The Next Generation of Wireless: 802.11n for the Business

Overview

Businesses, users, and the communications industry as a whole have long anticipated the introduction of next-generation wireless networks enabled by the 802.11n standard. This new technology adds to the arsenal of existing 802.11 standards for wireless networking. As with most technology advances, the discussions surrounding 802.11n have been muddled by hype and confusion. Most of these discussions have focused on the 802.11n standard's ability to deliver significant leaps in performance, with transmission rates of up to 600 Mbps on wireless networks. But while 802.11n does offer substantial performance improvements, businesses and users need to understand the other important benefits of the standard, including greater link reliability and predictability.

Currently, the 802.11n standard is in draft format, which means there is still work to be done before the final version of the standard is ratified. However, as with most nascent standards and new technologies, users are anxious to augment their existing wireless networks to better support mission-critical applications through improved performance.

Some significant progress has been made with respect to solidifying the readiness of 802.11n technology. In March of 2007, the 802.11n draft 2.0 specification passed the IEEE 802.11n working group letter ballot, an important milestone on the path to ratification. In June of 2007, the Wi-Fi Alliance began testing and certifying 802.11n products based on the draft 2.0 specification. Cisco set the benchmark for testing as the only manufacturer to provide a commercially available access point for the test bed. While the standard is still in draft format, this early testing and certification by the Wi-Fi Alliance helps provide confidence for broader industry inoperability that products based on the draft standard comply with it. In addition to being the reference platform in the Wi-Fi Alliance test bed for 802.11n draft 2.0 products, Cisco is working closely with Intel and other client manufacturers to ensure a robust level of interoperability between wireless infrastructure and clients devices.

The Evolving Need for 802.11n in the Enterprise

To understand the need for next-generation wireless based on 802.11n, it is helpful to look at the evolution of wireless networks. While wireless technology began as a convenient way for mobile workers to stay connected while traveling, it has quickly become a "must have" for most organizations and a critical part of their overall network strategy. As wireless technology has improved in critical areas such as security, enterprises have begun deploying wireless more pervasively, throughout their organizations—not simply for business travelers and in-building mobile workers, but for the entire organization. Pervasive networks supporting more users and applications require a wireless network that can scale in performance by providing increased throughput while delivering greater reliability and predictability.

The primary drivers for 802.11n adoption include the following:

- **An increasing number of users with varying needs want wireless connectivity.** In addition to the mobile workers and business travelers who were among the earliest adopters of wireless technology, organizations must now use their wireless networks to

serve a wide variety of users with diverse needs. Employees in remote offices want to remain connected to their corporate networks; previously desktop-bound employees now want the ability to move throughout a building or across an enterprise campus during their workday and remain connected; and factory workers, hospital employees, and students on university campuses all need to remain connected and access critical information without sacrificing mobility. The increasing number of users is placing a greater demand on wireless networks, resulting in a need for higher throughput, along with greater reliability and predictability.

- **More mission-critical applications are being placed on the wireless network.** The convenience of mobility, coupled with the availability of robust wireless security, has led organizations in a variety of industries to use their wireless networks for more than just e-mail and Internet access. Hospitals use their wireless networks to store patient records and send radiology images. Universities use WLANs to administer tests, and manufacturing facilities use them to track inventory. Stock exchanges use wireless networks to conduct financial transactions in real time, requiring the utmost in availability. The wireless network is now considered just as mission-critical as the wired network. For this reason, reliability and predictability are paramount.
- **Businesses must support growing diversity in devices and guarantee backward and forward compatibility.** Along with the increasing number of users from all areas of the organization comes a wider variety of client devices that require connectivity to the wireless network. In addition to the usual laptops, wireless networks must now support PDAs, mobile e-mail devices, and increasingly voice-over-WLAN (VoWLAN) or dual-mode phones. To realize the full capabilities of many of these new devices, businesses are looking for a next-generation wireless network that can provide compatibility with existing and emerging wireless networks across any device.
- **Voice, data, and video are now converging on the wireless network.** Businesses have recognized the benefits of using their WLANs for video and voice applications. As the technology for voice and video over WLAN has improved, the cost benefits of combining voice and video with data over one network has proved to be compelling for many enterprises. The wireless LAN must be designed to be voice ready and to handle the resulting latency-sensitive multimedia applications while delivering reliable and predictable coverage.
- **Wireless technology is being used in more challenging RF environments.** Wireless technology is deployed in a broad variety of environments, including those that present significant challenges for RF communications. Among these are factory floors, retail warehouses, hospitals and university campuses. These environments require more reliable RF coverage to combat interference and multipath challenges.

All of these factors have contributed to the development of 802.11n. 802.11n promises to deliver many of the attributes necessary to address the increasing number of users, the proliferation of various client devices, the convergence of voice, data and video on the wireless LAN, the increase in mission-critical applications over the wireless network, and the trend towards deploying wireless in more challenging environments. With its promise of improved performance when compared with previous generations of wireless networks, it’s no wonder that enterprises and the industry at large have been captivated by the 802.11n discussion.

