Introduction to LAN with its cables, connectors, Switches, Hubs and topologies

LAN

- Small interconnected computers or workstations within a building or small area up to 10 Kms.

- Small group of workers that share common application programs and communication needs.

- LANs are capable of very high transmission rates (100s Mb/s to G b/s).

- LAN is interconnected with other networks via switches and router/gateways.

- In general, a given LAN will use only one type of transmission medium.

Basic transmission medium concepts

- Medium is the physical path between transmitter and receiver in a data transmission system.

- Guided Medium: waves are guided along a solid medium path.

- Unguided medium: waves are propagated through the atmosphere and inner/outer space.
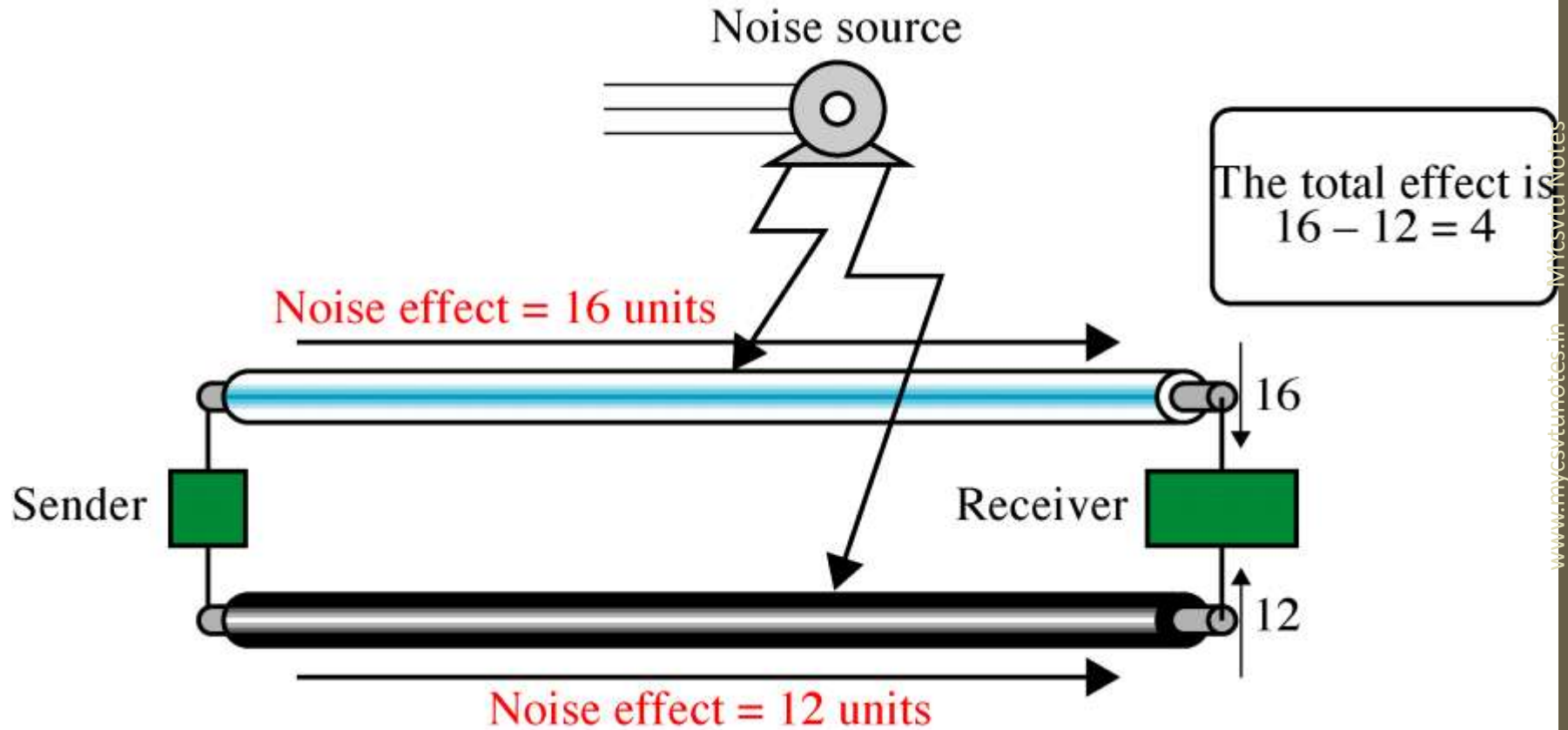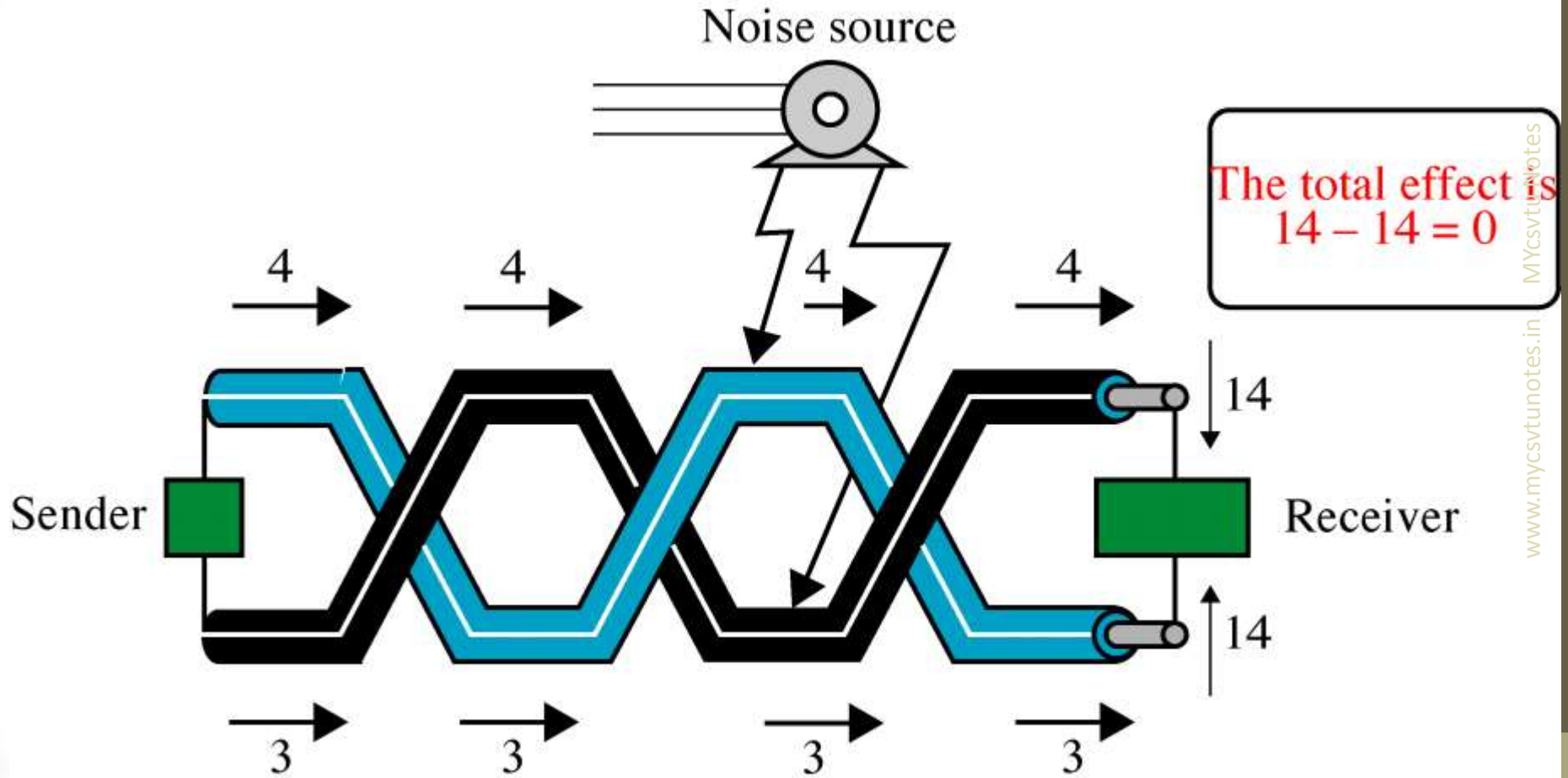
Transmission medium

