Wi-Fi 8

The Next Frontier in Wireless Connectivity

rgNets

Wi-Fi 8, officially known as IEEE 802.11bn and driven by the Ultra High Reliability (UHR) initiative, is the anticipated successor to Wi-Fi 7 (IEEE Std 802.11be). Rather than chasing purely higher nominal speeds, Wi-Fi 8 aims to deliver ultra-reliable, low-latency, spectrally efficient, and user-centric performance in increasingly crowded and mission critical environments.

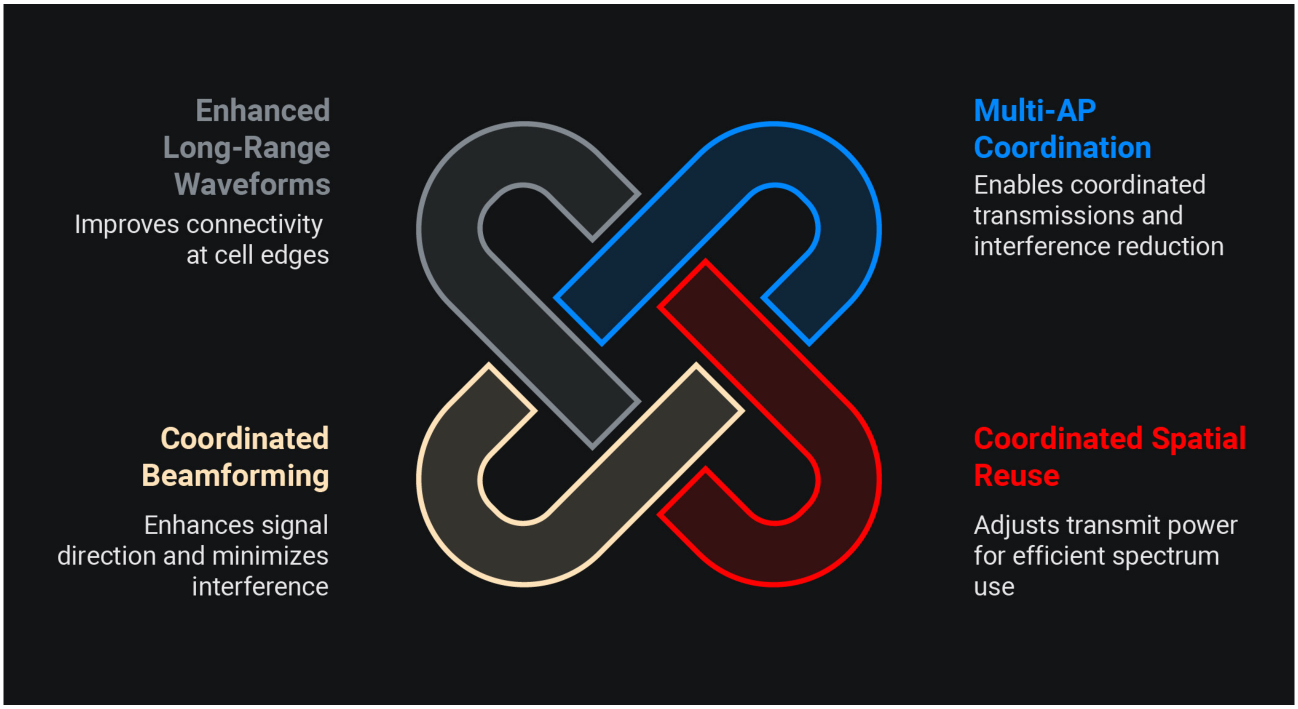
Bandwidth:

NO MAJOR LEAP IN PEAK RATES, BUT REAL GAINS

Peak data rates in Wi-Fi 8 will remain roughly the same as Wi-Fi 7 (up to 23 Gbps) using 4096-QAM, 8 spatial streams, and 320 MHz channel widths across the 2.4 GHz, 5 GHz, and 6 GHz frequency bands. There is some level of speculation in the industry suggesting that Wi-Fi 8 could extend the coverage to millimeter-wave frequencies (42.5–71 GHz) for ultra-high-rate short-range links, enabling 100 Gbps aggregate data rates, though such modes would be limited by line-of-sight conditions and regulatory constraints.

Despite maintaining the PHY peak rate largely unchanged, Wi-Fi 8 promises significant real-world bandwidth improvement, especially in challenging conditions where signal quality is poor or in dense device environments. Industry testing suggests up to 25% higher sustained throughput compared to Wi-Fi 7 under these conditions.

