Objectives

- Identify characteristics of Ethernet networks.
- Identify straight-through, crossover, and rollover cables.
- Describe the function, advantages, and disadvantages of repeaters, hubs, bridges, switches, and wireless network components.
- Describe and differentiate between serial, Integrated Services Digital Network (ISDN), digital subscriber line (DSL), and cable modem WAN connections.
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CABLELING THE LAN

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LAN Physical Layer

Token Ring

FDDI

Data link Layer

IEEE 802.2

Ethernet

IEEE 802.3

10Base5

IEEE 802.3u

10Base2

10Base-T

10Base-F

100Base-TX

100Base-FX

Physical Layer
advantage or disadvantage comparisons concern

- Cable length
- Cost
- Ease of installation
- Susceptibility to interference
Ethernet In The Campus

- An Ethernet speed of 10 Mbps can be used at the user level to provide good performance.
- Fast Ethernet is used as the link between user and network devices.
- To enhance client-server performance across the campus network and avoid bottlenecks, Fast Ethernet can be used to connect enterprise servers.
- Fast Ethernet or Gigabit Ethernet, as affordable, should be implemented between backbone devices.
# Ethernet Media And Connector Requirements

<table>
<thead>
<tr>
<th>Media</th>
<th>50Ω thin-net</th>
<th>50Ω thick-net</th>
<th>UTP Cat 3,4,5</th>
<th>62.5/50 mul-fiber</th>
<th>Single-mode fiber</th>
<th>STP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. segment length</td>
<td>185m</td>
<td>500m</td>
<td>100m</td>
<td>??????</td>
<td>10Km</td>
<td>25m</td>
</tr>
<tr>
<td>Topology</td>
<td>Bus</td>
<td>Bus</td>
<td>Star</td>
<td>Star</td>
<td>Star</td>
<td>Star</td>
</tr>
<tr>
<td>Conn.</td>
<td>BNC</td>
<td>AUI</td>
<td>RJ-45</td>
<td>SC/MIC</td>
<td>ST</td>
<td>RJ-45</td>
</tr>
</tbody>
</table>
Connection Media

International Organization for Standardization (ISO) 8877
RJ-45 connectors and jacks are slightly larger than
RJ-11 phone connectors and jacks.

Attachment unit interface (AUI) connectors are data bus (DB-15).

Fiber Connector Port

10/1000 Mbps FAST ETHERNET SWITCHING MODULE
RJ-45 Plug
RJ-45 Jack

The jack is the female component in a network device, wall outlet, or patch panel.

Punch-down connections at the back of the jack where the Ethernet UTP cable connects.
UTP Implementation
Straight-through Cable

- Switch to router
- Switch to PC or server
- Hub to PC or server

Wires on cable ends are in same order.
Cross-over Cable

- Switch to switch
- Switch to hub
- Hub to hub
- Router to router
- PC to PC
- Router to PC

The orange wire pair and the green wire pair switch places on one end of the cable.
Repeater

A repeater receives a sig., regenerates it.

It can retime network signals at the bit level to allow them to travel a longer distance on the media.
Hubs

- **Passive**
  - A passive hub serves as a physical connection point only.
  - It does not manipulate or view the traffic that crosses it.
  - It does not boost or clean the signal.

- **Active**
  - It needs power to amplify the incoming signal before passing it out to the other ports.

- **Intelligent**
  - These devices basically function as active hubs
  - It also includes a microprocessor chip and diagnostic capabilities.

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Bridges
Switches

<table>
<thead>
<tr>
<th>Interface</th>
<th>MAC Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0</td>
<td>0260.8c01.1111</td>
</tr>
<tr>
<td>E0</td>
<td>0260.8c01.2222</td>
</tr>
<tr>
<td>E1</td>
<td>0260.ec01.3333</td>
</tr>
<tr>
<td>E1</td>
<td>0260.8c01.4444</td>
</tr>
<tr>
<td>0260.8c01.1111</td>
<td></td>
</tr>
<tr>
<td>0260.8c01.2222</td>
<td></td>
</tr>
<tr>
<td>0260.ec01.3333</td>
<td></td>
</tr>
<tr>
<td>0260.8c01.4444</td>
<td></td>
</tr>
</tbody>
</table>
Micro-segmentation

Before

Shared Segment

All Traffic Visible on Network Segment

After

LAN Switch

Multiple Traffic Paths within Switch
Peer-to-peer

- In a peer-to-peer network, networked computers act as equal partners, or peers
- Individual users control their own resources
- Peer-to-peer networks are relatively easy to install and operate
- As networks grow, peer-to-peer relationships become increasingly difficult to coordinate
Client/server

