Cabling LANs and WANs

CCNA 1 v3 – Module 5

Cabling the LAN

Each media has advantages and disadvantages:

- Cable length
- Cost
- Ease of installation
- Susceptibility to interference

The most common is **Category 5 UTP** cable

Ethernet is the most widely used LAN technology

- first implemented by the **DIX** (Digital, Intel, Xerox) group
- Used as basis for **IEEE 802.3** specification
  - **802.3u** Fast Ethernet
  - **802.3z** Gigabit Ethernet over Fiber
  - **802.3ab** Gigabit Ethernet over UTP

Ethernet

Ethernet technologies can be used in a campus network in several different ways:

- **10 Mbps** at the **user level** to provide good performance.
- **100 Mbps** for clients or **servers** that require more bandwidth.
- Fast or Gigabit Ethernet between **backbone** devices.

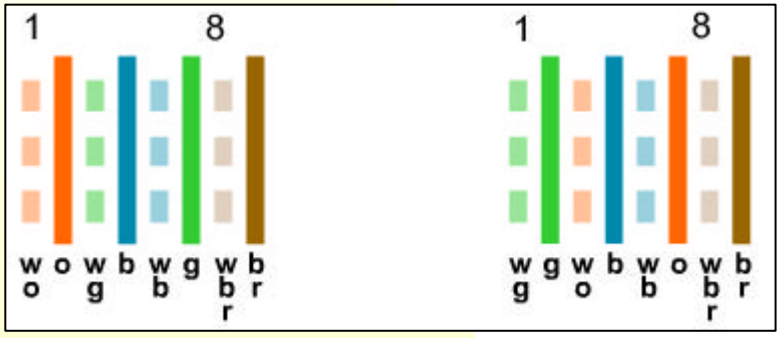
	10BASE2	10BASE5	10BASE-T	100BASE-TX	100BASE-FX	1000BASE-CX	1000BASE-T	1000BASE-SX	1000BASE-LX
Media	50-ohm coaxial (Thinnet)	50-ohm coaxial (Thicknet)	EIA/TIA Category 3, 4, 5 UTP, two pair	EIA/TIA Category 5 UTP, two pair	62.5/125 multimode fiber	STP	EIA/TIA Category 5 UTP, four pair	62.5/50 micro multimode fiber	62.5/50 micro multimode fiber; 9-micron single-mode fiber
Maximum Segment Length	185 m (606.94 feet)	500 m (1640.4 feet)	100 m (328 feet)	100 m (328 feet)	400 m (1312.3 feet)	25 m (82 feet)	100 m (328 feet)	275 m (853 feet) for 62.5 micro fiber; 550 m (1804.5 feet) for 50 micro fiber	440 m (1443.6 feet) for 62.5 micro fiber; 550 m (1804.5 feet) for 50 micro fiber; 3 to 10 km (1.86 to 6.2 miles) on single-mode fiber
Topology	Bus	Bus	Star	Star	Star	Star	Star	Star	Star
Connector	BNC	Attachment unit interface (AUI)	ISO 8877 (RJ-45)	ISO 8877 (RJ-45)	Duplex media interface connector (MIC) ST or SC connector	ISO 8877 (RJ-45)	ISO 8877 (RJ-45)	SC connector	SC connector

UTP implementation

- EIA/TIA specifies an **RJ-45** connector for UTP cable
- **RJ** stand for **Registered Jack**
- **45** refers to the specific **wiring sequence**
- A **transceiver** converts one type of connection to another

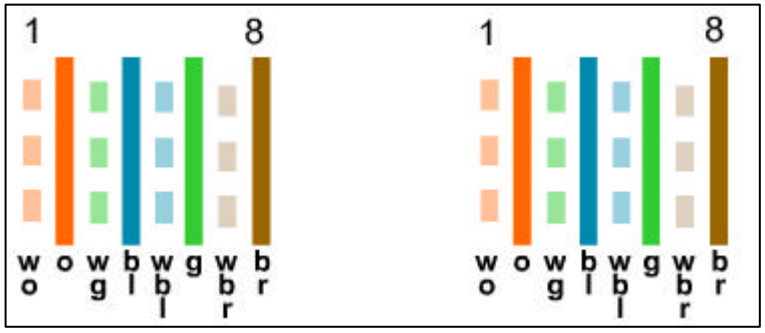
  Example: AUI to RJ-45, coax, or fiber optic connector

