

Medium Sharing

Computer Networks(CS31204)

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Bandwidth Utilization

Bandwidth: The maximum amount of data transmitted over an internet connection in a given amount of time.

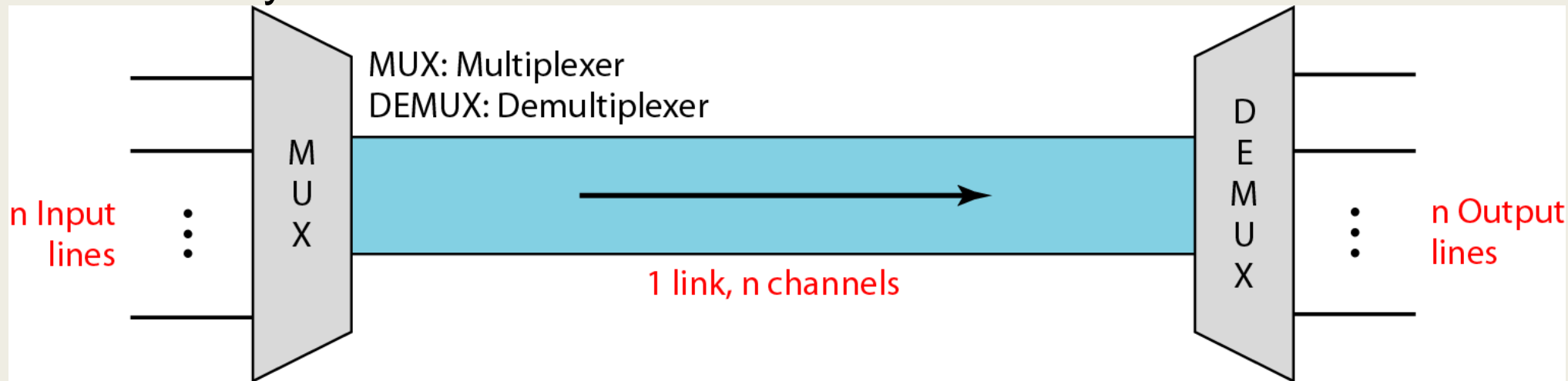
Bandwidth utilization : Bandwidth utilization is the wise use of available bandwidth to achieve specific goals.

Efficiency can be achieved by multiplexing; i.e., sharing of the bandwidth between multiple users.

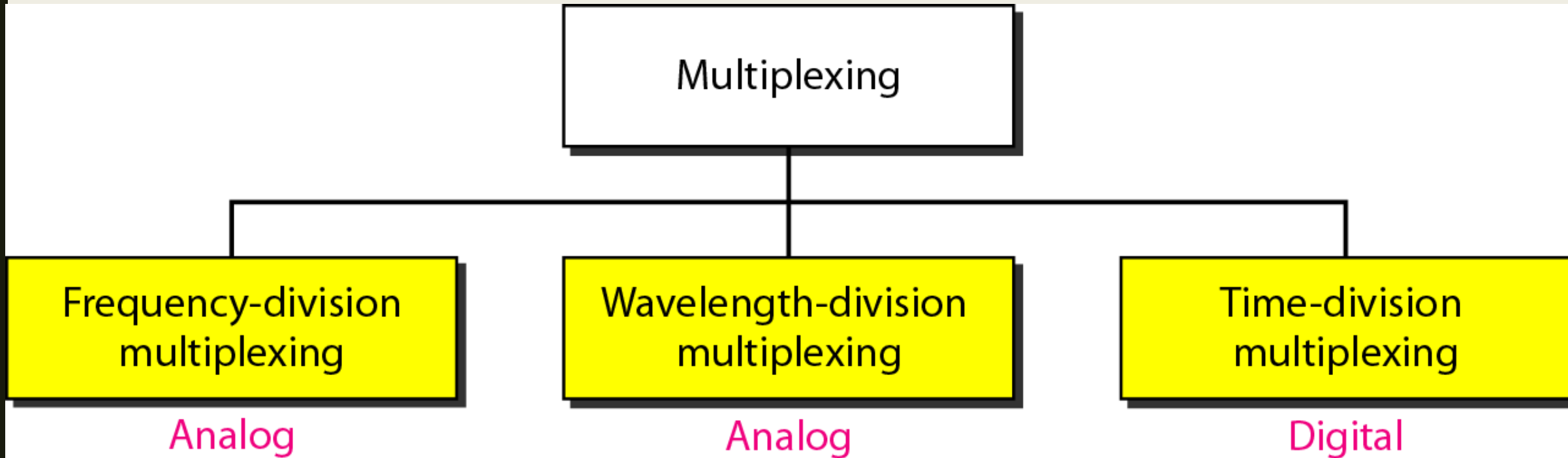


Multiplexing

- Multiplexing is the process of combining multiple signals into one signal, over a shared medium.
- It describes how several users can share a medium with minimum or no interference.
- It divides the high capacity medium into low capacity logical medium which is then shared by different streams.