Twisted-pair cable
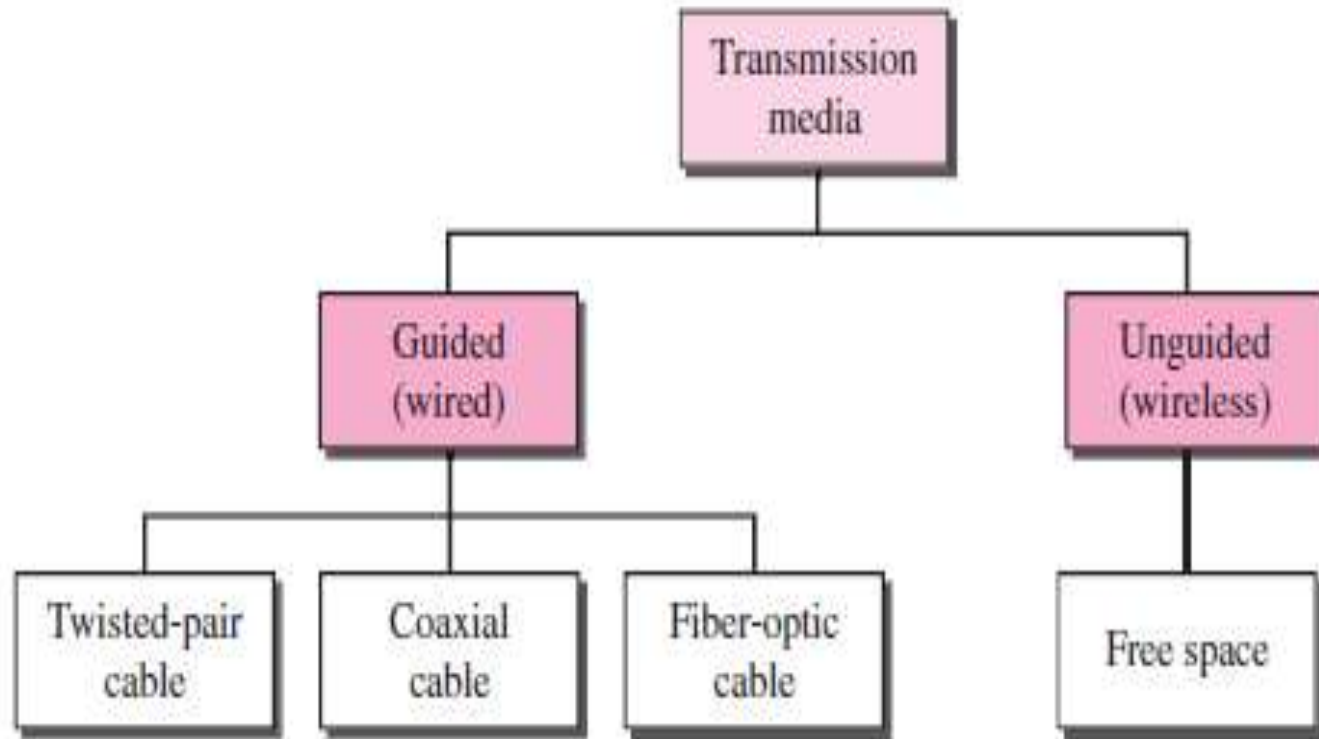
Insulator — Conductors
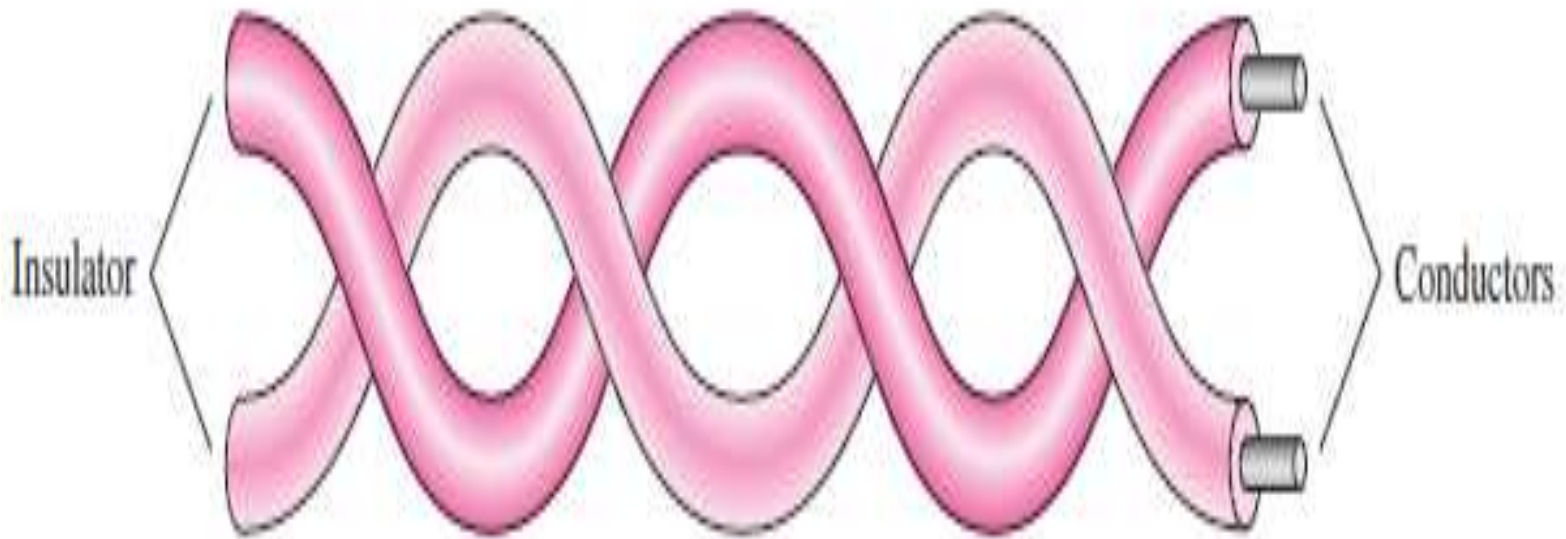
# Effect of Noise on Parallel Lines

