** What are the differences between WLAN, Wi-Fi, and WWAN?**

* **Answer:**
  + **WLAN (Wireless Local Area Network): Connects devices within a local area, like a home or office.**
    - **Example: Your home Wi-Fi network.**
  + **Wi-Fi: The technology that enables devices to connect to WLANs wirelessly.**
    - **Example: Connecting your laptop to your home Wi-Fi.**
  + **WWAN (Wireless Wide Area Network): Covers larger geographic areas, like cellular networks (4G, 5G).**
    - **Example: Your smartphone’s mobile data connection.**

** Explain the 802.11 wireless standards and their key differences.**

* **Answer:**
  + **Standards like 802.11a/b/g/n/ac/ax improve speed and range.**
    - **Example: 802.11ac supports faster speeds for streaming compared to 802.11n, while 802.11ax (Wi-Fi 6) enhances performance in crowded places, like stadiums.**

** What are the roles of an access point (AP) and a wireless controller in a wireless network?**

* **Answer:**
  + **Access Point (AP): Connects devices to the network wirelessly.**
    - **Example: A hotspot in a café.**
  + **Wireless Controller: Manages multiple APs for centralized control.**
    - **Example: IT managing all APs in a large office from one central location.**

** Describe the security protocols used in wireless networks (e.g., WEP, WPA, WPA2, WPA3).**

* **Answer:**
  + **WEP: Outdated and weak.**
  + **WPA: More secure than WEP.**
  + **WPA2/WPA3: Provide stronger encryption.**
    - **Example: Home networks often use WPA2 or WPA3 to ensure security.**

** What is SSID, and why is it important?**

* **Answer:**
  + **SSID (Service Set Identifier): The Wi-Fi network name users see.**
    - **Example: When connecting to “Home\_WiFi,” the SSID indicates which network you’re joining.**

** Explain the process of wireless network authentication.**

* **Answer:**
  + **The network checks your credentials (like a password) when you try to connect.**
    - **Example: You enter the café's Wi-Fi password to gain access.**

** What is the difference between infrastructure mode and ad-hoc mode in WLAN?**

* **Answer:**
  + **Infrastructure Mode: Uses APs to connect devices.**
    - **Example: Your phone connecting to a home router.**
  + **Ad-Hoc Mode: Connects devices directly without an AP.**
    - **Example: Two laptops sharing files directly.**

** How do you prevent interference in a wireless network?**

* **Answer:**
  + **Choose a clear channel, keep APs away from other electronics, or use the 5 GHz band.**
    - **Example: Changing your Wi-Fi channel if neighbors are on the same one reduces interference.**

** Describe the purpose of frequency channels in Wi-Fi and how channel overlap affects performance.**

* **Answer:**
  + **Wi-Fi channels help networks operate without interference; overlapping channels slow performance.**
    - **Example: Setting your router to a unique channel avoids interference from nearby networks.**

** How does roaming work in wireless networks, and what is a handoff?**

* **Answer:**
  + **Roaming allows devices to switch APs without losing connection; a handoff occurs when a device moves to a new AP.**
    - **Example: Walking through an office while on a call, your phone connects to different APs seamlessly.**

** What is MIMO, and how does it improve wireless communication?**

* **Answer:**
  + **MIMO (Multiple Input, Multiple Output): Uses multiple antennas to send/receive more data simultaneously.**
    - **Example: A smart TV streams movies faster using multiple antennas.**

** Explain the difference between 2.4 GHz and 5 GHz bands and their pros and cons.**

* **Answer:**
  + **2.4 GHz: Covers longer distances but is slower.**
  + **5 GHz: Faster but has a shorter range.**
    - **Example: Use 5 GHz for speed near the router; 2.4 GHz for wider coverage throughout a house.**

** What is the purpose of a wireless LAN controller (WLC), and how does it operate?**

* **Answer:**
  + **A WLC manages multiple APs for easier control of large networks.**
    - **Example: A campus network where IT configures all APs from one place.**