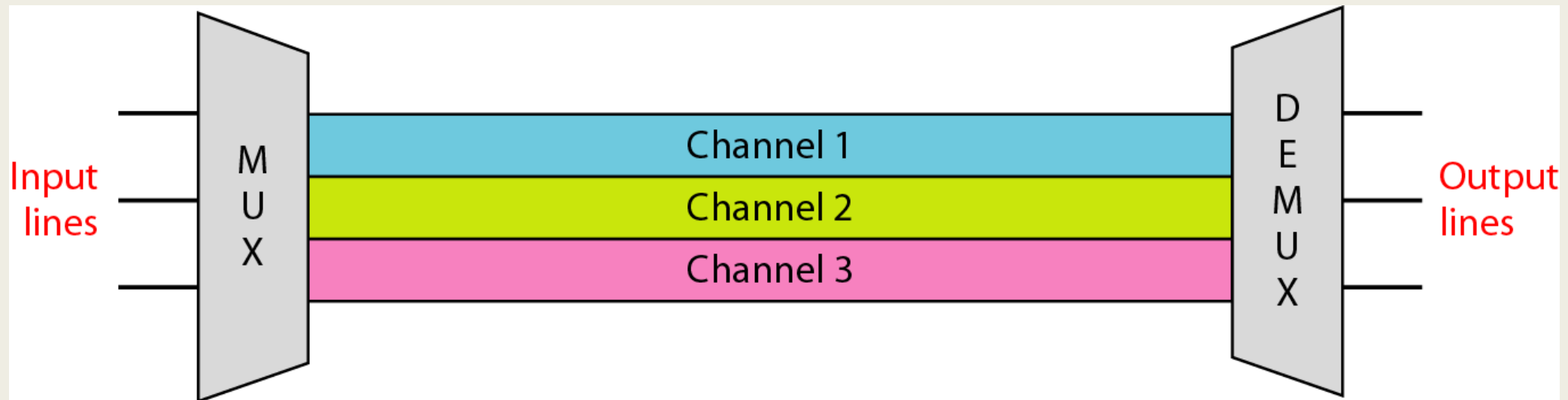
Categories





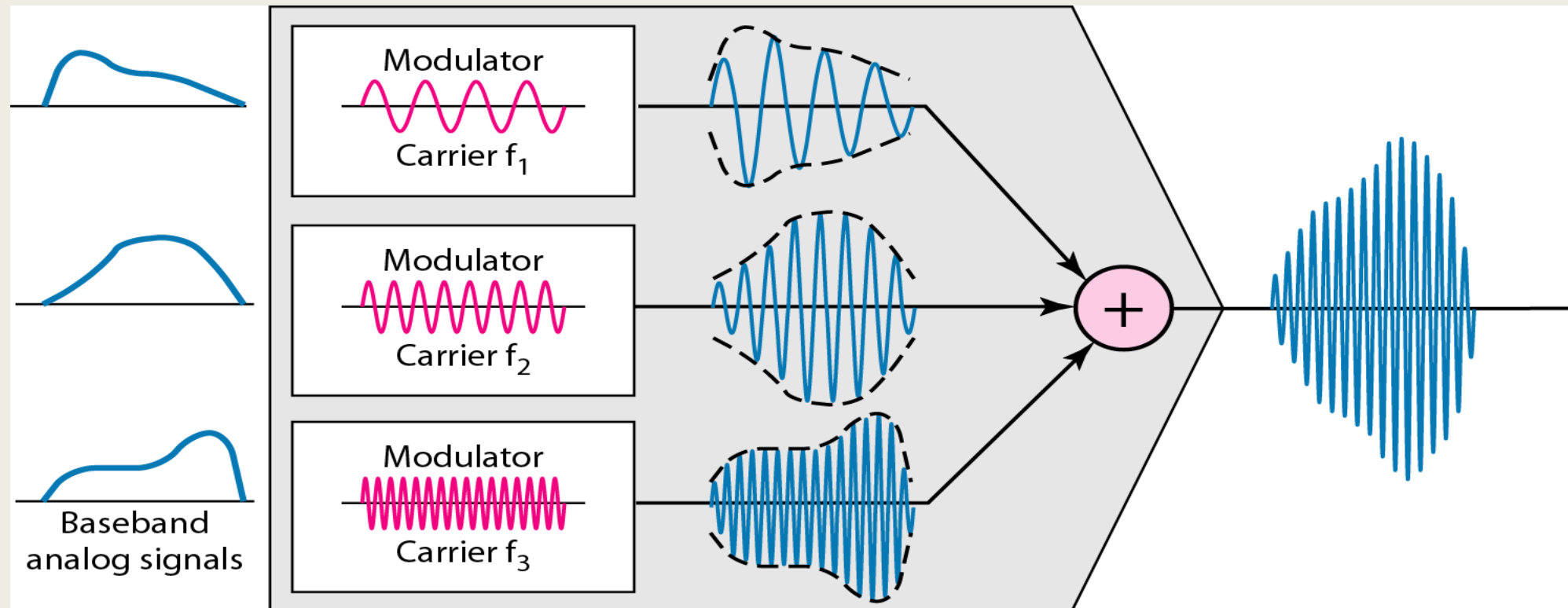
Frequency Division Multiplexing

- ❑ FDM divides the in logical channels and allocates one user to each channel.
- ❑ Each user can use the channel frequency independently.
- ❑ The channels do not overlap with each other.
- ❑ Channels are separated by guard bands.



