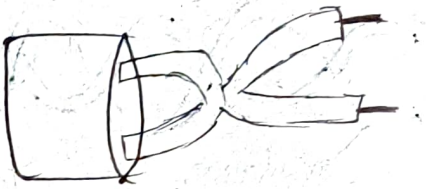
1. Unshielded Twisted Pair

→ These are a pair of two insulated copper wires twisted together without any other insulation or shielding.
→ Hence these are called UTP
→ They reduce the external interference.
→ These are arranged in pairs, so that we can add a new connection whenever required.
→ When UTP are arranged in pairs, each pair is coded with a different color.



Advantages

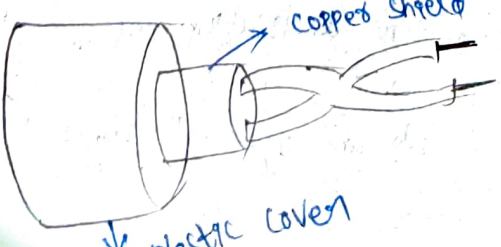
→ easy to install
→ Cables are cost-effective
→ less costly than other types of cables.

Disadvantages

→ Not Secure
→ Short bandwidth as compared to STP

2. Shielded Twisted Pair Cables (STP)

→ These types of cables have extra insulation over the conductors in the form of a copper braid covering.
→ This covering provides strength to the overall structure of the cable.
→ It also reduces noise & signal interference in the cable.
→ The STP cables are also color-coded like the UTP cables.
→ These cables are costly & difficult.



→ Extra metal sheets available
→ To Protect from any interference

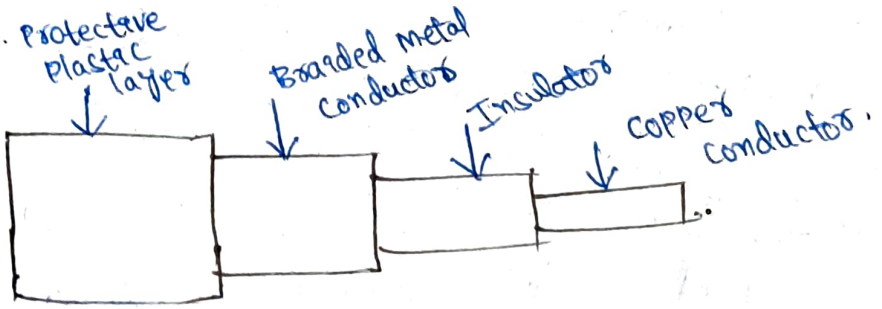
Adv:
→ used for long-distance communication & transmission.
→ And are installed underground.
→ have a higher bandwidth as compared to UTP.

Dis:
→ These cables are very expensive.
→ requires lot of maintenance.
→ These can be installed underground only.

Coaxial Cable

→ It is typically used by cable operators, telephone companies & internet provides to transmit data, video & voice communications to customers.
→ It's installation & implementation are easy.
→ But it is less efficient than optical fiber.
→ It provides moderately low bandwidth in comparison to optical fiber.
→ It is a type of guided media made of plastics & copper wires.
- which transmit the signal in electrical form, rather than light form.
→ Coaxial cable is also known as Coax

Structure of Coaxial Cable



* **Copper Conductor:** A central conductor, which consists of copper.
- The conductor is the point at which data is transmitted.

* **Insulator:** Dielectric plastic insulation around the copper conductor.
- It is used to maintain the spacing b/w the center conductor & shield.

* **Braided Mesh:** A braided mesh of copper helps to shield from electromagnetic interference.
- the braid provides a barrier against EMI moving into and out of the coaxial cable.

* **Protective Plastic layer:**
→ An external polymer layer, which has a plastic coating.
→ It is used to protect internal layers from damage.

Uses
→ used for television.
→ used for carrying internet signals.
→ used in CCTV systems.
→ used in video Transmission.

Adv:
→ It supports high bandwidth.
→ It is easy to install.
→ More reliable & durable.
→ It support multiple channels.

Dis:
→ these are expensive
→ It must be grounded inorder to prevent any crosstalk.
→ It is very bulky.

→ Cladding makes the light to be inside the cable instead of going outside of cable.

Features of Guided media

- High speed
- Secure
- Used for comparatively shorter distance.

Unguided Media (or) Unbounded Media

→ Unguided medium transport electromagnetic waves without using a physical conductor.

