Network Technology And Administration

Ch-2 Transmission Media Multiplexing And Switching Concepts & Network Devices
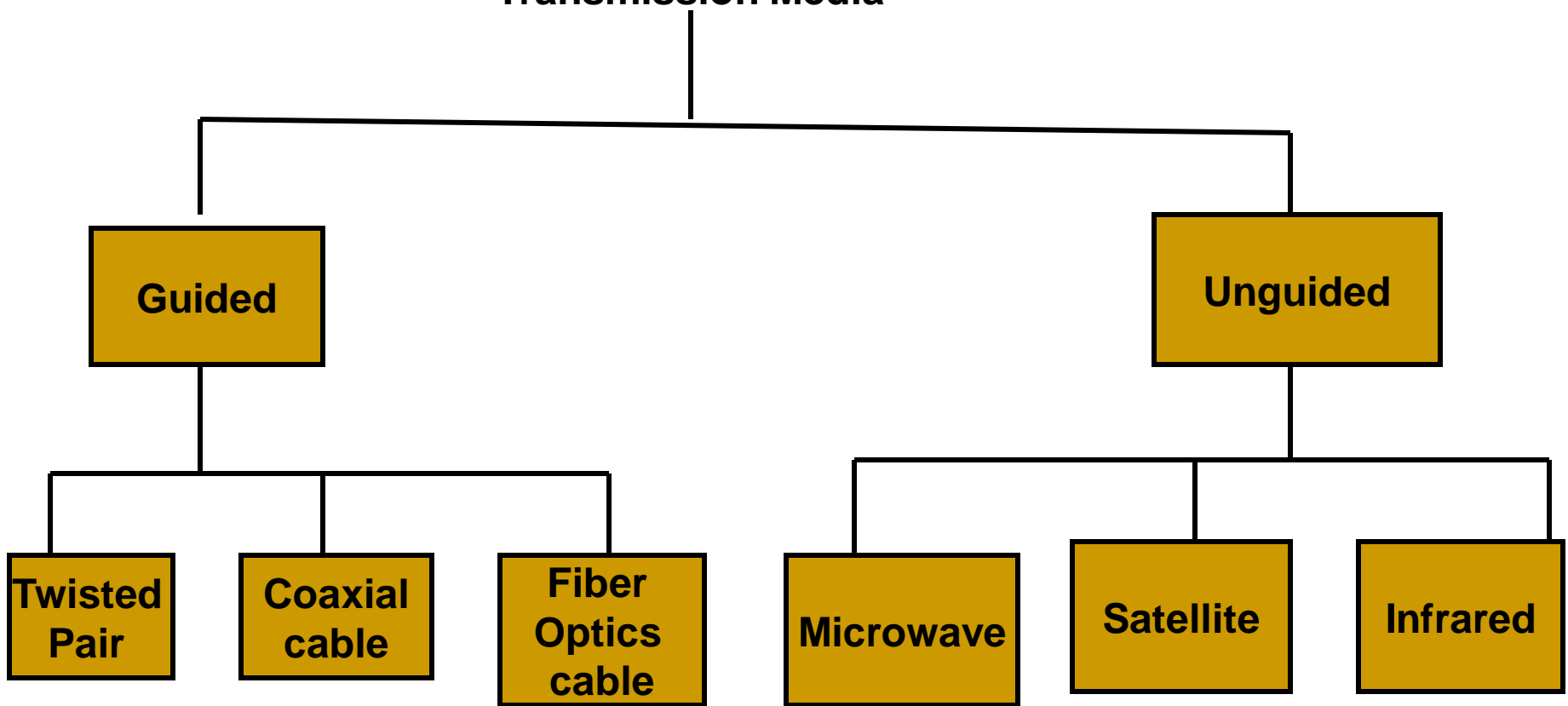
- ■ Transmission Media
- ■ Unguided Media

Transmission Media :

- A transmission medium is a material substance (solid, liquid, or gas) which can propagate energy waves.

- For example : The transmission medium for sound received by the ears is usually air but solid and liquids may also act as transmission media for sound.

