



TRANSMISSION MEDIA

What is Media?

- Media means physical path between transmitter & receiver in data communication.
- what the messages is transmitted over like Television, Newspaper or Journal / Technical Report.
- In computer networking, media determines how quickly and to whom a computer can talk and how expansive process is.
- There are two main groups of transmission media, namely the **guided medium** and the **unguided/wireless medium**.

- **Guided Media:**

use a conductor such as a wire or a fiber optic cable to move the signal from sender to receiver. i.e. waves are guided along with solid medium.

- **Unguided Media:**

use radio waves of different frequencies and do not need a wire or cable conductor to transmit signals. i.e. signals transmits trough air.

- Communication is possible only if the information is encoded in a signal, and the signal is carried on a transmission .

- So, the characteristics of the signal and of the medium both determine the quality of the communication medium.

● **Bandwidth:** CHARACTERISTICS

Amount of data(Frequency) that a cable can carry.

● **Attenuation:**

The loss of signal strength due to external interference.

● **Segment Length:**

A **network segment** is a portion of a computer network wherein every device communicates using the same physical layer.

● **Cost:**

Depends upon type of cable chosen.

● **Crosstalk:**

is the effect of one wire on other.

TYPES of TRANSMISSION MEDIA

Transmission Media

Guided Media

Twisted Pair Cable

Coaxial Cable

Fiber-Optic Cable

Unguided Media

Radio

Microwave

Satellite



Guided Media

Guided media includes everything that 'guides' the transmission. That usually takes the form of some sort of a wire. Usually copper, but can also be optical fibre.

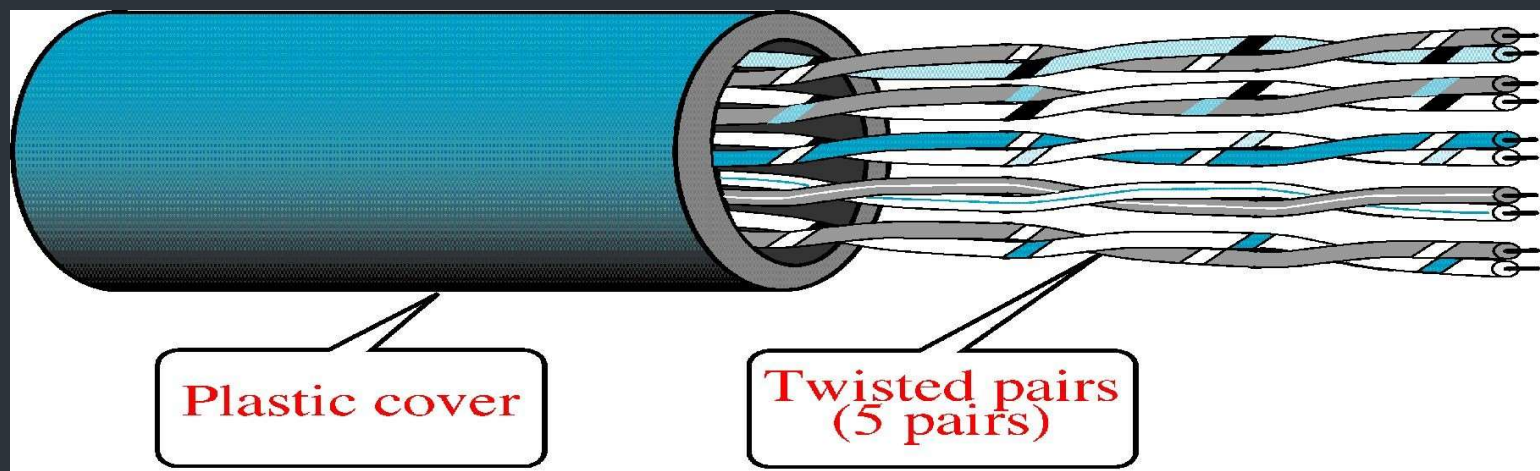
1. Twisted Pair Cable
2. Coaxial Cable
3. Fiber Optic Cable

1. Twisted Pair Cable

- It has two conductors wires scratch around each other & each are surrounded by an insulating material.
- Twisted Pair come in two forms.
 - a. Unshielded Twisted Pair cable
 - b. Shielded Twisted pair cable

Unshielded Twisted Pair Cable: (UTP)

- It is a most common type of telecommunication medium.
- It is used in the telephone system.
- Each pair is twisted with different number of twist per inch to help to eliminate interference from adjacent pair.
- Unshielded twisted pair is also popular for token ring network, which were traditionally wired with shielded twisted pair.



