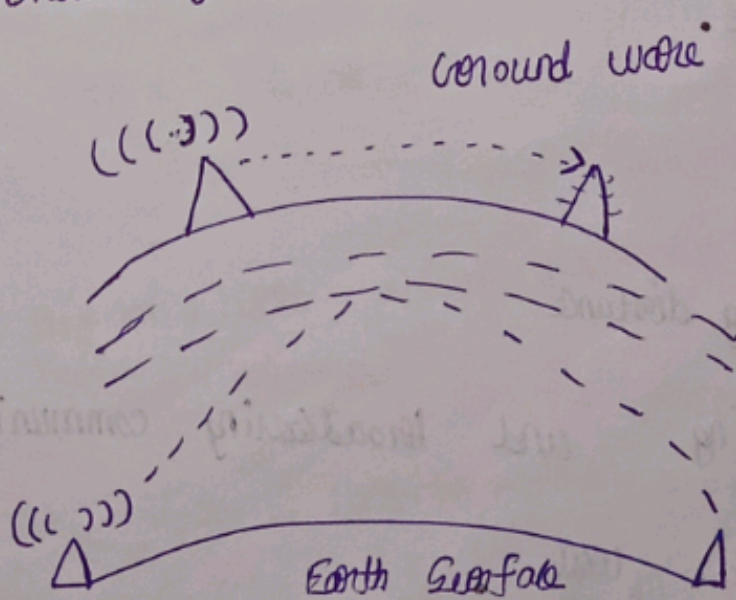


unit - II

wireless transmission:

electromagnetic spectrum:

- * The electromagnetic waves travel at the same speed, no matter what their frequency.
- * The radio, micro wave, infrared and visible light portion of the spectrum can all be used for transmitting spectrum. LF, RF and MF.



Microwave transmission:

Above 100 MHz, the waves travel is generally straight lines and can be normally focused concentrating all the energy.

~~Multi~~

Infrared and millimeter waves:

unguided infrared and millimeter waves are widely used for short - range communication. The remote controls used on television, VCRs and stereos all use infrared communication.

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Signal Propagation:

- * Ground propagation
- * Sky propagation
- * line of sight (LOS) propagation

Application of

Radio transmission - FM radio, television broadcast, cordless phone.

Advantage:

1. cover long distance
2. multicasting and broadcasting communication
3. penetrate wall.

Disadvantage:

1. unicast is very difficult
2. needed more power to generate radio waves
3. ~~Antenna~~ antenna is costly

Microwave application - telephone communication, satellite network, cellular phone, wireless LAN.

advantage:

1. one to one communication
2. needed less power to generate and receive the signal.
3. high data rate is possible.

Disadvantage:

1. needed more network structure
2. cover short distance
3. high frequency cannot penetrate walls

Infrared waves:

300 GHz to 400 THz

Application:

remote signal, light vision equipment.

Advantage:

1. high data rate is possible
2. longer wave length than radio and microwave.

Disadvantage:

1. It cannot penetrate walls.
2. It covers short range of distance.

Light transmission:

The optical ~~light~~ laser ^{light} is used to transmit the signal from sender to receiver in a ~~from~~ line-of-sight transmission.

Advantage:

1. It work in short and medium range distance (less than 500m)
2. The signal is detected correctly because of thickness of laser beam.

Disadvantage:

1. It cannot penetrate even in fog and rain.

Satellite networks:

The Satellite network is a combination of nodes like mobile phone, earth station, end of terminal.

It provide communication from one place of earth to another place of earth.

orbit:

An orbit is a path in which the satellite is travel ~~all~~ around the earth.

There are three types of orbit

1. ~~Equatorial~~ Equatorial
2. Inclined
3. Polar

The time require to make a complete trip around the earth is called period of satellite. it is calculated by Kepler's law.

$$\text{Period} = C \times \text{distance}^{1.5}$$

C - constant is equal to 1/100

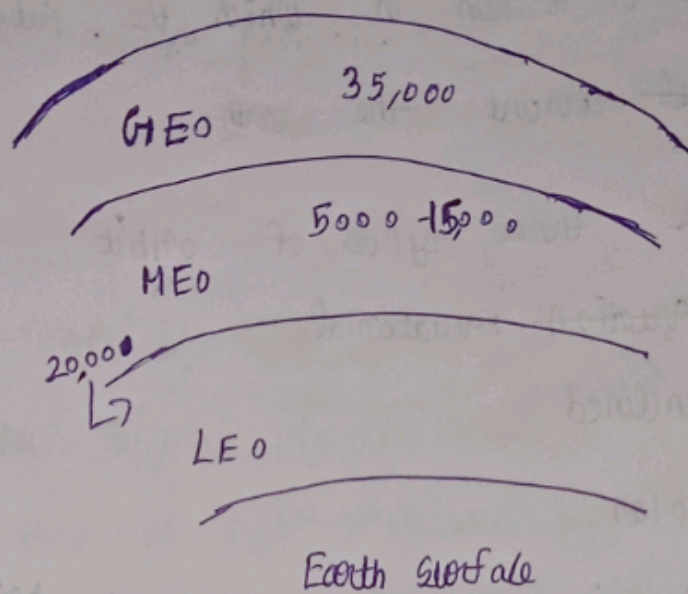
The signal from the satellite ^{d - distance of the satellite from center of the earth} are a ~~are~~ bidirectional

line of sight propagation aimed at specific area is called foot print.

