

Multiplexing

- Multiplexing is the sharing of a medium or bandwidth. It is the process in which multiple signals coming from multiple sources are combined and transmitted over a single communication/physical line.

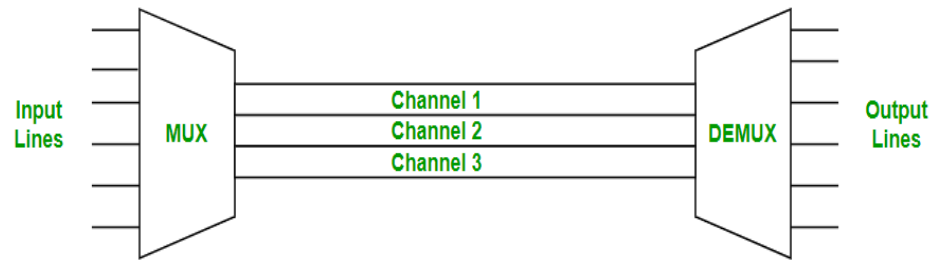


Types of Multiplexing

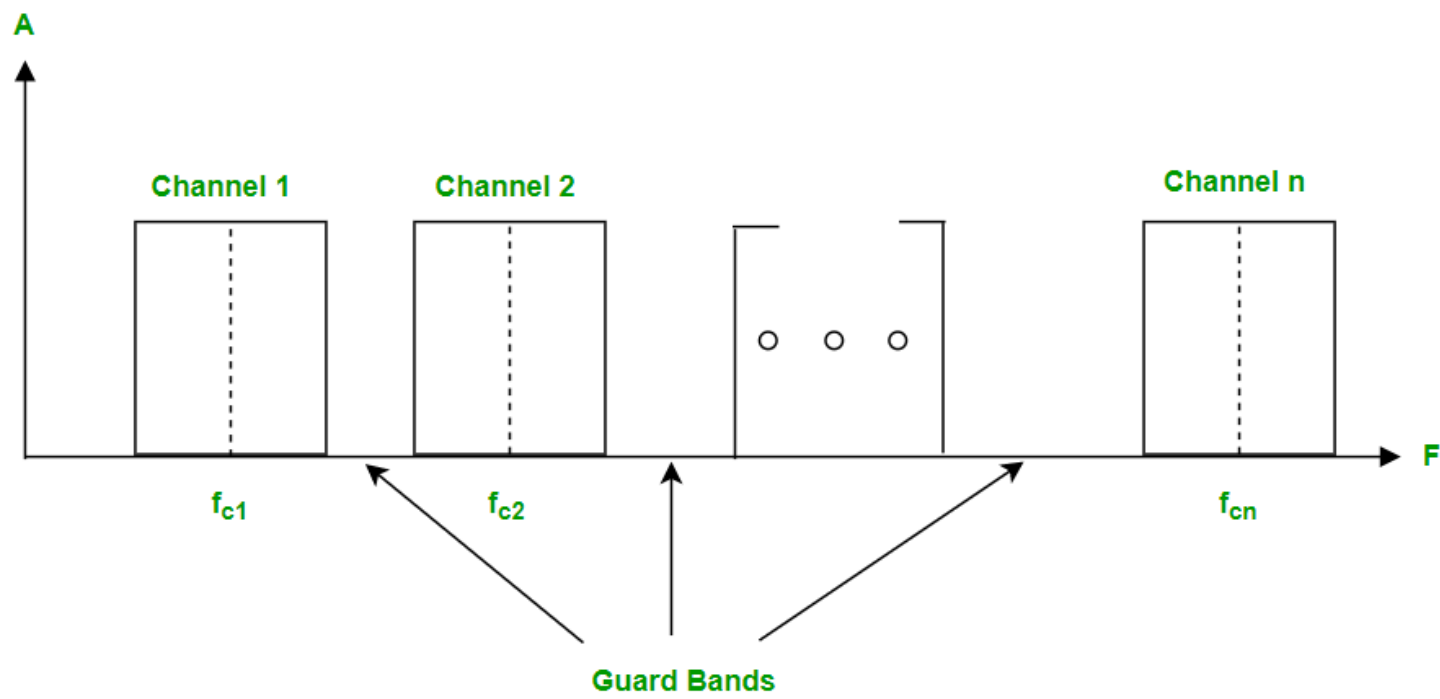
1. Frequency Division Multiplexing (FDM)
2. Time-Division Multiplexing (TDM)
3. Wavelength Division Multiplexing (WDM)

1. Frequency Division Multiplexing :

- Frequency division multiplexing is defined as a type of multiplexing where the bandwidth of a single physical medium is divided into a number of smaller, independent frequency channels.

