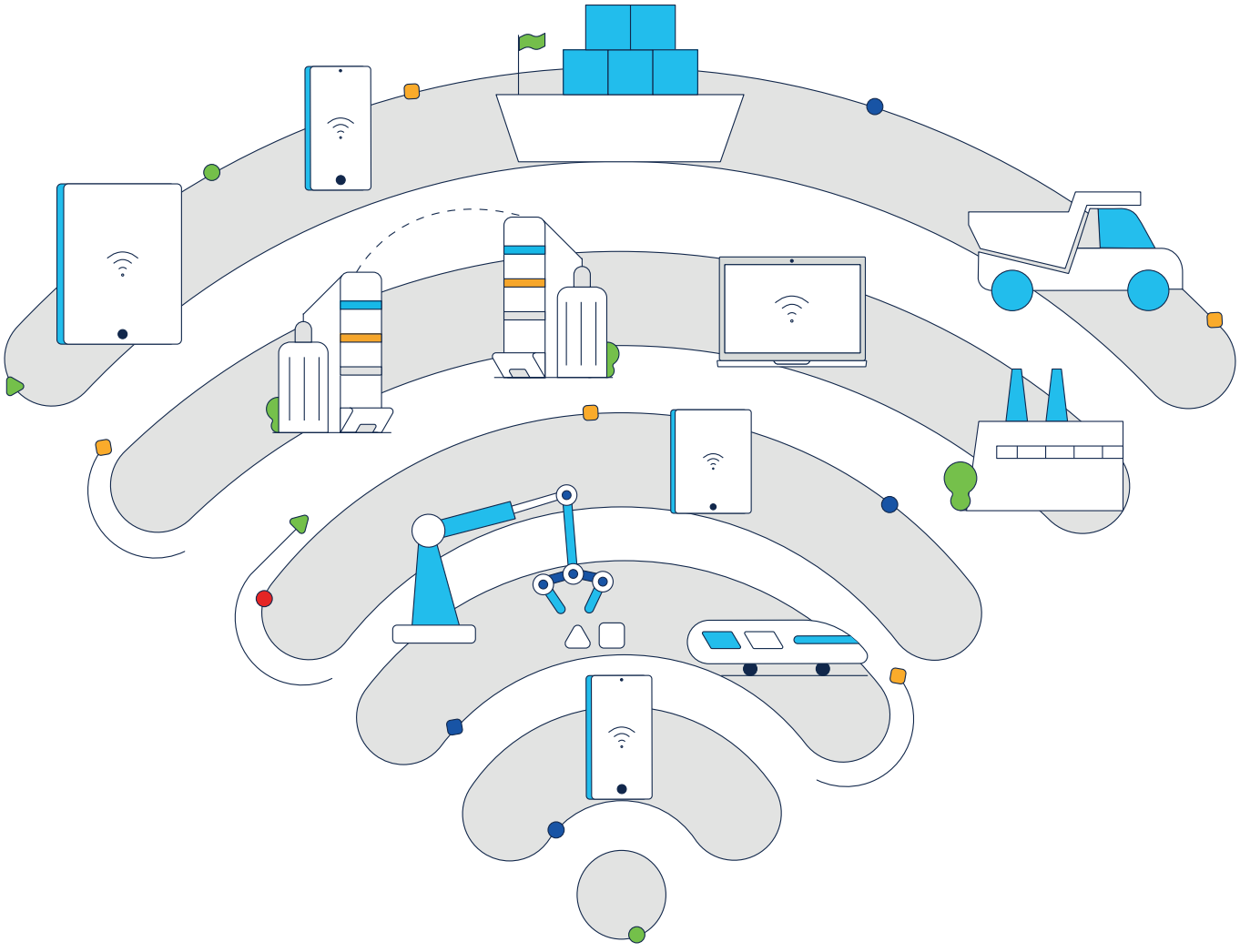
Innovating beyond Wi-Fi boundaries for ultra-reliable wireless connectivity

Cisco Ultra-Reliable Wireless Backhaul (URWB) delivers ultra-low latency and “make-before-break” handoffs essential for connecting mission-critical assets.



