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White Paper

4 Steps to Successfully Deploying an Enterprise Wireless Network

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4 Steps to Successfully Deploying an Enterprise Wireless Network

What's the best way to prepare for emerging wireless network demands? If your organization made a relatively recent upgrade to its wireless network, it might not be ready to adopt the latest wireless networking technology. Perhaps a short-term solution would meet your needs. Or, maybe your organization is ready to invest in the newest system — one with the bandwidth and infrastructure that will allow the business to keep up with rising data use for years to come.

Leviton recommends following four important steps to successfully deploy a wireless enterprise network.

1. **Develop an understanding of wireless technology.**
2. **Determine device types and capacity needs.**
3. **Consider your environment and building layout.**
4. **Choose cabling and connectivity that will best suit your goals.**

The first step is a general information gathering phase: You want to understand the technology and the differences between various wireless specifications. Steps two through four fall under the "planning" umbrella — they're key to any successful wireless setup.

STEP 1: KNOW THE TECHNOLOGY

History and Evolution of Wireless Speeds

Twenty years ago, first generation wireless wasn't considered a necessity. But the technology has evolved to a point where a robust wireless network is mandatory in many building locations; it's as crucial to a healthy enterprise as computers and smartphones. Organizations in a variety of sectors have seen a dramatic increase in network speeds required to operate effectively. These organizations include office environments, manufacturing facilities, schools and campuses, and hospitals.

The advent of mobile devices significantly increased the amount of IP traffic. And the rise of the Internet of Things — connecting millions of everyday devices — will increase it even more. This demand has led to recent updates to wireless network standards and technologies, with faster speeds and greater bandwidth.

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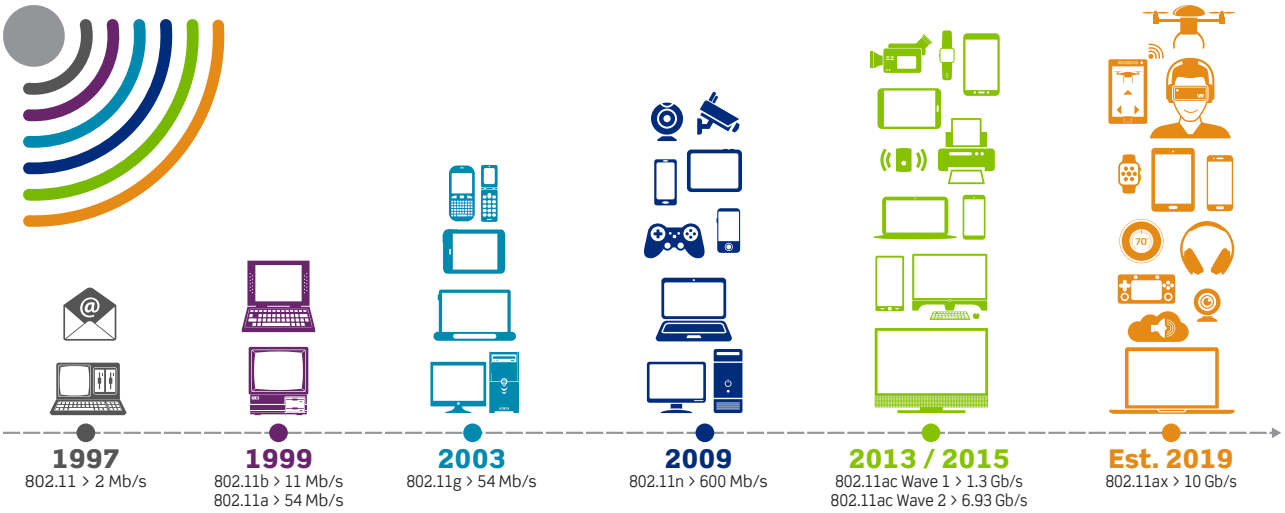


An easy way to visualize how a more robust Wi-Fi network increases workplace efficiency is to take a look at the amount of time it takes for a 5 gigabyte file to download. In 1999, the speed for Wi-Fi was 54 megabits per second (Mb/s). A 5 gigabyte file took almost 14 minutes to transfer. But now, that same file can download in 6 seconds at the theoretical maximum speed of 6.93 gigabits per second (Gb/s) with 802.11ac Wave 2 technology.

What determines wireless speed?

