

## Network Media

Communication across a network is carried on a medium. The medium provides the channel over which the message travels from source to destination.

Modern networks primarily use three types of media to interconnect devices and to provide the pathway over which data can be transmitted. These media are:

- Metallic wires within cables (Twisted pair, Coaxial cable)
- Glass or plastic fibers (fiber optic cable)
- Wireless transmission

The **signal encoding** that must occur for the message to be transmitted is **different for each media type**. On metallic wires, the data is encoded into electrical impulses that match specific patterns. Fiber optic transmissions rely on pulses of light, within either infrared or visible light ranges. In wireless transmission, patterns of electromagnetic waves depict the various bit values.

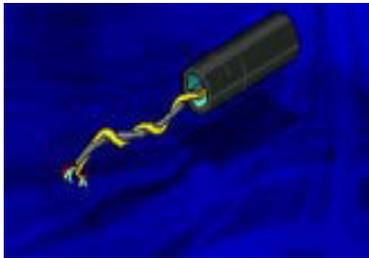
### Twisted-pair wires:

This type consists of two insulated copper wires, typically about 1mm thick. The wires are twisted together in a spiral form. The purpose of twisting the wires is to reduce electrical interference from similar pairs or from outside noise. There are two kinds of twisted pairs:

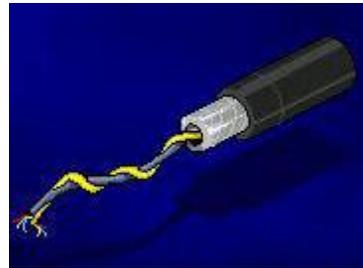
- Unshielded Twisted Pair (UTP): it consists of two wires that are twisted together within insulated outside covering. UTP suffer from the interruption of the data communication signals caused by the radio frequency interference or electromagnetic interference.
- Shielded Twisted Pair (STP) cable: consists of pairs of insulated solid wire surrounded by a braided or corrugated shielding. STP reduces the interruption of the data communication signals caused by the radio

frequency interference or electromagnetic interference. The superiority of STP over UTP came from that STP

- give better noise immunity.
- support a long distance transmission Quality.
- provide high-speed transmission



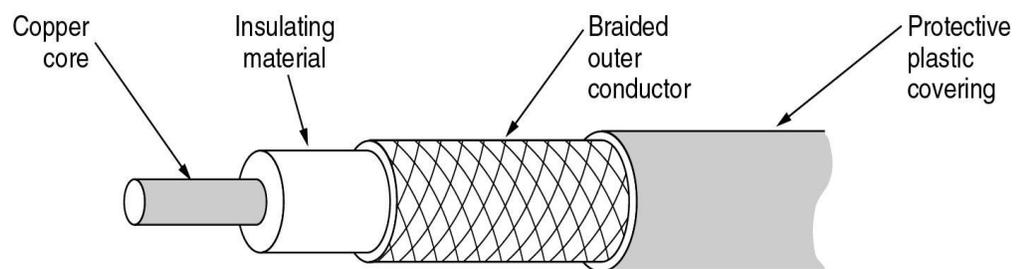
UTP cable



STP cable

### Coaxial Cables:

A coaxial Cable consists of a stiff copper wire as the core, surrounded by an insulating material. The insulator is encased by a cylindrical conductor, often as a closely woven braided mesh. The outer conductor is covered in a protective plastic sheath. A coaxial Cable is much less susceptible to electromagnetic interference and can carry much more data than the twisted pair wires. Because of this, it is used to carry high-speed data traffic as well television signals.



Coaxial cable

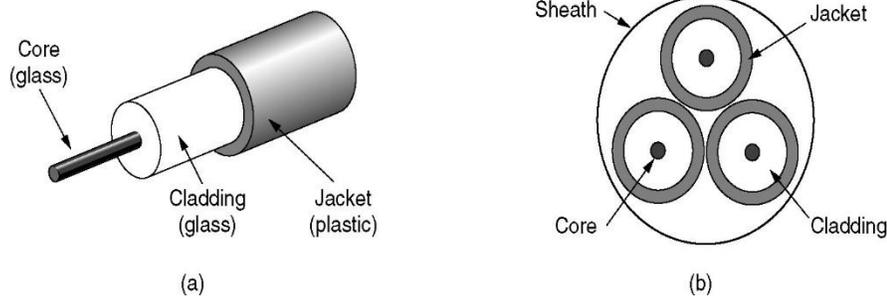
There are two types of coaxial Cable:

- Thin coaxial cable: Bus network with diameter 0.6 cm and runs Ethernet media access up to 185 meters and used in 10Base2 networks.