In practice, the effective bandwidth (expressed as the performance that users experience in real networks) is more important than advertised peak speeds. Wi-Fi 8 targets this with innovations that enhance reliability, consistency, and spectral utilization.



Service Coverage:

SMARTER COORDINATION, LONGER REACH

Wi-Fi 8 is expected to deliver better service coverage and mobility support by leveraging multi-AP coordination and network intelligence, without the increased transmit power or new spectrum alone.

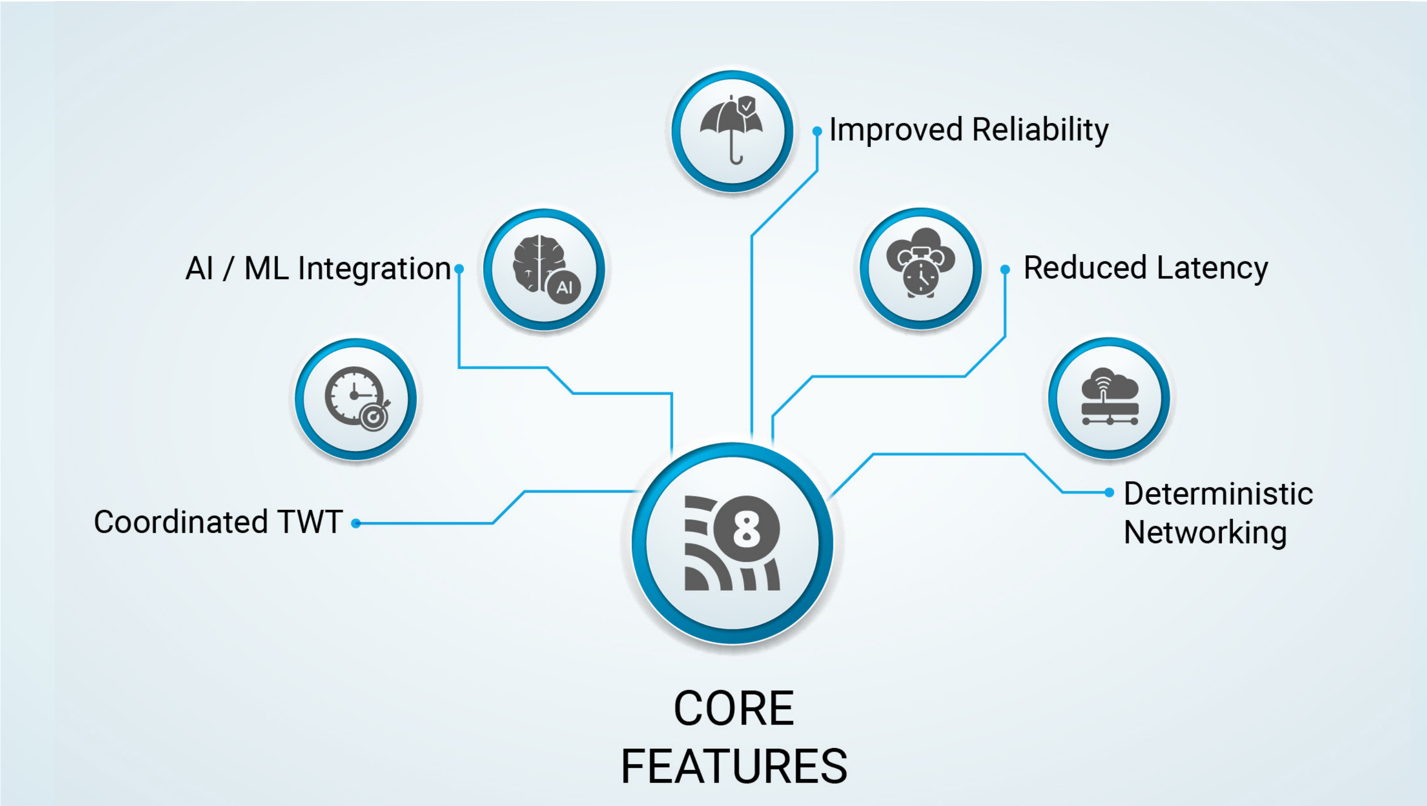
Multi-AP Coordination (MAPC) is a core mechanism enabling multiple access points in a dense deployment (e.g., offices, campuses, malls) to coordinate transmissions, share channel-state information, and reduce inter-AP interference. Studies and vendor insights indicate throughput gains of 20–50% in mesh/enterprise scenarios when MAPC is active.