Crossover

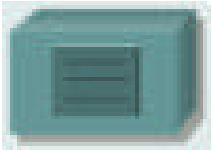


Switch to switch
Switch to hub
Hub to hub
Router to router
PC to PC
Router to PC

Straight-through



Switch to router
Switch to PC or server
Hub to PC or server
X to no X



Repeaters

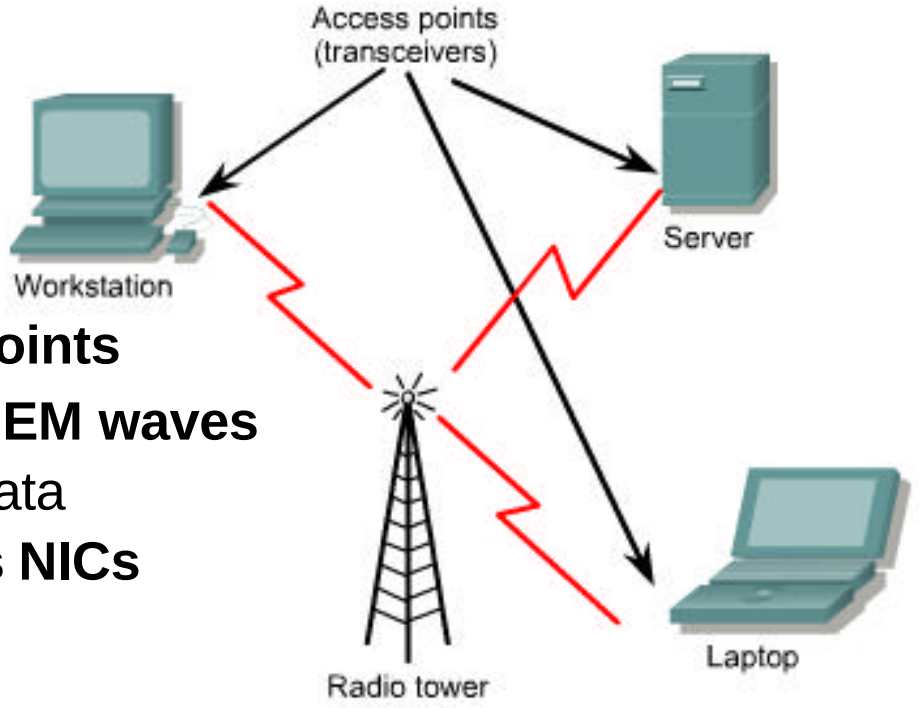
- A repeater **regenerates** and **retimes** network signals at the bit level to allow them to travel a **longer** distance
- 5-4-3 Rule for 10-Mbps Ethernet should be used to limit latency
- Too much latency on the LAN increases the number of **late collisions** and makes the LAN less efficient

Hubs

- Hubs are actually multiport repeaters
- Change the network topology from a linear bus to a star
- Three basic types:

1. **Passive** – no boost, no clean and no power
2. **Active** - needs power to amplify the incoming signal
3. **Intelligent (Smart)-** microprocessor chip and diagnostic capabilities

Wireless



Much less cabling

RF, **IR**, laser, satellite, microwaves

The only cabling can be to the **Access Points**

The **transmitter** converts source **data** to **EM waves**

The **receiver** converts waves back into data

All devices in WLAN must have **Wireless NICs**

IR weaknesses:

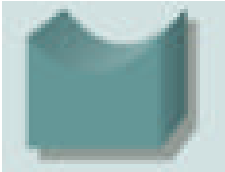
- '**Line of sight'** limitation (newer technologies combat this)
- **Signal weakening** or **obstruction** by people or humidity

RF technology works **between rooms** or even buildings

RF weaknesses:

- **Single frequency** is subject to outside **interference** and **obstructions**
- Single frequency is **easily monitored** by others making it **insecure**

FHSS and DSSS are **Spread Spectrum** technologies which **add security** and **immunity to noise** by using **multiple frequencies**



Bridges

Bridges and switches operate at the Data Link layer.
Destination MAC address is looked up in the bridge table to determine whether to filter, flood, or copy the frame onto another segment.