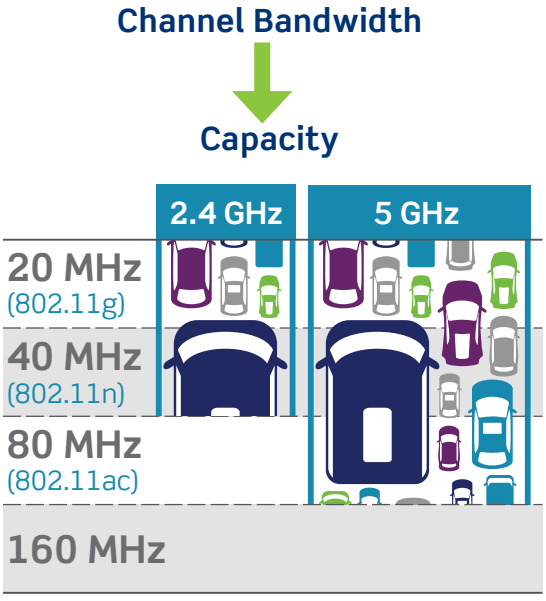
Wireless speed relies on:

1) Channel bandwidth

2) Spatial streams (related to antenna configuration)

3) Signal modulation

Channel Bandwidth — Wireless networks can run on 20, 40, 80, or 160 MHz channels, within a 2.4 GHz or 5 GHz band. Older Wi-Fi such as 802.11b and 802.11n use the narrower 2.4 GHz, while 802.11ac uses 5 GHz. The 5GHz frequency band is wider, which means it allows for more capacity. Think of it as wider roads — they allow more traffic (information) to move. In addition to capacity, signals over 5GHz are much cleaner and faster, as the channel is less congested than 2.4 GHz channels.



Wider channels allow more traffic (information) to move.

Spatial Streams — Early 802.11 networks used a single antenna and one data stream, which means there was only one transmitting antenna sending a signal to a receiving antenna through one path. 802.11n made improvements, supporting up to 4 antennas and 4 spatial streams for parallel data transfers within the same channel. Technology called multiple-input multiple-output (MIMO) allows multiple data streams on the same channel, instead of sending signals to one device at a time. 802.11ac goes a step further, allowing up to 8 antennas and 8 spatial streams for increased efficiency and higher throughput. It also supports multi-user MIMO (MU-MIMO), which allows a wireless access point to transmit independent data streams to multiple clients simultaneously.

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802.11ac also improves on beamforming, a technology that sends a more concentrated signal to each device instead of broadcasting a single signal to a wide area. Beamforming was an option with 802.11n, but was not implemented until 802.11ac due to interoperability concerns.

Comparing spatial streams and antenna configurations	802.11g	802.11n	802.11ac	
			Wave 1	Wave 2
Spatial Streams	1	4	8	8
Antenna Configuration	SISO	4x4 MIMO	8x8 MIMO	8x8 MU MIMO

Signal Modulation — Over the last decade, signal modulation techniques have evolved to improve the speed of wireless networks. Earlier renditions of 802.11 networks that used older techniques — such as QPSK, 16 QAM, or 64 QAM — have fewer bits per signal, while 802.11ac uses 256 QAM, allowing 8 bits per signal. This gives 802.11ac a 33% faster speed over 802.11n with 64 QAM.

The combination of increased capacity, concentrated signal paths, and enhanced modulation techniques in 802.11ac has significantly improved wireless performance. However, there is one tradeoff that must be considered with 802.11ac: coverage. While 802.11ac WAPs provide faster and cleaner signals by running on a 5GHz frequency, they may not provide wider coverage because of the shorter wavelength in the 5GHz frequency band. A shorter wavelength means that the signal has a harder time moving through walls or furniture, so you have to be closer to the WAP to get a good signal. Also, while the modulation of 256 QAM gives you faster speed, you also have to be closer to the WAP to attain it, since there are more symbols in a constellation, as shown below.

There are trade-offs between options, so it's important to understand the technology and invest enough time during the planning stage to make the right choice for your business. Proper planning will help you maximize the benefits of an 802.11ac wireless network.

Careful planning considers potential trade-offs of 802.11ac

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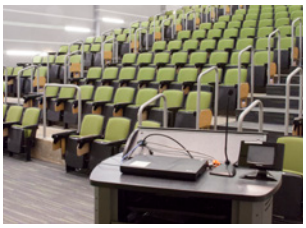
STEP 2: UNDERSTAND WHICH DEVICES WILL USE THE WIRELESS NETWORK AND YOUR CAPACITY NEEDS

Answer some important questions about the makeup of your applications. What types of devices will be accessing the wireless network and how many people will be using Wi-Fi at one time? Will hospital imaging machines or smart machines on a warehouse floor dominate your bandwidth? Will the Wi-Fi serve people using smartphones in a waiting room? Or maybe your setting is a huge university, where students will be using laptops and tablets in a lecture hall or dorm. Needs can vary from building to building.