Coordinated Spatial Reuse (Co-SR) allows neighboring APs to adjust transmit power based on client proximity and shared spectrum contexts, while helping devices reuse timbre more efficiently, boosting coverage and capacity by anywhere between 15 and 25%.

Coordinated Beamforming (Co-BF) enhances beamformed signal direction across multiple APs, minimizing interference while improving reach, which is especially useful in high device-density indoor environments like stadiums and retail venues.

Enhanced Long-Range (ELR) waveforms are expected to improve robust connectivity over reduced data rates, even at cell edges, benefiting IoT nodes or mobile devices requiring stable service in fringe areas. This includes longer symbol durations or narrowband fallback modes for extended coverage.

Together, these innovations help maintain consistent service across larger indoor/outdoor deployments, reduce dead zones, and enable smoother roaming, supporting tools like real-time AR/VR, industrial sensors, and safety-critical devices.



Quality of Service:

ULTRA-LOW LATENCY AND PREDICTABLE THROUGHPUT

For the first time, Wi-Fi aspires to deliver deterministic networking features comparable to wired or cellular URLLC (Ultra-Reliable Low-Latency Communications). Wi-Fi 8 targets at least a 25% reduction in tail latency (95th percentile) compared to Wi-Fi 7, rather than aiming only at average latency. That means fewer unexpected delays, which is critical for real-time applications like XR, robotics, or remote control systems. Mechanisms such as improved EDCA scheduling, sometimes referred to as High-Priority EDCA (HIP EDCA), enable urgent traffic to access the medium with minimal contention even under load.

The UHR goal includes 25% fewer packet drops in poor signal or mobility conditions, improving seamless roaming and reducing retransmissions, which improves both latency consistency and effective throughput. Additional resilience comes from enhanced MCS granularity, allowing smooth rate transitions across varying SNR levels to avoid sudden link degradation or station disconnects. Improvements are expected between 5% and 30% in throughput stability depending on the deployment.

Wi-Fi 8 is expected to natively support AI/ML routines at the AP or network controller level, automatically optimizing channel assignments, beamforming direction, noise suppression, and resource timing in real time. This programmability is geared toward adaptive QoS, self-healing networks, and predictive congestion management in dense or dynamic conditions.

For IoT and mobile clients, features like Coordinated Target Wake Time (TWT) enable devices to schedule wake/sleep times in coordination with the AP, reducing contention and saving battery life, while preserving QoS for critical traffic.

Use Cases:

WHO STANDS TO BENEFIT MOST?

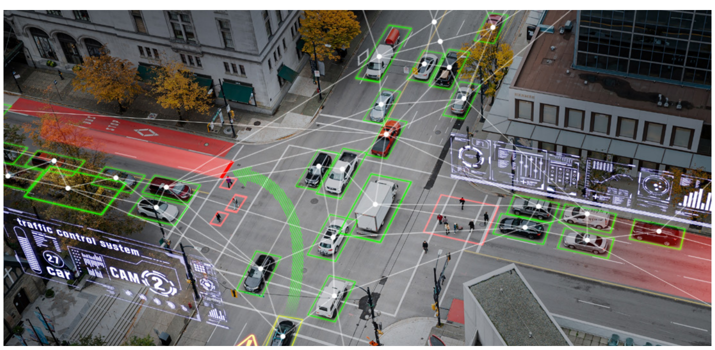
Wi-Fi 8's combination of enhanced bandwidth, coverage, and quality of service positions it for three classes of primary use cases:

IMMERSIVE MEDIA & XR (AR/VR/HOLOGRAPHY)

With promises of sub-millisecond latency, reliable roaming, and multi-link coordination, Wi-Fi 8 is ideal for untethered AR/VR use, especially across multi-AP mesh networks, public venues, or enterprise campuses where continuous fluid handoff without lag is essential.

INDUSTRIAL AUTOMATION & ROBOTICS (INDUSTRY 5.0)

Wi-Fi 8's reliability and bounded latency are critical in automated warehouses, factories, and robotics platforms where real-time control and seamless handoff between APs are mandatory. Mechanisms like MAPC and HIP EDCA give wireless networks the determinism often required in industrial systems.



