Explain the different design issues for Wireless MAC protocol with certain ex- amples.

1. Channel Access: How devices share the wireless channel to transmit data.
    - Example: CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) used in Wi-Fi, where devices listen for a clear channel before transmitting to avoid collisions.
2. Collision Handling: Dealing with data collisions when multiple devices transmit simultaneously.
    - Example: CSMA/CD (Carrier Sense Multiple Access with Collision Detection) used in Ethernet, where collisions are detected and resolved by retransmitting.
3. Contention vs. Scheduled Access: Deciding between letting devices contend for the channel or scheduling access.
    - Example: Contention-based protocols like CSMA for dynamic networks, vs. TDMA (Time Division Multiple Access) for fixed schedules in cellular systems.
4. Hidden Terminal Problem: Addressing situations where devices can’t hear each other.
    - Example: Using RTS/CTS (Request-to-Send/Clear-to-Send) exchange in Wi-Fi to prevent hidden terminal collisions.
5. Exposure Problem: Avoiding excessive interference caused by nearby transmissions.
    - Example: WiMAX uses beamforming techniques to direct signals towards specific devices, reducing exposure to unrelated devices.
6. Energy Efficiency: Maximizing device battery life while maintaining effective communication.
    - Example: Zigbee uses low-duty cycle and sleep modes to save energy in sensor networks.
7. Quality of Service (QoS): Prioritizing traffic based on application requirements.
    - Example: IEEE 802.11e (Wi-Fi QoS Extension) introduces QoS classes for different traffic types like voice and video.
8. Security: Preventing unauthorized access and data breaches.
    - Example: WPA2/WPA3 in Wi-Fi use encryption and authentication to secure

communications.

9. Backoff Mechanisms: Defining rules for devices to wait before retrying after collisions.
    - Example: Ethernet uses binary exponential backoff to reduce collisions in shared media networks.
10. Frame Format: Structuring data frames for efficient transmission and reception.
    - Example: Wi-Fi frames include headers for addressing, control, and error-checking information.

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2. Explain the design goals of a MAC protocol for adhoc wireless network.
3. Explain the basic concept of Multiple Access Schemes? Explain with brief com- parison FDMA, TDMA with suitable example?
4. How does slotted ALOHA improve throughput as compared with pure ALOHA? Explain.
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