Fibre Channel Overview

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What is Fibre Channel?

- A high-speed interface that can be used to connect workstations, mainframes, supercomputers, storage devices and peripherals
- A transport mechanism that supports a variety of upper level protocols, such as IP, SCSI, IPI, HIPPI, and ATM
- An interconnect standard that provides throughput of over 100 MB/s

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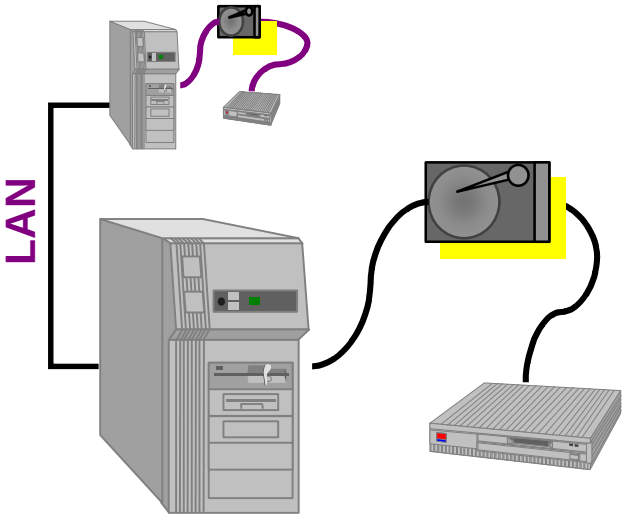
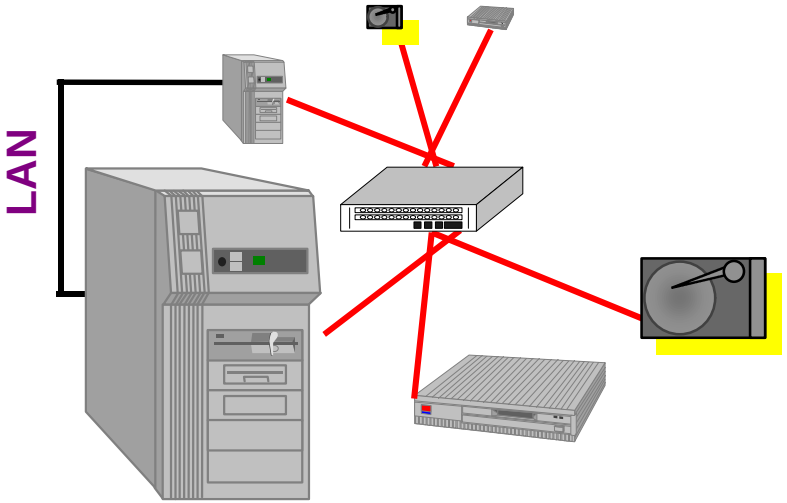
I/O Channel Comparison

SCSI



- Single host connection
- Up to 15 peripherals
- Up to 12 meters total
- Parallel interface
- 160 MB/sec

FIBRE CHANNEL



- Multiple host connectivity
- 126 per loop; 16 million per switched fabric
- Up to 10 kilometers per segment
- Serial interface
- 200 MB/sec

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What Is It Useful For?

- High Performance Storage Connections
- High Performance LAN Connections
- Multi-Purpose I/O for Data Intensive Workgroups
- Clustering Connections
- Storage Area Networking

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Why Implement Fibre Channel?

- Scalability
  - Supports loop & fabric topologies
- Flexibility
  - Longer cable distances
  - Easier moves and adds
  - Multiple Initiators
  - Multiple Protocols
- Availability
  - Multiple redundant paths
  - Multiple protocols support failover and load balancing
- Performance
  - High bandwidths
  - Low latency

