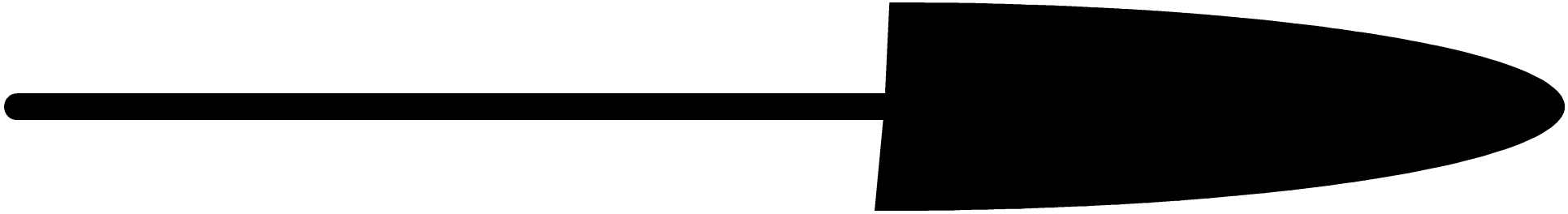

Managed, Digital Fibre Channel Hub

LH5000 Training

Training Peter Höhl

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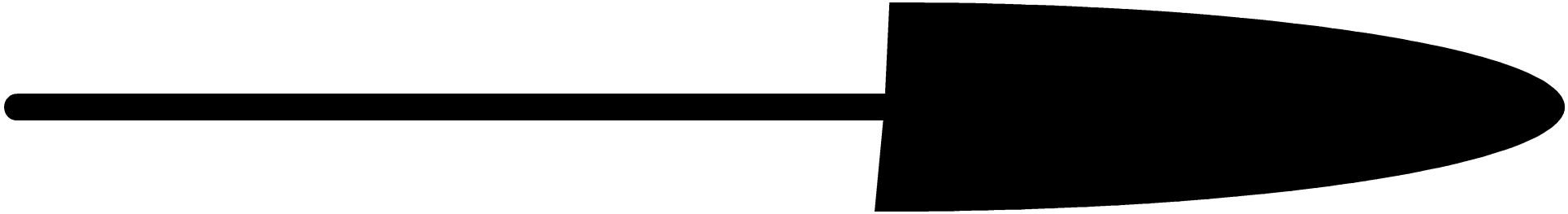
Agenda

- Fibre Channel Overview
- Why Loop Management
- Digital Hub - LH5010
- Management Module
- Hub Installation
- Troubleshooting Fibre Channel



Managing Fibre Channel Loops

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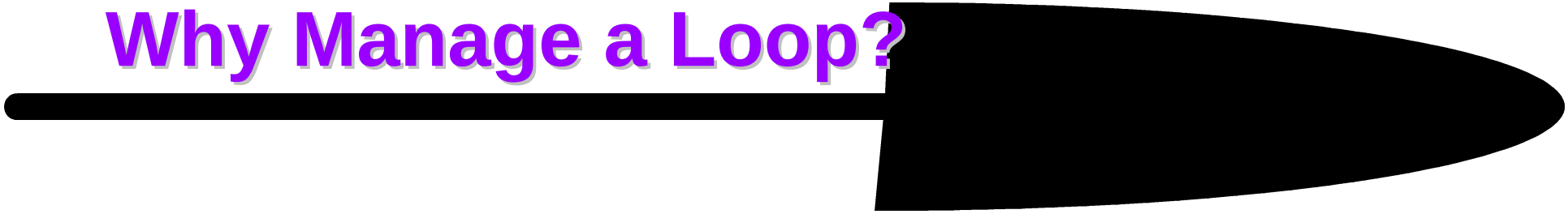
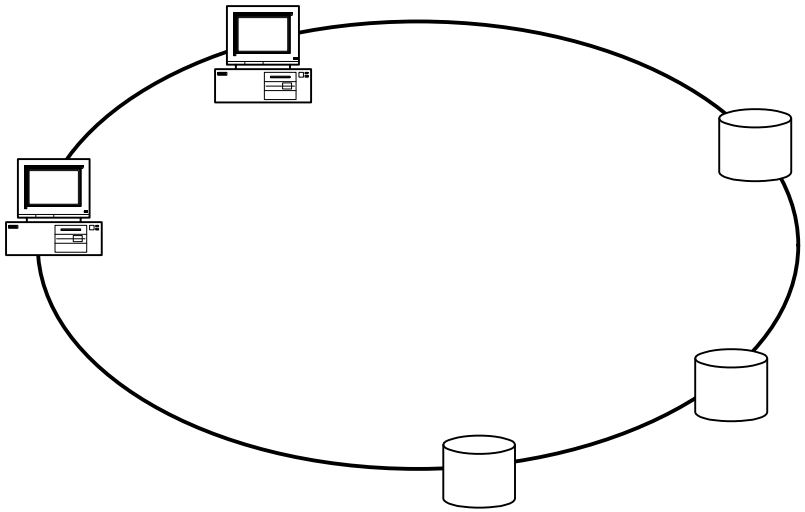
Why Manage a Loop?



