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Data Communication CS601 Lecture No 30

Lecture Prepared By

Muhammad Abid Ali

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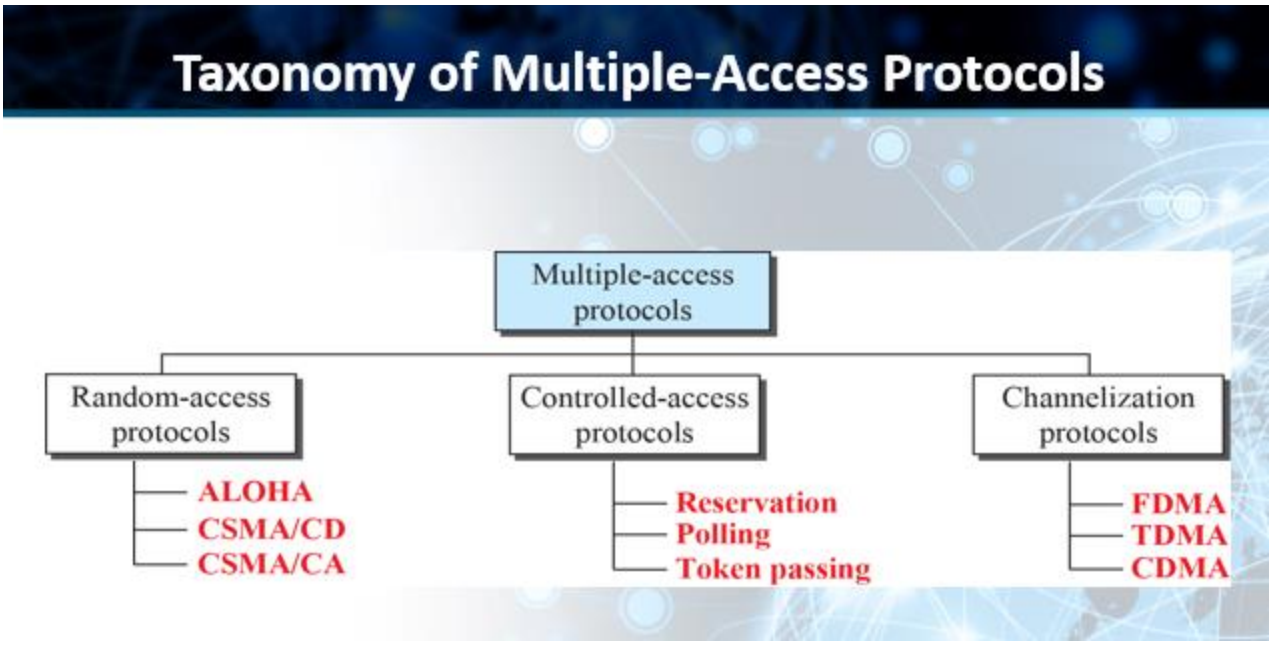
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CS601 Lecture No 30 Topic 171 to 179

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Carrier Sense Multiple Access (CSMA)

