

NATIONAL INSTITUTE OF TRANSPORT



DEPARTMENT OF COMPUTING AND COMMUNICATION TECHNOLOGY

HIGHER DIPLOMA IN COMPUTER SCIENCE

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NETWORKING TRANSMISSION MEDIA.

In networking transmission media, we do have two categories/types of media which are: -

1. Guided media (physical media).
2. Unguided media.

1: GUIDED MEDIA (PHYSICAL MEDIA)

Guided transmission media are more commonly known as the wired communication or bounded transmission media or physical media. Signals used in this type of media transmission is **electromagnetic signals or light signal that travel between the communicating devices through a physical medium/conductor**. As the medium for transmission is a physical conductor, it also provides direction to the signal. But there are physical limitations of the conductor in the guided media. Like the length of the conductor, its installation cost, its maintenance, etc. **A transmission mechanism in this type of media is through cables where by transferred data can either be in electromagnetic signals or in light signals.**

The guided media is categorized further into three categories that are:-

- a) Twisted-pair cable.
- b) Coaxial cable.
- c) Fiber-optic cable.

a): Twisted pair cable

The twisted pair cable has two conductors wires wound around each other and each surrounded by an insulating material.

The twisted pair cable is flexible and easy to install. But it has low bandwidth and provide less protection from interference, Twisted pair cable are also of two types.

- ❖ Shielded twisted pair cable.
- ❖ Unshielded twisted pair cable.

Advantages of twisted pair cable

Twisted pair cable are the oldest and most popular cables all over the world. This is due to the many advantages that they offer –

- Trained personnel easily available due to shallow learning curve
- Can be used for both analog and digital transmissions
- Least expensive for short distances
- Entire network does not go down if a part of network is damaged

Disadvantages of twisted pair cable

- Signal cannot travel long distances without repeaters
- High error rate for distances greater than 100m
- Very thin and hence breaks easily
- Not suitable for broadband connections

Shielded twisted pair cable (STP).

To counter the tendency of twisted pair cables to pick up noise signals, wires are shielded in the following three ways –

- Each twisted pair is shielded.
- Set of multiple twisted pairs in the cable is shielded.
- Each twisted pair and then all the pairs are shielded.

Such twisted pairs are called shielded twisted pair (STP) cables.

SHIELDED ADVANTAGES

Through the use of the a metallic foil, it is possible to cancel out the electromagnetic interference thoroughly to maintain faster data transfer speeds. For companies that need that security it is important to make sure that your network cabling is all STP standard otherwise there is the possibility of either throttled data speeds or even outages.

SHIELDED DISADVANTAGES

- Cost - the STP cables are noticeably more expensive in cost which can add up quickly.
- Size - due to the foil in casing the cable size increases that's more space is needed when cabling your network.
- Installation - a higher level of expertise is needed when installing the cables as the STP cables need to be grounded. if they are not grounded then the shield doesn't work and data transfer speed suffer or outages may occur.
- Fragile - If the foil is compromised anywhere along the cable, the shielding is then rendered useless.
-

Unshielded twisted pair cable (UTP)

The wires that are not shielded but simply bundled together in a protective sheath are called unshielded twisted pair (UTP) cables. These cables can have maximum length of 100 metres.

Shielding makes the cable bulky, so UTP are more popular than STP. UTP cables are used as the last mile network connection in homes and offices.

UNSHIELDED ADVANTAGES

- Cost - cheaper than the STP.
- Maintenance - As there is no foil to break and bo? grounding cable, there is less to break. This reduces the need to find a small tear in the foil.
- Installation - No need for extra special care to be taken of the cables during installation.
- Size - smaller and less sensitive makes it easier to squeeze them into tight spaces.
- Ubiquity - Use in most situations so there are more common.

