This five-day course provides a comprehensive and accelerated understanding of SAN technologies and concepts. Students will gain the experience needed to tackle the challenges of working in enterprise class SAN environments.

Audience

This course is designed for technical professionals seeking an accelerated learning path that includes both conceptual knowledge of Fibre Channel SAN technologies and experience in heterogeneous SAN environments.

Prerequisites

Participants will be expected to have the following experience:

- Basic technical understanding of networking and storage, concepts and terminology.
- Experience managing Windows or UNIX systems.
- Recommended free web-based training: U5527aae,SAN Fundamentals (U5527aae). Go to http://h20546.www2.hp.com/eshop/

Course objective

This practical five-day course provides comprehensive exposure to SAN solutions and supporting technologies, such as Fibre Channel and IP storage. Participants learn about protocols, standards, management practices and tools, and SAN design and implementation considerations. Class discussions cover a wide range of topics, including the capabilities and limitations of the various supporting technologies and SAN management in enterprise environments. Each lab provides experience with component configuration, SAN management, and other SAN related activities.

Course title: Accelerated SAN Essentials

HP product number: UC434S

Category/Subcategory: Storage

Course length: 5 days

Level: Intermediate

Delivery language: English

To order: You can order this course online at http://www.hp.com/learn. At the site, select a country, then choose "registration" or "Book a course" and fill out the online registration form.

Benefits to you

This course provides a comprehensive understanding of the leading SAN technologies and the experience needed to tackle the challenges of working with SAN solutions.

Why education services from HP?

- Online instructor-led and self-paced training at http://www.hp.com/education
- Comprehensive student materials
- Online instructor-led and self-paced training at http://itresourcecenter.hp.com
- State-of-the-art classroom facilities
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- More than 80 training locations worldwide
- Online instructor-led and self-paced training at http://www.hp.com/learn

- Focus on job-specific skills
- Customized on-site delivery

Next steps

- Managing HP StorageWorks Enterprise Virtual Array (U4879S)
- HP StorageWorks XP Disk Arrays (H6773S)

Detailed course outline

Introduction

- What is a SAN? / Why a SAN?
- Definition of a SAN
- HP SAN goals
- Fast backup and restore
- Business continuance
- High availability
- Server and Storage consolidation
- Efficiency improvements
- Centralized management
- DAS, NAS and SAN
- Direct Attached Storage (DAS)
- Network Attached Storage (NAS)
- Storage area Network (SAN)
- SAN considerations
- Comparing SAN and NAS
- DAS versus NAS versus SAN
- Comparison by purpose
- SAN components
- Host, target and interconnect device characteristics
- Power-on sequence

Fiber Channel Basics

- Why not SCSI?
- SAS vs. parallel SCSI
- World Wide Name (WWN)
- Fibre Channel WWN
- Nodes, Ports and Links
- SAN Topologies
- Point-to-point topology
- Arbitrated loop topology
- Arbitrated loop hubs
- Private and public loop
- Switched fabric topology
- Topology comparison
- Fibre Channel port types
- Fibre Channel architecture – Functional levels
- FC-0 — Physical level
- Transceivers
- Fibre Channel cabling
- Multi and single-mode fiber
- Single-mode step-index fiber
- Attenuation
- Dispersion
- Cable bends and damage
- FC-1 Coding layer and encoding process
- FC-2 — Signaling Protocol level
- Fibre Channel terminology
- Frame structure and header
- Cisco EISL header
- SCSI (FCP) write operation
- Class of service
- FC-3 Common Services
- FC-4 ULP mappings

Fiber Channel Switches

- Principal switch
- Upstream and Downstream links
- Frame routing - FSPF
- Flow- and Exchange-based routing
- ISL bandwidth aggregation
- B-series Trunk
- C-series portchannel
- FSPF and host-based load balancing
- Virtual fabrics
- B-series virtual fabrics
- C-series virtual SANs (VSANs)
- Switches and Directors
- Switch management