→ There is no involvement of any physical media.

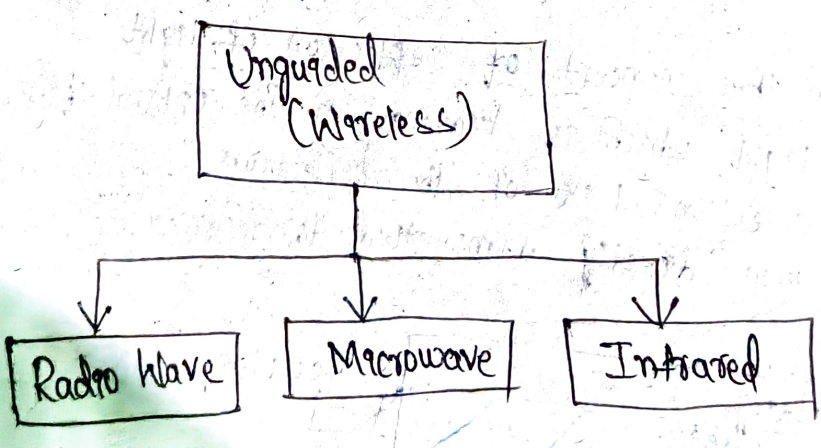
→ Also known as Wireless communication.

→ Signals are normally travel through free space

→ And are available to anyone who has a device capable of receiving them.

→ Unguided signals (or) data can travel from the source to the destination in several ways:

- Ground Propagation
- Sky Propagation
- Line-of-Sight Propagation



1. Radio Waves

→ Electromagnetic waves ranging in frequencies b/w 3kHz and 1 GHz are called as "Radio Waves"

→ Radio waves, for the most part are Omnidirectional

→ It means, the data can be transmitted in any direction.

→ there is no specific direction

→ When an antenna transmits radio waves, they are propagated/transmit/travel in all directions.

→ Radio waves those are propagate in the sky mode can travel long distance.

→ This makes radio waves to be making them in AM radio.

→ Radio waves use omnidirectional antennas, that send out signals in all directions.

2. Microwaves

→ Electromagnetic waves having frequencies b/w 1 and 300 GHz are called "Microwaves"

→ Microwaves are Unidirectional.

→ It means, the data can be transmit in one direction

→ When an antenna transmits microwaves, they can be narrowly focused.

→ It means the sending and receiving antennas need to aligned

→ Inorder to make them work they should be aligned

→ the Unidirectional property has an advantage.

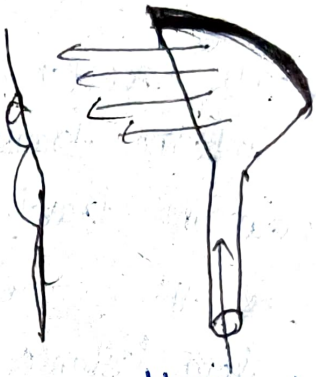
→ A pair of antennas can be aligned without interfering with another pair of aligned antennas.

→ Macrowaves need unidirectional antennas that send out signals in one direction.

→ Two types of antennas are used for macrowave communications:

- Parabolic dish
- horn

Parabolic dish antenna



Horn antenna

3. Infrared Waves

→ Infrared waves have frequencies from 300 GHz to 400 THz (wavelengths from 1mm to 770 nm)