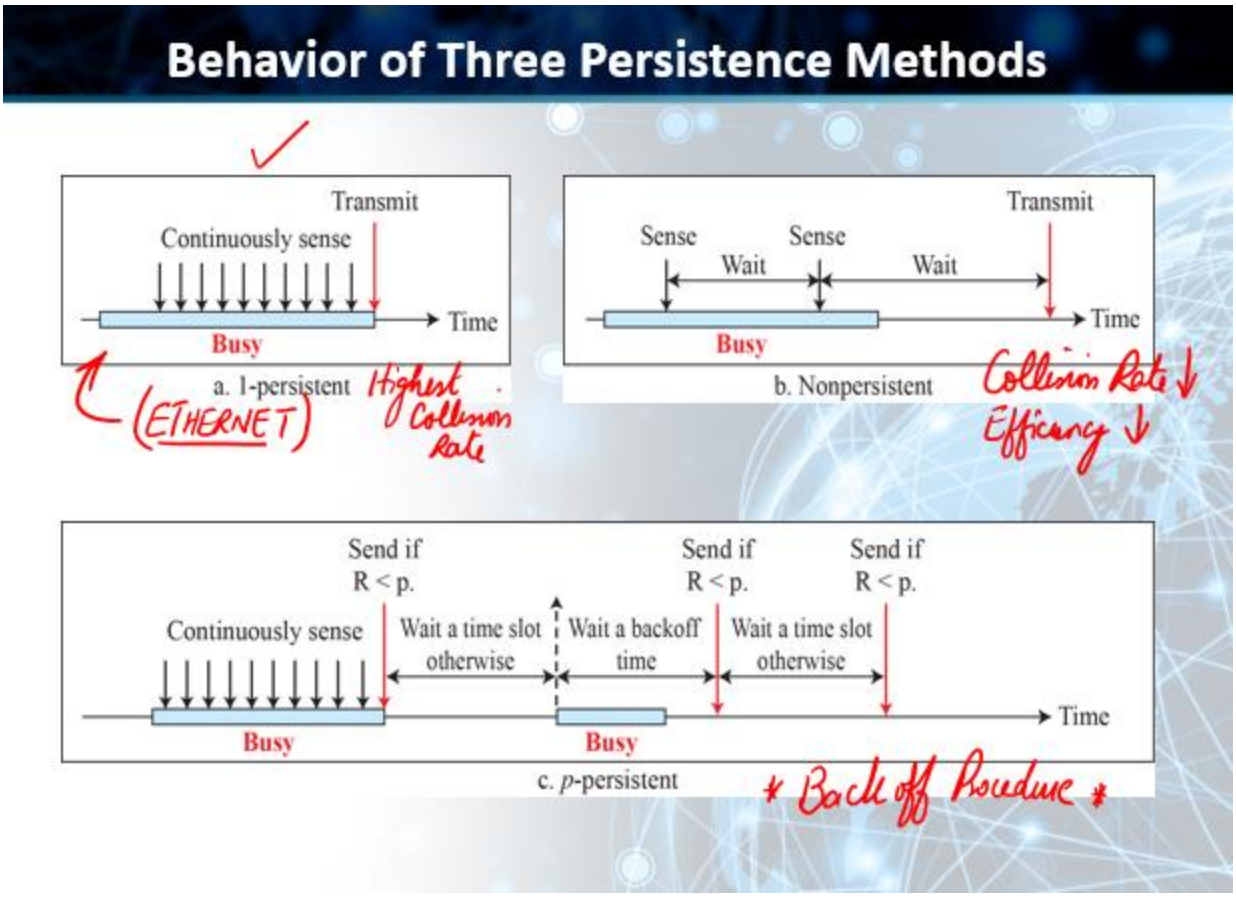
- **To minimize the chance of collision and, therefore, increase the performance, CSMA was developed**
- **The chance of collision is reduced as the station is required to sense/listen to the medium before sending data**
- **'Sense before transmit' or 'listen before talk'**

This method was developed to decrease the chances of collisions when two or more stations start sending their signals over the data link layer. Carrier Sense multiple access requires that each station first check the state of the medium before sending.

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Carrier Sense Multiple Access/Collision Detection

- **CSMA method does not specify the procedure following a collision**
- **CSMA/CD augments the algorithm to handle the collision**
- **The station monitors the medium after it sends a frame to see if the transmission was successful. If there is a collision, the frame is sent again**

In this method, a station monitors the medium after it sends a frame to see if the transmission was successful. If successful, the transmission is finished, if not, the frame is sent again.

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Throughput and Efficiency: The throughput of CSMA/CD is much greater than pure or slotted ALOHA.

Carrier Sense Multiple Access/Collision Avoidance

- **CSMA/CA was invented for Wireless Networks**
- **Collisions are avoided through the use of three strategies:**
  - ✓ **The Interfame Space**
  - ✓ **The Contention Window**
  - ✓ **Acknowledgements**

These are three types of strategies:

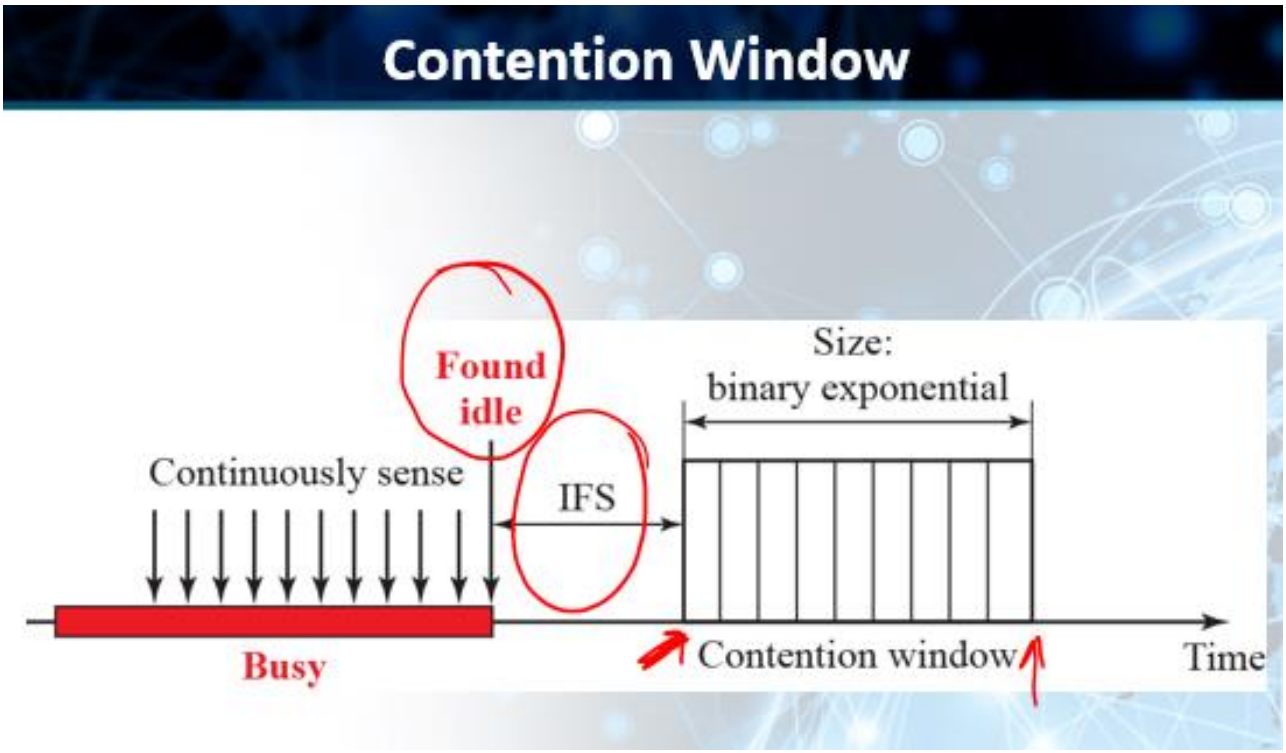
1. **InterFrame Space (IFS):** When a station finds the channel busy it senses the channel again, when the station finds a channel to be idle it waits for a period of time called **IFS time**. IFS can also be used to define the priority of a station or a frame. Higher the IFS lower is the priority.
2. **Contention Window:** It is the amount of time divided into slots. A station that is ready to send frames chooses a random number of slots as **wait time**.
3. **Acknowledgments:** The positive acknowledgments and time-out timer can help guarantee a successful transmission of the frame.

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- **Interframe Space (IFS): Collisions are avoided by deferring transmission even if the channel is idle**
- **Contention Window: Amount of time divided into slots. Station chooses a random number of slots as its wait time (one slot first time and double each time system cannot detect an idle channel)**

