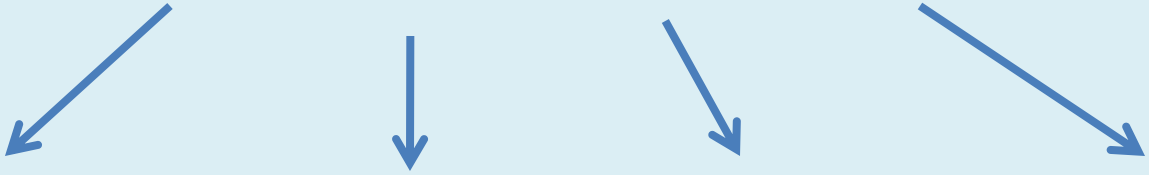
Transmission Media

Guided **Unguided**

Guided Transmission Media

- **Uses “Cabling” system**
- **The data signals are bound by the "cabling" system**
- **Also known as Bound Media.**

Types of Guided Media



Open Wire **Twisted Pair** **Coaxial Cable** **Optical Fibre**

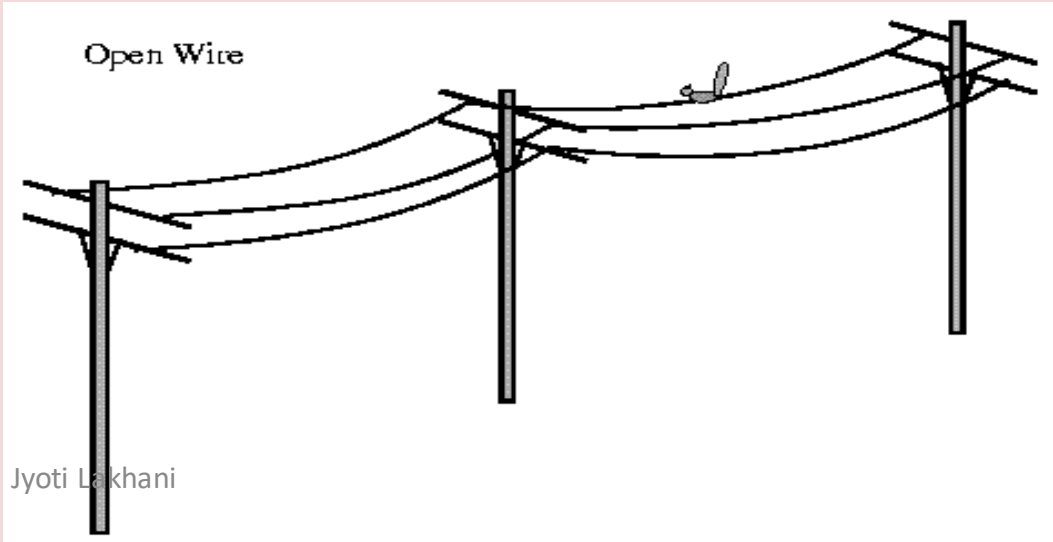
Open Wire

There is a single wire strung between poles

No shielding or protection from noise interference is used.

