



Transmission Media

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- In data communication terminology, a transmission medium is a physical path between the transmitter and the receiver i.e. it is the channel through which data is sent from one place to another.

Transmission Media

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- Guided Media
- Unguided Media

Types of Transmission Media

- It is also referred to as **Wired or Bounded transmission media**.
- Signals being transmitted are directed and confined in a narrow pathway by using physical links.
- Features are:
 - High Speed
 - Secure
 - Used for comparatively shorter distances

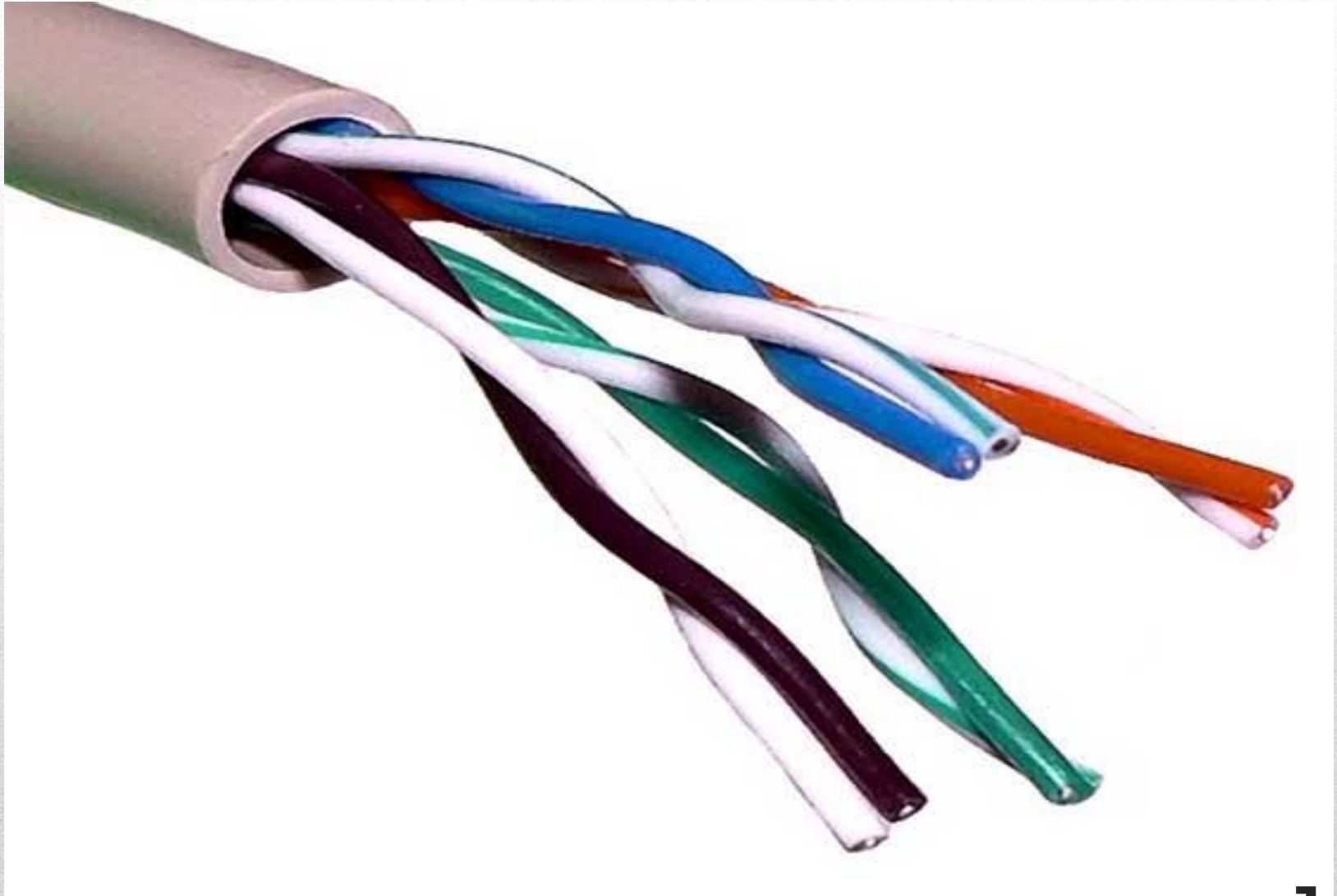
Guided media

- Twisted Pair Cable
 - Unshielded Twisted Pair (UTP)
 - Shielded Twisted Pair (STP)
- Coaxial Cable
- Power Lines
- Fiber Optic Cables