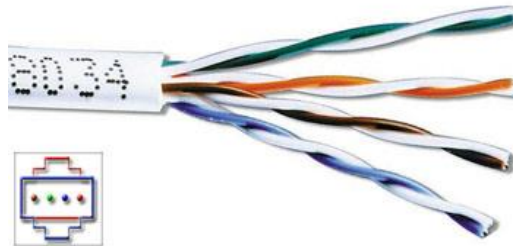
UNSHIELDED DISADVANTAGES

Really the only disadvantage that UTP have over STP is when they would be used in an environment not fit for purpose. Meaning that they would be used in a situation where there is a lot of electromagnetic noise. To Sum up, if there is a lot of electromagnetic noise that needs to be cancelled, then go with the STP cables, otherwise the UTP cables should suit your needs just fine.

Shielded twisted pair (STP)



Unshielded twisted pair (UTP)

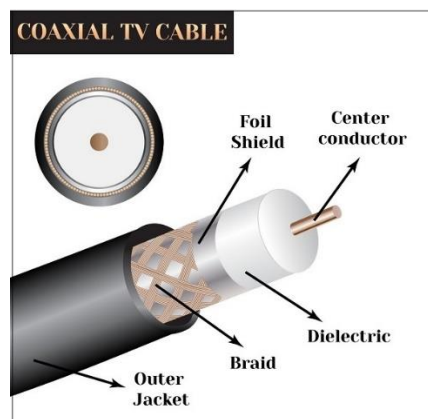


b): Coaxial cable

Coaxial cables are copper cables with better shielding than twisted pair cables, so that transmitted signals may travel longer distances at higher speeds. A coaxial cable consists of these layers, starting from the innermost –

- Stiff copper wire as core
- Insulating material surrounding the core
- Closely woven braided mesh of conducting material surrounding the insulator
- Protective plastic sheath encasing the wire

Coaxial cables are widely used for cable TV connections and LANs.



Advantages of Coaxial Cables

- Excellent noise immunity
- Signals can travel longer distances at higher speeds, e.g. 1 to 2 Gbps for 1 Km cable
- Can be used for both analog and digital signals
- Inexpensive as compared to fibre optic cables
- Easy to install and maintain

Disadvantages of Coaxial Cables

- Expensive as compared to twisted pair cables
- Not compatible with twisted pair cables

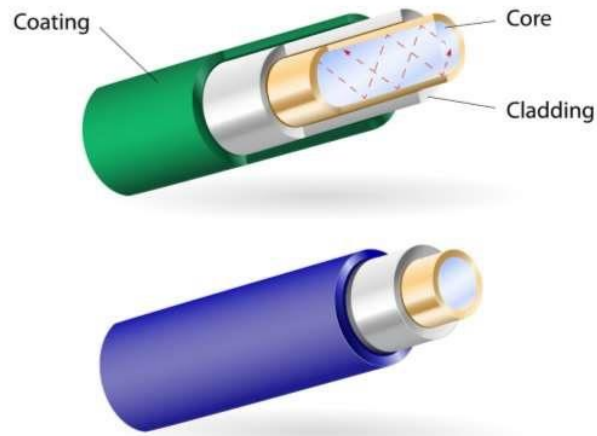
C): Optical Fibre

Thin glass or plastic threads used to transmit data using light waves are called optical fibre. Light Emitting Diodes (LEDs) or Laser Diodes (LDs) emit light waves at the source, which is read by a detector at the other end. Optical fibre cable has a bundle of such threads or fibres bundled together in a protective covering. Each fibre is made up of these three layers, starting with the innermost layer –

- Core made of high quality silica glass or plastic
- Cladding made of high quality silica glass or plastic, with a lower refractive index than the core
- Protective outer covering called buffer

Note that both core and cladding are made of similar material. However, as refractive index of the cladding is lower, any stray light wave trying to escape the core is reflected back due to total internal reflection.

