UNIT – V

MULTIPLEXING AND MULTIPLE ACCESS

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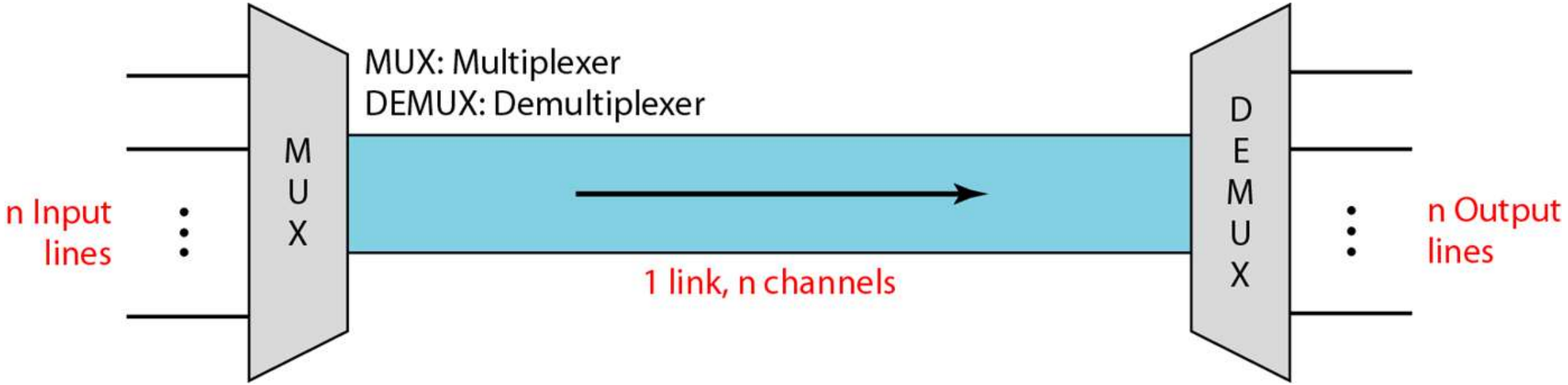
Multiplexing

- Frequency-Division Multiplexing
- Wavelength-Division Multiplexing
- Synchronous Time-Division Multiplexing
- Statistical Time-Division Multiplexing