- Transmission media are the physical pathways that connect computer other device.

❑ Transmission Media :

- Transmission medias can be of two types :
  - Guided Media (Wired)
  - Unguided Media (Wireless)

Transmission Media

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                        Transmission Media
                               |
          ┌────────────────────┴────────────────────┐
       Guided                                    Unguided
          |                                          |
   ┌──────┼──────┐                          ┌────────┼────────┐
Twisted  Coaxial  Fiber                  Microwave  Satellite  Infrared
 Pair     cable   Optics
                  cable
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Guided

- Twisted Pair
- Coaxial cable
- Fiber Optics cable

Unguided

- Microwave
- Satellite
- Infrared

1. Coaxial Cable :

- A coaxial cable consists of four concentric cylinders.

- An inner conductor , surrounded by an insulating cylinder , surrounded by an outer conductor , surrounded by an a final protective cover.

- This combination is called a coax.
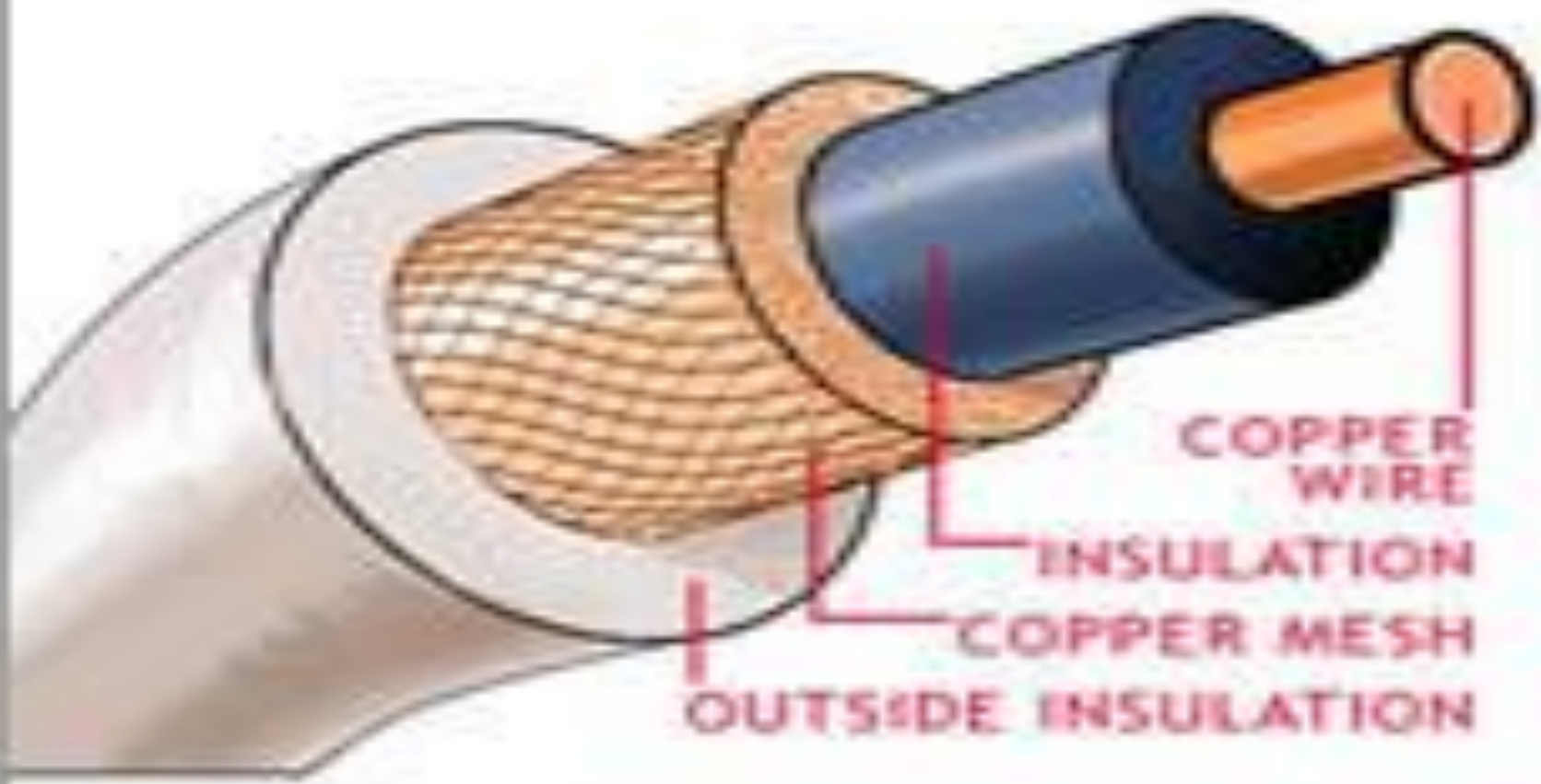
COPPER WIRE