Types of Guided Media

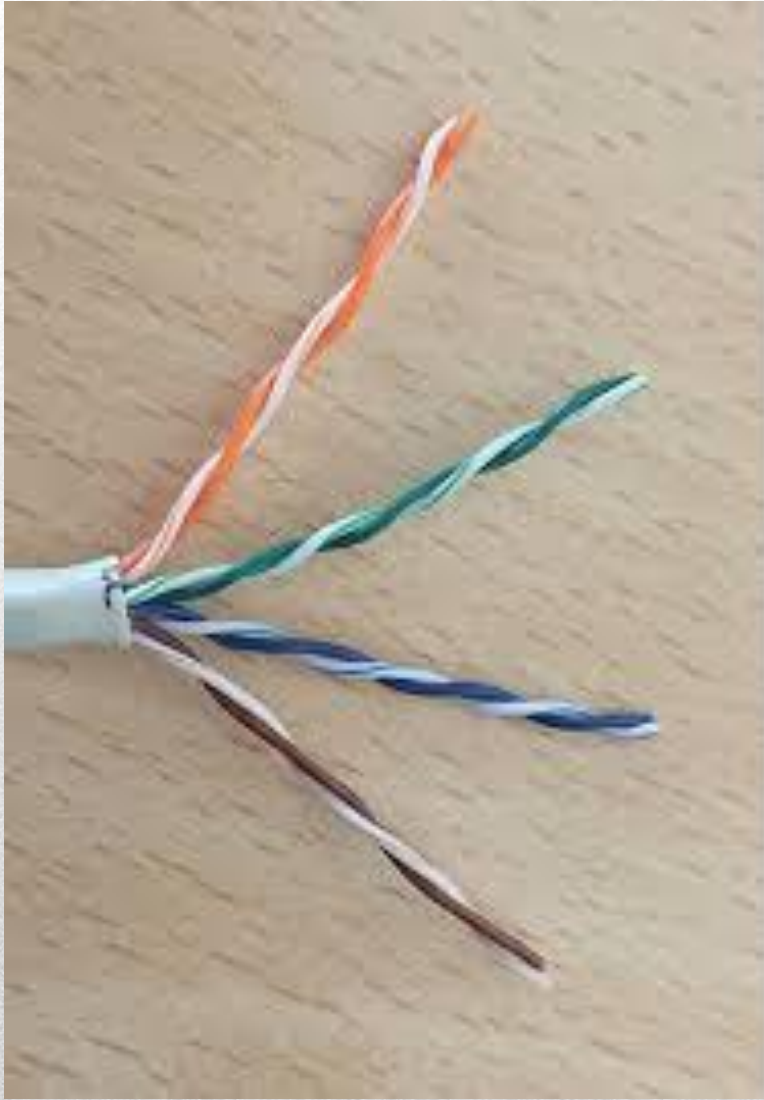
- A twisted pair cable is made of two plastic insulated copper wires twisted together to form a single media.
- Out of these two wires, only one carries actual signal and another is used for ground reference.
- The twists between wires are helpful in reducing noise (electro-magnetic interference) and crosstalk.

