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Data Communication Part-4

Data communication part -4

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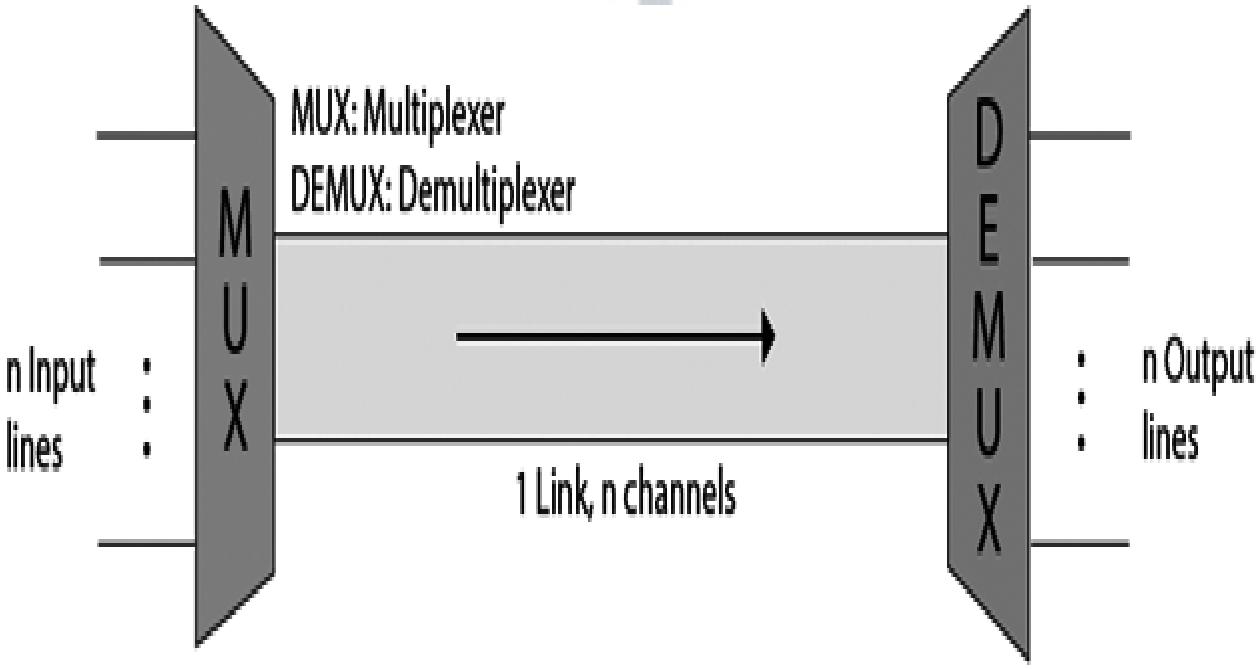
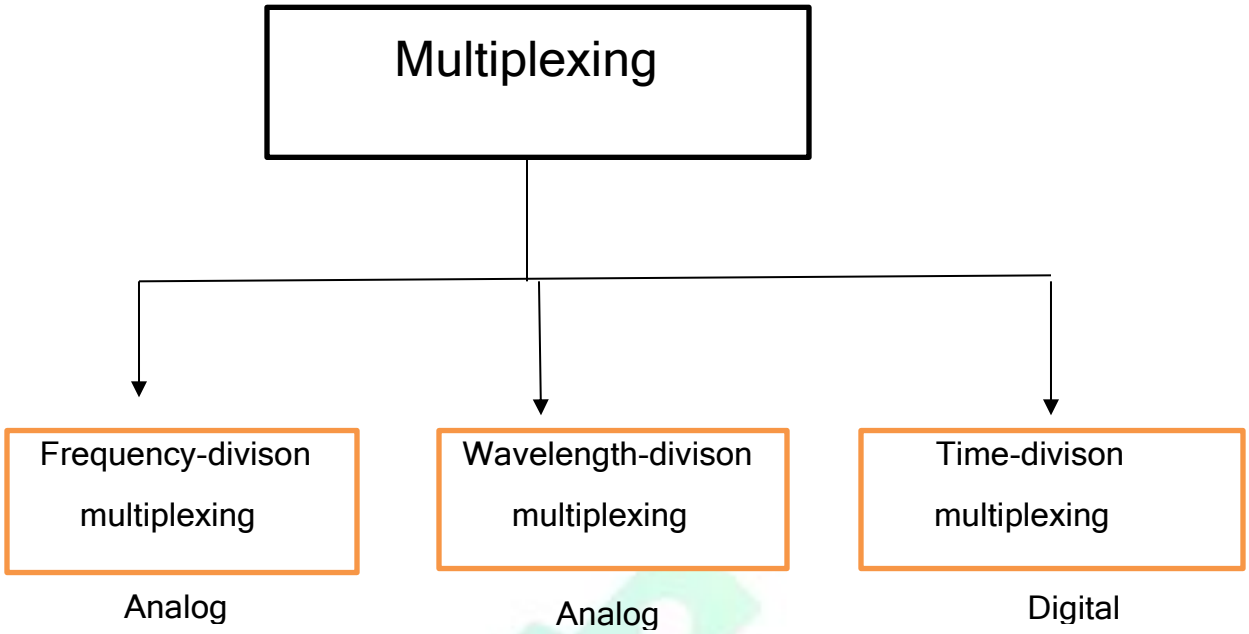
Multiplexing : It is the set of techniques that allow the simultaneous transmission of multiple signals. In a multiplexed system, n lines share the bandwidth of one link .Diagram shows the basic format of a multiplexed system . The lines on the left direct the transmission streams to a multiplex(MUX) , which combines them into a signal stream (many-to-one) . At receiving end, that streams is fed into demultiplexer (DEMUX) , thatwill separates the stream back into its component transmissions(one-to-many) and directs them to their corresponding lines.