INSULATION

COPPER MESH

OUTSIDE INSULATION

1. Coaxial Cable :

- Coaxial cable are superior to twisted pairs both in terms of bandwidth and communication distance and can provide bandwidth to distance ratio in order of 10s of MHz per kilometer.

- Coaxial cable are extensively used in LANs and long distance telephone trunk lines.

- There are two types :

1 Thinnet Cable : Thinnet cable is light , flexible & less expensive cable medium.

- It is easy to install.

2 Thicknet cable : Thicknet is thicker than thinnet.

- It can carry more signals at longer distance than thinnet.

2. Twisted Pair Cable :

- It has become the dominant cable for all new network designs.

- It has become popular due to the low cost.

- It is inexpensive to install and costs very low per foot for any cable type.
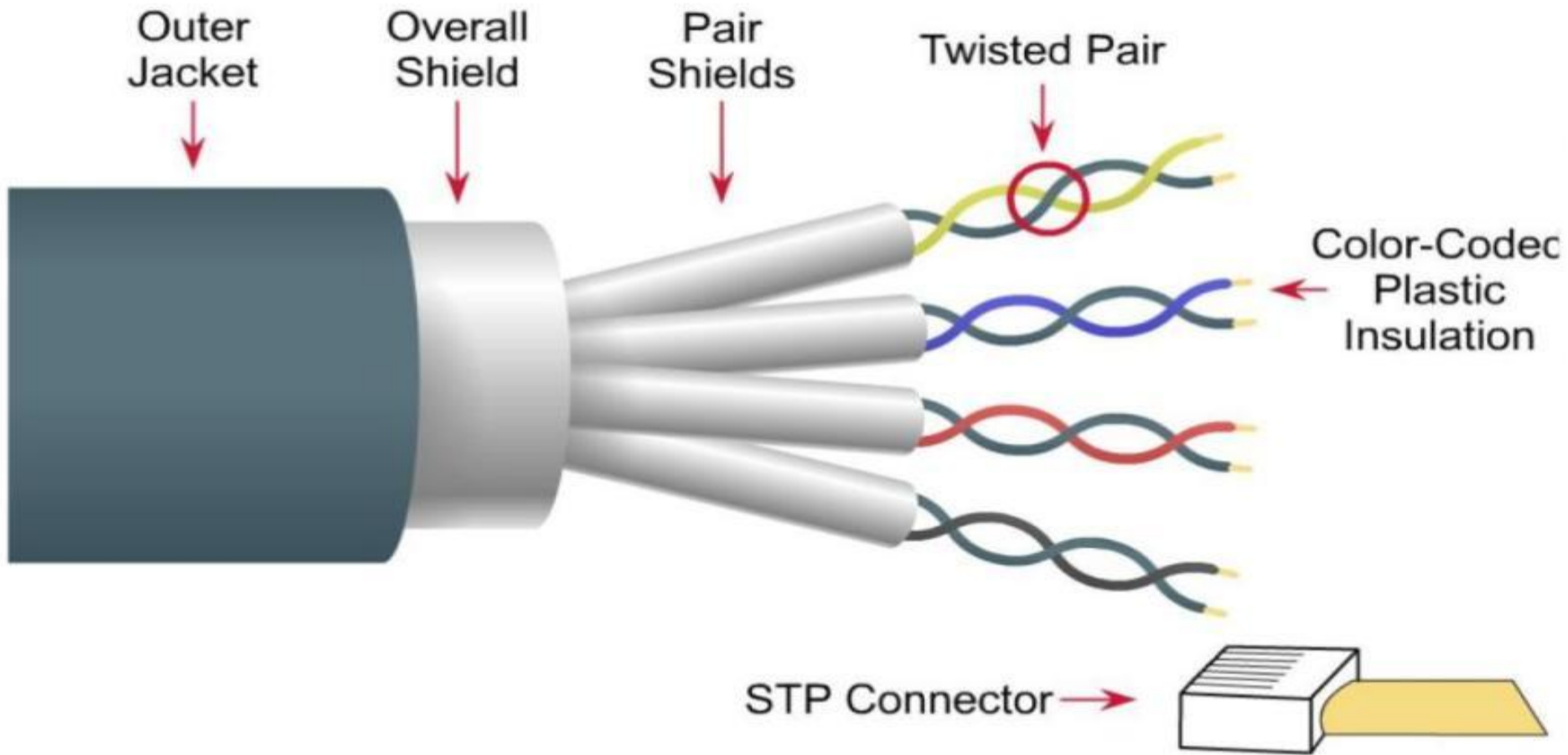
2. Twisted Pair Cable :