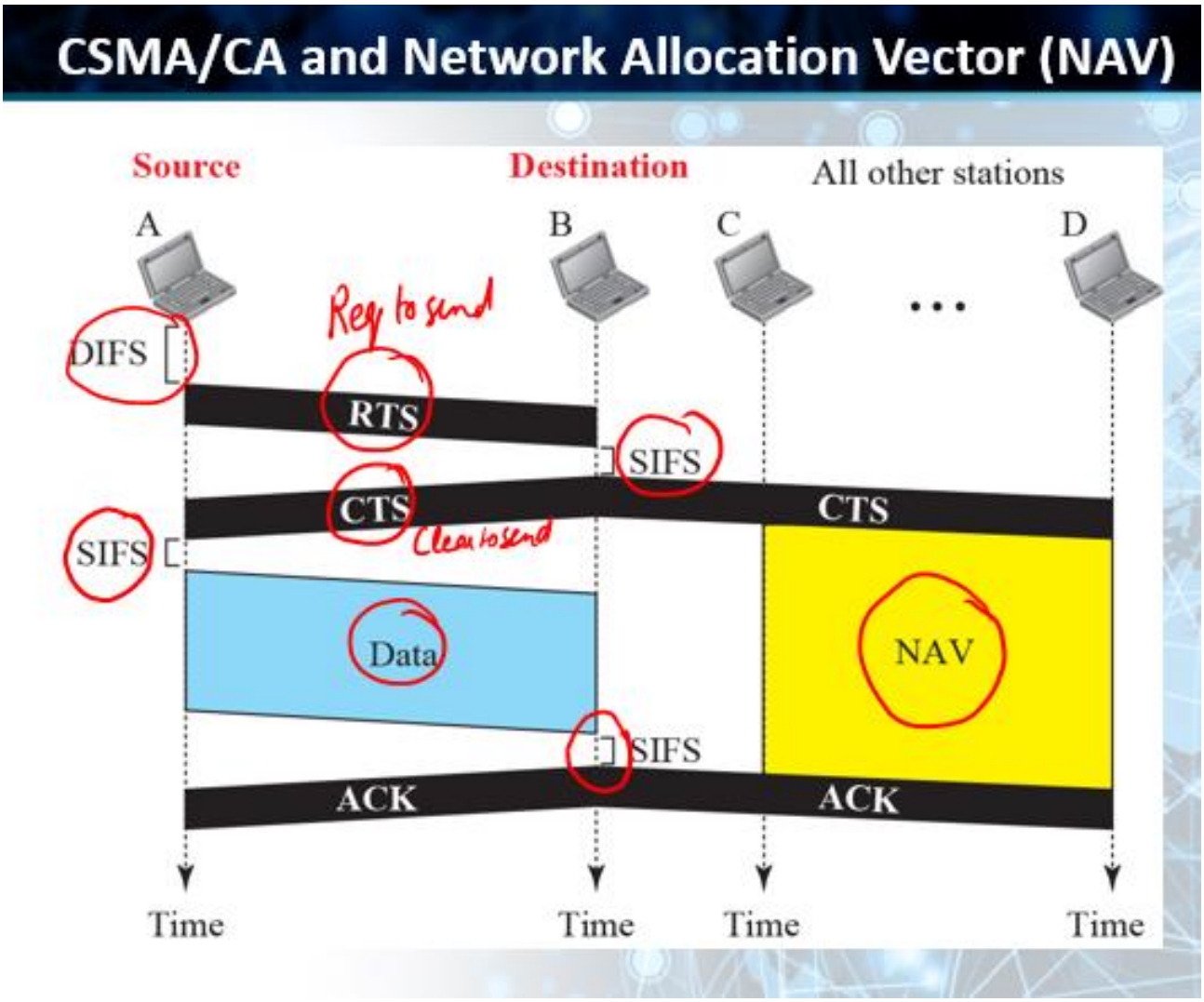


- **Acknowledgement: Positive acknowledgement and time-out timer can help guarantee that the receiver has received the frame**

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CONTROLLED ACCESS

- **The stations consult one another to find which station has the right to send**
- **A station cannot send unless authorized by other stations**
- **We discuss three controlled-access methods:**
  - ✓ **Reservation**

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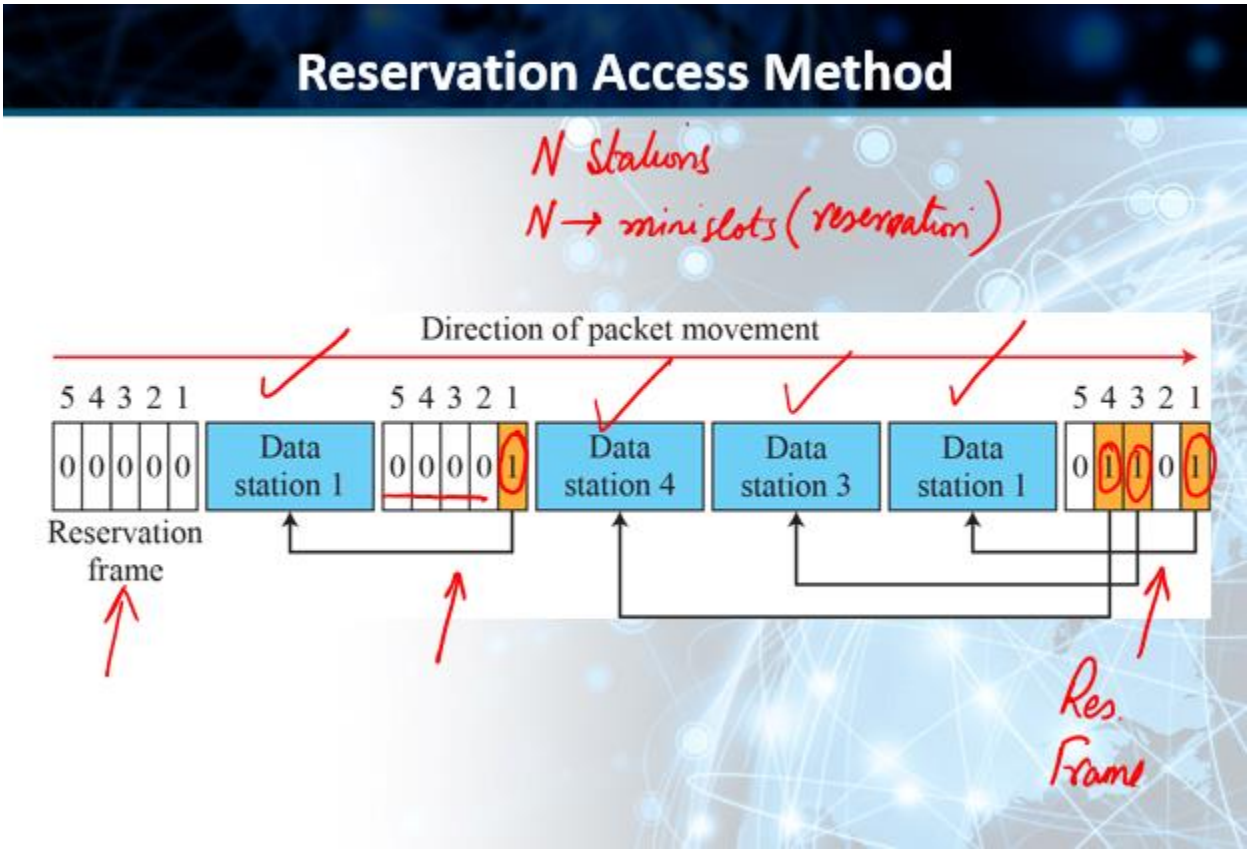
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- ✓ **Polling**
- ✓ **Token Passing**

