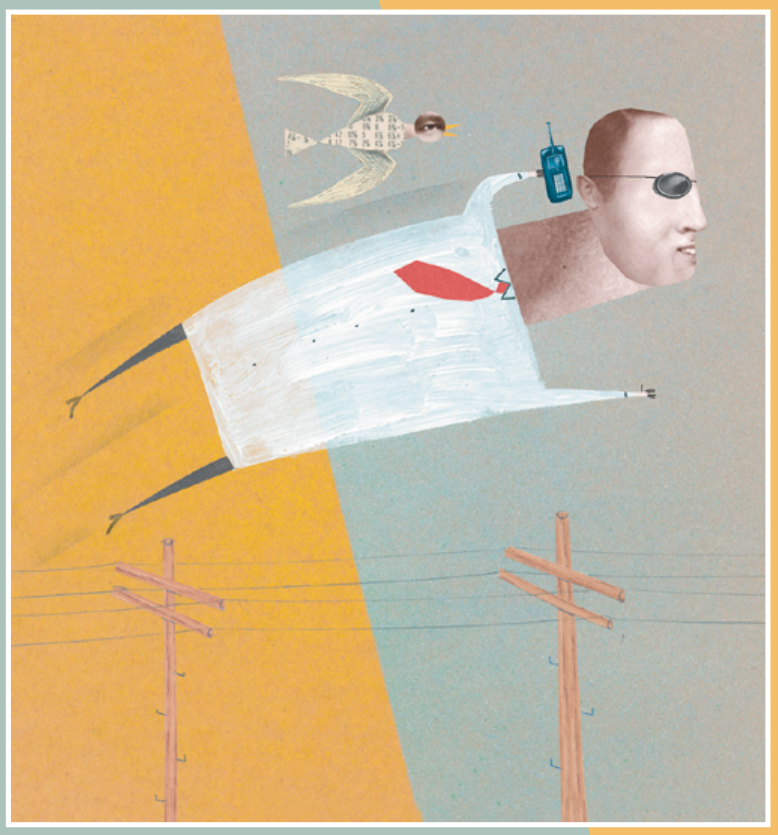


Portable office phones have instant appeal, but high costs and connectivity issues may favor gradual deployments

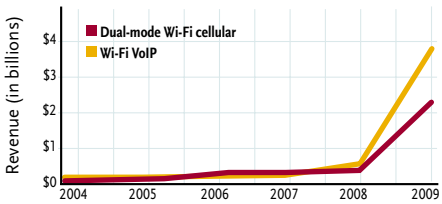
VoIP without Wires

ILLUSTRATION BY DAVID PLUNKERT

THE BASIC BUSINESS PHONE CAN BE A REAL PAIN. You're not at your desk all day but your phone is, so callers get voice mail, everyone plays phone tag, and critical conversations get delayed. Callers try your cell phone, but if reception in your building is spotty, you miss the call.

BY GALEN GRUMAN

Projected Global Wi-Fi Sales



SOURCE: INFONETICS RESEARCH

Why can't your office phone go with you as you move throughout your building or across campus? In fact, it can. The convergence of two rising technologies within the enterprise makes the office phone portable: VoIP telephony and 802.11 wireless LANs.

Chances are that your enterprise is keeping a close eye on these trends. It's probably considering replacing analog PBX phone systems with VoIP, and it just might be considering adding wireless LANs to support mobile devices within your building or campus. So why not combine the two? IT is well aware that it can work together to carry voice traffic over a wireless LAN so that mobile staff, such as maintenance workers, executives, and HR reps, can make all their calls anywhere within the facility while avoiding pricey cell phone service.

At first glance, the combination seems like an easy fit, but adding voice to wireless LANs demands strategic thinking and a unique implementation strategy. The reality is, costs are steep and deployment is complex.

"A wireless LAN for voice costs about double what a data-only one costs," notes Gartner analyst Ian Keene, although he expects the cost to decline over time. Because VoIP and 802.11 technologies are relatively immature, many businesses are reluctant to commit a critical communications infrastructure to them until they have proven themselves. What's more, enterprises that have recently invested in a telecom infrastructure won't be compelled to replace it until the current investment becomes obsolete. Traditional enterprises mostly view voice over wireless as something to explore for future use.

Nevertheless, many businesses are moving to wireless VoIP. They tend to be in highly mobile industries, such as

Add-On Server Routes Calls and Manages Voice Traffic

VOICE OVER WIRELESS REQUIRES MORE THAN WIRELESS handsets and a wireless LAN. There also needs to be a telephony server to manage the voice traffic.