- There are two type of twisted pair cable :

  1)Shilded Twisted Pair Cable (STP)

  2)UnShilded Twisted Pair Cable (UTP)

1) STP :

- STP cable consists of one or more twisted pairs of cable enclosed in a foil wrap and woven copper shilding.

- It include two twisted pairs of wires within a single shield.

Shielded Twisted Pair Cable

Labels in figure:
- Outer Jacket
- Overall Shield
- Pair Shields
- Twisted Pair
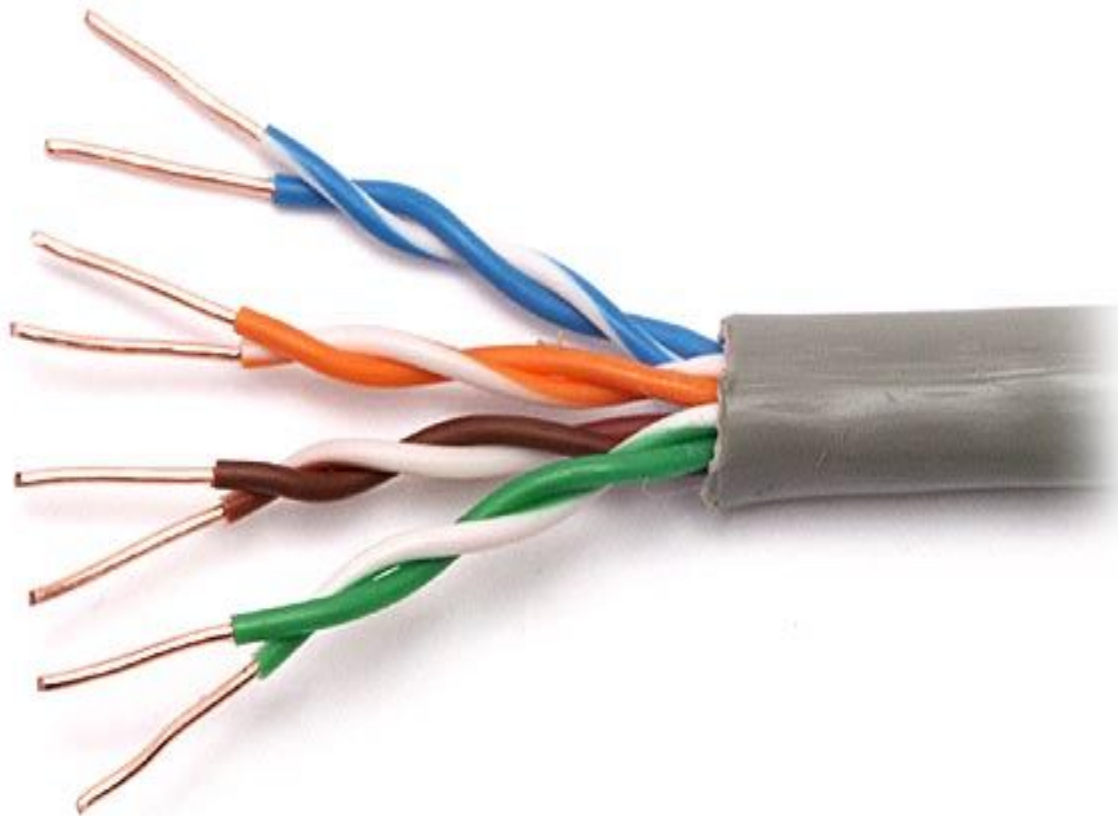- Color-Coded Plastic Insulation
- STP Connector

