

Storage Foundations Intensive Workshop

The Storage Foundations Intensive Workshop will provide an overview of the topics you will encounter when taking the [Storage Networking Foundations Exam \(SN-110\)](#). Not only do these topics cover exam objectives but they provide you with many key aspects and elements of storage technology as it pertains to data centers. Topics will cover host elements, storage protocols and hardware, disaster recovery, storage functions and cloud storage basics. Once you complete this workshop you will be better prepared to pass the Storage Foundations exam or simply be more proficient as a storage technology professional. This intensive workshop covers all topics vetted by the Storage Foundations exam and provides you with information that will elevate your storage networking knowledge.

Course Outline

Host Elements

- Identify host connectivity components used in a support matrix including; OS software, Physical (e.g., HBA, CNA, switch, routers, cabling), Host features (e.g, volume managers, file systems, multipathing, SAN boot, clustering).
- Describe host-based functions for storage including; Volume management, File systems, Clustering, SCSI protocol concepts (e.g., initiators, targets, LUNs, CDB), Multipathing and load balancing concepts, and Redundancy.
- Identify storage mapping elements including; Fibre Channel – WWPN, iSCSI – IQN, EUI, LUN masking/mapping, and File shares/sharing.
- Describe virtualization concepts and techniques including; Clustering, Storage, Network, Guest (e.g., MS Windows, Linux) and Hypervisors (e.g., VMware, Hyper-V).
- Describe data storage planning for various business applications including; Tiered storage applications, Data capacity planning (e.g., deduplication, RAID, space requirements, growth), Caching/Flash for host, storage, and controllers.
- Describe how to improve performance for host applications including; Queuing impact on performance, Caching techniques (e.g., read ahead, write back, most recently used), Load balancing, Multipathing, Jumbo Frames and Performance metrics (e.g., MB/sec, low latency, bandwidth, throughput, IOPs)

Storage Protocol Concepts

- Identify NAS components including; File level storage (e.g., block vs. file level access) and NAS controllers (e.g., SMB, NFS, Active Directory, frontend-backend-permissions-file level).
- Identify Fibre Channel SAN components including; FC fabric services (e.g., name service), FC logins (e.g., fabric, process, port-to-port), NPIV, FC switches/topologies, Zoning (e.g., alias), WWPN/WWNN, 4/8/16/32 Gbps, FC port types (e.g., F-Port, E-Port), FC addressing (e.g., domain ID, port ID, port number), FC flow control (e.g., buffer credits), FCIP storage concepts, ISL, and Trunking/link aggregation.
- Identify Ethernet/IP SAN components including; IP connectivity, iSCSI, Flow control, Jumbo frames, End-to-end (e.g., initiator, target, LUN), and FCoE.
- Describe DCBX switching technology including Priority flow control using pause (PFC), Enhanced Transmission, Congestion management and Lossless Ethernet.
- Identify the software storage model including; Software defined storage, Storage grid, Lustre, Hadoop, and Object Storage.

Storage Hardware

- Identify host to SAN components including; HBA, CNA, TOE, switch, router, Heat/cooling, Controllers (e.g., HA MPIO, HW RAID, failover, redundancy), Cabling (e.g., FC specs, Eth cable, rack, SFPs, SFP+, QSFP, single mode and multi-mode fiber, Twinax), and Scalability (e.g., drives, enclosures, SDN/SDS concepts).
- Identify Flash technology for enhancing applications including; Caching, Flash characteristics (e.g., garbage collection, write amplification, wear leveling), Flash uses in storage devices, and SSDs.
- Describe the different RAID levels including; RAID levels (e.g., RAID 0, 1, 5, 10, 6), Hot spares, and RAID rebuilding.
- Describe disk technologies including; HDD (hybrid) storage interfaces, HDD recording technology (e.g., perpendicular, longitudinal, shingle), and SSDs.
- Identify DAS technology including; Direct attached SAS, SATA, and NVMe.

Disaster Recovery

- Identify backup technologies including; Archiving and purging, Tapes (e.g., legacy vs. VTL, transfer rates, tape capacity, LTO 5/6), NDMP, LAN free, and Serverless backups.
- Describe backup types including; Incremental, Differential, Full backup/image and Synthetic backups (e.g., full back up then incremental).
- Describe disaster recovery concepts including; RPO requirements, RTO requirements, Asynchronous mirroring concepts and Synchronous mirroring concepts.

Storage Functions

- Describe storage security methods including; Protecting data in flight and data at rest, IP storage security (e.g., IPsec), CHAP, ACLs, Key management (e.g., KMIP), Compliance preservation and eDiscovery, Encryption (e.g., SED).
- Identify storage management technologies including; CIM, WEBM, SMI-S, SNMP and Storage management functions (e.g., controller access via URL/application, attach hosts, carve LUNs, provision LUNs, thick/thin provisioning, snapshots)
- Describe data reduction techniques including; Compression, Deduplication technology (e.g., inline and post process), and Thin provisioning.

Cloud Storage

- Identify Cloud storage Access methods (e.g., CDMI, S3).
- Identify Cloud storage types including; Private cloud storage (e.g., collocated storage), Public cloud storage, and Hybrid cloud storage.