This media is susceptible to a large degree of noise and interference

Not acceptable for data transmission except for short distances under 20 ft



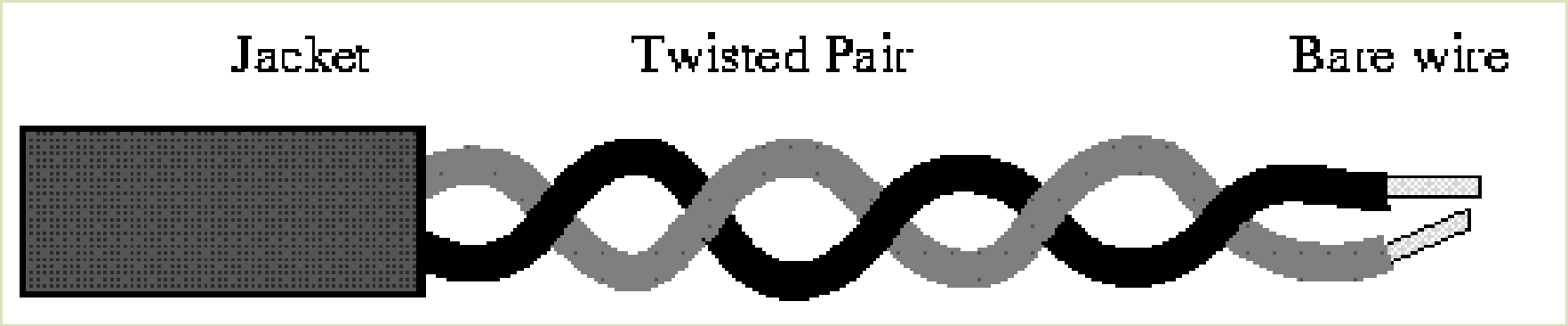
Twisted Pair

The wires in Twisted Pair cabling are twisted together in pairs.

Each pair would consist of a wire used for the +ve data signal and a wire used for the -ve data signal.

Any noise that appears on 1 wire of the pair would occur on the other wire

Because the wires are opposite polarities, When the noise appears on both wires, it cancels or nulls itself out at the receiving end.

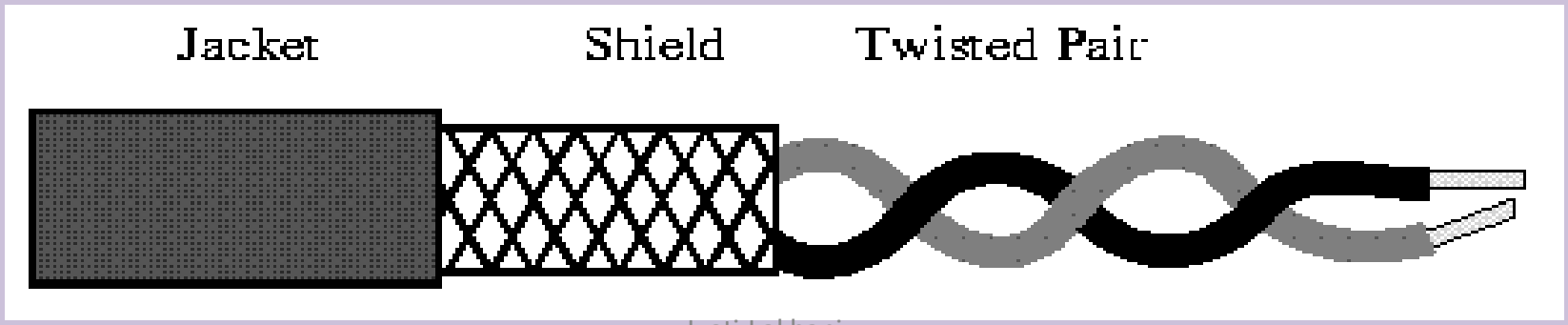


The degree of reduction in noise interference is determined specifically by the number of turns per foot.

Increasing the number of turns per foot reduces the noise interference

To further improve noise rejection, a foil or wire braid shield is woven around the twisted pairs

This "shield" can be woven around individual pairs or around a multi-pair conductor (several pairs).



Twisted Pair

UTP (Unshielded Twisted Pair)

STP (Shielded Twisted Pair)

Twisting the wires together results in a characteristic impedance for the cable.

A typical impedance for UTP is 100 ohm for Ethernet 10BaseT cable.

UTP or Unshielded Twisted Pair cable is used on Ethernet 10BaseT and can also be used with Token Ring.

It uses the RJ line of connectors (RJ45, RJ11, etc..)