Twisted Pair Cable

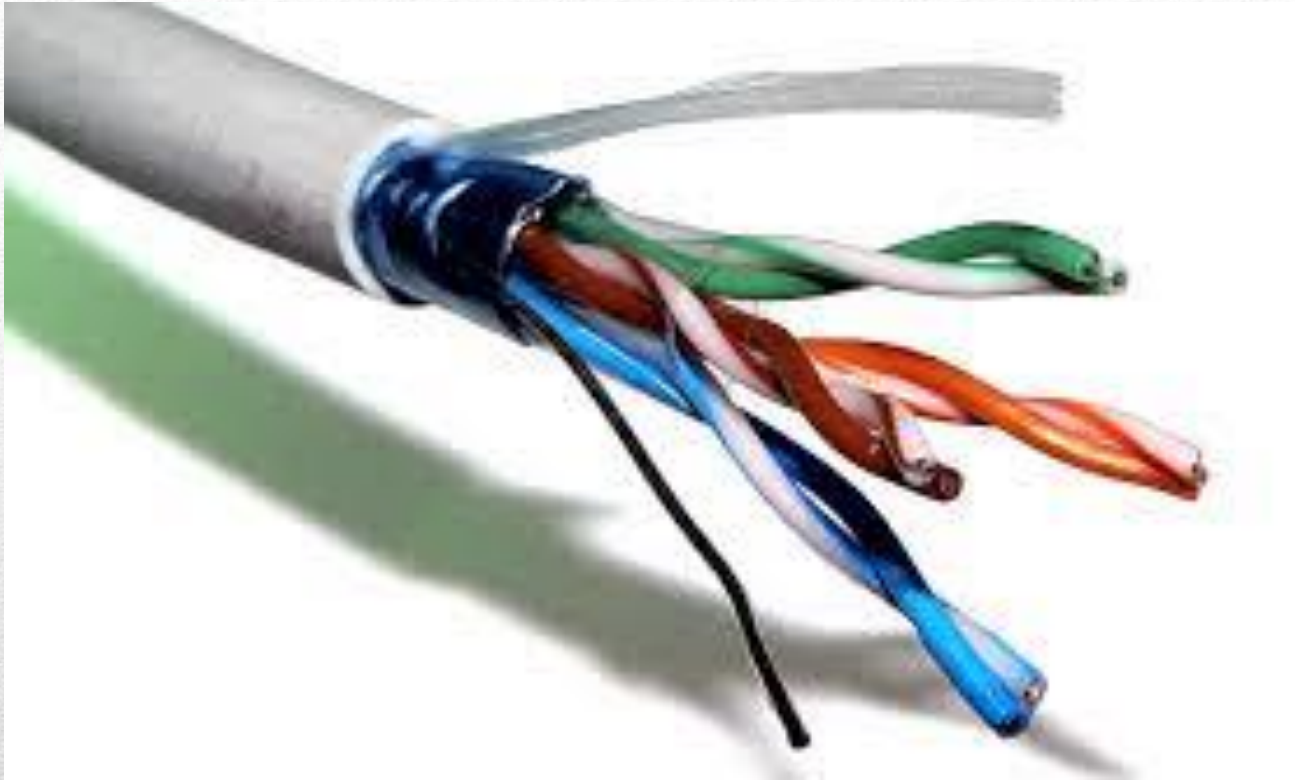


- There are two types of twisted pair cables:
 - Shielded Twisted Pair (STP) Cable
 - Unshielded Twisted Pair (UTP) Cable
- STP cables comes with twisted wire pair covered in metal foil. This makes it more indifferent to noise and crosstalk.
- UTP has seven categories, each suitable for specific use. In computer networks, Cat-5, Cat-5e, and Cat-6 cables are mostly used. UTP cables are connected by RJ45 connectors.

Types of Twisted Pair



Unshielded Twisted Pair



Shielded Twisted pair

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- **Advantages:**
 - Least expensive
 - Easy to install
 - High speed capacity
- **Disadvantages:**
 - Susceptible to external interference
 - Lower capacity and performance in comparison to STP
 - Short distance transmission due to attenuation

Pros & Cons of UTP

- **Advantages:**

- Better performance at a higher data rate in comparison to UTP
- Eliminates crosstalk
- Comparatively faster

- **Disadvantages:**

- Comparatively difficult to install and manufacture
- More expensive
- Bulky

Pros & Cons of STP

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- Coaxial cable has two wires of copper.
- The core wire lies in the center and it is made of solid conductor.
- The core is enclosed in an insulating sheath.
- The second wire is wrapped around over the sheath and that too in turn encased by insulator sheath.
- This all is covered by plastic cover.

Coaxial Cable



- Because of its structure, the coax cable is capable of carrying high frequency signals than that of twisted pair cable.
- The wrapped structure provides it a good shield against noise and cross talk.
- The transmission of digital signal on the **cable** is bi-directional.
- Baseband **coaxial cables** are 50 ohm **cables** used for 'digital transmission'.
- For 1Km **cables** the **bandwidth** is 1-2 Gbps. Longer **cables** can be used with low data rates or periodic amplifiers.

Features of Coax

- There are three categories of coax cables namely,
 - RG-59 (Cable TV)
 - RG-58 (Thin Ethernet)
 - RG-11 (Thick Ethernet)
- RG stands for Radio Government.
- Cables are connected using BNC connector and BNC-T. BNC terminator is used to terminate the wire at the far ends.

Categories of Coax

- **Advantages:**
 - High Bandwidth
 - Better noise Immunity
 - Easy to install and expand
 - Inexpensive
- **Disadvantages:**
 - Single cable failure can disrupt the entire network

Pros & Cons of Coax

- Power Line communication (PLC) is Layer-1 (Physical Layer) technology which uses power cables to transmit data signals.
- In PLC, modulated data is sent over the cables.
- The receiver on the other end de-modulates and interprets the data.
- Because power lines are widely deployed, PLC can make all powered devices controlled and monitored.
- PLC works in half-duplex.