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A new generation of wirelessly connected assets, including AI-driven robots, autonomous and automated vehicles, fast-moving trains and mega data-producing endpoints such as cameras that feed AI-systems, has created new demands on wireless networks. These applications require a network that delivers ultra-low latency, higher reliability, and seamless handoffs, exceeding the capabilities of even the latest Wi-Fi versions.

Cisco® Ultra-Reliable Wireless Backhaul (URWB) was developed to support applications that are sensitive to latency, packet loss, and need uninterrupted roaming. URWB delivers reliable connectivity with seamless handoffs, making it an ideal complement to Wi-Fi. URWB allows you to extend your network infrastructure to fixed or moving assets.

Together, Wi-Fi and URWB provide an unparalleled wireless solution that supports a broad range of applications and use cases using unlicensed spectrum, thereby reducing the costs and complexities associated with a licensed spectrum solution.

A new world requires a new class of wireless networks

The future of industrial wireless is set for explosive growth, driven by innovations such as AI and robotics, including automated guided vehicles (AGVs) and collaborative robots (cobots). These advancements open limitless possibilities, with new use cases never seen before. They are revolutionizing automation, boosting productivity and quality across industries. As a vast number of new devices, machines, and robots need to be deployed, wireless networks become essential, offering flexibility and cost-effectiveness that wired systems lack.

Many assets being connected today, such as AGVs in manufacturing, teleremote applications in ports and mines, and communication-based train control (CBTC) in rail, have stringent network requirements. These applications cannot tolerate dropped connections or network latency; lost packets can jeopardize reliability and compromise safety and productivity, leading to severe operational and financial consequences.

In a recent survey, 48% of industry experts say AI will have the greatest impact on industrial networking over the next 5 years.[1] The increased use of AI will require more endpoints and applications to be deployed to gather more data to feed their AI models. Wireless connectivity is vital for linking these AI-powered assets.

The growing number of innovations demands a new class of wireless networks to support critical assets that collect and receive real-time data. Fortunately, wireless technologies have evolved to address these needs. Wi-Fi 6E and Wi-Fi 7 bring significant improvements in bandwidth, speed, and capacity compared to their predecessors, enabling organizations to connect a wider range and greater number of devices. To support these latency- and roaming-sensitive applications, a technology such as Cisco URWB is needed. URWB delivers ultra reliability, ultra-low latency, and seamless handoffs to highly critical applications.

[1] Cisco 2024 State of Industrial IoT Voice of Customer Survey

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Together, Wi-Fi and URWB enable you to accommodate a diverse range of use cases and applications, including those that demand high performance, ultra-low latency, and uninterruped handoffs.

