

# Transmission Media



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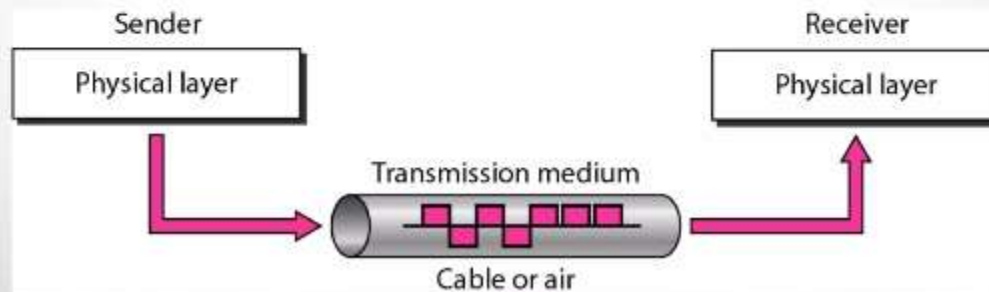
## What is Transmission Media ?

In data communication,

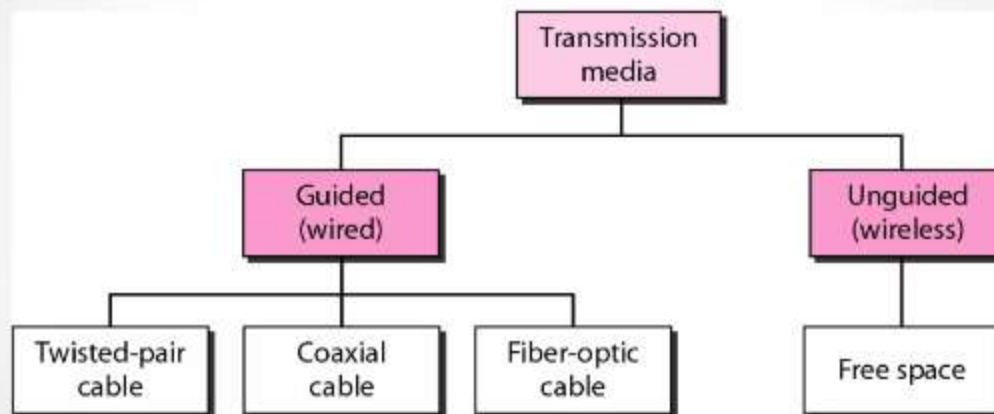
- **Transmission media** is a pathway that carries the information from sender to receiver.
- We use different types of cables or waves to transmit data.
- Data is transmitted normally through electrical or electromagnetic signals.

# Description

- Transmission media are located below the physical layer
- Computers use signals to represent data.
- Signals are transmitted in form of electromagnetic energy.



## Classification of Transmission media



## Twisted-pair cable

- A twisted pair consists of two conductors
- Basically copper based
- With its own plastic insulation, twisted together.



## Twisted Pair Description

- Provide protection against cross talk or interference(noise)
- One wire use to carry signals to the receiver
- Second wire used as a ground reference
- For twisting, after receiving the signal remains same.
- Therefore number of twists per unit length, determines the quality of cable.



# Twisted Pair

## Advantages:

- Cheap
- Easy to work with

## Disadvantages:

- Low data rate
- Short range



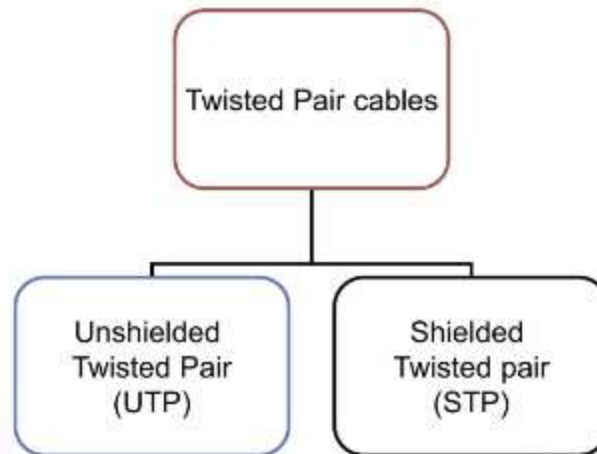


# Twisted Pair - Applications

- Very common medium
- Can be use in telephone network
- Connection Within the buildings
- For local area networks (LAN)



