Wireless, the Next Generation: 802.11ac

Gigabit Wi-Fi promises extraordinary improvements in speed, reliability and quality.

Over the last decade, wireless networking has evolved from a new and somewhat unproven technology to a critical component in the enterprise IT arsenal. Today, virtually every organization operates a Wi-Fi network for internal or public use.

“It has become the primary way to access the Internet and network data,” observes Zeus Kerravala, principal analyst at ZK Research in Westminster, Mass. “It has moved beyond hot spots to the point of becoming pervasive.”

The need to access network resources is heavily driven by the widespread use of mobile devices, including notebooks, smartphones and tablets. In many cases staff, independent contractors and business partners carry multiple devices and require instant access to the enterprise network, and the Internet.

“BYOD and the consumerization of IT have changed the dynamics of business in a significant way. Organizations must provide access with no trade-off in performance, convenience or security risk. It’s the baseline for business in the digital age,” Kerravala says.

As a result, a growing number of organizations are eyeing — and in some cases deploying — 802.11ac networking. The standard — soon to be ratified by IEEE — offers greater bandwidth, much faster throughput speeds and a number of other features that make it ideal for today’s organizations.

Sizing-up 802.11ac

The successor to 802.11n, named 802.11ac, is far enough along the way to standardization that vendors have the assurance to start releasing product. The 802.11ac standard is said to enable dramatic increases in wireless speed, reliability and quality.

So how should an organization approach 802.11ac? What timetable should it set for deployment? And what practical and technical considerations should IT executives consider when rolling out the technology?

Although there’s no single template for approaching the wireless standard, entities should recognize that it’s not so much a question of if an organization should move forward with 802.11ac but rather when. “The technology will move rapidly into the mainstream over the next few years,” notes Robert Wardin, a solution architect for CDW.

What’s more, it is backward compatible with previous generations of wireless technology operating in the 5GHz spectrum including 802.11a and 802.11n. “It represents an attractive upgrade for many organizations,” says Wardin.

Embracing a Wireless World

When wireless networking technology took root in the late 1990s, it introduced a revolutionary concept: the ability to connect online without plugging in cables and wires. Most early networks were constructed in an isolated and ad hoc way, Kerravala points out. Since then, various generations of wireless technology, commonly referred to as Wi-Fi, have rippled through the enterprise and into the mainstream of society — adding speed, security protections and better connectivity.

Of course, many organizations currently rely on 802.11n, which offers two spectrum bands: 2.4GHz and 5GHz — and does a good job of providing bandwidth and speed, particularly at the higher band. The standard, introduced in 2009, also introduced multiple-input multiple-output antennas (MIMO) while offering maximum throughput to 450Mbps

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Robert Wardin, Solution Architect, CDW
video and other high bandwidth applications. In many cases, depending on the distance of the device from the access point, speed and performance rival or exceed Gigabit Ethernet. (IT decision-makers may want to consider upgrading edge switch uplinks to support the increased capacity.)

Final ratification of the 802.11ac standard is expected later in 2013. However, industry experts don’t expect any significant changes — and any minor changes will be addressed through firmware updates. It’s also important to note that 802.11ac will come in two waves. The first release will include all basic features while a more advanced refresh — expected within three to five years — will likely introduce far more advanced capabilities, including channel bonding up to 160MHz, four spatial streams and multi-user MIMO. The latter allows multiple network users to communicate with an access point simultaneously at a theoretical throughput of 68 gigabits per client.

Wardin says that about 80 percent of the organizations he encounters use 802.11n. A few use 802.11a or 802.11b/g standards because they rely on legacy devices — often medical equipment — that operate only in workgroup bridge mode or do not require any additional throughput speed. In addition, some legacy endpoint devices don’t support WPA or WPA2 encryption.

But many organizations are moving forward with plans to migrate to 802.11ac, Kerravala says. “As networks become more saturated or ‘densified’ with devices, a lot of IT shops are finding that there simply isn’t enough bandwidth for everyone and everything,” he adds.

In fact, once an 802.11n access point hits 65 or more devices using it simultaneously, performance and speed drop off considerably. In addition, the bring-your-own-device (BYOD) approach to mobility has created a more unpredictable environment. “It’s more difficult to anticipate usage patterns. There is less predictable data flow,” he explains.

The end result? A few large corporations as well as educational institutions and stadiums have become early adopters of 802.11ac, Wardin says. 802.11ac is also a boon for organizations involved in data intensive fields such as financial trading, hospitals using medical imagery and customer support centers, he adds. Many of these organizations rely on ultrafast speeds and use multiple technology channels — including audio, video and telepresence — to communicate internally or with partners and customers.