- **Stability**
- **Performance**
- **Security**

Loop Physiology



- Shared Physical Medium
- All Devices act as Peers
- Each Device Analyzes and Acts on Every Piece of Information

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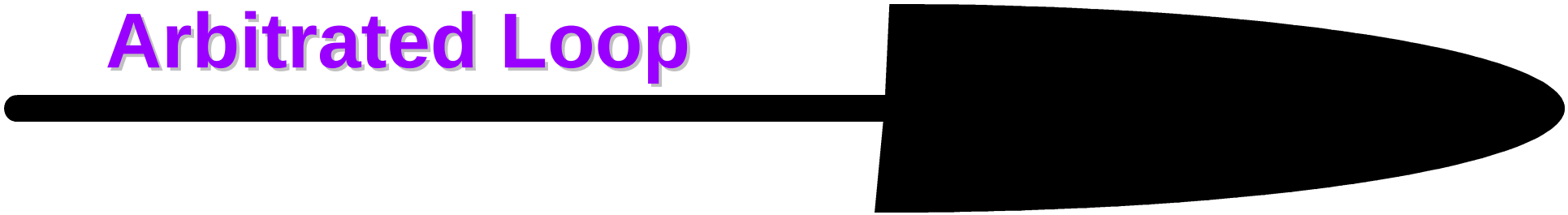
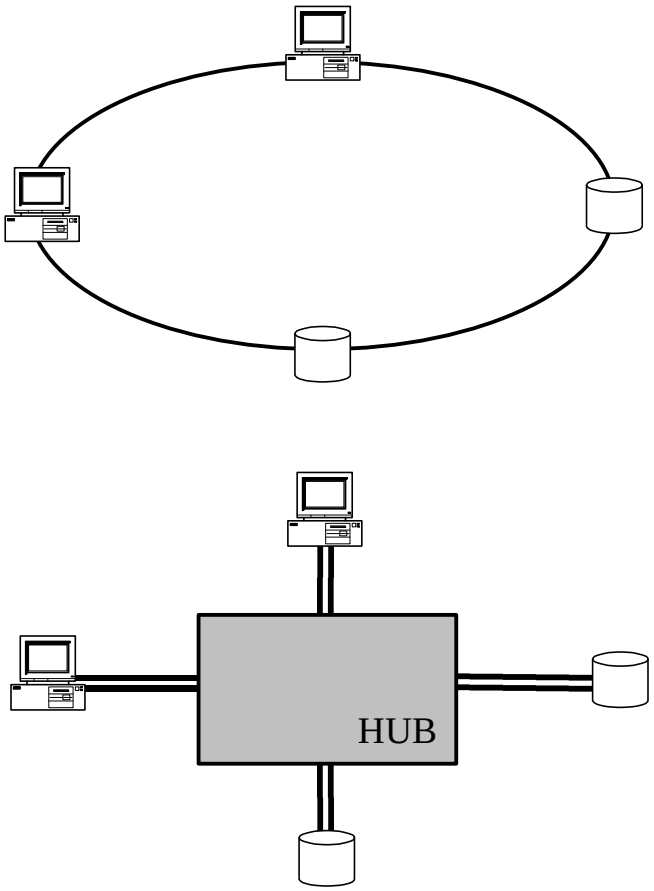
Arbitrated Loop



- Advantages
  - **Inexpensive**
  - **Supports virtually all available FC components**

- Disadvantages
  - **Shared Bandwidth**
  - **Break in physical media can affect all devices on loop**
  - **Errors or fault conditions are propagated throughout the loop**

The Role of the Hub



- Provides easy to manage star topology
- Cable breaks do not affect overall loop operation
- Devices easily added or removed
- Provides a central point of management

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Making Loops Robust

- **Problem Areas Today**
  - **Cascading of hubs increases signal jitter and induces errors**
  - **Frequent LIP's degrade performance**
  - **A single faulty port can make entire loop unusable**
  - **No way to isolate errors or faults to the offending device**

Eliminating Signal Jitter

- **Problem**
  - **Jitter is incurred any time a signal passes through physical media such as cables, connectors, circuit boards etc...**
  - **Existing analog repeater technology cannot eliminate jitter resulting in accumulated signal degradation through each hub port in a cascade configuration**
- **Solution**
  - **Digital hubs use digital technology and elastic buffers to regenerate signal and eliminate jitter**
- **Result**
  - **Unlimited cascading is possible with no signal degradation**