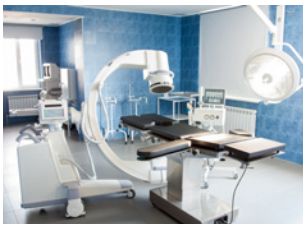
When trying to determine how to deploy wireless networks, you need to carefully plan based on the business needs, and the size and application type that the network will serve. Based on that information, you can make a better decision as to which wireless technology makes sense for you.

Consider the devices used in different areas of your facility

Commercial
Laptops
Computers
Tablets
Smartphones
Video Conferencing
VoIP



Education
Laptops
Computers
Tablets
Smartphones



Health Care
Imaging Devices
Laptops
Computers
Tablets
Smartphones
Tablets
RTLS

Manufacturing
Inventory Control
Line automation
Smart Machines

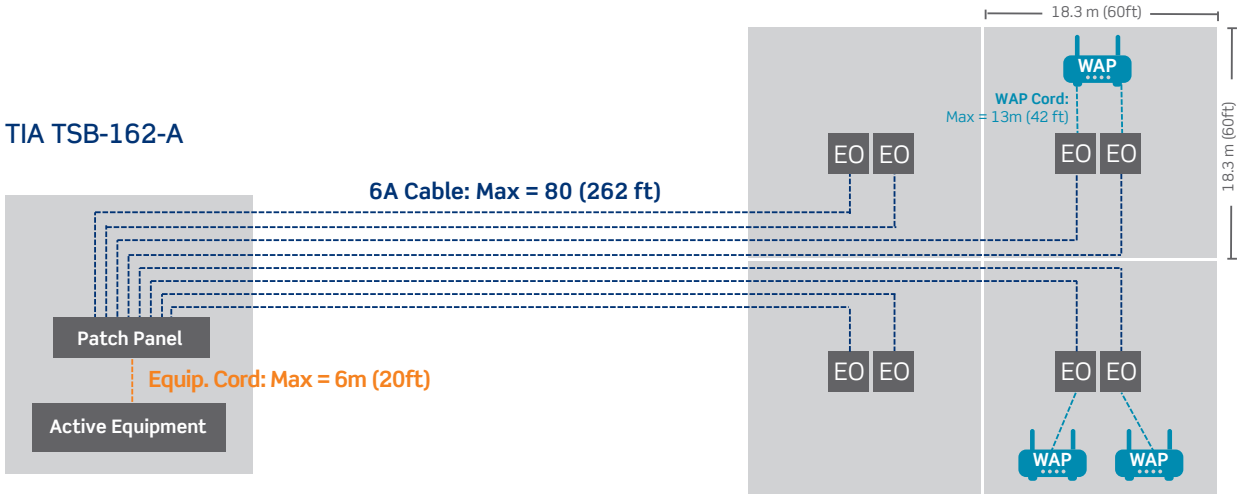
STEP 3: UNDERSTAND WHAT TYPE OF WIRELESS TECHNOLOGY IS BEST FOR YOUR ENVIRONMENT AND THE BUILDING LAYOUT

Your environment influences the type of WAPs you choose and where they will be installed. Is the wireless network for a commercial space, a school, a health care setting, or a manufacturing environment? How big is the building? What's the layout? If it's a commercial space, are the workers in an open, closed, or semi-enclosed space? What are the building materials inside the space? The 5 GHz frequency can be affected by concrete, security glass, and metal partition barriers. When you're planning for an 802.11ac deployment, you need to ensure it will work in your setting.

At this point, you'll want to conduct a Radio Frequency (RF) survey to test for coverage, signal strength, and any possible interference. Based on the results of the RF survey, you can think about where you want to place the WAPs and how you will install them. Will it be a drop ceiling installation? A wall installation? Will you use a WAP enclosure? A combination of all three? Again, your environment comes into play here. For example, in a health care setting, WAPs should be enclosed, as infection control requirements place restrictions on removing or lifting ceilings.