The telephony server can replace or be added to a PBX, the central routing mechanism for today's phone systems. Most PBX makers — such as Avaya, Mitel Networks, Nortel Networks, and Siemens — provide IP telephony servers or switches that plug into their PBXes. This usually provides the same PBX features to VoIP users that PBX users get, including call forwarding, internal phone directories, internal extension-only quick dialing, and voice mail. The add-on server or switch connects to the enterprise's network (wired or wireless) and routes calls within the network, as well as between the network, and the PBX.

In an all-IP telephony system, there is no PBX. It's replaced completely by a telephony server that handles all the calls, both internally and externally. Cisco Systems, 3Com, and a raft of smaller companies offer such pure-play IP telephony servers. (Some are designed for small businesses, whereas others are for large enterprises.) They also offer typical PBX features such as internal directories and voice mail, but they usually also allow you to integrate faxes, calendars, and address books, because these are all available over the network. (Perhaps you recall the promise of unified messaging about six years ago? This is that same technology, but it has now found a more viable outlet, notes Gartner Analyst Ian Keene.) Such systems also let you program your call responses, so certain people (such as your boss or spouse) might be forwarded to your cell phone during staff meetings and others are routed to voice mail.

You can also set alerts, which are transmitted over e-mail or BlackBerry devices, based on who calls and when. For example, the on-duty overnight IT staffer would be sent the numbers of all help-desk callers only on his scheduled overnight periods.

Whichever type of hardware you use, it's critical to upgrade your network to support VoIP, Keene says. "VoIP affects the whole network infrastructure," requiring support for QoS for the streaming of voice traffic to ensure voice quality as well as sufficient bandwidth for the added traffic, he notes.

Furthermore, companies that deploy VoIP should be sure to have a backup power and a backup communications system that includes cell phones in the event of network or power outages, advises Scott Haugdahl, CTO of wireless LAN provider WildPackets. Unlike analog phones, VoIP requires both power and an operational network to handle calls. — *G.G.*

> "When you try to do a sparse grid [of access points], you tend to run into problems."
>
> — Rohan Mahy, Airespace

hospitals and warehousing, and typically are replacing their entire telecom infrastructure, says Ben Guderian, director of strategic marketing at SpectraLink, a provider of voice-over-wireless handsets.

