Internet Of Things

Assigment#02

Section-S

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Q1 **Explain the operation of following MAC IEEE 802.11 terms in your own words and draw abstract diagrams: (10 Marks)**

A. Distributed Coordination Function (DCF)

The Distributed Coordination Function (DCF) is a medium access control (MAC) technique used in IEEE 802.11-based WLAN (Wi-Fi) networks. DCF employs a carrier-sense multiple access with collision avoidance (CSMA/CA) mechanism along with a binary exponential backoff algorithm.

Here is a simplified explanation of how DCF operates:

• Channel Sensing: Before transmitting data, a station listens to the channel for a Distributed Inter-Frame Space (DIFS) interval. If the channel is found to be busy during this interval, the station defers its transmission.

• Random Backoff: If multiple stations sense the channel as busy and defer their access, they may simultaneously find the channel released and attempt to transmit. To avoid collisions, DCF specifies a random backoff period. The length of this backoff period is determined by a random number multiplied by a slot time.

• Data Transmission: Once the backoff period expires, the station can transmit its data frame. DCF also includes a positive acknowledge

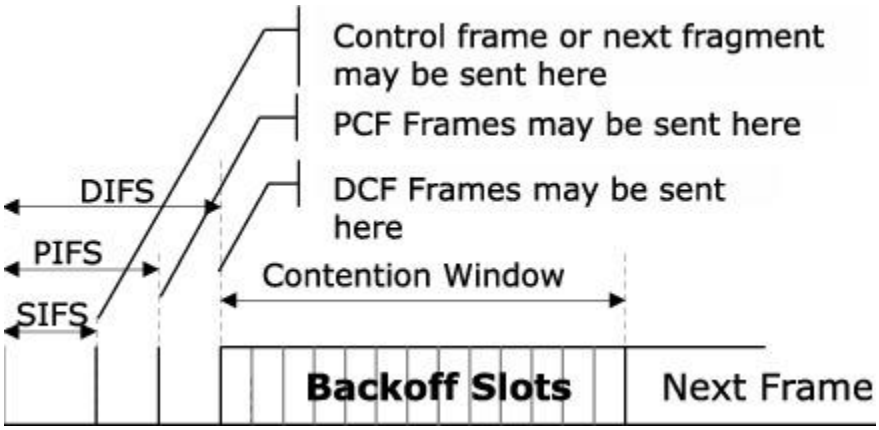
scheme, where the destination station sends an ACK frame to confirm successful reception of the data frame.

• Optional Virtual Carrier Sense: DCF includes a virtual carrier sense mechanism using Request-to-send (RTS) and Clear-to-send (CTS) frames. These short frames are exchanged between the source and destination stations during intervals between data frame transmissions.

It's important to note that DCF does not completely solve the hidden node and exposed terminal problems. However, it mitigates these issues by using RTS and CTS frames and recommends a larger carrier sensing range.

Overall, DCF is the default MAC technique used in Wi-Fi networks and helps ensure fair and efficient access to the wireless medium by multiple stations.

Diagram:



B. Point Coordination Function (PCF)

The Point Coordination Function (PCF) is a media access control (MAC) technique used in IEEE 802.11-based WLANs (Wi-Fi) networks. PCF operates in conjunction with the Distributed Coordination Function (DCF) and is located above it in the IEEE 802.11 MAC Architecture.

Here is a simplified explanation of how PCF operates:

• Centralized Channel Access: In PCF mode, the channel access is centralized, meaning that a point coordinator, also known as an access point (AP), manages the communication within the network. The AP has priority access to the channel and waits for a shorter duration called the Point Inter-Frame Space (PIFS) instead of the Distributed Inter-Frame Space (DIFS) used by DCF.

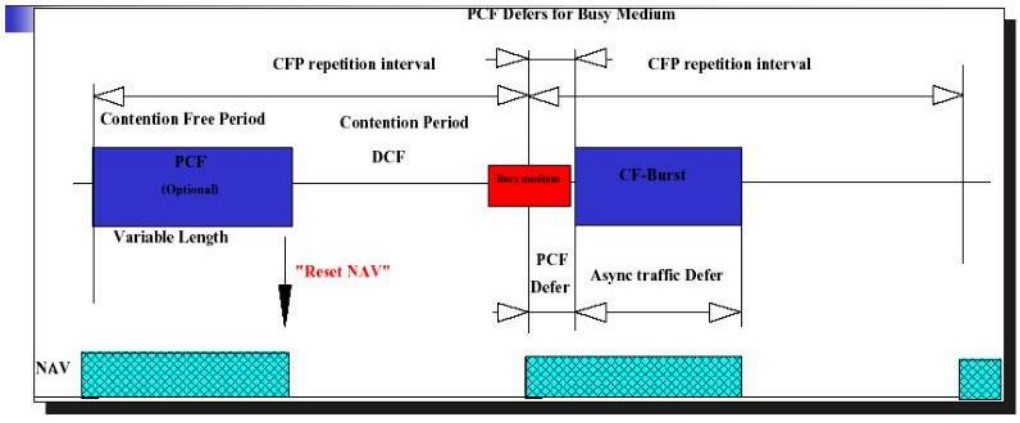
• CF-Poll Frame: The point coordinator sends a CF-Poll frame to a PCF-capable station, permitting it to transmit a frame. This frame serves as a request for the station to send data. If the polled station has no frames to send, it must transmit a null frame to indicate its readiness.

