



# Crossroads Systems, Inc.

## *Storage Router Product Training*





# Part I Agenda

- **Introduction**
  - SCSI Overview
  - Fibre Channel Overview
  - SAN Overview
  - Motivation
  - Basic Operation
- **Architecture**
  - Standards
  - Architectural Model
  - Program Flow
  - Addressing
- **Software**
  - Core Software Modules
  - Configuration Options



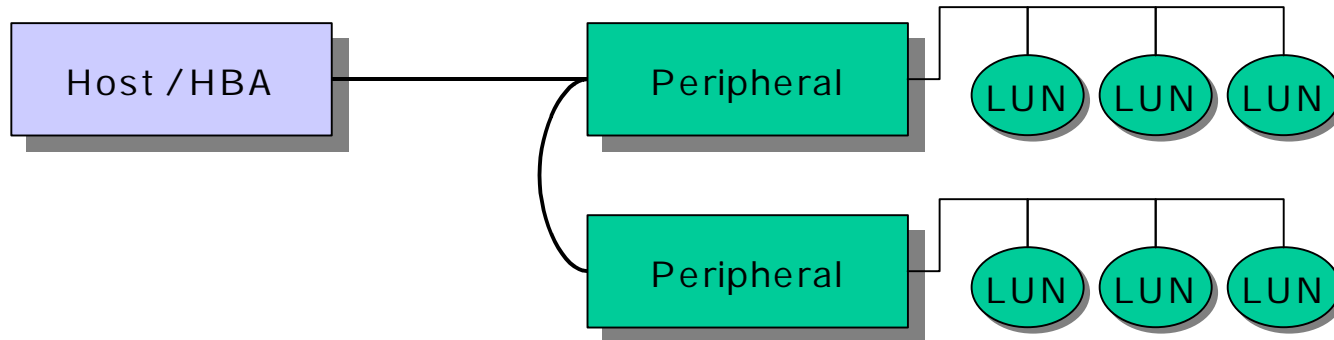
# SCSI History

- 20+ years old
- Based on SASI, Shugart Associates System Interface
  - Modeled on IBM I/O channel
  - Device-independent interconnect
- Three standards: X3.T10
  - SCSI-1: Initial implementations began in 1979 , and was finalized in 1983
  - SCSI-2: Definition began in 1983, and was finalized in 1994; includes fast/wide options
  - SCSI-3: still under development, but widely implemented; contains SCSI-FCP

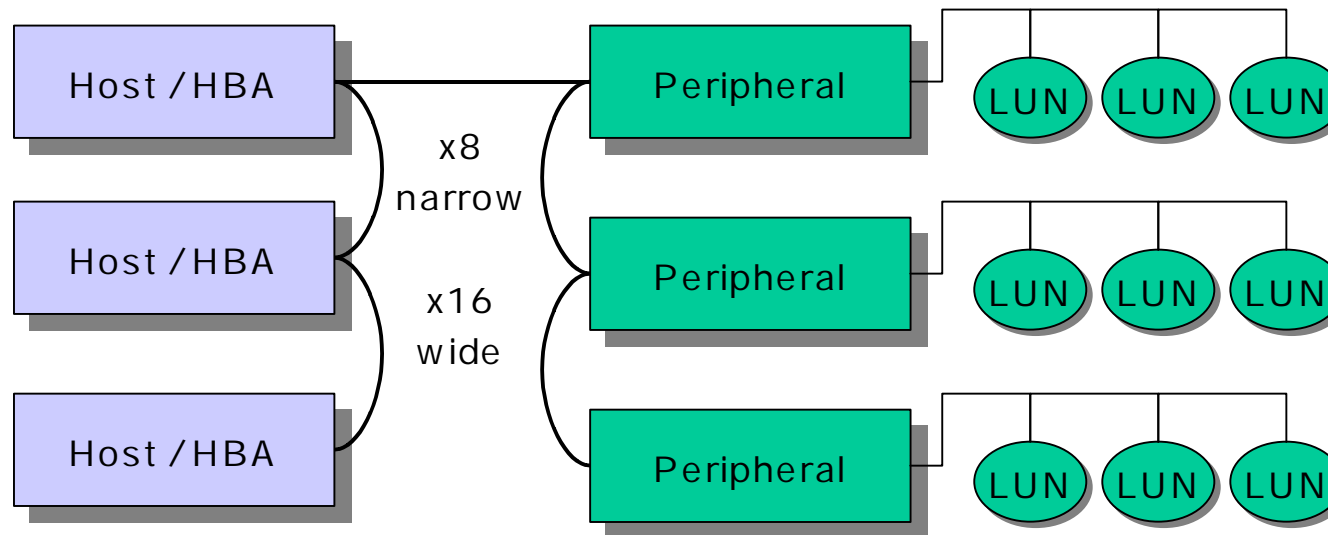


# Typical SCSI Configurations

## Single Initiator and Multiple Targets



## Multiple Initiators and Multiple Targets





# SCSI Speeds

SCSI Term	Bus Width (bits)	Speed (MB/sec)
SCSI-1	8	5
Fast SCSI 10	8	
Fast Wide SCSI	16	20
Ultra SCSI 20	8	
Wide Ultra SCSI	16	40
Ultra2 SCSI (LVD)	8	40
Wide Ultra2 SCSI (LVD)	16	80
Wide Ultra3 SCSI (LVD)	16	160

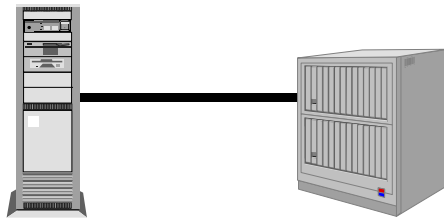


# Fibre Channel

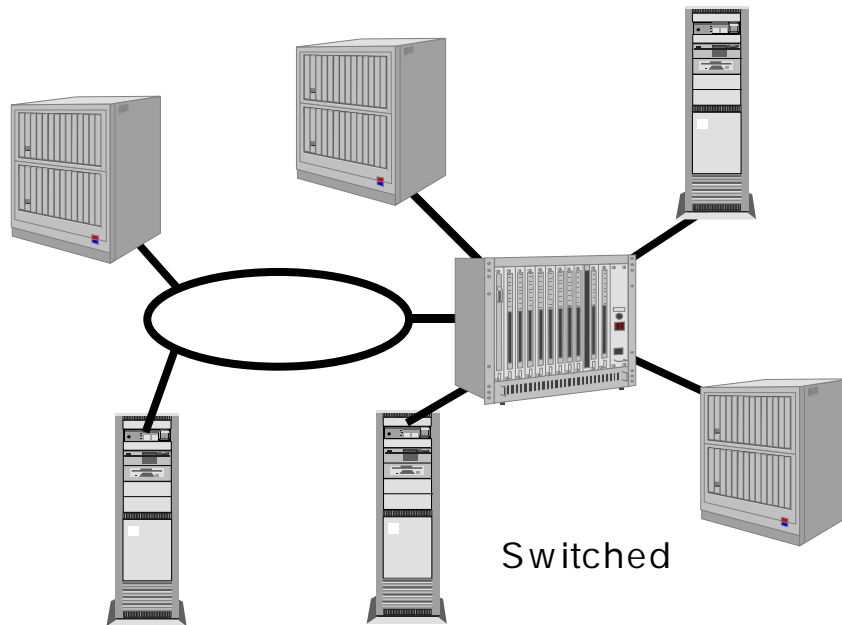
- Developed by IBM in 1989.
- ANSI standard X3.T11
  - SCSI-FCP and FC-AL finished in 1996
- IO Channel with a Network Flavor
  - High data rates + long distances
  - Low latency + excellent connectivity
  - Low cost + high availability
- Fabrics
  - Point-to-point
  - Arbitrated loop (public and private)
  - Switched