Noise on Twisted-Pair Lines

Twisted-pair cable

- A twisted pair consists of two conductors (normally copper), each with its own plastic insulation, twisted together.

- One of the wires is used to carry signals to the receiver, and the other is used only as a ground reference.

- If the two wires are parallel, the effect of these unwanted signals is not the same in both wires because they are at different locations relative to the noise or crosstalk sources (e.g., one is closer and the other is farther).

- By twisting the pairs, a balance is maintained. For example, suppose in one twist, one wire is closer to the noise source and the other is farther; in the next twist, the reverse is true.

- Twisting makes it probable that both wires are equally affected by external influences (noise or crosstalk).

- This means that the receiver, which calculates the difference between the two, receives no unwanted signals.

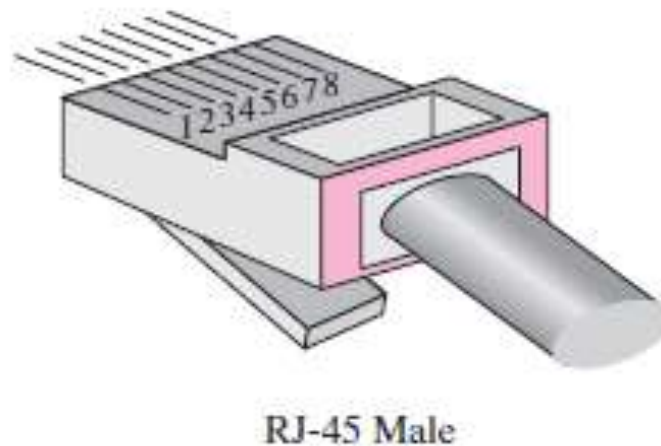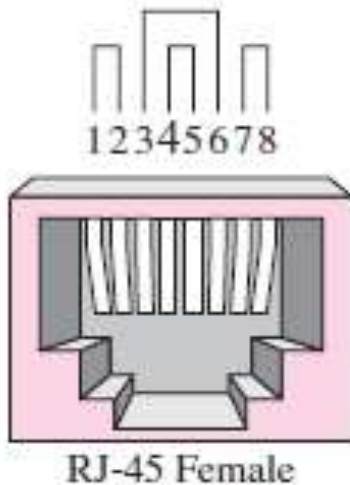# Types of *Twisted-pair cable*
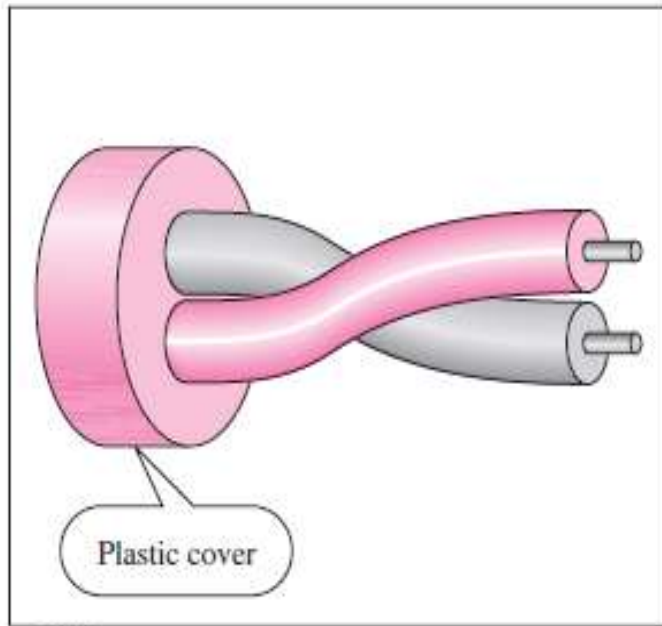
a. UTP
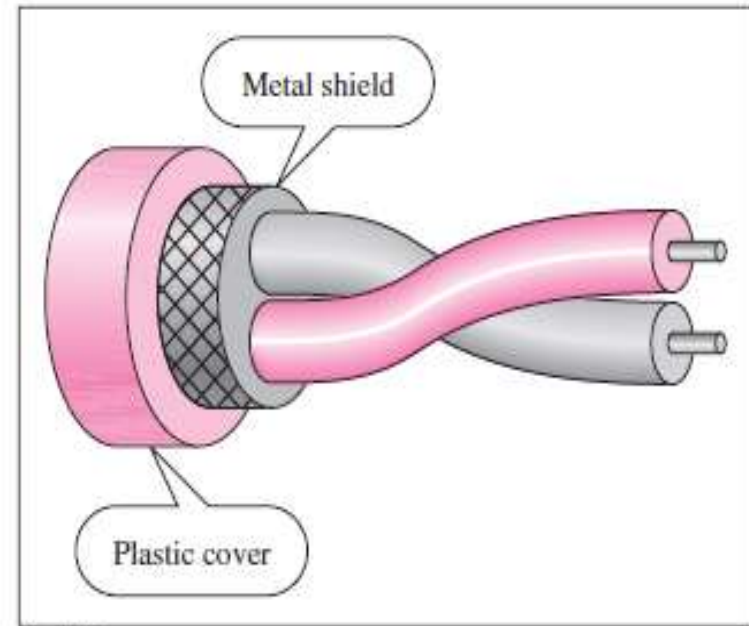
b. STP

Frequency range

- 100Hz-5MHz

Applications

- Common in building for digital signaling used at speed of 10's Mb/s (CAT3) and 100Mb/s (CAT5) over 100s meters.
- Common for telephone interconnection at home and office buildings
- Less expensive medium; limited in distance, bandwidth, and data rate.