Categories of Satellite:

Based on the location of the orbit from the earth surface the satellites are classified into three types

1. ~~Geostationary~~ Geostationary earth orbit (GEO)
2. Middle earth orbit (MEO)
3. Low earth orbit (LEO)



The transmission of signals from earth to satellite is called uplink.

The transmission of signal from satellite to earth is called downlink.

Telephone system :

LAN is a small size for home, small office, small scale industry, small organization creation is very easy. whenever it moves to large scale it has to move ^{for the} MAN and WAN. Telephone system is used.

Structure of telephone system:

* Telephone was invented by ~~Amagabal~~ ^{Croham bal} 1876

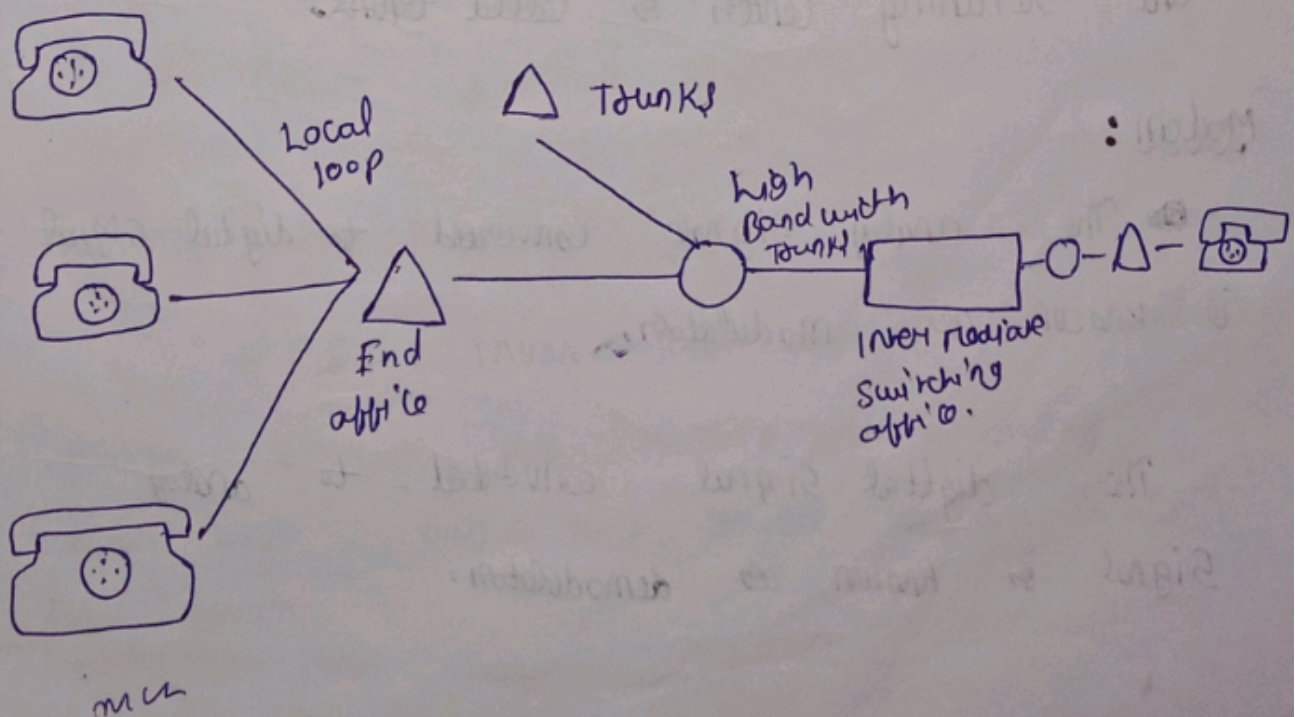
* The mesh topology is follow to connect a person with 'n' end person.

* If the city has n number of telephones, each connect with others by

$$\frac{n(n-1)}{2}$$

* To overcome the problem of mesh topology in ~~1978~~ ¹⁸⁷⁸ the centralized switching mechanism was introduced. This is manual mechanism.

* To avoid this multilevel switching offices were establish



Components of telephone system:

There are three major components

1. Local loops
2. Trunks
3. Switching offices

1. Local loops :

* The local loop is a two wire connection existing between the user and end office.