SAN Hosts

- Hosts and Fibre Channel
- Virtualization for hosts
- HP Integrity Virtual Machines
- NPIV - N_Port Virtualization
- Server virtualization with NPIV
- Brocade Access Gateway

- F_Port Trunking
- Cisco N_Port Virtualixation
- Transparent Router Technology
- Boot from SAN
- Host preparation and install
- HBA installation
- Windows connectivity – Device Manager
- Windows Disk Manager
- Local HBA management
- Verifying HBA installation hp-ux
- HBA interrogation
- Agile addressing hp-ux 11i v3
- Multiple paths to storage
- Multi-path concepts
- Automatic path failover
- Load balancing
- Microsoft Multi-Path I/O (MPIO)
- Microsoft storage stack
- MPIO driver modules
- DSM utilities

Disk Targets

- Disk Drives
- Standard disk driver interfaces
- Parallel ATA/IDE and SCSI
- SATA (Serial ATA)
- SAS (Serial Attached SCSI)
- SAS device limitations
- Solid State Disks
- SCSI-3 command set and encapsulation
- RAID - Redundant Array of Inexpensive Disks
- Disk enclosures
- Disk drive connections
- LUN masking
- Storage Virtualization
- Fabric Based virtualization
- Thin and Fat provisioning
- HP StorageWorks arrays
- Storage Management Utility – MSA 2300, P2000
- Command View EVA
- Command View XP AE

Fiber Channel Advanced

- Fibre Channel addressing
- FC-AL Loop IDs and AL-Pas
- Addressing public NL_Ports
- Loop ID to ALPA conversion
- Ordered sets and primitives
- Primitive signals and sequences
- Flow control
- FCP write I/O class 2
- Link services
- Fabric login
- N_Port login sequence
- Well known addresses
- Fabric services
- Name Server detail
- Registered State Change Notification
- Fabric zoning and zone members
- Zone enforcement
- Zoning granularity
- Traffic Isolation Zones
- QoS Zones
- Fabric segmentation

SAN Design

- SAN architecture choices and considerations
- Planning process
- Defining the infrastructure requirements
- Approaches to simplified design
- HP Standard SAN topologies
- Design using HP SAN topologies
- Cascaded Fabric
- Ring, meshed and core-edge Fabrics
- Initial cost of deployment
- Data locality
- Topology data access usage
- SAN infrastructure performance factors
- Level 1: Single connectivity fabric
- Level 2: Single resilient fabric
- Level 3: Single resilient fabric with multiple device paths
- Level 4: Multiple fabrics and device paths

- HP StorageWorks SAN Design Reference Guide
- B-Series, C-Series and M-Series port topology maximums
- Review – Solution design and complexities

iSCSI

- IP storage
- iSCSI Stack
- iSCSI encapsulation
- iSCSI Packet
- iSCSI Host Driver
- iSCSI initiators
- iSCSI Name Support
- iSCSI Name Structure
- iSCSI name examples
- iSNS
- State Change Notification
- iSCSI target discovery
- iSCSI operations
- iSCSI authentication
- iSCSI CHAP
- IP Security
- HP StorageWorks iSCSI SAN
- HP StorageWorks iSCSI SAN Recommended architecture
- Centralized Management Console (CMC)
- CMC Navigation

SAN Extension

- What is a SAN extension?
- Why extend the SAN?
- HP Supported SAN extension technologies
- SAN Extension – distance summary
- Long Wave Transceivers
- Dense and coarse Wave Division Multiplexing
- Fibre Channel over IP (FCIP)
- FCIP Encapsulation and Virtual Channels
- FCIP Jumbo Packets
- FCIP performance
- Brocade Fastwrite
- Brocade FCIP Fastwrite + Tape pipelining
- Cisco Write Acceleration
- FCIP compression
- IP network considerations and best practices
- FCIP security - encryption and advantages
- FCIP hardware
- Fibre Channel routing overview
- Fabric, Virtual Fabric and VSAN independence
- SAN scaling
- Fabric services limits
- Fibre Channel routing implementations
- B-Series and C-Series routing differences
- Routing through an IP network

