Types of Unguided Transmission Media:-

1- Satellite Microwave Transmission:-

Transmitting data using electro radio waves through free space is called satellite communication. In satellite communications there are many transponders (a device for receiving a radio signal and automatically transmitting a different signal) called frequency band. this type of transmission uses two types of frequencies .uplink frequency and downlink frequency. Satellites can be classified into two types:-

- C-band: the frequency range of C-band satellite is from 3.7 to 4.2 GHz and from 5.9 to 6.4 GHz. C-band are more reliable than Ku-band.
- Ku-band: the frequency range of Ku-band satellite is from 11 to 12 GHz.

Usages of satellite microwave :-

- Distributing signal over television channel.
- Telephone transmission over long distance.
- Networks that are used for private business.

2- Radio wave transmission :-

Its broadcast signals only in single direction which is in contrast with the microwave transmission that broadcast in both directions. One of the advantage of radio wave transmissions is that it does not require any antennas. Radio waves are propagated using ground wave and sky wave. Radio waves performs modulation of electromagnetic waves using the frequency that is below the range of visible light.

Usages of radio microwave:-

- Radio waves are generally used for transmitting sound, images that include both voice signal and television signals. These signals are converted into electrical signals by performing modulation, the modulated signals are amplified and transmitted to antennas that converts the electrical signals to electromagnetic signals that are used for radiation into ionosphere.
- Radio waves are used for directing the movement of ships and aircraft with the help of radio compass or radio time signals.

3- Terrestrial microwave transmission :-

Microwave transmission make use of microwave link for transmitting information. Terrestrial microwave use large height antennas to cover long sight distances. It is more suitable for line-of-sight transmission link.

Usages of Terrestrial microwave transmission:-

- Microwave relay links are used for television and telephone transmission.

- Microwave act as a backbone carrier in cellular network.
- They are used both for larger heave telecommunication services as well as short heave by-pass applications.

4- Infrared wave transmission:-

Infrared waves are electromagnetic waves that have the wavelength longer than visible light but shorter than radio wave. One of the advantage of infrared waves over other unguided media is that it cannot pass through walls due to which the security is more and the impairment such as interference is not present.

Modes of transmission

When we talk of data communication we are primarily concerned with serial transmission although other types of transmission does exists. In serial transmission the data is transmitted bit by bit as a stream of 0s and 1s. **Protocols** are implemented for these types of transmissions so that the communication takes place in a well-defined manner. Protocols are mutually agreed set of rules and are necessary because the format of transmission should be understood by the receiver
The following key factors have to be observed regarding serial transmission:

• **Timing problem:** There should be some mechanism to know when the bit has arrived and at what rate the next bit is going to arrive at the serial input terminal of the receiver. We will see this can be accomplished in two ways.

• **Error detection:** Provision should be made (during transmission itself) to verify the integrity of the received data. Like parity, checksum bits.

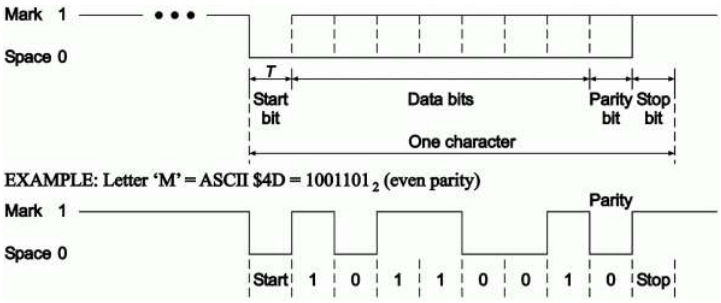
• **Error correction:** Ability to correct the data in case of corrupted data reception.
Timing problems require a mechanism to synchronize the transmitter and receiver. There are two approaches regarding transmission of serial data.

- **Asynchronous transmission**
- **Synchronous transmission**

1. Asynchronous transmission

Asynchronous transmission is a type of transmission mode in which data is transmitted along with start and stop bits to indicate beginning and end of data. Also The data is send one character or bit at a time i.e. , each character act as individual unit. It make use of two additional bits called stare and stop bit, where binary '0' is used to represent start bit and binary '1' is used to represent stop bit.

The most common usage of asynchronous transmission is seen in land line communication system. In order to ensure accuracy, parity bit may also be included in the data that is being transmitted. Start and stop bits provide synchronization by indicating when the data character have been sent or received. Timing for each character in data stream is initiated with start bit and ends with stop bit. It is also possible for gaps or spaces to exist in the data stream.