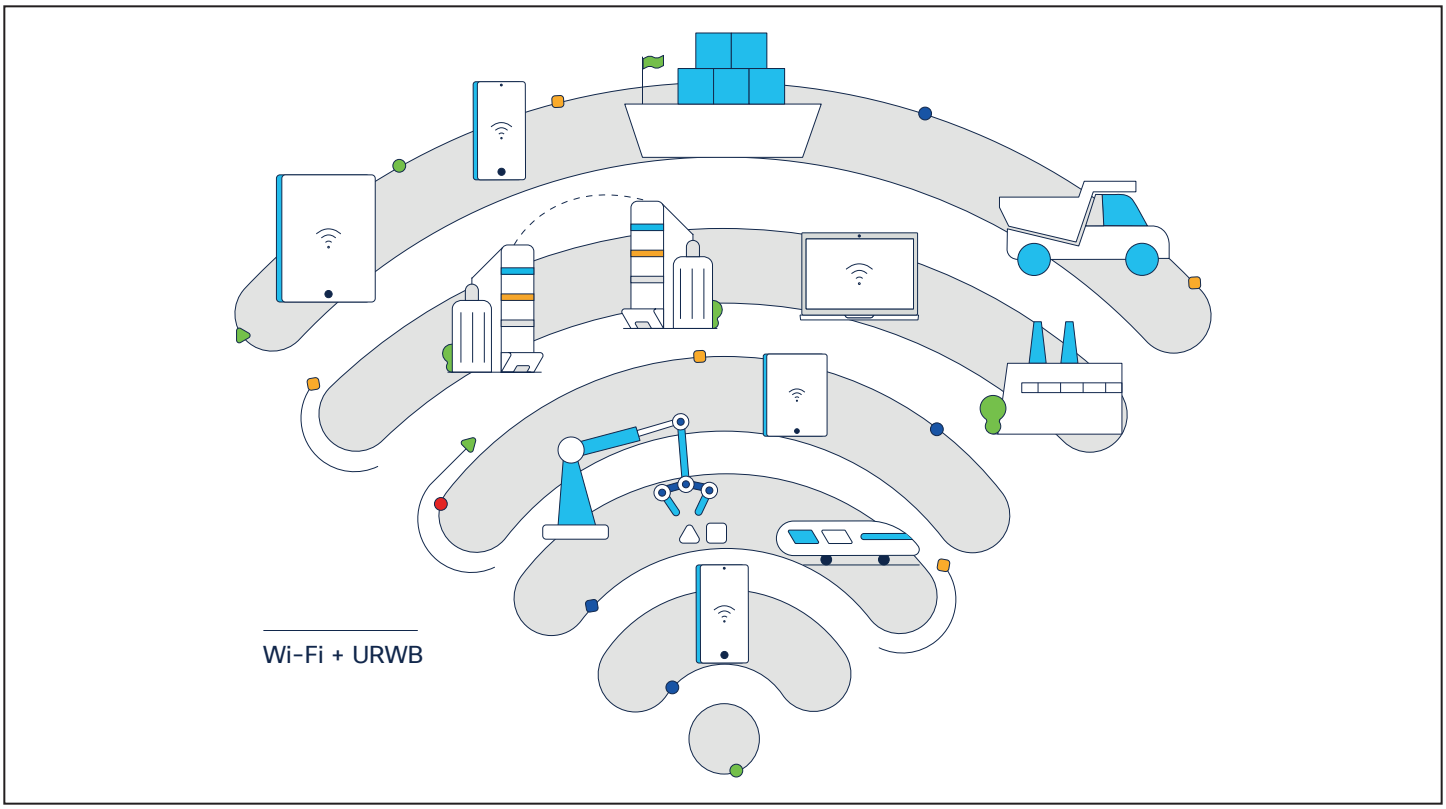


Figure 1. **With Wi-Fi and URWB, you can connect what you need, no matter how challenging the environment or how tough your applications' requirements are.**

"Cisco URWB is uniquely designed to meet the demands of highly critical applications that require minimal packet loss and ultra-low latency. It is suited to connect moving assets and provides backhaul connections where wired options are unavailable or too expensive. By sharing the same technology underpinnings as Wi-Fi, URWB evolves alongside it, benefiting from advancements in data rates and additional spectrum. As the ideal companion to Wi-Fi, URWB empowers organizations to rapidly connect an increasing number of new assets efficiently and reliably."

– Chantal Polsonetti,
VP, Industry Analyst, ARC Advisory Group

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Wi-Fi for applications that need high bandwidth and low latency

Wi-Fi 6E extends Wi-Fi 6 connectivity into the 6-GHz spectrum. This expansion represents the most significant increase in available spectrum for Wi-Fi since its inception, enabling new use cases that require high-performance connectivity.

The benefits of Wi-Fi 6E compared to Wi-Fi 5 include:

- Greater capacity that supports a high density of clients.
- Less interference with broader channels.
- Higher throughput that supports high-performance and bandwidth-heavy applications.
- Lower latency for applications that need a fast response time.

For most use cases today, Wi-Fi 6E can readily handle even high-density scenarios with bandwidth-hungry applications.

Wi-Fi 7, the latest release in Wi-Fi technology, is based on the IEEE 802.11be amendment, also known as Extremely High Throughput (EHT).