- Thick coaxial cable: Bus network with diameter 1.2 cm and runs Ethernet up to 500 meters and used in 10Base5 networks.

### Optical fiber cables:

Optical fiber consists of a thin core made of glass or plastic, surrounded by a cladding, also glass or plastic, but with different properties from the core and finally there is a protective jacket (plastic). In general, light confined to the central core by a phenomenon called total internal reflection, whereby it cannot escape through the discontinuity in optical properties at the core-cladding interface.



(a) view of a single fiber. (b) End view of a sheath with three fibers.

Fiber optic cable can carry huge amounts of information at fast data rates. There are two modes (multi-mode and single mode) for propagating light along optical channels, each requiring fiber with different physical characteristics.

### Advantages of fiber optic cable

- They have far superior electromagnetic isolation and more resistance to noise.
- The attenuation rates are very low.

- The transmission speed of data is very high and carries the data for long distances.
- In optical fiber, the digital data transformed to light pulses, this leads to prevent the electrical signal to pass through these fibers. This provides a good security.

Disadvantages of fiber optic cable:

- It is most expensive.
- The energy of the light pulse reduced through the propagation, due to absorption and scattering.

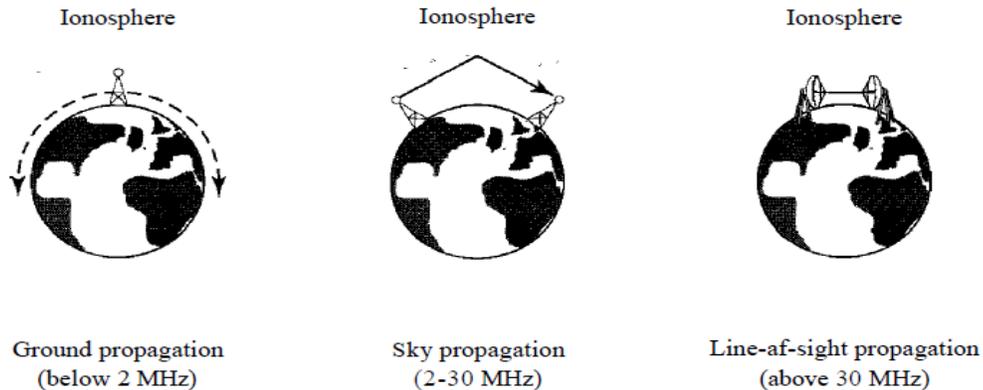
### **Wireless Transmission Media:**

Electromagnetic waves ranging in frequencies between 3 kHz and 1 GHz are normally called radio waves; waves ranging in frequencies between 1 and 300 GHz are called microwaves

#### **1. Radio Transmission:**

It is electromagnetic waves can also be broadcast through free space and some material media such as air. Carrier of these frequencies is used to transmit audio, digital Baseband, and video by means of modulation. The range of radio carrier frequencies is divided into a number of bands as follows:

<i>Band</i>	<i>Range</i>	<i>Propagation</i>	<i>Application</i>
VLF (very low frequency)	3-30 kHz	Ground	Long-range radio navigation
LF (low frequency)	30-300 kHz	Ground	Radio beacons and navigational locators
MF (middle frequency)	300 kHz-3 MHz	Sky	AM radio
HF (high frequency)	3-30 MHz	Sky	Citizens band (CB), ship/aircraft communication
VHF (very high frequency)	30-300 MHz	Sky and line-of-sight	VHF TV, FM radio
UHF (ultrahigh frequency)	300 MHz-3 GHz	Line-of-sight	UHF TV, cellular phones, paging, satellite
SHF (superhigh frequency)	3-30 GHz	Line-of-sight	Satellite communication
EHF (extremely high frequency)	30-300 GHz	Line-of-sight	Radar, satellite



## 2- The Microwaves:

Microwaves may be guided using hollow metal tubes called waveguides. Microwaves can be transmitted directionally through space using special antenna (such as parabolic dish. the microwave travel in straight line. Unlike radio waves at lower frequencies, microwaves do not pass through building well. Microwave communication is widely used for long distance telephone communication, cellular telephones, and television distribution.

### 3- The Infrared Waves:

it is widely used for short-range communication (e.g., the remote control that used on the TV). It is cheap and easy to build, but the major drawback: it does not pass through solid objects. It is used in the local network inside the building.

### 4- The Light Wave Transmission:

It is unguided optical signaling. A most modern application is to connect the local networks in two buildings via lasers mounted on their rooftops. Coherent optical signaling using lasers is inherently unidirectional, so each building needs its own laser and its own photo detector. This scheme offers very high bandwidth and very low costs. A disadvantage is that laser beams cannot penetrate rain or thick fog, but they work well on sunny days.