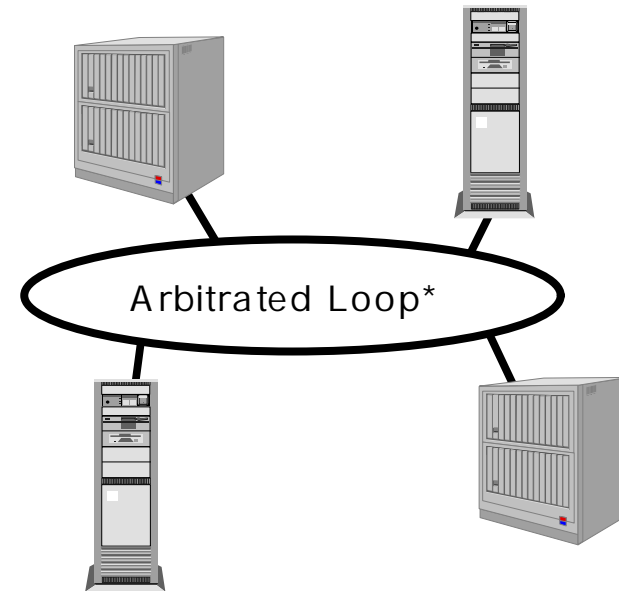
# Fibre Channel Fabric Types



Point-to-Point



Switched



*\* typically collapsed into a Fibre Channel hub*



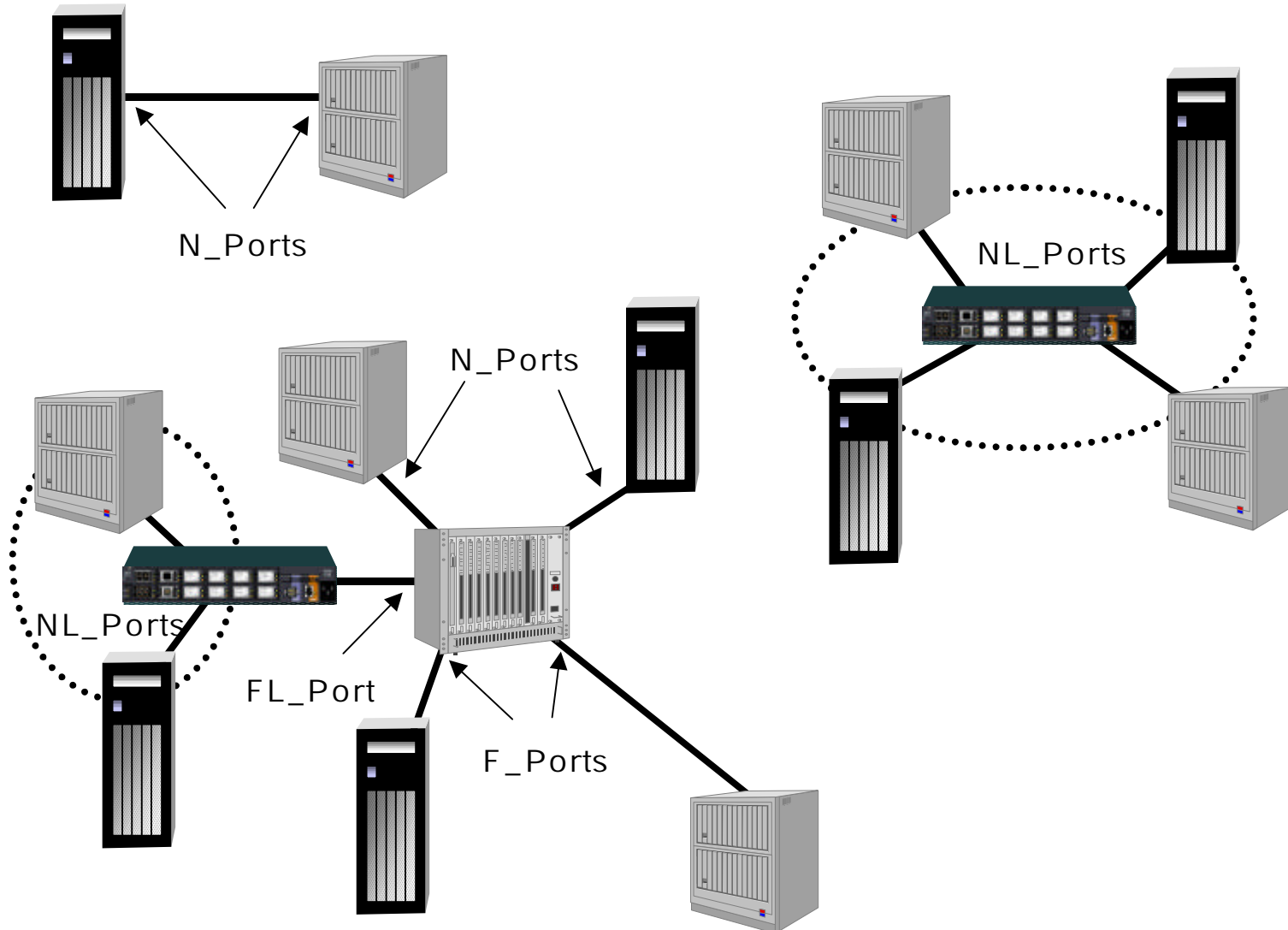
# FC Basics

- Protocol Support
  - SCSI, IP, HIPPI, IPI3, ATM, ESCON
- Interoperability Profiles
  - Storage
  - Video
  - Networks
  - Avionics
- Port Types
  - Node Ports
    - N\_Port : dedicated connection between two nodes
    - NL\_Port : host or device attached to an FC-AL
  - Fabric Ports
    - F\_Port : switch port
    - FL\_Port : switch port with an FC-AL attached
    - E\_Port : inter-switch link





# Fibre Channel Ports





# FC Protocol

- Frames, Sequences, Exchanges
  - Words, Sentences, Paragraphs
  - Frames: Basic unit of transfer in FC
    - Header (24 bytes) + data (0-2112 bytes) + trailer (12 bytes)
    - Overhead of 36 bytes = 1.7%
    - TCP/IP on GbE overhead = 4.2%
  - Sequences: a set of one or more related frames
    - Transmitted unidirectionally between N\_port pairs
    - Contains Information Units (SCSI, TCP/IP)
  - Exchange: set of one or more related sequences
    - Basic unit of SCSI IO
    - Long-lived for IP

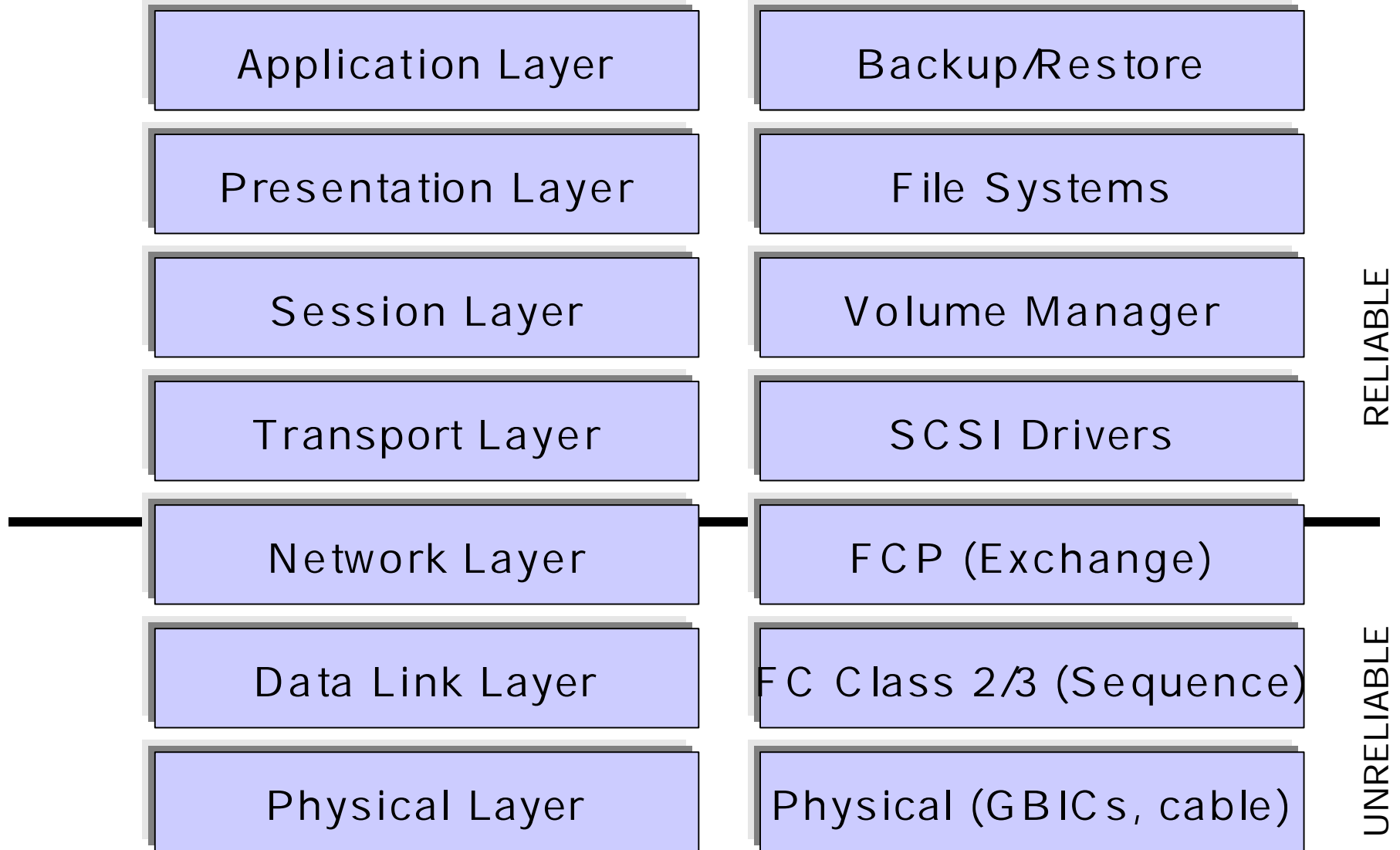


# FC Classes

- Class 1
  - Acknowledged Connection-Oriented Service
  - Full bandwidth w/guaranteed delivery
  - Dedicated path between ports
- Class 2
  - Acknowledged Connectionless Service
  - Independently switched frames
  - Non-dedicated path between ports
- Class 3
  - Unacknowledged Connectionless Service
  - Same as Class 2 without acks