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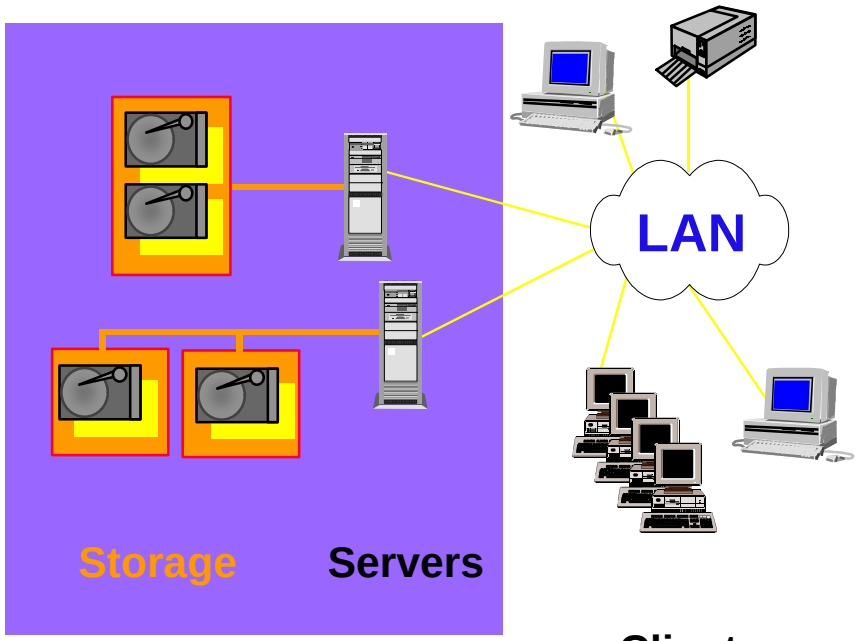
Traditional Enterprise Model

Traditional
Server-Centric Storage



- **"Islands of storage" behind each server have created performance bottlenecks and LAN congestion**
- **Scalability comes at a high price**
- **SCSI has failed to evolve**

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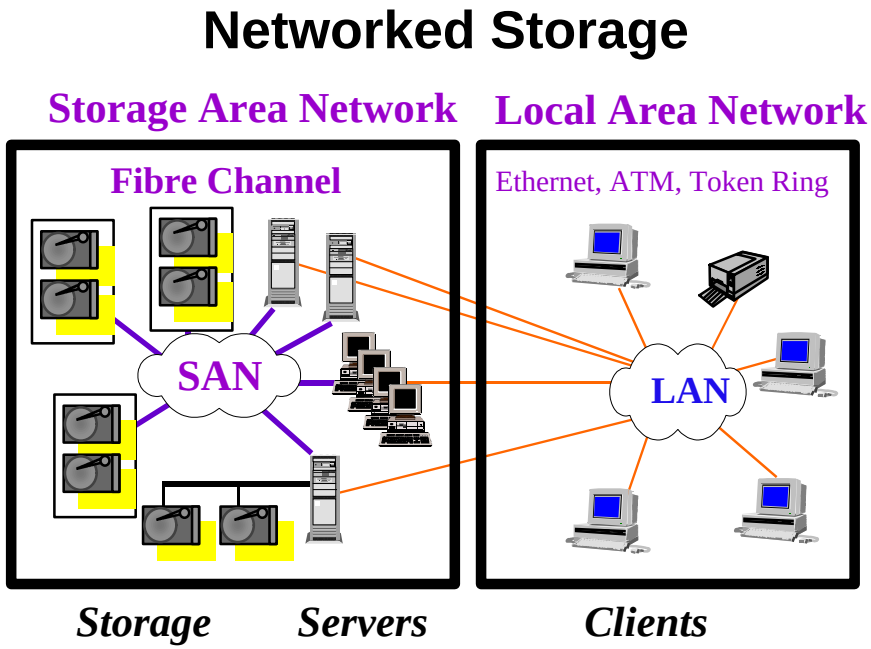
The Storage Area Network

- Complementary network to the LAN
  - Storage traffic is off-loaded to fail-safe I/O channel
- Servers and storage are network resources
  - Provides improved performance and scalability
- Tremendous flexibility to optimize price/performance
  - Topology, number of nodes, distance, performance



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Fibre Channel Topologies

- Switched Fabric
- Arbitrated Loop
- Point-to-Point

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Fibre Channel: Switched Fabric