- Speed and throughput: 10-100 Mbps
- Cost per node: Moderately expensive
- Media and connector size: Medium to Large
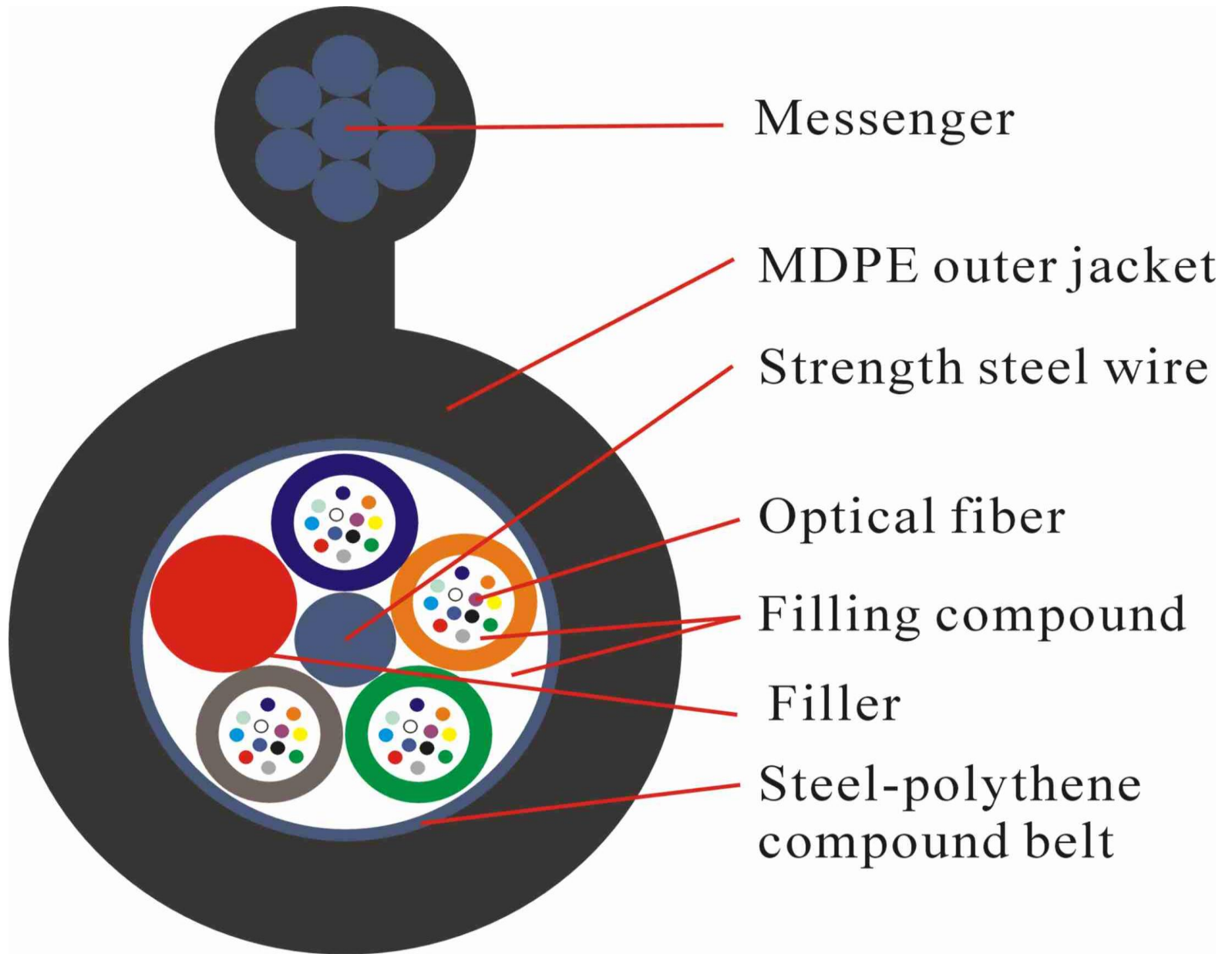- Maximum cable length: 100m (short)

