Multuple Access Techniques

- multiplexing techniques that provide communication services to multiple users in a single-bandwidth wired or wireless medium
- Communication channels (wireless spectrum segments or cable connections), they are expensive.
- Communication service providers must engage multiple paid users over limited resources to make a profit
- Access methods allow many users to share these limited channels
- There are five basic access or multiplexing methods
    - Frequency Division Multiple Access (FDMA)
    - Time Division Multiple Access (TDMA)
    - Code Division Multiple Access (CDMA)
    - Orthogonal Frequency Division Multiple Access (OFDMA)

Frequency Division Multiple Access (FDMA)

- one channel or bandwidth is divided into multiple individual bands and each is assigned to single user
- Each individual band or channel is wide enough to accommodate the signal

Time Division Multiple Access (TDMA)

- Divides a single channel or band into time slots
- Each time slot is used to transmit one byte or another digital segment of each signal in sequential serial data format

Code Division Multiple Access (CDMA)

- CDMA is another pure digital technique.
- It is also known as spread spectrum because it takes the digitized version of an analog signal and spreads it out over a wider bandwidth at a lower power level
- The digitized and compressed voice signal in serial data form is spread by processing it in an XOR circuit

Orthogonal Frequency Division Multiple Access (OFDMA)

- used in Long-Term Evolution (LTE) cellular systems to accommodate multiple users in a given bandwidth.
- a modulation method that divides a channel into multiple narrow orthogonal bands
- Each band is divided into hundreds or even thousands of 15-kHz wide subcarriers.
- The data to be transmitted is divided into many lower-speed bit streams and modulated onto the subcarriers

Carrier Sense Multiple Access with Collision Detection (CSMA-CD)

- access method used in Ethernet local-area networks (LANs)
- It allows multiple users of the network to access the single cable for transmission
- All network nodes listen continuously.
- When they want to send data, they listen first and then transmit if no other signals are on the line.

- For instance, the transmission will be one packet or frame. Then the process repeats.
- If two or more transmissions occur simultaneously, a collision occurs.
- The network interface circuitry can detect a collision, and then the nodes will wait a random time before retransmitting.
- A variation of this method is called carrier sense multiple access with collision avoidance (CSMA-CA).
- a special scheduling algorithm is used to determine the appropriate time to transmit over the shared channel.
- CSMA-CD technique is most used in wired networks
- CSMA-CA is the preferred method in wireless networks.