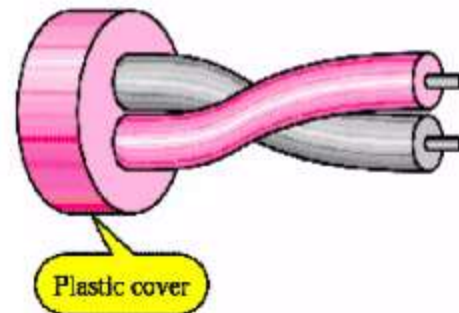
# Twisted Pair Cables



## Unshielded Twisted Pair (UTP):

### Description

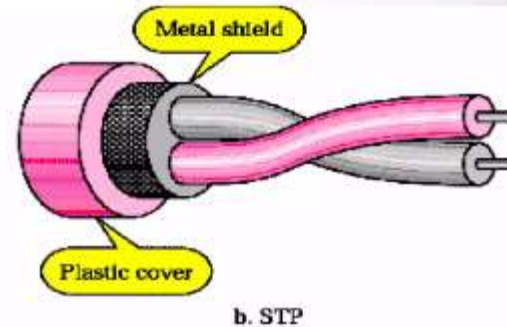
- Pair of unshielded wires wound around each other
- Easiest to install



a. UTP

## Shielded Twisted Pair (STP)

- Pair of wires wound around each other placed inside a protective foil wrap
- Metal braid or sheath foil that reduces interference
- Harder to handle (thick, heavy)



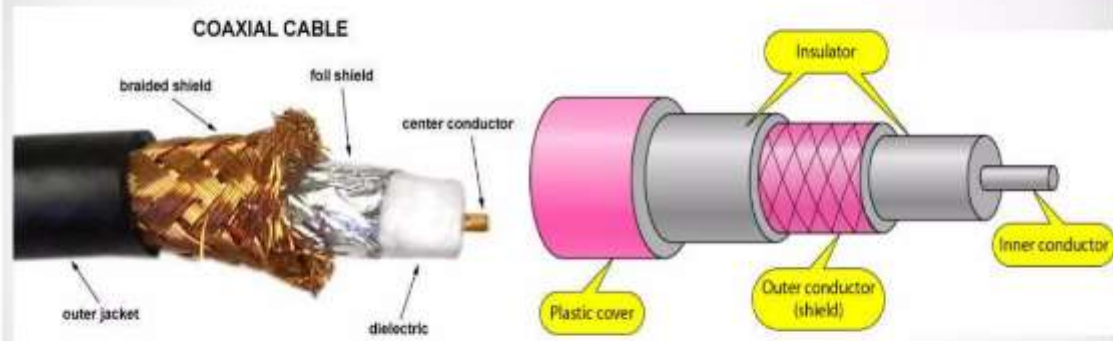
# STP Application



- STP is used in IBM token ring networks.
- Higher transmission rates over longer distances.

# Co-axial Cable

Co-axial cable carries signal of higher frequency ranges than twisted pair cable



- Inner conductor is a solid wire
- Outer conductor serves as a shield against noise and a second conductor

# Coaxial Cable Applications

- Most versatile medium
- Television distribution
- Long distance telephone transmission
- Can carry 10,000 voice calls simultaneously
- Short distance computer systems links
- Local area networks



# Fiber-Optic Cable

A fiber optic cable is made of glass or plastic and transmit signals in the form of light.