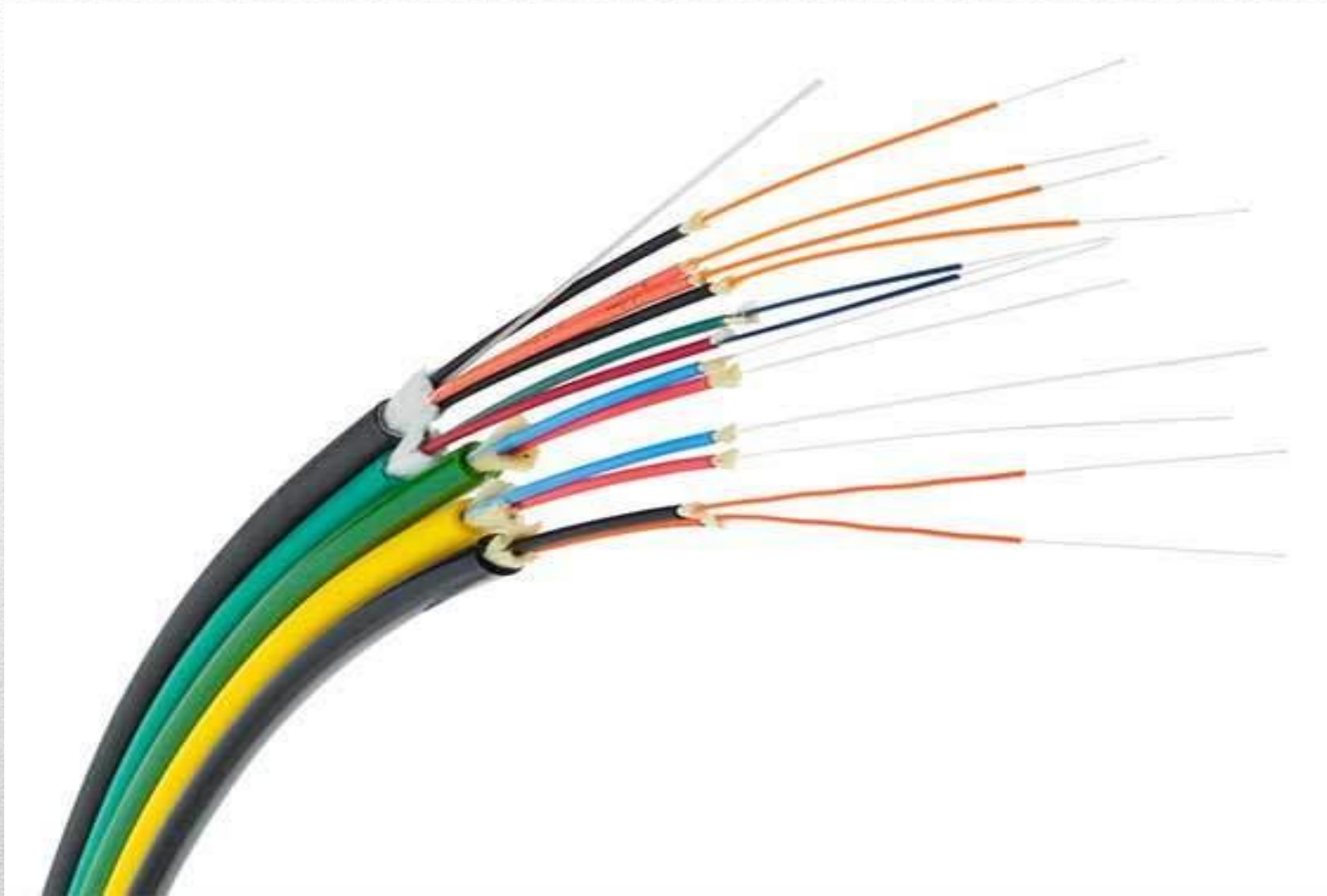
Power Lines

- There are two types of PLC:
 - Narrow band PLC
 - Broad band PLC
- *Narrow band PLC* provides lower data rates up to 100s of kbps, as they work at lower frequencies (3-5000 kHz). They can be spread over several kilometres.
- *Broadband PLC* provides higher data rates up to 100s of Mbps and works at higher frequencies (1.8 – 250 MHz). They cannot be as much extended as Narrowband PLC.

Types of PLC

- Fiber Optic works on the properties of light.
- When light ray hits at critical angle it tends to refract at 90 degree. This property has been used in fiber optic.
- The core of fiber optic cable is made of high quality glass or plastic.
- From one end of it light is emitted, it travels through it and at the other end light detector detects light stream and converts it to electric data.
- Fiber Optic provides the highest mode of speed. It comes in two modes, one is single mode fiber and second is multimode fiber. Single mode fiber can carry a single ray of light whereas multimode is capable of carrying multiple beams of light.

Fiber Optics





- Fiber Optic provides the highest mode of speed. It comes in two modes,
 - Single mode fiber
 - Multimode fiber.
- *Single mode fiber* can carry a single ray of light whereas *multimode* is capable of carrying multiple beams of light.
- Fiber Optic also comes in *unidirectional* and *bidirectional* capabilities. To connect and access fiber optic special type of connectors are used. These can be Subscriber Channel (SC), Straight Tip (ST), or MT-RJ.

Modes of Fiber

- **Advantages:**
 - Increased capacity and bandwidth
 - Light weight
 - Less signal attenuation
 - Immunity to electromagnetic interference
 - Resistance to corrosive materials
- **Disadvantages:**
 - Difficult to install and maintain
 - High cost
 - Fragile
 - Unidirectional, ie, will need another fibre, if we need bidirectional communication