STP or Shielded Twisted Pair is used with the traditional Token Ring cabling

Coaxial Cable

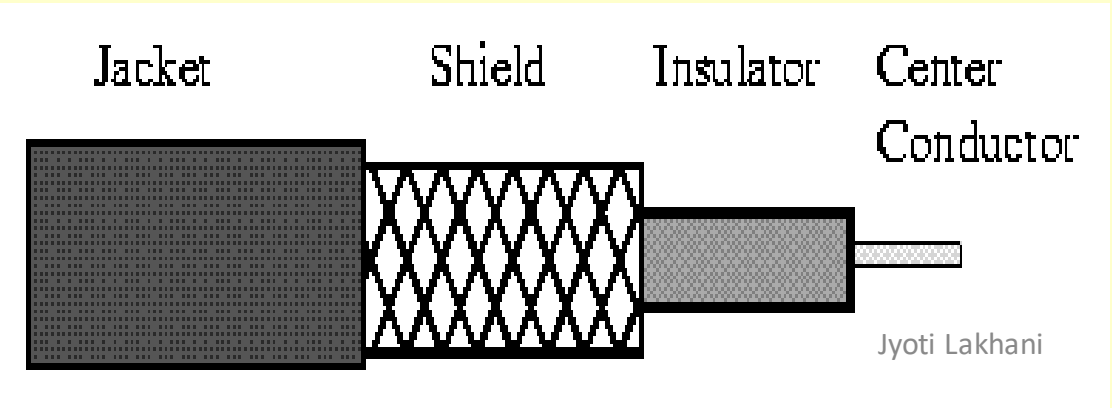
Coaxial Cable consists of 2 conductors

The inner conductor is held inside an insulator

The outer conductor woven around it providing a shield

An insulating protective coating called a jacket covers the outer conductor.

The outer shield protects the inner conductor from outside electrical signals



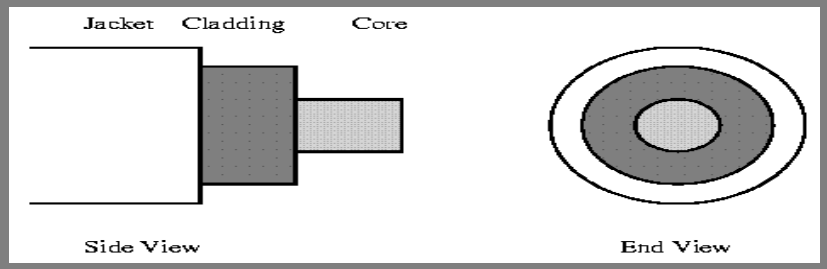
The distance between the outer conductor (shield) and inner conductor plus the type of material used for insulating the inner conductor determine the cable properties or impedance.

Typical impedances for coaxial cables are 75 ohms for Cable TV, 50 ohms for Ethernet Thinnet and Thicknet.

The excellent control of the impedance characteristics of the cable allow higher data rates to be transferred than Twisted Pair cable.

Optical Fibre

Optical Fibre consists of thin glass fibres that can carry information at frequencies in the visible light spectrum and beyond.



The typical optical fiber consists of a very narrow strand of glass called the **Core**.

Around the Core is a concentric layer of glass called the **Cladding**. A typical Core diameter is 62.5 microns (1 micron = 10-6 meters).

Typically Cladding has a diameter of 125 microns. Coating the cladding is a protective coating consisting of plastic, it is called the **Jacket**