## **Nature of light:**

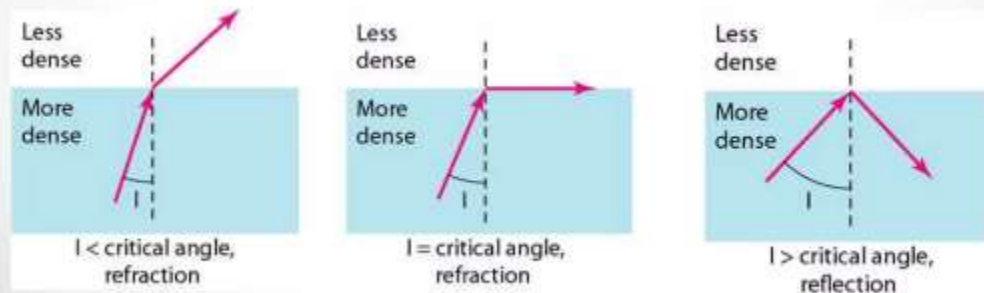
- Light travels in a straight line
- If light goes from one substance to another then the ray of light changes direction
- Ray of light changes direction when goes from more dense to a less dense substance





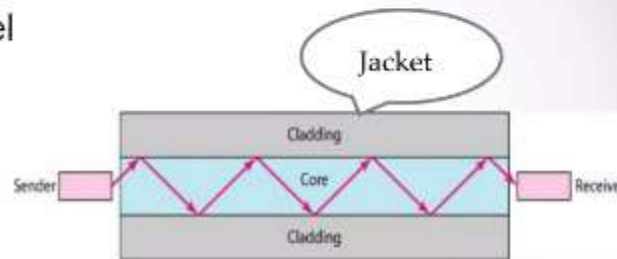
# Bending of light ray

- Angle of Incidence ( $i$ ): the angle the ray makes with the line perpendicular to the interface between the two substances
- Critical Angle: the angle of incidence which provides an angle of refraction of 90-degrees.



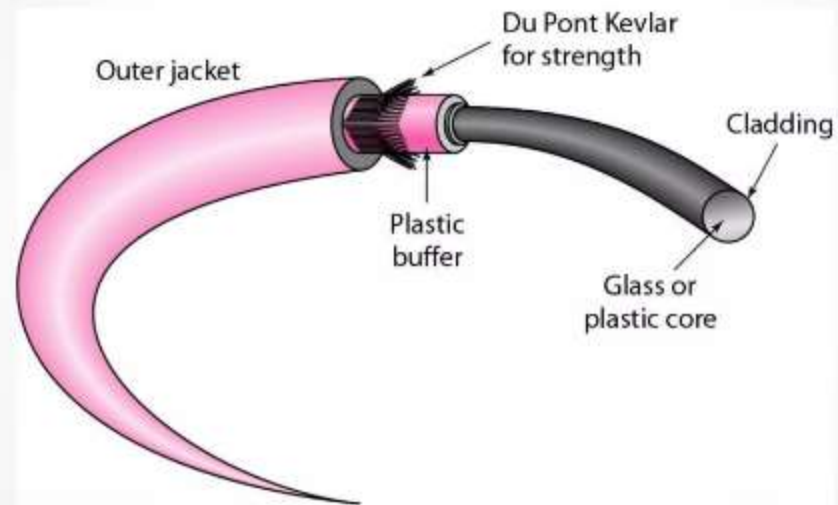
# Optical fiber

- Uses reflection to guide light through a channel
- Core is of glass or plastic surrounded by Cladding
- Cladding is of less dense glass or plastic



**An optical fiber cable has a cylindrical shape and consists of three concentric sections: the core, the cladding, and the jacket(outer part of the cable).**