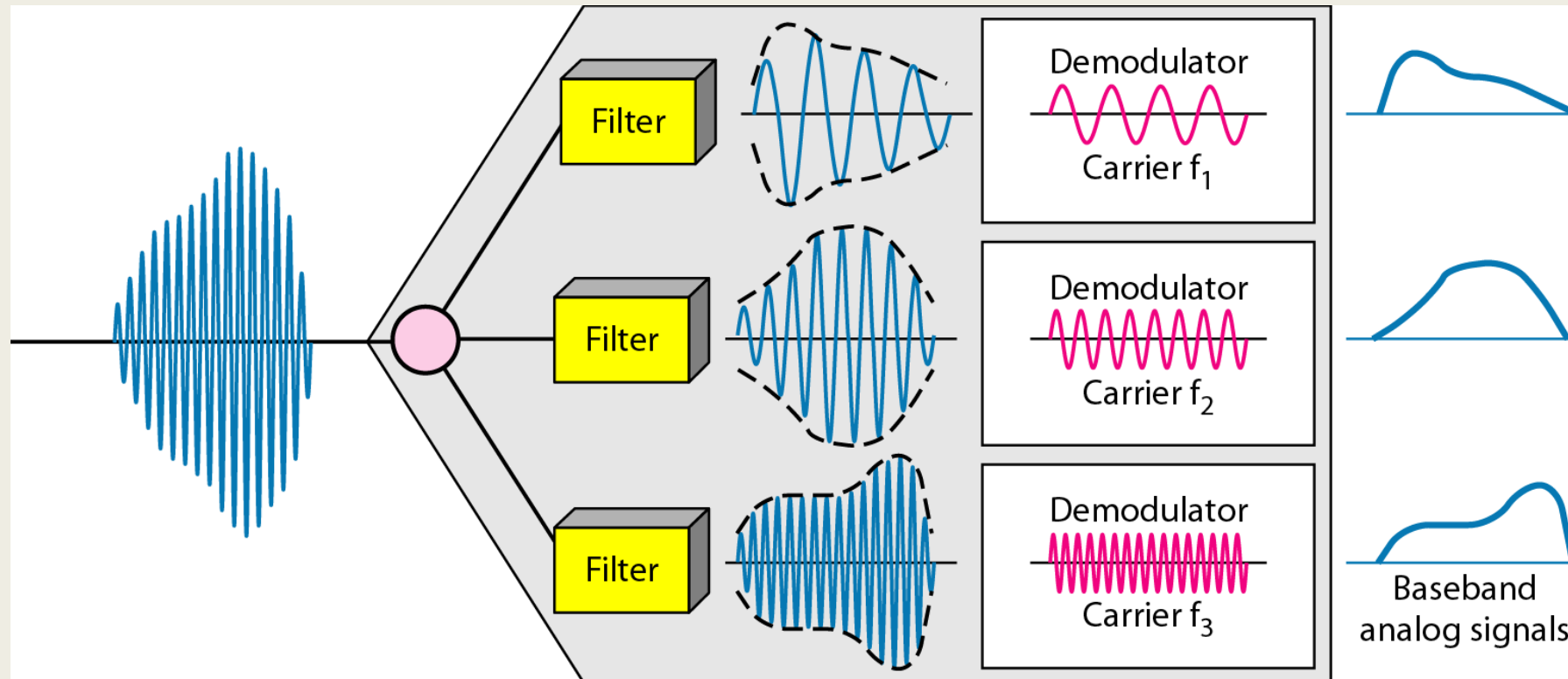
FDM Process

- Each source generates a signal of a similar frequency range.
- Inside the multiplexer, these similar signals modulates different carrier frequencies
- The resulting modulated signals are then combined into a single composite signal that is sent out over a media link that has enough bandwidth to accommodate it.



