DATA STORAGE TECHNOLOGIES & NETWORKS
(CS C446 & IS C446)

LECTURE 34 – SAN, FIBRE CHANNEL

SCSI to SAN

- Limitations of Parallel SCSI
  - Limited to 16 devices on a bus
  - Possible but not usually practical to connect 2 computing devices to the same storage
  - Cable length limitation (due to cross talk and interferences). Can overcome by SCSI – Fiber – SCSI conversion
  - Each device added to a SCSI chain shortens its total possible length
- 5 alternatives to SCSI parallel interface (SPI)
  - Serial SCSI, Fibre Channel, SCSI over ST, SCSI over VI, iSCSI

Advantage of Fibre Channel over SPI

- Distance
  - Up to 10 k.m. (single mode fiber theoretically go unlimited distance with bridging technology)
- Speed
  - Trunk multiple fibre channel connections together for more bandwidth (20 – 40MB/s to 2Gb)
- Number of devices connected in one computer
  - Can connect 16 million devices to a serial SCSI card (Fibre channel bus host adaptor)
- Number of computers connected to one device
  - Can connect to 16 million computers

Storage Area Network (SAN)

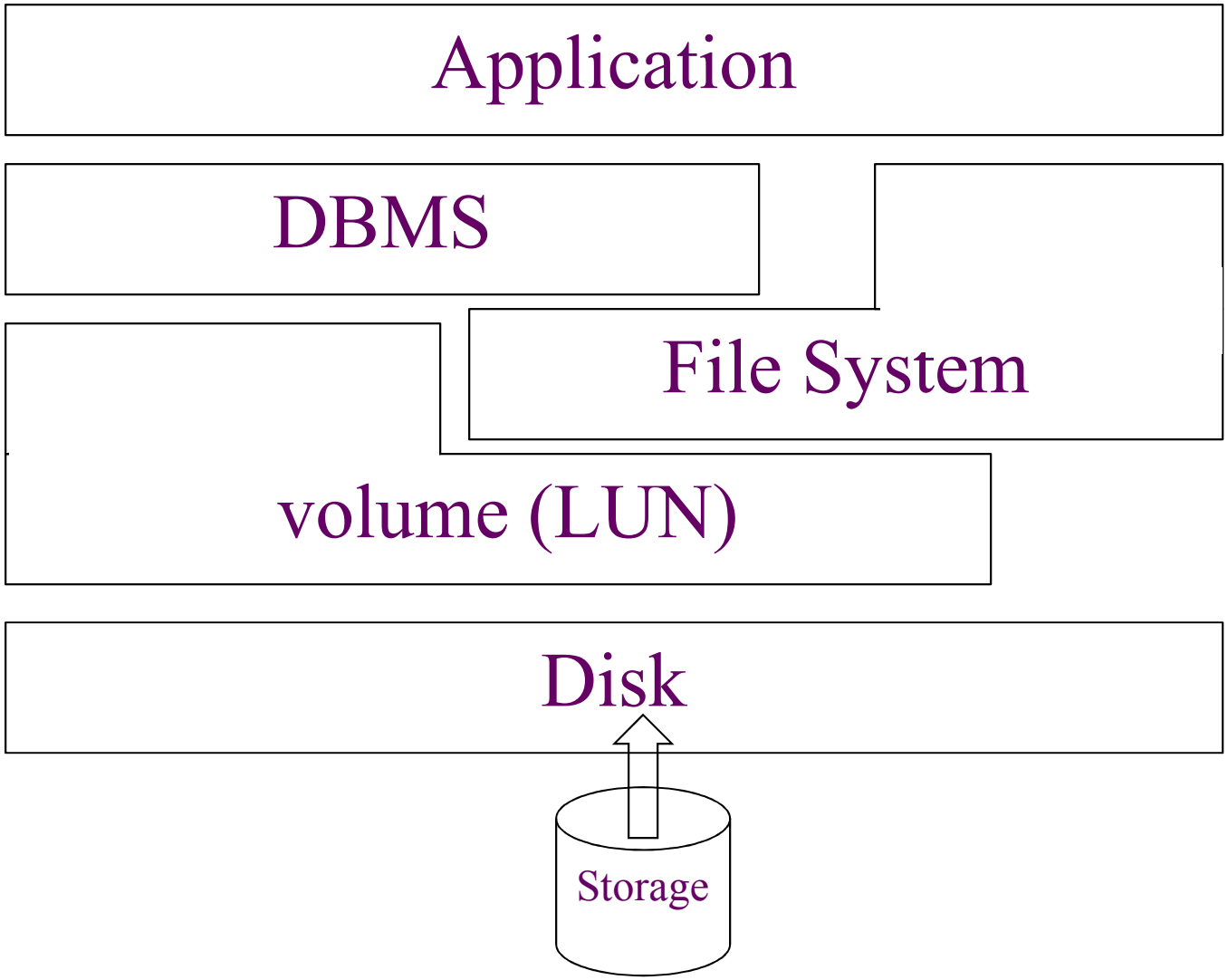
- Is any high performance network whose primary purpose is to enable storage devices to communicate with computer systems and with each other
  - SAN's only purpose is to communicate between computers and storage
    - Any to any connectivity of computers and storage devices
  - SAN uses fibre channel, ethernet or any other specific interconnect technology
  - Overcomes the problem of deploying and maintaining multiple servers and its dedicated storage which creates unconnected islands of information

