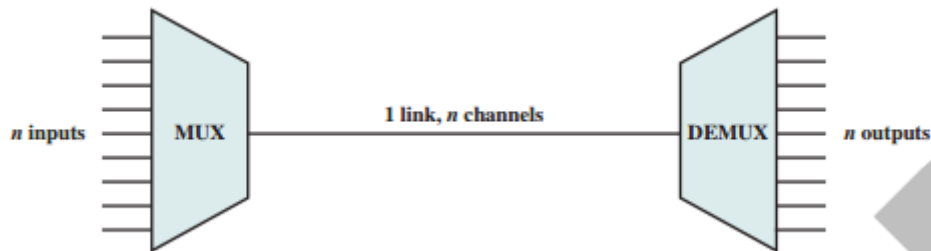


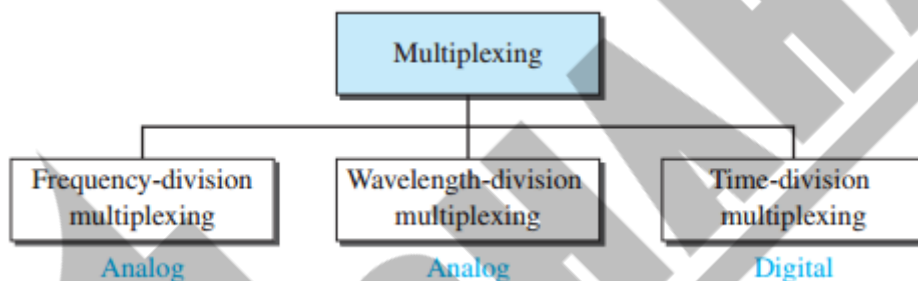
Multiplexing & Demultiplexing

Multiplexing is the set of techniques that allow the simultaneous transmission of multiple signals across a single data link. In a multiplexed system, n lines share the bandwidth of one link it is known as Multiplexer (**MUX**). At the receiving end, that stream is fed into a demultiplexer (**DEMUX**), which separates the stream back into its component transmissions (one-to-many). The word link refers to the physical path.



There are three types of Multiplexing:

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

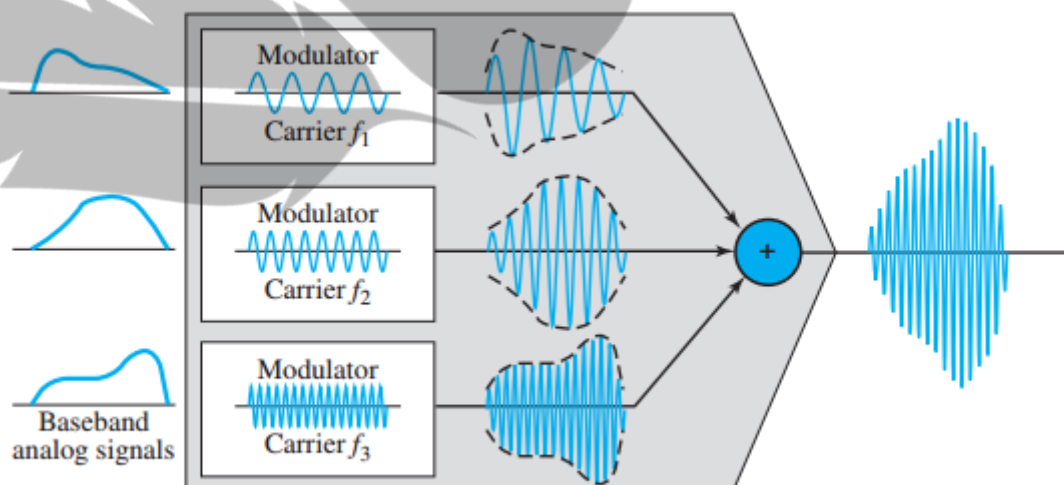


Their Details are as follow:

1. Frequency Division Multiplexing (FDM)

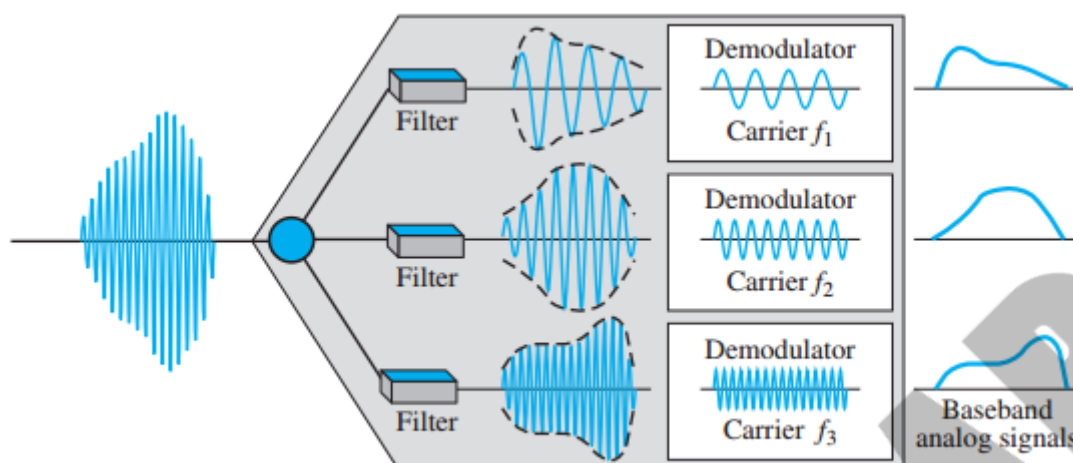
FDM is an analog multiplexing technique that combines analog signals. In the case of digital input, the input signals must be passed through modems to be converted to analog.

In FDM, signals generated by each sending device modulate different carrier frequencies. These modulated signals are then combined into a single composite signal that can be transported by the link or transmission medium.



Carrier frequencies are separated by sufficient bandwidth to accommodate the modulated signal. These bandwidth ranges are the channels through which the various signals travel. Channels can be separated by strips of unused bandwidth—guard bands—to prevent signals from overlapping.

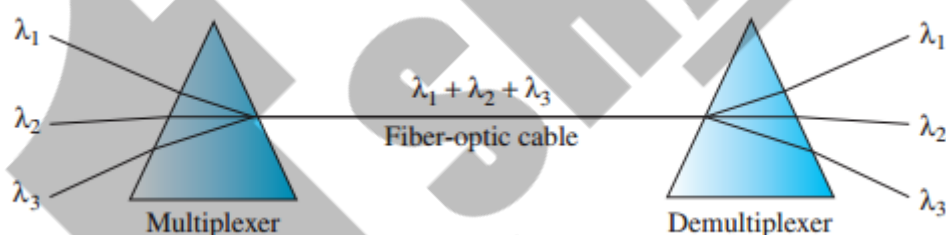
The demultiplexer uses a series of filters to decompose the multiplexed signal into its constituent component signals. The individual signals are then passed to a demodulator that separates them from their carriers and passes them to the output lines.



A very common application of FDM is AM and FM radio broadcasting. Radio uses the air as the transmission medium.

2. Wavelength Division Multiplexing (WDM)

WDM is an analog multiplexing technique to combine optical signals. Wavelength-division multiplexing (WDM) 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 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.



The combining and splitting of light sources are easily handled by a prism. Recall from basic physics that a prism bends a beam of light based on the angle of incidence and the frequency. Using this technique, a multiplexer can be made to combine several input beams of light, each containing a narrow band of frequencies, into one output beam of a wider band of frequencies. A demultiplexer can also be made to reverse the process.

3. Time Division Multiplexing (TDM)

TDM is a digital multiplexing technique for combining several low-rate channels into one high-rate one. Time-division multiplexing (TDM) is a digital process that allows several connections to share the high bandwidth of a link. Instead of sharing a portion of the bandwidth as in FDM, time is shared. Each connection occupies a portion of time in the link.

