Teacher Document

1) What are the types of Multiplexing?(5M)

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. 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. Space-division multiplexing (SDM) : Space Division Multiplexing (SDM) is a technique used in wireless communication systems to increase the capacity of the system by exploiting the physical separation of users. In SDM, multiple antennas are used at both the transmitter and receiver ends to create parallel communication channels. These channels are independent of each other, which allows for multiple users to transmit data simultaneously in the same frequency band without interference. The capacity of the system can be increased by adding more antennas, which creates more independent channels. SDM is commonly used in wireless communication systems such as cellular networks, Wi-Fi, and satellite communication systems. In cellular networks, SDM is used in the form of Multiple Input Multiple Output (MIMO) technology, which uses multiple antennas at both the transmitter and receiver ends to improve the quality and capacity of the communication link.
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2) How does Frequency Division Multiplexing differ from Time Division Multiplexing?(5M)

Bandwidth Allocation: In FDM, the bandwidth of a single physical medium is divided into smaller, independent frequency channels. Each channel is allocated to a different signal. In contrast, TDM allocates time slots within the same bandwidth to different signals, allowing them to share the frequency but occupy separate time intervals.
Interference and Crosstalk: FDM can suffer from inter-channel cross-talk, where signals from adjacent channels interfere with each other due to overlapping frequencies. To mitigate this, guard bands are often used between channels. On the other hand, TDM generally avoids interference between signals since each signal is transmitted during its designated time slot.
Suitability: FDM is commonly used in applications such as radio and television transmission, where different channels operate at different frequencies simultaneously. TDM, on the other hand, is suitable for applications like digital telephony, where multiple signals can be efficiently transmitted over the same physical medium by dividing it into time slots.

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