- Wi-Fi 7 doubles the channel width of the previous generation to 320 MHz and increases the modulation to 4K QAM (Quadrature Amplitude Modulation) to deliver higher data rates. With faster speeds, enterprises can deploy more devices and smarter applications needed to transform their businesses.
- Wi-Fi 7 introduces Multi-Link Operation (MLO), which allows clients to send traffic to the same access point on more than one band at a time, including 2.4 GHz, 5 GHz, and 6 GHz. This increases speed and reliability while reducing latency. Multi-link implementations are currently client specific, and they will evolve along with client radio capability and tradeoffs.

Presently, the Wi-Fi 7 client ecosystem is limited and will take a couple of years to mature. However, when a more significant number of clients supports Wi-Fi 7, more applications will emerge that require higher speed and lower latency.

For industrial applications, the benefits of Wi-Fi 7 at this point will be incremental compared to those of Wi-Fi 6E, as the most important requirement for industrial applications is reliability, not throughput.

> "Wi-Fi 6E and Wi-Fi 7 expand the unlicensed spectrum available for Wi-Fi into the 6-GHz band, enabling as much as three times more capacity for Wi-Fi."
>
> – IDC[2]

[2] 6GHz Wi-Fi: Powering the Future of Enterprise Connectivity.

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URWB for applications that need ultra reliability and ultra-low latency

Cisco URWB provides ultra-low latency and ultra reliability to support mission-critical applications in different industries and to connect devices such as trains, buses, subways, remotely controlled cranes, AGVs, and autonomous mobile robots. URWB supports both mobility and fixed architectures. It extends your core network, supporting your protocols from Layer 2 and above all the way to the devices, much like wired connectivity, allowing the network to scale in size without compromising reliability and availability. This is possible due to a few factors:

- **URWB uses a specialized implementation of the Multiprotocol Label Switching (MPLS)-over-wireless links**, created to overcome the limits of standard wireless protocols when transmitting any IP-compatible traffic with very low latency in a mobility context.
- **URWB delivers a "make-before-break" handover**, enabling moving vehicles to establish a reliable connection with the next access point along their path before losing connectivity to the current one.
- With **Multipath Operations (MPO) technology**, URWB can deliver uninterrupted connectivity to fast-moving devices by sending high-priority packets via redundant paths on uncorrelated frequencies at the same time to multiple access points. It **can duplicate protected traffic up to eight times, exploiting time, spatial, and frequency diversity**. This functionality, combined with cutting edge hardware capability, can further reduce latency and improve reliability, addressing both interference and hardware failures.

URWB is built upon 802.11 technology and evolves alongside it. It takes advantage of the standard's inherent backward compatibility and can leverage advancements in future standards improvements as needed.

URWB was introduced in the market in 2005 by Fluidmesh Networks, which was acquired by Cisco in 2020. Since its inception, the technology has continued to evolve and has been adopted by many customers in different industries. Read the Cisco URWB solution brief to learn more about URWB and how it is being used today in a wide variety of industries.





Figure 2. URWB has been used to connect applications that require ultra reliability such as AGVs in manufacturing, CBTC in rail, and teleremote applications in ports.

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It is important to note that Wi-Fi is an access technology while URWB is a backhaul technology (see Figure 3).

- **Access networks** provide extensive connectivity to end-user devices (such as computers, smartphones, and IoT devices). There is no ownership of the client side from an access network (if standard, the connecting device can be any model, chipset, etc.). It is not intended to be used to connect network devices beyond the end-user device.
- **Backhaul networks** extend the core connectivity to remote assets for which wired connectivity is not possible. The backhaul network owns and manages both sides of the communication (access point and client), optimizing protocol support, latency, and roaming capabilities. It is equivalent to running a cable to connect devices beyond the client (like programmable logic controllers [PLCs], cameras, Wi-Fi access points) to the core network.