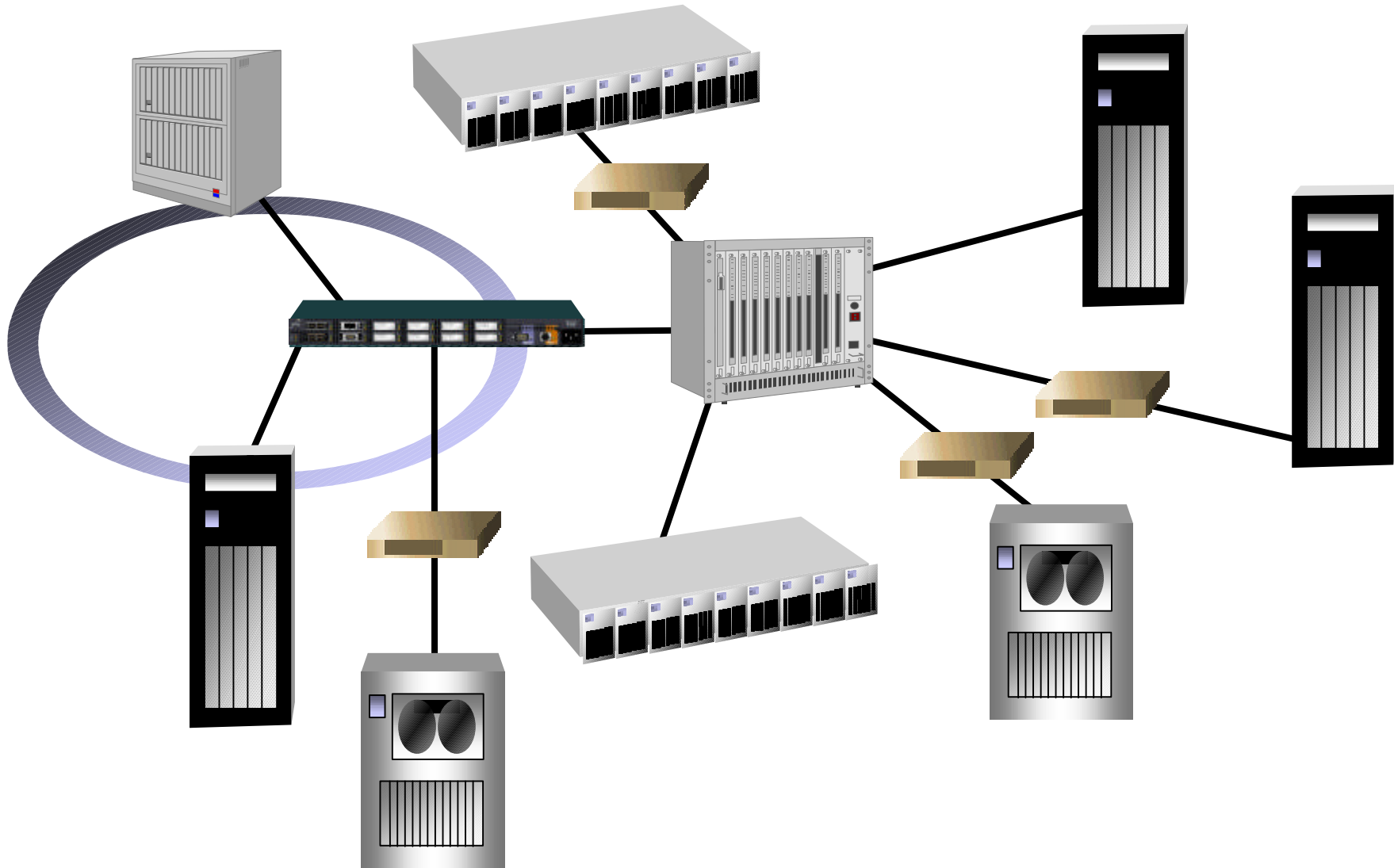


# OSI and SAN Layers





# SAN Overview





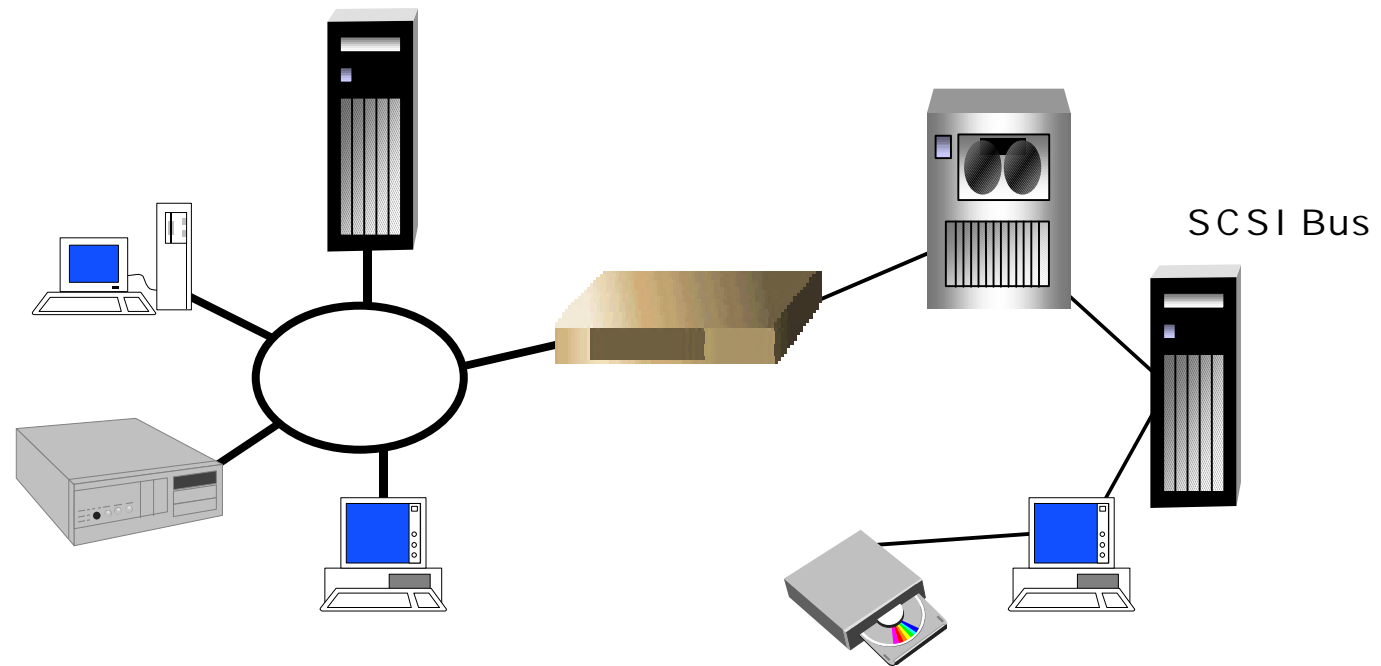
# Why SANS?

- Scaling capacity: 126 devices per loop instead of 15 per bus
- LAN-Free Backup: Backup traffic is moved from the LAN to the SAN reducing or eliminating backup windows
- Longer distances: 10Km instead of 30 meters
- Device sharing
  - One tape library for many servers instead of one per server
  - One disk data store for many hosts
- Server clustering: high application availability and load sharing



# Product Overview - Storage Router

- Connects Fibre Channel Devices to SCSI Devices



Fibre Channel Fabric -  
Arbitrated Loop or Switched



# Product Motivation

- Migration Path to Fibre Channel Storage Area Networks
- Preserves Investment in Existing SCSI Equipment
- Provides Path Between Existing and New Data Stores
- Allows Vendors to Adapt Existing SCSI devices to FC





# Basic Storage Router Operation

- Multiple Device Support – FC and SCSI
  - Disks
  - Tapes
  - Changers
  - Initiators
- FC Initiators to SCSI Targets, aka Initiator Mode
  - SCSI-3 FCP to SCSI-3 Parallel
- SCSI Initiators to FC Targets, aka Target Mode
  - SCSI-3 parallel to SCSI-3 FCP



