Time Division Multiple Access (TDMA) is a channel access method used in telecommunications, where multiple users share a single communication channel by dividing the channel into time slots. While TDMA has its advantages, it also has some limitations, which have led to the development of alternative channel access methods.

The working of TDMA can be explained in the following steps:

1. Channel Allocation: The communication channel is divided into a fixed number of time slots. Each time slot has a fixed duration, which is equal to the time required to transmit a data packet.
2. User Allocation: Each user is allocated a fixed time slot, which they can use to transmit data. The time slot is assigned to the user based on a predefined schedule, which is determined by the system.
3. Data Transmission: Each user can use their allocated time slot to transmit data. During their time slot, the user transmits a data packet, which is received by the receiving device.
4. Synchronization: TDMA requires precise synchronization between the transmitting and receiving devices to ensure that data is transmitted and received correctly. Synchronization signals are used to ensure that the transmitting and receiving devices are synchronized.
1. Repeat: Once all users have transmitted their data packets, the process repeats, and each user is allocated a new time slot for the next data transmission.

In summary, TDMA works by dividing the communication channel into time slots, allocating each user a fixed time slot, allowing them to transmit data during their time slot, and ensuring synchronization between the transmitting and receiving devices. By allowing multiple users to share a single

communication channel, TDMA can increase the efficiency of the communication system and reduce interference between users.

what is synchronisation in Time division multiplexing

In Time Division Multiplexing (TDM), synchronization refers to the coordination of the transmitting and receiving devices to ensure that the data is transmitted and received at the correct time slot.

In TDM, a single transmission channel is shared among multiple users, with each user allocated a fixed time slot during which they can transmit their data. The synchronization is important because if the transmitting device starts transmitting data at the wrong time slot, the receiving device will not be able to receive it. This can lead to errors and loss of data.

To achieve synchronization in TDM, the transmitting device sends synchronization signals to the receiving device at regular intervals. The receiving device uses these signals to adjust its timing and ensure that it is ready to receive data in the correct time slot. These synchronization signals can also be used to adjust the timing of the transmitting device, ensuring that it is transmitting data at the correct time.

Overall, synchronization is a crucial aspect of TDM, as it allows multiple users to share a single transmission channel without interfering with each other's data transmissions.

While Time Division Multiple Access (TDMA) has several advantages, it also has some disadvantages that should be considered when selecting a channel access method for a particular communication system. Some of the main disadvantages of TDMA are:

1. Synchronization: TDMA requires precise synchronization between the transmitting and receiving devices. If there is a synchronization error, it can lead to data loss and errors. Furthermore, as the number of users increases, the overhead for synchronization signals increases, which can reduce the efficiency of the communication channel.
2. Latency: TDMA requires each user to wait for their turn to transmit data, which can result in latency and reduced network throughput. As the number of users increases, the time slots become shorter, which can increase the latency.
3. Inefficient use of bandwidth: TDMA requires each user to be allocated a fixed time slot, regardless of whether they have data to transmit or not. This can result in inefficient use of the communication channel, reducing the overall throughput of the system.
4. Limited number of users: As the number of users increases, the time slots become shorter, which can increase the overhead for synchronization signals and reduce the efficiency of the communication channel. This can limit the number of users that can be accommodated in the system.

Frequency Division Multiple Access (FDMA) is a channel access method used in telecommunications, where multiple users share a single communication channel by dividing the channel into frequency bands. Each user is assigned a unique frequency band, which they use to transmit and receive data.

FDMA is used in various communication systems, including cellular networks, satellite communication systems, and radio broadcasting. In cellular networks, FDMA is used to divide the available frequency bands into multiple channels, allowing multiple users to communicate simultaneously. In satellite

communication systems, FDMA is used to transmit multiple signals over a single satellite transponder. In radio broadcasting, FDMA is used to divide the frequency band into multiple channels, allowing multiple radio stations to broadcast simultaneously.

The working of FDMA can be explained in the following steps:

1. Channel Allocation: The communication channel is divided into a fixed number of frequency bands. Each frequency band has a fixed bandwidth, which is equal to the range of frequencies that can be used to transmit and receive data.
2. User Allocation: Each user is allocated a different frequency band, which they can use to transmit and receive data. The frequency band is assigned to the user based on a predefined schedule, which is determined by the system.
3. Data Transmission: Each user can use their allocated frequency band to transmit and receive data. During their allocated frequency band, the user transmits and receives data packets.
4. No Synchronization: FDMA does not require precise synchronization between the transmitting and receiving devices, as each user is allocated a separate frequency band. This can simplify the hardware required for the system and reduce the overall complexity of the system.
5. Repeat: Once all users have transmitted and received their data packets, the process repeats, and each user is allocated a new frequency band for the next data transmission.

In summary, FDMA works by dividing the communication channel into frequency bands, allocating each user a different frequency band, allowing them to transmit and receive data during their allocated frequency band, and not requiring precise synchronization between the transmitting and receiving

devices. By allowing multiple users to share a single communication channel, FDMA can make efficient use of the available bandwidth and increase the overall throughput of the system.

Disadvantage of FDM

While Frequency Division Multiplexing (FDM) has several advantages, it also has some disadvantages that should be considered when selecting a channel access method for a particular communication system. Some of the main disadvantages of FDM are:

1. Limited Number of Channels: The number of channels that can be created in FDM is limited by the available bandwidth of the communication channel. As the bandwidth is divided into smaller frequency bands, the number of channels that can be created decreases. This can limit the number of users that can be accommodated in the system.
2. Interference: FDM can be susceptible to interference from other signals operating in the same frequency range. Interference can cause data loss and errors, which can degrade the quality of the communication.
3. Complex Hardware: FDM requires complex hardware to separate and combine the signals on the communication channel. This hardware can be expensive and can add to the overall complexity of the communication system.
4. Inefficient Use of Bandwidth: FDM does not make efficient use of the available bandwidth, as some of the frequency bands may be unused or lightly used, while others may be heavily used. This can result in inefficient use of the communication channel, reducing the overall throughput of the system.

In summary, while FDM is a useful channel access method, it has some disadvantages that should be considered when

selecting a channel access method for a particular communication system. These disadvantages include a limited number of channels, susceptibility to interference, complex hardware, and inefficient use of bandwidth.

Difference Between TDMA and FDMA

TDMA		FDMA
Basic principle	Time division multiplexing	Frequency division multiplexing
Resource division	Time slots	Frequency sub-channels
Number of users	Can support many users in a single frequency band	Can support fewer users in a single frequency band
Interference	Users share the same frequency band, but not time	Users share the same frequency band, but not frequency
Spectrum efficiency	Higher	Lower
Implementation	Requires precise time synchronization	Requires precise frequency synchronization
Usage	Cellular communication systems	Radio and television broadcasting