## Fiber Construction



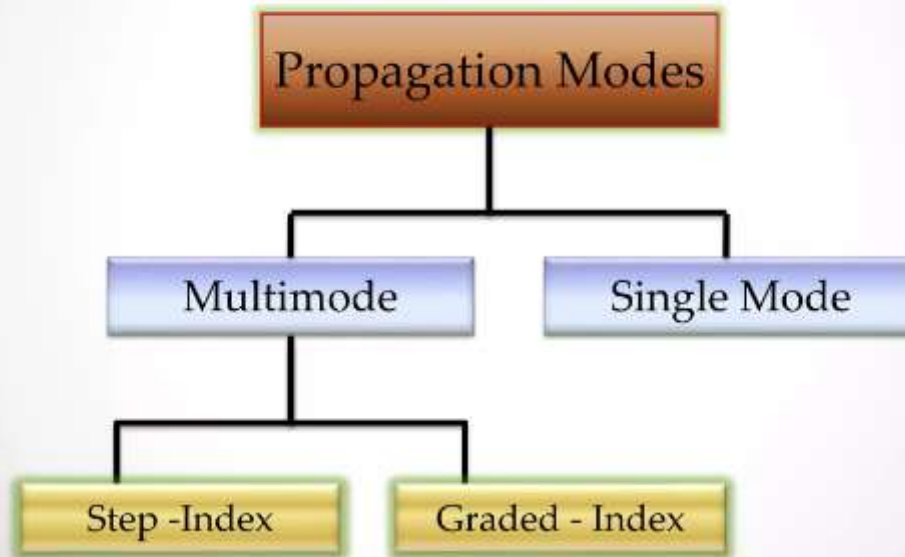
# Areas of Application

- Telecommunications
- Local Area Networks
- Cable TV
- CCTV
- Medical Education



## Propagation Modes

When signal goes from one point to another there are need for propagation modes.



## Propagation Modes



a. Multimode, step-index



b. Multimode, graded-index



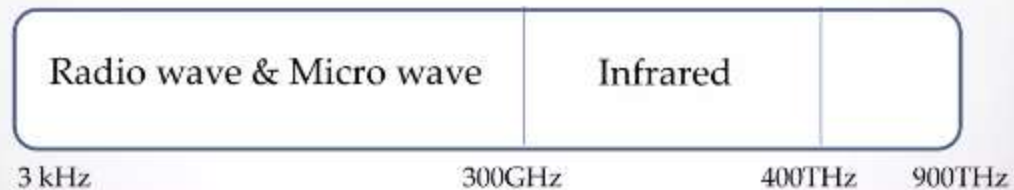
c. Single-mode

## Unguided Media: Wireless Transmission

Unguided media transport electromagnetic waves without using a physical conductor it is known as wireless communication.

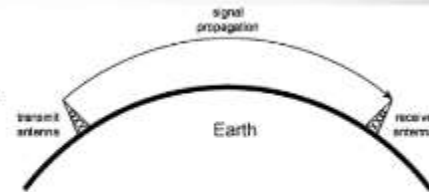
Signals broadcast through free space and available to capable receiver

**Electro magnetic spectrum for wireless communication:**



### Ground propagation:

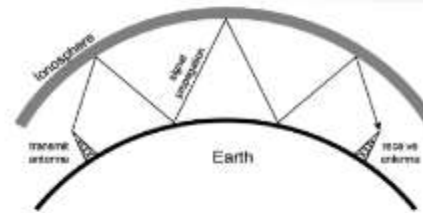
- Radio waves travel through the lowest portion of the atmosphere
- Touching the earth.



(a) Ground-wave propagation (below 2 MHz)

### Sky propagation:

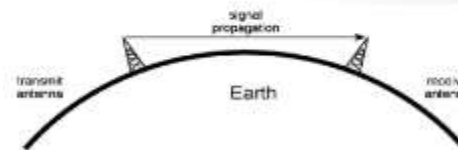
- Radio waves radiate to the ionosphere then they are reflected back to earth.



(b) Sky-wave propagation (2 to 30 MHz)

### Line-of-Sight Propagation:

- In straight lines directly from antenna to antenna.

