

Significance of OFDM Layer in WLAN:

- OFDM is a cornerstone of modern Wireless Local Area Networks (WLANs), introduced in 802.11a/g and evolved through 802.11n/ac/ax, enabling efficient use of the radio spectrum.
- It supports high data rates, scaling from 54 Mbps to 9.6 Gbps, making it vital for bandwidth-intensive applications.
- It enhances reliability in challenging environments, such as urban areas with signal reflections.
- OFDM's flexibility with adaptive modulation and wide channels underpins its role in high-density and high-performance wireless networks.

OFDM Improves Performance:

- **Mitigates Multipath Interference:** Uses a cyclic prefix to manage delayed signal reflections, ensuring accurate data recovery despite multipath effects.
- **Boosts Spectral Efficiency:** Divides bandwidth into orthogonal subcarriers, allowing simultaneous data transmission without interference, maximizing throughput.
- **Enhances Noise Resistance:** Spreads data across multiple subcarriers, so a single subcarrier's failure doesn't halt communication, improving robustness.
- **Enables Adaptive Modulation:** Adjusts modulation (e.g., BPSK to 1024-QAM) based on signal quality, optimizing speed and range dynamically.
- **Supports Wider Channels:** Scales with channel widths (e.g., 160 MHz in 802.11ac/ax), increasing data capacity and performance.
- **Integrates with MIMO:** Works with Multiple Input Multiple Output to multiply data streams, significantly enhancing capacity in dense environments.