Reservation

- **In the reservation method, a station needs to make a reservation before sending data**
- **Time is divided into intervals**
- **In each interval, a reservation frame precedes the data frames sent in that interval**

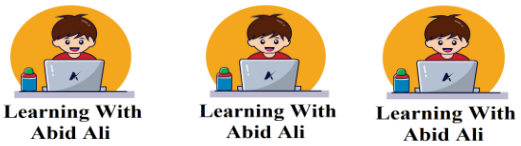


Polling

- **Polling works with topologies in which one device is designated as a primary station and the other devices are secondary stations**

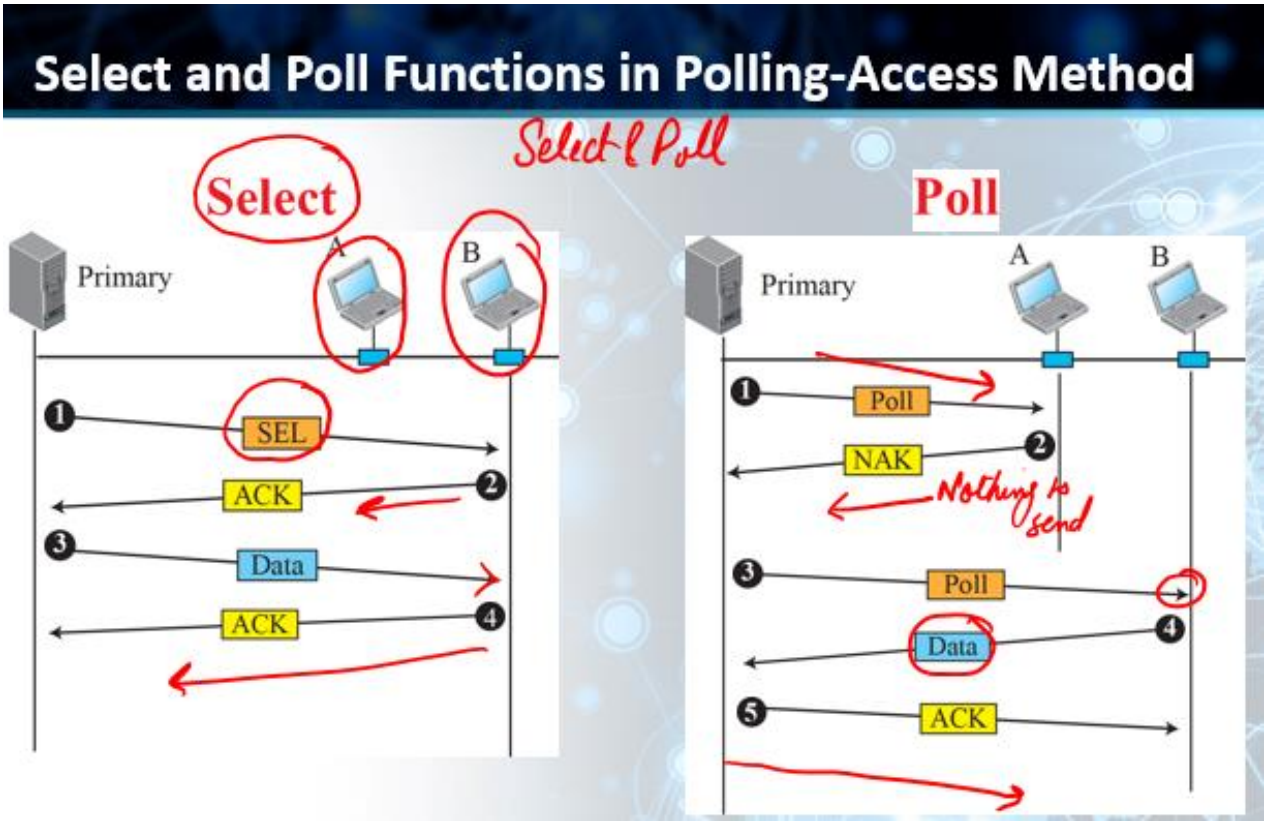
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- **All data exchanges must be made through primary device even when the ultimate destination is a secondary device**
- **The primary device controls the link; the secondary devices follow its instructions**