- The Electronic Industry Association(EIA)/ Telecommunication Industry Association (TIA) has establish standard of UTP and rated five category of wires:

Type	Use
Category 1	Voice Only(Telephone Wire)
Category 2	Data Transmission of up to 4 MBPS(Local talk)
Category 3	Data Transmission of up to 10 MBPS(Ethernet)
Category 4	Data transmission of up to 20mbps(16 mbps token)
Category 5	Data transmission of up to 100mbps(Fast Ethernet)

Advantages

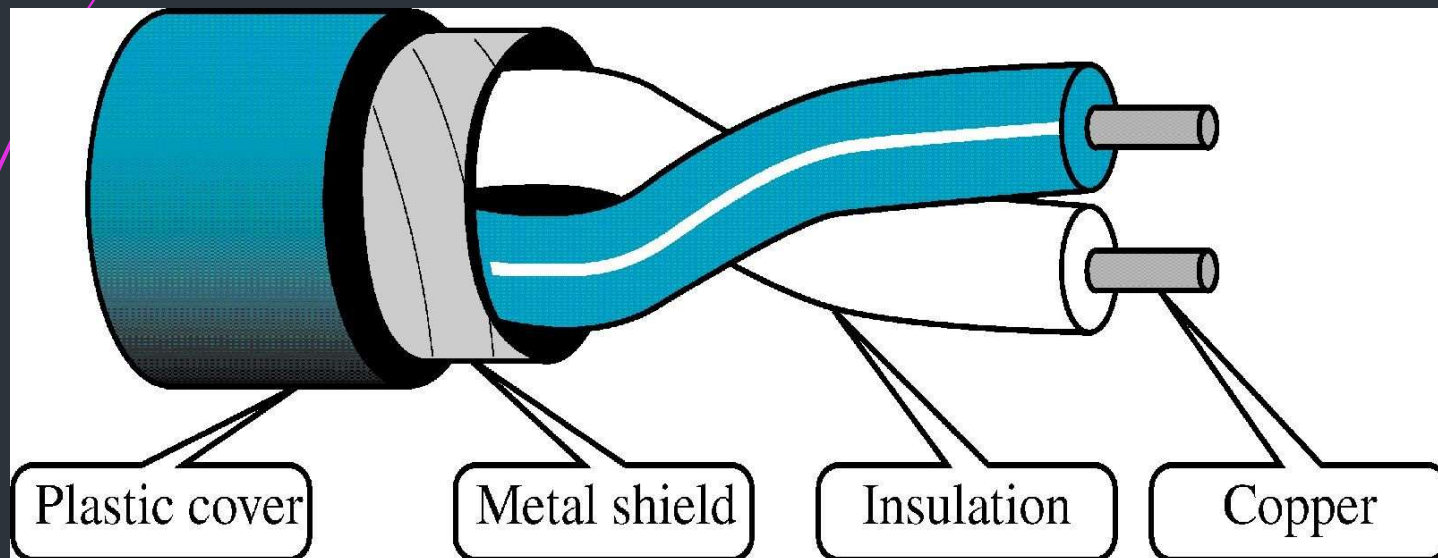
- UTP system is colour coded cabling.
- UTP is less expensive than co-axial and fiber.
- UTP is a very easy media to install and reconfigure.

Unshielded Twisted Pair connector:

- Each wire in a cable is attached to one pin in the connector.
- The most frequency use of this plug is RJ45 connector with 8 pin.
- One for each wire of four twisted pair.