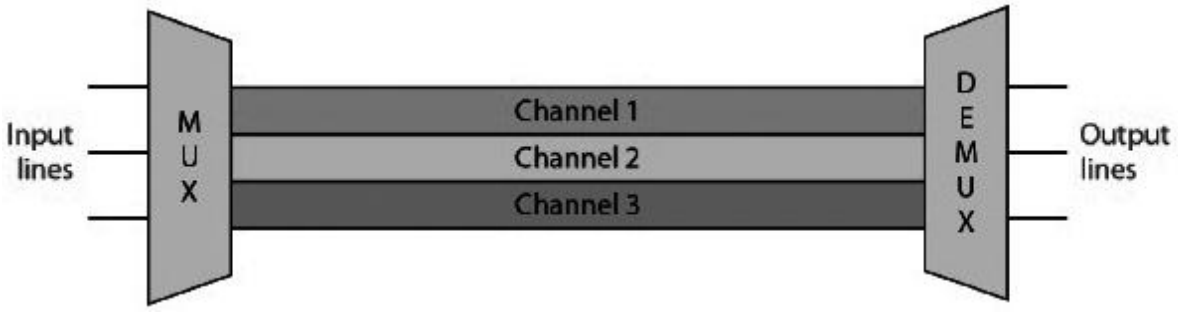


There are basically three multiplexing techniques which are as follows :



Frequency -Division Multiplexing :

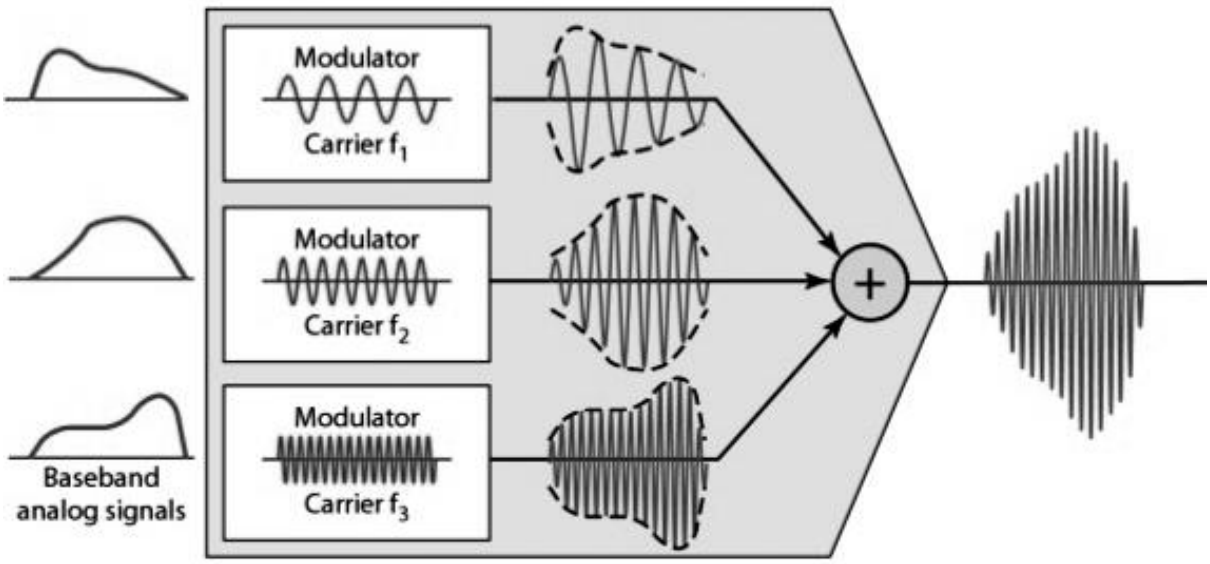
It is the analog technique that can be applied when bandwidth of the link (in hertz) is greater than the combined bandwidth of the signals to be transmitted. In FDM , the signals generated by each sending device modulate the different carrier frequencies. These modulated signals are separated by sufficient bandwidth to accommodate the modulated signal. These bandwidth ranges are the channels through which the various signals travels. The carrier frequencies must not interfere with the original data frequencies.