OPTICAL FIBER



Optical fibre is rapidly replacing copper wires in telephone lines, internet communication and even cable TV connections because transmitted data can travel very long distances without weakening. Single node fibre optic cable can have maximum segment length of 2 kms and bandwidth of up to 100 Mbps. Multi-node fibre optic cable can have maximum segment length of 100 kms and bandwidth up to 2 Gbps.

Advantages of Optical Fibre

- High bandwidth
- Immune to electromagnetic interference
- Suitable for industrial and noisy areas
- Signals carrying data can travel long distances without weakening

Disadvantages of Optical Fibre

- Optical fibre cables are expensive
- Sophisticated technology required for manufacturing, installing and maintaining optical fibre cables
- Light waves are unidirectional, so two frequencies are required for full duplex transmission

2: UNGUIDED TRANSMISSION

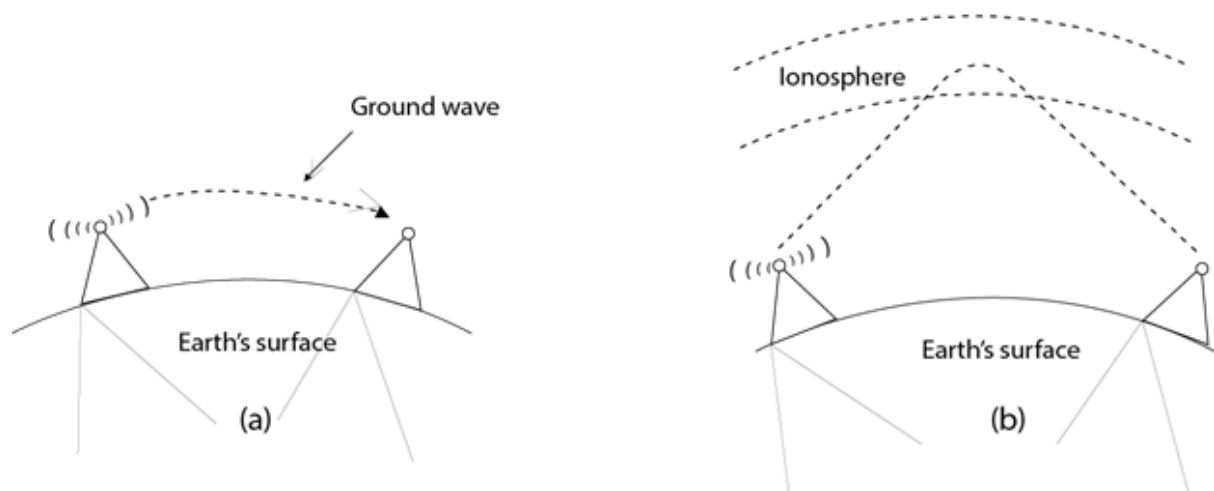
An unguided transmission transmits the electromagnetic waves without using any physical medium. Therefore it is also known as **wireless transmission**. In unguided media, air is the media through which the electromagnetic energy can flow easily. **The signal used in this type of media transmission only electromagnetic waves, where the transmission mechanism is through air medium where those signals flows.**

Unguided transmission is broadly classified into three categories:

1): Radio waves

Radio waves are the electromagnetic waves that are transmitted in all the directions of free space. Radio waves are omnidirectional, i.e., the signals are propagated in all the directions. The range in frequencies of radio waves is from 3Khz to 1 khz. In the case of radio waves, the sending and receiving antenna are not aligned, i.e., the wave sent by the sending antenna can be received by any receiving antenna.

An example of the radio wave is **FM radio**.