Pros & Cons of Optical Fibre Cable



Optical Fiber Transmission in the Form of Light Waves

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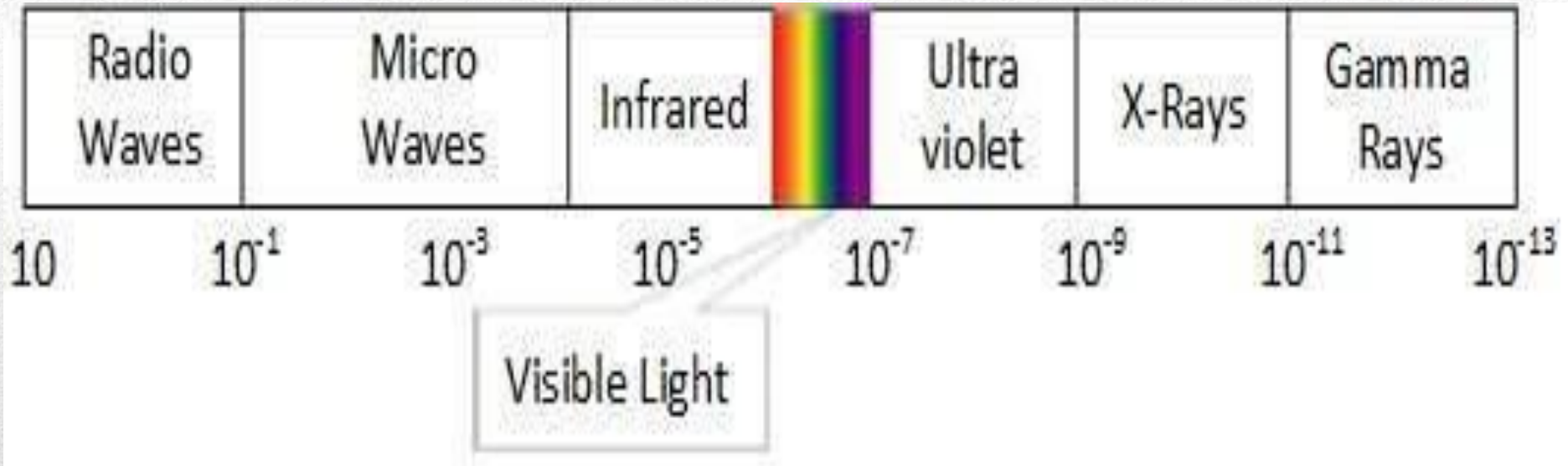
- It is also referred to as *Wireless or Unbounded* transmission media.
- No physical medium is required for the transmission of electromagnetic signals.
- **Features:**
 - Signal is broadcasted through air
 - Less Secure
 - Used for larger distances

Unguided Media

- Wireless transmission is a form of unguided media.
- Wireless communication involves no physical link established between two or more devices, communicating wirelessly.
- Wireless signals are spread over in the air and are received and interpreted by appropriate antennas.
- When an antenna is attached to electrical circuit of a computer or wireless device, it converts the digital data into wireless signals and spread all over within its frequency range.
- The receptor on the other end receives these signals and converts them back to digital data.

Wireless Transmission

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A little part of electromagnetic spectrum can be used for wireless transmission.

- In the present days, wireless communication system has become an essential part of various types of wireless communication devices, that permits user to communicate even from remote operated areas.
- There are many devices used for wireless communication like mobiles. Cordless telephones, ZigBee wireless technology, GPS, Wi-Fi, satellite television and wireless computer parts.
- Current wireless phones include 3G, 4G & 5G networks, Bluetooth and Wi-Fi technologies.

Present Scenario of Wireless

- Radio wave
- Infrared
- Microwave
- Light waves

Types of Wireless Transmission Media

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- Radio frequency is easier to generate and because of its large wavelength it can penetrate through walls and structures alike.
- Radio waves can have wavelength from 1 mm – 100,000 km and have frequency ranging from 3 Hz (Extremely Low Frequency) to 300 GHz (Extremely High Frequency).
- Radio frequencies are sub-divided into six bands.