→ It can be used for short range communication

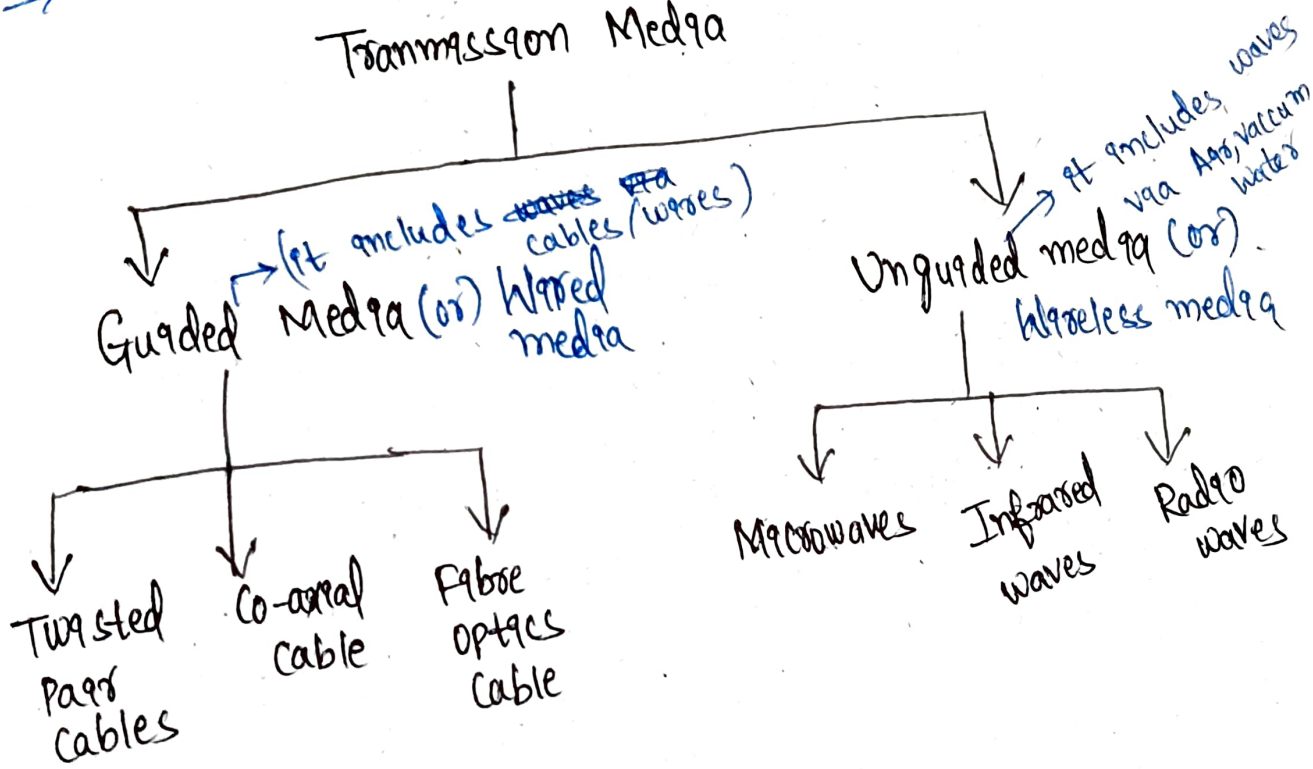
→ they cannot penetrate through walls.

→ the advantage is that, it prevents interference b/w one system and another.

→ A short-range communication system in one room cannot be affected by another system in the next room.

Transmission Media

→ Communication channel is called as "medium".



Physical layer → It is the lower layer (or) Hardware layer.

→ It is responsible for interacting with the hardware & signalling mechanism.

Device 1 ←h/w→ Device 2

→ Inorder to establish communication b/w two devices, there should be some sort of hardware is needed

→ It provide services to the next highest layer i.e (Data link layer)

→ Frames are given by data link layer to physical layer.

→ Physical layer takes frames and convert it into Electrical pulses.

→ Electrical pulses means Binary data.

→ this binary data will be transmitted to the devices

→ It deals with the physical connectivity b/w the devices.

→ this layer is responsible for physical connection b/w two devices.

→ Responsible for : establishment of connection
Maintenance of connection
Deactivation of connection

→ the information will be in form of bits.

Functions

1. Bit Synchronization:
→ At a time, only one bit should be transferred to one system to another system.
→ No overlapping.
→ By providing a clock, the synchronization will be achieved b/w bits of receiver & sender

2. Bit Rate control:
→ Defines no. of bits transmitted per second.

3. Physical Topology:
→ Defines the arrangement of devices in a n/w either bus, ring, mesh or star.

4. Transmission Mode:
→ In which mode data is transmitted.
- Simplex A → B (uni direction) Ex: Monitor, keyword
- Half-Duplex A ⇄ B (Bi-directional) (not simultaneously) Ex: Walkie Talkie
- Full-Duplex A ⇄ B (Bi-directional) (simultaneously)
  Ex: Telephone line

Data link layer (DLL)

→ Data is represented as frames.
→ It is responsible to transmit error-free data.
→ Also responsible for reliable & efficient communication.
   ↳ data should not corrupted

Functions

- Framing → Frame is defined by adding bits at front & end

- Physical Addressing:
→ Destination Hardware address will be included as header.
- Error Control:
- Flow control:
→ Maintaining constant bit rate
→ If bit rate is maintained constantly, then data will not get corrupted.
- Access control:
→ If more than one device sharing same communication channel
- then DLL protocols are responsible to identify the device which have to get control at the given time.