Advantages of Optical Fiber

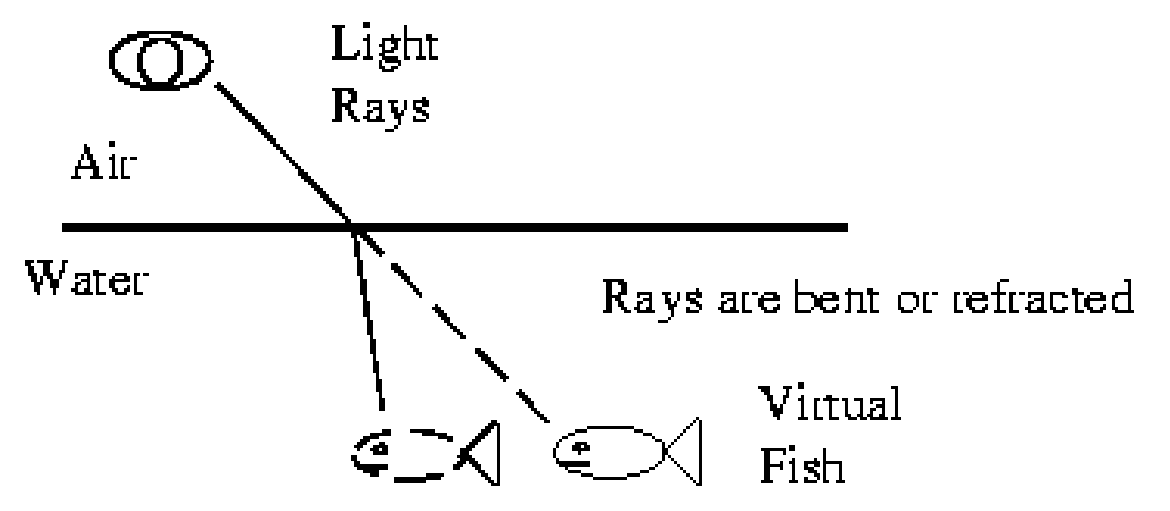
- **Noise immunity:** RFI and EMI immune (RFI - Radio Frequency Interference, EMI - ElectroMagnetic Interference)
- **Security:** cannot tap into cable.
- **Large Capacity** due to BW (bandwidth)
- **Longer distances** than copper wire
- **Smaller and lighter** than copper wire
- **Faster transmission rate**

Refraction

An important characteristic of Fibre Optics is Refraction

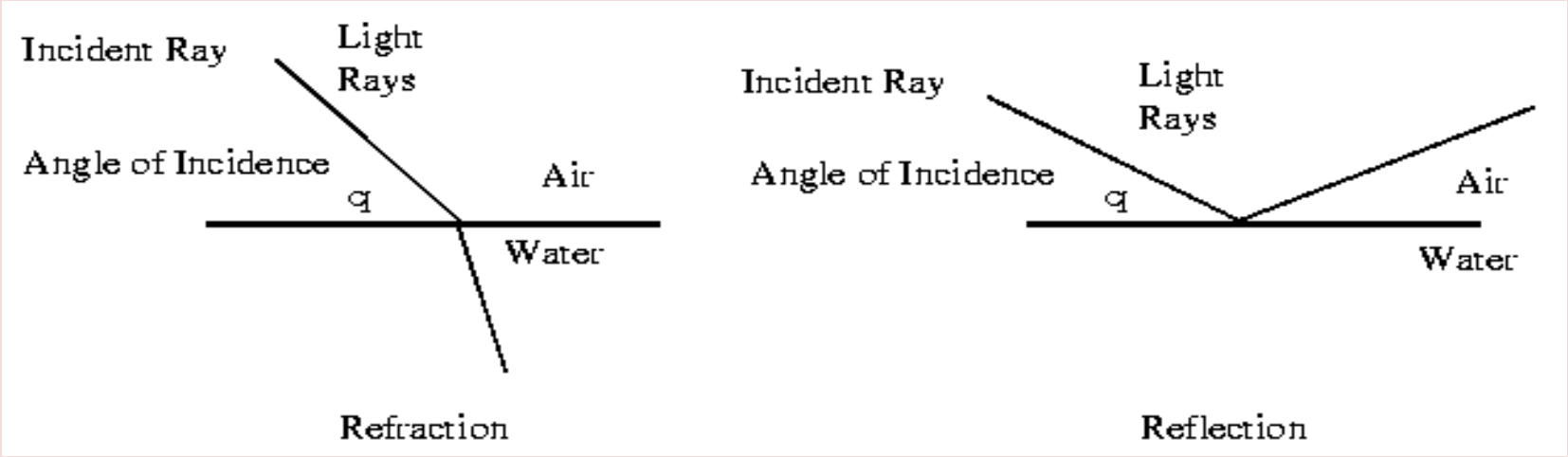
Refraction is the characteristic of a material to either pass or reflect light.