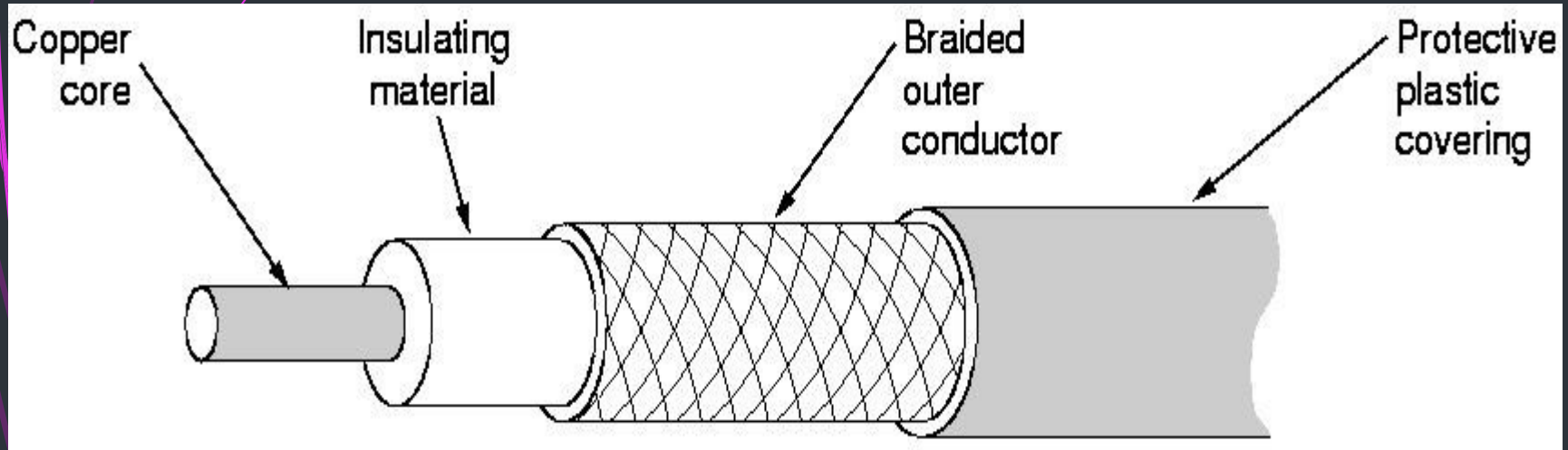
Shielded Twisted Pair Cable: (STP)

- STP cable has a metal foil covering each pair of conductor.
- It can eliminate cross talk, which is the undesired effect of one circuit on another line.
- It occurs when line pick up some of the signals travelling down another signal or another line.



- Shielded twisted pair's shielded increase its immunity to electromagnetic interference which allows it to transmit data over longer distance than UTP.
- Shielded twisted pair (STP) has the same quality consideration and uses the same connector as UTP.
- Materials and manufacturing requirement make STP more expensive than UTP.

- In its simplest form, coaxial cable consists of a core made of solid copper surrounded by insulation, a braided metal shielding, and an outer cover.



- It is the oldest network cable which is easy to use.
- It has a larger bandwidth and can support transmission over long distance.
- The metal shield help to block any outside interface from florescent light, motors and other computers.
- Although Co-axial cable is difficult to install. It is highly resistance to signal interface.
- It can support greater cable length then twisted pair cable.
- There are two types of co-axial cable.
 - Thick co-axial cable
 - Thin co-axial cable

● Thin co-axial cable

- Thin co-axial cable is also referred to as a thin net.
- 10base2 refers to the specification for thin co-axial cable carrying Ethernet signals. The 2 refers to approximate maximum segment length being 200 meters.
- Thin co-axial cable is popular in school network.

