Communication Channels:

Physical Channel: Twisted Pair Cable, Co-axial Cable, Optical Fibre Cable (Diagram, description, application).

Wireless Channel: Microwave, Radio wave, Satellite Links.

Communication: means exchange of information. Main components of communication are: sender, receiver, message and medium. In computer communication the medium can be wires, optical fiber or electromagnetic waves.

Communication Channel: A path through which information is transmitted from one place to another is called communication channel. It is also referred to as communication or transmission medium or link. Twisted pair wire, coaxial cable, fiber optic cable, microwave, satellite etc. are examples of communication channels.

In a communication channel, data is transmitted in the form of signals (analog signal). The data transmission is measured in bandwidth. Bandwidth measures the amount of information that can be transmitted through the media within the given period of time. For analog signals, bandwidth is represented in hertz (Hz). It means number of signals transmitted per second. For digital signals, it is represented in bits per second (bps). Different transmission media have different bandwidths. The higher the bandwidth of the transmission media, the more information can be transmitted.

Types of Communication Channel: The communication channel or media is divided into two types - Guided Media and Unguided Media.

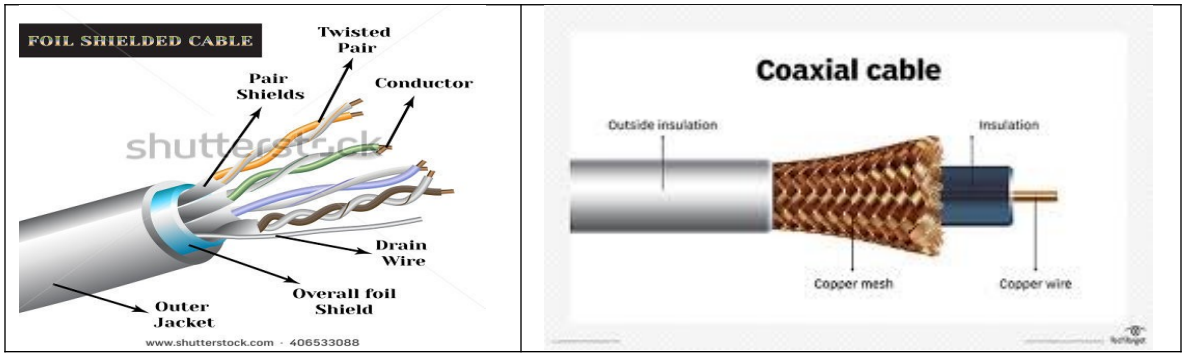
Guided Media: In guided communication media, communication devices are directly linked with each other via cables or physical media for transmission of data. The data signals are bounded to a cabling media. Therefore, guided media is also called bounded media. The guided media are usually used in LAN. The examples of guided or bounded media are: Twisted pair wire, Coaxial cable, Fiber optic cable.

Twisted Pair Cable: is one of the most commonly used and least expensive communication media. It is used in local area network (LAN) for data communication between different computers. It is also used in telephone lines to carry voice and data signals. A twisted pair cable consists of a pair of thin diameter copper wires. These wires are covered by insulating material (such as plastic). These pair of wires are twisted together to form a cable. The wires are twisted around each other to minimize (or reduce) interference from other twisted pairs in the cable.

The data transmission speed through twisted pair cable is about 9600 bits per second in a distance of 100 meters. However, this transmission speed is less than coaxial cable or optical fiber. The twisted pair cable has been the standard communication channel for voice and data communication. But now its use is reducing because today more reliable communication media are available such as

coaxial cable and fiber optic cable. Compared to coaxial cable and optical fiber, twisted pair is limited in distance, bandwidth, and data rate.

Twisted pair comes in two varieties: unshielded and shielded.
Unshielded twisted pair (UTP) is ordinary telephone wire. This is the least expensive of all the transmission media commonly used for local area networks and is easy to work with and easy to install. Unshielded twisted pair is subject to external electromagnetic interference, including interference from nearby twisted pair and from noise generated in the environment. A way to improve the characteristics of this medium is to shield the twisted pair with a metallic braid or sheathing that reduces interference. This shielded twisted pair (STP) provides better performance at higher data rates. However, it is more expensive and more difficult to work with than unshielded twisted pair.