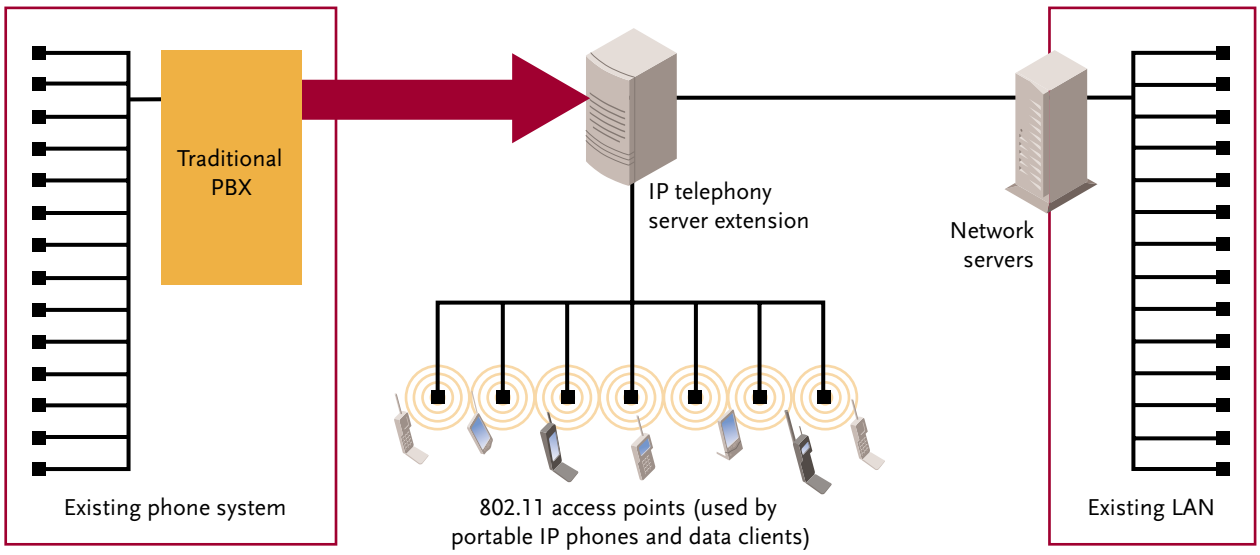
Simple Idea, Complex Execution

The technology behind voice over wireless — varyingly referred to as wireless IP telephony, wireless VoIP, and Wi-Fi telephony — is straightforward. Mobile handsets connect to the network over wireless access points, routing the voice traffic to the telephony server or digital PBX in the same way that VoIP handsets connect to the network over Ethernet cables, routing their voice traffic to the telephony server or digital PBX (see "Add-On Server Routes Calls and Manages Voice Traffic," page 48). That apparent simplicity is why many enterprises consider implementing voice over wireless when they implement a VoIP system, Keene notes. Chances are they're also deploying wireless access points for data usage, so they believe that most of the infrastructure required to make VoIP mobile is already in place. "On the face of it, it looks like a no-brainer," he says. But in reality, IT faces several deployment hurdles.

- Wireless LANs for voice require denser access-point placement to reduce contention for the access point's bandwidth and require deployment in areas like hallways, elevator shafts, and facilities service areas in which data usage would not occur. That means greater hardware and installation costs.
- The number of simultaneous calls over an access point is limited to anywhere from four to two dozen, depending on the wireless LAN's implementation and architecture, as well as actual usage.
- Users can experience interruptions or even dropped calls due to contention for access points.
- Wireless handsets cost about $300 to $400 each.
- Wireless LAN deployments tend to occur before VoIP deployments, so enterprises must overengineer their

Expanding Your PBX

Most PBXes allow you to plug in a VoIP server, thereby granting you the capability to add VoIP lines while retaining your existing phone system. By connecting wireless access points — often on their own LAN segment — to that VoIP server, wireless phones will be capable of tapping your telephony network. If you support data over wireless, wireless phones will also be capable of connecting to your Ethernet network and thus to the servers and other resources on it.



NANCY SUESS

wireless LANs to accommodate future VoIP deployments.

Despite these challenges, many organizations are claiming success and sufficient ROI to justify the move. For example, the John C. Lincoln Hospital in Phoenix saves about $50,000 annually in cell phone costs, which paid back its voice-over-wireless deployment costs in less than a year, says Colleen Sharneck, vice president of patient care. (The hospital used to equip charge nurses with cell phones so they could always be reached and readily talk to other medical staff.) And it's not just hospitals. "Many enterprises see 30 percent of their cell phone use in-building," notes Kamal Anand, vice president of sales and marketing at wireless LAN provider Meru Networks.

Planning for Contention

Even when the ROI is compelling enough to justify voice-over-wireless deployment today, there's important strategic thinking that IT must do before implementing the technology.

The biggest technical issue in deploying voice over wireless is dealing with contention. Although wireless networks can provide 5Mbps or more of sustainable bandwidth, their access points don't dedicate a circuit within that bandwidth to each device. Like any Ethernet-based device, the access point takes in packets as they arrive, no matter the source, and the recipient then recombines them to get the message or file. For streaming media, such as voice and video, this approach can lead to dropouts and even dropped calls if the voice data keeps losing out to other access-point requests — even if the full bandwidth is not being used.

This is complicated further by the fact that access points have multiple radio channels, which helps avoid interference with neighboring access points. In case of interference from a neighbor in a specific channel, an access point will simply switch traffic to a different channel. The client devices will use whatever access point provides the best signal, so they will either change channels as well or move to another access point, both of which introduce other delays.

"If you have 20 to 30 clients, you lose much of the wireless LAN's bandwidth to contention," Meru's Anand notes. The popularly deployed 802.11b and 802.11g wireless networks have three nonoverlapping channels, reducing the chances that dense wireless networks can avoid channel-switching. The less-popular 802.11a networks have 12 channels.

Analyst Keene says each business will experience a different maximum number of simultaneous calls based on the environment, network architecture, wireless engineering, and type of concurrent data usage. "There is no standard approach, so companies should investigate the vendors' capabilities carefully," he advises.

"There is a lot of art to this," concurs Steve Renda, vice president of marketing and corporate development at wireless LAN provider Vivato. He says Vivato's phased-array access points allow as many as 18 simultaneous voice connections. "In a standard environment, you can support 20 simultaneous calls per access point," says Brent Lang, vice president of marketing at Vocera Communications, which makes wireless communication badges.

Enterprises may not experience such high access rates, analyst Keene notes. "The biggest issue is coverage. They haven't done effective site surveys." Inadequate coverage means more contention for the access points you do deploy and thus less real-world capacity.

Rohan Mahy, voice architect at wireless LAN provider Airespace, agrees: "With a dense grid [of access points], you are not going to see a problem with capacity. But when you try to do a sparse grid, you tend to run into problems."