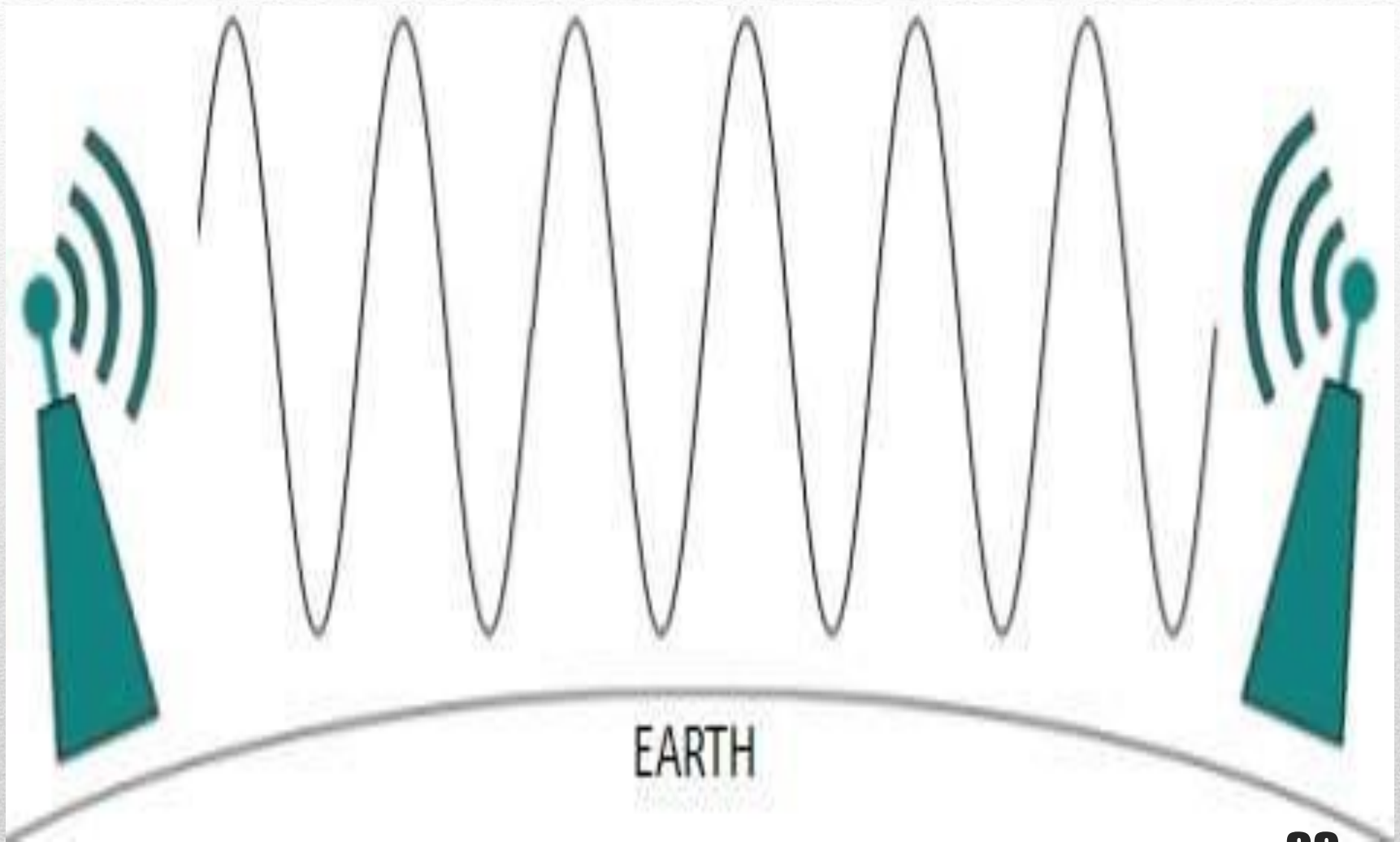
Radio Transmission

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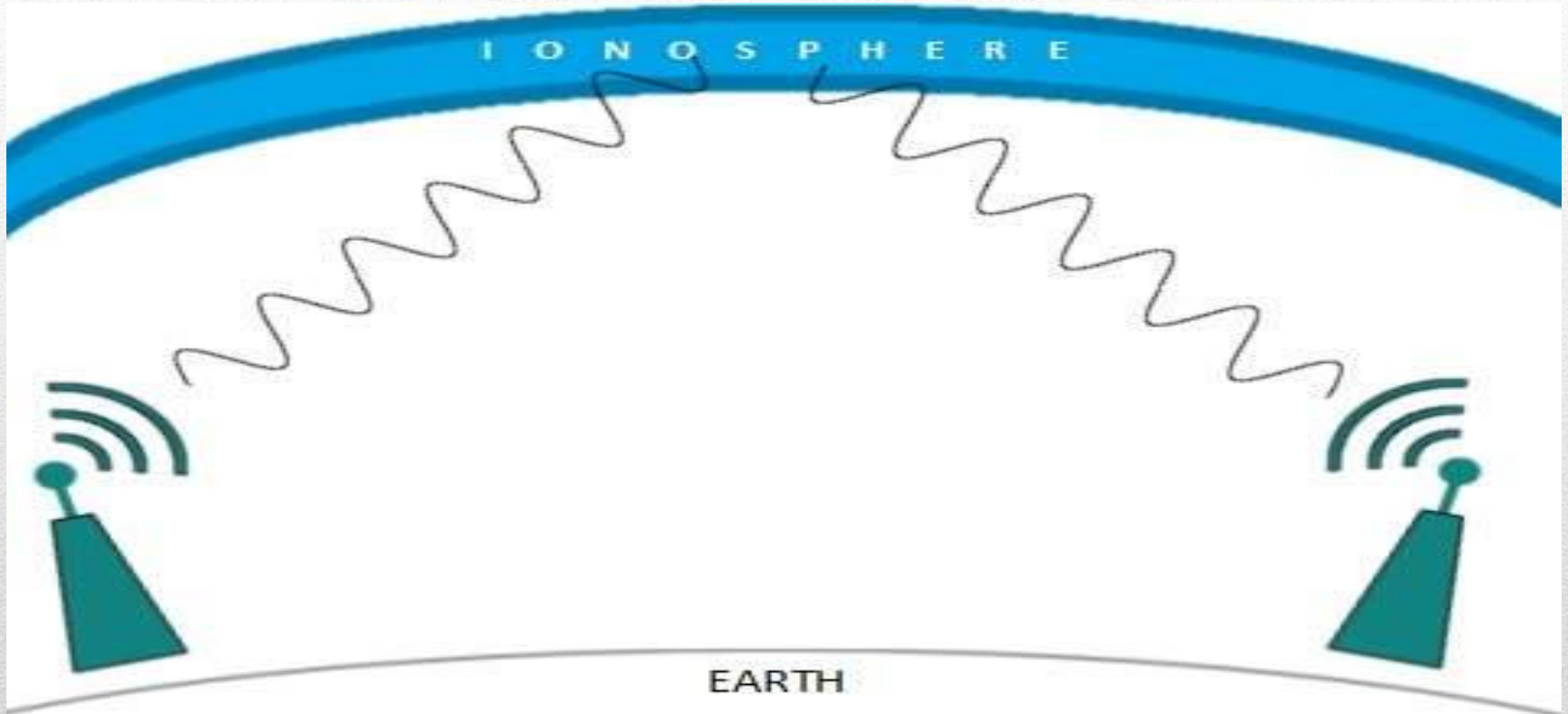
- Radio waves at lower frequencies can travel through walls whereas higher RF can travel in straight line and bounce back.
- The power of low frequency waves decreases sharply as they cover long distance.
- High frequency radio waves have more power.
- Lower frequencies such as VLF, LF, MF bands can travel on the ground up to 1000 kilometres, over the earth's surface.