Asynchronous transmission

Advantage :-

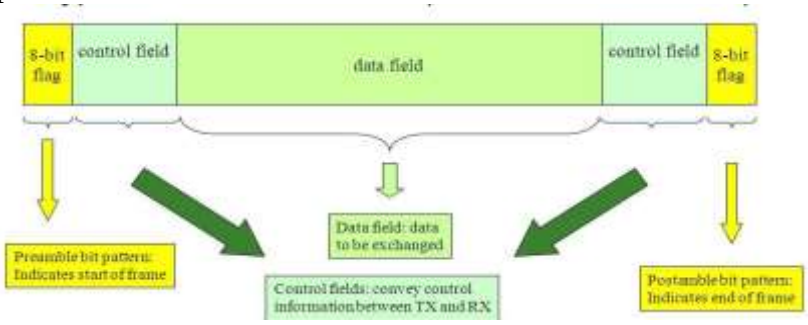
- Asynchronous transmission is cheap and effective.
- It is used for low-speed transmission.

Disadvantage:-

- It require more overhead of 2 to 3 bits/character.
- Its efficiency is less when compared to synchronous transmission.

2. Synchronous transmission

Synchronous transmission refers to continuous and consistent time transfer of data blocks. Here data is transmitted at regular intervals. Asynchronous transmission doesn't use start and end bits but synchronizes the speed of transmission at both sender receiving end using clock signals.However,synchronization using clock signal is suitable over shorter distance but not for longer because these clock signals are more susceptible to impairments, due to which more errors are generated. This problem can be solved by resynchronization of clocks and through the use of check digits that ensure that byte is correctly interpreted and received.



frame format of synchronous transmission

Advantage:-

- The timing information is accurately maintained at receiver end that allow higher data rate operations.
- Synchronous character transmission is more efficient than asynchronous character transmission.

Disadvantage:-

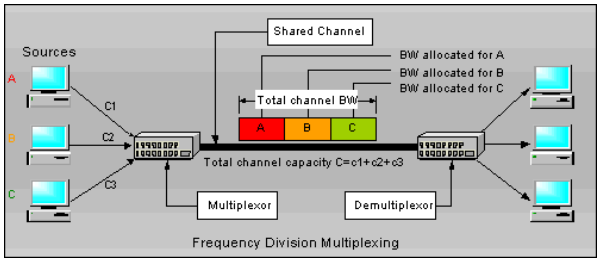
- It requires a complex design of interface.

Multiplexing

By Multiplexing different message signals can share a single transmission media (The media can be guided or unguided). All they need is they should either differ in their frequency slot or wavelength slot or in time slot.

1. **Frequency domain multiplexing (FDM)**

   In this each message signal is modulated by different radio frequency signals called RF carriers. At the receiving end filters are used to separate the individual message signals. Then they are demodulated (removing the RF carrier) to retrieve back the original messages.

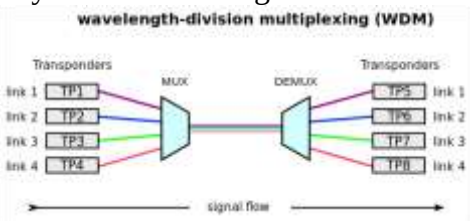


The Radio /TV broadcasting are the best examples for frequency domain multiplexing. Several individual stations broadcast their programs in their own allotted frequency band sharing the same unguided media. The receiver tunes his set according to his choice. The cable TV network is another example of Frequency domain multiplexing employing guided media.

2. **Wavelength division multiplexing (WDM)**

   Wavelength division multiplexing is a type of FDM scheme used in fiber optical communications where various wavelengths of infrared light are combined over strands of fiber.

   Optical communication with few exceptions are digital since light transmitters and receivers are usually poorly suited for analog modulation.

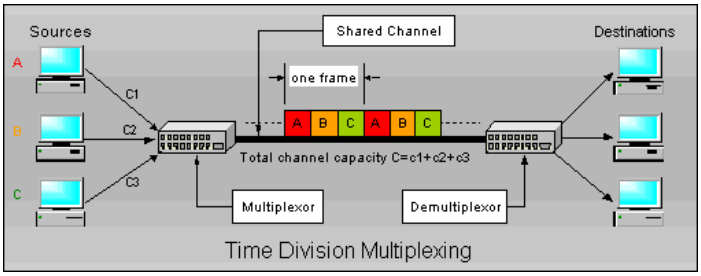


3. **Time domain multiplexing (TDM)**

   A type of multiplexing where two or more channels of information are transmitted over the same media by allocating a different time interval ("slot" or "slice") for the transmission of each channel. The channels take turns to use the media. Some kind of periodic synchronizing signal or distinguishing identifier is usually required so that the receiver can tell which channel is which.

