

# Storage Area Networking

## DATE \\* MERGEFORMAT

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## Definitions

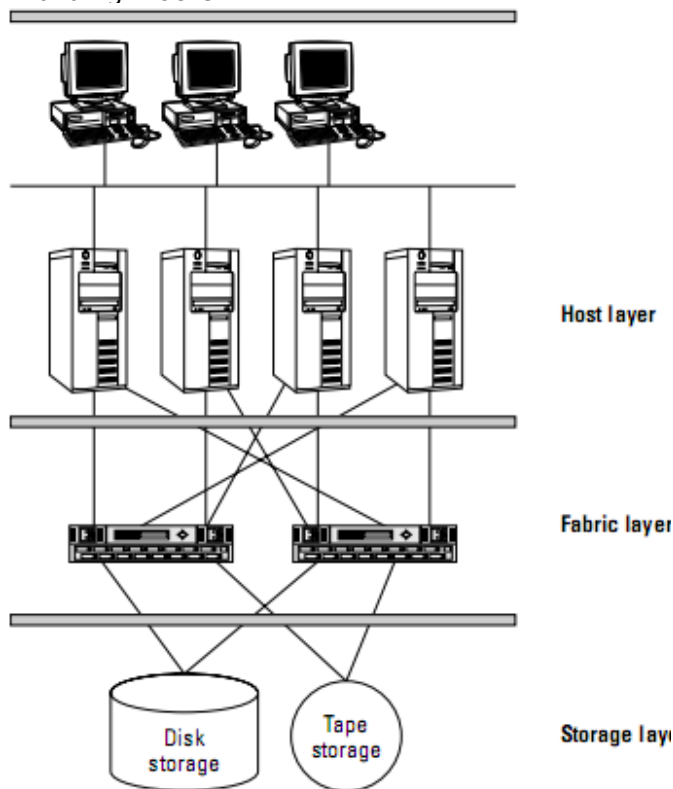
- SAN – Storage Area Network
  - NAS – Network Attached Storage
  - DAS – Direct Attached Storage
  - SCSI – Small Computer Storage Interconnect (Interface?)
  - FC – Fiber Channel Protocol
  - FC – Fibre Channel light pipe cabling
  - iSCSI – IP based SCSI communication
  - TCP – Transmission Control Protocol/Internet Protocol
  - LAN – Local Area Network
  - ROI – Return on Investment
  - TCO – Total Cost of Ownership
  - PBP – Pay Bay Period
  - CDP – Continuous Data Protection
  - IB – Infiniband
  - Backup window – time it takes to back up data
  - Server Clustering – method of making two or more servers appear as one
  - DNS – Domain Name Servers
  - WINS – Windows Internet Naming Servers
  - DC – Domain Controllers
  - HBA – Host Bus Adapter
  - GBIC – Gigabit Interface Controller
  - RAID – Redundant Array of Inexpensive (Independent) Disks
  - JBOD – Just a Bunch Of Disks
  - Storage Array – hardware/firmware combo
  - Storage Network Industry Alliance
  - GLM – Gigabit Link Module
  - SAS – Serial Attached SCSI
  - SATA – Serial ATA
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- Layers
    - Physical Layers
    - Software Layers
      - Protocol stack
  - TCP/IP v.s. FC
    - TCP/IP protocol with Ethernet (Files)
    - FC protocol with FC Switches (Data)
  - Functions
    - LAN – move files
    - SAN – direct access to hardware
  - 4 P's
    - Parts
    - Protocols
    - Players
    - Platforms
  - Parts
    - Host Layer/Fabric Layer/Storage Layer
    - Host Layer