FDM Demodulation Process

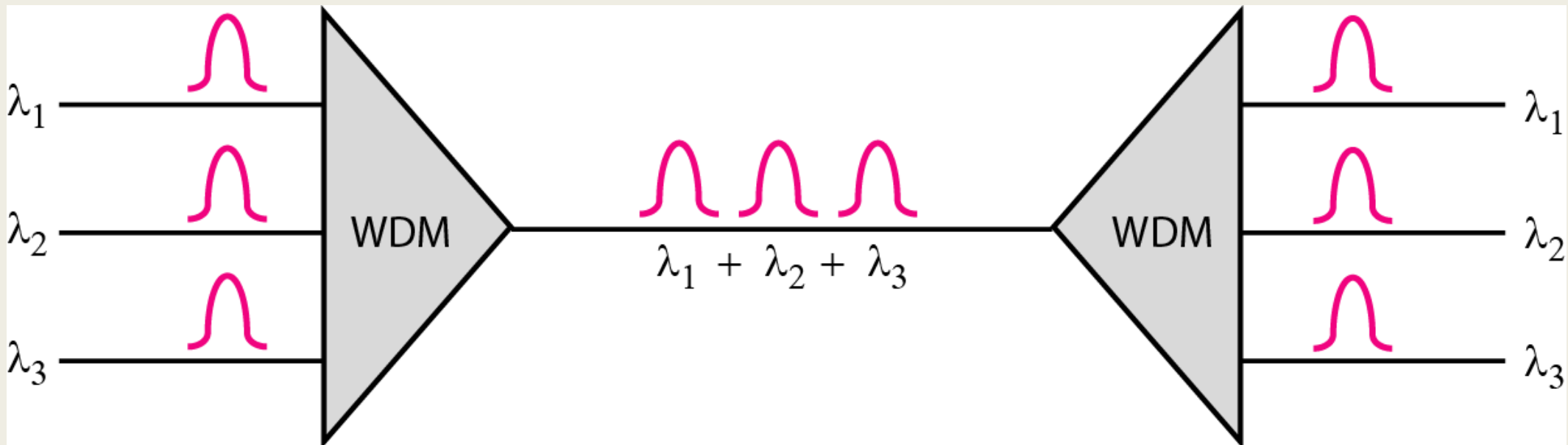
- The demultiplexer uses a series of filters to decompose the multiplexed signal into its constituent component signals.
- The individual signals are then passed to a demodulator that separates them from their carriers and passes them to the output lines.