# Architecture

- Standards
- Architectural Model
- Program Flow
- Addressing

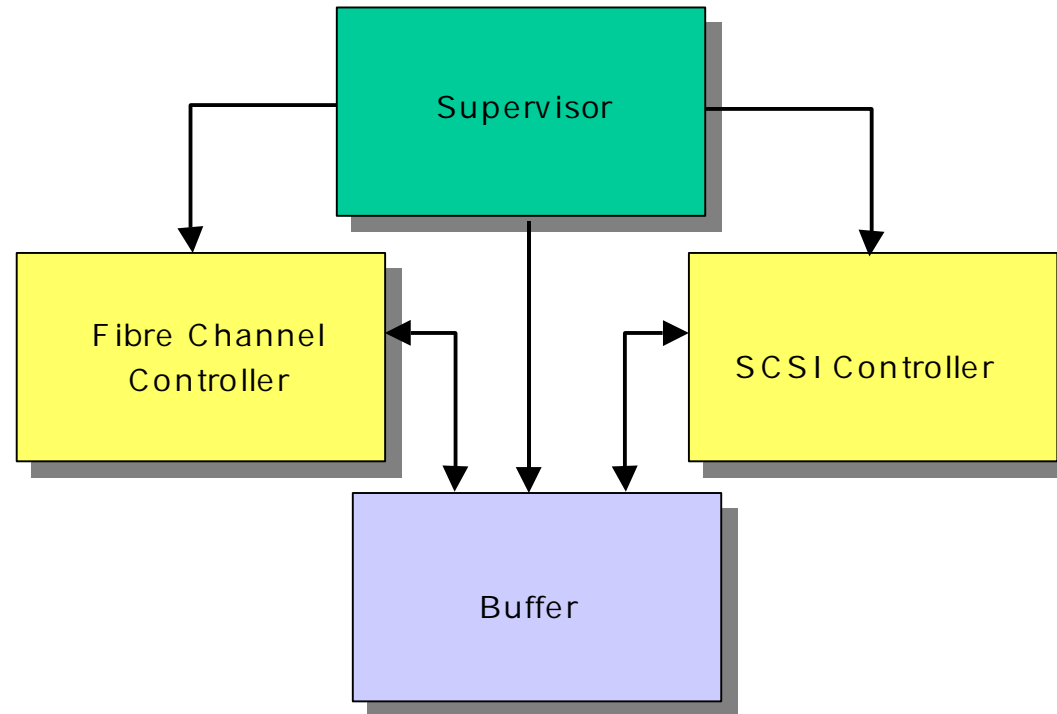


# Standards

- **Small Computer System Interface (ANSI X3.131-199X) (SCSI-2)**
- **SCSI-3 Architecture Model (ANSI X3.270-1996) (SAM), revision 18** - defines the functional partitions and specifies a model for SCSI-3 I/O system and device behavior which applies to all SCSI interconnects, protocols, access methods, and devices
- **SCSI-3 Common Access Method (X3.332-199X) (CAM)** - host architecture for performing SCSI device I/O
- **SCSI-3 Primary Commands (X3T10/995D/Rev 4) (SPC)** - Commands and device behavior common to all SCSI-3 target devices
- **SCSI-3 Block Commands (X3T10/996D/Rev 0) (SBC)** - Block oriented SCSI-3 devices, e.g. disks
- **SCSI-3 Stream Commands (X3T10/Project 997D/Rev x.x) (SSC)** - Stream oriented SCSI-3 devices, e.g. tape
- **SCSI-3 Controller Commands (X2T10/1047D/Rev 5) (SCC)** - SCSI-3 I/O subsystem controllers
- **SCSI-3 Interlocked Protocol (X3T10/856D) (SIP)** - Parallel interface protocol
- **SCSI-3 Parallel Interface (X3T10-885D) (SPI)**
- **SCS-3 Fast-20 (X3T10/1071D)** - Supplement to SCSI-3 Parallel Interface Standard that defines Fast-20
- **Fibre Channel Protocol for SCSI (ANSI X3.269-1996) (FCP)** - SCSI-3 protocol for Fibre Channel interconnects
- **Fibre Channel Physical and Signaling Interface (ANSI X3.230-1994) (FC-PH)**
- **Fibre Channel Physical and Signaling Interface-2 (ANSI X3T11/Project 901D/Rev 7.4) (FC-PH2)**
- **Fibre Channel Physical and Signaling Interface-3 (ANSI X3T11/Project 1119D/Rev 9.2) (FC-PH-3)**
- **Fibre Channel Arbitrated Loop (ANSI X3.272-1996) (FC-AL)**
- **Fibre Channel Private Loop SCSI Direct Attach Technical Report (TR X3.XXX-199X) (FC-PLDA), Revision 1.5**
- **PCI Local Bus, Revision 2.1, published by the PCI Special Interest Group**



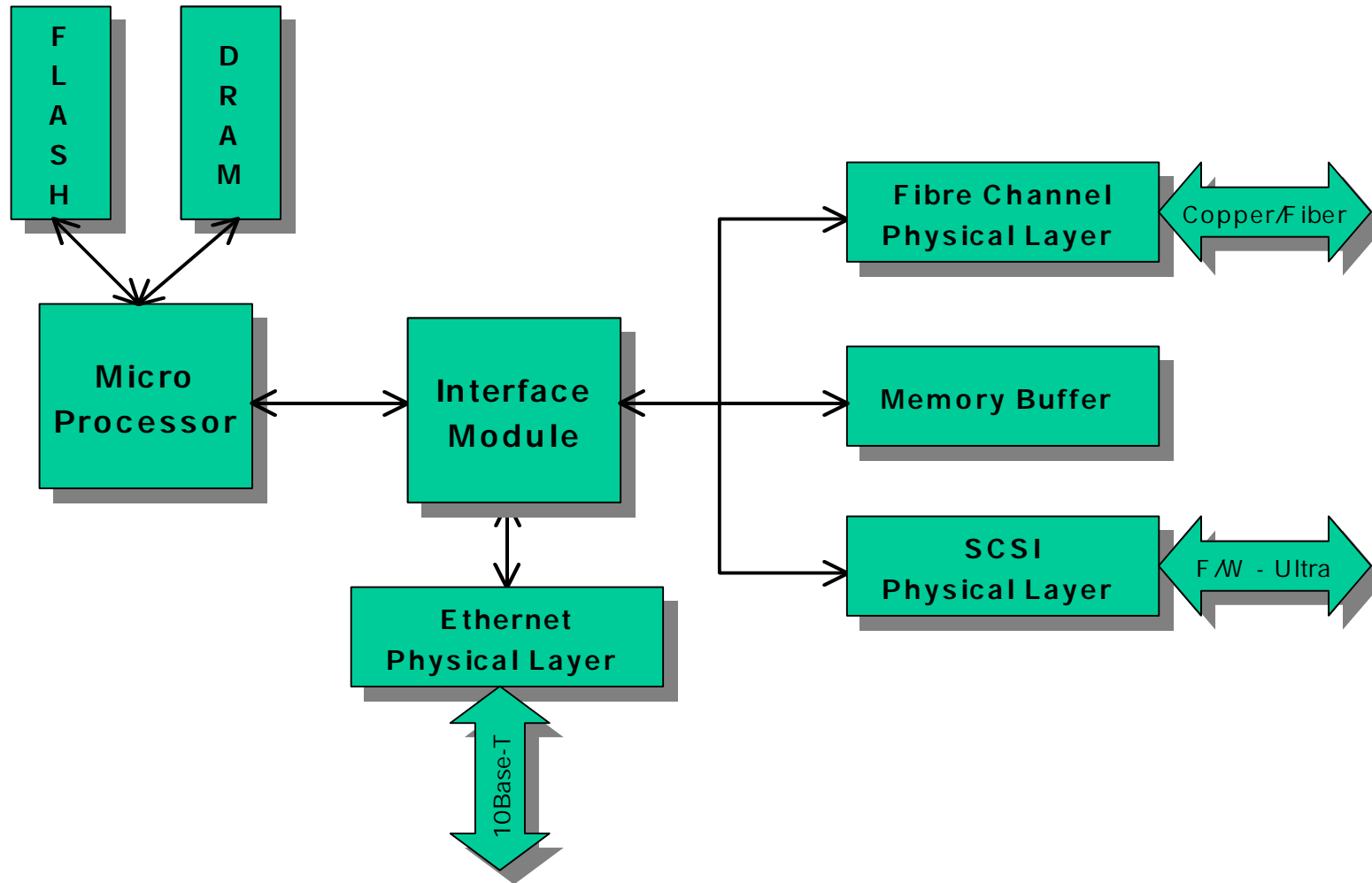
# Software Architectural Model



- Event Driven
- Store and Forward Buffer Memory
- FC, SCSI and Protocol Memory on Common PCI bus
- Ethernet and serial port on separate PCI bus
- Program memory, other devices on Processor bus



# Hardware Architectural Model





# Storage Router Addressing

- Translates FC Identifiers to SCSI Identifiers
  - FCP Port ID:LUN <-> SCSI Bus:Target:LUN
- SCSI
  - BUS:Target:LUN
    - Each bus has up to 16 targets
    - Each target has up to 32 addressable LUNs
- Fibre Channel
  - N\_Port ID:LUN
    - 126 Devices per Arbitrated Loop
    - Each device has up to  $2^{14}$  (~16K) addressable LUNs



# Storage Router Addressing Modes

- Multiple Options Available
  - FC Initiator to SCSI Target
    - SCC Mode Addressing
    - Indexed Addressing
    - Auto-assigned Addressing
  - SCSI Initiator to FC targets
- Indexed and Auto-assigned provide generic driver functionality for device discovery
- SCC provides full controller capabilities, but requires SCC-capable host
- Target mode allows SCSI host access to FC devices



# SCC Addressing

- SCC = SCSI Controller Command set
- SCC-capable devices responsible for the devices behind them
- Requires SCC-capable HBA driver
  - Currently only supported by JNI
- Relieves host of device responsibility





# Indexed Addressing

- Flash memory table : FCP LUN values map to SCSI Devices
  - Table filled by user with Editing Assists, and saved in flash

FCP LUN Value	SCSI BUS:TARGET:LUN
0	0:0:0
1	0:1:0
2	0:2:0
3	0:3:0
4	0:4:0
5	0:5:0
	(0:6:0 occupied by SCSI Initiator ID)
6	0:7:0
(...)	(...)
13	0:14:0
14	0:15:0
15	1:0:0
16	1:1:0
17	1:2:0
(...)	(...)