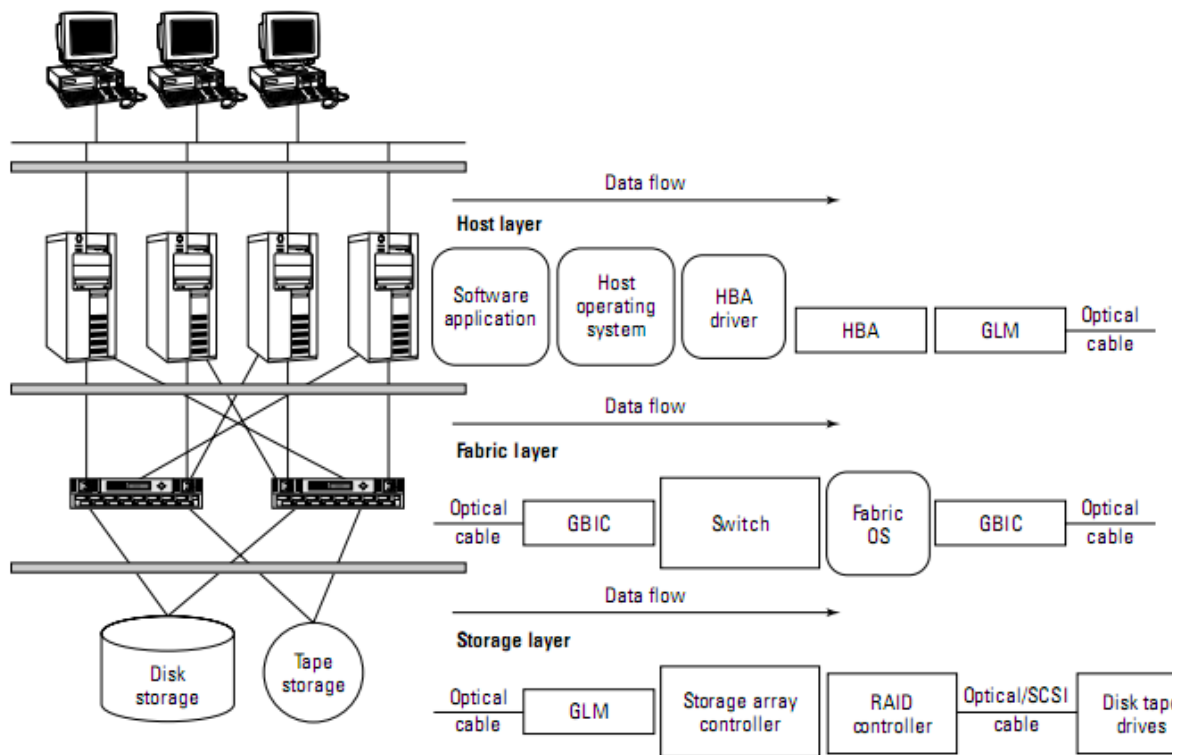
- HBA – Host Bus Adapter
    - Plugs into server itself
    - Interfaces between software and hardware
  - Gigabit Interface Controller
    - This port is present at EVERY connection point in the FC network
    - Houses laser and electronics that convert data from/to light/electronic pulses
    - Interfaces between FC protocol and HBA for block access
  - Fiber Optic Cable
    - Used as interconnect
    - 3 types, based on wavelength employed in the FC network
  - o Fabric Layer
    - Middle layer of a SAN
    - Hub
      - (only one device talks at a time) creates loop, thus SAN loop
    - Switch
      - Smart device that routes information to SPECIFIC destination
    - Gateway/Bridge
      - Converts data to/from differing protocols
      - iSCSI to FC
    - Router
      - Moves data from separate networks
  - o Storage Layer
    - All data exists here
    - Disk drives, Tape drives, optical storage
    - RAID/JBOD arrays
    - Storage Array – big box of disks running smart code(firmware) for managing disks
      - Modular
        - o Smaller unit with computer memory for caching data from slower disks
        - o Fewer port connections
        - o Upgrade via
          - Shelves of 10-16 disks
          - Plug-in controllers for more throughput
        - o Controllers usually are mirrored and have 16-32G memory
        - o
      - Monolithic
        - o Huge machine with 100s of Gigs of memory
        - o Many port connections
        - o Hundreds of disks
        - o Shared GLOBAL memory
        - o
- SAN Protocols
  - o Fibre Channel
    - Low-level protocol between disks and host applications
    - FC-AL (Fibre Channel – Arbitrated Loop) [HUBS]
    - FC-SW (Fibre Channel – Switched ) [SWITCHES]
    - Fibre Channel provides a pipe for SCSI to work within
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  - o SCSI
    - Works on top of FC
  - o iSCSI over IP
    - Infiniband iSER and SRP
- Platforms
  - o Older OS's such as Windows NT don't support SAN
  - o Big, fast servers with Intel/AMD do
  - o Unix machines
  - o Mainframes