Token Passing

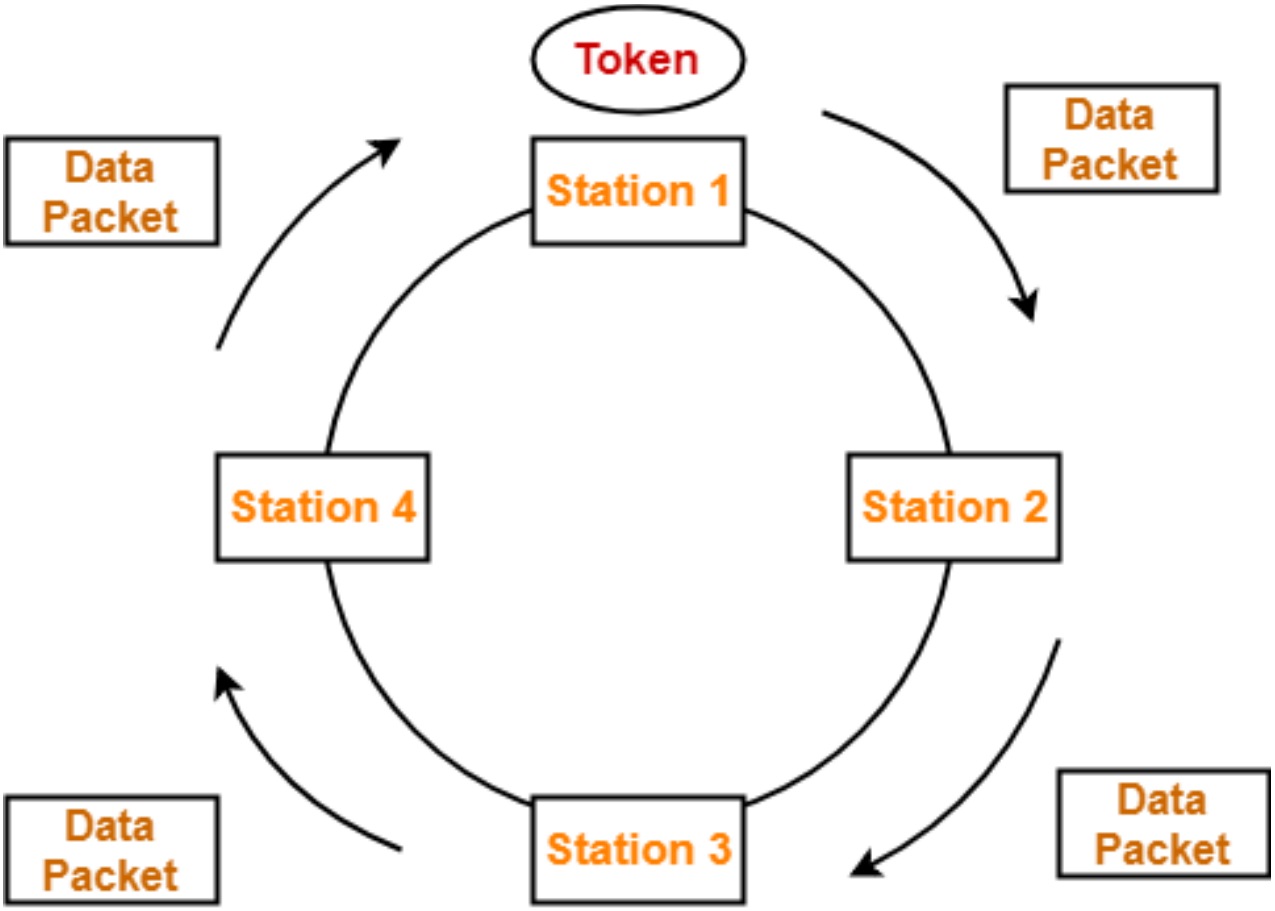
- **In the token-passing method, the stations in a network are organized in a logical ring**
- **For each station, there is a predecessor and a successor**
- **The predecessor is the station which is logically before the station in the ring; the successor is the station which is after the station in the ring**
- **Special packet called TOKEN circulates through the ring**
- **Possession of TOKEN gives the station the right to send the data**