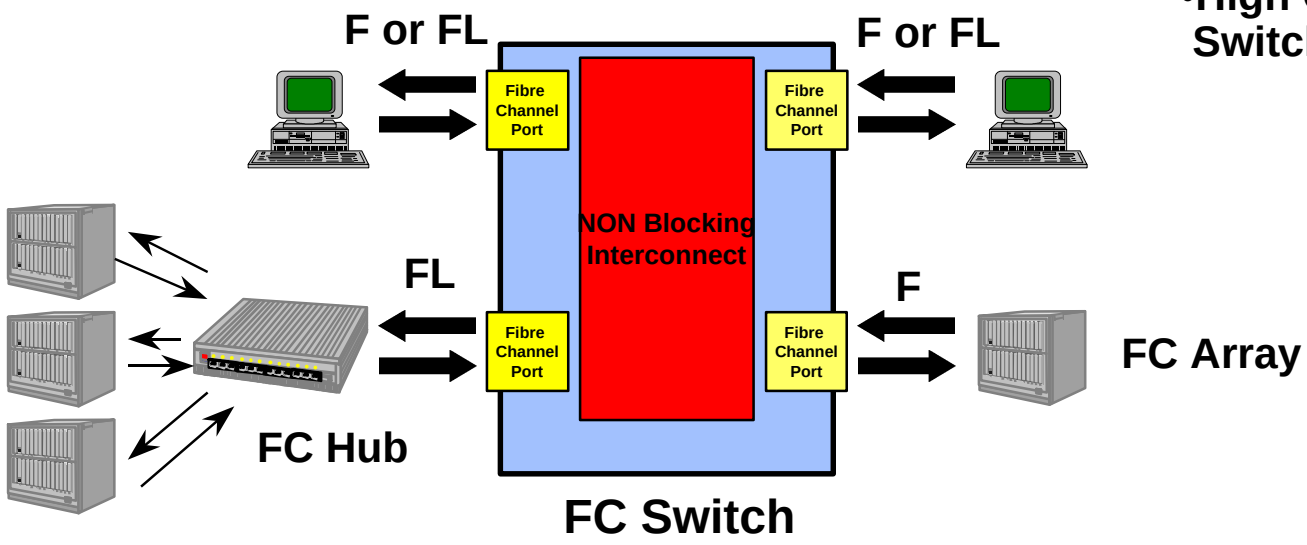
- Multiple simultaneous full-bandwidth connections
- Can support devices with varying data link speeds
- Higher cost per port

F-Port

- 200 MB/sec (full-duplex)
- Point-to-Point Protocol

FL-Port

- Arbitrated Loop
- High Connectivity to a Single Switch Port



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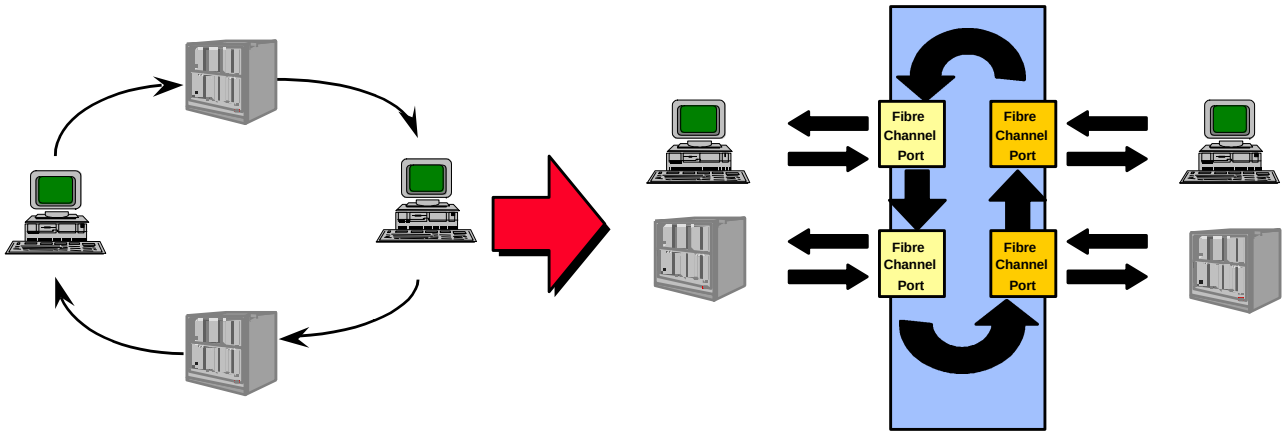
Fibre Channel: Arbitrated Loop

- **Logical Loop, Physical Loop**
  - **Low Cost**
  - **Simple**
  - **From 2 to 126 nodes**
- **Logical Loop, Physical Point-to-Point**
  - **Essentially Half-Duplex**
  - **Shared bandwidth**
  - **Improved Fault Isolation**