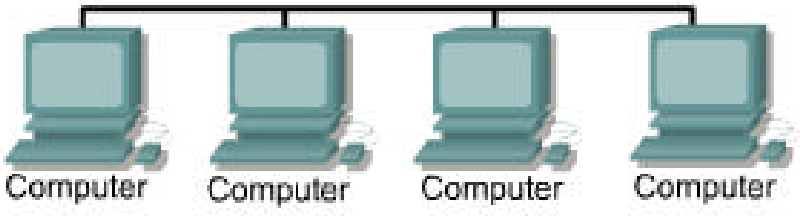
Switches

A switch has many ports with many network segments connected to them.
A switch chooses the port to which the destination device is connected.
Alleviates congestion in LANs by reducing the size of collision domains, reducing traffic and increasing bandwidth.
Two basic operations:

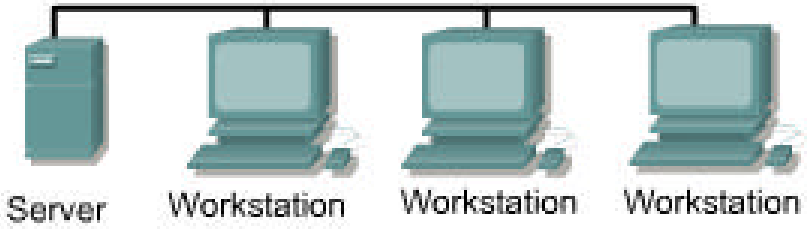
1. Switching data frames.
2. Build and maintain switching tables and search for loops.

Switches operate at much higher speeds than bridges and can support new functionality, such as virtual LANs.

Peer-to-Peer



Client/Server



Advantages of Peer-to-Peer	Advantages of Client/Server
Less expensive to implement	Provides better security
Does not require additional software	Centralised administration
Does not require administrator	Central backup
Disadvantages of Peer-to-Peer	**Disadvantages of Client/Server**
Does not scale to large networks	Expensive software
Users take on administrator tasks	Expensive hardware
Less secure	Requires network administrator
Performance	Single point of failure

Cabling the WAN - Physical Layer

- Serial connections support WAN services such as dedicated leased lines that run PPP or Frame Relay.
- ISDN offers dial-on-demand or dial backup

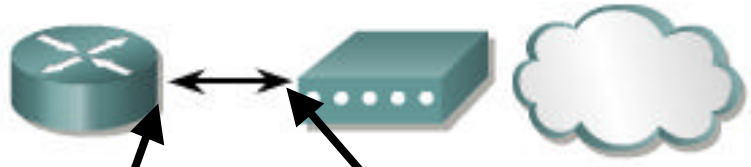
  ISDN BRI has two 64 kbps B channels for data + one 16 kbps D channel for signaling and link-management.

  PPP is typically used to carry data over the B channels.
- Residential DSL - T1/E1 speed over telephone line
- Cable services use existing coaxial cable TV line

  Cable provides high-speed connectivity matching or exceeding that of DSL.