Controlling LIP's

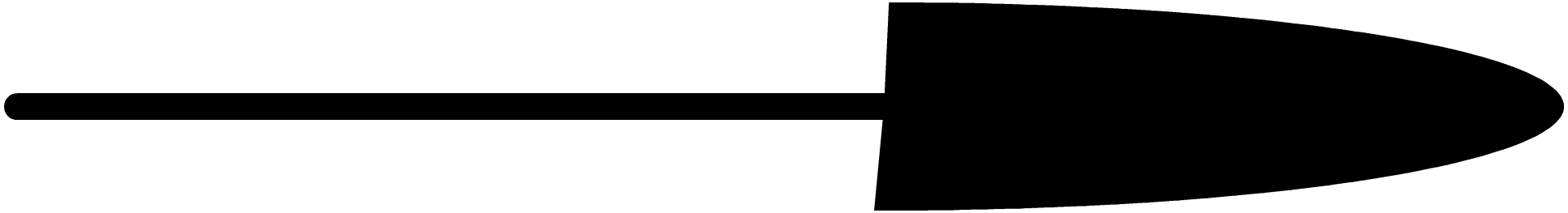
- **Problem**
  - **LIP's (calls for the loop to re-initiallize using the Loop Initialization Procedure) are made by devices under certain defined error conditions**
  - **LIP's ensure that all devices on loop are aware of all other devices on the loop, but LIP's take time**
  - **Some legacy devices produce numerous LIP's**
- **Solution**
  - **Digital hub technology can bypass unnecessary LIP's and shield downstream devices from LIP generating faults**
- **Result**
  - **Maximum feasible loop performance maintained**

Avoiding Loop Downtime

- **Problem**
  - **LIP F8 characters are generated by devices seeing faulty signal**
  - **LIP F8's flood the loop blocking valid traffic**
- **Solution**
  - **New hub technology can bypass ports generating LIP F8's until the problem is resolved**
- **Result**
  - **Loop integrity is maintained allowing valid traffic to continue**

Isolating Faults in the Loop

- **Problem**
  - **Because every device repeats characters given it, faults are difficult to isolate to the offending device so that it can be reconfigured, repaired or replaced**
- **Solution**
  - **New managed hubs collect data on a per-port basis, allowing administrators to quickly see which ports are generating errors.**
- **Result**
  - **Faults can be quickly isolated to offending device allowing quicker resolution and increased uptime.**



Emulex

LH5000 Hub

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LH5000 Digital Arbitrated Loop Hub

A New Standard for Arbitrated Loop Management

- The Only Digital Re-timing Hub
- Highest Port Density Available
- Zero Signal Jitter
- Loop Integrity Features
- Management via
  - Web Browser
  - SNMP
  - Telnet/Console

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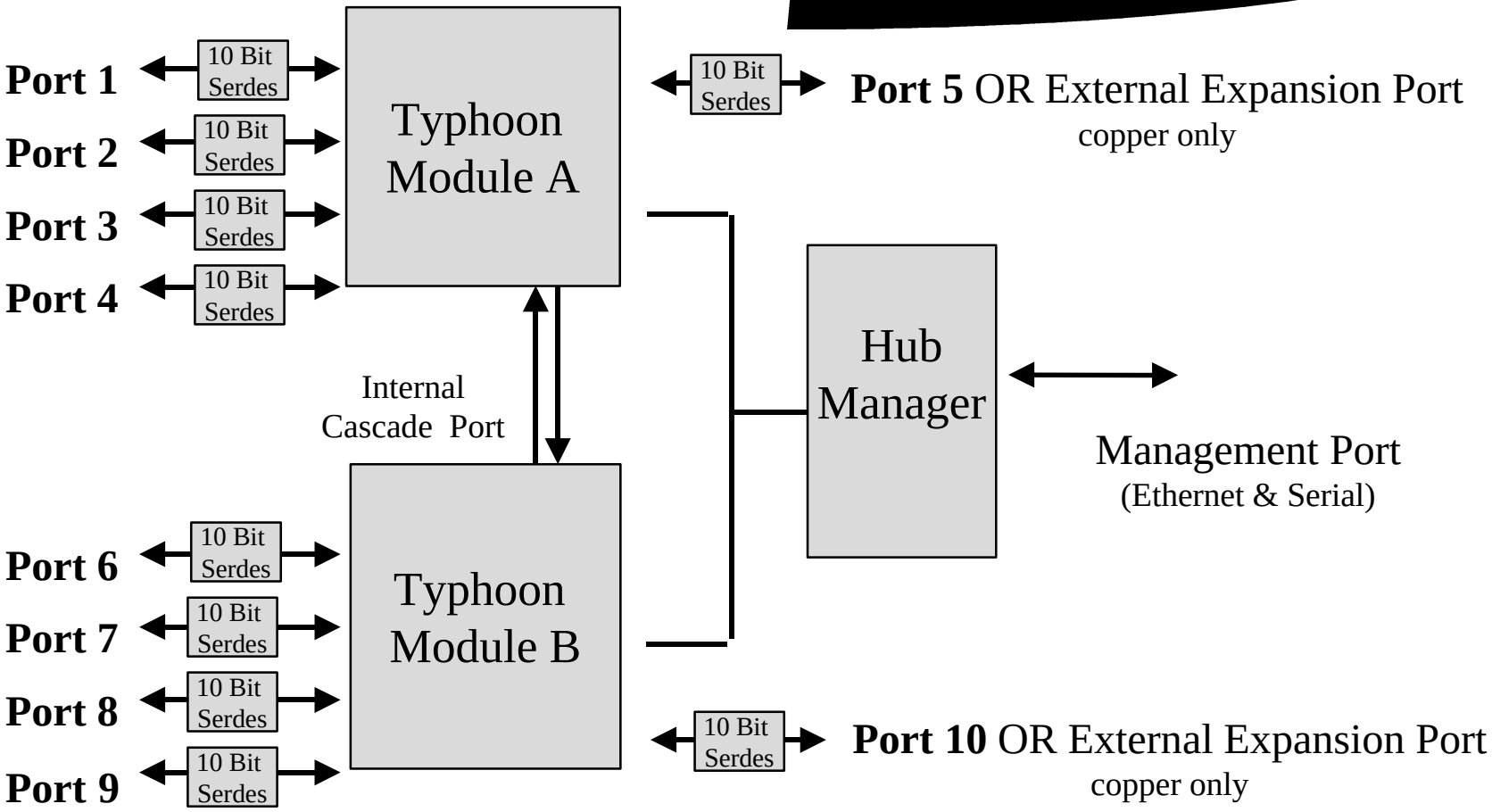
LH5000 - Architecture