Speed Matters

What’s appealing about 802.11ac is that it operates at about triple the speed of today’s Wi-Fi, or approximately 1.3Gbps. In practical terms, this translates into an access point (AP) supporting a greater number of clients — and providing much better performance for those that rely on video and other high bandwidth applications. In many cases, depending on the distance of the device from the access point, speed and performance rival or exceed Gigabit Ethernet. (IT decision-makers may want to consider upgrading edge switch uplinks to support the increased capacity.)
The 5GHz band, he says, creates more spectrum and, in turn, greater flexibility and real-world speed. He believes the standard will take shape in a major way this year. “You can use larger channels and still have room for other nearby access points to use a different part of the 5GHz spectrum.” The 5GHz spectrum has 23 non-overlapping channels compared to 2.4GHz which is limited to three non-overlapping channels. This helps minimize congestion and improves performance with less contention between devices.

Solis points out that a number of smartphone manufacturers, including Samsung and HTC, are now introducing phones that use 802.11ac. Wardin says that when Apple introduces the 802.11ac chips in its iPhones and iPads, adoption will spike. “There will be a huge reaction among corporate IT departments as well as educational institutions and government.”

Strategy and Implementation
Developing a strategy and implementing a plan for 802.11ac is essential. The first step, Kerravala says, is to conduct an extensive site survey and include a spectrum analysis. It’s crucial to understand how, where and what types of devices people use on wireless connections — and how the situation might change over the next few years.

“Congested areas might include conference rooms, meeting areas or lobbies,” he explains. “Right now, if a bunch of people sit down at the same time and switch on their devices for a meeting, the experience can quickly deteriorate.”

But it’s also important to understand how people access data and interact in order to place APs in the right spots. For example, a virtual conference room that relies on video or other multimedia capabilities is likely to consume significant bandwidth.

“Some organizations record every meeting and they have cameras in conference rooms. This type of environment is likely to require additional bandwidth and some adjustments to the wireless infrastructure,” Kerravala notes. “It’s not as simple as swapping out 802.11n access points for an 802.11ac access points. The coverage patterns and interference patterns are different.”

### 802.11ac Product Intros
A number of vendors have already released 802.11ac infrastructure products. The list includes: Aruba Networks, Cisco Systems, D-Link and NETGEAR. NETGEAR 6xxx WiFi Routers are ac ready. For instance, Cisco’s 5760 Wireless Controller provides a robust platform designed for 802.11ac networks. The device is designed for mission-critical wireless networks and delivers maximum performance and services at scale, combined with high availability — for both converged access mode and centralized mode. Through the Unified Access Data Plane (UADP) application-specific integrated circuit (ASIC), it delivers comparable wire-speed performance with advanced quality of service (QoS), flexible NetFlow v9 and downloadable access control lists (ACLs).

Cisco has also introduced the Aironet 3600 Series access point, which provides advanced technology

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<td>Wider coverage with fewer dead spots</td>
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<td>More reliable</td>
<td>Ideal for media streaming</td>
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Source: NETGEAR

### KEY ADVANTAGES OF 802.11AC

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**802.11n 802.11ac (3x speed)**
Source: NETGEAR
support for 802.11ac. This includes adaptive radio modules that maximize flexibility for wireless infrastructures. Cisco’s 802.11ac Adaptive Radio Module is based on the IEEE 802.11ac Wave 1.

The D-Link Cloud Router 5700 also provides next-generation features. The device delivers up to 1,750Mbps using channel bonding — about three times faster than conventional routers — as well as other advanced features. It unleashes high definition streaming capabilities and enables an array of other high bandwidth interactive features. Meanwhile, D-Link’s Wireless AC Dual Band USB Adapter eases the conversion to the new technology by allowing individuals to connect existing notebooks and other devices to an 802.11ac network.

In fact, many organizations that have only a marginal need for higher bandwidth and faster performance today are likely to see the situation change during the coming months — as employees and others bring a greater number of their own devices into the enterprise. Others already operating large wireless networks — including airports, hospitals, museums, stadiums and other large institutions — can reap immediate benefits and avoid future congestion and problems, particularly as the number of smartphone and tablet users continues to rise.

The fast network speeds 802.11ac supports make it a viable alternative to conventional Gigabit Ethernet, Wardin points out. (See accompanying sidebar.) “As organizations move heavily into wireless environments, it doesn’t make sense to pull cables and wind up shackled by the limitations of wired connections,” he adds.

What’s more, properly installed and managed wireless technology offers security advantages over wired connections which may surprise IT staffs that believe Wi-Fi is less secure. “A user must authenticate and is potentially subjected to limits on access points, depending on how the network is configured,” Wardin says.

To be sure, the high reliability and flexibility of today’s wireless technology is radically changing the stakes for the medium- and large-sized enterprise, small- to medium-sized businesses (SMBs) and consumers. It is ushering in a new era of connectivity.

As the mobility revolution continues to unfold, 802.11ac will undoubtedly play a key role in supporting the infrastructure and bandwidth required for anytime, anywhere communication.
HIGH-SPEED 802.11ac WIRELESS: COMING TO A NETWORK NEAR YOU.