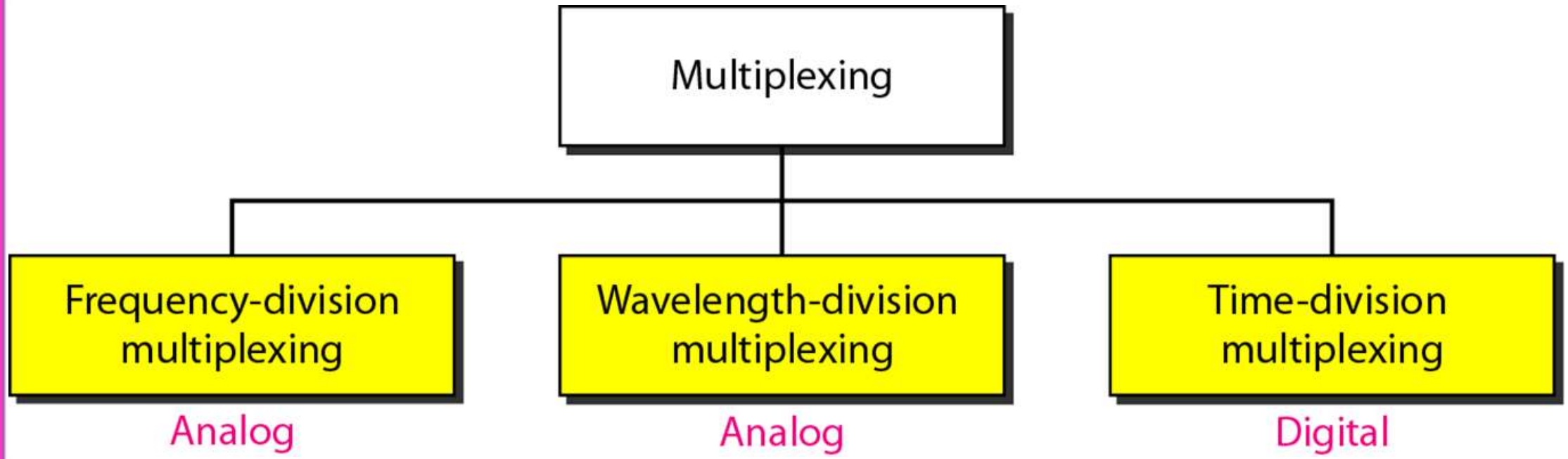
Multiplexing

Multiplexing is the set of techniques that allows the (simultaneous) transmission of multiple signals across a single data link.