Why Digital?

- Eliminates signal jitter
- Allows additional loop integrity features
  - LIP insertion/deletion
  - Clock balancing
  - Word fill
- Allows signal monitoring
  - Error conditions
  - Bit error reporting
  - Signal quality
  - Usage statistics

LH5000 is the only digital re-timing hub to include the elastic buffer necessary to be fully re-timing

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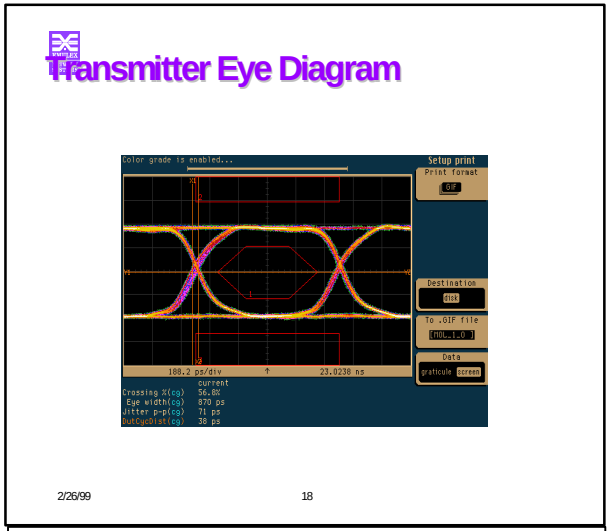
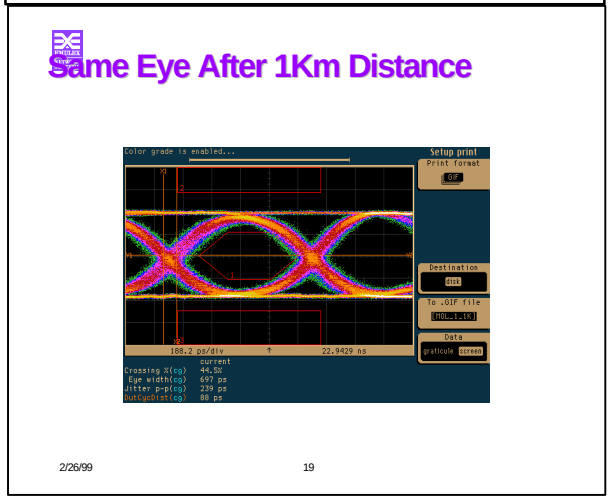
Jitter Eye Patterns





- Jitter is incurred any time a signal passes through physical media such as cables, connectors, circuit boards, etc..
- Types of Jitter
  - Random Jitter (noise)
  - Deterministic Jitter (pattern dependent)
- Reaction of devices to jitter
  - Jitter transfer
  - Jitter generation
- Port hardware types
  - retimer (no jitter transfer)
  - Repeater (both types of jitter)

