Guided Transmission Media

● Transmission media can be twisted pair wire such as that used for telephone installation, wire media are referred to as bounded media and wireless media are sometimes referred to as unbounded media.

● Different types of transmission media is used for different data transfer rates and long distances. Bandwidth, noise, radiation and attenuation are considered while using the different transmission media.

● Higher bandwidth transmission media support higher data rates. Attenuation limits the usable distance that data can travel on the media. Noise is related to electrical signal noise that can cause distortion of the data signal and data errors.

● Radiation is the leakage of signal from the media caused by undesirable electrical characteristics of the transmission media.

● Classification of transmission media:

● The transmission medium mainly classified into two types.

● Bounded or guided media

● Unbounded or unguided media

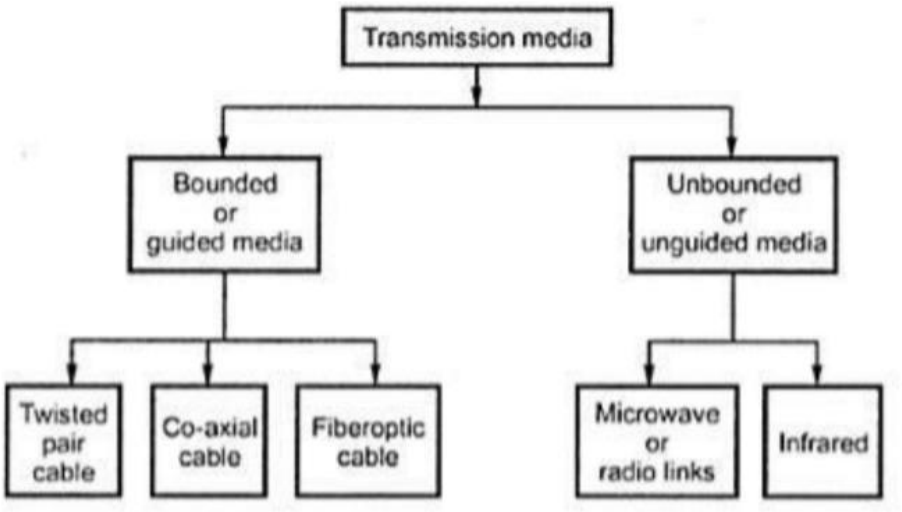

Fig1: Classification of Transmission Media

● Bounded or guided media: Depending on the type of transmission medium used the bounded media can be further classified into three types.

Twisted pair cable

Co-axial cable

Fiber optic cable

● The bounded media is also called as wired media.

● Unbounded or unguided media: Depending on the method of transmission the unbounded media can be further classified into two types.

Microwave links

Radio links

Infrared

1) Twisted Pair (TP):

● Twisted pair is least expensive and most widely used.

● A Twisted pair (TP) consists of two insulated copper wires arranged in a regular spiral pattern.

● A wire pair acts as a single communication link. TP may be used to transmit both analog and digital signals. For analog signals amplifiers are required about every 5 to 6 km. For digital signals, repeaters are required every 2 or 3 km.

● TP is most commonly used medium for in the telephone network. Compared to other commonly used transmission media, TP is limited in distance, bandwidth and data rate when two copper wires conduct electric signal in close proximity, a certain amount of electromagnetic interface occurs (EMI).

● This type of interference is called crosstalk. Twisting the copper wire reduces crosstalk. Twisted pair comes in two varieties.

● 1) Unshielded Twisted Pair (UTP)

2) Shielded Twisted Pair (STP)

● Unshielded Twisted Pair (UTP):

● UTP is a set of twisted pairs of cable within a plastic sheath. UTP is ordinary telephone wire. This is the least expensive of all the transmission media commonly used for LAN, and is easy to work with and simple to install. UTP is subject to external electromagnetic interference. Fig1 shows Unshielded four pair cable.

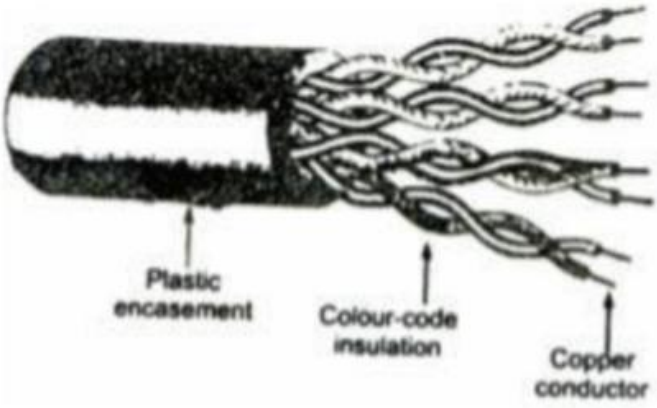

Fig1: Unshielded four pair cable

Shielded Twisted Pair (STP) :

● STP offers a protective sheathing around the copper wire. STP provides better performance at lower data rates. They are not commonly used in networks. Installation is easy. Special connectors are required for installation. Cost is moderately expensive. Distance is limited to 100 M for 500 Mbps. STP will still suffer from outside interference but not as much UTP.