Dividing a link into channels



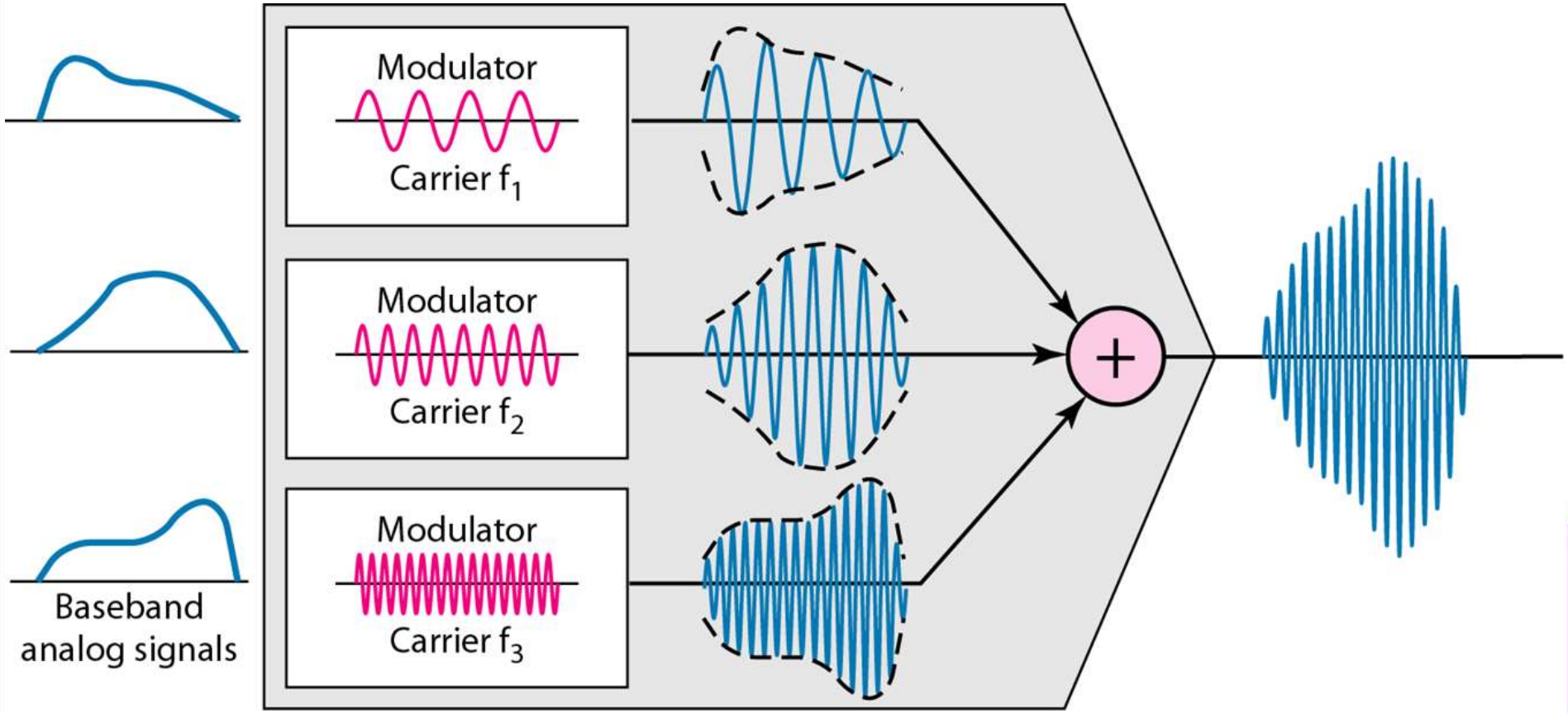
Categories of Multiplexing



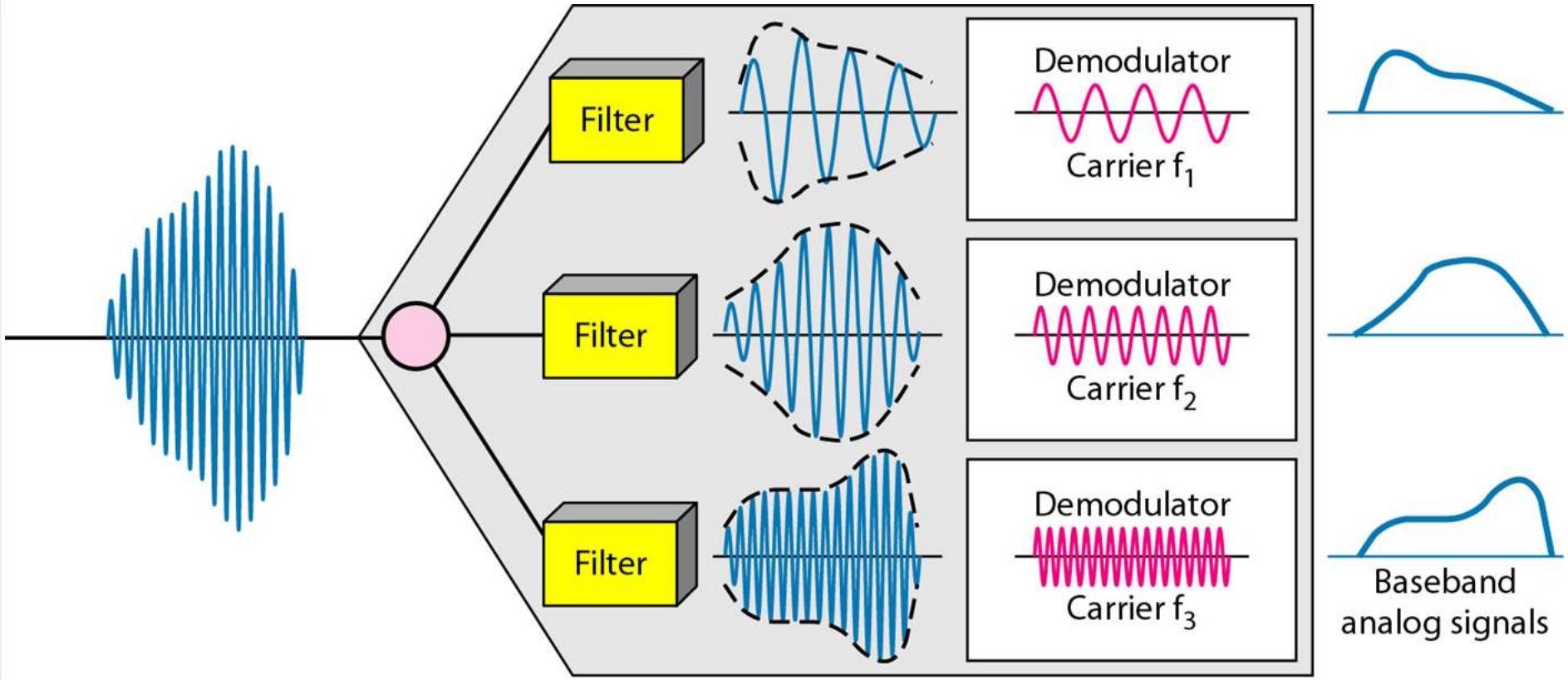
Frequency-division multiplexing (FDM)

- FDM is an analog multiplexing technique that combines analog signals.
- It uses the concept of modulation.
- Modulating signals are modulated using Carriers well separated from each other considering bandwidth required for each signal.
- The bandwidth ranges are referred as the channels.
- Channels are usually separated by small strips of unused bandwidth called “guard bands” to prevent signals from overlapping.