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LH5000 - Configuration

- **Two Models**
  - **DB9 -** Ten Port All Copper
  - **GBIC -** Eight GBIC Ports Plus Two Copper Ports
- **Highest Density Hub in Industry**
  - **20 Ports in a 19” Rack**
    - **1U half rack modular design**
    - **10 ports (9 1/2” wide - 1/2 rack)**
      - Front Access - 8, Rear Access - 2
    - **20 ports in a 19” Rack**
      - Front Access - 16, Rear Access - 4

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LH5000 Features

- Jitterless transmissions
- Automatic Clock Speed Matching
- Limitless Cascading
- Programmable Automatic LIP Generation
  - *upon port insertion*
- Programmable Lip F8 bypass
  - *Retains loop operation around faults*
- Character Validation
  - *Corrects invalid characters*
- Synchronous Cut-in/Cut-out
  - *Sends only complete FC words*

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LH5000 - Management Interface

- **3 Included management interfaces allow access from most user environments**
  - Command Line Interface (Direct RS232 console or Telnet connection)
  - Embedded Web Server (Allows management from any connected device running a Web Browser)
  - SNMP MIB (Allows the interface of any SNMP compliant management utility, i.e. HP-Openview)

Local Console Port

- RS232C
  - RJ12 to DB9 or DB25
  - Default Configuration (possible)
    - 9600 bps (2400, 4800, 192K)
    - 8 bits (6, 7)
    - None Parity (odd, even)
    - Remote Echo
    - Xon/Xoff (11/13)
    - Software I/O Flow Control ON
  - ANSI-type Terminal (soft copy)
- Command Line Interface
  - Commands (show, change, monitor, etc.)
  - ANSI Editing Keys (Arrow keys on PC)
- LOG-ON Process
  - # (Access)
  - Local > (CMDS)
  - SU (Super-user)

Remote Telnet Facility

- Log into Hub Manager via Ethernet/Telnet
- Uses same CLI commands, passwords, edit keys
- Only one concurrent console connection (local or remote)
- Limitations
  - Must have IP before logging on
  - Must log off before change of IP/System name (reboot)
  - No startup post results
- Log on Command
  > Telnet ___.___.___.___ (IP address)
  - Use remote echo

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Web Management

- DHub contains HTTP web server
- Displays HTML screens
- Supports most newer browsers (e.g. Netscape 3.x, Explorer 3.x)
- Available from Windows, Apple or Unix
- On Line help documentation
- Multiple clients concurrently
- Can be logically arranged in bookmarks
  - Create bookmark defaults to DHMXXXXXX (XXXXX = last 6 digits of MAC address) OR Network Name
- Log on process
  - Http://<IP address)

Interface Comparison

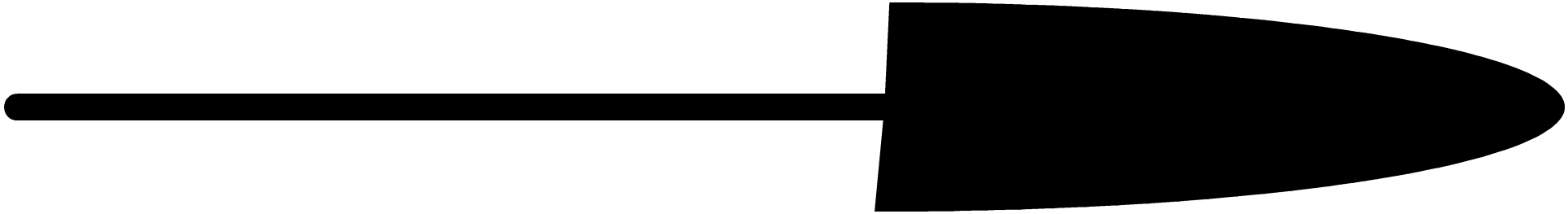
- Local Console
  - Advantages
    - No LAN required
    - Post diagnostics
    - No IP required
  - Disadvantages
    - Must have terminal
    - Must be local
    - CLI only
- Telnet
  - Advantages
    - Accessed from anywhere
    - No utility required (available on Windows)
  - Disadvantages
    - Need IP
    - Uses CLI
- Web Interface
  - Advantages
    - Available anywhere
    - Any browser
    - GUI interface
    - Familiar feel
    - On Line help
    - Auto Reload
    - Interface can be updated
  - Disadvantages
    - Need IP
    - No immediate post results

Digital Hub - Management Features

- **Programmable Port Characteristics**
  - **Forced port bypass**
  - **Bypass during error burst** ***(per port or global setting)***
  - **Bypass hysterisis** ***(per port or global setting)***
  - **Automatic LIP F8 bypass** ***(per port or global setting)***
  - **Automatic LIP insertion** ***(per port or global setting)***
- **Statistics on a Per Port Basis**
  - **Port bypass count**
  - **Bit error count / rate**
  - **Invalid transmission words**
  - **View loop status and event logs**