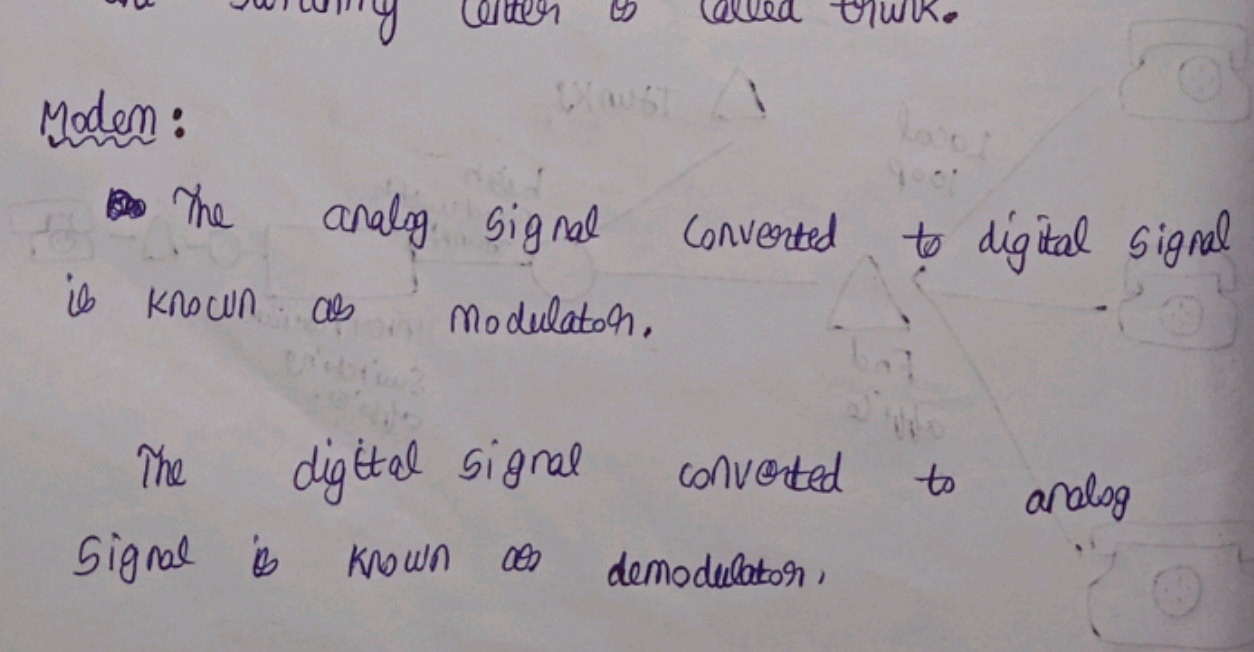
* The end office are connected to one or more switching centers to extend the connectivity, known as, toll offices.

* The lines used to connect the toll office and switching center is called trunk.

Modem:

The analog signal converted to digital signal is known as modulator.

The digital signal converted to analog signal is known as demodulator.



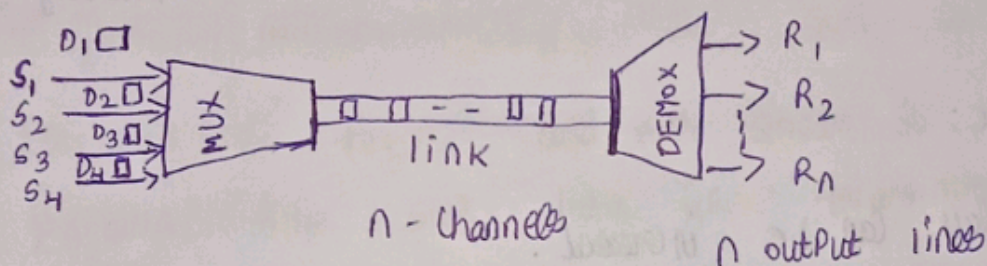
Multiplexing

10M

Multiplexing

Multiplexing in networking refers to the process of combining multiple data streams into single signal for transmission over a shared medium.

It allows for more efficient use of network resources by enabling multiple users or devices to share the same communication channel simultaneously.



There are four kinds of multiplexing

1. Frequency division multiplexing (FDM)
2. Wavelength division multiplexing (WDM)
3. Time division multiplexing (TDM)
4. Carrier division multiplexing (CDM)

1. Frequency division multiplexing (FDM)

* FDM involves in dividing the available frequency spectrum into multiple non overlapping frequency bands, each band allocate to a different data stream.

* This technique is often used in radio and television broadcasting, where different channels are assigned different frequencies.