FDM process



FDM demultiplexing

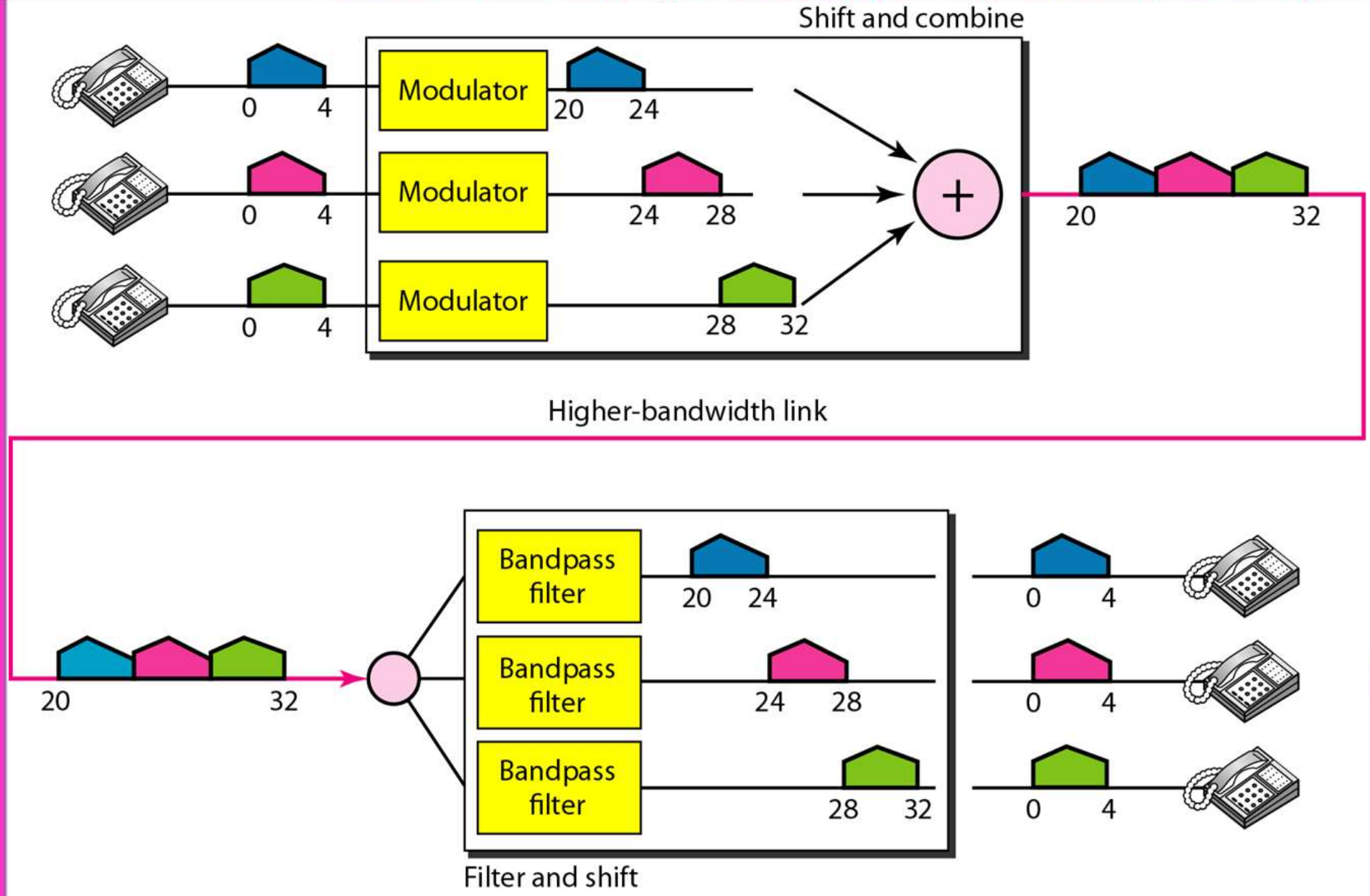


Example 1

Assume that a voice channel occupies a bandwidth of 4 kHz. We need to combine three voice channels into a link with a bandwidth of 12 kHz, from 20 to 32 kHz. Show the configuration, using the frequency domain. Assume there are no guard bands.

