### Q8)Medium Access Control (MAC) Methodologies

**Medium Access Control (MAC)** methodologies define how multiple devices share a common communication medium efficiently and without collision. These methods ensure **fairness**, **efficiency**, and **order** in data transmission, especially in shared networks like **wireless LANs**, **Ethernet**, and **sensor networks**.

**Types of MAC Methodologies**

1. **Contention-Based Access (Random Access Methods)**

Devices compete for medium access. Collisions can occur but are managed.

* + **Carrier Sense Multiple Access with Collision Detection (CSMA/CD)**:
    - Used in **wired Ethernet**.
    - Device checks if medium is free (carrier sensing).
    - Transmits if free; if collision occurs, it stops, waits random time (backoff), and tries again.
  + **Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)**:
    - Used in **wireless networks (Wi-Fi)**.
    - Devices avoid collisions by using **RTS/CTS** (Request to Send/Clear to Send) and **backoff timers**.
  + **ALOHA & Slotted ALOHA**:
    - Devices send data anytime (ALOHA) or in time slots (Slotted ALOHA).
    - Simple but high collision risk; used in satellite and RFID.

1. **Scheduled Access (Deterministic Access Methods)**

Access is controlled and collision-free. Suitable for real-time or high QoS systems.

* + **Time Division Multiple Access (TDMA)**:
    - Medium divided into **time slots**; each device gets a slot.
    - Used in **cellular networks** and **Bluetooth**.
  + **Frequency Division Multiple Access (FDMA)**:
    - Each device transmits on a **separate frequency** band.
    - Reduces interference; used in traditional analog systems.
  + **Code Division Multiple Access (CDMA)**:
    - All devices transmit simultaneously but use **unique codes** to separate signals.
    - Used in **3G mobile systems**.

1. **Polling**
   * A central controller (like an Access Point) **polls devices** to grant permission to transmit.
   * Efficient when traffic is predictable; avoids collisions.
   * Used in **wired/wireless industrial networks**.
2. **Token Passing**
   * A special frame called a **token** is passed around the network.
   * Only the device with the token can transmit.
   * Ensures collision-free communication.
   * Used in **Token Ring** and **FDDI networks**.