

## *Voice over Wireless LAN*

### **Introduction**

Companies are rapidly adopting Wireless LAN (WLAN) technology. IDC, for example, projects that worldwide shipments of WLAN technology will have a compound annual growth rate of 28.4 percent through 2009.

WLAN technology is taking off because of the company-wide productivity benefits it provides. Giving workers greater flexibility to access the corporate network without being tethered to the network by a wire, means that workers can access and contribute data far more quickly than before, boosting the productivity of all other workers who depend on critical information and, hence, increasing the overall agility of the organization. In addition, WLANs make it possible to more easily offer new applications, such as secure guest access to network resources. Such access can benefit many in the workplace, from temporary consultants for a financial audit, to parents needing to stay in contact with their professional lives while waiting by the hospital bedside of an ill or injured child.

Meanwhile, Internet Protocol (IP) telephony or Voice over IP (VoIP) is also gaining popularity as a way to implement business communication anywhere, any time. More than 40 percent of North American enterprises have deployed VoIP or are in the process of doing so.

The marriage of WLAN and IP telephony technologies is Voice over WLAN (VoWLAN), which enables voice communications throughout a corporate campus or other facilities served by a WLAN.

The number of companies using VoWLAN is expected to triple between 2005 and 2007, according to Infonetics Research, with 10 percent of companies already using VoWLAN technology and 31 percent of companies expecting to do so. Infonetics cites the greater availability of handsets and infrastructure for the technology, as well as the use of voice applications to justify and spur adoption of WLANs. “The perfect storm is brewing” for VoWLAN adoption.

This Tutorial explains The business benefits of VoWLAN technology, the relevant technologies and standards and their evolving nature.



### **Business Benefits of VoWLAN Technology**

Expectations for mobility are on the rise throughout the business world. Employees who already enjoy wireless e-mail and wireless intranet access to corporate resources are ready to enjoy that access through mobile devices that enable real-time communications anywhere employees may be in their organization's facility or campus. Many observers see VoWLAN, which can enable that access, as one of the major new applications for WLANs. The productivity boon from VoWLAN—which helps to ensure that workers can always reach and be reached by their colleagues when needed, especially when they're away from their desks—is substantial.

In theory, cell phones should already provide the anywhere-connectivity benefit of VoWLAN. But many enterprise facilities experience cell interference or poor interior coverage, making cell phones unreliable and impractical. Meanwhile, for the organization, VoWLAN also means avoiding or minimizing the expense of cell phones and per-minute or per-month charges. Companies can leverage their existing WLANs and IP telephony infrastructure—and boost their ROI in those technologies—by adopting VoWLAN. Alternatively, companies that lack one or both of these enabling technologies can use the productivity benefits of VoWLAN as an additional reason to justify their adoption.

Another factor driving adoption of VoWLAN and increasing its benefit to the organization is the convergence of technologies on the client device. Mobile devices already have access to the WLAN as well as the ability to support both voice and data on a single handheld device. Organizations contemplating a move to such converged mobile devices from other mobile platforms, like DECT or proprietary cordless phones, will find the business benefits of VoIP another compelling reason to make that move. For example, VoIP enables the use of intuitive graphical interfaces, so users are freed from having to reference PBX cheat sheets or to enter non-intuitive, even cryptic, key sequences on legacy phone pads to access special phone features. As a result, users are more productive.

By adding a wireless capacity to VoIP, VoWLAN technology extends the benefits of applications such as presence, find-me follow-me, unified messaging, and push-to-talk to the wireless environment. It has particular application in several key vertical markets, including healthcare, retail, and education.

**Healthcare** - Because VoWLAN gives hospital workers immediate access to each other and to their patients, the productivity benefits of the technology translate into improved



patient care. The time lag inherent in paging systems is eliminated, so doctors can immediately give potentially life-saving instructions or reduce the time it takes to arrive at a patient's bedside. Nurses can be more productive as well, giving or receiving instructions and resolving issues about patients without having to return repeatedly to the nurses' station. These benefits are especially critical in the emergency room or trauma center, where every second's delay in communication can have life-threatening consequences. In addition, many healthcare facilities restrict or disallow the use of cellular phones, due to concerns over interference with medical equipment. VoWLAN provides for a way to provide real-time communication for healthcare personnel when cellular communication is prohibited.

***Retail***—Better, faster, more satisfying customer service is the bottom-line benefit of enabling retail employees—from store clerks and associates to managers—to be in touch anywhere in the retail environment. Store associates and other employees can respond to customer requests anywhere in the store, without having to find a telephone or a manager. Managers, in turn, can play a more active role on the retail floor, and be more available to employees and customers, without having to miss the calls they would take from their desks. VoWLAN can also enhance the effectiveness of site security and inventory personnel.

***Education***--VoWLAN enables real-time communications throughout a school campus, including classrooms, assembly halls, lunchrooms, and outdoor athletic fields. As a result, educators and school staff can communicate immediately with each other, with first responders, with parents, and others as needed, while maintaining supervision over students. Messages—both voice and text—can be sent without the intrusion and distraction of public address or paging systems. School administrators gain the flexibility to communicate to specific teachers and staff or simultaneously to the entire school population. Teachers can communicate directly with parents during the school day to address problems as they occur.

