IDC TECHNOLOGY SPOTLIGHT

Wireless Networking: The Promise of the 802.11ac Standard

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The explosion of mobile devices within the enterprise has introduced a new dynamic into the enterprise wireless LAN (WLAN) market. This market is rapidly evolving as enterprise IT and end users alike discover more possibilities and growth potential with enterprise mobility, communication and collaborative applications, and cloud services. The combination of technological, business, and organizational changes taking place is driving innovation across the entire mobility landscape and certainly within the enterprise wireless LAN infrastructure and access network market.

This Technology Spotlight explores the trends driving "bring your own device" (BYOD) adoption and the associated impact on enterprise-grade WLANs, especially as it relates to the emerging high-capacity 802.11ac WiFi standard. Besides highlighting the drivers and benefits of this new standard, the paper explores the difference between single-channel and multichannel deployment modes, as well as the role that Meru Networks' contextual architecture plays in addressing the need for next-generation WLAN infrastructure.

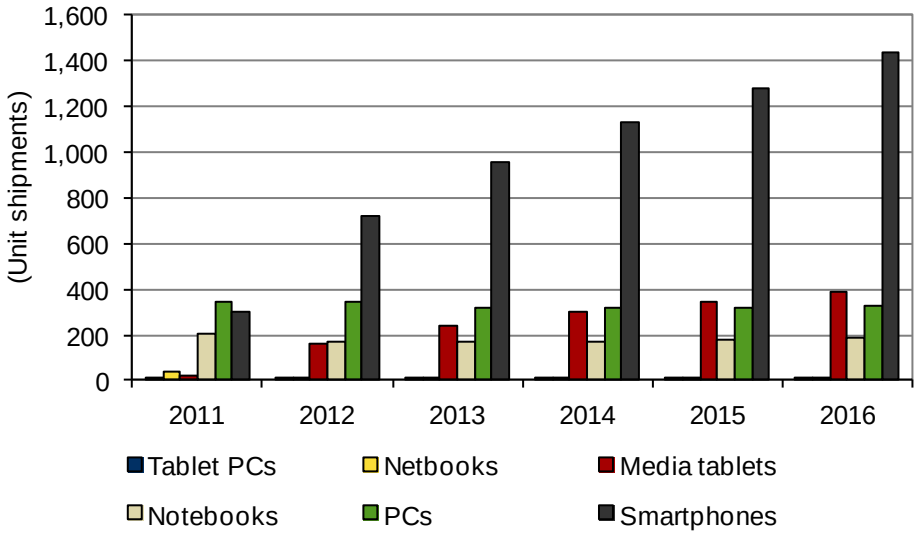
BYOD: The Next Phase

The BYOD phenomenon — also referred to by many as the "consumerization of IT" — shows no signs of losing momentum. But as this trend continues, IT managers are coping with the impact of increased wireless demands on their current network infrastructure. As new "smarter" devices are being brought into the enterprise, and in larger numbers, performance requirements are surpassing the capabilities of many legacy wireless networks that were originally designed to accommodate primarily low-volume traffic. In addition, many of these devices are increasingly running mission-critical business applications — many of which are latency sensitive — that require a resilient, scalable network infrastructure.

With this growth in mobile devices and the propensity of users to have multiple devices, enterprise IT departments are rethinking their long-term mobility plans to support users running rich media (streaming video and audio) and virtualized, cloud-based applications. While the introduction of these technologies creates opportunities and business benefits for employees and the enterprise itself, it potentially creates challenges for the IT organization. Specifically, the network administrator is now seeing application performance, reliability, and latency mitigation as key goals to enable and optimize the rollout of these business applications across a plethora of mobile devices (see Figure 1).

Figure 1

Growth in Mobile Devices Worldwide, 2011–2016 (M)



Note: The PCs category includes notebooks and desktops.

Source: IDC, 2013

This BYOD trend and its impact are evident in a number of IDC studies. For example, a recent IDC study found that, in 2012, 68% of enterprises were using BYOD to access enterprise business applications — up significantly from 45% in 2010. When this data is seen in the context of mobility becoming ubiquitous and enterprise employees using multiple, diverse devices, the capacity and scaling requirements become quite apparent.