Digital Hub - Management Features

- **Hub Management**
  - **Configure as one 10-port or two 5-port loops**
  - **Set IEEE address or establish acquisition method**
  - **Provide device name**
  - **Set security passwords**
  - **View network status and event logs**
  - **Complete local of on-line help facilities**



LH5000 Installation

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Unpacking

- Contents LH5000
  - Hub
  - USA power cord
  - Manual / CD
  - RJ12 cable
  - DB9 connector
  - DB25 connector
  - Feet
- Options
  - LH5KIT
    - 4 nut retainers (clip on nuts, Tinnerman nuts)
    - 4 rack screws
    - 8 hub screws
  - LC200-E
    - Cascading Cable (.5 Meter)

Management Installation - Console

- Attach console cable
- Attach ANSI/soft copy compatible terminal
  - terminal
  - Hyperterminal
  - PC
  - Kermit PC
  - Tip, Unix
- Log on (can be changed)
  - # access
- Local >SU (allows changes)
  - password > system
- Set IP if needed

Management Installation - Telnet

- Attach LAN cable (10baseT)
  - LED green = power; yellow = LAN activity
- Configure IP
  - Local console
  - ARP/Ping (see attached)
  - Subsequently can configure for DHCP or BOOTP
- Use terminal on TCP LAN
  - Unix - most terminals automatically provide Telnet
  - PC - Use
- Telnet <IP address>
- Log on

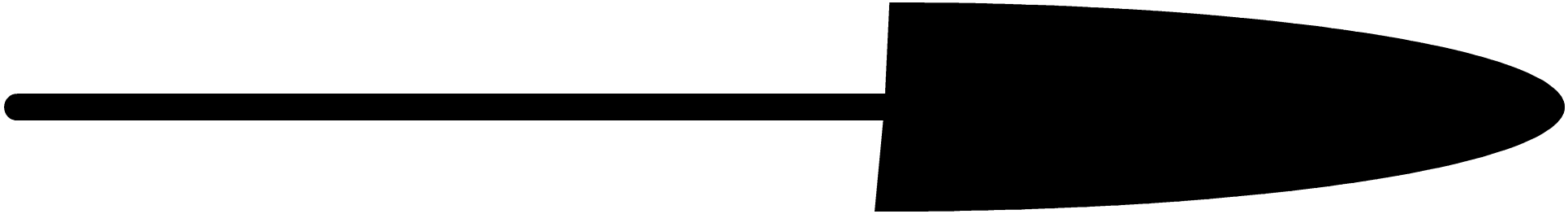
Management Installation -
Web Interface

- Attached LAN cable (10BaseT)
- Configure IP
- Select Browser
- HTTP://<IP address>
- Browse
- Password for changes:
  - SU (user name)
  - System (password)

  (once prompted will not ask again during same session)

Manager Updating

- Contains
  - Runtime firmware (aka software)
  - Loader diagnostic firmware
  - HTML pages
- Naming
  - Software/firmware combined (DHMFLASH.SYS)
  - HTML pages - DHMPAGE.SYS
- Load Method
  - TFTP
- Set Up
  - Web page will lead to reload
  - CLI Command
    - Change server load TFTP software <name>
    - Init
- Factory Default
  - Resets all manager and hub parameters; include IP address
  - Use button, web or CLI (init default)



Troubleshooting

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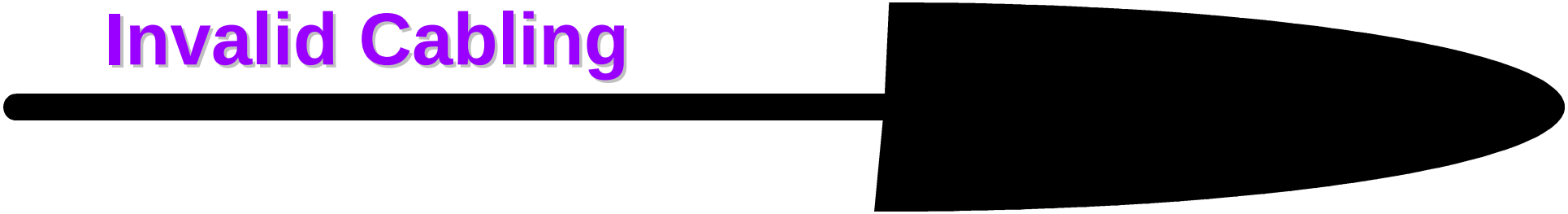
Common Physical Layer Problems

- Bad cable
  - Many I/O timeouts
  - Slow performance
  - Unstable link -- many LIPs
  - No Link LED indication (potentially on only one side of link)
- Loose MIA
  - Symptoms similar to bad cable
  - May happen if connector is not screwed down
- End device set for incorrect topology
  - Driver configured for point to point but connected to hub port