PUBLIC VENUES & SMART CITIES

Stadiums, airports, malls, and urban hotspots benefit from Wi-Fi 8's ability to serve extremely high device density, coordinate across APs, and maintain stable performance under heavy contention, minimizing interference and packet loss.

MASSIVE IOT / SMART INFRASTRUCTURE

With coordinated TWT, energy-saving scheduling, and support for low-power connectivity in the 6 GHz band (via features like distributed Resource Units), Wi-Fi 8 enables large scale deployment of sensors, HVAC systems, environmental monitors, and smart metering with predictable performance and low battery drain.

5 GHz

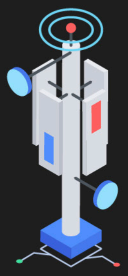
Suitable for short-range, high-penetration scenarios.

2.4 GHz

Ideal for long-range, high-penetration coverage.

6 GHz

Best for short-range, low-penetration applications.



Millimeter Wave

Designed for long-range, low-penetration environments.

Service Coverage and Physical Reach

Wi-Fi 8 retains the same frequency bands used in Wi-Fi 6E and Wi-Fi 7, specifically 2.4 GHz, 5 GHz, and 6 GHz, though introduces intelligent coordination to extend effective coverage. ELR waveforms and AP cooperation help mitigate high-frequency signal attenuation, making inner-building coverage and roaming more reliable without increasing transmit power.

Millimeter-wave support (42.5–71 GHz) may allow short-range high-throughput segments in open spaces, such as conference halls or VR arenas, but this frequency range is not suitable for long-range or penetration-required deployments due to line-of-sight limitations.

Adoption Timeline & Ecosystem Implications

Wi-Fi 8 is still under development. The early version of draft 1.0 of IEEE 802.11bn is expected around mid-2025, with Wi-Fi Alliance certification planned for early 2028 and final IEEE ratification by March 2028. Commercial product availability is expected to follow in 2027–2029, after interoperability testing and mainstream deployment.

Supporting Wi-Fi 8 will require new AP platforms and client chipsets with capabilities for MAPC, AI-based scheduling, and potentially mmWave radios. Moreover, enterprise network infrastructures, specifically controllers, cabling, and management systems, may need upgrades to support advanced coordination and low-latency QoS features.

Challenges and Open Questions

While Wi-Fi 8 promises impressive improvements, several challenges remain:

- **Legacy device compatibility:** Wi-Fi 8 must interoperate with billions of existing Wi-Fi devices (Wi-Fi 4, 5, 6, and 7). Ensuring backward compatibility while enabling advanced features adds complexity to standardization and implementation.
- **Mesh/Group coordination overhead:** MAPC and Co-SR require synchronizing APs across time/frequency. Testing and interoperability across vendors could be challenging, especially for mesh or multi-vendor deployments.
- **Spectrum constraints:** mmWave suitability varies across indoor/outdoor use cases. Regulatory approval for higher frequency usage (above 6 GHz) remains uncertain in many regions.
- **Hardware cost & complexity:** Supporting AI/ML scheduling, beamforming, and coordination may increase device costs and power requirements, especially in entry-level or consumer devices.

Conclusions

Wi-Fi 8 represents a paradigm shift from incremental speed increases toward ultra-reliable, deterministic wireless communication built for future workloads, dense IoT infrastructure, and immersive experiences. Though peak physical rates remain similar (~23 Gbps), the real-world improvements in throughput, latency, packet reliability, coverage, and QoS are expected to surpass those of previous generations.

By introducing multi-AP coordination, AI/ML-based optimization, enhanced QoS scheduling, and better spectrum utilization, Wi-Fi 8 could redefine how wireless networks serve mobile, industrial, and latency-sensitive applications in homes, enterprises, and public spaces.

Wide adoption remains dependent on vendor implementation, regulatory alignment, and device ecosystem readiness, with commercial availability likely between 2027 and 2029. As Wi-Fi 8 moves from draft to deployment, it promises to elevate wireless connectivity into a new era of reliability, consistency, and intelligence.

www.rgnets.com
sales@rgnets.com
316 CALIFORNIA AVE
RENO, NV 89509

–• –• – – – – –• – • –• – – – – • –•• / –• –• – – – – – – – – •• – –• •• –
• –• • – – •• – – – – –• / –• –• – – – – – –• –• •• – –•• • – –• –• –• •