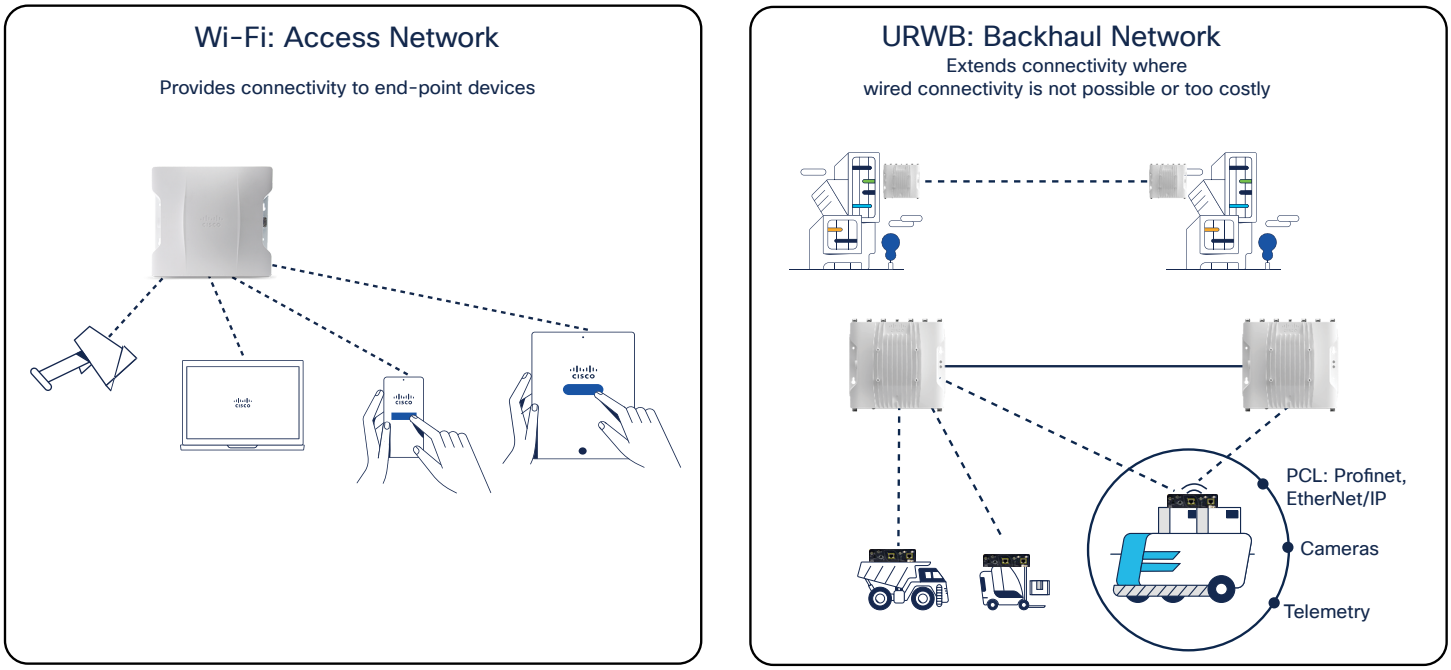


Figure 3. Wi-Fi is an access technology providing access to Wi-Fi enabled devices. URWB is a backhaul technology, which is equivalent to running a cable to connect devices beyond the client to the core network.

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Helping you succeed today and tomorrow

The use of Wi-Fi with URWB offers robust options to connect your applications, critical or not, indoors, outdoors, and in industrial settings. Wi-Fi supports a wide variety of use cases that require high throughput and low latency. URWB helps ensure that use cases that cannot tolerate any loss of communication and that have ultra-low-latency requirements are supported. Both technologies operate on unlicensed spectrum, saving you the costs and complexities associated with using a licensed spectrum.