FCoE Fiber Channel over Ethernet

- FCoE (Fibre Channel over Ethernet)
- CEE (Converged Enhanced Ethernet)
- FcoE Terminology
- OSI, FCoE and FC stacks
- FCoE encapsulation
- Frame Format
- Lossless Ethernet
- HP Converged network switches offerings
- Converged Network Adapters (CANs)
- FCoE initialization Protocol
- FIP Login / FIP Logout
- Standard CEE integrations
- SAN Integration
- CEE and LAN integration
- CEE Map
- DCBX (Data Center Bridging eXchange Protocol)
- VLAN Membership
- Minimum CEE configuration to allow FCoE traffic flow
- FCIP, ISCSI & FCoE
- Storage Support
- Operating System Support

SAN Management

- Storage management tasks
- Why storage management?
- Storage Resource Management

- HP Information Lifecycle Management (ILM)
- Information Lifecycle Management
- SAN management concepts
- HP SAN Management strategy
- SAN performance management
- Storage capacity management
- SMI-S
- HP Storage Essentials
- Enterprise Edition plug-ins
- Description of Base Components
- System Manager
- Capacity Manager
- Performance Manager
- Application Viewer
- Policy Manager
- Event Manager
- Database Viewer
- Exchange Viewer
- File System Viewer
- Backup Manager
- HP StorageWorks Fabric Manager
- HP/Brocade Data Center Fabric Manager (DCFM)
- Cisco Fabric Manager

Security

- Security in a SAN
- Attacks and Exposures
- Mitigation of risk
- Authorization
- Audits
- Encryption
- Role Based security
- RADIUS
- Planning SAN Security prevention
- Response to attacks
- Security in practice
- FCIP encryption and Data encryption at rest

Data Protection

- Challenges in Data Protection
- Recovery Operations
- Protection and Recovery methods
- Data Protection Technologies
- Direct backup – tape
- Centralized server backup
- Automated centralized backup
- Centralized SAN backup
- Tape Libraries
- Zoning for backup
- Backup performance considerations
- Virtual Tape Libraries
- Disk to Tape
- Data replication
- Split-mirror backup concept
- Snapshot backup concept
- De-duplication
- How Accelerated De-duplication Works
- How Hash Based Chunking Works
- How Hash Based Chunking Performs restores
- Disk to Disk and virtual library portfolio with duplication
- Remote replication
- HP StorageWorks Continuous Access EVA (CA EVA)
- Synchronous and Asynchronous replication
- Comparing replication modes
- HP OpenView Storage Mirroring
- OVSM mirroring – full and file difference

SAN Performance

- SAN performance objectives
- Performance factors
- Performance terms
- Drive speed
- Response time
- Bus utilization
- Device utilization
- Improving performance
- Reducing service time
- SAN performance Considerations
- Latencies
- ISL oversubscription
- Bandwidth consumption and congestion
- Hop latency
- Data Priority – Quality of Service

- Device attachment points
- Distance considerations
- Maintaining performance in an extended SAN beyond 5 or 10km
- Distributed fabrics
- Long distance link modes
- Performance Guidelines within the SAN
- Determining the required bandwidth
- Drive selection and performance
- RAID and RAID selection
- RAID levels
- RAID selection and planning
- RAID level efficiency
- Disk Performance
- Planning a disk system
- Data caching technologies
- Write-back caching
- Write-back cache benefits
- Protecting write-back cache
- Cache coherency in dual controller configurations
- Effects of cache
- Read-ahead caching
- Application effects on performance
- Environment profiling
- Large sequential read environment
- Server Application
- Databases, mail and messaging
- SQL Server 2000
- Oracle 8 Server
- Exchange Server
- Improving performance
- Comparing VRAID1 and VRAID5
- Safe IOPs Calculator
- EVAPerf
- Windows Performance Monitor counters
- Physical disk counters
- EVAPerf counters
- EVA storage cell counters
- End to End monitoring
- Top talker

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