Wavelength Division Multiplexing

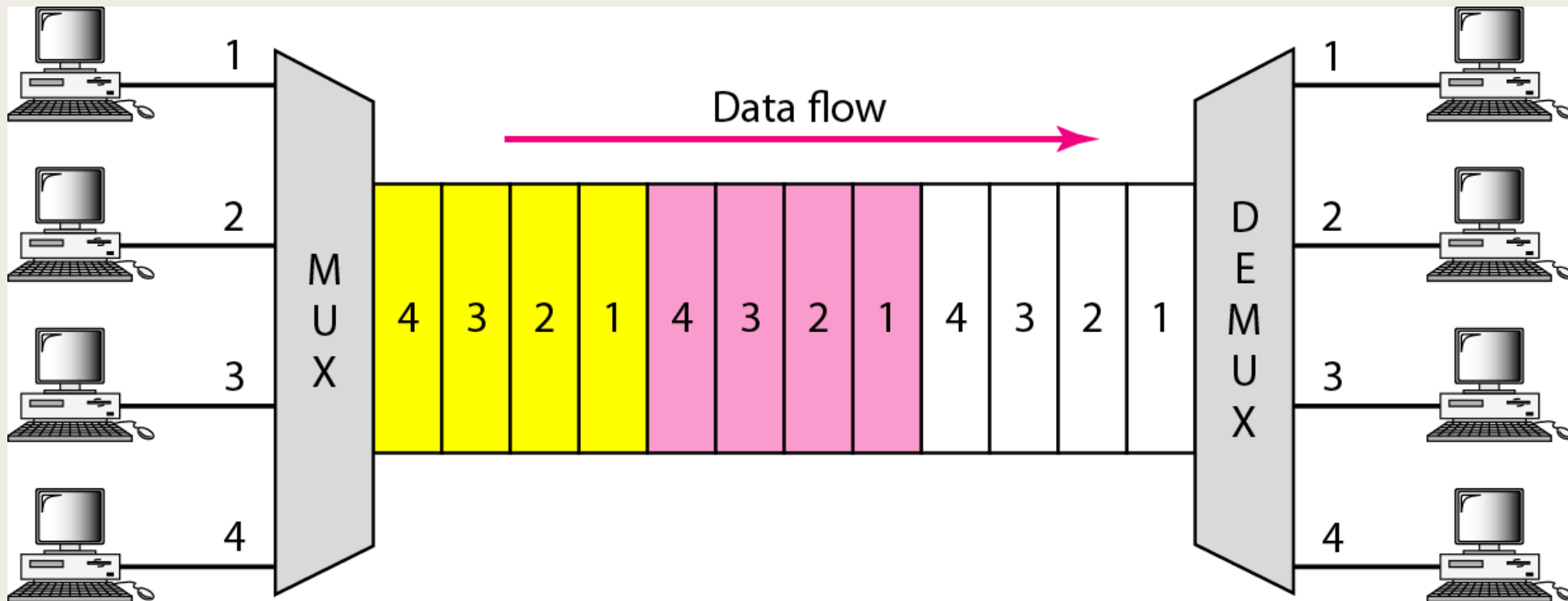


- WDM is an analog multiplexing technique to combine optical signals.
- The multiplexing and demultiplexing involve optical signals transmitted through fiber-optic channels.
- Combining different signals of different frequencies.
- The frequencies are very high.



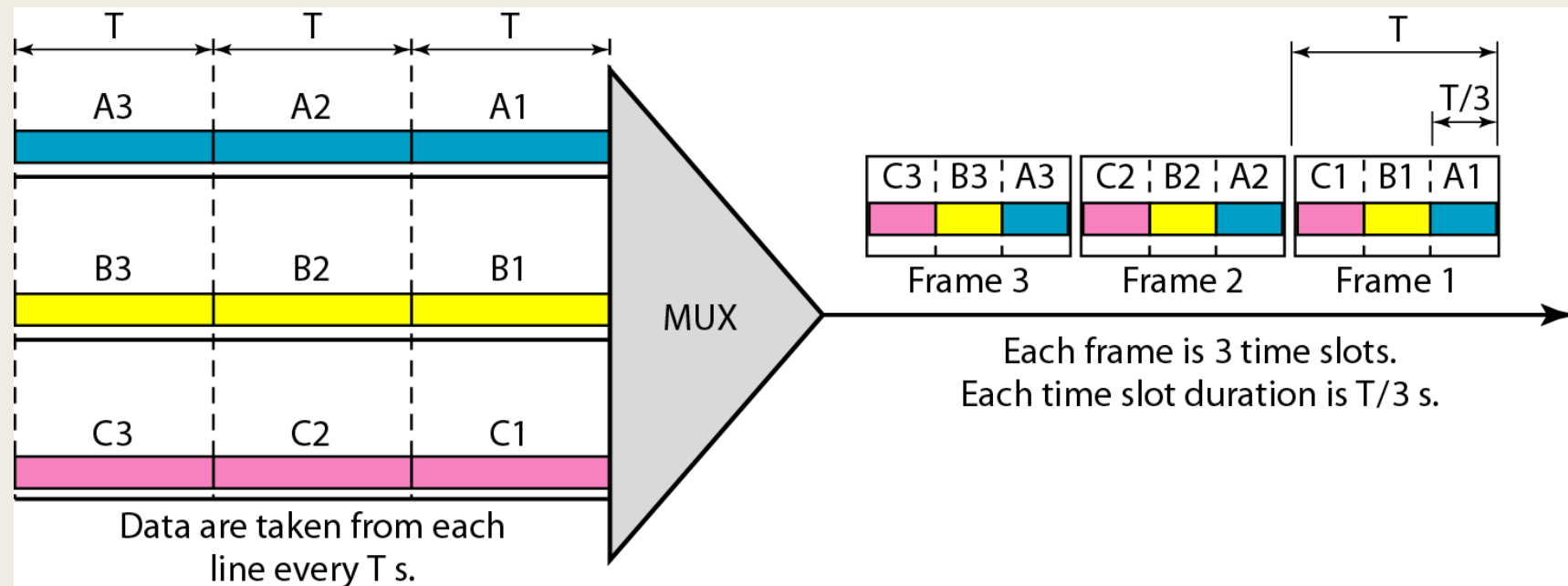
Time Division Multiplexing

- ❑ In TDM the shared channel is divided among its user by means of time slot.
- ❑ Each user can transmit data within the provided time slot only.