Connector

- The most common UTP connector is **RJ45** (RJ stands for registered jack)

- It is a keyed connector, meaning the connector can be inserted in only one way.

- It has 8 wires.

RJ-45 Female

RJ-45 Male

connectivity

Connection can be made between

- Computer-computer
- Computer-hub
- Hub-hub
- Hub-switch
- Switch-switch

Straight-through cable

- *Straight-through cable* is a type of twisted pair copper wire cable for local area network (LAN) use for which the RJ-45 connectors at each end have the same *pinout* (i.e., arrangement of conductors).

- Straight-through cable is also commonly referred to as *patch cable*.

- Straight-through cable is used to connect computers and other end-user devices (e.g., printers) to networking devices such as hubs and switches

Cross over cable
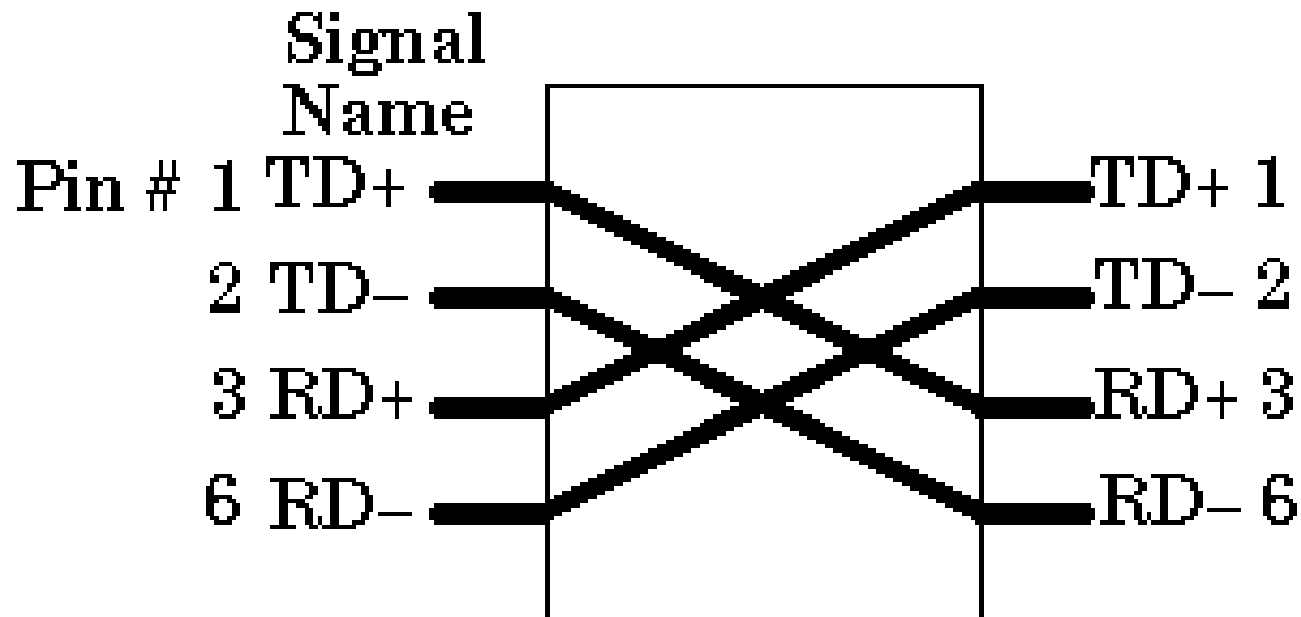
Cross over cable

- It is generally used to connect similar devices.
- Such as hub-hub, switch-switch.

Roll over cable

- You can identify a roll-over cable by comparing the two modular ends of the cable.

- Holding the cables side-by-side, with the tab at the back, the wire connected to the pin on the outside of the left plug should be the same color as the wire connected to the pin on the outside of the right plug.

Roll over cable

Conn 1	conn2
1	8
2	7
3	6
4	5
5	4
6	3
7	2
8	1

Coaxial Cable

- Coaxial cable (or *coax*) carries signals of higher frequency ranges than those in twisted pair cable.
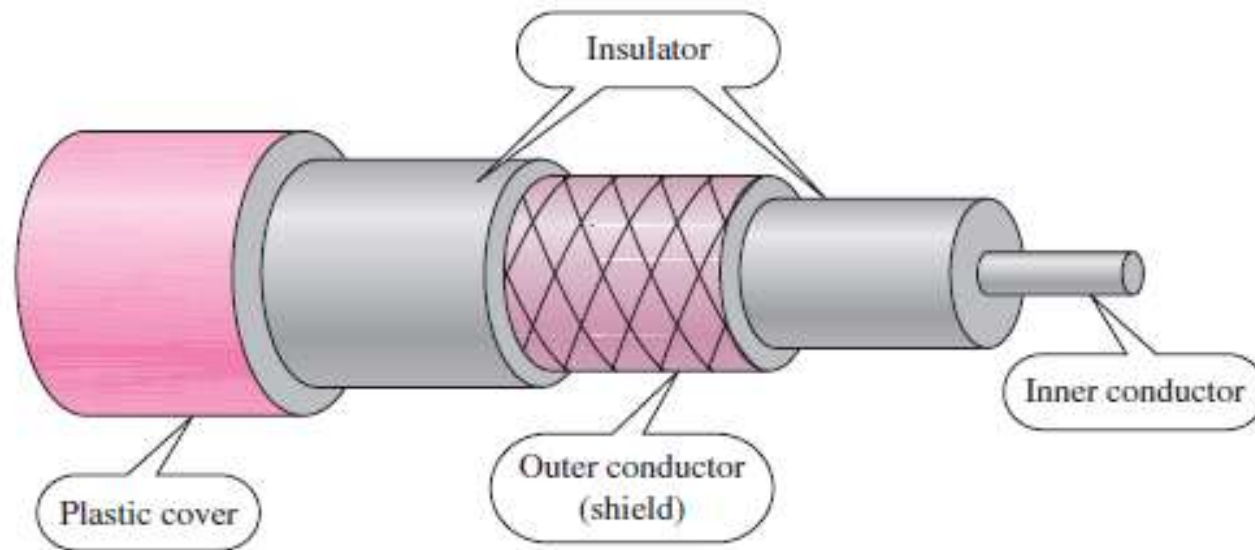
Frequency range