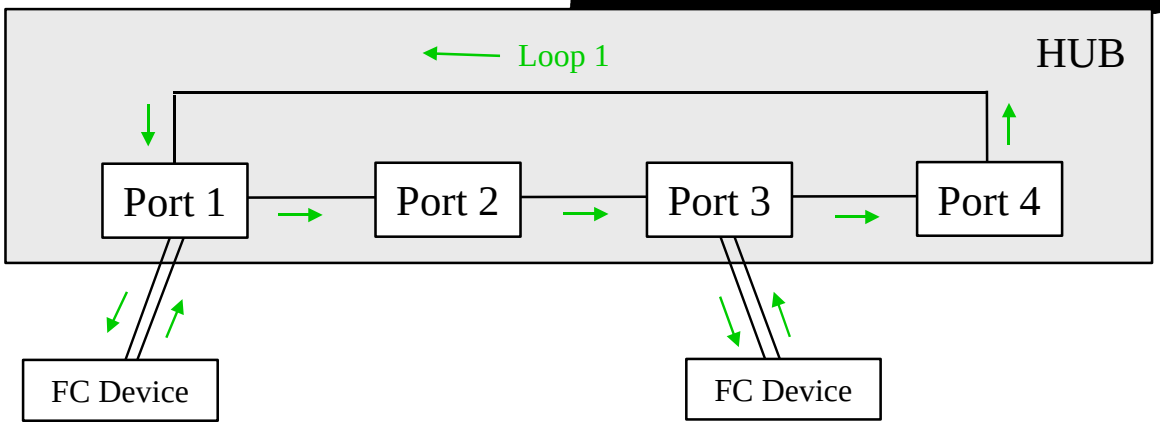
Invalid Cabling



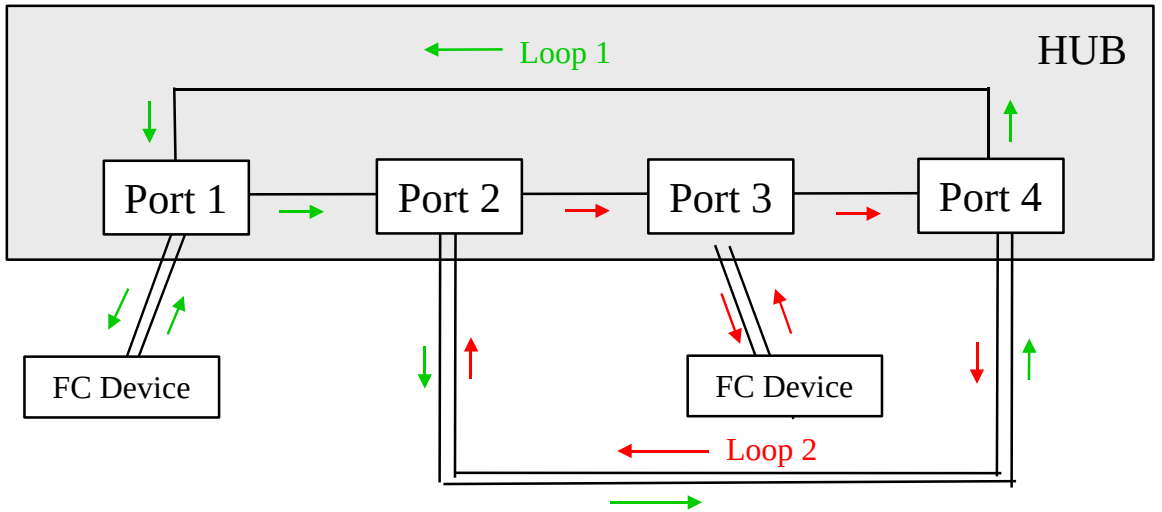
- Hub looped back to itself
  - Results in multiple loops within hub
  - Some ports cannot see other ports
- Invalid cascade configurations
  - Results in multiple loops between the hubs
  - Some ports cannot see other ports

Invalid Cabling

Correct



Incorrect



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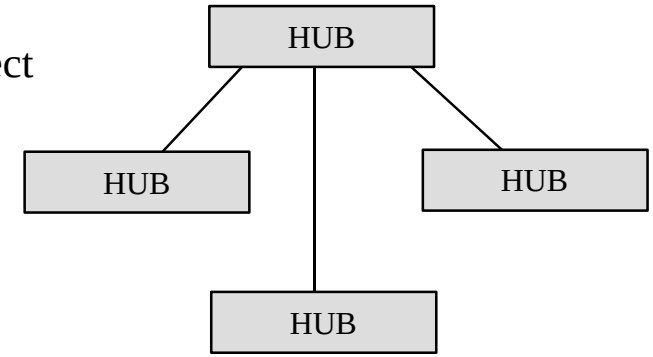
Invalid Cabling