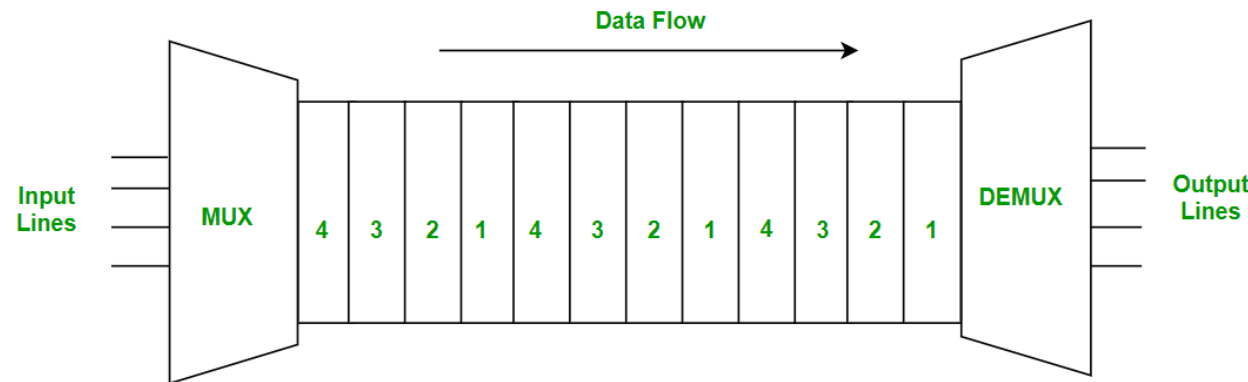


- Frequency Division Multiplexing is used in radio and television transmission.
- In FDM, we can observe a lot of inter-channel cross-talk, due to the fact that in this type of multiplexing the bandwidth is divided into frequency channels. In order to prevent the inter-channel cross talk, unused strips of bandwidth must be placed between each channel. These unused strips between each channel are known as **guard bands**.



2. Time Division Multiplexing :

- ▶ Time-division multiplexing is defined as a type of multiplexing wherein FDM, instead of sharing a portion of the bandwidth in the form of channels, in TDM, time is shared. Each connection occupies a portion of time in the link.
- ▶ In Time Division Multiplexing, all signals operate with the same frequency (bandwidth) at different times.



There are two types of Time Division Multiplexing:

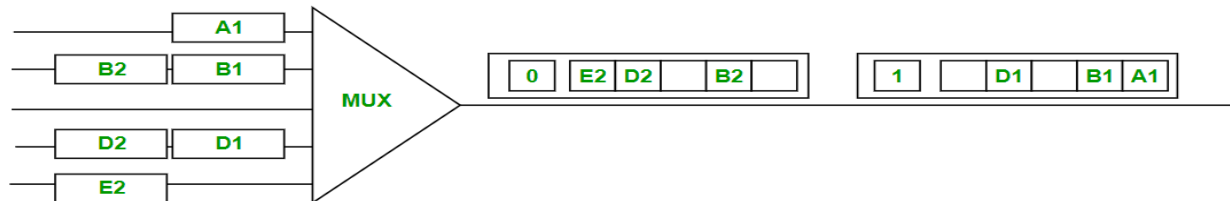
- ▶ Synchronous Time Division Multiplexing
- ▶ Statistical (or Asynchronous) Time Division Multiplexing

▶ Synchronous TDM:

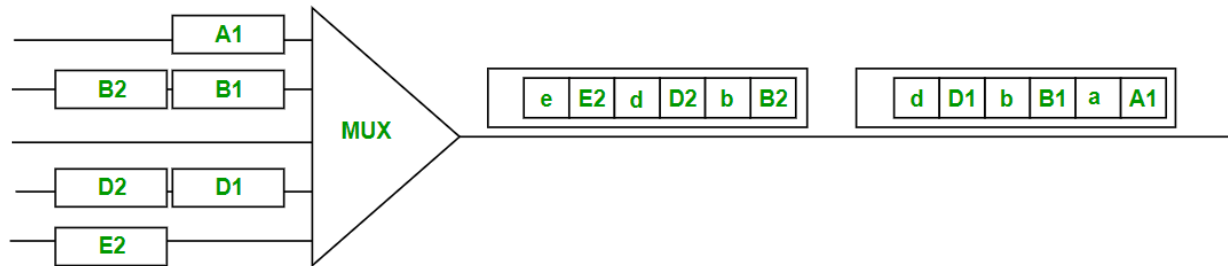
Synchronous TDM is a type of Time Division Multiplexing where the input frame already has a slot in the output frame. Time slots are grouped into frames. One frame consists of one cycle of time slots.

Synchronous TDM is not efficient because if the input frame has no data to send, a slot remains empty in the output frame.

In synchronous TDM, we need to mention the synchronous bit at the beginning of each frame.



- ▶ **Statistical TDM:**
- ▶ Statistical TDM is a type of Time Division Multiplexing where the output frame collects data from the input frame till it is full, not leaving an empty slot like in Synchronous TDM.
- ▶ In statistical TDM, we need to include the address of each particular data in the slot that is being sent to the output frame.



- ▶ Statistical TDM is a more efficient type of time-division multiplexing as the channel capacity is fully utilized and improves the bandwidth efficiency.

3. Wavelength Division Multiplexing:

- ▶ Wavelength Division Multiplexing is used on fiber optics to increase the capacity of a single fiber. It is an analog multiplexing technique. Optical signals from the different sources are combined to form a wider band of light with the help of multiplexers. At the receiving end, the de-multiplexer separates the signals to transmit them to their respective destinations.
- ▶ Is technique in fiber-optic transmission that uses multiple light wavelengths to send data over the same medium.