● Thick Co-axial Cable

- 10base5 refers to the specification for thick co-axial cable carrying Ethernet signals. The 5 refers to the maximum segment length being 500 meters.
- Thick co-axial cable has extruded protective plastic cover.
- One disadvantage of thick co-axial cable is that it does not bend easily and is difficult to install.
- The advantage of thick co-axial cable is that it is most robust, harder to change and transmit data over a longer₁₆ distance.

Advantage

§ 17 Co-axial has a sufficient frequency range to support multiple channels, which allows for much greater throughput.

- Because it has a greater bandwidth per channel, it supports a mix range of services. For ex, voice, data and video.
- Because the inner conductor is in a shield, it has lower error rate.
- It reduces the noise and cross talk.

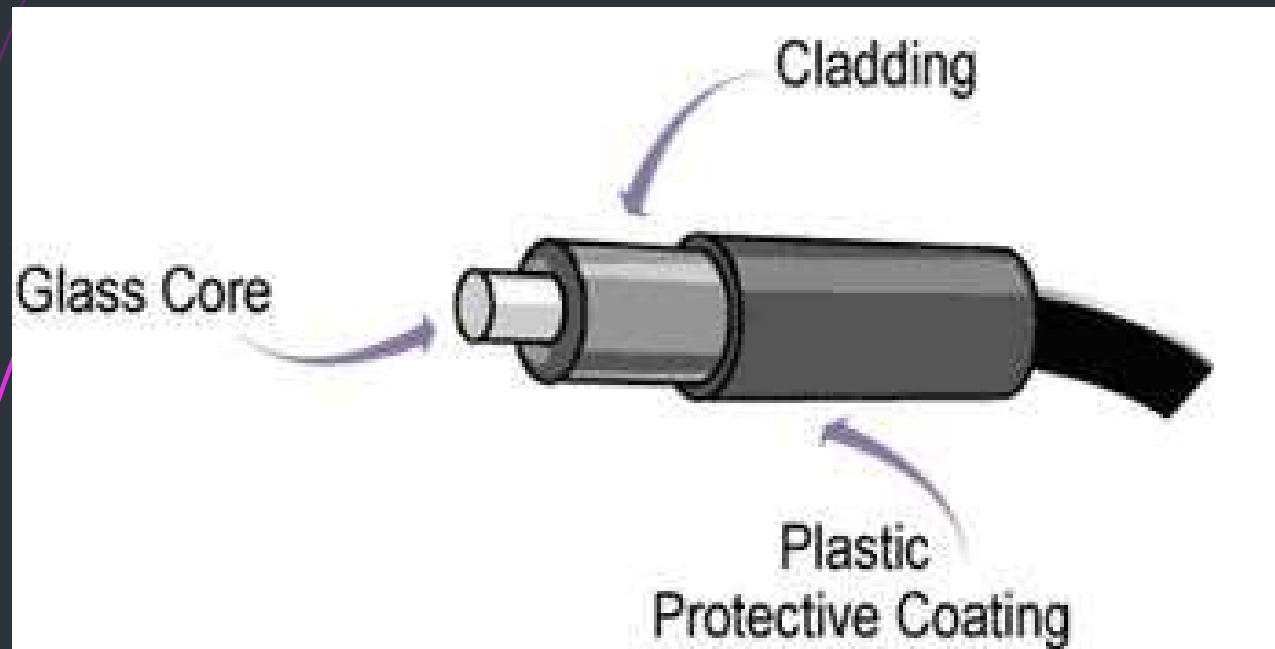
Disadvantages:

- Co-axial cable may be damage by lighting sock.
- Installation cost in the local environment is high.
- It is not supported for some network standard.

Co-axial cable connector:

- The most common type of connecter used with co-axial cable is the BNC connector.

- Optical fiber consists of a glass core, surrounded by a glass cladding with slightly lower refractive index.



- Fiber Optics is long, thin of very pure glass about the diameter of human hair.
- They are arranged in bundles called optical and used to transmit light signals over long distance.
- It has a following parts:
 - **Core:** Thin glass centre of the fiber where the light travels.
 - **Cladding:** Outer optical material surrounding the core that reflects light back into the core.
 - **Buffer coating:** Plastic coating that protect the fiber form damage.
- Hundreds or thousands of these optical fiber are arranged in bundles in optical cables. The bundles are protected by the cables outer covering called a jacket.