Correct



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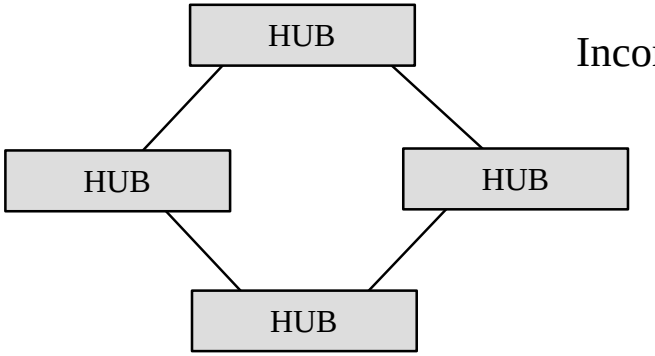

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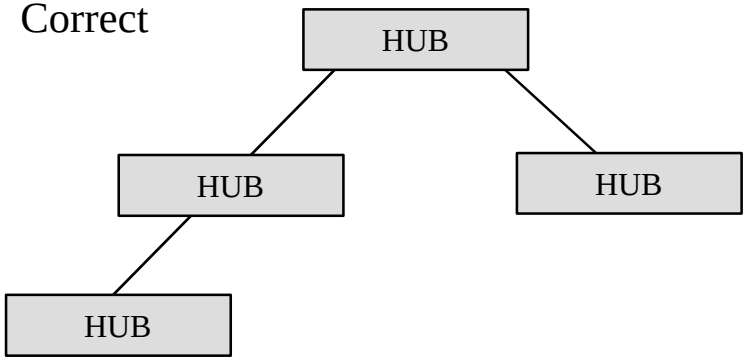

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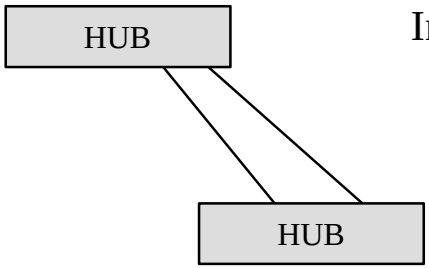

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Potential Problems and Resolutions

- LED does not turn from Amber to [illegible] plugged in
  - Bad Cable
    - Replace Cable
  - End Device is not functioning properly
    - Check status indicators or device management applications for end device to determine proper operation and configuration
  - End Device is not a loop device
    - Replace end device
  - End device set for incorrect topology
    - Reset Topology

Potential Problems and Resolutions

- **LED does not turn from Amber to Green when device is plugged in (Cont.)**
  - **End device is different speed than Hub**
    - **Replace or reconfigure end device**
  - **End device is broadcasting LIP F8's**
    - **Repair or replace bad cable**
    - **Repair or replace end device**
    - **Turn off LIP F8 Bypass Feature (LED will turn green, but Loop operation will be hampered)**

Potential Problems and Resolutions

- Neither Green nor Amber LED appears next to a port
  - The port is set as disabled by Hub Manager
    - Use Manager to return to enabled state
  - No GBIC, GBIC fault, or GBIC improperly seated
    - Add GBIC
    - Reseat or replace GBIC
  - The LED is not functioning
    - Return to factory for repair

Potential Problems and Resolutions

- Two Devices cannot see each ot[illegible] loop even though both have green LED's
  - Invalid Cabling
    - Correct the cabling error
  - Hub is set for "two separate 5-port hub" operation
    - Look for flashing power LED (Green LED on e-net conn.)
    - Use manager to change setting
    - Move devices onto same row of connectors
  - Device incompatibility
    - Replace or reconfigure end devices

Troubleshooting Tips

- **Isolating bad components**
  - **Insert Loopback in hub and see if LED turns Green**
  - **Insert Loopback in end devices and see if Loop goes active (indications vary by device)**
  - **Connect device to device without hub and see if they communicate**
  - **Swap components**
    - **Hub Ports**
    - **Cables**
    - **Host Adapters or other end device components (does problem follow a component as it moves)**

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Troubleshooting Tips

- Manager Unavailable
  - Console Port
    - Unit will print POST results and load status when reset or powered on
    - <esc> <esc> required to wake up com port for input
  - Ethernet
    - Look for blinking activity light (amber LED on e-net connector)
    - Use console port to test ping
    - Examine power on messages via console port for any POST failures
    - Delete IP entry from ARP table before assigning new IP address.

Emulex Technical Support

- How to contact us:
  - Phone: (800) 854-7112 or (800) 854-8270 (24 hr)
  - Fax: (714) 513-8269
  - e-mail: tech_support@emulex.com
  - Web: www.emulex.com
- What to prepare before you call:
  - Versions of all Emulex software and firmware
  - LED activity
  - Web access to status, properties, hub diagnostics

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