White paper
Cisco public

The Power Pair: How Private 5G and Wi-Fi Conquer Connectivity

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A unified solution that multiplies wireless capabilities

This white paper covers the benefits of Cisco Private 5G together with Wi-Fi, top use cases, decision criteria for each technology, how they complement each other, and the advantage of choosing an experienced, trusted partner such as Cisco to help guide enterprise customers through the evaluation, design, selection, and deployment process.

Introduction

The need for reliable, high-performance wireless connectivity is skyrocketing for enterprises across industries. From factory floors to corporate offices, hospitals to retail stores, organizations are looking to leverage wireless for mission-critical applications, IoT deployments, and enhanced mobility experiences.

Two key technologies have emerged to meet these evolving needs: private 5G networks and the latest Wi-Fi 6/6E standards. While both provide secure wireless connectivity, they are complementary solutions optimized for different use cases. This white paper explores the benefits of private 5G together with Wi-Fi, top use cases for each, decision criteria on when to use one over the other, and the advantages of partnering with an experienced vendor like Cisco.

What is private 5G?

Private 5G refers to a 5G mobile network deployed for the dedicated use of an enterprise or organization, rather than a telecom operator. It leverages 5G's newest mobile technology, including mmWave spectrum bands, to deliver multigigabit bandwidth, ultra-low latency, and massive connectivity for sensors and devices.

Key benefits of private 5G include:

- Reliability and availability rivaling wireline networks.
- Secure, airtight encryption and isolated network slicing.
- Ultra-low latency under 10 ms, enabling near-real-time control.
- Support for millions of device connections per square km.
- Predictable performance with outstanding quality of service
- Capability to assign tailored frame configurations for optimizing uplink or downlink data rates based on specific use case requirements.
- Ability to perform carrier aggregation to achieve higher overall data rates.

Private 5G is ideally suited for environments and use cases that require secure, deterministic, mission-critical wireless connectivity such as industrial manufacturing, hospitality services, and automated logistics.

One notable advantage of deploying private 5G rather than Wi-Fi is its utilization of clean and dedicated spectrum for specific use cases. This dedicated spectrum isolates mission-critical applications from potential contention that may occur in Wi-Fi networks, enabling more reliable connectivity outcomes.

As Private 5G continues to gain traction, there are some present-day considerations:

- Dedicated licensed spectrum provides guaranteed performance, while shared spectrum options like CBRS offer additional flexibility for Private 5G deployments.
- Lack of dedicated and free (unlicensed) spectrum, although the availability of shared spectrum (Citizens Broadband Radio Service [CBRS]) can alleviate this limitation to some extent.
- Operational complexity of managing a private cellular network. This challenge is being addressed by cloud-hosted offerings that can reduce the operational complexity faced by enterprise IT teams.

What is Wi-Fi?

Wi-Fi has become the de facto standard for wireless connectivity in the enterprise, powered by the 802.11 standard and variants like 802.11ax (Wi-Fi 6). While Wi-Fi 6 represents a major performance boost over previous generations, it is optimized for efficiently sharing bandwidth across many clients rather than ultra-reliable low-latency communication.

Top benefits of Wi-Fi include:

- Ubiquity and widespread adoption, reducing costs.
- Ease of deployment with limited planning.
- Support for seamless mobility across access points.
- Cost-effective delivery of high-bandwidth. connectivity.

Wi-Fi remains ideal for traditional enterprise uses like internet access, email, video, and similar applications that are lag tolerant. The latest Wi-Fi 6/6E standards also support improved quality of service, lower latency, and IoT connectivity to better address business-critical applications.

Wi-Fi also has its own limitations, including susceptibility to contention. The 802.11 protocol family implements a “listen before talk” mode for establishing a connection. This means the controller must recognize every new device entering its domain of control. As a result, Wi-Fi controllers can easily become overwhelmed with new device connection requests, even from devices that may not actually enter the domain.

The power of private 5G and Wi-Fi together

While both private 5G networks and Wi-Fi provide secure wireless connectivity, they are built for different purposes.

Wi-Fi continues to be the mainstream and preferred mode of wireless connectivity for general enterprise use cases. Its ease of use and ubiquity make it a natural fit, and it performs well in most situations. However, Wi-Fi’s limitations become apparent when wireless demand increases due to factors such as a higher number of devices requiring connectivity, an expanded coverage footprint, or increased throughput and latency demands from applications. As wireless use cases proliferate across enterprise contexts, it becomes clear that relying solely on Wi-Fi for all wireless connectivity needs is insufficient. In these highly demanding contexts, a better approach is to use Wi-Fi for basic use cases while implementing demanding use cases with private 5G networks.

This makes the two technologies remarkably complementary when deployed together in the enterprise.