***Generic drivers discover devices sequentially, and assigning  
FCP\_LUN values until No Device Found***



# Auto Addressing

- Table structure identical to Indexed mode
- Table filled by discovery on SCSI bus
- Will not persist over power cycles
- Ideal for tapes and changers
- System implementation can allow for disks
- RAM table - FCP LUN values map to SCSI devices



# SCSI Initiator to FC Target Addressing

- Flash memory table
  - SCSI Bus:Target:LUN maps to FCP Destination\_ID:LUN
- Table filled by user with editing assists
- SCSI drivers on host discover sequential SCSI LUN values until No Device Found, then search for next available target

SCSI Address	FC Address
SCSI Bus 0, Target 0, LUN 0	ALPA EF LUN 0x0000
SCSI Bus 0, Target 1, LUN 0	ALPA E8 LUN 0x0000
SCSI Bus 0, Target 2, LUN 0	ALPA E4 LUN 0x0000
(...)	(...)
SCSI Bus 0, Target 0, LUN 1	ALPA EF LUN 0x0001
SCSI Bus 0, Target 1, LUN 1	ALPA E8 LUN 0x0001
SCSI Bus 0, Target 2, LUN 1	ALPA E4 LUN 0x0001
(...)	(...)
SCSI Target 7 Unavailable (Bridge Initiator ID)	



# Router Addressing Summary

- Four addressing modes:
  - **SCC**
    - Addresses controller and devices
    - Requires intelligent driver on host system
  - **Indexed**
    - Uses persistent table for device addressing
    - Requires user configuration of table
  - **Auto-assigned**
    - Discovers attached devices at boot time
  - **SCSI to FC**
    - SCSI Host attached to FC fabric, accessing FC devices

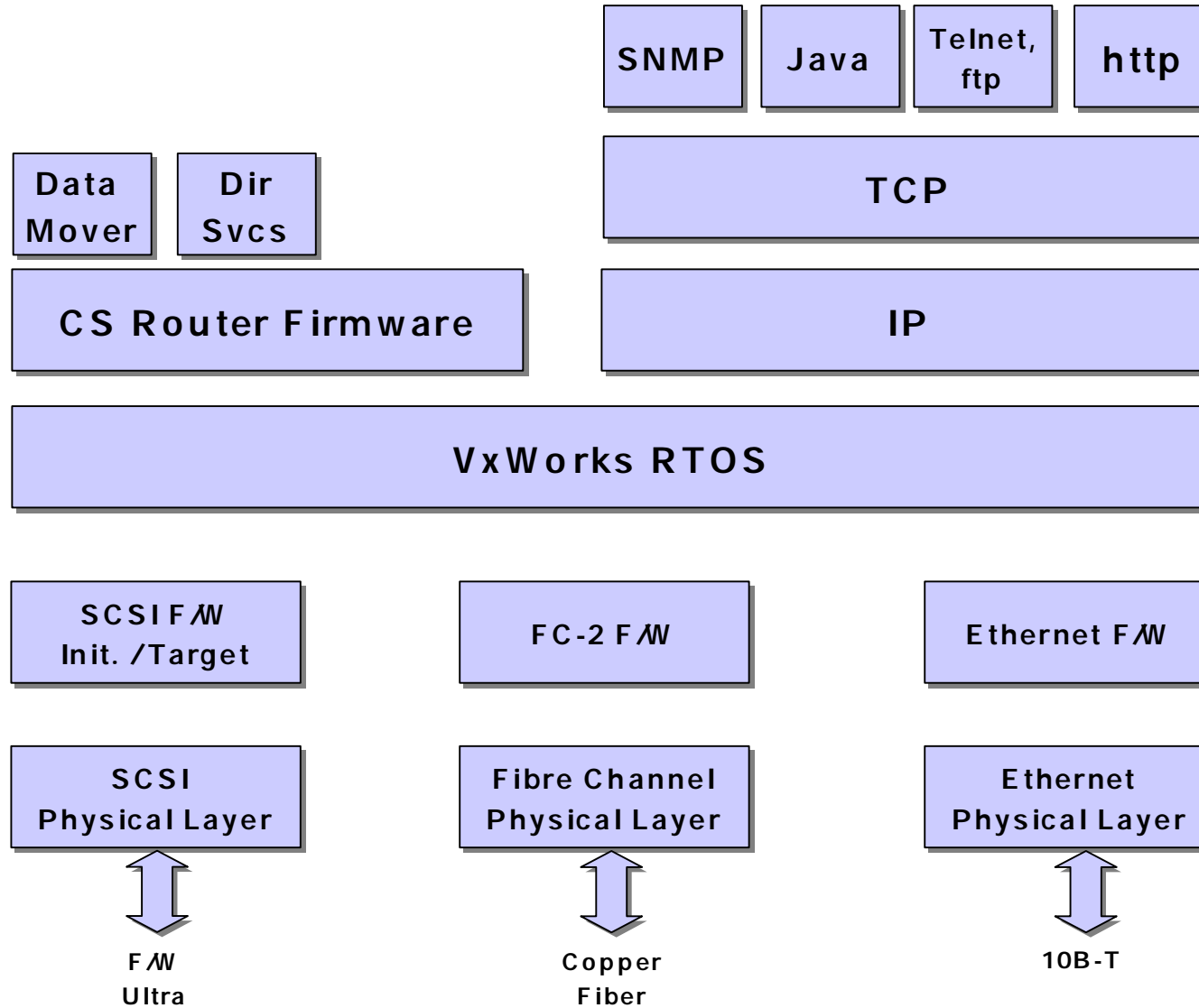


# Software Overview

- Structure
- Fibre Channel Driver
- SCSI Driver
- Router
- Configuration Management



# Structure





# Fibre Channel Driver

- Class 3 Loop or Switch Initialization
- Manages FC Exchanges
- Manages FCP commands
- Receives all FCP Data Commands
- Manages FC Sequences
- Initiation and Termination of Sequences
- SEQ\_ID assignment
- Manages Sequence Initiative
- Manages DMA to/from Protocol Buffer Memory



# SCSI Driver

- Provide SCSI initiator support
- Manage commands and messages to target
- Provide SCSI target support
- Respond to multiple target IDs
- Process commands and messages
- Manage DMA to/from Protocol Buffer Memory
- Manage all SCSI bus phases and transitions
- Manage synchronous and wide negotiation





# Router

- Process incoming CDBs from FC and SCSI
- Command and data transfer between FC and SCSI drivers
- Manage data buffers and internal command structures
- Manage FC interface
- Manage SCSI interface
- Translate protocols from FCP to Parallel SCSI
- Translate addresses between FC and SCSI



# Configuration and Management

- Configuration required for various options
  - FC and SCSI options
  - Router and extender configuration (addressing)
  - Ethernet and serial configuration
- Multiple configuration interfaces
  - Serial port for configuration and firmware downloads
  - Ethernet
    - SNMP Private and Public MIB-II
    - Telnet configuration interface
    - HTTP interface for web browser
    - FTP firmware upgrade



# Configuration Options

- Serial options
  - Baud rate: 9600-115K baud
- Fibre Channel Options
  - Use hard or soft FC-AL addressing
  - Set Loop Address (AL\_PA)
  - Set World Wide Name
- SCSI Options
  - Set Initiator ID
  - Set Target ID(s)
  - Bus reset on boot
  - Device discovery delay



# Configuration Options

- Ethernet Options
  - Set IP address
  - Set IP subnet mask
  - Set Default Gateway
  - Set MAC address
  - Set SNMP options
- FC > SCSI Addressing Options
  - Set mapping mode
  - Modify address table
  - Display attached SCSI devices
- SCSI > FC Addressing Options
  - Modify address table



# Configuration Options

- Debug Trace Options
  - Set trace levels
- General Options
  - Save configuration
  - Restore factory defaults
  - Restore last saved configuration
- From the Main Menu
  - Download microcode
  - Dump trace information, both current and previous
  - Reboot



## Part II Agenda

- Host Setup
- Configuration Screens
  - FC Initiator
  - FC Target
- Maintenance
- Troubleshooting



# SCSI vs. FC Install : NT

## SCSI

- HBA
  - Symbios, Adaptec, etc.
  - NT "Have Disk" install
  - Usual driver and f/w
- Device
  - Follow mfrs instructions
- NT Apps
  - Control Panel SCSI Applet
  - Backup
  - Disk Admin

## FC

- HBA
  - Emulex, JNI, Qlogic, etc.
  - NT "Have Disk" install
  - Usual driver and f/w
  - **README.TXT**
- Device
  - Follow mfrs instructions
- NT Apps
  - Control Panel SCSI Applet
  - Backup
  - Disk Admin
- Router
  - 4xx0 Installation



# Fibre Channel HBA readme.txt

- Network or SCSI Miniport support
- Manual configuration through the Registry
  - Targets
  - Buses
  - Adapter count
  - Number of IO requests
  - Example: Registry location for JNI
    - HKEY\_LOCAL\_MACHINE> System> Current Control Set> Services> fcascsi> device0> Parameters
- Location of latest drivers
- Diagnostics and Utilities
- Release Notes





# POST to Configuration

```
Performing Power-on Self Test ...
  Monitor-flash Check-sum ..... passed
  Program-store Main RAM ..... passed
  Trace Buffer in Main RAM ..... passed
  PCI Protocol RAM (4Mb) ..... passed
  SCSI Script RAM ..... passed
Initializing Ports ...
  Fibre-channel Port Single-frame Sequence Loopback ..... passed
  Fibre-channel Port Multi-frame Sequence Loopback ..... passed
```



# POST to Configuration (cont.)

```
Ethernet Port Loopback ..... passed
SCSI Port Loopback ..... passed
Self test completed successfully
```

Select which mode to boot :

1. Fibre Channel/SCSI Router
2. Diagnostics Monitor

seconds left 1 : 1

Verifying firmware checksum ... Target Name: Crossroads

Attaching network interface lnPci0... done.