Fig. 2 shows the STP cable.

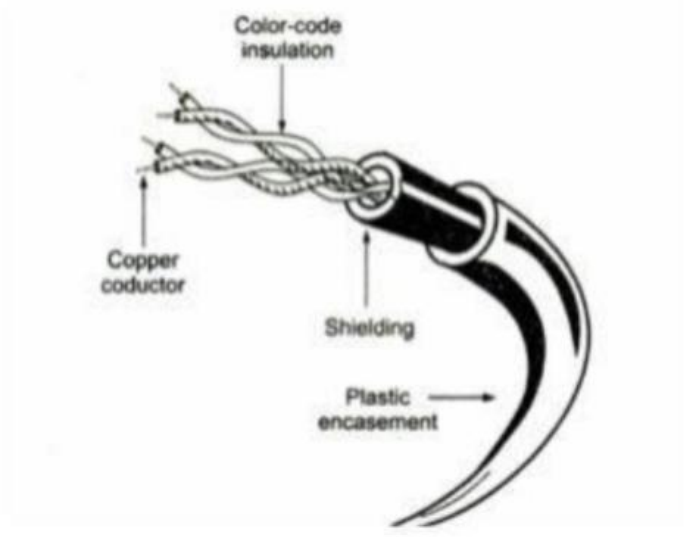

Fig2: Shielded Twisted Pair (STP) Cable

2) Coaxial Cable:

● It is made up of two conductors that share the common axis. It consists of a hollow outer cylindrical conductor that surrounds a single inner wire conductor.

● Coaxial cable is used to transmit both analog and digital signals. Data transfer rate of

co-axial cable is in between TP and fiber optic cable. Coaxial cable must be grounded and terminated.

● Coaxial cable transmits information in two modes: Baseband mode or Broadband mode.

● In baseband mode, the cable bandwidth is devoted to a single stream of data. The high bandwidth capability allows high data rates over a cable.

● Mostly used in local area networks. In LAN, only one data stream is present at any time. In Broadband the bandwidth is divided into ranges.

● Each range typically carries separate coded information, which allows the transmission of multiple data streams over the same cable simultaneously. Cable television is an example of multiple signals.

3) Fiber Optic Cable (FOC):

● A fiber optic cable is a light pipe which is used to carry a light beam from one place to another. Light is an electromagnetic signal and can be modulated by information.

● Since the frequency of light is extremely high hence it can accommodate wide bandwidths of information, also higher data rate can be achieved with excellent reliability.

● The modulated light travel along the fiber and at the far end, are converted to an electrical signal by means of a photo electric cell. Thus the original input signal is recovered at the far end.

● FOC transmits light signals rather than electrical signals. Each fiber has a inner core of glass or plastic that conducts light. The inner core is surrounded by cladding, a layer of glass that reflects the light back into core.

● A cable may contain a single fiber, but often fibers are bundled together in the centre of the cable. FOC may be multimode or signal mode.

● Multimode fibers use multiple light paths whereas signal mode fibers allow a single light path and are typically used with laser signaling. It is more expansive and greater bandwidth.

Wireless Transmission:

1) Radio Transmission:

● Radio waves have frequencies between 10 kilohertz (kHz) and 1 gigahertz (GHz). Radio waves include the following types:

● a) Short wave b) Very high frequency (VHF) television and FM radio. c) Ultra high frequency (UHF) radio and television.

2) Microwave Transmission:

● Above 100 MHz, the waves travel in straight lines and can therefore be narrowly focused. Concentrating all the energy into a small beam using a parabolic antenna (like the satellite TV dish) gives a much higher signal to noise ratio, but the transmitting and receiving antennas must be accurately aligned with each other.

● In its simplest form the microwave link can be one hop, consisting of one pair of antennas spaced as little as one or two kilometers apart or can be a backbone, including multiple hops, spanning several thousand kilometers.

● A single hop is typically 30 to 60 km in relatively flat regions for frequencies in the 2 to 8 GHz bands. When antennas are placed between mountain peaks, a very long hop length can be achieved.

3) Infrared Light Wave Transmission:

● Unguided infrared light (wave) is widely used for short range communication. The remote control used in TV, VCR and stereos all use infrared communication.

● They are relatively directional, cheap, and easy to build, but have a major drawback: they do not pass-through solid objects. On the other hand, the fact that infrared waves do not pass-through solid walls well is also a plus.

● It means that an infrared system in one room of a building will not interfere with a similar system in adjacent rooms. Security of infrared system against eavesdropping is better than that of radio system precisely for this reason; infrared light is suitable for indoor wireless LAN