Synchronous Time Division Multiplexing

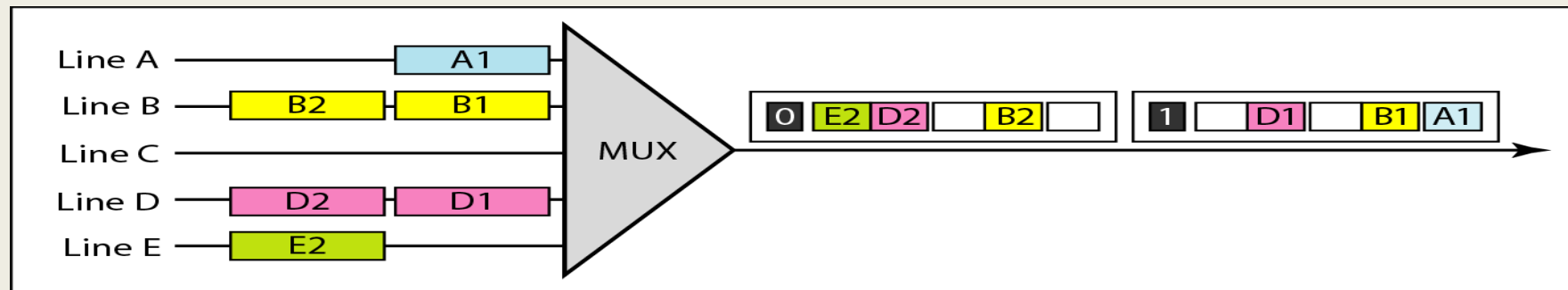
In synchronous TDM, the data rate of the link is n times faster, and the unit duration is n times shorter.



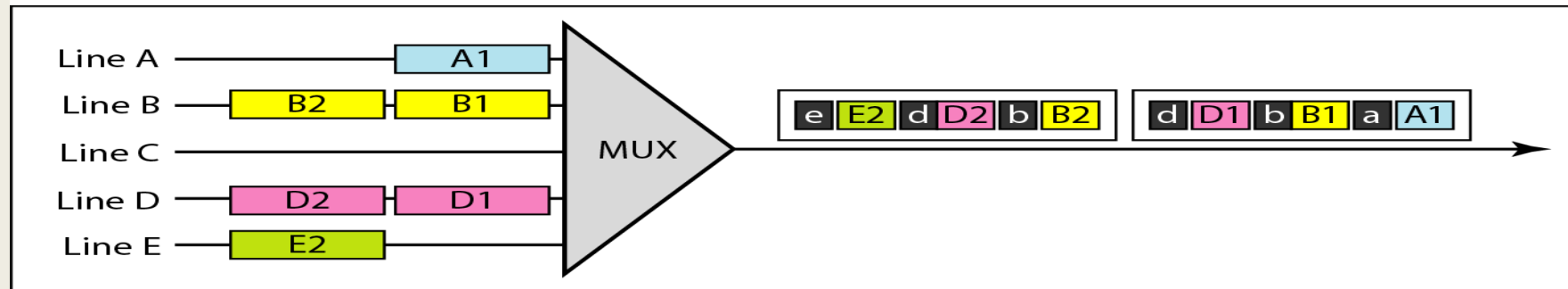


Statistical Time Division Multiplexing

- In statistical multiplexing, the number of slots in each frame is less than the number of input lines.
- The multiplexer checks each input line in round robin fashion; it allocates a slot for an input line if the line has data to send; otherwise, it skips the line and checks the next line.



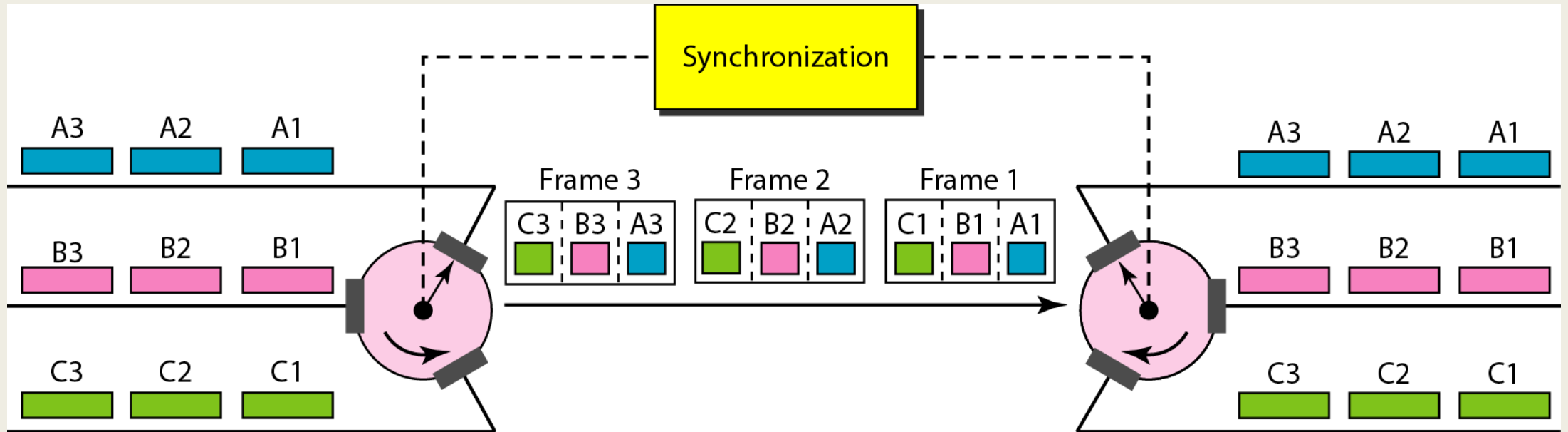
a. Synchronous TDM



b. Statistical TDM

Interleaving

The process of taking a group of bits from each input line for multiplexing is called interleaving.