## Post to Configuration (cont.)

Attaching network interface lo0... done.

NFS client support not included.

Initializing sioc...

SCRIPTS start @ 0x88002000 (3568)

Initialized Successfully

Build Level: 9808h

Crossroads Systems CP4100 Configuration

Version: 2.1 9808h

- 1) Perform Configuration
- 2) Display Status of Power-on Self Test
- 3) Display Trace and Assertion History
- 4) Reboot
- 5) Download a New Revision of The Firmware

Command >



# Main Menu

**Crossroads Systems 4100 Configuration  
Version: 2.1 9808h**

- 1) Perform Configuration**
- 2) Display Status of Power-on Self Test**
- 3) Display Trace and Assertion History**
- 4) Reboot**
- 5) Download a New Revision of The Firmware**

**Command >**



# Serial Port Configuration

## Configuration Menu

Version: 2.1 9808h

- 1) **Baud Rate Configuration**
- 2) Fibre Channel Configuration
- 3) SCSI Configuration
- 4) Ethernet Configuration
- 5) Fibre Channel to SCSI Mapping Configuration
- 6) SCSI to Fibre Channel Mapping Configuration
- 7) Trace Settings Configuration
  
- A) Save Configuration
- B) Restore Last Saved Configuration
- C) Reset Configuration to Factory Defaults
  
- X) Return to main menu

- Autobaud feature detects and sets router to terminal speed
- Hyperterminal Settings
  - Data bits: 8
  - Parity: none
  - Stop bits: 1
  - **Flow control: none**
  - Use XMODEM for downloads
- router Serial Cable
  - RJ12 flat cable and D-sub adapter
- 4250 will be DB9



# Fibre Channel Configuration

Configuration Menu  
Version: 2.1 9809B

- 1) Baud Rate Configuration
  - 2) Fibre Channel Configuration**
  - 3) SCSI Configuration
  - 4) Ethernet Configuration
  - 5) Fibre Channel to SCSI Mapping Configuration
  - 6) SCSI to Fibre Channel Mapping Configuration
  - 7) Trace Settings Configuration
- 
- A) Save Configuration
  - B) Restore Last Saved Configuration
  - C) Reset Configuration to Factory Defaults
- 
- X) Return to main menu

Current Fibre Channel Configuration:

World Wide Name High: 0x10000E0

World Wide Name Low: 0x0200011F

Use Hard ALPA: YES

Hard ALPA: 0xE8

- 1) Change World Wide Name High
  - 2) Change World Wide Name Low
  - 3) Toggle Hard ALPA Usage
  - 4) Change Hard ALPA Value
- 
- X) Return to previous menu



# Ethernet Configuration

## Configuration Menu Version: 2.1 9808h

- 1) Baud Rate Configuration
  - 2) Fibre Channel Configuration
  - 3) SCSI Configuration
  - 4) **Ethernet Configuration**
  - 5) Fibre Channel to SCSI Mapping Configuration
  - 6) SCSI to Fibre Channel Mapping Configuration
  - 7) Trace Settings Configuration
- 
- A) Save Configuration
  - B) Restore Last Saved Configuration
  - C) Reset Configuration to Factory Defaults
  - X) Return to main menu

- To telnet into router
  - Set an IP address and netmask thru the serial port.
  - Save cfg and reboot.
  - Ping to verify.
  - telnet <ip address>
  - Login as root:password
  - Connection lost at reboot.
- FTP for download
  - Login as root:password
  - Router will automatically reboot at end of FTP.



# Save and Restore Configurations

## Configuration Menu

Version: 2.1 9808h

- 1) Baud Rate Configuration
  - 2) Fibre Channel Configuration
  - 3) SCSI Configuration
  - 4) Ethernet Configuration
  - 5) Fibre Channel to SCSI Mapping Configuration
  - 6) SCSI to Fibre Channel Mapping Configuration
  - 7) Trace Settings Configuration
- A) Save Configuration
- B) Restore Last Saved Configuration
- C) Reset Configuration to Factory Defaults
- X) Return to main menu

- Option A
  - Saves changes in “new config” in flash memory
- Option B or OOPS!
  - Has previous, or “-1” config
- No configuration changes take place until reboot, except trace levels.





# Save and Restore Configurations

## Configuration Menu

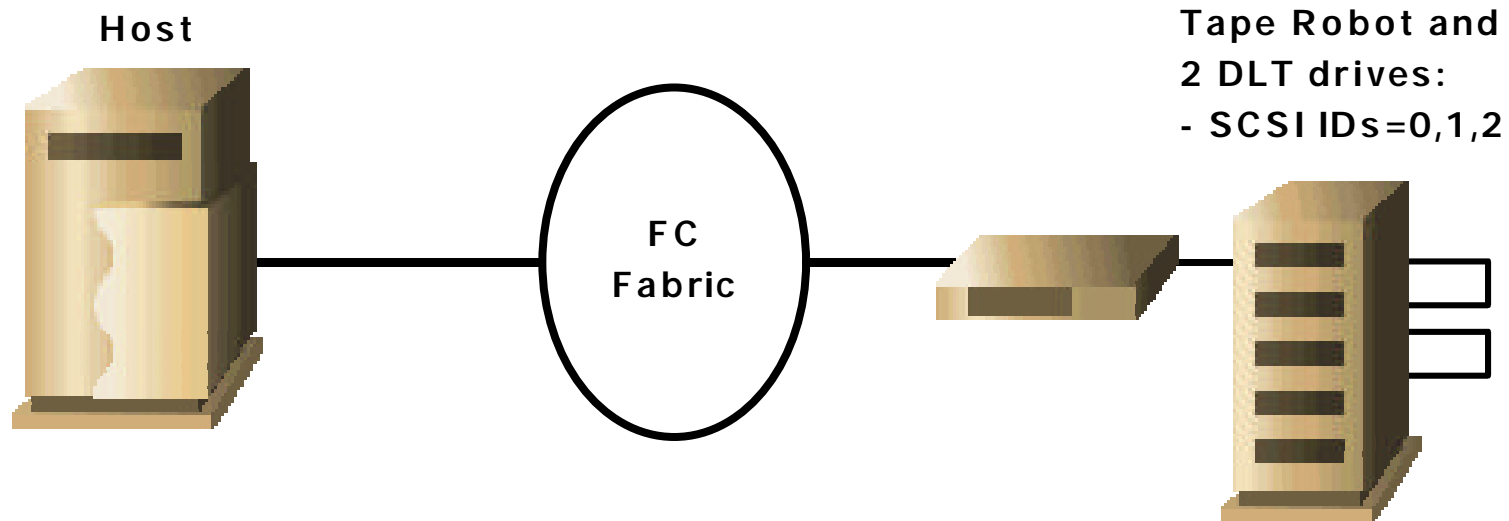
Version: 2.1 9808h

- 1) Baud Rate Configuration
  - 2) Fibre Channel Configuration
  - 3) SCSI Configuration
  - 4) Ethernet Configuration
  - 5) Fibre Channel to SCSI Mapping Configuration
  - 6) SCSI to Fibre Channel Mapping Configuration
  - 7) Trace Settings Configuration
- 
- A) Save Configuration
  - B) Restore Last Saved Configuration
  - C) **Reset Configuration to Factory Defaults**
- 
- X) Return to main menu

- Option C
  - Resets to factory defaults
    - IP 1.1.1.1
    - Trace Level 0
    - SCSI Initiator ID 7
    - No SCSI target
    - Addressing = auto-assigned
    - Serial port 9600
    - WWN and MAC set to OUI



# FC Initiator Configuration



- Fabric can be point-to-point, hub or a switch
- SCSI is self-negotiating for fast, wide, Ultra
  - SE or Differential must be specified at order time
- Router can be in the middle or the end of bus



# FC Initiator Config Cheat Sheet

- Main Menu: Option 1 for Configuration
- Configuration Menu Items 1, 3, 4, 6, & 7 are assumed to be factory defaults. Use RESET TO FACTORY DEFAULTS if you are unsure
- Set Hard ALPA to YES in FC Configuration (Option 2)
- Set ALPA value to unique number on FC-AL
  - JNI, Qlogic: use high value
    - EF = SCSI ID 0
    - E8 = SCSI ID 1
    - E4 = SCSI ID 2
  - Emulex: use low value
    - 00 = SCSI ID 0
    - 01 = SCSI ID 1
    - 02 = SCSI ID 2