• Coordination Function: PCF allows the AP to coordinate the channel access and manage the transmission of frames. It provides

a contention-free period during which the AP can allocate time slots to individual stations for transmission. This helps reduce collisions and improves the overall efficiency of the network.

It's worth noting that PCF is not widely implemented in Wi-Fi hardware devices and is not part of the Wi-Fi Alliance's interoperability standard. However, it is defined in the IEEE 802.11 standard and can be used in specific scenarios where centralized channel access and coordination are required.
In summary, PCF is a MAC technique that enables centralized channel access and coordination in IEEE 802.11-based WLANs, allowing the AP to manage the communication within the network and improve overall network efficiency.

Diagram:



Q2 Explain following controlled access protocols in your own word: (10 Marks)

- Reservation

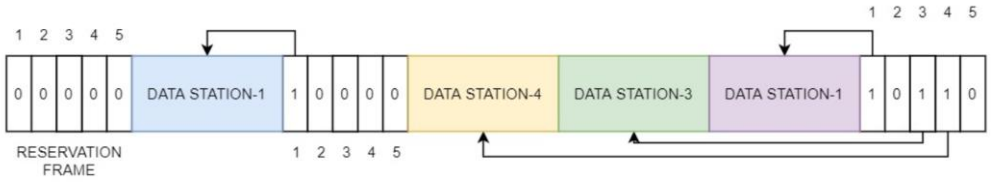
  • Reservation is a technique where a station reserves the resource before accessing it.

  • Stations in the network make reservations during specific intervals, indicating their intention to transmit data.

  • The reservation frame precedes the data frame, and only stations with reservations can send their data during the reservation period.

  • Advantages of reservation include efficient resource utilization and reduced collisions.

  • Disadvantages include increased overhead due to the reservation frame and the need for synchronization among stations.



- Polling

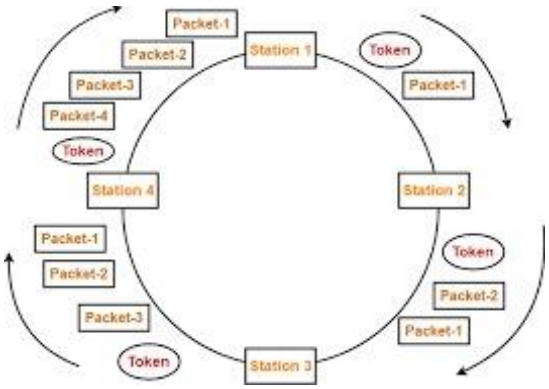
  • Polling is a technique where a central device, known as the primary station, controls access to the resource.

  • The primary station sequentially polls other stations, allowing them to transmit data when it's their turn.

• Stations indicate their readiness to transmit by responding to the poll from the primary station.

• Advantages of polling include centralized control, fairness in resource allocation, and reduced collisions.

• Disadvantages include increased overhead due to the polling process and potential delays for stations waiting to be polled.



- Token Passing

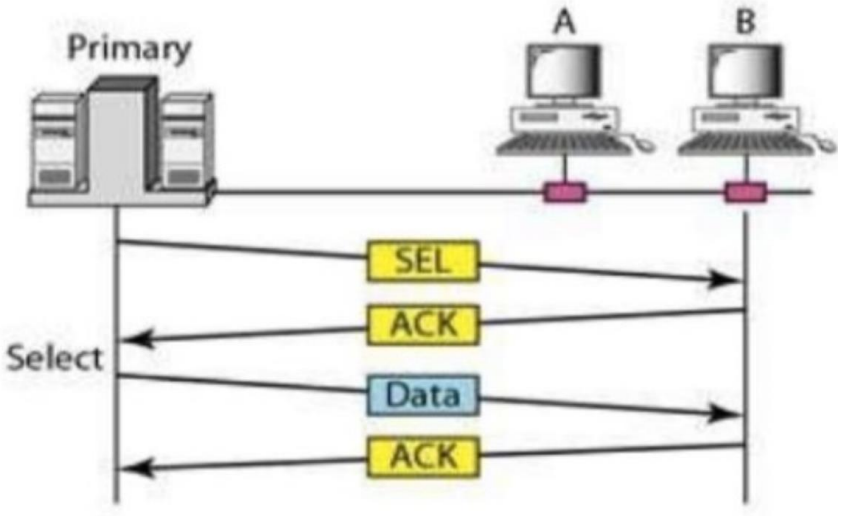
• Token passing is a technique where a special token circulates among stations in a predefined order.

• Only the station possessing the token has the right to access the resource and transmit data.

• Stations can only transmit data when they receive the token and have completed their transmission.

• Advantages of token passing include fairness, as each station gets a turn to transmit, and efficient resource utilization.

• Disadvantages include the need for synchronization and potential delays if a station holds onto the token for an extended period.



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Each of these controlled access protocols has its own advantages and disadvantages, and the choice of protocol depends on the specific requirements and characteristics of the network.