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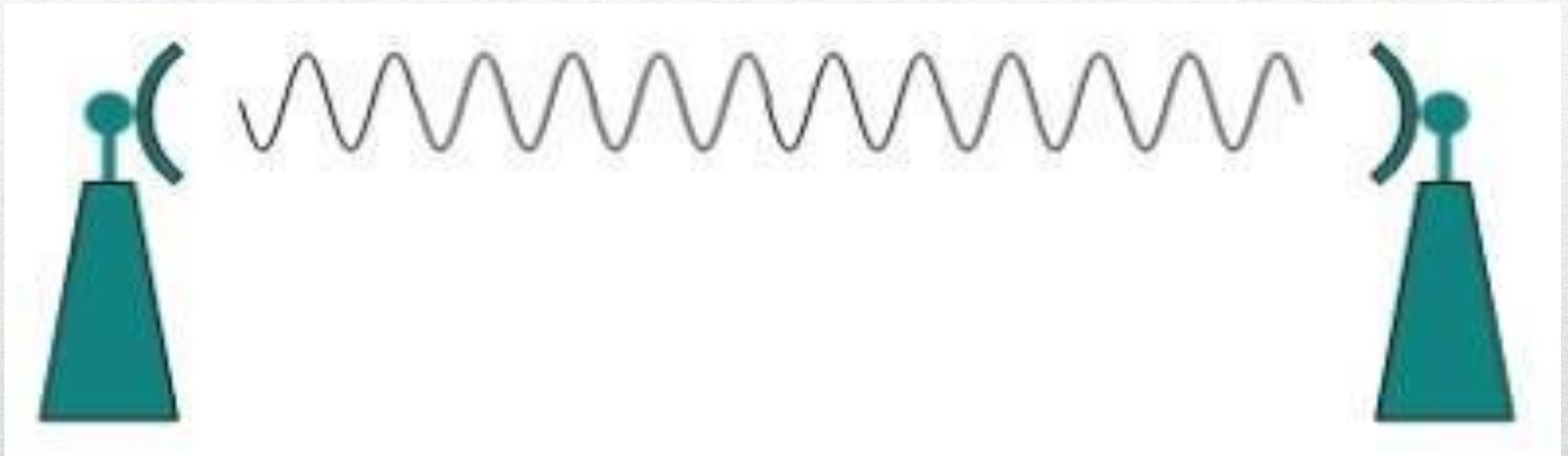
- Radio waves of high frequencies are prone to be absorbed by rain and other obstacles.
- They use Ionosphere of earth atmosphere. High frequency radio waves such as HF and VHF bands are spread upwards.
- When they reach Ionosphere, they are refracted back to the earth.



- Electromagnetic waves above 100 MHz tend to travel in a straight line and signals over them can be sent by beaming those waves towards one particular station.
- Because Microwaves travels in straight lines, both sender and receiver must be aligned to be strictly in line-of-sight.
- Microwaves can have wavelength ranging from 1 mm – 1 meter and frequency ranging from 300 MHz to 300 GHz.

Microwave Transmission

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Microwave Transmission

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- Microwave antennas concentrate the waves making a beam of it.
- Multiple antennas can be aligned to reach farther.
- Microwaves have higher frequencies and do not penetrate wall like obstacles.
- Microwave transmission depends highly upon the weather conditions and the frequency it is using.

MT Contd...

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- Infrared wave lies in between visible light spectrum and microwaves.
- It has wavelength of 700-nm to 1-mm and frequency ranges from 300-GHz to 430-THz.
- Infrared wave is used for very short range communication purposes such as television and it's remote.
- Infrared travels in a straight line hence it is directional by nature.
- Because of high frequency range, Infrared cannot cross wall-like obstacles.