Design Recommendations

- TIA TSB-162-A: 802.11ac networks rely on a square-cell layout. This standard calls for an 18.3-meter uniform cell design, with two cables per cell. The WAP cord should be no more than 13 meters. The maximum length of the cable that connects the patch panel and equipment outlet should be no more than 80 meters — this cable will be your permanent link. The maximum length of your equipment cord should be no more than 6 meters.



- TIA-4966: Schools and education facilities call for another type of installation. This recommendation is based on the number of people in the space. The telecommunications infrastructure recommends one WAP for every 25 people, or every 230 square meters. In settings that contain high RF interference, such as dorms, place one WAP every 150 square meters.

STEP 4:
MAKE CABLING AND CONNECTIVITY CHOICES

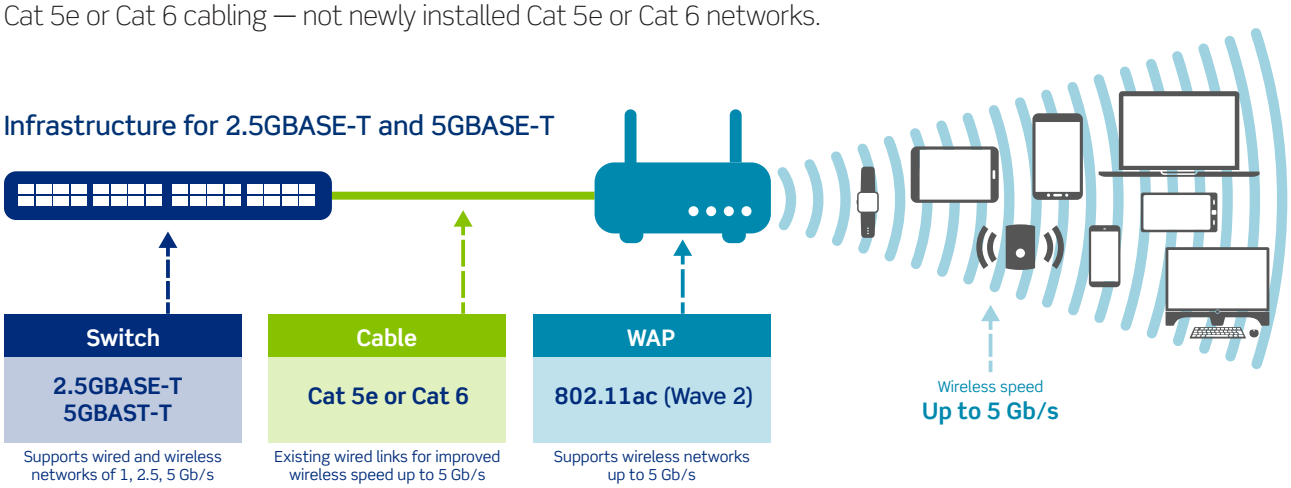
To get the most out of 802.11ac, the Telecom Industry Association (TIA) recommends using a minimum of two Cat 6A cables per WAP, which will give you higher data rates and increased power. The organization suggests you consider wiring at least two Cat 6A drops for every WAP, so future upgrades take less time. Also, Cat 6A is the cable you'll need to prepare for the next generation wireless network, 802.11ax. It is predicted to have a top speed of 10 Gb/s, and is due for release in 2019.

How to Get More Out of Your Cat 5e or Cat 6 Cable

What if you've recently installed Cat 5e or Cat 6 cabling, and your budget won't allow you to install Cat 6A? Because so many enterprise organizations have an existing Cat 5e or Cat 6 infrastructure, active-gear manufacturers have developed switches that support intermediate speeds of 2.5 and 5 Gb/s.

In place of upgrading your entire network infrastructure, you can upgrade the switch to support 2.5 and 5GBASE-T, and wireless access points to 802.11ac, which will allow system speeds of up to 5 Gb/s. This is a less expensive, temporary fix compared to upgrading all network cabling.

2.5GBASE-T and 5GBASE-T Ethernet products are new, and they're designed exclusively for existing Cat 5e or Cat 6 cabling — not newly installed Cat 5e or Cat 6 networks.