FC Hub

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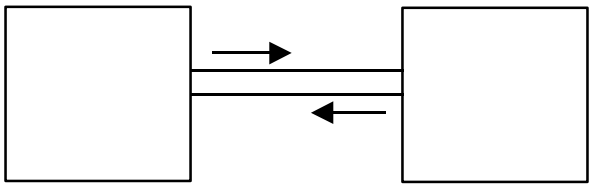
Fibre Channel: Point-to-Point

- Two devices
- Both devices must use the same data link speed
- Both devices must support the same cabling scheme



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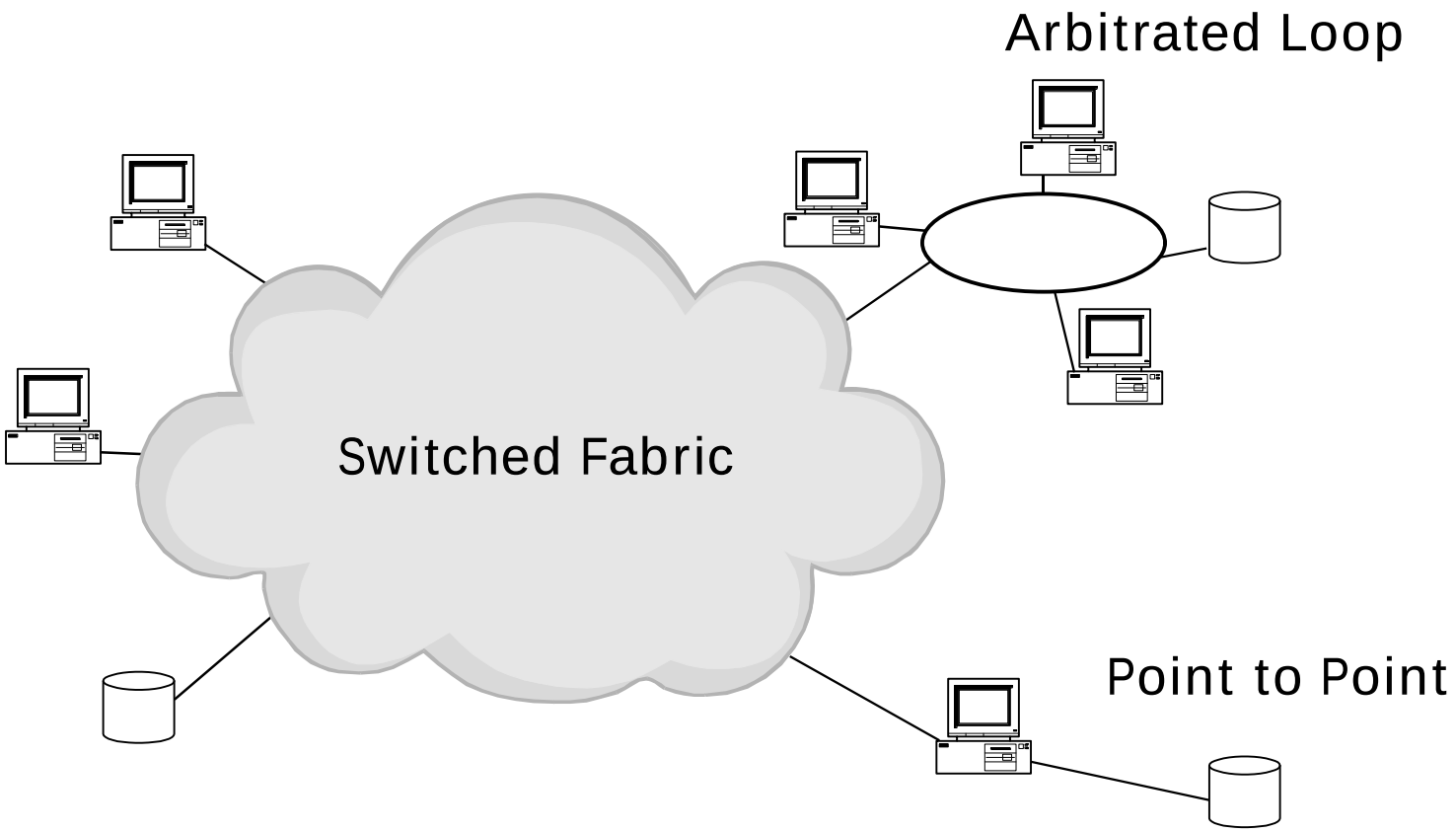
Mixed Topology Networks



