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Wi-Fi Training Program 2025

Module 5

Question 7:

Explain the concept of Multi-Link Operation (MLO) and its impact on throughput and latency.

Solution:

Multi-Link Operation (MLO) is a groundbreaking feature introduced in Wi-Fi 7 (802.11be) that significantly enhances wireless performance by enabling a device to simultaneously transmit and receive data over multiple frequency bands or channels.

Concept of Multi-Link Operation (MLO)

Traditionally, Wi-Fi devices operate on a single link at a time—either on 2.4 GHz, 5 GHz, or 6 GHz. With MLO, a device can:

- Combine multiple links (e.g., one in 5 GHz and another in 6 GHz),
- Use them in parallel, and
- Switch dynamically between them for optimal performance.

These links can be either:

- Simultaneous (concurrent) – used at the same time, or
- Alternating (seamless switching) – used one at a time, depending on quality.

Impact on Throughput

1. Higher Aggregate Speed
    - By using two or more links at once, MLO combines their bandwidth, resulting in faster data rates.
    - Example: A device using a 160 MHz link on 5 GHz and a 160 MHz link on 6 GHz could achieve up to 320 MHz effective bandwidth.
2. Load Balancing

- Traffic can be split across links based on capacity and load, preventing congestion on a single band.
- Ensures consistent high throughput even in busy networks.

Impact on Latency

1. Lower and More Stable Latency
    - If one link experiences interference or delay, MLO can dynamically reroute traffic through another, keeping latency low.
    - This ensures a smoother experience for real-time applications like gaming, video calls, or AR/VR.
2. Reduced Retransmissions
    - Since traffic can avoid congested or unreliable links, there are fewer retransmissions and dropped packets, reducing overall delay.