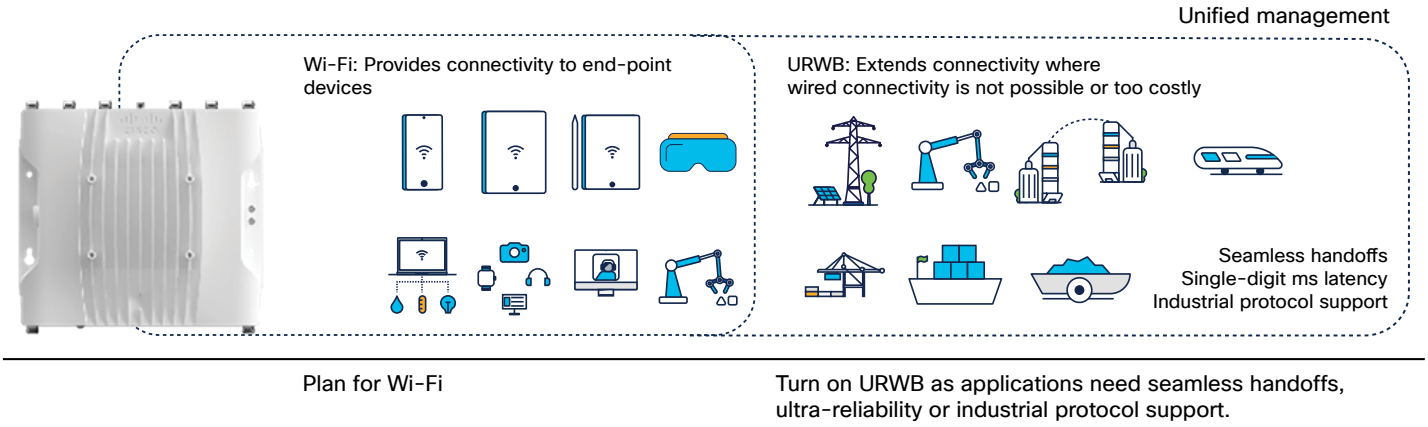


Figure 4. URWB and Wi-Fi are complementary technologies that today are integrated in a single access point, allowing you to connect a broad range of applications using unlicensed spectrum.

"Cisco Ultra-Reliable Wireless Backhaul has redefined our perception of what can be done with wireless. It is the first time that our operators have been able to drive around the terminal without dropping a single ping. We believe this solution to be a no-brainer for any terminal looking to solve TOS connectivity or any terminal looking to roll out an automation-capable OT network. Uptime for us is king and Cisco Ultra-Reliable Wireless Backhaul has over-delivered on its promises."

– Stefano Lorenzini,
Technical Department of La Spezia Container Terminal[3]

[3] La Spezia Container Terminal success story

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We have been working hard to provide you with wireless technology options tailored to meet your diverse application requirements. Our goal is to equip you with the right solutions for today's deployment scenarios and future-proof your infrastructure for automation and AI. That's why we've integrated URWB into our Wi-Fi access points.

Our innovative converged approach – a single piece of hardware that supports both Wi-Fi and URWB, enabling activation and set up of URWB capabilities in Cisco Wi-Fi access points via the Wireless LAN Controller (WLC), allowing management of ultra-reliable networks effortless through Cisco Catalyst™ Center – gives you unparalleled flexibility without added complexity:

- **Optimized investment:** Avoid duplicating infrastructure needed to support different wireless technologies.
- **Simplified deployment:** Easily enable URWB in the field, streamlining your setup.
- **Single management:** Manage Wi-Fi and URWB management from a single pane of glass, enhancing operations and extending end-to-end visibility to OT networks.
- **Cost effective operations:** URWB uses unlicensed spectrum, reducing costs and eliminating the complexities of staff training, licensing, and spectrum management.
- **Effortless connectivity:** Wi-Fi is readily available on the assets you need to connect, and you can attach an access point to connect assets with URWB with ease.
- **Comprehensive solution:** Wi-Fi with URWB access points in a variety of form factors supporting indoor, outdoor and industrial use cases eliminating complexities, time and gaps of dealing with point solutions and multiple vendors.

Prepare for success today and in the future with our innovative, integrated wireless technology solution.

The use of Wi-Fi with URWB offers robust options to connect your applications, critical or not, indoors, outdoors, and in industrial settings.

Intrigued? Reach out to one of our sales representatives or partners or request a one-on-one demo. Learn more about our products and solutions by visiting cisco.com/go/iw.

Related content: You may also be interested in the Reliable Wireless for Automation in Manufacturing solution overview, which discusses factors to consider when selecting wireless technology and illustrates an example based on a real organization.

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