storage access
  - Supports all apps
  - Transparent migration from direct attached storage

- **Lower TCO than FC**
  - Zero host connection cost
  - Less costly infrastructure
  - Easier to manage

- **Leverages IP Expertise**
  - Expertise in existing staff
  - Robust well-understood management software
  - Easily enables remote integration of data assets
iSCSI Host Connectivity/Security

Connectivity:
- 1 Gb or 10Gb Ethernet
- Jumbo frames (recommended)
- Link aggregation or MPIO or Multi-Connection Sessions (bandwidth and/or availability)

Security:
- Host authentication (CHAP)
- Private network
  - Physical
  - VLAN (zoning)
- Array LUN masking
- Optional IPSec
- Optional key management
## iSCSI Host Support

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Simplify Server Hardware Upgrades/Repurposing
Easy to configure temporary or test servers
Simplify Server OS Imaging
Simplify disk drive replacement
Centralize storage monitoring and management
Boot from iSCSI HBA or from native OS initiator
Industry standard implementation of iBFT
Removes spinning media from server
   — Important for power saving strategies and reduced maintenance
iSCSI Boot with S/W Initiators

Boot Parameters transferred via Network

Ethernet Switch

DHCP Server
PXE Server

NIC
UNDI
Int13
iBF Table

Boot Manager/Kernel
iSCSI Software Initiator
TCP/IP
Network Stack
NIC drivers

Boot Disks
Storage Array
iSCSI: High Availability Options

MPIO
- Pseudo Disk
  - Disk #1
  - iSCSI Session #1
  - Connection #1
  - Connection #2

MCS
- Disk
- iSCSI Session
  - Connection #1
  - Connection #2
Quality of Service Policies

**Host Systems**

- OLTP Server
- Customer Web Catalog Server
- Corporate Email Server
- Corporate File Server

**Partitioned Intelligent Storage Subsystem**

- OLTP Server
- Customer Web Catalog Server
- Corporate Email Server
- Corporate File Server

**Traffic Prioritization Engine**

- QoS Mechanisms: IEEE 802.1p/Q, IETF DiffServ, IETF MPLS, IETF RSVP
- DCB – Data Center Bridging

- **Incoming Traffic**
  - First In: Corporate File Server
  - Last In: OLTP Server

- **Outgoing Traffic**
  - High Priority: A - OLTP Server
  - Outgoing Priority: B - Customer Web Catalog
  - Low Priority: D - Corporate File Server

Server and Storage Consolidation with iSCSI Arrays
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iSCSI: High Availability
Demystifying iSCSI Performance

- iSCSI Protocol is not limited in performance, only by underlying bus speed
  - iSCSI operates at 10Gig Wire Speed today with software initiators
  - HBAs may reduce CPU utilization for some workloads
  - Performance scales with Ethernet speeds 10 Gb, 40 Gb, and up
10 Gigabit Ethernet

- IEEE 802.3ae ratified 2002
- Broadly deployed in inter-switch links
- Host-side proliferation now happening
  - Affordable Price
  - Server I/O architecture support
  - Standard component on commodity servers
  - Offload built into on-board components, supported by operating systems

- Deployment/applications
  - Backbone and port aggregation for 1Gb LANs
  - File and block storage over 10GbE
Multi-Core changes the game

- Multi-core Processors scale iSCSI software initiator performance
- Performance is no longer limited by processing power of HBA engine
- iSCSI Digest Offload directly to CPU hardware instruction set
Typical iSCSI Array Capabilities

- **Basic storage considerations**
  - Redundant components
  - Dual active controllers with failover
  - RAID
  - SATA drives; FC drives; SAS drives

- **Storage features**
  - Point in time copies (Snapshot)
  - Network Boot
  - Multi-path I/O for High Availability
  - Thin provisioning (sparse allocation)
  - Remote data copy
  - Asynchronous mirroring for disaster recovery

- **Growth/scalability/configurability**
  - Capacity
  - Performance
  - Host integration
Scenario Description:
• Manage high availability with multipathing and Live migration for planned downtime situations, such as hardware and software maintenance
• Failover individual virtual machines (VMs) to other hosts within a
• Use iSCSI software initiator within the guest connected to iSCSI storage to provide guest clustering
• Nodes in cluster can be active-active