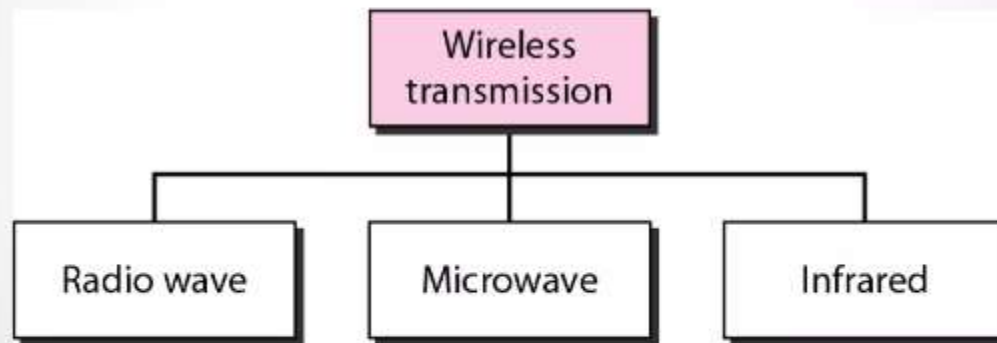


(c) Line-of-sight (LOS) propagation (above 30 MHz)



# Unguided Media

Wireless transmission waves



## Unguided Media – Radio Waves



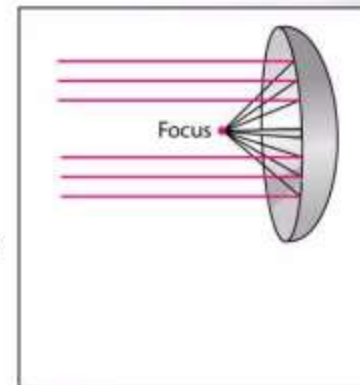
- Omnidirectional Antenna
- Frequencies between 3 KHz and 1 GHz.
- Used for multicasts(multiple way) communications, such as radio and television, and paging system.
- Radio waves can penetrate buildings easily, so that widely use for indoors & outdoors communication.

# Antennas

An Antenna is a structure that is generally a metallic object may be a wire or group of wires, used to convert high frequency current into electromagnetic waves.

Antenna are two types:

- **Transmission antenna**
  - Transmit radio frequency from transmitter
  - Radio frequency then  
Convert to electromagnetic energy by antenna
  - Then, radiate into surrounding environment
- **Reception antenna**
  - Electromagnetic energy get in antenna
  - Then Antenna convert radio frequency to electrical energy
  - Then, Goes to receiver

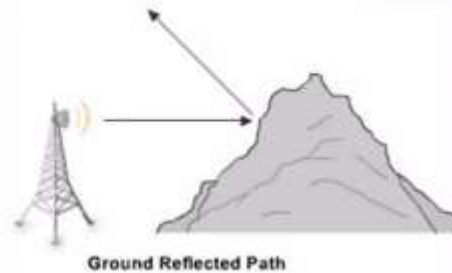
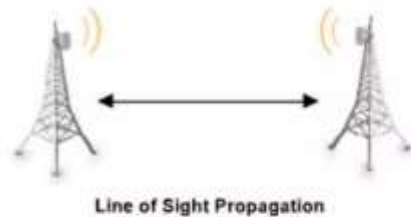


Dish antenna

same antenna can be used for both purposes

# Microwaves

Microwaves are ideal when large areas need to be covered and there are no obstacles in the path



## Micro waves Transmission

- Microwaves are unidirectional
- Micro waves electromagnetic waves having frequency between 1 GHZ and 300 GHZ.
- There are two types of micro waves data communication system : terrestrial and satellite
- Micro waves are widely used for one to one communication between sender and receiver,  
example: cellular phone, satellite networks and in wireless LANs(wifi), WiMAX,GPS



# Infrared

- Frequencies between 300 GHz to 400 THz.
- Used for short-range communication
- Example: Night Vision Camera, Remote control, File sharing between two phones, Communication between a PC and peripheral device,