Ultrafast, extreme range Gigabit Wi-Fi may require some network tweaks.

According to the experts, moving forward with an 802.11n implementation is not a bad choice. This is particularly true because while ratification of the 802.11ac standard is expected later this year, from that point it can take a while before we see really robust products that take full advantage of the technology — going by the implementation of past standards.

What’s more, current 802.11n technology isn’t scheduled to be phased out until 2018. That will still allow roughly five years of use. And there is something to be said for taking advantage of the benefits and capabilities of technology that is currently available.

While the IEEE 802.11ac wireless LAN standard, said to offer more speed and range than 802.11n, isn’t ready for prime time today, strategic IT decision-makers will want to begin moving forward with some network considerations. Taking these steps now will allow for a more smooth migration to 802.11ac when the time is right.

Network Moves

There are a number of worthwhile upgrades currently on the table that should serve to improve wireless network capacity. This is especially important with the proliferation of mobility and the increasing use of smartphones and tablets in the workplace. What follows are a few action items to consider in preparation for 802.11ac.

1. Review the wired network. Don’t expect individual 802.11ac-equipped devices to exceed 500–megabit-per–second throughput anytime soon — the fastest three-stream 802.11n devices clock in at around 200Mbps. However, the potential for more data flowing through the network is clear. Conduct an inventory of all switches, routers, backhaul links and related infrastructure to identify needed upgrades before that first 802.11ac access point (AP) hits the network.

2. Consider backward-compatible operations. Because it may be awhile before plentiful choices of 802.11ac network adapters are available, many 11ac APs will operate in backward-compatible mode with 802.11n. (Keep in mind, 802.11ac is a 5GHz-only technology.) Most 11ac performance specifications call for the use of 80 megahertz radio channels, as opposed to the 40MHz common for 11n. Thus, operating new 11ac APs in 40MHz 11n mode should be essentially a drop-in with no disruption or adaptation required on the part of current users. These APs can be reconfigured to 80MHz channels when needed.

3. Review management and operations requirements. While 802.11ac is not expected to require wholesale replacement of WLAN controllers and management...
appliances or systems, advances in the functionality of these elements is likely. Begin with a review of current management solutions and overall wired and wireless network operations. Today, it’s possible to have a single point of control across both wired and wireless networks. And what new features or functions are desirable? What about assurance functions such as spectral analysis and intrusion detection and prevention?

4. Wait for enterprise–class 802.11ac solutions. Current 802.11ac offerings are mainly targeted at the residential and small business markets. If only one or two APs are required in a given location, these solutions can be quite valuable and inexpensive. But consumer-grade Wi-Fi products lack the advanced management, security and integrity functions essential in commercial and government deployments. Regardless, some organizations may want to use 802.11ac APs along with other Wi-Fi standards on the same network. Band steering, to steer 802.11n clients to the 5GHz band, is also an option.

5. Plan for capacity, not throughput alone. Some potential 802.11ac users believe that fewer 802.11ac APs will be required due to higher throughput and (likely) improved radio performance. But a shorter distance between endpoints of a connection yields better results. (Cisco recommends a 15 to 20 percent overlap of access point coverage.) What’s more, increasing demand from all those users with multiple devices will require more APs, not fewer. APs are inexpensive relative to the productivity of the users they serve, so a strategy of dense deployment continues to make sense.

6. Plan for gigabit switching at the network edge. The 802.11ac standard, in its first phase, will offer 600Mbps to 1.3GHz bandwidth. This is going to demand that the edge switching infrastructure can keep up with the data flow and 10/100 switching will be a hindrance. Add this upgrade in now as if doing an 802.11n upgrade. 802.11n offers bandwidth to the client up to 600Mbps. That means a 10/100 edge switch port can be a bottleneck in a secure wireless network.

7. Consider 10Gb from the edge to the core. Edge switch uplinks are recommended to have 10Gb interfaces to the data core. At the least, make sure uplinks can support some type of link aggregation protocol like LACP or EtherChannel. Aggregating links offering 2, 3 or 4Gbps to the core will provide better performance than a single gigabit link.

8. 10Gb interface required at switch core. Aggregation switches will need 10Gb links to accommodate the uplinks from the edge switching infrastructure. Backbone switches also need 10Gb interfaces. These are required to support the links from the aggregation switches and for connectivity with wireless controllers.

9. Radio Frequency (RF) designs require a 5GHz context. 802.11ac only offers high–performance benefits in the 5GHz spectrum. 2.4GHz will still be supported on access points, but the speeds will be comparable to 802.11n. This will mean AP density will be higher because the 5GHz wavelength is shorter and attenuates greater than 2.4GHz when transmitting through building materials such as plasterboard or wood.

Upside Potential
Building upon the success of 802.11n, now the predominant WLAN standard in the marketplace, 802.11ac shows a great deal of potential in advancing wireless speed, reliability and quality.

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