- 100 KHz-500MHz

Categories of coaxial cables

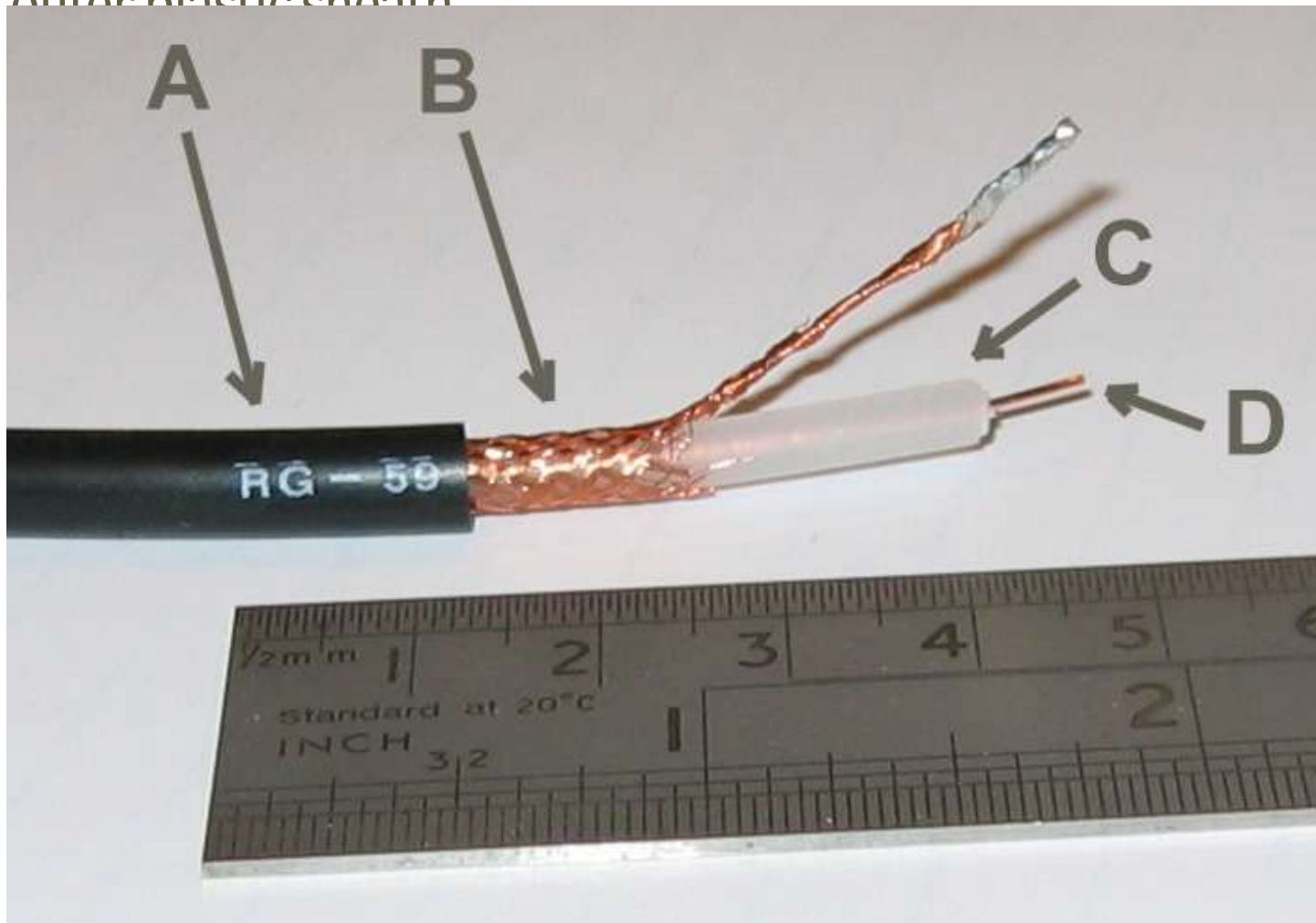| Category	Impedance	Use
RG-59	75 Ω	Cable TV
RG-58	50 Ω	Thin Ethernet
RG-11	50 Ω	Thick Ethernet

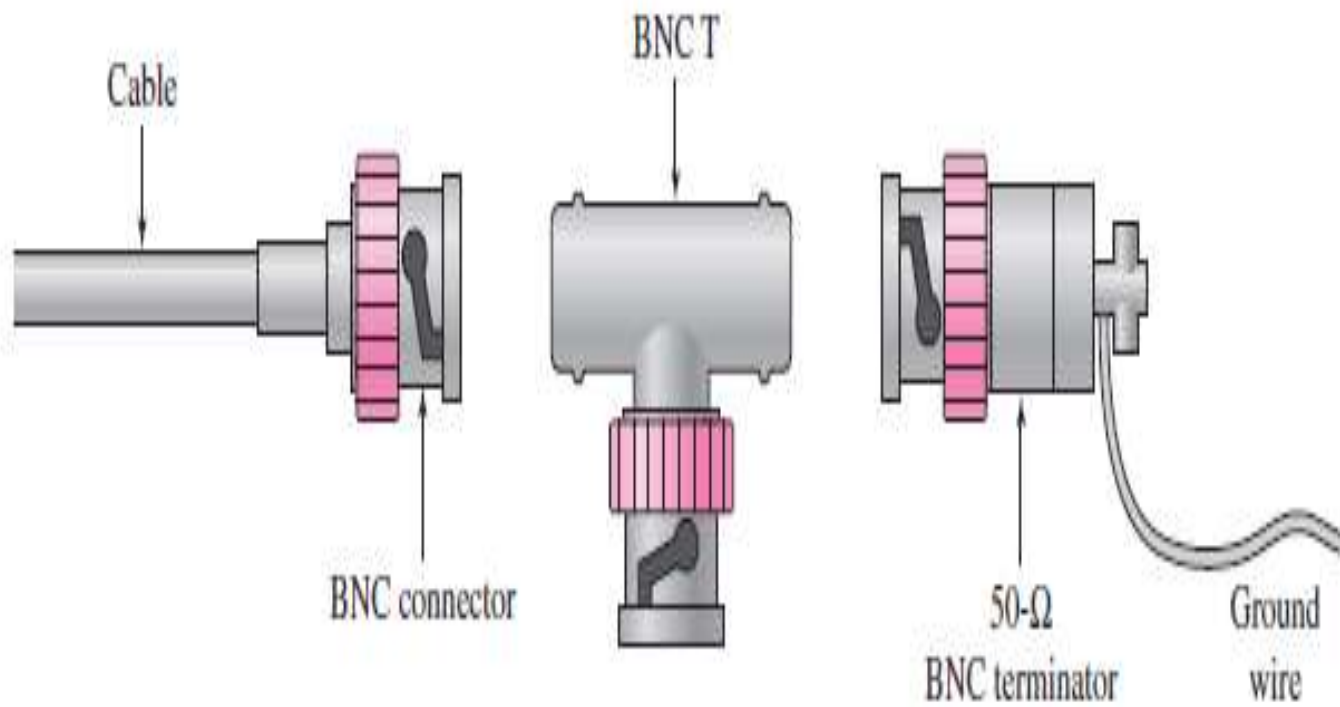A section of RG-59 cable with its end stripped.
A: outer plastic sheath
B:
C:
D:

Coaxial Cable Connectors

- **Bayone-Neill-Concelman (BNC)**

- BNC T connector,

- BNC terminator

Cable

BNC T

BNC connector
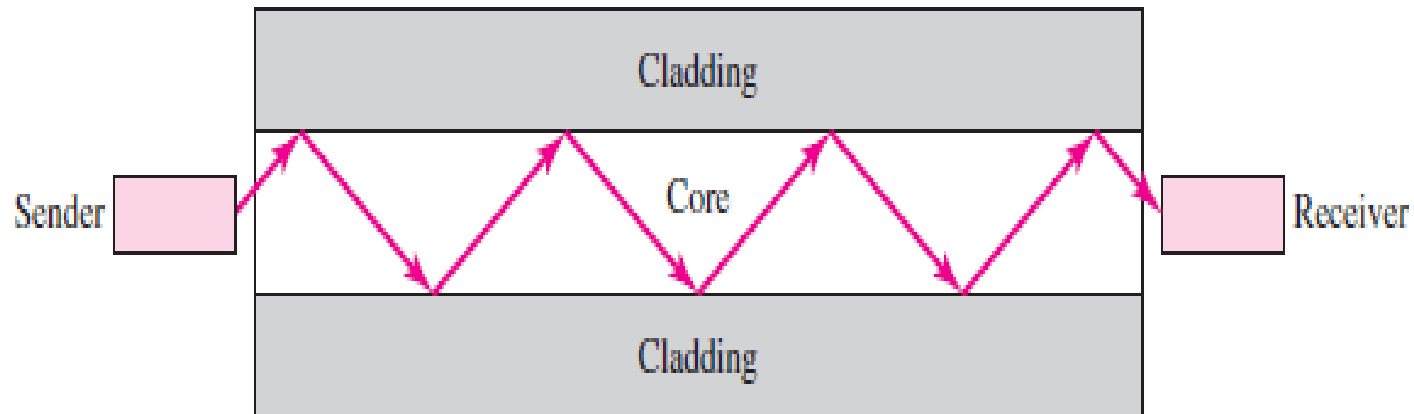
50-Ω
BNC terminator

Ground
wire

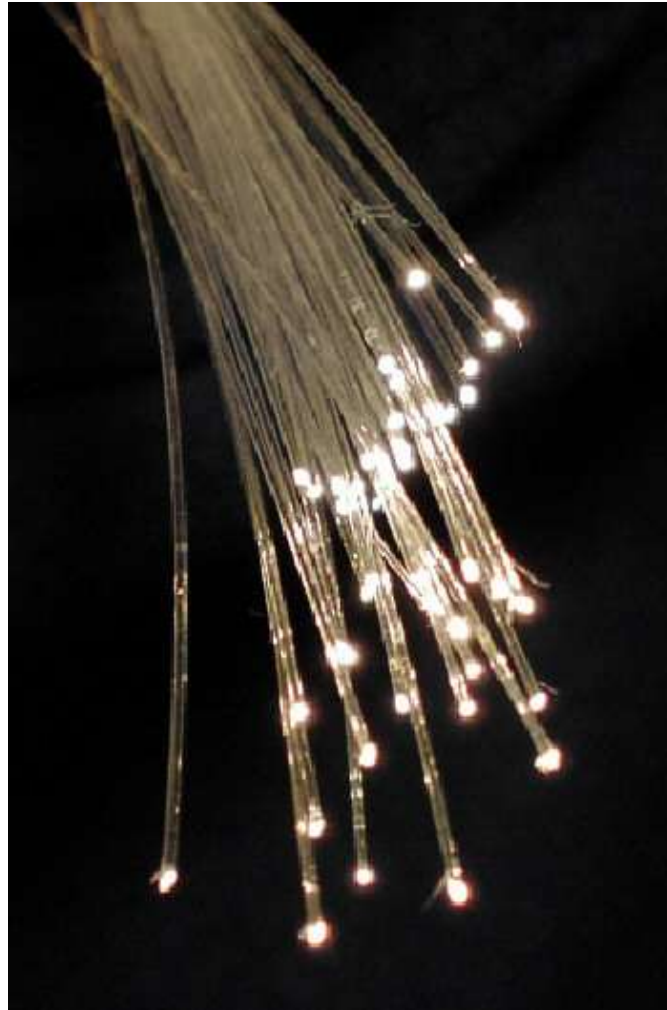# BNC(British Naval Connector)

Fiber-optics

- A fiber-optic cable is made of glass or plastic and transmits signals in the form of light.

Fiber-optics

Fiber-optics

- Optical fibers use reflection to guide light through a channel. A glass or plastic **Core** is surrounded by a **cladding** of less dense glass or plastic.

- The difference in density of the two materials must be such that a beam of light moving through the core is reflected off the cladding instead of being refracted into it.
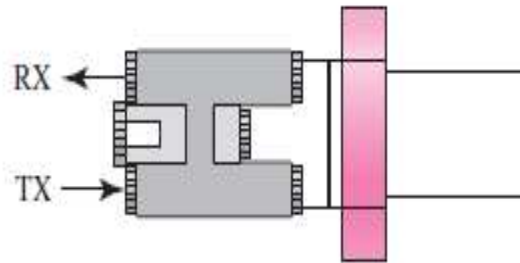
Fiber optics cable connector
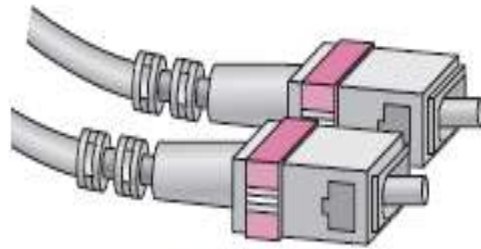
SC connector

ST connector

RX

TX
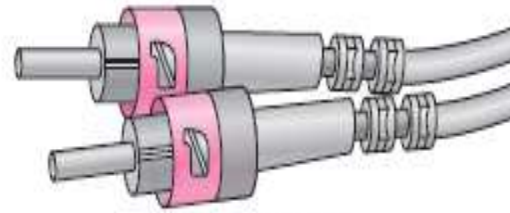
MT-RJ connector

Connectors

- The **subscriber channel (SC) connector** is used for cable TV. It uses a push/pull locking system.

- The **straight-tip (ST) connector** is used for connecting cable to networking devices. It uses a bayonet locking system and is more reliable than SC.