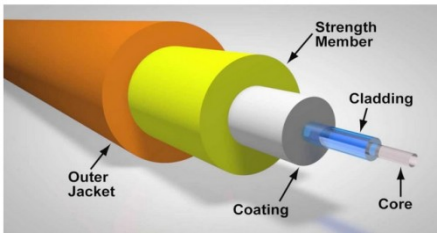


Coaxial cable, like twisted pair, consists of two conductors, but is constructed differently to permit it to operate over a wider range of frequencies. It consists of a hollow outer cylindrical conductor (copper mesh) that surrounds a single inner wire conductor. The inner conductor is held in place by a solid dielectric material. The outer conductor is covered with a jacket or shield. A single coaxial cable has a diameter of from 1 to 2.5 cm. Coaxial cable can be used over longer distances and support more stations on a shared line than twisted pair.
Coaxial cable is used to transmit both analog and digital signals and is used for telephone lines for voice and data transmission with very high frequency. The bandwidth of coaxial cable is 80 times greater than that of twisted pair media. Coaxial cable is also widely used in local area network (LAN). It is more expensive than twisted-pair wire. Because of its shielded, concentric construction, coaxial cable is much less susceptible to interference and crosstalk than twisted pair.

Applications
- Television distribution - as a means of distributing TV signals to individual homes in cable TV
- Long-distance telephone transmission
- Local area networks
- Short- range computer system links – to provide connections between devices.

Fiber-Optic Cable: In twisted-pair cable and coaxial cable, data is transmitted in the form of electric frequencies. The fiber optic cable uses light to transmit data. The data transmission speed is very high up to billions bits per second. Today, most

of the telephone companies and cable TV operators are using fiber optic cables in their networks.



A fiber optic cable consists of tubes of glass (or thin glass fibers) through which data is transmitted as pulses of light by means of **total internal reflection**. A typical optical fiber consists of a very narrow strand or fiber of glass called the core. It is thinner than a human hair. The core is surrounded by a concentric layer of glass called Cladding. **The cladding** has optical properties different from those of the core. The interface between the core and cladding acts as a reflector to confine light that would otherwise escape the core. The outermost layer, surrounding the cladded fibers, is the **jacket**.The jacket is composed of plastic and other material layered to protect against moisture, abrasion, crushing, and other environmental dangers.

Applications

Optical fiber is used in long-distance telecommunications. The continuing improvements in performance and decline in prices, together with the inherent advantages of optical fiber, have made it increasingly attractive for local area networking. The following characteristics distinguish optical fiber from twisted pair or coaxial cable:

- **Greater capacity:** The potential bandwidth, and hence data rate, of optical fiber is immense with data rates of hundreds of Gbps over tens of kilometers.
- **Smaller size and lighter weight**
- **Lower attenuation (loss of signal)**
- **Electromagnetic isolation:** Optical fiber systems are not affected by external electromagnetic fields. Thus the system is not vulnerable to interference, impulse noise, or crosstalk. By the same token, fibers do not radiate energy, so there is little interference with other equipment. In addition, fiber is inherently difficult to tap and there is a high degree of security from eavesdropping.

Greater repeater spacing at distances of tens of kilometers: Fewer repeaters mean lower cost and fewer sources of error. Coaxial and twisted-pair systems generally have repeaters every few kilometers.

Five basic categories of application have become important for optical fiber:

- Long-haul trunks with average about 1500 km in length and high capacity (typically 20,000 to 60,000 voice channels)
- Metropolitan trunks with average length of 12 km and as many as 100,000 voice channels are used to join telephone exchanges in a metropolitan or city area.
- Subscriber loops circuits that run directly from the central exchange to a subscriber and handle voice, data, image and video.

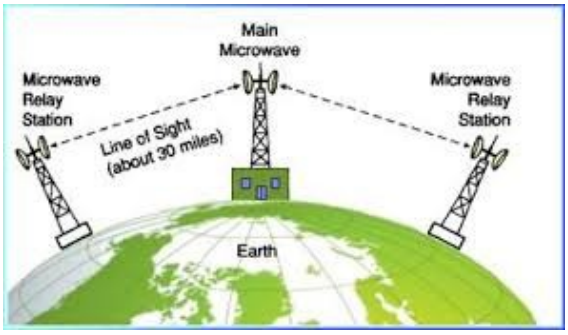
• Local area networks that have a total capacity of 100 Mbps to 10 Gbps and can support hundreds
of stations

2. Unguided Media:

In unguided communication media, data is communicated between communication devices in the form of wave. Unguided media provides means to transmit data signals but does not guide them along a specific path. The data signals are not bounded to a cabling media. Therefore, unguided media is also called unbounded media. This transmission medium is used when it is impossible to install the cables. The data can be transmitted all over the world through this medium. Wave transmission is susceptible to weather effects like rain and thunderstorms. It is also not a secure mode of transmission due to unbounded nature of the medium and requires sophisticated encryption to provide data security. The examples of unguided or unbounded media are: Microwave, Satellite, Radio Broadcast.