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- **TOKEN Management is required to manage possession time, Token monitoring, priority assignment etc.**



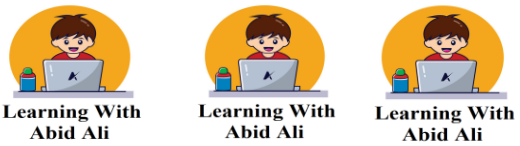
Delayed Token Reinsertion Token Passing

CHANNELIZATION (Channel Partition)

- **The available bandwidth of a link is shared in time, frequency, or through code, among different stations**

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- **We discuss three protocols:**
  - ✓ **Frequency Division Multiple Access (FDMA)**
  - ✓ **Time Division multiple Access (TDMA)**
  - ✓ **Code Division Multiple Access (CDMA)**

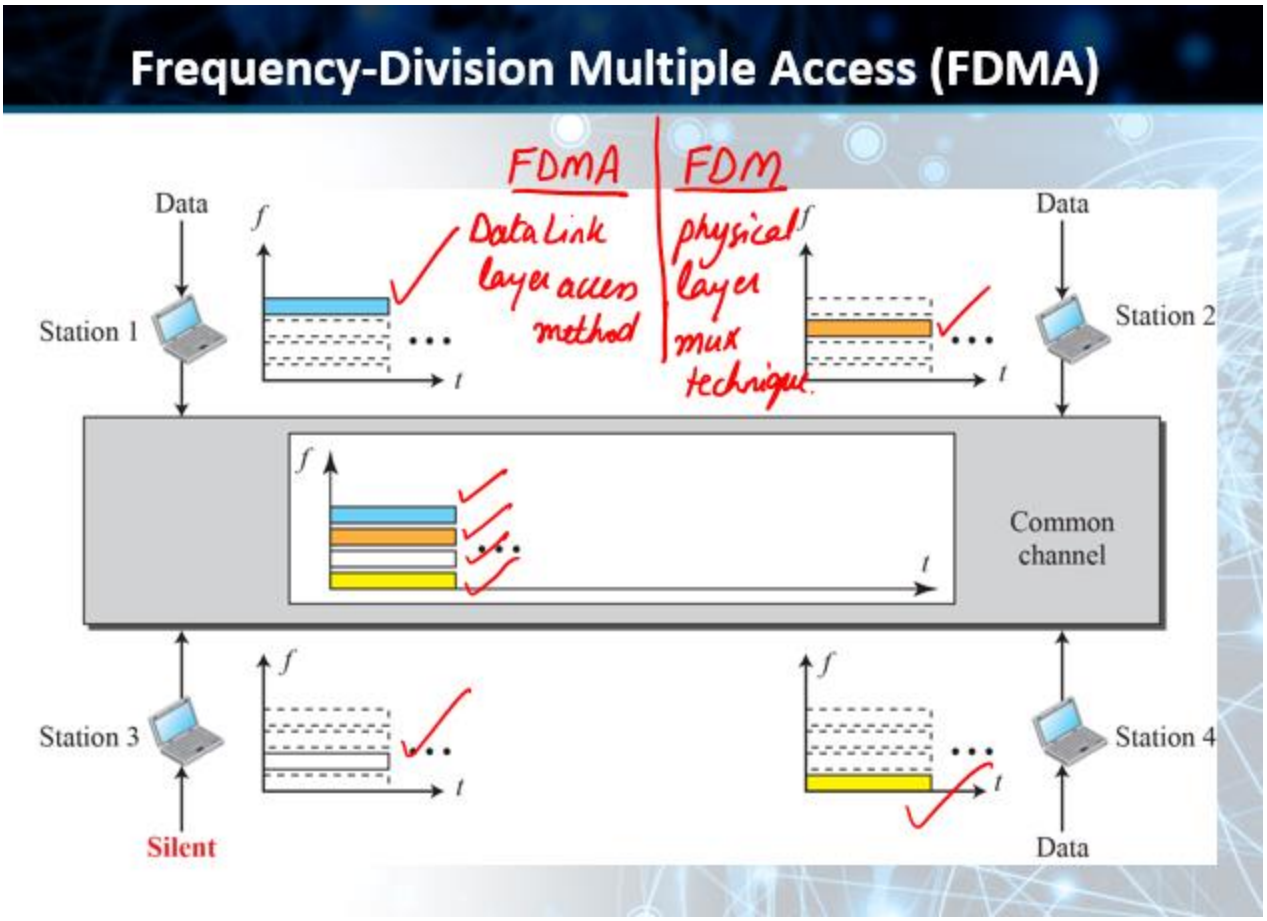
Frequency-Division Multiple Access (FDMA)