20 ● In a fiber cable the electrical signals are converted into appropriate light signals and converted into appropriated light signals and transmitted through it.

● An emitter sends the signals from one end of the cable and a light sensor senses this signals and then convert into its digital equivalence.

● There are transited which located at both end of cable, where the signals are converted from electrical to light signal and vice-versa.

● Fiber optic cables are available in different size.

○ There are two source of light:

- Laser

- LED [Light Emitting Diode]

- Fiber optic cables use the principle of total reflection to transmit light signals.
- Speed of a light defers depending on the medium.

Use and Need of the fiber optics:

- Fiber optic cables are mainly used in environment that is highly susceptible to noise other interface.
- These cables are highly secure as they do not emit any external signals.

- It is use due to the following characteristics:

22 **Bandwidth :**

Carries hugh amount of data ranging from 100 mbps to 1 gbps.

- **Segment length :**

Transmit readable data signals in a range of 2km to 100km. this allows the user to transmit data over a long distance.

- **Interface :**

Secured data from being securely read as no electrical signal pass through this type of cable. It is used in TV towers, radio station and electric transformer.

How the Light propagate in FiberOptic?

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- Fiber optic cables can support two modes for propagation light.

- ☐ Single Mode

- ☐ Multi Mode

- **Single Mode :**

- In this type cable the light travels straight down the fiber, which means data can travel greater distance.
- Single mode cable has a larger diameter then multi mode cable. it is header to manufacture.

Disadvantage of signal mode:

- only one signal can be transmitted through it.
- To transmit two signals you need two strands of fiber optic cables.

- Multi Mode:

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- In multimode cable the light bounce off the cables as it travel down, which causes the signal to be slower and therefor data can not travel great distance.
- Multi mode code is often used in LAN, seems Data is not required to travel acroce the country.
- Two or more signal can be transmitted though it.

Advantages of Fiber Optics:

- Expansive:
 - Several miles of optic cable can be made chipper then equivalent length of copper wire.
- Thinner :
 - Optical fiber can be drawn to smaller diameter then copper wire.

- **Higher carrying capacity :**

Because optical fiber are thinner than copper wire, more fiber can be bundled in to a given diameter cable than copper wire.

- **Less Signal Degradation :**

- The loss of signal in optic fiber is less than copper wire.

- **Light signal :**

- Unlike electrical in copper wire, light signal from one fiber do not interfere with other fiber in the same cable.

- **Digital signal**

- Optical fiber are ideally suited for carrying digital information which is useful in computer network.

- **Light weight**

- This cable weight is less than as compare to copper wire.

Disadvantage Of optical

fiber optic cable is expensive.

- Glass fiber is more easily broken than wire. It is less useful for applications where hardware portability is required.

Fiber Optic Connector :

- The most common connector used with fiber optic cable is an **ST connector**. It is similar to BNC connector.

Basics Of Difference

	UTP	STP	CO-axial	Fiber Optic
Bandwidth	10Mbps-100 Mbps	10Mbps-100 mbps	10Mbps	100Mbps-1G bps
Attenuation	Very high Attenuation	High Attenuation	Low Attenuation	Very Low Attenuation
Segment Length	500metres	100metres	185m- 500m	2km – above.
Installation	Least expensive	Costly than UTP	Costly than Twisted Pair	More costly to install.
Cost	Rs. 10 -20/m	Rs. 20- 40 /m	Rs. 250/m	Rs. 700/m
Crosstalk	More	Relatively less	Minimum	No affect

Unguided/ Wireless Media

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- Wireless transmission that sends electromagnetic (EM) signals through air or space without any physical wire.
- Common uses of wireless data transmission include pagers, cellular telephones, microwave transmissions, communication satellites, mobile data networks, personal digital assistants, television remote controls.