Increasing Video, Unified Communications, and Client Virtualization

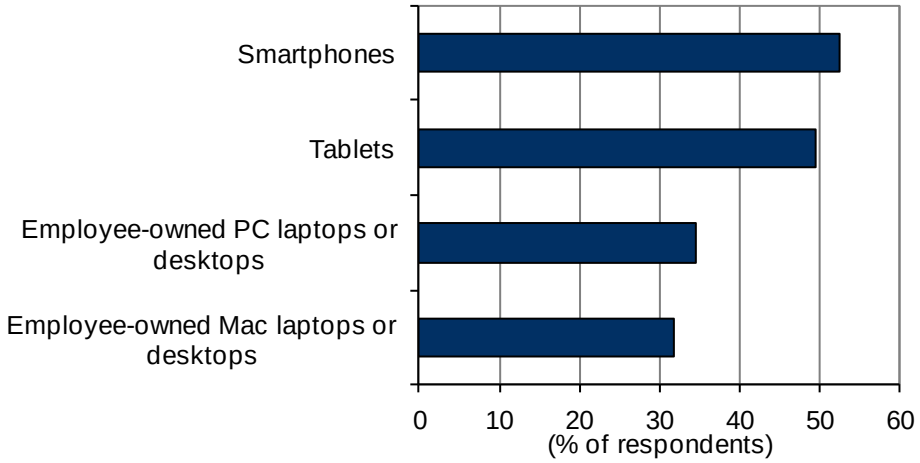
The use of video collaboration in the enterprise is starting to become nearly as prevalent as other means of communication such as email and, of course, voice communications. Consumers and businesses are making greater use of the Internet to access rich-content media, including streaming audio and video, as well as virtual desktop infrastructure (VDI) to host users' desktops within a centralized virtual environment. Collaboration services such as email, Web conferencing, and unified messaging now incorporate video. In a recent IDC survey, over one-third of all organizations reported that they currently use some type of video, such as desktop videoconferencing or telepresence, and one-third indicated that they plan to do so within the next one to two years.

VDI, also described as centralized virtual desktops, is another area that is seeing increased traction within IT environments, with the worldwide market expected to exceed $2 billion in 2013. One of the key factors influencing adoption is the cost savings that accrue via centralized administration and management of distributed systems and mobile endpoints. Automation of desktop upgrades certainly provides a compelling argument, but the security and reliability of IT infrastructure are also driving IT to take another look at client virtualization in conjunction with mobility. Figure 2 shows client virtualization as a technology that spans a spectrum of wired and wireless devices within an enterprise.

Figure 2

Business Support for BYOD Client Virtualization

Q. Which of these devices, if any, does your organization support or plan to support with client virtualization?



n = 202

Source: IDC's Virtual Client Computing Multiclient Study, 2012

Coupled with these significant changes, user expectations have also changed with the consumerization of IT, as instant access to mobile consumer apps on users' smartphones has helped create similar expectations for access to mobile applications within the work environment. Essentially, with a focus on WiFi as a primary access network technology, these recent trends have created new requirements with regard to capacity and density of the enterprise WLAN network, which now must be able to handle the following:

- The explosion in mobile devices, creating the need for handling capacity and density
- Increased WiFi spectrum interference, especially in the 2.4GHz band
- Latency-sensitive voice, video, and VDI applications
- Mission-critical business applications with improved robustness and resiliency
- Application prioritization to ensure optimal user experience via a contextual policy approach
- Spectrum challenges with WiFi to support BYOD

The current WiFi standard, IEEE 802.11n, has become the de facto industry standard over the past many years. When ratified in 2009, it had several significant enhancements to its credit, mainly improved reliability and the use of wider 40MHz channels along with a multiple in, multiple out (MIMO) architecture to augment wireless capacity and throughput. While wider channels and MIMO allowed clients to support aggregate (theoretical) bandwidth up to 450Mbps using three spatial streams, their use in a high-capacity mode was mostly limited to higher-end laptops and similar devices. The vast majority of smartphones and tablets were still being largely built using single- and two-stream wireless capabilities, key considerations being power and cost.

Another key consideration was the continued use of the 2.4GHz band for most wireless rollouts, which limited its deployment to three nonoverlapping channels. This was a legacy that had carried over from the earlier days of WiFi when 802.11g was the dominant standard for deployment, while 802.11a, with many more nonoverlapping channels in the 5GHz band, saw relatively less uptake and fewer deployments.