- **In FDMA, the available bandwidth is divided into frequency bands**
- **Each station is allocated a band to send its data i.e. each band is reserved for a specific station, and it belongs to the station all the time**
- **Each station also uses a bandpass filter to confine the transmitter frequencies**

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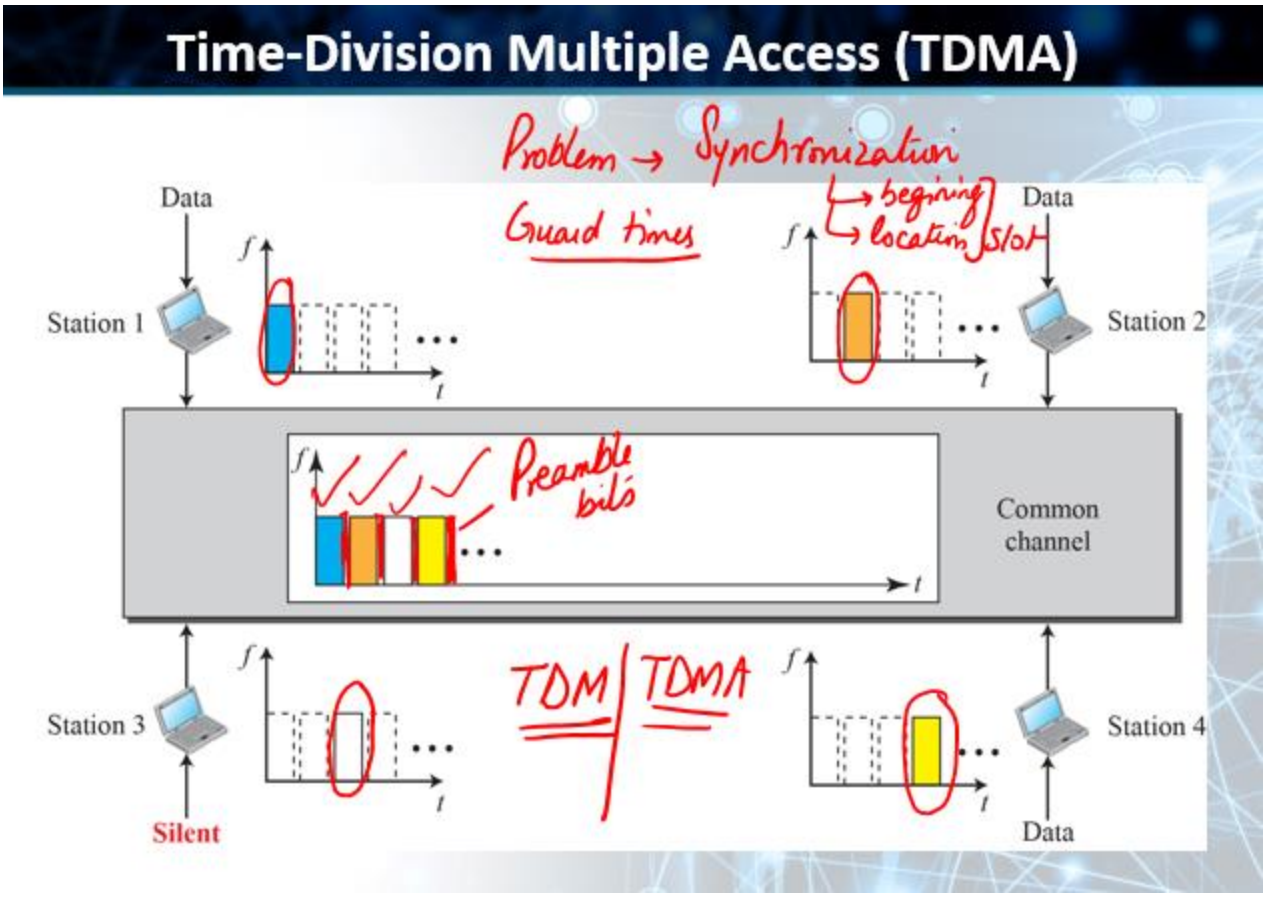
TDMA

- **Stations share the bandwidth of the channel in time**
- **Each station is allocated a time slot during which it can send data**
- **Each station transmits its data in its assigned time slot**

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Code Division Multiple Access (CDMA)

- **CDMA differs from FDMA in that only one channel occupies the entire bandwidth of the link**
- **CDMA differs from TDMA in that all stations can send data simultaneously; there is no timesharing**

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