When light passes through a medium, it "bends" as it passes from one medium to the other.



If the angle of incidence is small, the light rays are reflected and do not pass into the water

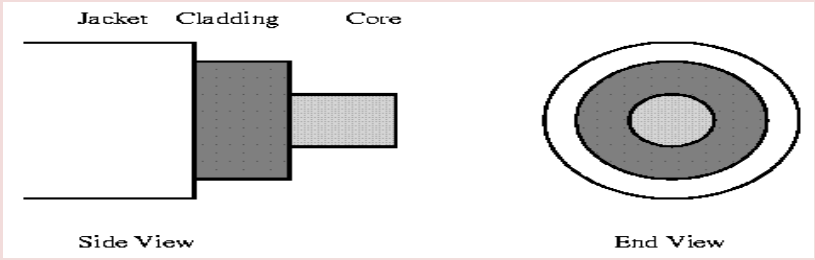
If the angle of incident is great, light passes through the media but is bent or refracted.

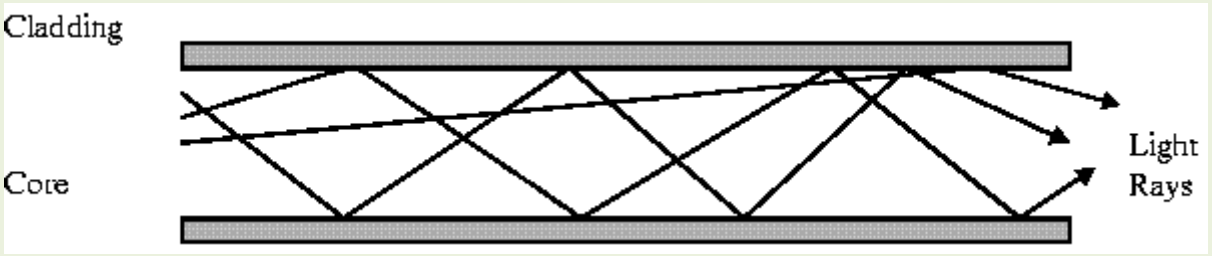


Optical Fibres work on the principle that -

The core refracts the light

The cladding reflects the light.





The core refracts the light and guides the light along its path.

The cladding reflects any light back into the core and stops light from escaping through it - it bounds the media

Optical Transmission Modes

There are 3 primary types of transmission modes using optical fibre.

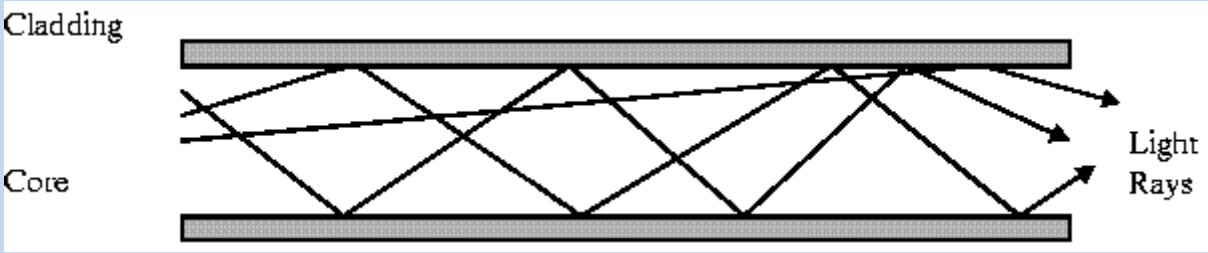
a) Step Index
b) Grade Index
c) Single Mode

Step Index

Step Index has a large core. the light rays tend to bounce around, reflecting off the cladding, inside the core.

This causes some rays to take a longer or shorted path through the core. Some take the direct path with hardly any reflections while others bounce back and forth taking a longer path.