Multiplexing Process :

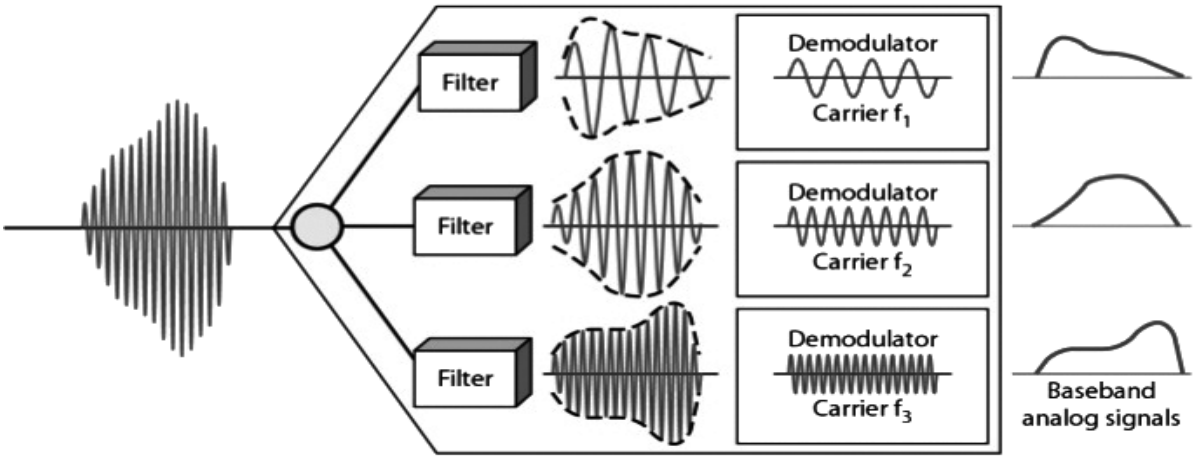
Diagram given below is conceptual illustration of the multiplexing process. Signal of similar frequency range is generated by each source. Inside the multiplexer, these similar

signals modulate different carrier frequency(f_1, f_2 and f_3) . Resulting modulated signals are then combined into a signal composite signal that is sent out over a media link that has enough bandwidth to accommodate it.



De-multiplexing Process :

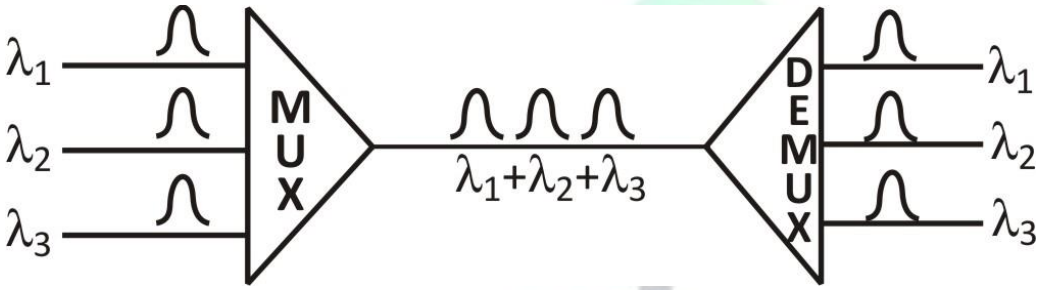
Series of filters is used by the de-multiplexer to decompose the multiplexed signal into its constituent componentsignals. The individual signals are then passed to a demodulator that separates them from their carriers and then passes them to the output lines .



Wavelength-Division Multiplexing(WDM) :

It is designed to use the high-data-rate capability of fiber-optic cable. The optical fiber data rate is higher than the data rate of the metallic transmission cable but using a fiber-optic cable for a single line wastes the available bandwidth. Multiplexing allows us to combine several lines into one (many-to-one).