### ***A VoWLAN Technology Primer***

Companies contemplating a move to VoWLAN may understand the business benefits but they also need to understand how they can address issues regarding the technology, such as the ability to deliver toll-quality voice in a reliable and secure fashion. Here's a look at key concepts in VoWLAN technology.

Wireless LAN security used to get bad press due to the effectively now-obsolete Wired Equivalency Privacy (WEP) security scheme. Researchers quickly discovered that WEP was



insecure and vulnerable to eavesdropping because of its weak keying scheme and poor vector initialization. The widely available IEEE 802.11i security specification has addressed the need for heightened wireless security through robust authentication, encryption, and key rotation schemes to deliver enterprise-class security to protect all network resources and keep them safe.

Internet protocols and Ethernet LANs were designed primarily for relatively bursty, asynchronous data traffic. As a result, the latency and jitter associated with the transmission of data packets have not been major issues, because they rarely create a noticeable impact in applications like e-mail and Web browsing. Voice transmission, in contrast, requires a steady stream of audio packets to satisfy the user. Excessive packet loss and jitter will result in voice quality degradation with noticeable gaps in the audio stream—similar to the poor voice quality experience when talking on a cell phone with weak signal strength.

Since real-time voice and video traffic is delay-sensitive, network impairments like delay, jitter, and packet loss can adversely affect the quality of the application. A high-quality converged network must be designed and configured with quality of service (QoS) end-to-end to ensure that voice quality is maintained and video runs smoothly. The challenge for implementing wireless voice applications is even higher, since available over-the-air bandwidth is more limited than in a hardwired environment.

In order to provide predictable voice quality over a WLAN network, SpectraLink Corporation has developed a de-facto industry standard QoS mechanism called SpectraLink Voice Priority (SVP). It is implemented in wireless phone handsets, wireless access points, and SpectraLink servers. This IEEE 802.11-compliant mechanism minimizes latency for voice transmission by providing priority queuing for voice packets over data packets and increasing the probability that all voice packets are transmitted in a predictable and timely manner. In addition to priority queuing, the enhanced access points and phone handsets transmit voice packets using a zero backoff interval in a coordinated fashion, thereby eliminating the random contention based transmission delays that can have an adverse effect on voice traffic for solutions without QoS.

The SpectraLink VIEW (Voice Interoperability for Enterprise Wireless) Certification Program is a strategic program designed to guarantee interoperability and ensure superior



voice quality between wireless LAN infrastructure equipment and SVP-compatible Wi-Fi telephony client devices available from many leading manufacturers. In addition, SpectraLink VIEW-certified products must meet enterprise-grade performance criteria for voice quality, security, capacity, and seamless roaming. For optimal wireless telephony performance, it is best to deploy solutions that have passed the rigorous SpectraLink VIEW Certification. Several emerging wireless standards are further enabling VoWLAN implementation. For example, the IEEE 802.11e-2005 ratified specification for wireless QoS enhancements includes packet prioritization, scheduled access, and call admission control. Eager to spur interoperability among multi-vendor wireless gear, the Wi-Fi Alliance created a certification process on a subset of 802.11e called Wi-Fi Multi-media (WMM). WMM provides four categories of relative QoS: voice, video, best-effort and background. Wi-Fi Alliance-based certification, including WMM, is supported by many leading wireless vendors.

Another requirement for seamless VoWLAN solutions is “fast roaming”—with no dropped calls and audio degradation—as users move from access point to access point across a large area. Fast roaming minimizes the time it takes to associate and authenticate to a new access point by caching the user’s security credentials, in effect “pre-identifying” the user to the new access point and eliminating the need—and costly overhead—for the user to be authenticated. The result is that the user roams more effectively, without the latency that could impact a voice call.

Today, fast roaming is accomplished through proprietary techniques. A proposed IEEE specification for fast roaming—IEEE 802.11r—is currently under development and is expected to be ratified in Spring 2007.

Finally, customers may have concerns about whether VoWLAN phones are compatible with, and can meet the regulatory requirements of, Emergency Call Services (ECS) such 911. In the U.S., Enhanced-911 provides ECS operators with the physical location of a caller's phone, to improve emergency responsiveness. VoWLAN phones used in enterprise environments, which are not subject to cellular telephone locationing requirements, are treated like any other wired extension on a corporate telephone system. The administrator programs location information for phones (both wired and wireless) into the traditional PBX or IP PBX for downloading to the local telephone company's Automatic Location Information (ALI) database and updates the information whenever the primary location of the telephone is changed.



Since wireless phones are identified with the locations stored in the ALI database, users should be cautioned not to use VoWLAN phones for ECS calls when the phones are outside their primary facility.

### ***Summary***

Organizations are moving rapidly to adopt VoWLAN solutions to enhance business communication and boost employee productivity while leveraging their existing investment in WLAN and VoIP infrastructures. To ensure that those moves are successful, businesses require solutions that can provide the necessary reliability, enterprise-class security, and QoS requirements to ensure even the most demanding applications, like wireless voice and video, run smoothly. But while voice and video traffic need preferential treatment, the organization will benefit by using a single, comprehensive management system for its entire network—voice and data, wireless and wired—to reduce the time and operational cost to manage and provide consistent service to employees regardless of where they are in the network or how they are connecting to it.