- **MT-RJ** is a connector that is the same size as RJ45.

Applications

- Fiber-optic cable is often found in backbone networks because its wide bandwidth is cost-effective.

Advantages

- **SPEED:** Fiber optic networks operate at high speeds - up into the gigabits.

- **BANDWIDTH:** large carrying capacity.

- **DISTANCE:** Signals can be transmitted further without needing to be "refreshed" or strengthened.

- **RESISTANCE:** Greater resistance to electromagnetic noise such as radios, motors or other nearby cables.

- **MAINTENANCE:** Fiber optic cables costs much less to maintain.

Disadvantages

Installation and maintenance.

- Fiber-optic cable is a relatively new technology. Its installation and maintenance require expertise that is not yet available everywhere.

Unidirectional light propagation.

- Propagation of light is unidirectional. If we need bidirectional communication, two fibers are needed.

Cost.

- The cable and the interfaces are relatively more expensive than those of other guided media. If the demand for bandwidth is not high, often the use of optical fiber cannot be justified.

Switches

- A **network switch** is a computer networking device that connects network segments.

- The term commonly refers to a Network bridge that processes and routes data at the Data link layer (layer 2) of the OSI model.
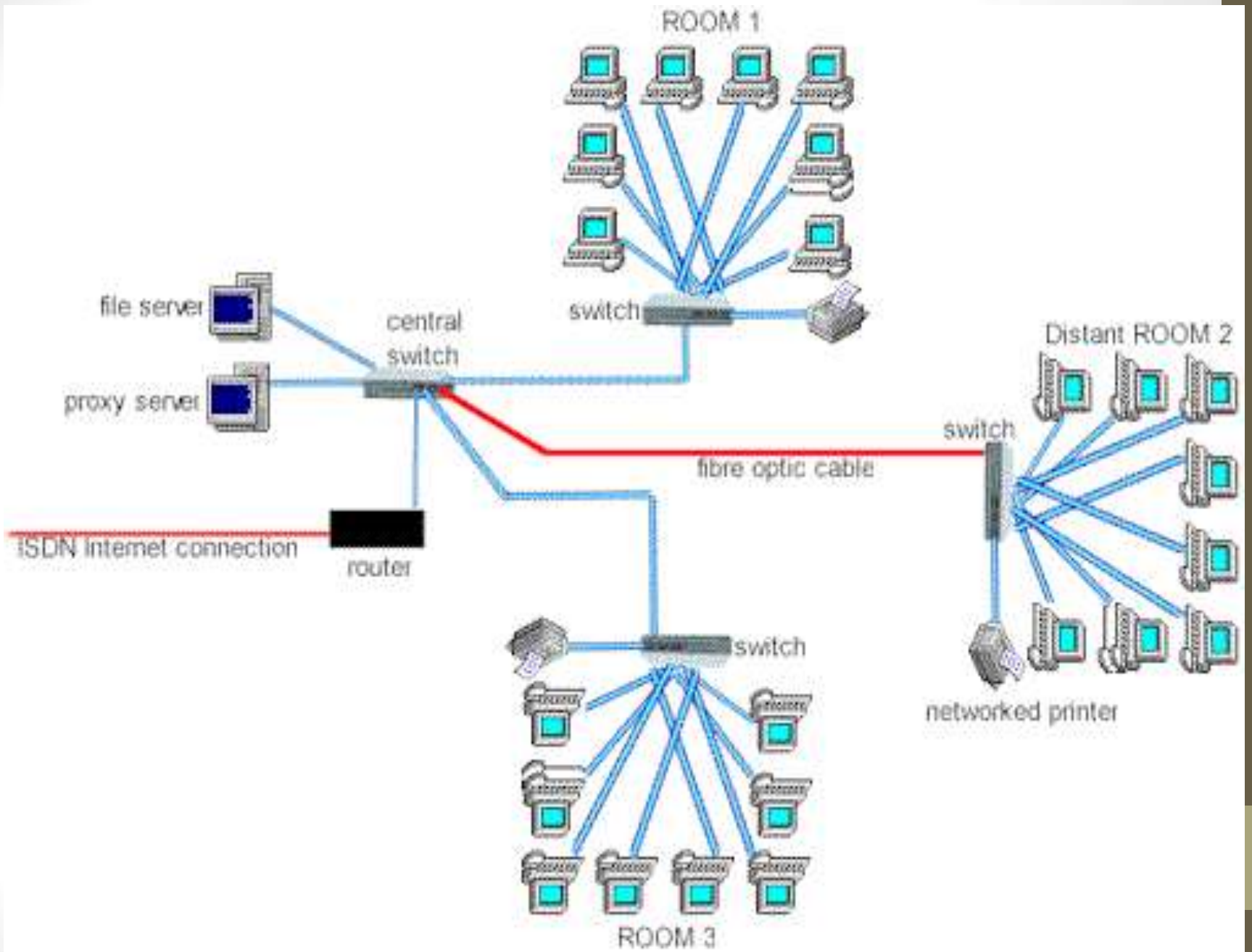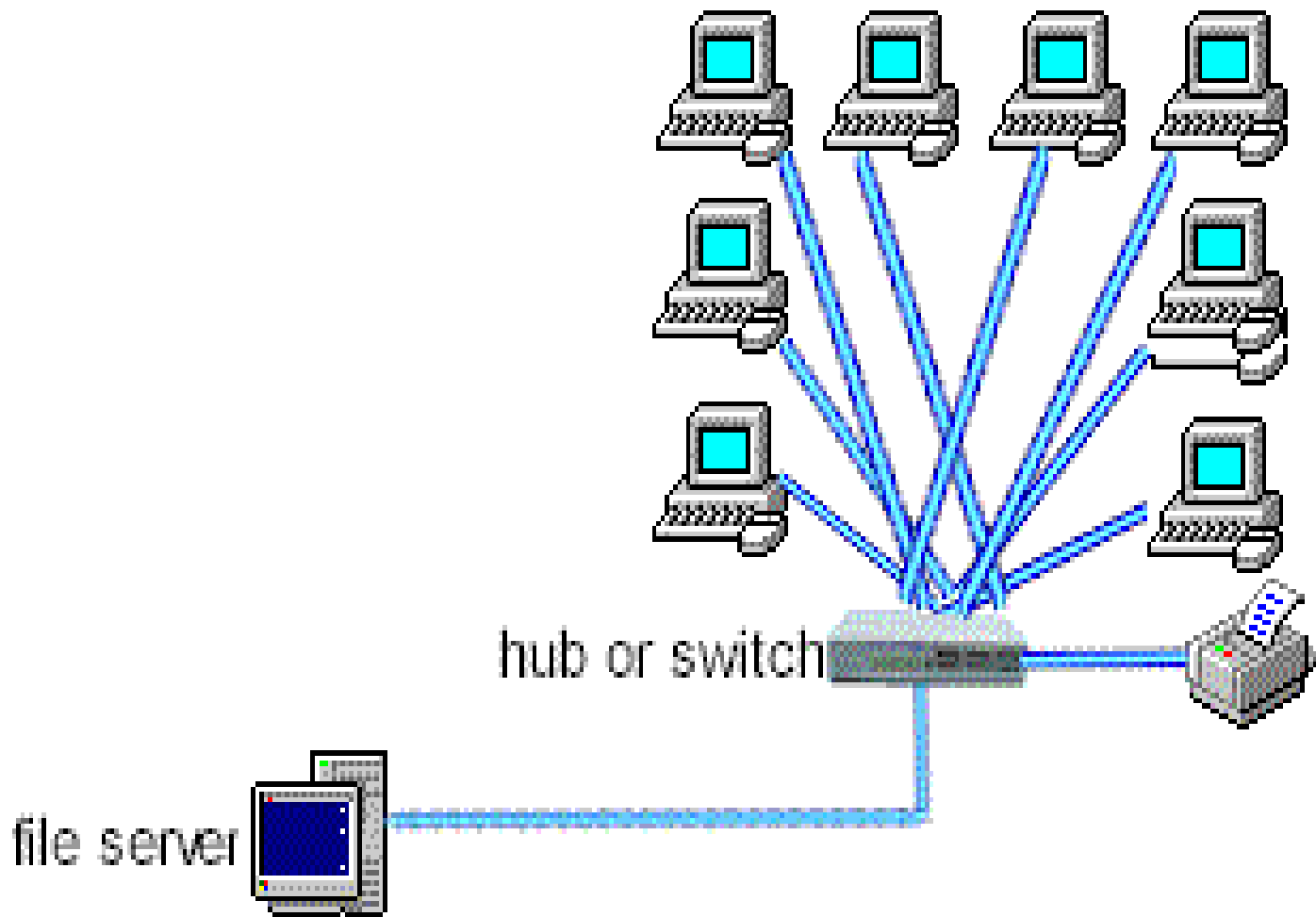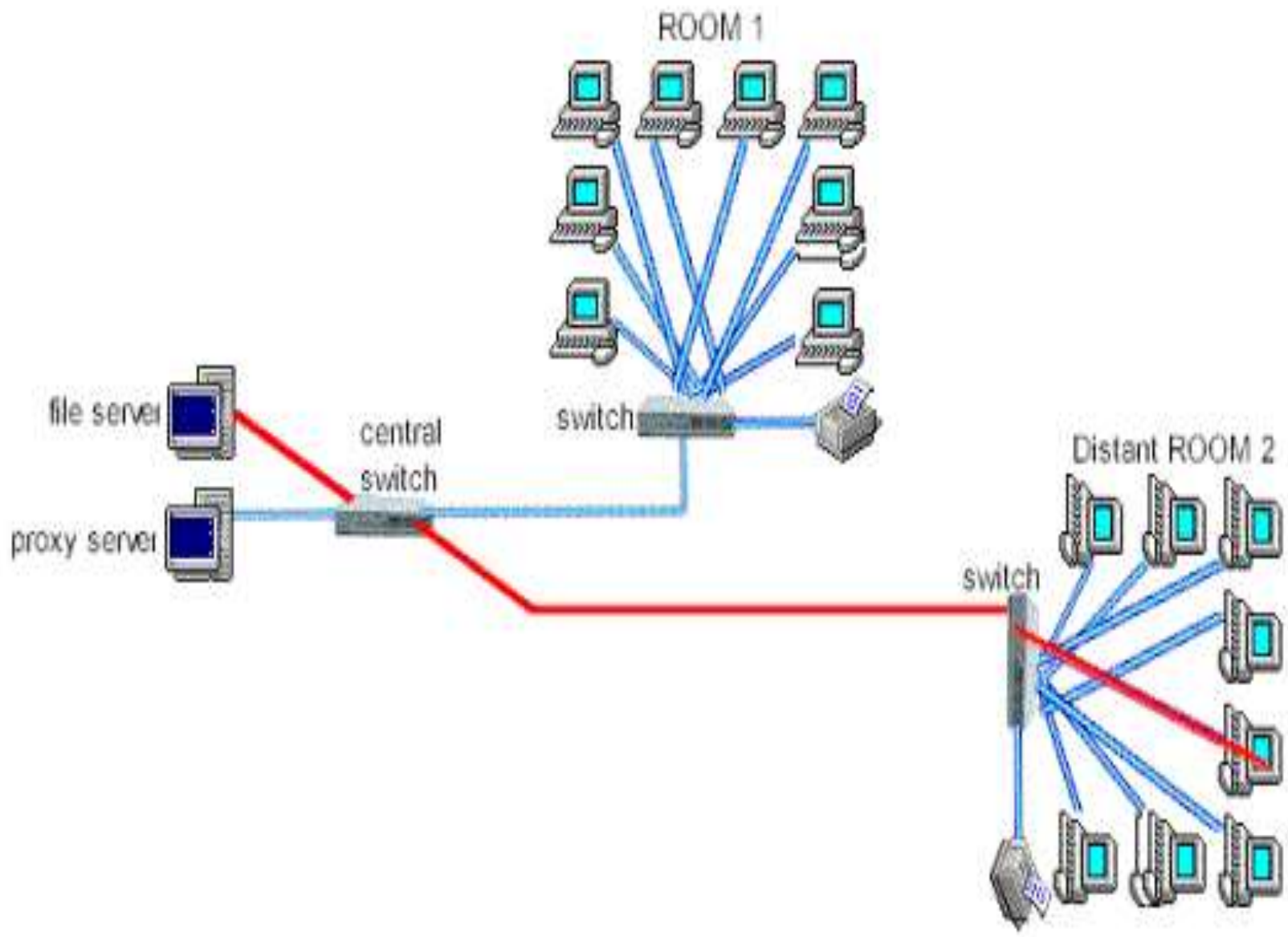
Rack mounted 24 port switches

HUB

- A hub is a device that lets a single network cable to split into multiple cables leading to **nodes.**

4-port Ethernet hub

ROOM 1

file server

central switch

proxy server

switch

ISDN internet connection

router

Distant ROOM 2

switch

fibre optic cable

networked printer

switch

ROOM 3

hub or switch

file server

ROOM 1

file server

proxy server

central switch

switch

Distant ROOM 2

switch

Difference between HUB & Switch

LAN topologies

- LAN topologies are bus, ring, and star