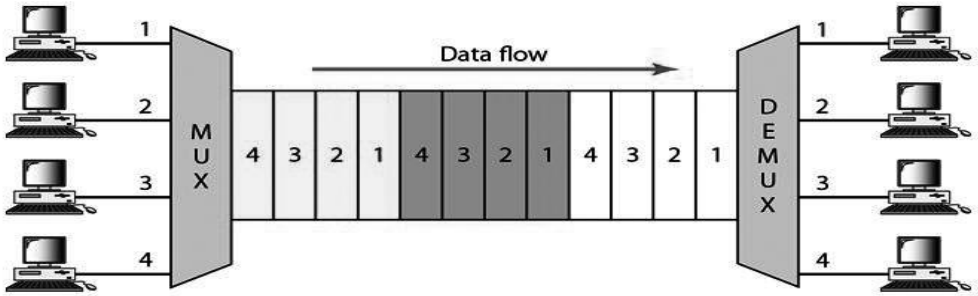
WDM is conceptually the same as FDM , except that multiplexing and de-multiplexing involve optical signal transmitted through fiber-optics channels . The idea is the same : we are combining different signal of different frequencies . The main difference is that the frequencies are very high.



Time-Division Multiplexing :-

It is a digital process that allows several connections to share the high bandwidth of a link. Instead of sharing a potion of the bandwidth as in FDM , time is shared . Each and every connection occupies a portion of time in the link. Diagram given below gives the conceptual view of TDM.

Note: The same link is used as in FDM ; here however , the link is shown sectioned by time rather than by frequency .

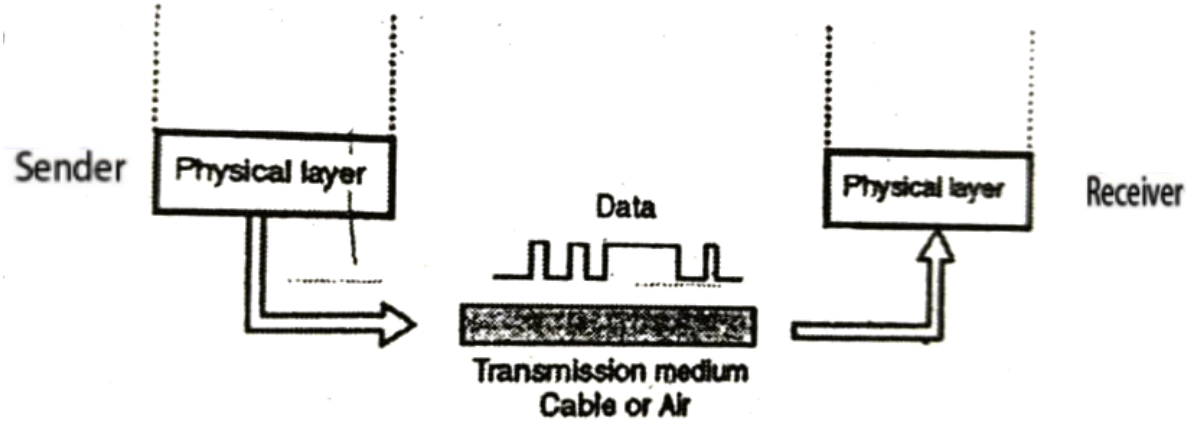


we need to remember that TDM is , in principle, a digital multiplexing technique. Digital data are combined from different sources are combined into one timeshared link. However, this does not mean that sources cannot produce analog data can be sampled , changed to the digital data and then multiplexed by using TDM.

Physical Layer :

Transmission Media and Physical Layer:

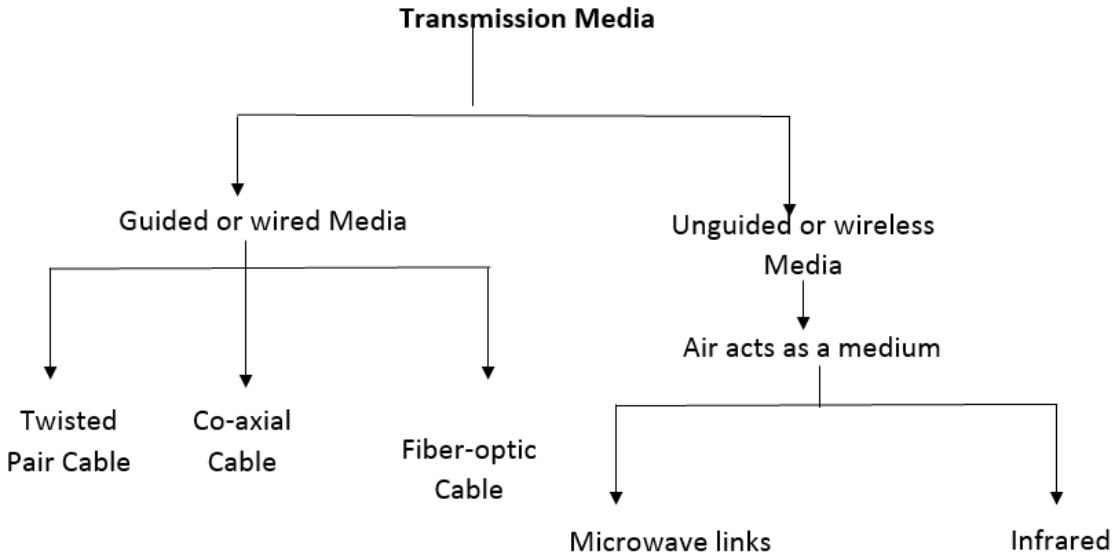
- In OSI model the transmission media are located below the physical layer. It is directly controlled by the physical layer.
- So we can say that transmission media belong to the lowest layer (layer 0) of the OSI model , as shown in the diagram .
- Transmission medium is the air or cable over which data can travel from sender to receiver.

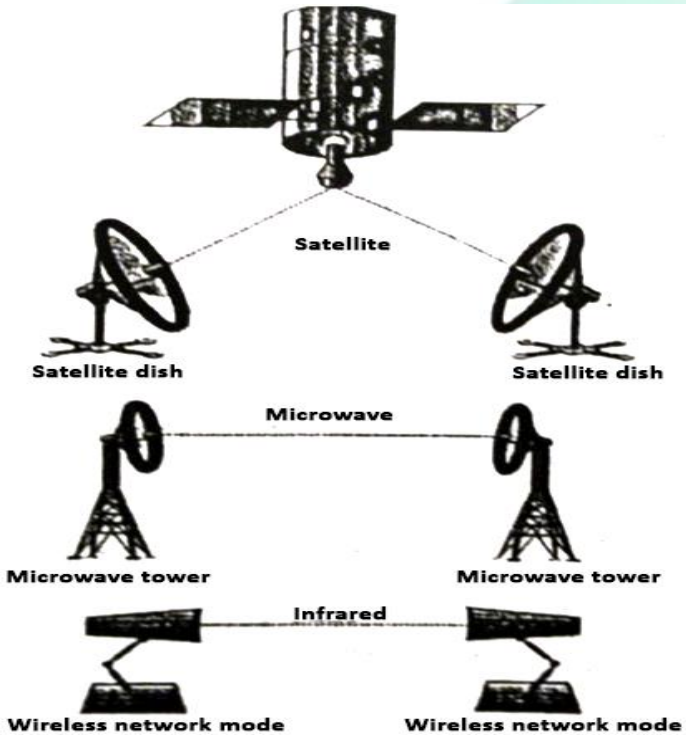


Transmission Media :

- Media are what the message is transmitted over . In other words a communication channel is also called as a medium .
- Different media have different properties and use in different environments for different purposes .
- The purpose of the physical layer is to transport a raw bit stream from one computer to another .

Classification of Transmission Media :





- Media are roughly grouped into two classes:
  1. Guided media
  2. Unguided media

Guided Media : It is a communication medium that allows the data to get guided along it. For this media there is need to have a point to point physical connection.

Unguided Media: The wireless media is also called as an unguided media .

- The examples of guided media are copper wires and fiber-optics. Similarly radio and lasers through the air are examples of unguided media in diagram.
- Every aspect of communication is affected by the medium in computer networking. Most important, it determines how quickly and to whom a systemcan talk and how expensive the process is.

Types Of Transmission Media:

Wired Media :

- In this type of media , the signal energy is contained and guided within a solid media.
- The example of wired media are copper pair wires , coaxial cable and fiber optic cables .
- The wired media is used for point to point communication.

Comparison of Wired and Wireless Media:

S.No.	Wired Media	Wireless Media
1	Signal energy is contained and guided within a solid medium.	Signal energy propagates in the form of unguided electromagnetic waves.
2	Twisted pair wires, coaxial cable, optical fiber cables are the examples are wired media.	infrared light and Radio are the examples of wireless media
3	Used for point to point communication	Used for radio broadcasting in all direction
4	Wired media lead to discrete network topologies	Wireless media leads to continuous network topologies
5	Additional transmission capacity can be procured by adding more wires	It is not possible procure additional capacity
6	Installation is costly , time consuming and complicated	Installation needs less time and memory.
7	Attenuation depends exponentially on the distance	Attenuation is proportional to square of the distance

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