Virtualization Benefits:
• Less downtime and loss of service for failover with Live Migration.
• Server Virtualization combined with storage virtualization
• Improve availability with less complexity
• Better server utilization due to consolidation
• Seamless backup and recovery
• Management efficiency
Virtualization for BI Infrastructure

Scenario Description:
- Heavy transactional database remains physical
- SQL Server Integration Services & Data Warehouse could be physical or virtual. If virtual, keep them in same virtual machine.
- Virtualize Data Mart, OLAP cubes and Reporting Server

Virtualization Benefits:
- Scale-out and rapidly provision BI components
- Reduce the number of physical servers
- Reduce hardware costs, save on power and space

Diagram:
- Operational Data Store
  - External
  - ERP
  - Web
  - Legacy
  - SQL Server Integration Services
  - Data Warehouse
  - 1. Reporting Server
  - 2. Data Mart & OLAP Cube
  - Virtual
  - Physical
  - Reporting Server
  - Data Mart & OLAP Cube

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Where iSCSI-based Storage Fits – Medium/Small Enterprise

LAN
Production Data Center
Bus. Internal, some Bus. Operations

Storage Network
Primary Storage

WAN
Remote Offices

Storage Network
D/D Backup & DR

Networked Storage in remote offices

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**Application**
- SQL Server databases
- Microsoft Exchange

**Pain Points**
- Challenge to meet SLAs with direct attached storage environment
- Affordable SAN storage for SQL Server databases
- Affordable DR solution

**Solution**
- IP SAN in each location
- Multiple snapshot backups per day to US core data center
- Async mirror to DR site

**Benefits**
- High performance solution
- Simple, cost-effective storage network
- DR between existing data centers
- Enhanced ability to meet demanding airline customer SLAs
Case Study

Application
- Web hosting services

Pain Points
- Rapid growth
- Outgrowing “green” data center
- Very poor server utilization
- Disruptive backup process

Solution
- Virtual servers w/ IP SAN
- Disk-to-disk backup for HA and DR

Benefits
- Virtual server environment provides the flexibility to host additional clients and increase revenue potential.
- Server and storage consolidation reduced data center power consumption by 60 percent.
- Replacement of 120 white box servers with four SMP servers reduced cooling costs and data center footprint.
- Cost savings and cost avoidance enabled pursuit of additional environmental conservation solutions.
Spec scheduled for completion June 2010

Source: John D’Ambrosia, Force 10 Networks Chair, IEEE P802.3ba Task Force; Ethernet Alliance
Fibre Channel over Ethernet

An Extension of Fibre Channel onto a 10Gb Ethernet network
FCoE is a direct mapping of Fibre Channel over Ethernet
TCP/IP is not required and not present for FCoE
Preserves ops, control and management environments for the FC layer
IEEE 802.1 DCB Protocol Status

- FCoE requires “lossless” Ethernet
  - Possible with Ethernet plus some extensions
- Data Center Bridging benefits iSCSI and FCoE
  - Ensures Storage IO receives priority over lower priority traffic
- The IEEE 802.1 DCB WG is defining these extensions
  - Priority-based Flow Control (PFC): 802.1Qbb
  - Enhanced Transmission Selection (ETS): 802.1Qaz
    - Including DCBX (DCB eXchange protocol)
  - Congestion Notification (CN): 802.1Qau
- Standards-compliant products shipping now
- FCoE I/O Consolidation requirements:
  - PFC is required,
  - ETS is highly recommended,
  - CN is optional (not required for initial FCoE deployments)
- DCB required for multiprotocol support (FCoE and TCP/IP)
Summary - iSCSI Storage

- Sophisticated storage consolidation solutions for low-end and mid-range server environments
- Takes advantage of existing IT knowledge base
- Provides simpler, more affordable SAN infrastructure
- Improves data availability and performance
- Integrates distributed data and resources
- Solutions are deployed in many thousands of companies around the world
- Ultimately provides one technology for connecting clients, servers & storage devices
Q&A / Feedback

Please send any questions or comments on this presentation to SNIA: trackstoragemgmt@snia.org

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SNIA Education Committee

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