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graph TD; A["Wireless Transmission"] --> B["Radio Wave"]; A --> C["Microwave"]; A --> D["Infrared"]; A --> E["Satellite"];
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Wireless Transmission

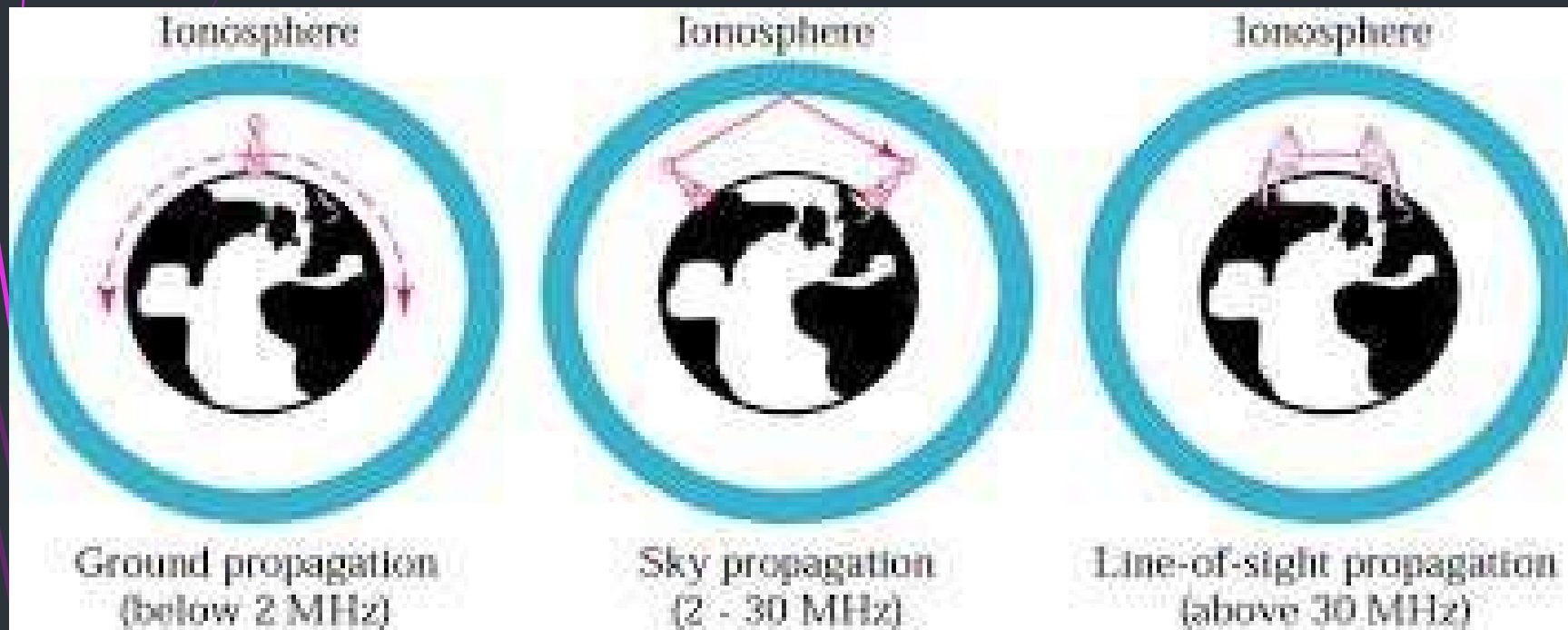
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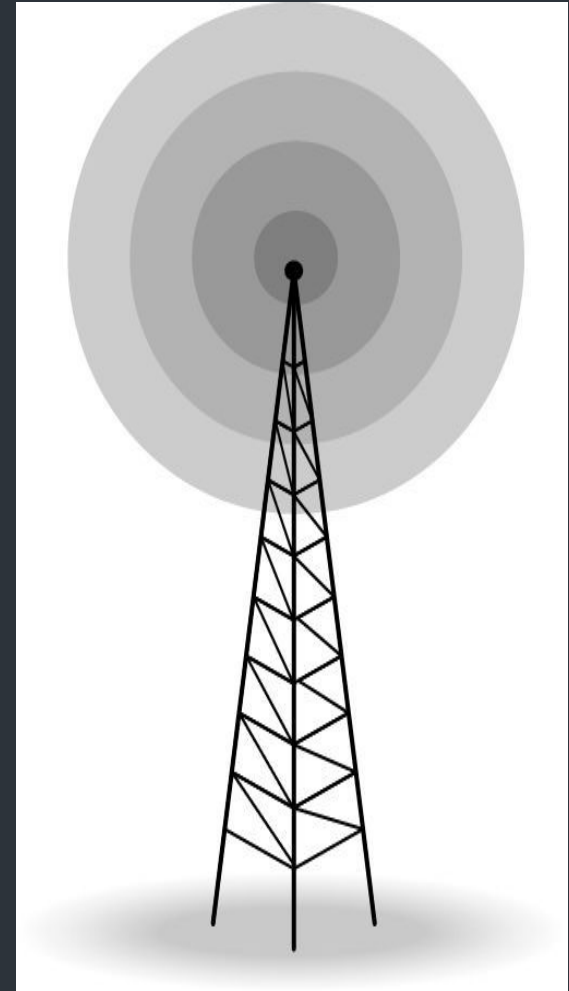
Propagation Method