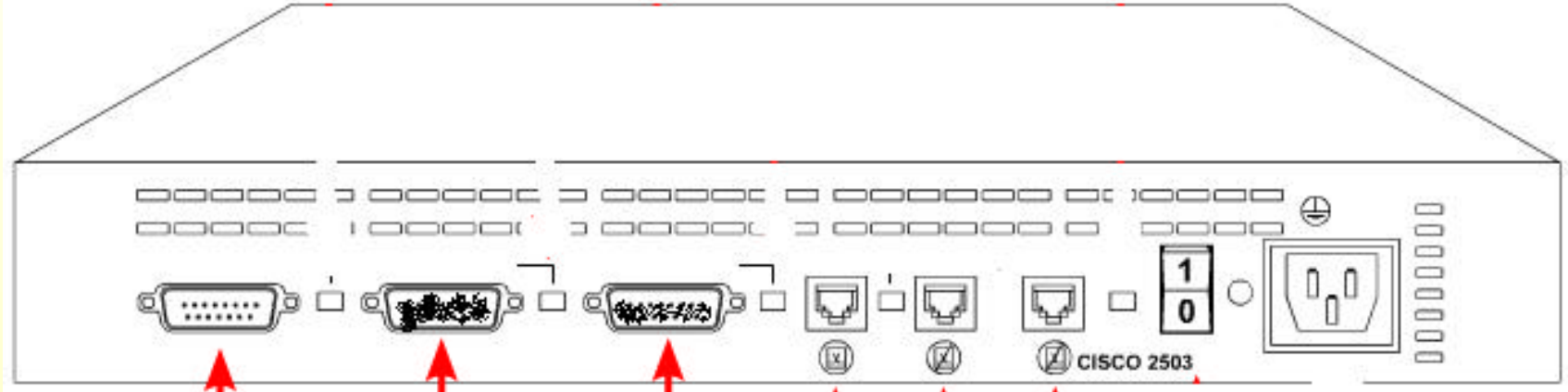
Cisco HDLC / PPP / Frame Relay	ISDN BRI (with PPP)	DSL Modem	Cable Modem
EIA/TIA-232 EIA/TIA-449 X.21 V.24 V.35 High Speed Serial Interface (HSSI)	RJ-45 Note: ISDN BRI cable pinouts are different than the pinouts for Ethernet	RJ-11 Note: Works over telephone line	BNC Note: Works over Cable TV line

Routers and Serial Connections



The DTE is the endpoint of the user's device on the WAN link

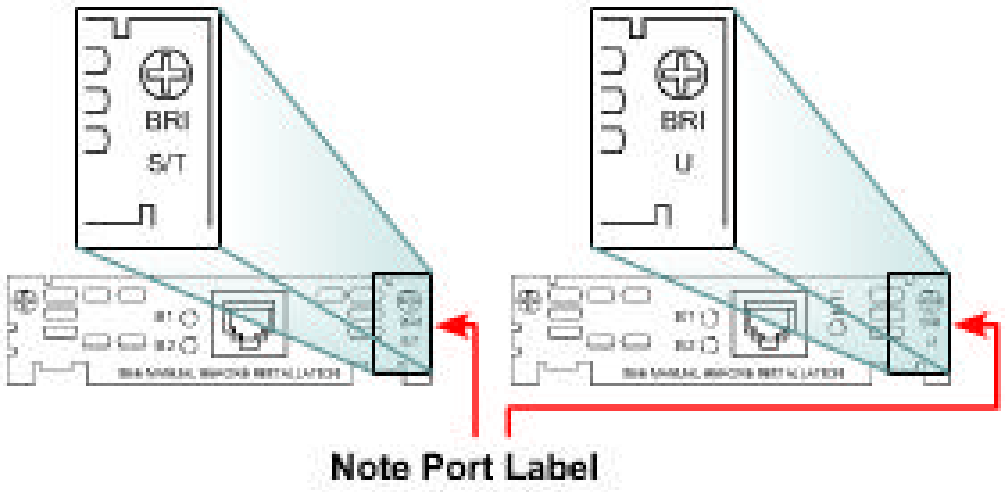
The DCE is typically the point where responsibility for delivering data passes into the hands of the service provider. Responsible for clocking



Routers and ISDN BRI Connections

With ISDN BRI, two types of interfaces may be used:

1. **BRI S/T -** BRI interface without internal NT1
2. **BRI U -** BRI interface with integrated NT1