Drivers and Benefits of 802.11ac

Until recently, most consumer devices, including smartphones, have typically supported single-band WiFi with 2.4GHz (with support for only three nonoverlapping channels). As these devices have proliferated, many enterprise networks have experienced issues relating to network congestion as well as interference. Some network managers therefore have moved their dual-band devices (such as laptops) to operate using 5GHz spectrum, thereby alleviating some of the congestion issues with 2.4GHz. Another solution often used is to deploy WLAN and controller architectures that have the intelligence to dynamically handle spectrum-related issues to optimize WiFi workloads.

The push for continuous improvements in capacity, bandwidth, and network robustness and the need to leverage the 5GHz band with its inherent benefits have driven standards bodies such as IEEE and industry groups such as the Wi-Fi Alliance to move quickly to the next evolutionary step in WiFi innovation — 802.11ac. WiFi silicon vendors have responded quickly, and several consumer and enterprise-grade versions of chipsets are now shipping.

Sometimes referred to as "Gigabit WiFi," 802.11ac is now being widely acknowledged by industry pundits and technology evangelists as the next frontier in broadband wireless — one that will further narrow the differences between wired and wireless in enterprise networks. As a testament to the certainty of a fairly rapid transition to this standard, as well as the battery-preservation benefits from moving to higher performance (i.e., requiring less time while transmitting or receiving), major mobile device brands including Samsung and Apple are now incorporating 802.11ac capabilities into their smartphone and tablet portfolios. Going forward, every WiFi-enabled mobile device will most certainly support this new WiFi standard.

Key enhancements in 802.11ac include:

- Wider channels with 20MHz, 40MHz, and 80MHz being mandatory and 160MHz being optional (although some vendors recommend staying with 40MHz to minimize interference)
- Improved modulation resulting in increased bandwidth/capacity
- Increased number of spatial streams — up to eight total, up to four per client
- Multiuser MIMO (This capability will be available in the second phase of .11ac, which is expected in 2014.)
- Beamforming to increase effective range/coverage while providing interoperability

The emerging 802.11ac WiFi standard promises increased bandwidth and improved resiliency that will benefit end users across a number of enterprise use cases. Whether due to the need to support advanced imaging devices in healthcare or video delivery to a connected classroom in education, end users' increasing data demands will quickly elevate .11ac from a "nice-to-have" dream to a "mission-critical" reality.

However, there are still some areas of uncertainty with regard to broad-based rollouts of 802.11ac. One issue is that the standard is not yet ratified by IEEE; ratification is expected in late 2013 or early 2014. This is no different from what transpired with 802.11n shipments that started a few years before the standard was ratified in 2009. Given the current ratification timeline, minimal changes, if any, are expected in the final standard, and they could be incorporated into .11ac deployments that happen in the interim.

Further, the Wi-Fi Alliance has confirmed plans to begin certifying 802.11ac products this summer, which should eliminate any interoperability risks. The second potential issue to be aware of is around the availability of nonoverlapping channels with the wider, higher-throughput 80MHz and 160MHz channels. As Figure 3 indicates, there are a limited number of channels with/without DFS, and that's a factor to be closely looked at when evaluating various WLAN solutions in terms of their ability to maximize wireless performance with minimal co-channel interference.

Figure 3

Channel Bandwidths with and Without Dynamic Frequency Selection in the United States and Europe

	Including DFS		Excluding DFS	
Channel Size	**United States**	**Europe**	**United States**	**Europe**
40MHz	8	9	4	2
80MHz	4	5	2	1
160MHz	1	2		

Source: IDC and IEEE, 2013

Another concern with 802.11ac revolves around the issue of deploying first-generation .11ac platforms versus waiting for second-phase platforms that will incorporate multiuser MIMO. Yet another issue to be considered by enterprise IT is that some 802.11ac solutions will require PoE+ (802.3at), as opposed to standard PoE, and in some environments that may mean wired infrastructure upgrades. For IT/network managers with valid use cases around the benefits of 802.11ac, IDC recommends a transition to 802.11ac for new deployments, as well as network upgrades to .11ac as an overlay on existing networks. In any event, it is important for IT to plan a gradual transition to 5GHz deployments while supporting 2.4GHz as these clients are expected to be around for at least the next three to five years.