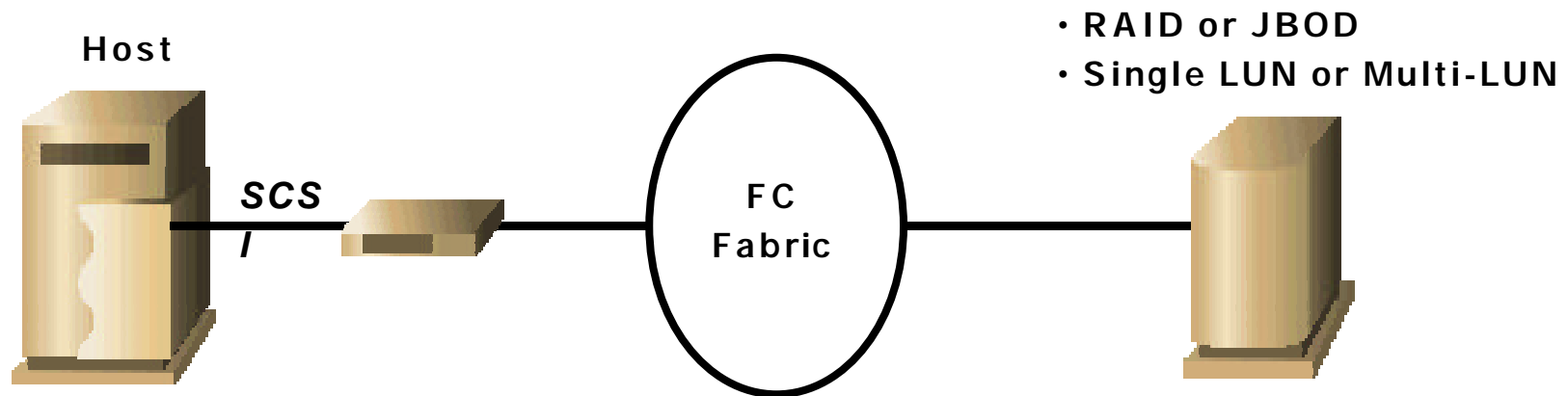


# FC Initiator Config Cheat Sheet

- Go to Option 5: FC to SCSI Mapping Configuration
- Option 1 or 2: display attached SCSI devices shows INQUIRY data and BUS:TGT:LUN triplet
- Set Mapping Mode
  - Auto-assigned discovers SCSI devices and builds map in RAM at boot time after every boot
  - Indexed saves map in flash, and doesn't change, even though the bus config might
  - SCC mode is rarely used
    - Uses supplied HBA driver
- Save Configuration, and reboot device
- Reboot host to force device discovery
- Check SCSI Applet in Control Panel for devices, or check with UNIX commands such as mt



# FC Target Configuration



- Fabric can be a hub or a switch
- SCSI is self-negotiating for fast, wide, Ultra
  - SE & Differential must be specified at order time
- Router can either in the middle or the end of bus
- **The trick is knowing the Destination\_IDs of the target devices**



# FC Target Cheat Sheet

- Leave options 1, 2, 4, 5, 7 at factory defaults
- Go to SCSI Configuration (Option 3)
- Add a Target ID for each FC device attached to the router
  - these are the IDs the router will respond on behalf of, or “fake” IDs
- Set Initiator ID
  - it must match one of the “fake” IDs set above
- If there is only one FC target attached to the router, it is required that it be assigned to the same SCSI Target ID as the Initiator ID
- Turn off SCSI bus reset on boot

(cont.)



# FC Target Cheat Sheet (cont.)

- Select SCSI to FC Mapping Configuration (Opt. 6)
  - Select option 2: Display Attached FC Devices
  - Verify that all FC targets and LUN's have been discovered during FC discovery (which is performed at boot time)
  - Fill the address map
    - The map can be filled using one SCSI target per FC device (Port ID) or sequential devices per target
  - Select option 5: Show/Edit SCSI to Fibre Channel Map to verify that the device map has been filled correctly
- Save the configuration
- Reboot the router
- Reboot the host to initiate SCSI device discovery



# FC Target Mode Configuration

## Configuration Menu

Version: 2.1 9808h

- 1) Baud Rate Configuration
- 2) Fibre Channel Configuration
- 3) **SCSI Configuration**
- 4) Ethernet Configuration
- 5) Fibre Channel to SCSI Mapping Configuration
- 6) SCSI to Fibre Channel Mapping Configuration
- 7) Trace Settings Configuration
  
- A) Save Configuration
- B) Restore Last Saved Configuration
- C) Reset Configuration to Factory Defaults
  
- X) Return to main menu

## SCSI Configuration Menu

Version: 2.1 9808h

Initiator SCSI ID: 1

Target SCSI ID(s) : 1 2

Reset SCSI bus on boot: No

1. Change Initiator SCSI ID
2. Add Target SCSI ID
3. Remove Target SCSI ID
4. Toggle SCSI Reset Operation





# FC Target Mode Configuration

## Configuration Menu

Version: 2.1 9808h

- 1) Baud Rate Configuration
- 2) Fibre Channel Configuration
- 3) SCSI Configuration
- 4) Ethernet Configuration
- 5) Fibre Channel to SCSI Mapping Configuration
- 6) **SCSI to Fibre Channel Mapping Configuration**
- 7) Trace Settings Configuration
  
- A) Save Configuration
- B) Restore Last Saved Configuration
- C) Reset Configuration to Factory Defaults
  
- X) Return to main menu

## SCSI to Fibre Channel Configuration Menu

Version: 2.2 9910k Link Up

- 1) Initiate FC Discovery
- 2) Display Attached FC Devices
- 3) Fill, One Device/Target
- 4) Fill, Sequential FC Devices
- 5) Show/Edit SCSI to Fibre Channel Mapping Table
- X) Return to Previous Menu



# FC Target Mode Configuration

SCSI to Fibre Channel Configuration Menu  
Version: 2.2 9910k Link Up

- 1) Initiate FC Discovery
  - 2) Display Attached FC Devices
  - 3) Fill, One Device/Target
  - 4) Fill, Sequential FC Devices
  - 5) Show/Edit SCSI to Fibre Channel Mapping Table
- X) Return to Previous Menu

Command > 2

PORT NO.	WWN	LUN	STAT	VENDOR	PRODUCT
0x0000EF	0x21000020 0x37008470	000	UP	SEAGATE	ST39102FC

Press any key to continue:



# FC Target Mode Configuration

**Command > 3**

**SCSI to Fibre Channel Configuration**

**Version: 2.2 9910k Link Up**

- 1) Initiate FC Discovery**
- 2) Display Attached FC Devices**
- 3) Fill, One Device/Target**
- 4) Fill, Sequential FC Devices**
- 5) Show/Edit SCSI to Fibre Channel Mapping Table**
  
- X) Return to Previous Menu**



# FC Target Mode Configuration

Command > 5

SCSI to Fibre Channel Mapping Table

Version: 2.2 9910k Link Up

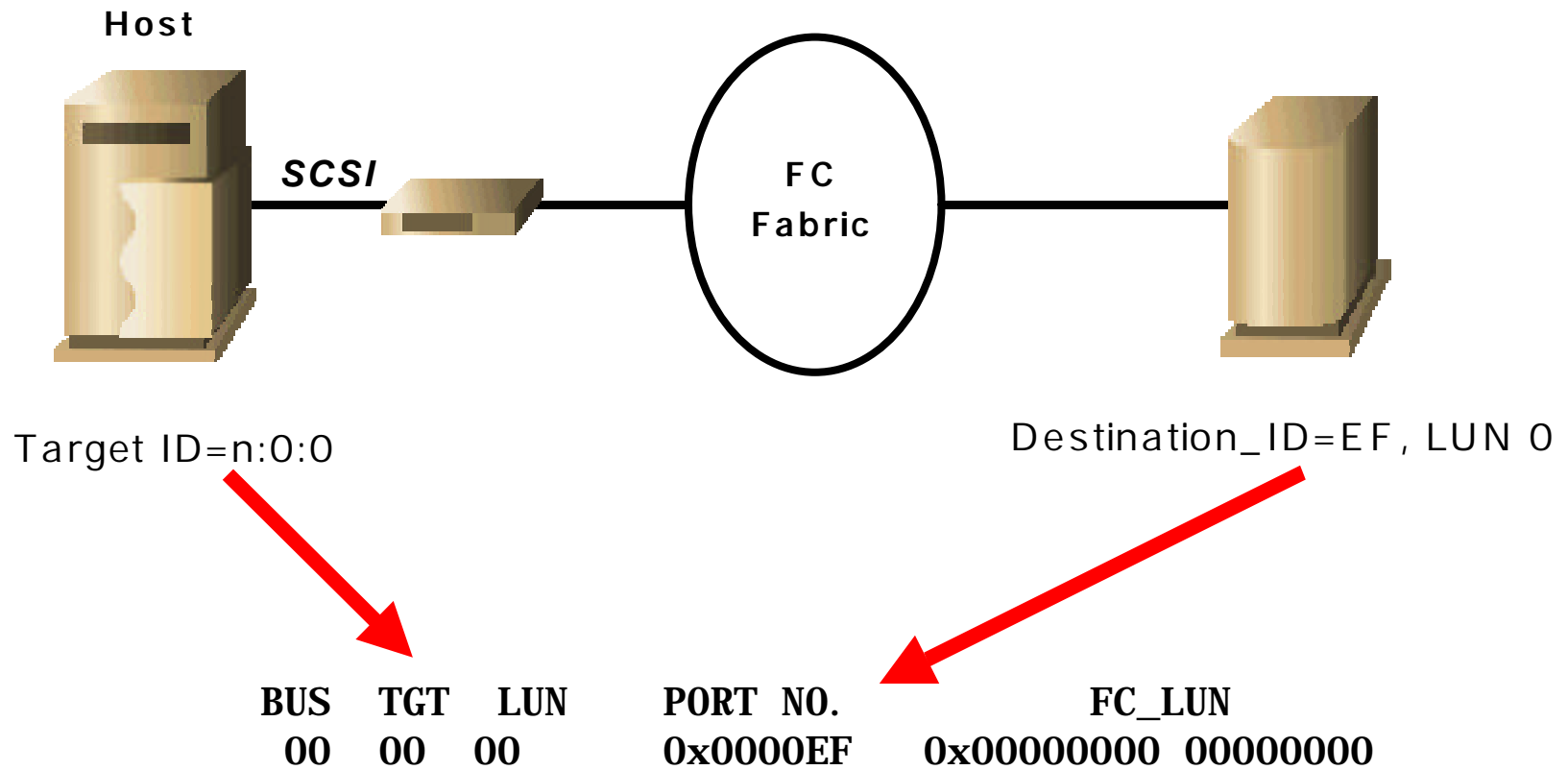
SCSI Bus/Tgt/Lun = 0/0/XX

BUS	TGT	LUN	PORT NO.	FC_LUN	WWN	STAT
00	00	00	0x0000EF	0x00000000 0x00000000	0x21000020 0x37008470	UP

Enter LUN entry to change, X to exit, <enter> for more >



# Putting It All Together





# Management Operations

- Download Firmware Image
- Attached Devices Discovery
- SCSI Override Table
- SNMP
- Trace Dumps
- Troubleshooting