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Classes of Service

- **Class 1:** Connection or dedicated service with guaranteed delivery
- **Class 2:** Connectionless service with guaranteed delivery
- **Class 3:** Connectionless datagram service
- **Intermix:** Class 1 connections, but unused bandwidth used for connectionless services

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Fibre Channel Media

- **Optical fiber - Dual SC Connectors**
  - **62.5/125 micrometer multi-mode - Up to 125 meters**
  - **50/125 micrometer multi-mode - Up to 500 meters**
  - **9/125 micrometer single-mode - Up to 10Km**
- **Copper - DB9 or HSSDC Connectors**
  - **Twinax Cable - Up to 30 meters**

Cable distance limitations represent the node to node length, not the total end-to-end distance

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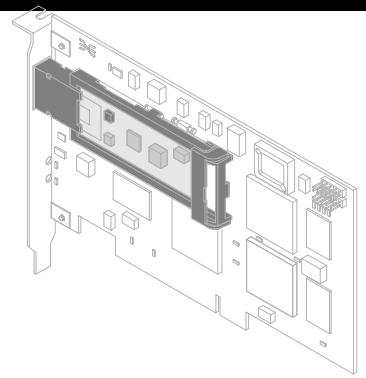
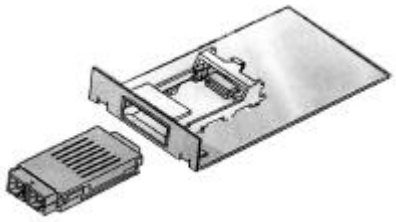
Interchangeable Media

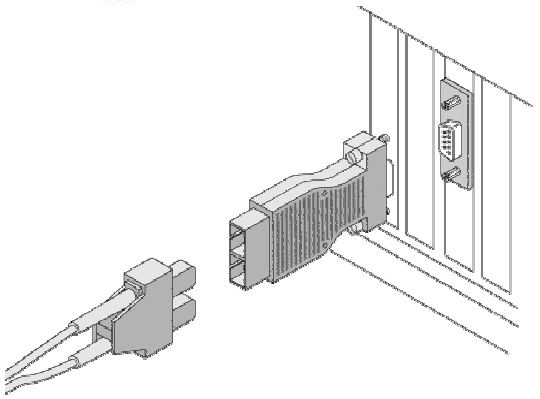
- Gigabaud Link Module (GLM)
  - Interchangeable interface



- Gigabit Interface Converters (GBIC)
  - Hot swappable interface



- Media Interface Adapters (MIA)
  - Converts Copper DB9 Connections to Multimode Fiber Optic



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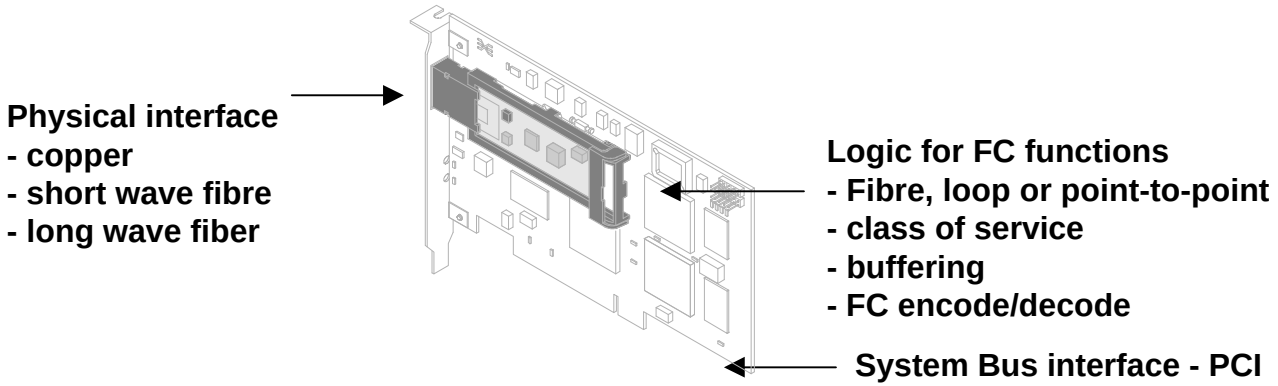
Host Bus Adapters