1. Radio Wave:

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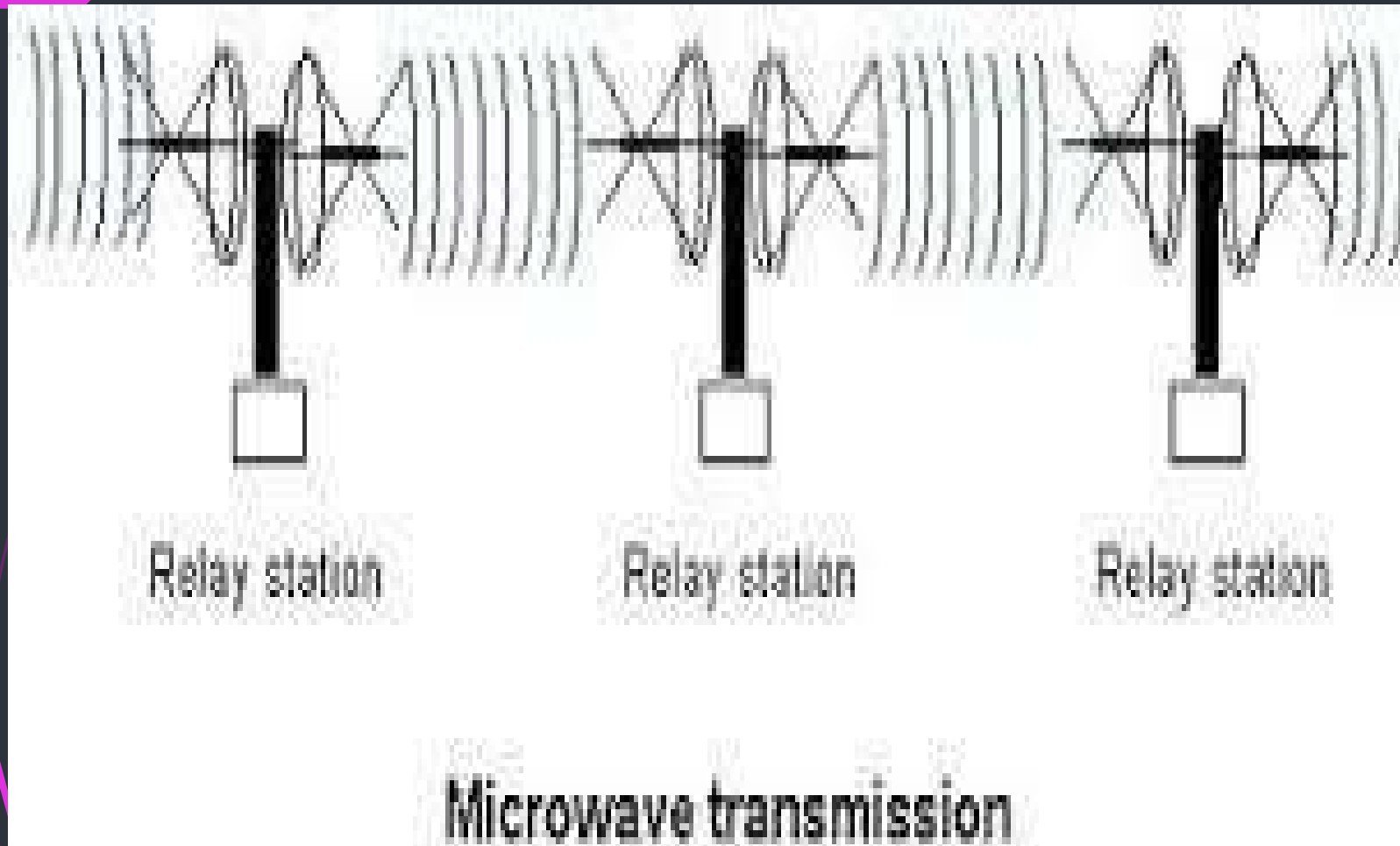
- used to enclose frequencies in the range 3 kHz to 300 GHz.
- Used Omni Direction Signal i.e. Signal is propagated in all direction & receiving antennas need not be aligned.
- Propagate signal in sky mode. So it can travel long distance & even it can penetrate walls easily .
- Is Multicast i.e. one sender & multiple receiver.
- Example, F.M. Radio, Television