• network services are located on a dedicated computer called a server
• Servers are designed to handle requests from many clients simultaneously
• Data generated is easier to back-up and maintain
• Some disadvantages
  – It also incurs some costs.
  – The server introduces a single point of failure into the network.
  – Servers require a trained, expert staff to administer and maintain.
  – Server systems also require additional hardware and specialized software that add to the cost.
CABLING THE WAN
## WAN Physical Layer

<table>
<thead>
<tr>
<th></th>
<th>Cisco HDLC</th>
<th>PPP</th>
<th>Frame Relay</th>
<th>ISDN BRI (with PPP)</th>
<th>DSL Modem</th>
<th>Cable Modem</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA/TIA-232</td>
<td></td>
<td></td>
<td>RJ-45</td>
<td>ISDN BRI cable pinouts are different than the pinouts of Ethernet</td>
<td>RJ-11</td>
<td>BNC</td>
</tr>
<tr>
<td>EIA/TIA-449</td>
<td></td>
<td></td>
<td>RJ-45</td>
<td>ISDN BRI cable pinouts are different than the pinouts of Ethernet</td>
<td>RJ-11</td>
<td>BNC</td>
</tr>
<tr>
<td>X.21, V.24</td>
<td></td>
<td></td>
<td>RJ-45</td>
<td>ISDN BRI cable pinouts are different than the pinouts of Ethernet</td>
<td>RJ-11</td>
<td>BNC</td>
</tr>
<tr>
<td>V.35, HSSI</td>
<td></td>
<td></td>
<td>RJ-45</td>
<td>ISDN BRI cable pinouts are different than the pinouts of Ethernet</td>
<td>RJ-11</td>
<td>BNC</td>
</tr>
</tbody>
</table>

- The physical layer implementations vary depending on the distance of the equipment from the services, the speed and the type of service itself.
WAN Serial Connections

- WANs use serial transmission.
- Two of serial connections are a 60-pin connector and a more compact ‘smart serial’ connector.
- A device providing clocking rate is data communications equipment (DCE) and use a DCE cable.
- If the connection is made directly to a device that provides signal clocking, the router will be a data terminal equipment (DTE) and use a DTE serial cable.
it is necessary to determine whether DTE or DCE connectors are required.

DCE like CSU/DSU will perform signal clocking
Fixed Module Router
Module Router

Serial WAN ports can be modular.

Cisco 1603 Router--Rear View

Ethernet 10BASE-T ISDN BRI S/T
Ethernet AUI Console

Cisco 3640 Router--Rear View

Slot 3 Slot 2
Slot 1 Slot 0

WAN Interface Card

Module

Power Supply
Routers and ISDN BRI Connections

Determine if a BRI S/T or U interface is needed. Routers have one or both types of port.

Note Port Label

- Ethernet 10BASE-T
- ISDN BRI Port
- Console Port
Routers and DSL Connections

- The Cisco 827 ADSL router has one asymmetric digital subscriber line (ADSL) interface.
- To connect an ADSL line to the ADSL port on a router
Routers and Cable Connections

- Use the following steps to connect the Cisco uBR905 cable access router to the cable system:
  - Verify that the router is not connected to power.
  - Locate the RF coaxial cable coming from the coaxial cable (TV) wall outlet.
  - Install a cable splitter/directional coupler, if needed, to separate signals for TV and computer use.
  - Connect the coaxial cable to the F connector of the router. Hand-tighten the connector, making sure that it is finger-tight, and then give it a 1/6 turn with a wrench.
  - Make sure that all other coaxial cable connectors, all intermediate splitters, couplers, or ground blocks, are securely tightened from the distribution tap to the Cisco uBR905 router.
Setting up Console Connections

Device with Console

RJ-45-to-RJ-45 Rollover Cable

PC

RJ-45-to-DB-9 Adapter labeled TERMINAL

- PCs require an RJ-45 to DB-9 or RJ-45 to DB-25 adapter.
- COM port settings are 9600 bps, 8 data bits, no parity, 1 stop bit, no flow control.
- This provides out-of-band console access.
- AUX switch port may be used for a modem-connected console.
Summary

• Use a crossover cable to connect between two similar devices, such as switches, routers, PCs, and hubs.
• Use a straight-through cable to connect between different devices.
• WANs use serial data transmission. WAN connection types include ISDN, DSL, and cable modems.
• A router is usually the DTE and needs a serial cable to connect to a DCE device like a CSU/DSU.
• The ISDN BRI has two types of interfaces, S/T and U interfaces.
• Rollover cable is used to connect a terminal and the console port of an internetworking device.