** What tools and commands can be used to troubleshoot a wireless network?**

* **Answer:**
  + **Tools like ping, traceroute, and Wi-Fi analyzers help troubleshoot issues.**
    - **Example: Using a Wi-Fi analyzer app to check for channel interference if the connection is slow.**

** How does signal-to-noise ratio (SNR) impact wireless performance?**

* **Answer:**
  + **SNR measures the strength of the signal compared to noise; higher SNR means better quality.**
    - **Example: Wi-Fi works better in a quiet room (high SNR) than in a crowded café (low SNR).**

** What is RSSI, and how is it measured?**

* **Answer:**
  + **RSSI (Received Signal Strength Indicator): Measures Wi-Fi signal strength, usually from -30 dBm (strong) to -90 dBm (weak).**
    - **Example: If RSSI is -70 dBm, moving closer to the router improves the signal.**

** Explain the concept of wireless channel bonding.**

* **Answer:**
  + **Channel bonding combines two channels for higher data rates.**
    - **Example: A router bonding two 5 GHz channels increases speed for streaming HD video.**

** How do you secure a wireless network against unauthorized access?**

* **Answer:**
  + **Use WPA2/WPA3 encryption, change default passwords, and enable MAC filtering.**
    - **Example: Setting a strong password and using WPA2 keeps outsiders from accessing your Wi-Fi.**

** What are some common wireless network topologies (e.g., mesh, star)?**

* **Answer:**
  + **Star: Devices connect to a central AP.**
  + **Mesh: Multiple APs connect to create a wider network.**
    - **Example: A mesh Wi-Fi system ensures full coverage in a large house.**

** How does QoS (Quality of Service) work in a wireless network?**

* **Answer:**
  + **QoS prioritizes important traffic (like video calls) to prevent lag.**
    - **Example: Your Zoom calls won’t lag even if someone else is streaming Netflix.**

** What is the function of a wireless access point?**

* **Answer:**
  + **An AP provides wireless connectivity to devices, allowing them to access the network.**
    - **Example: A public Wi-Fi hotspot in a library.**

** How do environmental factors affect wireless signals?**

* **Answer:**
  + **Physical barriers (walls, furniture) can weaken signals, and interference from other devices can cause problems.**
    - **Example: Wi-Fi signal may drop in a basement due to thick walls.**

** What is the significance of bandwidth in a wireless network?**

* **Answer:**
  + **Bandwidth determines the amount of data transmitted over the network; higher bandwidth allows more data transfer.**
    - **Example: A higher bandwidth connection enables multiple users to stream videos simultaneously without buffering.**

** Explain the concept of beamforming.**

* **Answer:**
  + **Beamforming directs the Wi-Fi signal towards specific devices rather than broadcasting it in all directions.**
    - **Example: A router using beamforming improves the connection for your phone by focusing the signal directly at it.**

** How does network congestion affect wireless performance?**

* **Answer:**
  + **High traffic can slow down the network, causing delays or dropped connections.**
    - **Example: If too many devices connect to the same Wi-Fi, streaming videos may become choppy.**

** What are the benefits of using a mesh network?**

* **Answer:**
  + **Mesh networks provide wider coverage and better reliability by using multiple interconnected APs.**
    - **Example: In a large home, a mesh system ensures every room has strong Wi-Fi without dead spots.**

** How can firmware updates improve wireless network performance?**

* **Answer:**
  + **Updates can fix bugs, improve security, and enhance performance features.**
    - **Example: Updating your router's firmware may resolve connectivity issues or improve speeds.**

** What is the impact of physical barriers on Wi-Fi signals?**

* **Answer:**
  + **Walls, furniture, and other obstacles can weaken Wi-Fi signals, reducing range and performance.**
    - **Example: A signal might be strong in one room but weak in another due to a thick wall.**

** How do antennas affect wireless communication?**

* **Answer:**
  + **Antennas determine the range and quality of the wireless signal; better antennas can provide a stronger signal.**
    - **Example: An AP with high-gain antennas can cover a larger area than one with standard antennas.**