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WI-FI 8 AND THE RISE OF ULTRA-RELIABLE CONNECTIVITY FOR THE AI ERA

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INTRODUCTION: WHY WI-FI 8 MATTERS NOW

For years, advances in wireless connectivity have been defined largely by speed. Each new Wi-Fi generation has pushed peak throughput higher and reduced latency, with Wi-Fi 7 representing a major leap forward in peak wireless performance. But as AI becomes increasingly embedded in the systems that shape how we live and work, the expectations placed on wireless networks are expanding beyond headline speeds alone.

Wi-Fi 8 is designed to build directly on the performance gains introduced with Wi-Fi 7, extending them by delivering higher and more consistent speeds in real-world, non-ideal network conditions. In the AI era, consistency and real-time responsiveness are becoming essential for automation, collaboration, immersive experiences, and intelligent systems that operate continuously in the background.

"As we enter the AI era, connectivity needs are evolving fast, devices and applications are becoming more intelligent, more autonomous, and more demanding," said Qualcomm Technologies Vice President of Technical Standards Rolf De Vegt. "The rise in agentic AI, the multiplication of AI endpoints, and the rise in AI modalities — audio, video, sensors — are going to dramatically increase the density and dynamism of local networks."

At the same time, networks are contending with denser device populations, more mobility, and more unpredictable traffic patterns due to emerging XR, robotics, and industrial applications. In this environment, occasional drops in performance or latency spikes are no longer acceptable.

Wi-Fi 8 represents a fundamental shift in how wireless performance is defined. In addition to delivering peak speeds , it is also designed to bring reliable, low-latency, and near-lossless connectivity under real-world conditions — particularly in congested, interference-prone, and mobile environments. Building on more than two decades of Wi-Fi evolution, Wi-Fi 8 extends existing capabilities to better support mission-critical and AI-driven use cases, bringing wireless connectivity closer than ever to the predictability and responsiveness traditionally associated with wired infrastructure.

FROM BEST-EFFORT TO "ULTRA-HIGH RELIABILITY" FOR THE AI-ERA

Wi-Fi 8 is designed to deliver ultra-high reliability to support future networks as traffic shifts from human-initiated applications like browsing and streaming to machine-driven, agentic AI applications. The reliability-focused technologies included in the standard allow for high-speed connectivity to be realized consistently, even under heavy traffic loads.

"Wi-Fi 8 sets the stage for predictable performance guarantees, a prerequisite for SLAs in enterprise and industrial deployments," commented De Vegt. Applications such as extended reality (XR), robotics, industrial control, and other mission-critical enterprise workloads require deterministic latency, high reliability, and predictable throughput — even in dense or otherwise challenging environments.

Advanced scheduling mechanisms are key Wi-Fi 8 innovations that allow Access Points (APs) to optimize spectrum usage, reduce contention, and mitigate interference by sharing transmission opportunities and enforcing exclusive access windows for latency-sensitive traffic. "This enables more deterministic operation where latency and throughput remain stable even under heavy load," added De Vegt.

One of the core Wi-Fi reliability improvements is Multi-Access Point Coordination (MAPC), which refers to the coordinated management of multiple access points within a single Wi-Fi network. Rather than operating independently and competing for airtime, coordinated access points share information and align their transmission behavior to reduce interference, manage congestion, and prioritize latency-sensitive traffic.

Earlier Wi-Fi generations introduced important advances such as MIMO, OFDMA and multi-link operation, which significantly increased capacity and

efficiency. However, these improvements did not fully address quality-of-service challenges in dense or highly dynamic environments, particularly around latency consistency. MAPC in Wi-Fi 8 builds on those foundations by shifting the focus from optimizing individual links to coordinating the behavior of the network, enabling more deterministic performance even under heavy load.

This coordinated approach enables a range of new mechanisms — such as coordinated scheduling, targeted wake times, and spatial reuse — that collectively reduce contention and tail latency, even in dense or interference-prone environments. These include:

- **Coordinated TDMA (Co-TDMA):** Enables access points to share transmission opportunities in a time-sliced manner, reducing contention and improving latency predictability.
- **Coordinated Restricted Target Wake Time (Co-rTWT):** Coordinates access windows across access points to prioritize latency-sensitive traffic, even in congested environments.
- **Coordinated Beamforming (Co-BF):** Uses advanced antenna steering to focus signals at clients while minimizing interference with neighboring access points.
- **Coordinated Spatial Reuse (Co-SR):** Dynamically adjusts transmit power based on link conditions, enabling more efficient spectrum reuse in dense multi-AP deployments.