Data link layer Design Issues

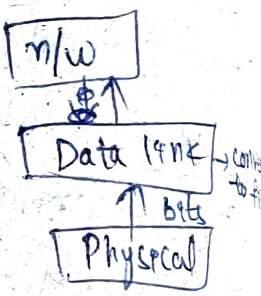
→ the data-link is located b/w the physical and network layers

→ It provides services to the network layer

→ It receives services from the physical layer

1. Services provided to n/w layer
2. Framing
3. Error Control
4. Flow Control

1. Services Provided to n/w layer



→ On top of data link layer, we have network layer.

→ On bottom of data link layer, we have Physical layer.

→ the main task of data link layer is to provide services to n/w layer

Ex: ARPANET

A - Advanced
R - Research
P - Project
A - Agency
NET - Network

→ Developed by ARPA on 1968

Subnet - n/w within n/w

→ It was used before Internet
→ It was first N/w
→ In 1969, the first message was transferred
→ It was splitted in 2 ways: N/w, host
→ It was first implemented to subnet
→ It was first implemented to TCP/IP then it is worked as local N/w in 1969
→ It is a Packet Switching N/w
→ It was given to Defence initially
→ It is a packet switching n/w.
→ It is basically a WAN
→ ARPANET was designed to source a nuclear attack.
→ ARPANET started development in 1966 by United States
→ NSFNET replaced ARPANET as the backbone of internet in 1986
→ It is shutdown in 1989

* Internet

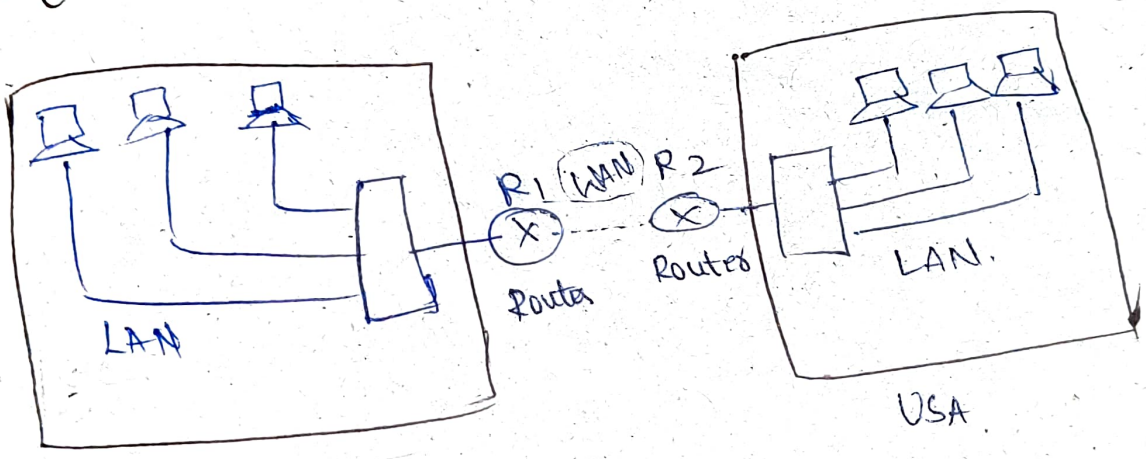
→ To connect devices - LAN

→ To connect n/w's - WAN

→ Internet is a Global n/w.

→ Millions of ~~computers~~ systems are connected in a n/w
- inorder to communicate with each other

→ Everything will work with internet;
- Email
- Search Engine
- chat
- Media (U tube)
- E-commerce



→ A Same company have branches in India & USA

→ If the employess of branch in India, want to communicate with employes of branch in USA

→ the employees of India can communicate each other with help of LAN.

→ Employees in USA can also communicate each other.

→ With the help of routers and WAN, employees of branch in India communicate with employees in USA

→ If Employee of India send msg
- then it will go to (R1) and (R2)

→ We require WAN (Wide Area Network) to establish connection b/w India and USA.

→ If we want to connect devices locally, then we use LAN (Local Area Network)

→ If we want to connect the n/w's of one part of world to another part of world.

then we use WAN

→ Internet also known as Internetworks.