2) UTP :

- Unshielded twisted pair cable doesn't incorporate a shield into its structure.

- Telephone system commonly use UTP.

- UTP cable is easy to install.

3. Fiber Optic :

- Fiber optic use light to transmit data.

- A thin glass fiber is encased in a plastic jacket which allow the fiber to bend without breaking.

- An fiber optic cable is the ideal cable for data transmission.

Messenger

MDPE outer jacket

Strength steel wire

Optical fiber

Filling compound

Filler

Steel-polythene compound belt

➤ Unguided Media :

- Media that do not use any physical pathway or physical transmission medium is called wireless transmission media.

- Network with no physical pathway or without any cabling uses wireless media.

- Earth atmosphere provides the physical data path for transmissions.

➤ Unguided Media :

- There are mainly four type of wireless transmission method are followed :

  1 Infrared

  2 Laser

  3 Narrow band radio

  4 Microwave

1. Infrared Transmissions :

- Infrared technology uses the invisible portion of the light spectrum with wave length just a little less than those of red light.

- These frequency are very high offering nice data transfer rates.

- We are used to seeing Infrared technology utilization for our television or VCR remote.

2 . Laser Transmission :

- The word laser is an acronym for light amplification by simulation emission of radiation.

- Laser light technology is employed in with LAN & WAN transmission , though it is more commonly used in WAN transmission.

3. Narrow Band Radio Transmission :

- Narrow band radio communication also called single frequency radio.

- The range of narrow band radio is higher then infrared.

- Higher power frequency hence less attenuation.

- Microwave communication can take two forms :

  1 Terrestrial Links [ground]

  2 Satellite Links

4. Microwave communication :

- **Terrestrial links :** Terrestrial microwave communication employ earth based transmitter & receivers.

- Terrestrial microwave equipment in the form of telephone relay towers.

- in such a case a microwave link is an ideal solution.

4. Microwave communication :

- **Satellite microwave :** Satellite microwave system relay transmission through communication Satellite.

- These Satellite operate in geographically synchronize orbits 22,300 miles above the earth.

- Earth station use parabolic antennas to communicated with Satellite.

❑ Bluetooth :

➤ Bluetooth is a radio-based wireless technology.

➤ It allows device to share information over a maximum range of 10 meters.

➤ Bluetooth technology enables computers, phones, and peripherals to communicate with one another without cables.

➤ Bluetooth enables devices give the user more flexibility, security, reduced power consumption.

➤ **Bluetooth Technology :...**

➤ As long as two Bluetooth devices are close enough to each other, it's possible to make a connection.

Advantages

- ➢ Video conferencing and video clips on cell phone is possible using this technology.

- ➢ Enhance user experience.

- ➢ Connecting devices without the need for cables.

- ➢ Becoming more integrated within laptops, mobile phones, and many other devices.

- ➢ Reduced power consumption.

