Multiplexing

COMP476
Networked Computer Systems

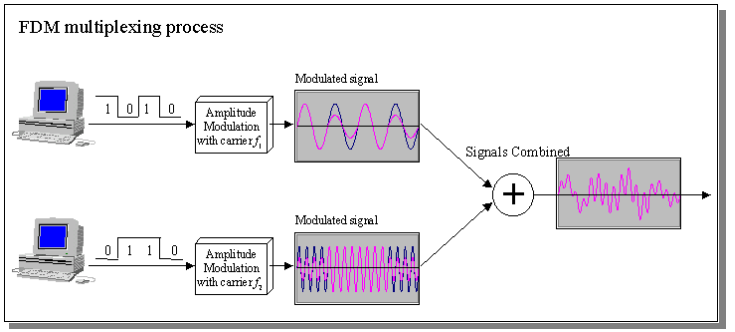
Multiplexing

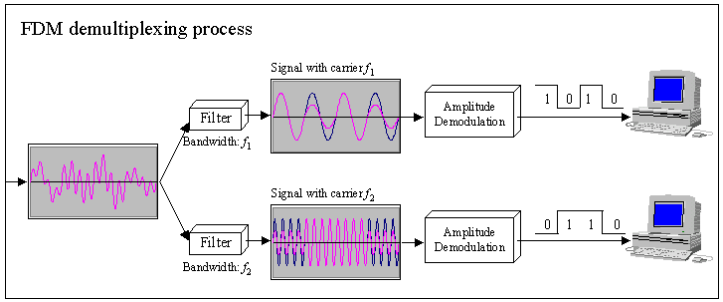
The set of techniques that allows the simultaneous transmission of multiple signals across a single data link.

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

Frequency-Division Multiplexing (FDM)

- Each logical channel is transmitted on a separate frequency.
- Television and radio uses FDM to broadcast many channels over the same media.
- Filters separate the multiplexed signal back into its constituent component signals





Wavelength Division Multiplexing

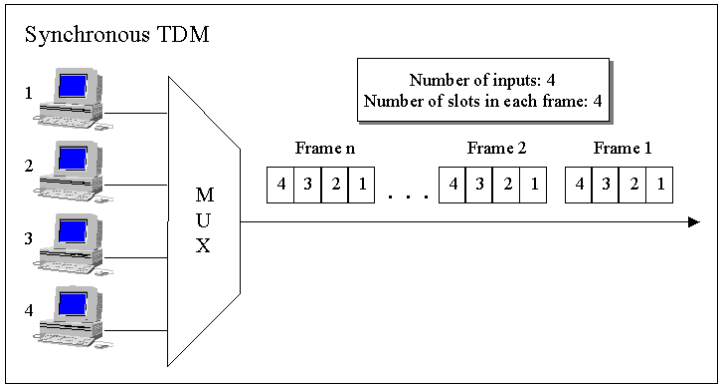
- Theoretically identical to Frequency Division Multiplexing.
- Used in optical systems while FDM is used in electrical systems.
- Requires more spacing between channels.

Time-Division Multiplexing (TDM)

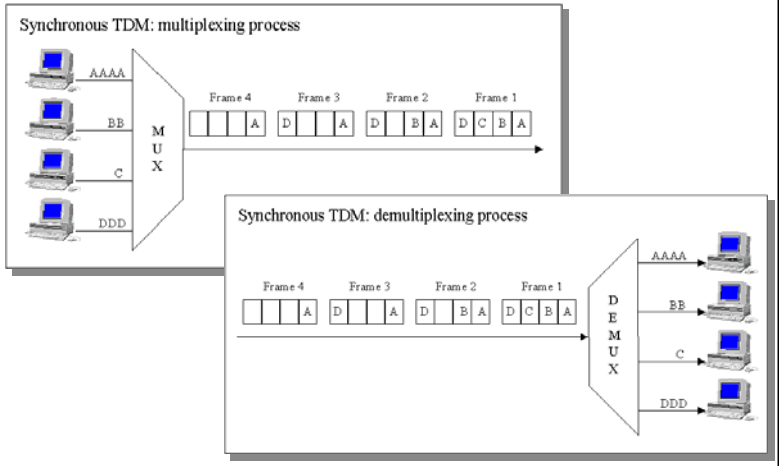
- multiple transmissions can occupy a single link by subdividing them and interleaving the portions
- We refer to TDM as a “round robin” use of a frequency
- TDM can be implemented in two ways:
  1. Synchronous TDM
  2. Asynchronous TDM

Synchronous TDM

- The multiplexer allocates exactly the same time slot to each device at all times, whether or not a device has anything to transmit
- A frame consists of one complete cycle of time slots. Thus the number of slots in frame is equal to the number of inputs.



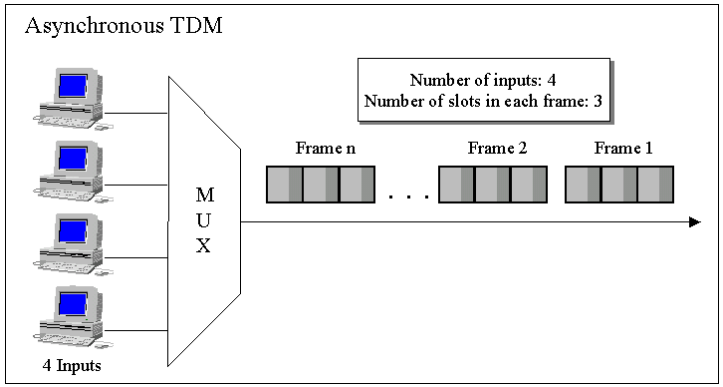
How Synchronous TDM Works



Asynchronous TDM

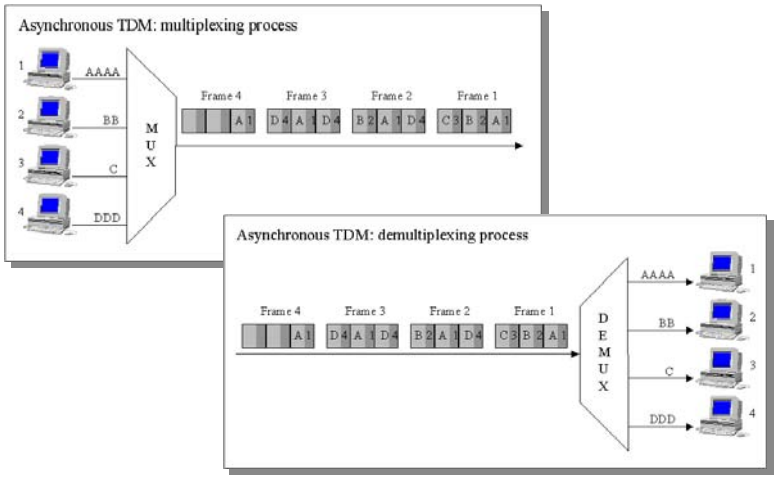
(or statistical time-division multiplexing)

- Each slot in a frame is **not** dedicated to the fix device
- The number of slots in a frame is not necessary to be equal to the number of input devices. More than one slots in a frame can be allocated for an input device.
- Allows maximum utilization of the link. It allows a number of lower speed input lines to be multiplexed to a single higher speed line



In asynchronous TDM, a frame contains a fix number of time slots. Each slot has an index of which device to receive.

How Asynchronous TDM Works



Code Division Multiplexing

- Sends many signals or “chips” per bit.
- Each sender uses a unique pattern of chips.
- May use multiple frequencies for spread spectrum communication.
- Common with wireless systems.