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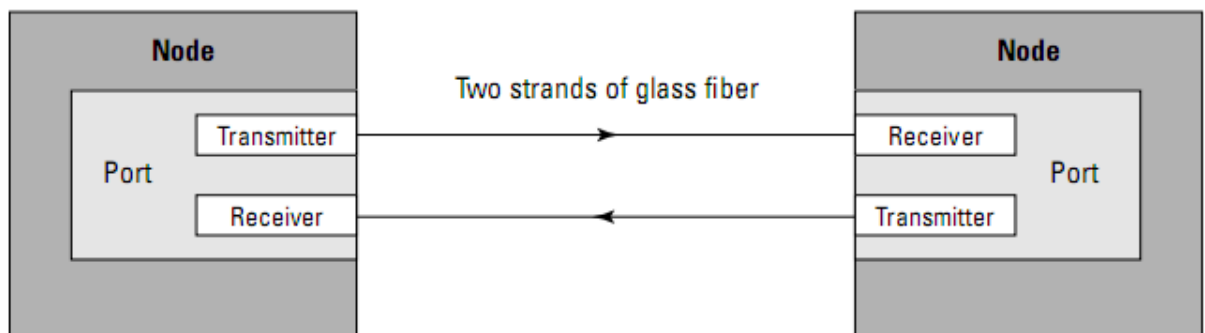
- ✓ Microsoft Windows NT 4.0
- ✓ Microsoft Windows 2000 or later
- ✓ Sun Solaris versions 2.6 or above
- ✓ HP-UX version 10.2 and higher
- ✓ IBM AIX version 4.2 and higher
- ✓ HP Tru64 Unix version 4.0F and higher
- ✓ HP Open VMS version 7.2 and higher
- ✓ Novell Netware version 4.11 and higher
- ✓ SGI IRIX version 6.5 and higher
- ✓ Sequent DYNIX version 4.5 and above
- ✓ All the various flavors of Linux (such as Red Hat, SuSE, and their cousins)
- ✓ IBM OS/390 Mainframe MVS, or Z/OS

#### SAN Building Blocks





- Host Layer
  - o HBA
  - o HBA Drivers
  - o GBIC
  - o Cables
  - o Host Bus Adapter
    - Hardware and BIOS firmware that works between OS and Disks
  - o GBICs and GLMs
    - Shortwave
      - .5 meters and 500 meters
      - 780 nm and 850 nm
    - Longwave
      - 2m to 10km
      - 1300nm and
    - Each GLM has 2 connections, IN and OUT (FULL DUPLEX)
    - Full Duplex allows for simultaneous comm IN/OUT
    - Each FC cable has 2 thin pieces of glass for this purpose
  - o SC
    - Original connectors used in SANs
    - 1Gps
  - o LC
    - Smaller 2<sup>nd</sup> generation
    - 2,4,8,10Gps



- Fabric Layer
  - o Fabric Layer – hardware in SAN, specifically FC components
  - o Storage Fabric – set of organized, connected storage devices on a network of interconnected switches that can be accessed by servers (up to 239)
  - o Switched Fabric – consists of all switches in a single storage fabric
  - o SAN Fabric – consists of all the individual switched fabrics in the SAN
  - o SANs can have more than one SAN fabric

- Usually two are present for redundancy
- When switches are not connected together, they constitute individual fabrics each with their own fabric ID in each switch
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