If are looking at an upgrade to 2.5 and 5GBASE-T switches, consider the following points:

- **Alien Crosstalk (AXT)** — When running higher data rates over existing Cat 5e or Cat 6 cable, AXT might be an issue, especially for longer channels with significant bundled cable lengths. AXT limits are not directly specified for 2.5GBASE-T or 5GBASE-T. However, Alien Limited Signal-to-Noise Ratio (ALSNR) — a new measure based on AXT, attenuation, and other factors — was developed to assess a channel's susceptibility to AXT, as well as its ability to support 2.5 Gb/s and 5 Gb/s speeds. Recent risk assessments 2.5 and 5GBASE-T based on modeling, testing, and the ALSNR calculation find a medium to high risk of Cat 5e and Cat 6 infrastructures not meeting the ALSNR requirement at longer channel lengths. Generally, the longer the overall channel length and the more bundled length of cable in the channel, the greater the risk. Cat 6 poses less risk than Cat 5e; using either for 5 Gb/s poses more risk than 2.5 Gb/s.

- **Power over Ethernet (PoE)** — If you intend to upgrade to an 802.11ac WAP, which gives you faster speed but less coverage, you'll likely need to install more WAPs. And those newer WAPs will have more antennas, and require more power and more cable. Additional cable means larger cable bundles, which could generate too much heat — especially with Cat 5e or Cat 6 cabling. Consider these factors as you weigh the benefits of sticking with your existing network or upgrading to Cat 6A.

- **Future Needs** — In the near future, an enterprise wireless network that supports 5 Gb/s may not be big enough, depending on the application and environment. IEEE 802.11ax, which supports up to 10 Gb/s, is expected to be released in 2019. If you migrate to Cat 6A now, you'll be ready for the future.

Leviton recommends upgrading to Cat 6A for new installations — as do industry standards — but if you do decide to go with an interim fix with 2.5 or 5GBASE-T, we suggest you conduct a thorough risk analysis before making a final decision. For more information, download a Leviton tech brief that covers the structured cabling considerations of 2.5 and 5GBASE-T.

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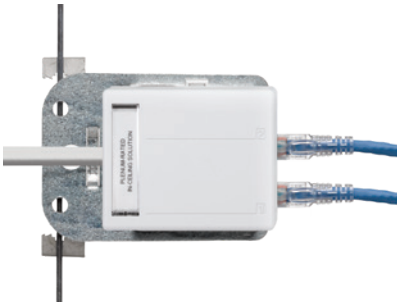
For larger networks and those with lengths that are more than 50 meters, it might cost less to upgrade to Cat 6A cabling. The full upgrade is the best solution for enterprise businesses looking for system longevity, faster data transfer, and support for higher-bandwidth wireless networks.

Solutions for the Latest Wireless Networks



Leviton Network Solutions is a leading provider of connectivity and cabling solutions for enterprise businesses. Our QuickPort® In-Ceiling Wireless Access Point Kit — consisting of plenum-rated cable, connectors, patch cords, surface-mount boxes, and brackets — provides a testable permanent link in drop ceilings to WAPs. It also allows the flexibility to move the In-Ceiling Bracket to refine Wi-Fi coverage or WAN placement without needing to retest the link.

Our Atlas-X1™ component-rated Cat 6A connectors and patch cords provide best-in-class performance, with enhanced Alien Crosstalk (AXT) protection for a clean wireless signal. And they've been independently tested and guaranteed to exceed all component, permanent link, and channel margins.

The Atlas-X1 connectors are also ideal for WAPs that rely on Power over Ethernet. They have a PoE optimized tine geometry that prevents damage from electrical arcing at the critical contact mating zone between the plug and connector. And the connecters use patented Retention Force Technology to maintain contact force between the plug and connector, preventing intermittent disconnects that may cause arcing. Finally, Atlas-X1 UTP connectors have a solid metal body, which dissipates 53% more heat than plastic alternatives, reducing temerature build-up and the potential for heat-related performance issues.

If a Cat 6A upgrade does not meet your budget, Leviton Cat 5e and Cat 6 components can support 2.5 Gb/s and 5 Gb/s speeds within the guidelines and limitations of TSB-5021. Unfortunately, because of the inherent limitations of all Cat 5e and Cat 6 cabling, diversity of channel configurations, installation practices, and cabling environments, Leviton cannot offer warranties or guarantees of performance on 2.5GBASE-T and 5GBASE-T installations using Cat 5e or Cat 6 components.

Learn more about Leviton's cabling systems for wireless networks at **Leviton.com/wireless**.

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We invent and manufacture the industry's best cabling and connectivity. We build them to last. And we stand behind every product and end-to-end system — delivering the highest performance and unbeatable service and support — throughout the life of your network. Add the peace of mind that comes from working with a stable, century-old supplier, and you get the **highest return** on **infrastructure investment**.

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