Data Rate Management

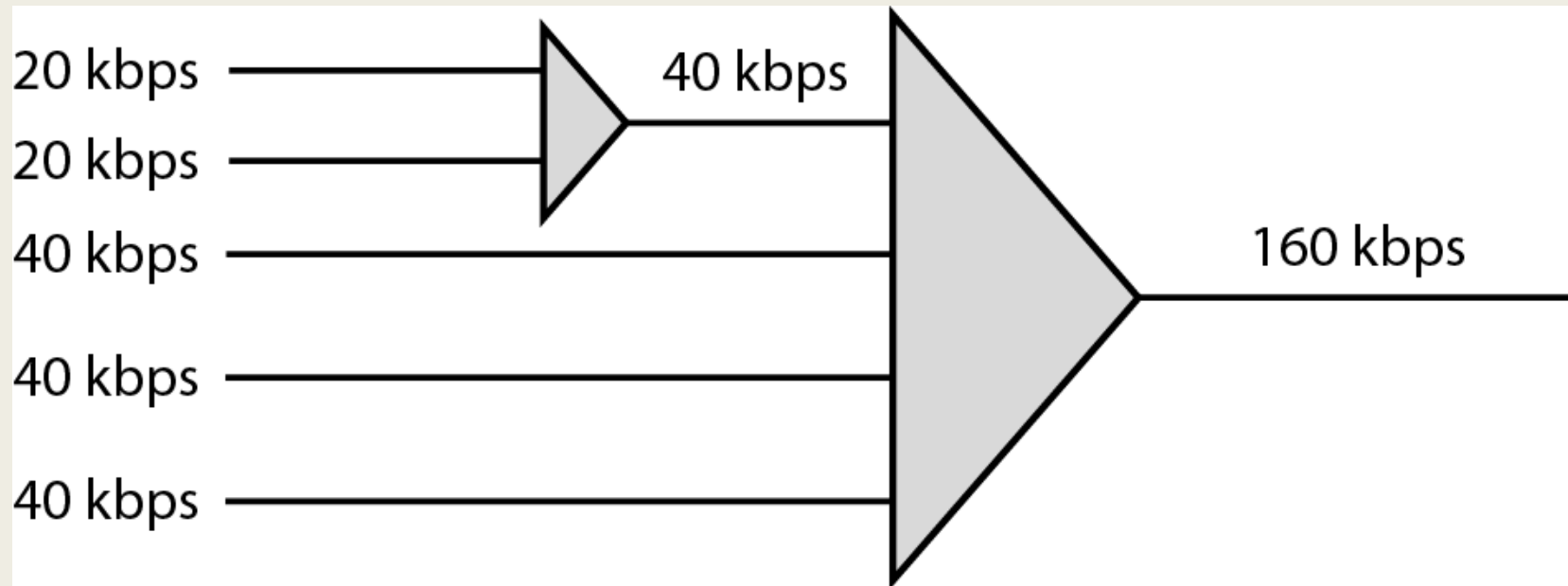
- Not all input links maybe have the same data rate.
- Some links maybe slower. There maybe several different input link speeds.
- There are three strategies that can be used to overcome the data rate mismatch: multilevel, multi-slot and pulse stuffing