- Provide fibre channel connection to servers and storage
- Require appropriate bus connection and operating system dependant software drivers
- Arbitrated Loop and direct fabric attach
- Media type
- Fibre channel physical interface FC1 and FC2
- On board data buffer



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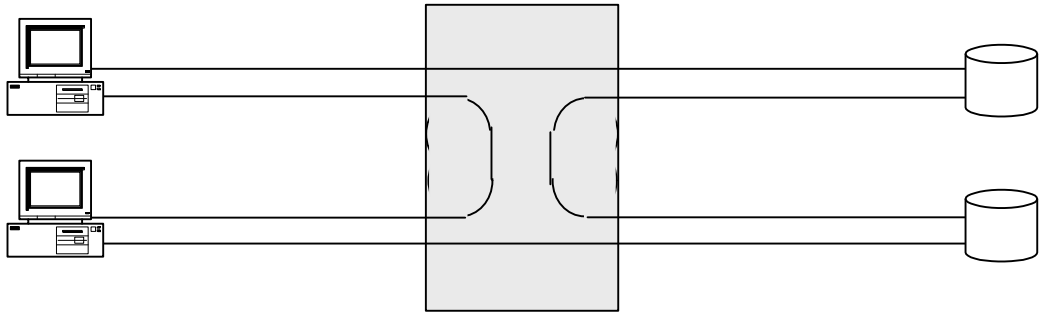
Arbitrated Loop Hubs

- Isolate and protect the loop from defective nodes and configuration changes
- Act as repeaters
- Allow “hot swapping” of storage devices, servers, or clients without destroying loop integrity
- Provide centralized point of management



Fibre Channel Hub

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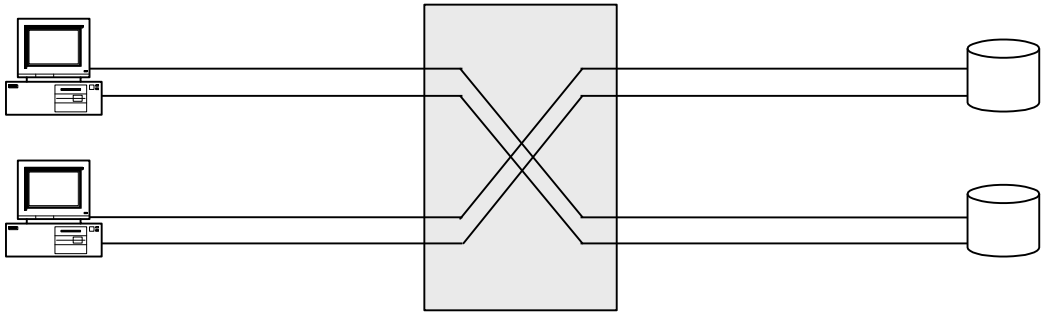
Fabric Switches

- Provide port to port switching
- Generally non-blocking
- Multiple switches cascaded to provide larger fabric
- Port Types
  - F-Port (direct fabric attach devices)
  - E-Port (“expansion port” for cascading switches)
  - G-Port (functions as either E or F Port)
  - FL-Port (allows attachment or one or more arbitrated loop devices or hubs)



Fibre Channel Switch

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Disk Storage Devices

- Disk Drives
  - Dual Ported
  - 9GB --> 18GB --> 36GB
  - Hot pluggable backplane connectors
- JBOD's
  - 2 to 10 drive bays
  - Generally dual ported
  - Hot plugGable drive bays
  - Moderate to high availability features
- Drive Arrays
  - Fibre Channel front end
  - Fibre Channel or SCSI back end (drives)
  - Generally dual ported
  - Moderate to high availability features
- Array Controllers
  - Support multiple Fibre Channel JBOD's

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Other Devices

- FC/SCSI Bridges
  - Allow attachment of legacy SCSI devices
- Media
  - Cables
  - MIA's
  - GBIC's
- Tape Drives
  - Expected announcements later this year
  - Ongoing standards work to facilitate tape back-up over Fibre Channel

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