NT1 is located between the router and the ISDN switch

NT1 connects four-wire wiring to the two-wire local loop

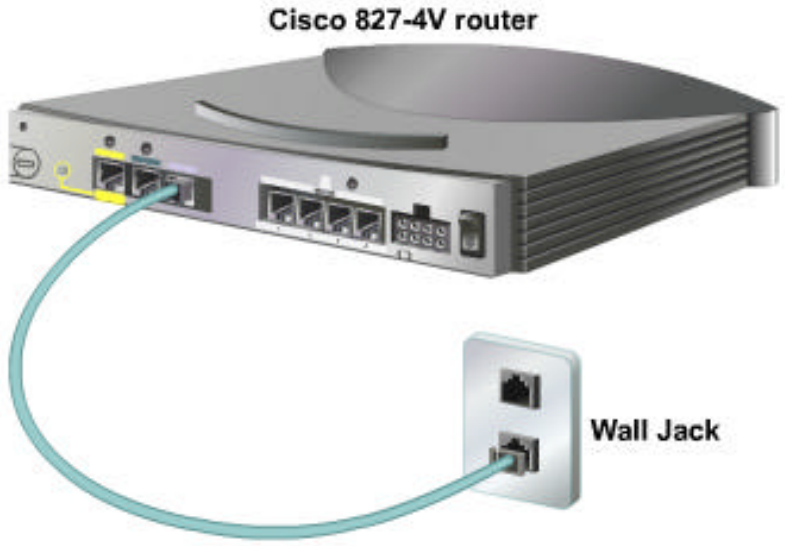
NT1 can be **External** devices or **integrated** into the router.

To interconnect the ISDN BRI port to the service-provider device, use a UTP Category 5 straight-through cable.

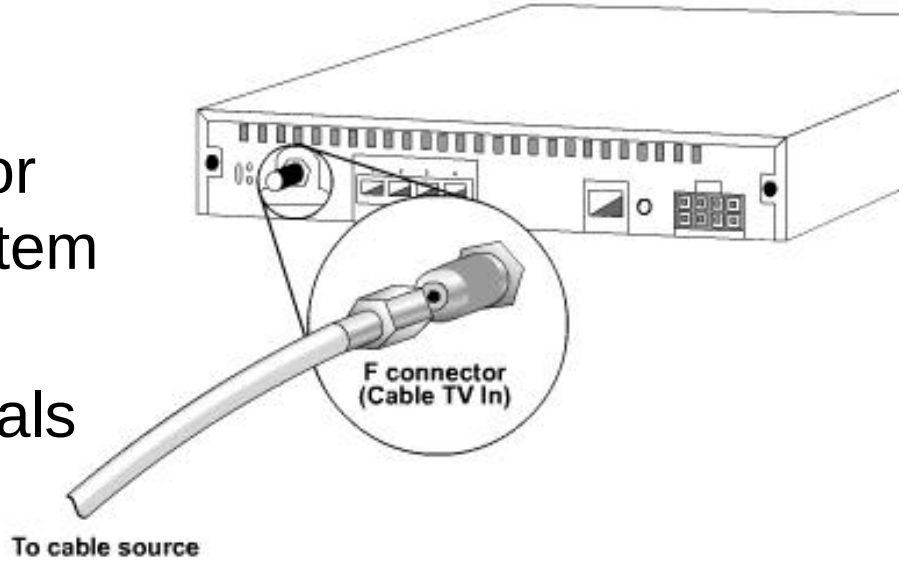
Caution: ISDN BRI uses voltages that can seriously damage non-ISDN devices.

DSL and Cable Connections

- The **Cisco 827 ADSL** router has one ADSL interface.
- Uses a phone cable with **RJ-11** connectors
- DSL works over standard telephone lines using **pins 3** and **4** on a standard RJ-11 connector.



- The **Cisco uBR905** - high-speed access on **Cable** TV to SOHO
- **F-connector** and **BNC** connector connect the router and cable system
- **Splitter/directional coupler** separates TV and computer signals



Review Questions

Q – What is the console port used for?

A – *To configure the router*

Q – What is microsegmentation?

A – *Using switches to break up the collision domain*

Q – What is the OSI Layer 1?

A – *Physical layer*

Q – What device can be active, passive or intelligent?

A – *Hub*

Q – What does 2B + D define?

A – *ISDN 2x64kbps Bearer + 1x16kbps Delta channels*