Regardless of some initial uncertainty around 802.11ac, the underlying drivers behind video, virtualization, and mobility will increase bandwidth demands — and that makes a strong case for 802.11ac. In addition, enterprises need adaptable, robust, easily deployed wireless LAN solutions as more enterprise users (employees, contractors, and guests) are accessing the network using smart mobile devices running bandwidth-hungry applications. Thus, WLAN architectures not only will continue to be relevant but also will become more important as they provide a comprehensive, context-based policy that can help optimize how applications are delivered to mobile devices. Incremental capabilities that add intelligence to the network, such as the ability to optimize RF for specific user/device/application requirements, are used increasingly in many solutions as a source of differentiation. In that context, 802.11ac needs to be looked at as part of the overall solution and the value it delivers to IT and network infrastructure.

Given these business drivers and benefits, it is clear that the new 802.11ac standard has been defined with the promise of delivering significant increases in bandwidth while improving the overall reliability of wireless in the enterprise. Despite some worries about hardware upgrades and spectrum-related issues, the benefits of 802.11ac look to far outweigh the costs.

Considering the Meru Networks WLAN Portfolio

Meru Networks, one of the first vendors to fully implement the 802.11n standard, has grown rapidly over the past few years. Focused on the enterprise WLAN market, Meru envisions an all-wireless enterprise leveraging an increasing number of mobile devices without traditional Ethernet capabilities. Its channel-stacking "Virtual Cell" technology allows all of the access points (APs) to operate off of one wireless channel while mitigating the traditional issues of co-channel interference found in multichannel microcell architectures. Meru's solution, which is appropriate for enterprises of all sizes, focuses on medium-sized to large customers.

Meru's virtualized RF technology and single-channel architecture does have an inherent advantage with the migration to 802.11ac, with its ability to provide pervasive coverage for both 2.4GHz and 5GHz environments. Due to Meru's single-channel architecture approach, the company intends to leverage, at the outset, wider 80GHz channels in the new 802.11ac standard to deliver higher-capacity wireless LAN solutions suited for best-in-class voice/video/unified communications and VDI applications.

Meru Networks offers 802.11ac support via the new AP832 access point, which is implemented as a *FLEX* Access component of the company's Mobile*FLEX* architecture and part of Meru's Air Traffic Control. The AP832 is a high-performing 802.11ac access point, capable of supporting two concurrent 5GHz 3x3:3ss radios, designed for high-density deployments in large offices, schools, universities, hospitals, hotels, and large retail stores. The AP832 supports up to an aggregate 2.6Gbps data rate for the most demanding business applications such as video and voice. It offers full performance using standard 802.3af PoE.

The AP832 access point, like all APs in the Meru portfolio, is designed to allow administrators to prioritize applications to improve the user experience using Meru's context-aware layers technology. The AP832 also provides network mobile roaming support. Also, like other Meru access points, the AP832 integrates with the company's E(z)RF network management system, Identity Manager, and additional application solutions to provide intelligent management and resilient wireless services to the network.

Meru's WLAN solutions are available globally with particular strength in education (K–12 and higher education), healthcare, and hospitality, although the company has significant deployments across other enterprise segments such as manufacturing and retail. Meru also has strong ecosystem partnerships — especially in VoIP, asset tracking, and other vertical-specific applications.

Challenges

While Meru's WLAN solution does have key inherent advantages, especially as enterprises transition to a 5GHz environment with 802.11ac, a challenge for Meru is educating customers about the differences between its unique Virtual Cell architecture and typical multichannel solutions. Enterprises that are not fully aware of Virtual Cell's advantages may have misgivings about the architecture's uniqueness and its ability to address the common problem of co-channel interference. To this end, Meru needs to redouble its efforts to educate the market about this key point of differentiation and its value proposition of contextual channel layering to optimize application delivery.

Conclusion

Mobility applications in the enterprise will continue to proliferate, whether they are tools for collaboration or more broad-based business applications that make the mobile device itself an information portal for data collection and business operations. In light of these broader mobility trends and application rollouts in the enterprise, a high-performance and reliable WLAN infrastructure is an important component of an organization's overall networking strategy.

As enterprise IT stays focused on improving its WLAN infrastructure, it is rapidly rolling out larger WiFi access point deployments to meet the need for additional wireless bandwidth and performance. The new 802.11ac standard is another tool that is now available at its disposal — one that promises to deliver more bandwidth while also improving the reliability of wireless connections.

Meru's WLAN portfolio gives enterprises seeking to upgrade their wireless network to 802.11ac an option to benefit from its single-channel Virtual Cell architecture to address potential spectrum or bandwidth issues. If Meru can address the challenges highlighted in this paper, IDC believes the company has a significant opportunity for success.