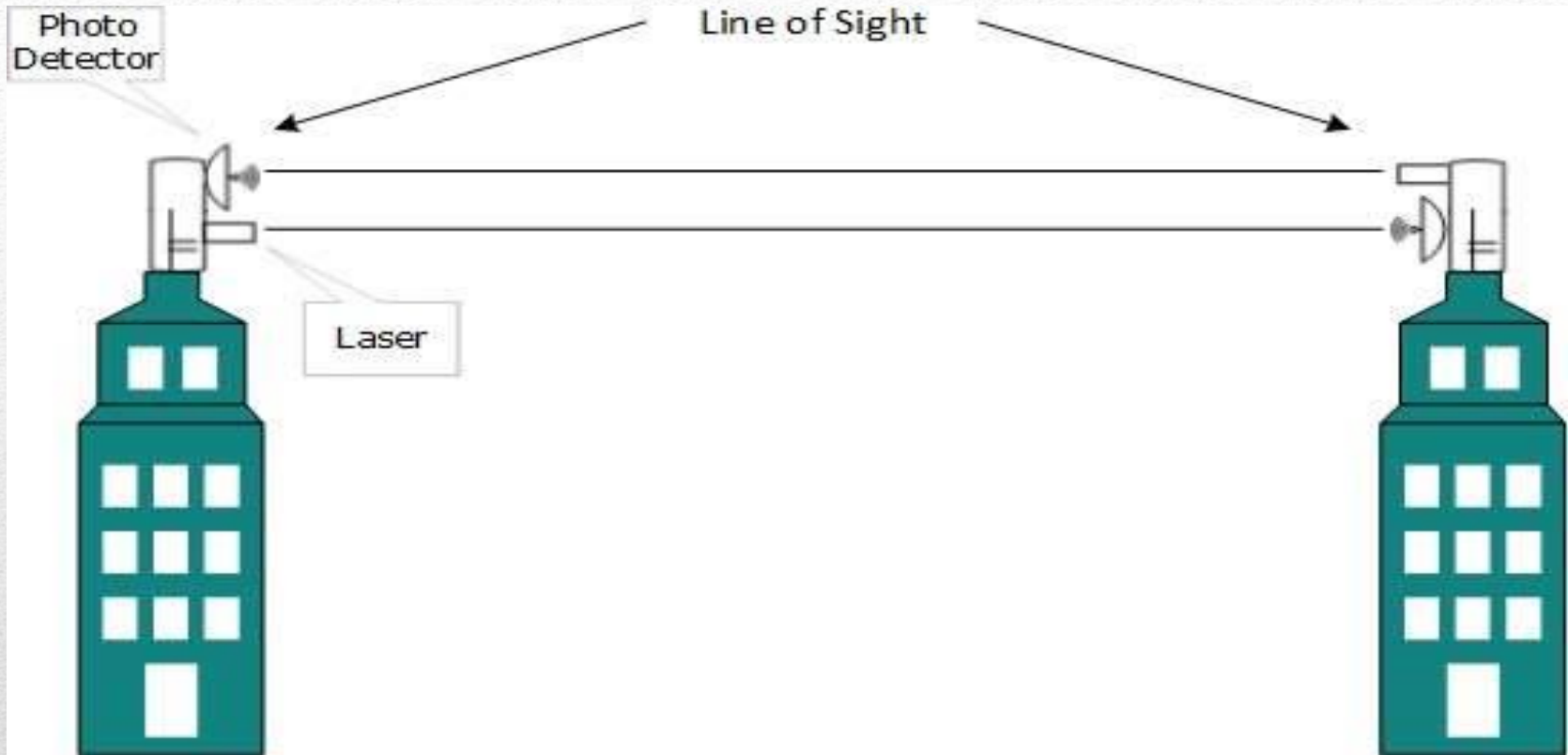
Infrared Transmission

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- Highest most electromagnetic spectrum which can be used for data transmission is light or optical signalling. This is achieved by means of LASER.
- Because of frequency light uses, it tends to travel strictly in straight line.
- Hence the sender and receiver must be in the line-of-sight.
- Because laser transmission is unidirectional, at both ends of communication the laser and the photo-detector needs to be installed.
- Laser beam is generally 1mm wide hence it is a work of precision to align two far receptors each pointing to lasers source.

Light Transmission

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Light Trans...

- Laser works as Tx (transmitter) and photo-detectors works as Rx (receiver).
- Lasers cannot penetrate obstacles such as walls, rain, and thick fog.
- Additionally, laser beam is distorted by wind, atmosphere temperature, or variation in temperature in the path.
- Laser is safe for data transmission as it is very difficult to tap 1mm wide laser without interrupting the communication channel.

LT Contd...

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- Advantages:
 - They are useful in wireless remote accessing methods.
 - Networks can be expanded without disturbing the current users.
- Disadvantages
 - Potential Security issues
 - They have limited speed as compared to guided media

Pros & Cons of Unguided Media



THANKS...