Building a Better WLAN with 802.11n

It's clear that 802.11n has much to offer enterprises in the areas of throughput, reliability, and predictability. However, it is important for enterprises to examine the specific ways in which 802.11n can enhance their wireless networks and to separate some of the hype from the facts. The following sections examine each of 802.11n's much-discussed benefits in greater detail.

Greater Link Reliability and Predictability

Although not as widely discussed as its throughput enhancements, the 802.11n standard's ability to provide improvements in link reliability and predictability is compelling and substantially enhances application performance. With more mission-critical applications riding on the wireless network than ever before, all enterprises have an interest in ensuring the availability and reliability of their wireless connections.

This is an area where 802.11n can truly offer breakthroughs in wireless networking. 802.11n uses multiple-input multiple-output (MIMO) signal processing that relies on multiple antennas and receivers to improve the reliability of the wireless link, decreasing the likelihood that packets are dropped or lost. The reduction of dropped packets improves the link reliability, and a more consistent throughput helps ensure predictable coverage at any point in the facility. This enhanced reliability and predictability extends to existing 802.11a/b/g clients in addition to emerging 802.11n clients, delivering substantial benefits regardless of the type of devices or the speed with which the business expects to conduct a device refresh. Furthermore, the advantages of MIMO extend to both the client and the access point. Because of its ability to negate the ill effects that building materials, free-space path loss, and multipath propagation all have on the radio frequency, the introduction of MIMO represents a fundamental shift in not just WLAN design, but more importantly in user expectations for performance..

Enhanced Throughput

Perhaps the most talked-about improvement made possible through 802.11n is its ability to increase the throughput on a wireless network. 802.11n has the potential to offer up to five times the performance of current wireless networks. For pure 802.11n environments, testing has shown performance enhancements that deliver transmission rates of up to 300 Mbps of bandwidth per radio. Dual-band radios, operating in both 2.4-GHz and 5-GHz bands, can deliver an aggregate of 600 Mbps. In a typical deployment, businesses will see a noticeable increase in the amount of bandwidth available per client. Testing has shown a single client could experience an increase of three to five times in the average amount of dedicated bandwidth. Features including 40-MHz channels, packet aggregation, and block acknowledgement deliver the throughput enhancements of 802.11n. Additionally, the improved signal resulting from MIMO enables clients to connect at faster data rates at a given distance from the access point compared with 802.11a/b/g.

The Cisco Unified Wireless Network—How to Bring 802.11n into the Enterprise

Although the benefits are clear, many enterprises are understandably concerned about adopting the 802.11n draft 2.0 prior to final ratification of the standard. Cisco® has taken measures to help ensure the investment protection of its customers. In addition to leading the IEEE standards process, being the benchmark against which all other draft 802.11n products are Wi-Fi certified, and conducting extensive joint interoperability testing with Intel and other client platforms, Cisco is delivering a flexible, modular architecture designed to be extensible to easily incorporate emerging wireless standards.

The Cisco Unified Wireless Network was designed with flexibility, modularity, and investment protection in mind. The Cisco Unified Wireless Network supports emerging technologies and is 802.11n-ready, eliminating the need for network redesigns.

The Cisco Aironet® 1250 Series Lightweight Access Point has a modular design allowing organizations to deploy 802.11n today, with the knowledge that the radios can be easily upgraded in the future, protecting their overall investment in wireless infrastructure. As mentioned, the Cisco Aironet 1250 Series is the only commercially available access point participating in the Wi-Fi Alliance's test bed to certify compliance with the 802.11n draft 2.0 specification. Cisco has conducted interoperability testing between its wireless infrastructure and client devices produced by Intel and other manufacturers to ensure optimal performance in an 802.11n wireless network. With Intel delivering the majority of Wi-Fi silicon into devices, this interoperability ensures Cisco infrastructure customers an optimal user experience. Such testing ensures interoperability not only between 802.11n clients and infrastructure, but more importantly between existing 802.11a/b/g solutions and emerging 802.11n products, thereby delivering seamless integration of this next-generation wireless technology.

The benefits of deploying 802.11n with a Cisco Unified Wireless Network extend from investment protection and future-proofing to better scalability and reliability of the enterprise network. As more users are added to the network and bandwidth consumption rises, enterprises can simply add more access points and controller capacity to scale the aggregate wireless throughput.

Summary

802.11n clearly delivers necessary advances and improvements in wireless networking. With the growing demands on enterprise wireless networks, including an increase in users, a wider variety of client devices accessing the network, more mission-critical and multimedia applications traversing the network, and wireless being deployed in more challenging RF environments, 802.11n delivers the next generation of wireless connectivity. To take full advantage of all that 802.11n has to offer, however, enterprises need to deploy the right wireless infrastructure—one that is not only 802.11n-ready but is flexible to adapt to technology changes, as well as new standards and services, with minimal impact to the network, its users, and the enterprise's bottom line. The Cisco Unified Wireless Network delivers the modular architecture required to implement 802.11n networks today, while ensuring a smooth migration path to future technologies and services.

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