Advantage:

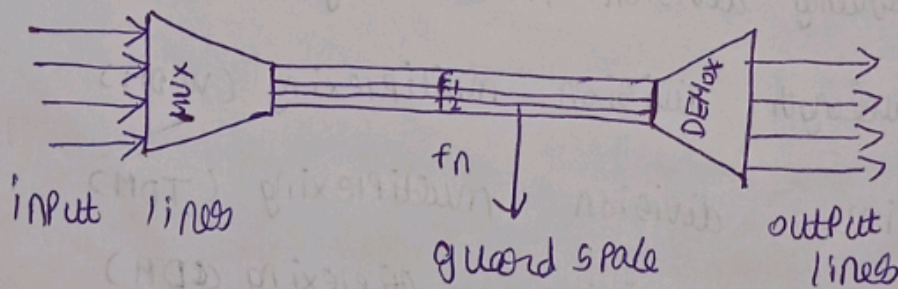
* Two or more signals can be combined, sent in a medium.

* Bandwidth of a medium can be used effectively.

Disadvantage:

* ^{The} delay can be increased.

* additional load by adding multiplexing and demultiplexing



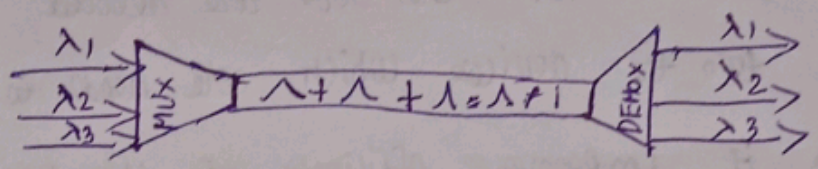
wavelength division multiplexing:

* WDM is similar to FDM but it used optical fibre communication system.

* Instead of dividing the frequency spectrum, WDM assign different wavelength of light to each data stream.

* This allows for multiple data streams to be transmitted over the optical fibre

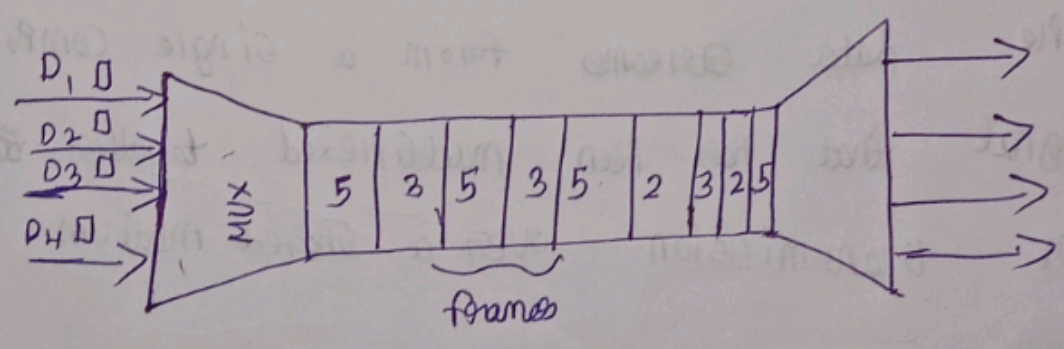
Simultaneously.



Time division multiplexing;

* In TDM different data streams are assigned non-overlapping time slot with a pre defined frame and each stream is given its own time slot data is transmitted sequentially.

* This is commonly used in telecommunication network for transmitting multiple phone calls over a single communication line.



There are two types of TDM:

1. Synchronous TDM
2. Statistical TDM

Statistical TDM:

In Statistical TDM the slots are allotted dynamically to the devices which are needed to send data. It improves efficiency of the bandwidth because no empty slots are allowed.

Synchronous TDM:

The slots are grouped into frames based on the number of ~~devices~~ devices connected to the multiplexer. If there are n devices then there are n slots, even if the devices ~~do~~ does not send data.

demultiplexer:

demultiplexing is the process of separating multiple data streams from a single composite signal that has been multiplexed together for transmission over a shared medium.

CRC (Cyclic Redundancy Code)

Let us consider 4 bit 1011 is send as information

here the data is 1011 and pattern is 1001.

The procedure is started with appending 000

to the original data and to do binary

division with pattern as quotient. The remainder

that we get replaced with the ~~pattern~~ appended

three digit 0.

1011 \rightarrow data
1001 \rightarrow Pattern

$$\begin{array}{r} 101 \\ 1001 \overline{) 1011000} \\ \underline{1001} \\ 00100 \\ 01000 \\ 1001 \\ \underline{00010} \end{array}$$

1011010

$$\begin{array}{r} 101 \\ 1001 \overline{) 1011010} \\ \underline{1001} \\ 100 \\ 1001 \\ \underline{1001} \\ 00000 \end{array}$$

At the receiver side the data received is divided by pattern and if there is no error then the remainder will zero.

if any other value is in remainder other than zero then the data received by the receiver is in error.