Raw access rates aren't the whole story. Just as in analog telecommunications, enterprises looking to deploy voice over wireless need to make some probabilistic calculations to predict their call usage, SpectraLink's Guderian says. In his experience, 12 simultaneous calls usurp 70 percent of an access point's capacity, but the AP supports 50 to 60 users, because typically only one in five employees is on the phone at any given time. In a help desk or call center, that ratio may be higher; for other types of users, such as a hospital's medical staff, it will be lower.

For example, the HP Pavilion sports arena in San Jose, Calif., anticipated its demand per access point would rarely exceed one call at a time, says systems administrator Joe Lee, so the IT group knew it could rely on voice over wireless. The organization needed the events staff and executives to have access to data anywhere in the stadi-

> "A wireless LAN for voice costs about double what a data-only one costs."
>
> — Ian Keene, Gartner

um and decided to also implement voice services so staffers could more easily stay in contact without running up cell phone bills or contending with intermittent cell coverage within the facility, says Jim Goddard, the arena's general manager.

Planning for Roaming

Problems often occur when users roam from one access point to another. To ensure that only authorized users are on the network, access points are usually set to authenticate devices as they connect, even if they were previously authenticated by another access point. This authentication can take several seconds if the enterprise is using industrial-strength technology such as IEEE 802.11i or LEAP (Lightweight Extensible Authentication Protocol) authentication. Authentication can cause a call to drop; at best, it interrupts the conversation for too long.

Vendors typically get around that by deploying WEP, which is easily hacked and not appropriate for data security. The more secure WPA (Wi-Fi Protected Access) authentication requires a two-second authentication as users roam between access points, notes Vocera's Lang. With the even better IEEE 802.11i authentication, enterprises can minimize disruption by using preshared keys among access points, so the authentication request does not have to travel to a policy or authentication server, says Airespace's Rohan Mahy.

Another workaround is to use lightweight access points that don't require reauthentication during roaming, because they are all managed by a central controller that needs to authenticate just once. Meru Networks provides such a solution, but it requires the exclusive use of Meru hardware rather than permitting a more flexible multivendor deployment.

Because 802.11i has only been available since summer 2004, the most popular solution today is to separate voice traffic from data traffic by using one virtual LAN for voice and one for data, which lets the data VLAN use better encryption and authentication methods and the weaker WEP authentication for voice traffic. (All enterprises *InfoWorld* spoke with for this story that deployed voice over wireless use the VLAN technique.) Using two LANs, however, increases management complexity.

Taking the Long View

Gartner analyst Keene doesn't expect voice over wireless to move into the mainstream for at least five years but recommends that businesses prepare for its arrival. They can do so by choosing network infrastructure such as switches and routers that will support IP telephony in both wired and wireless environments, as well as provide the redundancy required for IP telephony (analog phone lines work when the power goes out or the network crashes, but IP telephony won't). "That's cheaper than ripping it all out later," Keene notes.

802.11e Adds QoS to Wi-Fi Networks

THE LARGELY UNSOLVED HURDLE OF CONTENTION FOR ACCESS-POINT capacity keeps voice-over-wireless systems vulnerable to poor-quality calls, as well as calls marred by dropouts if too many voice or data users are trying to connect to the network simultaneously.

The IEEE is targeting the issue in a forthcoming standard called 802.11e that will add QoS capabilities to wireless networks. The idea is simple: Set priority levels for both traffic and users so the capacity can be distributed better. With 802.11e, an access point could give voice calls priority, lessening the chances of dropouts. Data users might see their connections become more intermittent, but the "bursty" nature of most data traffic will mask that fact much longer than is possible for streamed traffic such as voice.

The 802.11e standard will also permit scheduling, so traffic can be better managed. Scheduling helps the access point control its own usage of the wireless network to better match the priorities of the client traffic.

The 802.11e standard is expected to be ratified this spring and should start appearing in products this summer. Already, many vendors have deployed pieces of it based on the draft standard. The Wi-Fi Alliance, an industry consortium, has ratified some pieces to give vendors a head start and to dissuade them from promoting proprietary solutions. Deployed by some vendors, these pre-802.11e standards are WME (Wireless Media Extension) for prioritization WSM (Wi-Fi Scheduling Media) certification for scheduling.

Even before 802.11e became a standards effort at the IEEE, vendors tried to address the problem of contention. Several of them — including Avaya, Cisco Systems, Mitel Networks, and Nortel Networks — have licensed SpectraLink Voice Priority protocol, which gives basic prioritization to voice traffic on an IP network. SpectraLink plans to replace SVP with 802.11e when the standard is ratified. — *G.G.*