   A typical practical setup combines a set of low-bit-rate streams, each with a fixed and pre-defined bit rate, into a single high-speed bit stream that can be transmitted over a single channel.

The main reason to use TDM is to take advantage of existing transmission lines. It would be very expensive if each low-bit-rate stream were assigned a costly physical channel (say, an entire fiber optic line) that extended over a long distance.



Network Topology

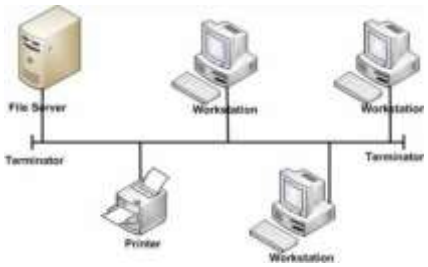
The topology defines how the devices (computers, printers..etc) are connected and how the data flows from one device to another. There are two conventions while representing the topologies. The physical topology defines how the devices are physically wired. The logical topology defines how the data flows from one device to another. **Broadly categorized into**

- Bus
- Ring
- Star
- Mesh
- Tree
- hybrid

1. Bus topology:

In a bus topology all devices are connected to the transmission medium as backbone. There must be a terminator at each end of the bus to avoid signal reflections, which may distort the original signal. Signal is sent in both directions, but some buses are unidirectional. Good for small networks. Can be used for 10BASE5 (thick net), 10BASE2(thin net) or 10BROAD36 (broad band) co-axial bus standards.

The main problem with the bus topology is failure of the medium will seriously affect the whole network. Any small break in the media the signal will reflect back and cause errors. The whole network must be shut down and repaired. In such situations it is difficult to troubleshoot and locate where the break in the cable is or which machine is causing the fault; when one device fails the rest of the LAN fails.



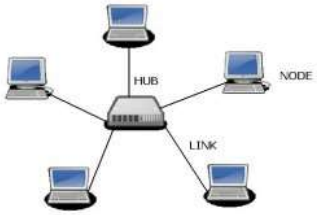
2. Ring Topology

Ring topology was in the beginning of LAN area. In a ring topology, each system is connected to the next as shown in the following picture.

Each device has a transceiver which behaves like a repeater which moves the signal around the ring; ideal for token passing access methods.
In this topology signal degeneration is low; only the device that holds the token can transmit which reduces collisions. If you see its negative aspect it is difficult to locate a problem cable segment; expensive hardware.

3. Star topology

In a star topology each station is connected to a central node. The central node can be either a hub or a switch. The star topology does not have the problem as seen in bus topology. The failure of a media does not affect the entire network. Other stations can continue to operate until the damaged segment is repaired.



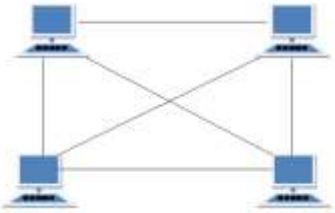
STAR TOPOLOGY

Commonly used for 10BASE5, 10BASE-T or 100BASE-TX types.
The advantages are cabling is inexpensive, easy to wire, more reliable and easier to manage because of the use of hubs which allow defective cable segments to be routed around; locating and repairing bad cables is easier because of the concentrators; network growth is easier.
The disadvantages are all nodes receive the same signal therefore dividing bandwidth; Maximum computers are 1,024 on a LAN.
Maximum UTP (Un shielded twisted pair) length is 100 meters; distance between computers is 2.5 meters.

4. Mesh topology

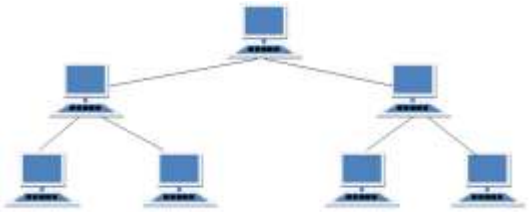
A mesh physical topology is when every device on the network is connected to every device on the network; most commonly used in WAN configurations Helps find the quickest route on the network; provides redundancy. Very expensive and not

easy to set up.



5. Tree topology

It is a hierarchy of a various hubs. All the nodes are connected to one hub or the other. There is a central hub to which only a few nodes are connected directly.
The central hub, also called active hub, looks at the incoming bits and regenerates them so that they can traverse over longer distances. The secondary hubs in tree topology may be active or passive hubs. The failure of a transmission line separates a node from the network.



6. Hybrid topology

It is formed by connecting two or more topologies together for example, hybrid topology can be created by using the bus, star and ring topologies.