- SAN provides “Storage centric information processing strategy” instead of existing “Server centric information processing strategy”
- SAN is an additional network added to the distributed information system infrastructure which creates a separate path for I/O between storage devices and servers
  - Load on enterprise network decreases significantly
  - Absolute I/O performance improves
  - Eliminates unwanted data movements compared to server centric strategy

- SAN may lead to heterogeneous distributed system in which applications running on different OS and hardware platforms can meaningfully access the same data
- SANs made “Storage Solution Providing” a possible option
- SAN uses SCSI protocol whereas NAS usues NFS and CIFS protocols

Benefits

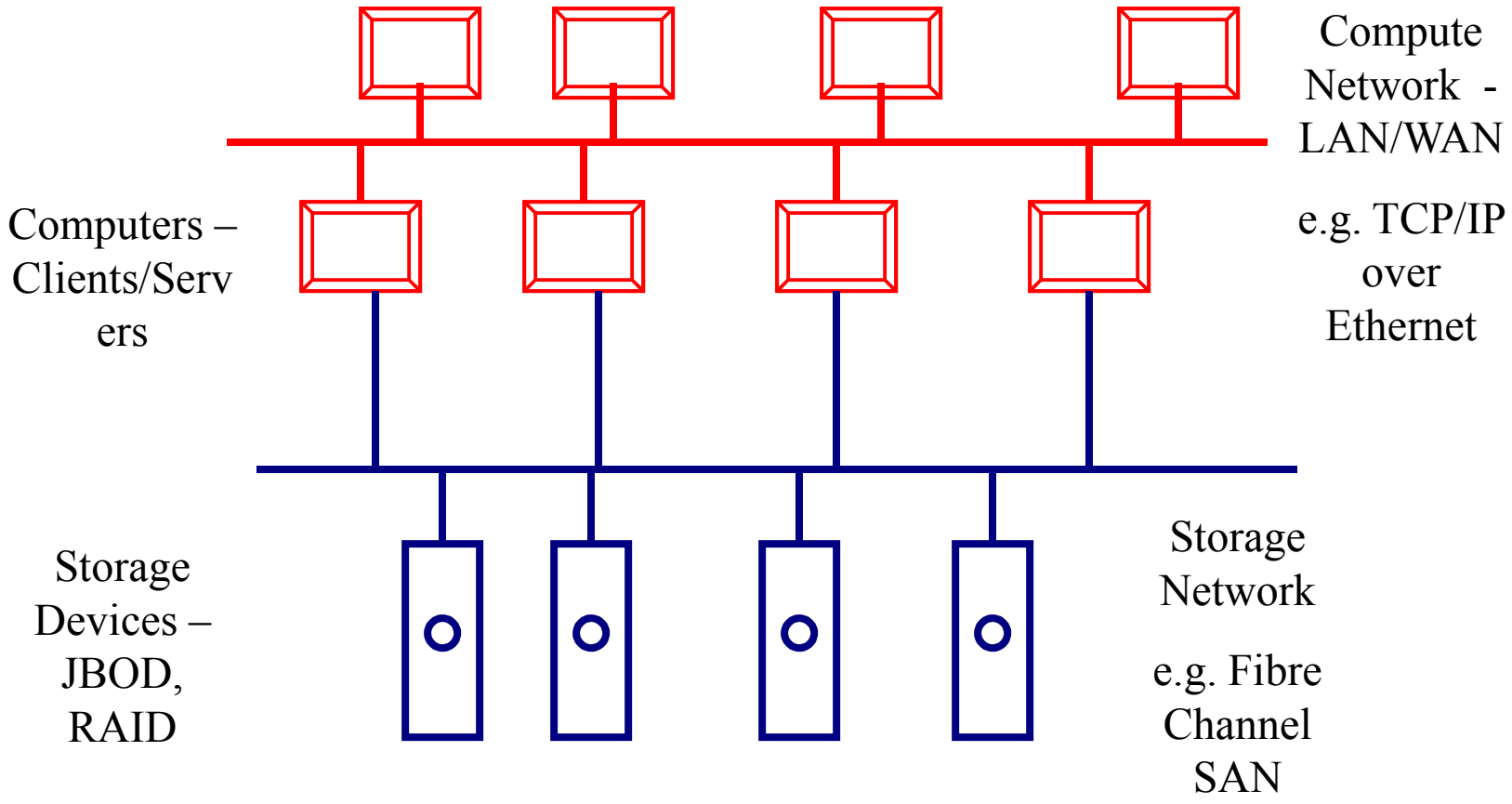
- More storage for less money
- More I/O for less money
- Better I/O protection for less money
- Global access to global data
- Less duplication more consistency
- Clustering becomes easy
  - N to 1 failover – one server can restart the other failed server
  - Cascading failover – an important application will be able to restart and run as long as a single server in the cluster is functional
- Disaster recovery
  - Remote mirroring is possible with clustering


Application
DBMS
File System
volume (LUN)
Disk
Storage

Storage Area Networks

- Storage units are on the network
  - Network / Protocol is (typically) different from the LAN
    - e.g. Fibre-Channel SAN
  - Data is accessed raw (in disk blocks) from storage units
    - As opposed to file access in NAS
- Fibre-Channel SANs were the earliest:
  - FC offers high Bandwidth
- Alternative SAN technologies available today:
  - E.g. IP SAN
- SAN and NAS are converging:
  - E.g. NAS head with a SAN backend.

Storage Area Networks



What makes a GOOD SAN

- SAN must be highly available
  - Switches, links, storage devices and computers must have built in strategies for surviving and recovering from failure
- The I/O performance of SAN must scale as the number of interconnected devices grows
  - A good SAN delivers both high data transfer rates and low I/O request latency

- The investment required to implement SAN is high – both direct capital cost and in terms of time and energy required to learn technology and to design, deploy, tune and manage SAN

Rules

- Rule 1:
  - Make sure SAN is highly available when designing for accessing critical enterprise data
    - Avoid failures of components in it and components attached to it
- Rule 2:
  - When evaluating SAN implementation options, once the basic capacity, availability and performance requirements can be met, look for advanced functionality available in the chosen architecture and consider how it might be used to further reduce cost or enhance the information services delivered to used
- Rule 3
  - Hardware makes SANs possible; software makes SANs happen