The result is that the light rays arrive at the receiver at different times. The signal becomes longer than the original signal.

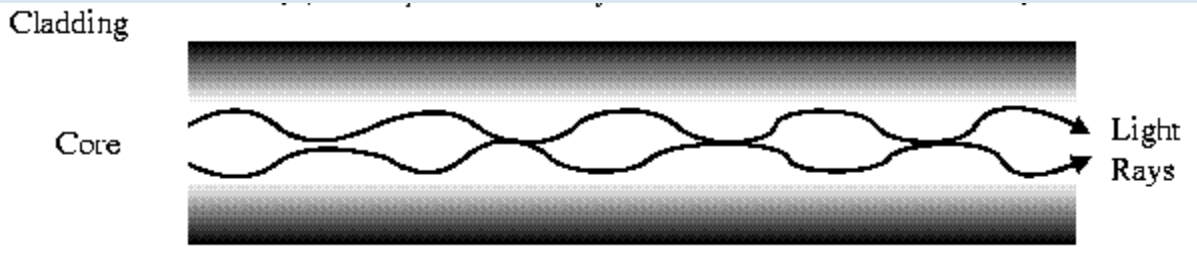


Grade Index

Grade Index has a gradual change in the Core's Refractive Index.

This causes the light rays to be gradually bent back into the core path.

The result is a better receive signal than Step Index. LED light sources are used. Typical Core: 62.5 microns.

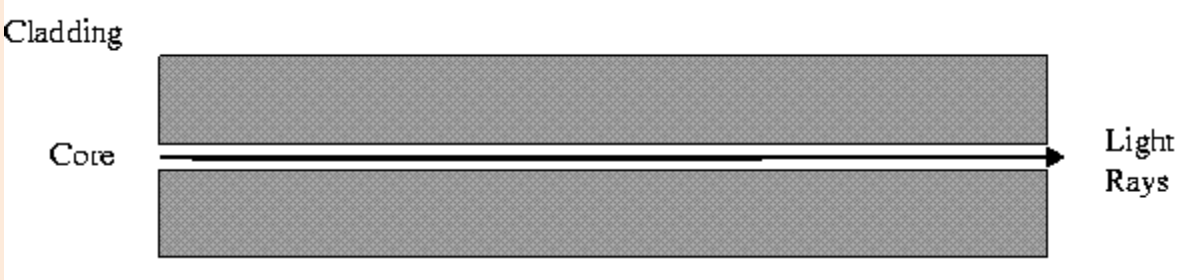


Note: Both Step Index and Graded Index allow more than one light source to be used (different colours simultaneously!). Multiple channels of data can be run simultaneously!

Single Mode

Single Mode has separate distinct Refractive Indexes for the cladding and core.

The light ray passes through the core with relatively few reflections off the cladding.



Single Mode is used for a single source of light (one colour) operation.

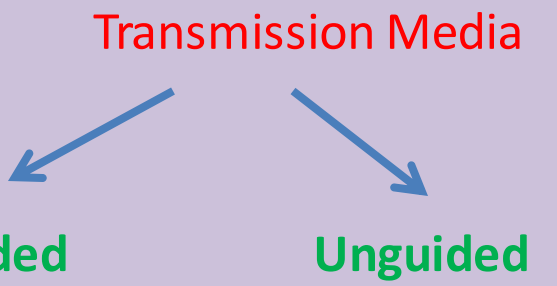
It requires a laser and the core is very small: 9 microns

Disadvantages of Optical Fibre:

- Physical vibration will show up as signal noise!
- Limited physical arc of cable. Bend it too much & it will break!
- Difficult to splice

The cost of optical fiber is a trade-off between capacity and cost.-

- At higher transmission capacity, it is cheaper than copper.
- At lower transmission capacity, it is more expensive.