"Ultra-High Reliability in Wi-Fi 8 means consistently delivering low-latency, high-throughput connectivity even in highly challenging real-world conditions," said De Vegt. "It's about maintaining strong, stable performance across dense networks, at the edge of coverage, and while devices are on the move — making Wi-Fi 8 dependable for mission-critical and immersive applications."

THE GATEWAY AS AN EDGE AI SYSTEM

As Wi-Fi networks evolve to support more intelligent and latency-sensitive applications, gateways are increasingly taking on a new role beyond simple connectivity hubs. Rather than serving only as access points, they are increasingly being architected as integrated edge platforms that combine high-performance wireless connectivity with on-device compute and AI capabilities. This shift enables not only higher performance, but also more adaptive and intelligent network behavior.

Importantly, this evolution is not driven by Wi-Fi 8 protocol advances alone. Instead, it reflects a broader architectural shift: the convergence of Wi-Fi, edge compute, AI acceleration, and cloud-connected intelligence into a unified platform designed to meet the demands of real-time, AI-driven workloads.

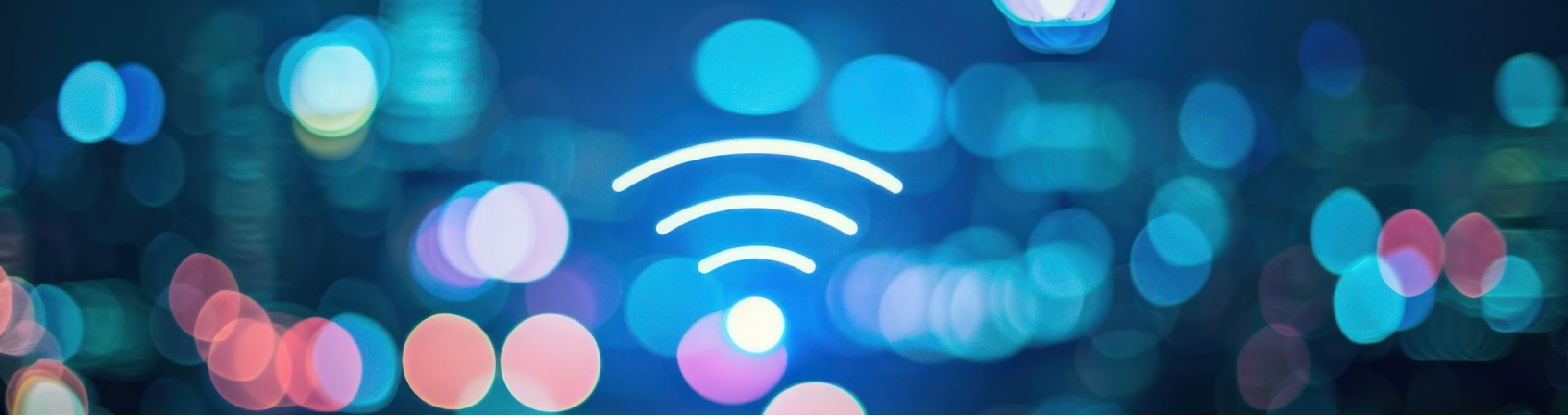
According to De Vegt, they are becoming powerful platforms for edge AI computing.

"There are two ways to think about how edge AI is fundamentally transforming the network," he said. First, he explained that it enhances connectivity and user experience by enabling near-real-time optimization of Wi-Fi and network performance. This category is sometimes referred to as 'AI for Wi-Fi.' On-device AI can identify and prioritize traffic for latency-sensitive applications such as streaming and gaming, directly influencing scheduling and traffic handling to sustain higher throughput while reducing delay. It can also dynamically optimize signal coverage based on RF conditions and improve operational efficiency through AIOps-driven network management.

This approach is already proving valuable across a wide range of device categories, including consumer devices such as smartphones, laptops, and smart home products, as well as XR headsets, smart glasses, and devices used in automotive, industrial, and IoT environments.

Edge AI also enables a new class of applications and services by running AI models — such as computer vision and speech recognition — directly on access points or gateways. This allows connected devices like cameras, smart speakers, and appliances to offload processing to local AI compute resources, reducing reliance on the cloud while improving responsiveness and privacy. In the industry, this is sometimes referred to as 'Wi-Fi for AI.'

"This is what we believe is the major paradigm shift: Enabling the AP/Gateway to go far beyond just connecting devices, making them more intelligent, capable, personal, and with a highly contextualized understanding of the local data specific to each user and their environment," said De Vegt. "By integrating edge AI capabilities alongside advanced features such as Wi-Fi Proximity Ranging, Wi-Fi Sensing, and proximity technologies like UWB and Bluetooth Channel Sounding, these devices will deliver unprecedented contextual awareness for AI-driven applications. This rich, real-time context empowers next-generation AI systems to operate autonomously and intelligently, enabling more adaptive, proactive responses, optimizing resource utilization, and enhancing user experience."