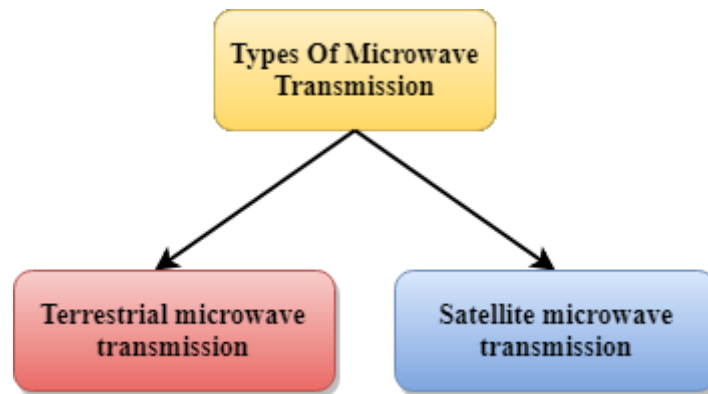
Applications Of Radio waves:

- A Radio wave is useful for multicasting when there is one sender and many receivers.
- An FM radio, television, cordless phones are examples of a radio wave.

Advantages Of Radio transmission:

- Radio transmission is mainly used for wide area networks and mobile cellular phones.
- Radio waves cover a large area, and they can penetrate the walls.
- Radio transmission provides a higher transmission rate.

2): Microwaves



Microwaves are of two types:

- i. Terrestrial microwave
- ii. Satellite microwave communication.

i): Terrestrial Microwave Transmission

Terrestrial Microwave transmission is a technology that transmits the focused beam of a radio signal from one ground-based microwave transmission antenna to another. Microwaves are the electromagnetic waves having the frequency in the range from 1GHz to 1000 GHz. Microwaves are unidirectional as the sending and receiving antenna is to be aligned, i.e., the waves sent by the sending antenna are narrowly focussed. In this case, antennas are mounted on the towers to send a beam to another antenna which is km away. It works on the line of sight transmission, i.e., the antennas mounted on the towers are the direct sight of each other.

Characteristics of Microwave:

- Frequency range.
- Bandwidth.
- Short distance.
- Long distance.
- Attenuation.

Advantages Of Microwave:

- Microwave transmission is cheaper than using cables.
- It is free from land acquisition as it does not require any land for the installation of cables.

- Microwave transmission provides an easy communication in terrains as the installation of cable in terrain is quite a difficult task.
- Communication over oceans can be achieved by using microwave transmission.

Disadvantages of Microwave transmission:

- Eavesdropping.
- Out of phase signal.
- Susceptible to weather condition.
- Bandwidth limited.

ii): Satellite Microwave Communication

A satellite is a physical object that revolves around the earth at a known height. Satellite communication is more reliable nowadays as it offers more flexibility than cable and fibre optic systems. We can communicate with any point on the globe by using satellite communication.

How Does Satellite work?

The satellite accepts the signal that is transmitted from the earth station, and it amplifies the signal. The amplified signal is retransmitted to another earth station.

Advantages Of Satellite Microwave Communication:

- The coverage area of a satellite microwave is more than the terrestrial microwave.
- The transmission cost of the satellite is independent of the distance from the centre of the coverage area.
- Satellite communication is used in mobile and wireless communication applications.
- It is easy to install.
- It is used in a wide variety of applications such as weather forecasting, radio/TV signal broadcasting, mobile communication, etc.

Disadvantages Of Satellite Microwave Communication:

- Satellite designing and development requires more time and higher cost.
- The Satellite needs to be monitored and controlled on regular periods so that it remains in orbit.

- The life of the satellite is about 12-15 years. Due to this reason, another launch of the satellite has to be planned before it becomes non-functional.

3): Infrared

- An infrared transmission is a wireless technology used for communication over short ranges.
- The frequency of the infrared is in the range from 300 GHz to 400 THz.
- It is used for short-range communication such as data transfer between two cell phones, TV remote operation, data transfer between a computer and cell phone resides in the same closed area.

Characteristics Of Infrared:

- It supports high bandwidth, and hence the data rate will be very high.
- Infrared waves cannot penetrate the walls. Therefore, the infrared communication in one room cannot be interrupted by the nearby rooms.
- An infrared communication provides better security with minimum interference.
- Infrared communication is unreliable outside the building because the sun rays will interfere with the infrared waves.

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