Multilevel Multiplexing

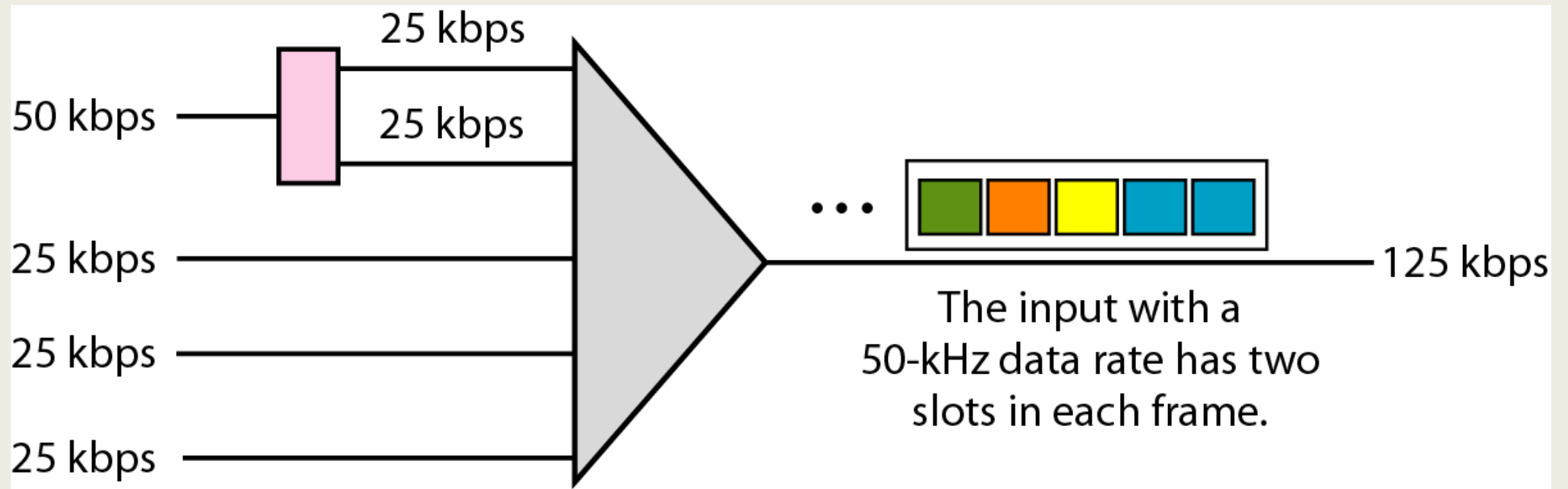
Multilevel multiplexing is a technique used when the data rate of an input line is a multiple of others.

For example, we have two inputs of 20 kbps and three inputs of 40 kbps. The first two input lines can be multiplexed together to provide a data rate equal to the last three. A second level of multiplexing can create an output of 160 kbps.



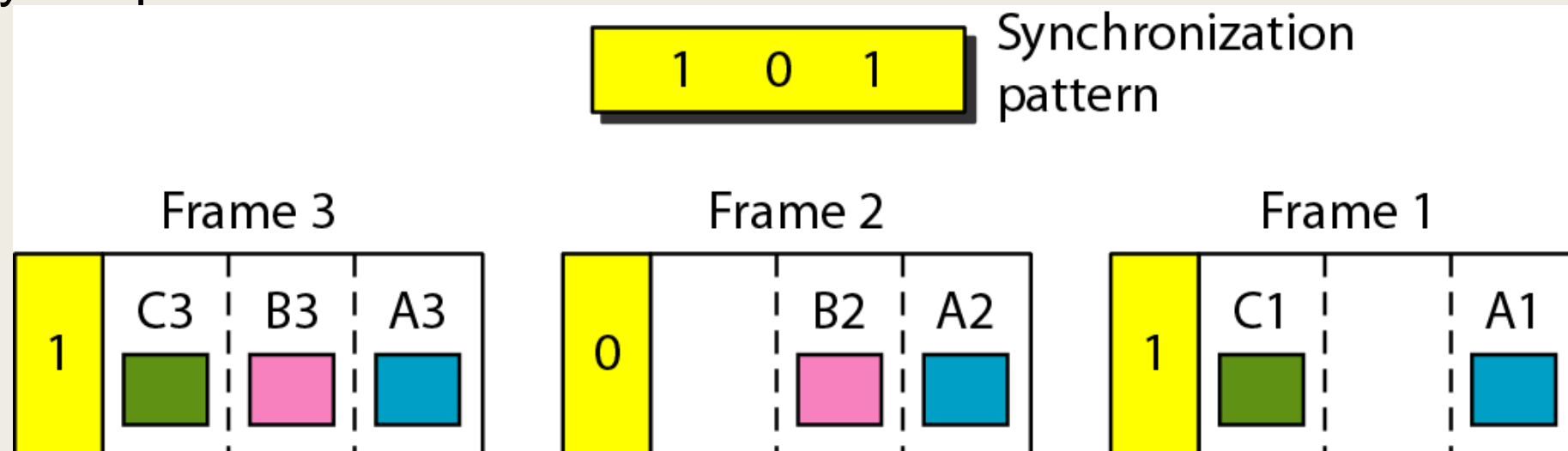
Multiple Slot Multiplexing

Used when there is a GCD between the data rates. The higher bit rate channels are allocated more slots per frame, and the output frame rate is a multiple of each input link.



Synchronization

- To ensure that the receiver correctly reads the incoming bits, i.e., knows the incoming bit boundaries to interpret a “1” and a “0”, a known bit pattern is used between the frames.
- The receiver looks for the anticipated bit and starts counting bits till the end of the frame.
- Then it starts over again with the reception of another known bit.
- These bits (or bit patterns) are called synchronization bit(s).
- They are part of the overhead of transmission.





Thank You!!!