Multiplexing :

- It enables broadband media to support multiple data channels i.e. single media can pass multiple data at same time.

- It helps when media costly, bandwidth is idle, when large amount of data to sent fro low capacity channels.

- Demultiplexing is separating two or more signals that have been combined into one signal.

1 FDM :

- In this any signal will convert to along.

  Each analog signal can be modulated by separate frequency called "carrier frequency" which helps to recover the original signal on opposite end.

- One advantage of FDM is that, it supports bidirectional signaling on the same time i.e. transmission of data can be done from both side of cable at the same time.

2 TDM :

- Time division multiplexing divides a channel into time slots that are allocated to data streams to be transmitted. It will transmits the multiplexed signal in baseband mode.

- TDM equipments utilize fixed time division and allocate time to channel.

- If channel is free then full utilized is not done as the time division are programmed into configuration of multiplexer this often known as synchronous TDM

3 CDM :

- Code division multiplexing is a networking technique in which multiple data signals are combined for simultaneous transmission over a common frequency band.

- When CDM is used to allow multiple users to share a single communications channel, the technology is called code division multiple access (CDMA).

4 WDM :

- In fiber-optic communications, wavelength-division multiplexing is a technology which multiplexes a number of optical carrier signals onto a single optical fiber by using different wavelengths of laser light.

4 WDM :

- Wavelength-division multiplexing is a method of combining multiple signals on laser beams at various infared wavelengths for transmission along fiber optic media

- Using FDM or TDM in each IR channel in combination with WDM or several IR channels, data in different formats and at different speeds can be transmitted simultaneously on a single fiber.

➢ Switching Techniques :

- Switching techniques are mechanism for moving data from one network segment to another. Switching technique is of three types circuit switching, message switching and packet switching.

1) Circuit switching :

■ In telecommunications, a circuit switching network is one that establishes a circuit between nodes and terminals before the users may communicate, as if the nodes were physically connected with an electrical circuit.

➢ Switching Techniques :

- Virtual circuit switching is a packet switching technology that may emulate circuit switching, in the sense that the connection is established before any packets are transferred, and that packets are delivered in order.

- There is a common misunderstanding that circuit switching is used only for connecting voice circuits.

➢ The call :

- For call setup and control, it is possible to use a separate dedicated signaling channel from the end node to the network.

- ISDN is one such service that uses a separate signaling channel while plain old telephone service does not.

➢ **Switching Techniques :**

➢ Examples of circuit switched networks :

- Public switched telephone network

- ISDN B-channel

- Circuit switched data and high-speed circuit-switched data service in cellular systems such as GSM

- Datakit

2) Message switching :

- In telecommunications, message switching was the precursor of packet switching, a here messages were route in their entirety, one hop at a time.

- Message switching systems are nowadays mostly implemented over packet-switched or circuit-switched data networks.

Switching Techniques :

- Each message contains addressing information, and at each switch this information is read and the transfer path to the next switch is decided.

- Depending on network conditions, a conversation of several messages may not be transferred over the same path.

3) Packet switching :

- Packet switching is a digital networking communications method that groups all transmitted data- irrespective of content, type, or structure-into suitably-sized blocks, callepackets.

- Packet switching features delivery of variables-bi-rate data streams over a shared network.

Network Devices

NIC :

- A Network interface card (NIC) is a hardware device that handle an interface to a co access that network

- The NIC has a ROM chip that a contains a unique number , the media address identifies the devices uniquely on the LAN.

- The NIC provides the physical connection between the network and computer workstation.

Modem :

- A Modem is a device that modulated an analog carrier signal to encode digital information and also demodulated such a carrier signal to decode the transmitted information.

- Modems can be used over any means of transmitting analog signals from driven diodes to radio.

➤ **Modem :**

- The most familiar example of a modem turns the digital' 1s and 0s' of a personal computer into sounds that can be transmitted over the telephone lines of plain old telephone system , and once received on the other side, converts those sounds back into 1s and 0s.

- Modems are send in a given time, normally measured in bits per second or "bps".