ENABLING NEW AI-DRIVEN SERVICES AT THE EDGE

Both users and service providers have a lot to gain from the integration of AI into the gateway. For users, it means more seamless connections, even in congested environments, as traffic is intelligently recognized and optimized to maintain consistent performance.

At the same time, edge processing can enhance privacy by allowing sensitive information to be analyzed locally rather than sent to the cloud. This is becoming increasingly important as connected devices like smart home sensors or cameras rely on cloud AI resources. By enabling local processing at the gateway, AI-powered edge platforms reduce cloud dependency while improving responsiveness.

For service providers, the gateway becomes a centralized platform for deploying edge AI and value-added services. In this model, Wi-Fi is one critical layer — but it is the combination of connectivity, compute, and intelligence at the edge that unlocks new capabilities, from real-time optimization and security to context-aware automation and sensing.

These capabilities position the Wi-Fi gateway not just as a connectivity device, but as an active edge AI compute platform that enables local inference, contextual automation, and more efficient, privacy-aware network behavior.

Beyond providing improved performance through Wi-Fi and AI integration and support for the next wave of smart home and AI-driven services, Wi-Fi 8 also maintains backward compatibility with legacy devices. This, explained De Vegt, allows service providers to upgrade networks without disrupting existing customer ecosystems, all while preparing for the demands of next-generation applications.

"Wi-Fi 8 is built to deliver a better experience for the people who use it — and that's exactly what service providers are measured by," summarized De Vegt. "In today's homes, users expect fast, seamless, and reliable connectivity across dozens of devices. Wi-Fi 8 is designed to meet those expectations, even in highly complex and demanding environments."

More broadly, this shift is part of a growing move toward hybrid AI architectures that distribute intelligence across the cloud, the network edge, and end devices. De Vegt described this as a move toward hybrid AI, where workloads are intelligently distributed between the cloud — which handles large-scale reasoning — and the edge, including gateways and on-device compute, where perception-driven models deliver real-time responsiveness. "This hybrid execution model is becoming essential for robotics, real-time IoT applications, and multimodal assistants, where ultra-low latency, privacy, and cost efficiency are critical," he said. "Wi-Fi 8, along with broadband technologies like 5G and fiber, serves as a crucial connectivity layer enabling coordination between cloud and edge."

CONCLUSION: AN ARCHITECTURAL EVOLUTION FOR WI-FI

If there is one key takeaway, it is that Wi-Fi is moving decisively beyond traditional connectivity. Wi-Fi 8 is less about replacing previous generations than it is about extending their gains and redefining what wireless networks are expected to deliver in an increasingly intelligent, automated, and AI-driven world. Consistency, reliability, and predictability are no longer "nice to have" characteristics — they are foundational.

Wi-Fi 8 reflects this shift by advancing the network's ability to deliver high performance not just in ideal conditions, but in the complex environments where Wi-Fi is actually used — dense deployments, mobile scenarios, and interference-prone spaces across both home and enterprise settings. This evolution positions Wi-Fi to support workloads that demand sustained throughput and real-time responsiveness, including immersive XR, industrial automation, and emerging edge AI applications.

Critically, Wi-Fi 8's evolution is not driven by protocol innovation alone. In other words, embedding AI compute into the access network is becoming a foundational part of Wi-Fi 8's evolution, not just an adjacent enhancement.

It also reflects a broader architectural transformation, where advanced compute and AI capabilities are increasingly embedded directly into the network itself. As intelligence moves closer to the edge, access points and gateways are becoming platforms for local inference, contextual awareness, and adaptive optimization, enabling new classes of AI-driven services and experiences beyond connectivity metrics alone.

Rather than functioning solely as connectivity devices, these systems are evolving into intelligent edge platforms that combine high-performance Wi-Fi with on-device compute and AI acceleration. In this model, intelligence runs not only on endpoints or in the cloud, but increasingly within the network itself.

Wi-Fi 8 will also complement cellular networks, as well as optical and other wired infrastructure, to support hybrid AI architectures that distribute intelligence across the cloud, the edge, and end devices. This evolution to Wi-Fi 8 ultimately signals a redefinition of Wi-Fi's role — from a best-effort access technology to a dependable, intelligent platform capable of supporting the next generation of AI-driven services and experiences.

ACKNOWLEDGEMENTS

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