Microwaves: In microwave transmission, data is transmitted through air or space, instead of through cables or wires. Microwaves are high frequency radio waves. These waves can only travel in straight lines. The data is transmitted and received through a microwave station. A microwave station is also called relay station or booster. A microwave station contains an antenna, transmitter, receiver, and other equipments that are required for microwave transmission. Microwave antennas are placed on the high towers or buildings and these are placed within 20 to 30 miles of each other. Data is transmitted from one microwave station to another. Each microwave station receives signals from previous microwave station and transmits to next station. In this way, data is transmitted over larger distances.

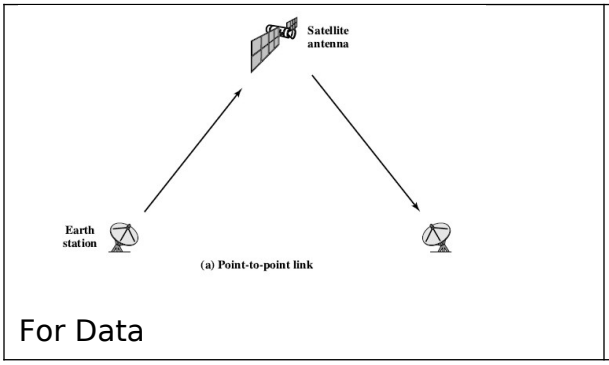
The data transmission speed of microwave transmission is up to 150 Mbps. Microwave transmission is used in environments where installing physical transmission media is impossible and where line-of-sight transmission is available, it is used in wide-open areas. Today, it is used by telephone companies, cable television providers, universities etc.



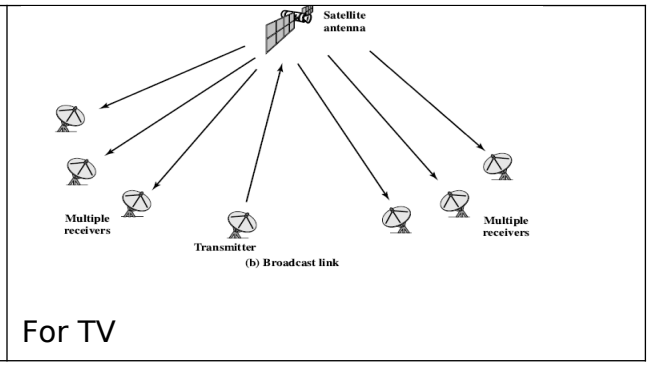
Applications
The primary use for terrestrial microwave systems is in long haul telecommunications service, as an alternative to coaxial cable or optical fiber. The microwave facility requires far fewer amplifiers or repeaters than coaxial cable over the same distance but requires line-of-sight transmission. Microwave is commonly

used for both voice and television transmission. Another increasingly common use of microwave is for short point-to-point links between buildings. This can be used for closed-circuit TV or as a data link between local area networks. Another important use of microwave is in cellular systems,

Satellite Communication: A communication satellite is a space station. It receives microwave signals (or messages) from earth stations. Satellite transmission station that can send and receive messages is known as earth station. The earth based stations often are microwave stations. Other devices, such as PDAs and GPS receivers, also functions as earth based stations.



For Data



For TV

Satellites rotate approximately 22,300 miles above the earth in precise locations. The communication satellite consists of solar powered, transceiver that receives and sends signals. The signals are transmitted from one earth station to the satellite. The satellite receives and amplifies the signals and sends them to another earth station. This entire process takes only a few seconds. In this way, data or messages are transferred from one location to another. Transmitting a signal from ground or earth station to a satellite station in space is called up-linking and the reverse is called the down-linking. The data transmission speed of communication satellite is very high such as upto 1 Gbps.

Different communication satellites are used to carry different kinds of information such as telephone calls, television transmissions, military communication, weather data, and even radio stations use them for broadcasting. The global positioning systems and Internet also use the communication satellites.

Applications

The communication satellite is a technological revolution as important as fiber optics. Among the most important applications for satellites are the following:

- Television distribution - Because of their broadcast nature, satellites are well suited to television distribution
- Long-distance telephone transmission - Satellite transmission is also used for point-to-point trunks between telephone exchange offices in public telephone networks. It is the optimum medium for high- usage long distance international trunks.
- Private business networks - The satellite provider can divide the total capacity into a number of channels and lease these channels to individual business users.

Radio Broadcast: It is a wireless transmission medium that is used to communicate information through radio signals in air, over long distance such as between cities and countries. In this medium, a transmitter is required to send messages (signals) and receiver is required to receive them. To receive the radio signal, the receiver has an antenna that is located in the range of signal. Some networks use a special device called transceiver used to send and to receive messages in the form of radio signals. The data transmission speed of radio broadcast is up to 54 Mbps.

Physical Description
The principal difference between broadcast radio and microwave is that radio is omni-directional and the latter is directional. Thus broadcast radio does not require dish-shaped antennas, and the antennas need not be rigidly mounted to a precise alignment.

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