Solution

Shift (modulate) each of the three voice channels to a different bandwidth, as shown in Figure. Use the 20- to 24-kHz bandwidth for the first channel, the 24- to 28-kHz bandwidth for the second channel, and the 28- to 32-kHz bandwidth for the third one. Then Combine them as shown in Figure



Example 2

Five channels, each with a 100-kHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference?

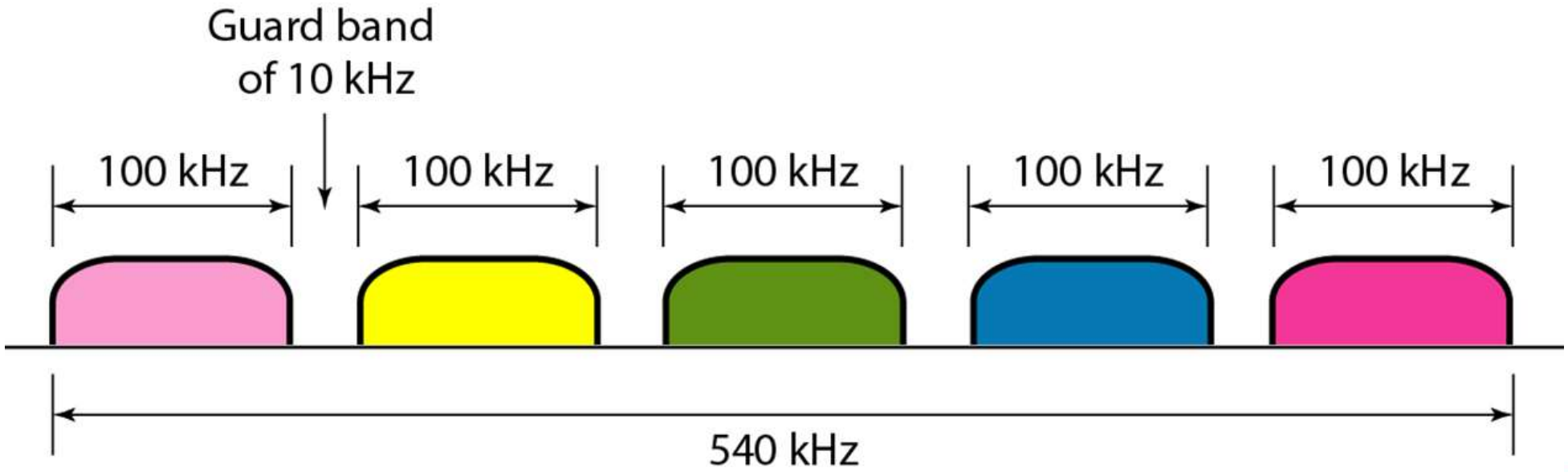
Solution

For five channels, we need at least four guard bands. This means that the required bandwidth is at least

$$5 \times 100 + 4 \times 10 = 540 \text{ kHz},$$

as shown in Figure

Example 2



Lecture Summary - Multiplexing

- **Frequency-Division Multiplexing**
- Wavelength-Division Multiplexing
- Synchronous Time-Division Multiplexing
- Statistical Time-Division Multiplexing

Next Lecture – Multiplexing(Contd..)

- Frequency-Division Multiplexing
- **Wavelength-Division Multiplexing**
- **Synchronous Time-Division Multiplexing**
- **Statistical Time-Division Multiplexing**

Assignment 5

Question 1:

Assume that a voice channel occupies a bandwidth of 4 kHz. We need to multiplex 12 voice channels with guard bands of 500 Hz using FDM. Calculate the required bandwidth.

Ask Questions & Share Responses

You can ask your questions and share your responses at:

- Email: barbindanandit@Sanjivani.org.in and/or
- WhatsApp Group: SE IT 2022 batch

Lecture Presentation and Literature

To refer presentation of this lecture and literature visit:

- https://github.com/aabarbind/IT2020