Types Of Modems :

- **Asynchronous modems :**

- The term asynchronous is usually used to describe communications in which data can be transmitted intermittently rather than in a steady stream.

- For ex. A telephone conversation is asynchronous because both parties can talk whenever they like.

➢ Types Of Modems :

- The difficulty with asynchronous communications is that the receiver must have a way to distinguish between valid data and noise.

- In computer communications this is usually accomplished through a special parity bit startbit and stopbit at the beginning and end of each piece of data

Types Of Modems :

- **Synchronous Transmission :**

- It does not use start stop mechanism for synchronization (match-status of sender and receiver)

- It uses clocking mechanism to synchronize the receiving and transmitting ends.

- This synchronization is accomplished with in three methods.

➢ Repeater :

- A repeater is a network device that repeats a signal from one network to another network or one machine to another to which is connected.

- A repeater does not filter it only repeats and provides strength to signal.

Repeater :

- As we know that all media are affected by attenuation on the signals they carry.

- The advantages of repeaters are that they are inexpensive and simple.

Hubs:

- It provide a central attachment point for network cabling.

- Hubs are also called wiring concentrators.

- Hubs in three types :

  - Passive

  - Active

  - Intelligent Hubs

Hubs:

- Passive Hubs : It dose not contain any electronic component and do not process the data signal in any way.

- It only combines the signal from several network cable segments.

- The distances between computer and hub must be less compare to distances in active hub.

Hubs:

- Active hubs :
- It is an electronic component that can amplify and clan up the electronic signals that flow between devices on the network.
- This process of cleaning up the signals is called signal regeneration.
- Active hubs requires electrical power to run.

Hubs:

- **Intelligent hubs :**
- In addition to signal regeneration , intelligent hubs perform some network management and intelligent path selection.
- Intelligent hubs are enhanced active hubs.

Bridges :

- Bridges operate in both the physical and Data link layer of OSI model.

- Like repeater , bridges also can be use to connect two network segment and can connect dissimilar physical media.

Bridges :

- The bridge is said to be transparent (invisible) to the workstation.

- The bridge will automatically initialize itself and configure its own routing information after it has been enabled.

1) Port mirroring :

Port mirroring is used on a network switch to used send a copy of network packet seen on one switch port to a network monitoring connection on another switch port.

2) Traffic Flow :

Traffic Flow, in mathematics and engineering is the study of interactions between vehicles , drivers , infrastructures ,with the aim of understanding and developing an optimal road network with efficient movement of traffic and minimal traffic congestion problem .

3) SNMP :

The Simple network management protocol is a standard application layer protocol that allows a management station to poll agents running on network devices for specific paces of information.

- All SNMP compliant devices include a specific text file called a management information base (MIB)

➢ Router :

- Router are combination of hardware and software and used to connect separate network to form an internet work .

- Also, unlike bridge , router can be used to connect two or more independent network.

- For example a FDDI network and an Ethernet network can be interconnected so that users on each network can share resources on the other network and still both network continue to function.

Router :

- A router is a devices that extracts the destination of a packet it receives , selects the best path to that destination and forwards data packets to the next devices along this path.

- There are main two type :
  - Static Routers

  - Dynamic Routers

  - Brouters

➢ Gateway :

- The sophisticated devices required to bridge two very different environment together is called a Gateway.

- Gateway are unique in that they have the capability of functioning on any level of the OSI model.

- Gateway are available in both external and internal models much in the same way that modems are available .

Wi-Fi Protected Access :

- Wi-Fi :   Wireless fidelity is a base band wireless networking technology that provide high speed internet connectivity to the office and home user.

- Wi-Fi protected Access is a certification program developed by the Wi –Fi Alliamce to indicate compliance with the security protocol created by the Wi –Fi Alliance to secure wireless computer networks.

➢Assignment :

1 What is NIC ?

2 Explain Modems.

3 Write a Short Note On :Bridge & Router.

4 Define in Repeater.

5 Explain HUB.

6 What is Gateway.