Guided Transmission Media

- **Uses “Cabling” system**
- **The data signals are bound by the "cabling" system**
- **Also known as Bound Media.**

Types of Guided Media

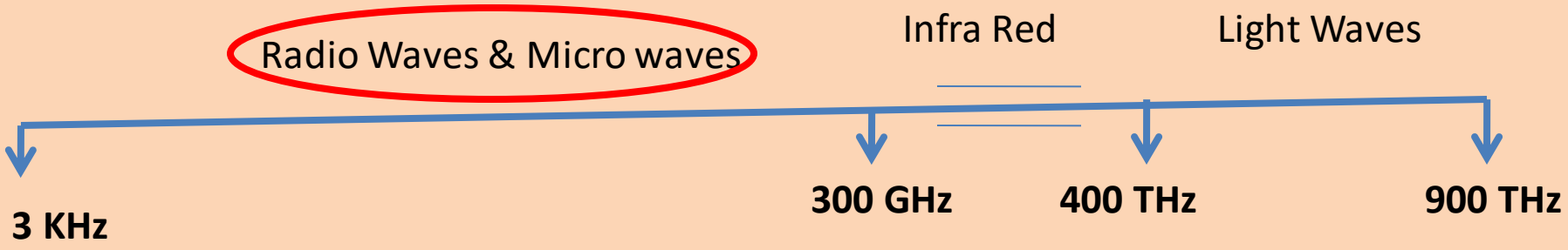
Open Wire **Twisted Pair** **Coaxial Cable** **Optical Fibre**

Un-Guided Media

Wire less Media

Signals are transmitted in the form of Electro Magnetic waves

Waves ranges from 3KHz to 900 THz



Classification of Un-Guided Media

On the basis of Band

- Radio Waves
- Micro waves
- Infra Red

On the basis of Propagation Method

- Ground
- Sky
- Line- of- Sight

Wireless Media (On the basis of Propagation Method)

GROUND Propagation

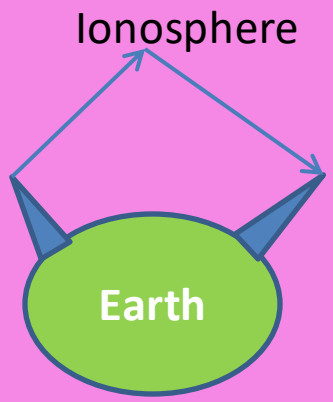
In ground Propagation-

The Radio Waves transmitted Through the lowest portion of the atmosphere

Low Frequency Signals are used

The distance is depended on the Power of the Signal

SKY Propagation

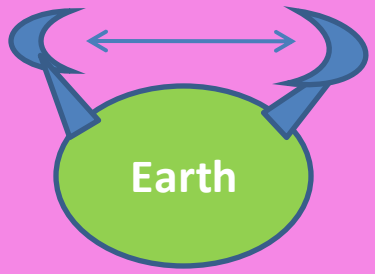


Higher Frequency Radio Waves

Transmission through Ionosphere

Allow greater Distance

Line- of- Sight propagation



Very High Frequency Signals

Transmitted in straight Lines from antenna to antenna

Antenna must be directional and faced each other

Antenna should not be affected by the curvature of the earth

Electromagnetic medium is divided into Eight Ranges- called BANDS

Band	Range	Propagation	Application
VLF (Very Low Frequency)	3-30 KHz	Ground	Long Range Radio Navigation
LF (Low Frequency)	30-300KHz	Ground	Radio Beacons and Navigational Locators
MF (Middle Frequency)	300KHz- 3 MHz	Sky	AM Radio
HF (High Frequency)	3 MHz – 30 MHz	Sky	Citizen Band, Ship & Air Craft Communication
VHF (Very High Frequency)	30 – 300 MHz	Sky & Line-of- Sight	VHF TV and FM Radio
UHF (Ultra High Frequency)	300 MHz- 3 GHz	Line-of-Sight	UHF TV, Cellular Phones
SHF (Super High Frequency)	3- 30 GHz	Line-of-Sight	Satellite Communication
EHF (Extremely High Frequency)	30-300 GHz	Line-of-Sight	Radar/ Satellite