On one hand, private 5G delivers truly transformative wireless capabilities like:

- Ultra-reliable low-latency connectivity for real-time control and automation.
- Predictable performance with guaranteed quality of service.
- Support for millions of critical IoT devices in a dense area.
- Top-grade security with encryption and network slicing.

These capabilities make private 5G networks ideal for driving an enterprise's most demanding, mission-critical applications that simply cannot tolerate inconsistency or lag.

Wi-Fi, on the other hand, remains optimized for more traditional access needs like:

- High-bandwidth internet and data connectivity.
- Seamless mobility and roaming between access points.
- Cost-effective coverage for basic wireless services.
- Easy deployment with limited planning required.

By combining private 5G and Wi-Fi, enterprises get the best of both worlds: ultra-reliable, secure connectivity precisely where it is needed most, while still providing the mobility experience clients have come to expect.

The complementary strengths allow IT to deliver deterministic, real-time performance for critical applications like factory automation or remote medical monitoring. At the same time, guests and employees benefit from pervasive Wi-Fi coverage for email, video streaming, and general internet access.

This potent private 5G plus Wi-Fi connectivity fabric lays the groundwork for enterprises to truly unleash new potential:

- Accelerate Industry 4.0 initiatives and intelligent automation.
- Enhance operational intelligence with real-time insights.
- Create exceptional wireless experiences for customers and visitors.
- Drive new revenue streams with innovative wirelessly enabled services.

In today's hypercompetitive landscape, resilient wireless is a strategic imperative. The combination of private 5G and Wi-Fi gives enterprises the best of both worlds—ultimate reliability and flexibility under one roof.

Key use cases

While private 5G and Wi-Fi each bring distinct capabilities, the real transformation happens when the two are intelligently combined into a unified wireless fabric. This allows enterprises to get the best of both worlds—unwavering reliability where it matters most, plus ubiquitous connectivity across facilities.

Manufacturing and industrial IoT

- Private 5G is used for ultra-reliable, real-time control of robotics, Augmented Reality and Virtual Reality (AR/VR), and automated guided vehicles.
- Wi-Fi is used for programming stations, Human- Machine Interface (HMI) terminals, and noncritical asset monitoring.
- Both technologies work together to enable lights-out automated manufacturing and industrial IoT.

Offices and smart buildings

- Private 5G powers mission-critical building systems like HVAC, energy management, and physical security.
- Wi-Fi is used for secure corporate access, collaborative workspaces, and employee mobility.
- The two technologies are blended to create intelligent, autonomous environments that optimize space utilization.

Healthcare

- Private 5G enables real-time patient monitoring, telemedicine, and robotics for remote procedures.
- Wi-Fi is used for electronic health record systems, administrative operations, and guest access.
- The two technologies are converged for next-generation clinical capabilities with centralized, uncompromised connectivity.

Retail and hospitality

- Private 5G is used for point of sale, inventory and asset tracking, and AI-driven video analytics for operations.
- Wi-Fi is used for seamless guest and customer experiences with high-bandwidth apps and services.
- The two technologies are united to power autonomous smart spaces and exceptional digital-first experiences.

In these scenarios, private 5G provides an ultra-reliable, high-performance connectivity fabric for an organization's most critical systems and data flows, while Wi-Fi supplements by blanketing facilities with ubiquitous access for traditional mobility uses.

This converged private wireless platform, with the two technologies working in concert, allows businesses to reinvent their processes and customer experiences through ubiquitous connectivity, from the intelligent edge all the way to the cloud.

Evaluation criteria

Rather than involving a choice between private 5G and Wi-Fi, the optimal wireless strategy often seeks to intelligently combine both technologies in a hybrid deployment model. Each solution has unique capabilities that can augment and complement the other based on an organization's specific requirements.

Coverage requirements

- Wi-Fi excels for broad, cost-effective coverage across offices and public areas.
- Private 5G provides exceptional range and penetration for outdoor and industrial spaces.

Bandwidth needs

- Wi-Fi delivers multigigabit shared bandwidth that is fitting for many enterprise needs.
- Private 5G enables truly massive bandwidth over dedicated, interference-free spectrum.

Application demands

- Wi-Fi is well suited for lag-tolerant, high-bandwidth applications like videoconferencing.
- Private 5G shines for latency-sensitive, mission-critical use cases requiring superior uptime.

Security posture

- Both provide robust security; private 5G offers advanced encryption and air-gap isolation.
- Wi-Fi 6 credentials and WPA3 protect general enterprise access.

Mobility requirements

- Wi-Fi enables mobile roaming between access points.
- Private 5G allows true mobile broadband connectivity for vehicles, robots, and AR/VR.
- Private 5G and Public 5G roaming support for use cases requiring connectivity across public and private 5G networks.