2. Micro Wave:

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- used to encompass frequencies in the range 1 GHz to 300 GHz.
- Used Uni Direction Signal i.e. transmission is done only in one direction.
- Propagate signal in line of sight i.e. towers with mounted antennas need to be in direct sight of each other.
- Transmitters & Receivers are mounted on high towers. So long distance of transmission is not possible & signal become weak.



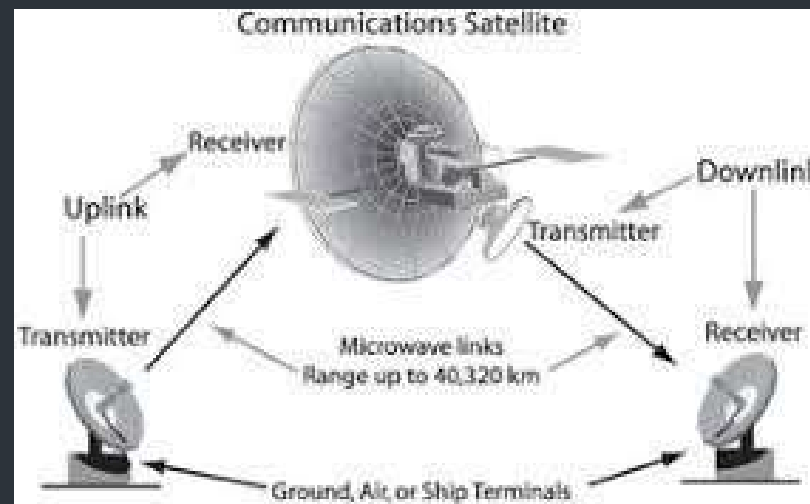
3. Infrared:

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- used to enclose frequencies in the range 300 GHz to 400 THz.
- Used for shorter distance communication.
- Line-of-sight propagation mode is employed in all applications of infrared waves means transmitter and receiver must be aligned with respect to each other so that nothing obstructs the path of infrared wave.
- They cannot penetrate through obstacles.

4. Satellite Communication:

- It is used to link two or more ground-based microwave transmitter/receivers, known as earth stations, or ground stations.
- The satellite receives transmissions on one frequency band (uplink), amplifies or repeats the signal, and transmits it on another frequency (downlink).
- used to enclose frequencies in the range 4GHz to 6 GHz.



THANK YOU