# Updating Firmware

- Get download image from your source
- Ensure previous settings are recorded
- Go to Main Menu, Option 5 - Download New Firmware
  - Reboot is automatic at end of download
- HyperTerminal instructions:
  - Transfer... , Send... , <file name> , Protocol... , XMODEM
  - Click SEND button
- After download and reboot, check configuration settings to ensure that they did not change



# Attached Devices Discovery

- Configuration Menu Option 5: FC to SCSI Configuration Menu
  - Select Options 1, 2, or 3
  - Router queries bus and displays attached devices
  - Returns the following:

**Currently Attached Devices  
Build Level 9808h**

<b>BUS</b>	<b>TGT</b>	<b>LUN</b>	<b>Device Description</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>STK9730</b>
<b>0</b>	<b>1</b>	<b>0</b>	<b>DLT7000</b>
<b>0</b>	<b>2</b>	<b>0</b>	<b>DLT7000</b>





# SCSI Override Table

- Allows operation of devices with special needs
  - Vendor unique commands
  - Can't deal with negotiation
- Press ESC , then 1 while in the Configuration Menu
  - Could cause HyperTerminal to end, or weird window look
    - Exit out and restart session
- Table has each target ID and its status
  - Asterisk (\*) next to ID means there is an override set for that target
- Options are to toggle:
  - CDB length for vendor unique command groups
  - Wide and synchronous negotiation
  - Unique commands table



# SNMP Overview

- MIB-2 Compliant
- Uses Private, or Enterprise, MIB
- Standard FC MIB under construction
  - FC Interconnect and FC Fabric
  - Working drafts available from IETF FC Group
- SNMP Settings are under Option 4 of the Configuration Menu
  - SNMP Management Station IP address
  - Community names
  - Trap enable and disable, and the reporting priorities



# Storage Router SNMP

- All functions of serial port available through SNMP
- Traps defined to date:
  - Power-on
  - Mismatched community names
- ConfigCommit will save configuration changes
- EnableReset will cause boot of unit
- N\_Port stats and SCSI stats are available using GETs



# SNMP Configuration

**Configuration Menu**  
Version: 2.1 9808h

- 1) Baud Rate Configuration
  - 2) Fibre Channel Configuration
  - 3) SCSI Configuration
  - 4) **Ethernet Configuration**
  - 5) Fibre Channel to SCSI Mapping Configuration
  - 6) SCSI to Fibre Channel Mapping Configuration
  - 7) Trace Settings Configuration
- 
- A) Save Configuration
  - B) Restore Last Saved Configuration
  - C) Reset Configuration to Factory Defaults
- 
- X) Return to main menu

**Ethernet Configuration Menu**  
Version: 2.2 9910k Link Up

Current Ethernet Configuration:

Ethernet Physical Address : 00:E0:02:00:29:BE  
IP Address : 1.1.1.1  
Subnet Mask : 255.255.255.0  
Hostname : 4200  
IP Gateway :

- 1) Change Ethernet Physical Address
  - 2) Change IP Address
  - 3) Change IP Subnet Mask
  - 4) Change SNMP Settings
  - 5) Change Security Settings
  - 6) Change IP Gateway
  - 7) Change Hostname
- 
- X) Return to previous menu



# SNMP Configuration

## Ethernet Configuration Menu

Version: 2.1 9819c Link Down

### Current Ethernet Configuration:

Ethernet Physical Address:  
00: E0: 02: 01: 07: 00

IP Address : 208.24.132.177

Subnet Mask : 255.255.255.0

- 1) Change Ethernet Physical Address
  - 2) Change IP Address
  - 3) Change IP Subnet Mask
  - 4) Change SNMP Settings
  - 5) Change Security Settings
- X) Return to previous menu

## SNMP Configuration

Version: 2.2 9910k Link Up  
Current SNMP Configuration:

Community Name for GET: public  
Community Name for SET: private  
Traps are disabled

- 1) Change Community Name for GET
  - 2) Change Community Name for SET
  - 3) Toggle Trap
- X) Return to previous menu



# Storage Router Troubleshooting

- Back Panel Indicators
  - Fault LED: i960 failure
  - Solid SCSI LED: bus hung
    - Check device, addresses, converters, terminators, cables
  - Blinking FC and SCSI LEDs during operation is **GOOD!**



# Trace Dumps

- Trace Dump Levels: Option 7 on Configuration Menu
  - Level 0: errors and exceptions
    - EX: "Bridge time out on SCSI req 0,0,0, check cable"
    - **SHOULD ALWAYS BE ON!**
  - Level 1: Fibre Channel routines
    - FC Login Sequence
  - Level 2: Router routines
    - Targets and AL-PA mappings displayed
  - Level 3: SCSI routines
    - Commands and targets listed



# Trace Dump Settings

**Configuration Menu**  
Version: 2.1 9808h Link Up

- 1) Baud Rate Configuration
- 2) Fibre Channel Configuration
- 3) SCSI Configuration
- 4) Ethernet Configuration
- 5) Fibre Channel to SCSI Mapping Configuration
- 6) SCSI to Fibre Channel Mapping Configuration
- 7) **Trace Settings Configuration**
- A) Save Configuration
- B) Restore Last Saved Configuration
- C) Reset Configuration to Factory Defaults
- X) Return to main menu

**Trace Settings**  
Version: 2.2 9910k Link Up

Level 0 : ON	Level 1 : ON
Level 2 : OFF	Level 3 : OFF
Level 4 : OFF	Level 5 : OFF
Level 6 : OFF	Level 7 : OFF

U) Update Current Operating Trace Levels  
X) Return to previous menu

Enter trace level to change >





# Trace Dump Display

## Crossroads Systems 4100

### Configuration

Version: 2.1 9808h

- 1) Perform Configuration
- 2) Display Status of Power-on Self Test
- 3) Display Trace and Assertion History
- 4) Reboot
- 5) Download a New Revision of The Firmware

## Trace Dump Menu

Version: 2.2 9910k Link Up

- 1) Display trace for current boot cycle
- 2) Display trace from previous boot cycle
- 3) Display trace from last assertion failure
- 4) Display history of assertion failures
- 5) Clear current trace buffer
- 6) Arm assert buffer lock
- 7) Clear assert buffer lock
  
- X) Return to previous menu



## Trace Dumps (cont.)

- HyperTerminal Setup for capturing dumps:
  - Set 115200 data rate so no data is lost
  - Use TRANSFER... , CAPTURE... to ensure that all data is captured
  - Use plain .TXT file for most dumps
  - If necessary, use MS-Word to highlight areas of concern
- Ensure Levels 0-3 are turned on for tracing
  - Turn off 1-3 after trace to avoid performance hit!
- When possible, clear dump logs or start from a fresh boot
- Send to techsupport@crossroads.com



# Host Side Troubleshooting

- NT
  - Event logs, boot logs, EXACT application error messages
  - HBA type and driver level
  - Registry settings for FC HBA
  - Router trace dump
- Send to [techsupport@crossroads.com](mailto:techsupport@crossroads.com)
- Tip: ensure that ALPA-LUN<->SCSI B:T:L mapping is supported by application
  - Example: some HBAs will map ALPA 0xEF to SCSI 5:2:1, which is probably unreachable by the application



# Host Side Troubleshooting

- Unix
  - Boot logs from `/var/adm/messages`
  - Exact application error messages
  - HBA type and driver level
  - `st.conf` file from `/kernel/drv` for tape drives
  - `???.conf` file from `/kernel/drv` for FC HBA
  - Router trace dump
- Send to `techsupport@crossroads.com`
- Tip: ensure that ALPA-LUN $\leftrightarrow$ SCSI B:T:L mapping is supported by application
  - Example: some HBAs will map ALPA 0xEF to SCSI ID 125, which is probably not in the default `st.conf` file



# Fibre Channel and SCSI Resources

- ANSI T11 Committee - Fibre Channel
  - [www.t11.org](http://www.t11.org)
- ANSI T10 Committee - SCSI
  - <http://www.symbios.com/t10/>
- ENDL Publications - Bench References
  - <http://www.rahul.net/endl/index.html>
- Crossroads Systems
  - <http://www.crossroads.com>
  - Tech Support: 512-794-2771