Cost factors

- Wi-Fi is a cost-effective connectivity option for most basic wireless needs.
- Private 5G helps ensure performance for critical applications, justifying the higher investment.

By holistically evaluating needs across these criteria, organizations can implement the right mix of private 5G and Wi-Fi across different sites, use cases, and user groups. Private 5G may serve as the high-performance wireless backbone for critical operations, augmented by Wi-Fi for general connectivity needs in office areas.

For instance, a manufacturer could leverage a private 5G network for real-time control of automated production lines, while still using Wi-Fi for typical office connectivity needs. This hybrid approach delivers the best combined capabilities, reliably enabling next-generation use cases while providing a seamless experience across the organization.

The key is taking the time to accurately assess all requirements, then architecting a solution that maps the right wireless technologies to each distinct need—helping ensure that every use case gets the optimal combination of performance, security, and cost-effectiveness.

Getting started: Unlocking transformative wireless with Cisco

Enterprises today need private wireless solutions that are precisely tailored to their unique connectivity, performance, and security requirements. Cisco offers a powerful yet flexible combination of private 5G and Wi-Fi technologies designed to deliver maximum benefits with minimal complexity.

As a leader across enterprise networking, cloud, and service provider domains, Cisco brings unparalleled expertise to the private wireless arena. Cisco's service-based architecture accelerates the delivery of new business models and innovative applications over private networks.

This future-ready Cisco® Private 5G plus Wi-Fi solution supports a vast range of leading-edge enterprise use cases:

- Computer vision and video analytics for smart spaces.
- Highly secure collaborative workflows and AR/VR.
- Real-time asset tracking and supply chain automation.
- Predictive maintenance and industrial robotics control.

Cisco, in partnership with Intel, provides collaborative Private 5G Innovation Centers—environments to experiment with 5G-enabled applications, evaluate offerings, and validate solutions before deployment. These help speed your evaluation and de-risk adoption while accelerating time to value.

Cisco has brought together decades of networking leadership and innovation into a powerful yet flexible private wireless platform. One that empowers enterprises to unlock truly transformative outcomes:

- Achieve ultra-reliable, real-time automation and control.
- Create exceptional digital experiences for customers.
- Drive operational intelligence with AI/ML over 5G.
- Unlock new revenue streams through innovative services.

Getting started is simple

Cisco offers a variety of resources to kick off your private wireless journey:

- Wireless strategy advisory workshops.
- Hands-on test drives and proof-of-concept trials.
- RF planning services and design sessions.
- Joint development of preliminary architectures.
- And more.

By engaging Cisco today, your enterprise can gain first-mover advantage—making the most of private 5G and next-generation Wi-Fi to outmaneuver competitors. Tap into our end-to-end portfolios, services, and expertise to help ensure that your private wireless deployment is an unqualified success.

Take the first step to unleashing the transformative potential of wireless across your operations. Accelerate your digital initiatives with Cisco as a trusted private wireless guide.

Unleash transformative wireless with Cisco

The need for reliable, high-performance wireless connectivity is only becoming more critical as enterprises pursue initiatives like intelligent automation, real-time operational insights, exceptional digital experiences, and new revenue streams. By intelligently combining private 5G and Wi-Fi 6/6E into a unified wireless fabric, organizations can unlock this transformative potential.

Cisco's powerful combined solution provides the ultra-reliable, secure connectivity backbone needed for mission-critical use cases, complemented by cost-effective, ubiquitous coverage across all facilities.

This best-in-class approach helps ensure that every application gets the optimal mix of performance, security, and cost-effectiveness.

With its decades of networking leadership and innovation, Cisco stands ready to guide enterprises through this journey as a trusted private wireless partner—from strategy and design to deployment and ongoing evolution. The time is now to embark on your transformative wireless future and gain competitive advantage through Cisco's expertise and comprehensive capabilities.

For more information

Cisco’s solution for private wireless networks provides enterprises with a powerful, end-to-end platform that supports advanced 5G and Wi-Fi-enabled use cases, delivering a hybrid solution optimized for critical enterprise requirements. By seamlessly integrating with existing networks and Wi-Fi, Cisco and Intel simplify 5G operations, reduce costs, and support pervasive mobility.

- To learn more about Cisco Private 5G, visit https://www.cisco.com/c/en/us/products/wireless/private-5g/index.html.
- To learn more about Cisco’s Wi-Fi technology, visit https://www.cisco.com/site/us/en/products/networking/ wireless/index.html.
- To schedule a demonstration of Cisco Private 5G and our joint Private 5G Innovation Center with Intel, contact your Cisco or Intel sales representative.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

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