**2. Describe about CAPWAP, explain the flow between AP and Controller**

**CAPWAP (Control and Provisioning of Wireless Access Points):**

CAPWAP is an essential networking protocol used to provide centralized management of wireless networks. It basically forms a standardized communication tunnel between Access Points (APs) and a Wireless LAN Controller (WLC). Through this tunnel, the WLC is able to configure, monitor, and manage multiple APs as if they were one unified system. This makes network administration easy and allows policies to be implemented consistently throughout the wireless infrastructure.

**CAPWAP Flow Between AP and Controller:**

1. **AP Discovery:** When an AP starts, it tries to find a WLC either by broadcasting, checking DHCP options, or using a pre-set IP.
2. **WLC Response:** The WLC replies with its details, letting the AP know it’s available for connection.
3. **Secure Tunnel Setup:** They create a secure tunnel using DTLS for control messages. Data usually travels over UDP.
4. **Configuration:** The WLC sends settings like SSID, security options, and radio parameters to the AP through the tunnel.
5. **Data Forwarding:** Client data is encapsulated and sent through the CAPWAP tunnel, allowing the WLC to manage traffic centrally.
6. **Live Management:** Control messages keep flowing between the AP and WLC for monitoring and adjustments.
7. **Keep-Alive Checks:** Regular heartbeat messages ensure the tunnel is active and detect any disconnections.
8. **Disconnection:** If an AP goes offline, it notifies the WLC so the controller can update its records and free up resources.