

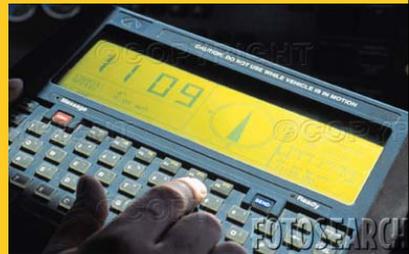
*Trends, Analyses,*



*and  
Case*

*Studies of Wireless*

*Deployment*



*in the*

*Enterprise*



FALL 2003 - US\$100.00

**it**wireless  
LEVERAGING WIRELESS TECHNOLOGIES FOR THE ENTERPRISE

# ***IT WIRELESS REPORT:* TRENDS, ANALYSES, AND CASE STUDIES OF WIRELESS DEPLOYMENT IN THE ENTERPRISE: 2003**

BY GALEN GRUMAN, EDITORIAL DIRECTOR, *IT WIRELESS*

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## Enterprise Deployment Trends for Wireless: Broader Deployments on the Horizon

Even with a major technology recession and the ongoing hangover from the dot-com party, one technology gained traction in the difficult 2002-2003 period: wireless.

Wireless LANs based on the IEEE 802.11 standard began replacing proprietary technologies in warehouses, hospitals, and other established wireless locations, and — more important, in new locations in business such as training centers, lobbies, and college dorms. In the white-collar world, consumers led the way with home-office setups, and soon mass-market eateries began making Wi-Fi service available throughout the nation to travelers.

Next-generation 2.5G and 3G cellular data services — with arcane labels such as GPRS, EDGE, CDMA2000 1XRTT, and CDMA2000 1EVDO — became nationally available, with carriers finally delivering on promises of high-speed services for on-the-road businesspeople. Aimed at sales forces and field forces, the first viable deployments for the enterprise finally began.

While 802.11 and cellular data were most prominent, the third popularly recognized wireless technology, Bluetooth, sputtered. Incompatibilities among devices and lack of clear purpose have kept this low-energy technology in the future. How-

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**57%** of U.S. companies already support 802.11-based wireless networks

**22%** plan to implement and support this technology in the next 12 months.

**83%** of small (those with less than \$10 million in annual revenue) either support 802.11 networks today or plan to in the next 12 months.

**71%** of U.S. large businesses (defined as those generating \$100 million or more in annual revenue) are supporting 802.11 networks or will do so in the next 12 months.

SOURCE: JUPITER RESEARCH

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ever, some companies like UPS and Toyota have found Bluetooth niches that may open up the technology's utility: UPS uses Bluetooth to connect handheld scanners to belt-worn devices that in turn connect via 802.11 to warehouse database systems. And Toyota will use Bluetooth to provide an electronic key to its new Prius gas/electric hybrid vehicle, so the doors unlock and engine starts when the owner comes within range. Bluetooth may find a strong niche in the emerging area of machine-to-machine communications such as these, where sensors link to devices over short distances.

Radiofrequency identification, which embeds small pas-

sive radios into devices that react when wirelessly pinged, is also gaining strong interest as a technology to replace bar codes and other label techniques that require direct sight. RFID is already used for automated toll booths and may one day be used to track individual products in a warehouse or on a store shelf, even allowing automated check-out at stores.

Enterprises can also consider several other wireless technologies, including the paging networks, a new form of cellular data called UMTS-TDD, and an emerging standard for high-speed wireless network covering multiple city blocks called IEEE 802.16. But these are either specialty technologies or not yet ready for prime time. Most enterprises today will consider 802.11 and/or cellular data, and in some cases paging networks, Bluetooth, and RFID.

In fact, a recent research report from Gartner highlighted that there is no wireless technology to meet all corporate business needs. Each technology provides different trade-offs in terms of bandwidth, range and cost, and the report thus concluded that businesses and their IT organization must unite to identify what to use the technology for and when to start doing it. It said companies developing a wireless strategy would need to support an array

of wireless technologies such as wireless LAN, cellular data (often more than one type), and Bluetooth for at least another five years.

#### ADOPTION OPTIMISM

“We’re pretty optimistic,” says Adam Zawel, an analyst at the Yankee Group research firm. “Wireless has slowly, steadily grown, and there is still pent-up demand. We expect to see another 30% of enterprises do something wireless over the next four years,” he says, up from the current 20%. Plus, the companies that have done one implementation are now looking at a second or third round, as they see how to move wireless into the core of their IT systems rather than leave it on its own island.”

Ovum analyst Richard Dinien agrees: “We’re seeing something of a thaw, so companies will start to replace legacy wired solutions with wireless where appropriate.” But no one should expect a flood of deployments, he adds: “One can’t blame them for approaching it a little gingerly. They still need to ask, ‘Is it worth the investment?’”

#### DRIVING FORCES

“The fundamental driver for wireless is that the real-time connectivity delivers some sort of return,” says Zawel.

That return can be faster communication, more available communication, or lower infrastructure management costs.

For example, “it’s easier to add and drop nodes on the net-

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**4.2** million users access wireless LANs in 2003

**31** million users are predicted to access wireless LANs by 2007

**50+ %** of wireless LAN deployments will be in vertical industries through 2004

SOURCE: GARTNER

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work with wireless LANs,” says Ovum analyst Dinien. “One of the biggest costs [in IT] is the reconfiguration of the network as you add people or reconfigure the space,” he notes.

In service-oriented industries, eliminating telephone tag, being able to check current inventory levels, and so forth can be critical advantages to both reduce inefficiency and retain customers. Cellular data services can keep field forces such as delivery staff, repair technicians, and salespeople connected at better-than-modem speeds throughout mostly urban and many suburban areas, as well as along major highways.

And in defined areas — such as warehouses, hospitals, and university campuses — a high-speed wireless LAN can ensure connectivity for both employees and visitors, while maintaining access security policies, no matter where they are. That can increase efficiency in, for example, truck loading and can, for example, ensure patient treatment is always based on the most current medical conditions.

Always-available wireless access may be nice, but enter-

prises need to decide whether it is essential. “A few minutes between synching isn’t that much,” Zawel notes.

Furthermore, with several technologies available, enterprises need to make sure they’re not overdoing it. “Companies should think about how they should change their processes to take advantage of the technology. For example, grocery stores might want to dynamically change prices on the shelves, but wireless LANs are overkill for that — you could have a simpler paging network to do that,” he says.

#### WHO’S ADOPTING

In many respects, the industries that are deploying wireless are the ones that have been pioneers in this area, with much of the effort focused on transitioning to the new standards.

For example, public safety agencies are looking at cellular data services, as well as at outdoor 802.11b-based wide area networks, to replace the outmoded and in process-of-being-phased-out, 9.6Kbps Cellular Digital Packet Data (CDPD) technology. Likewise, distributors and inventory management firms like FedEx and UPS are adopting 802.11-based wireless LANs in their warehouses, often replacing proprietary LANs.

“It’s education, health care, retail, and distribution — the same old verticals,” notes Gemma Paulo, an analyst at In-Stat/MDR. “We’re also seeing some small businesses such as design and consulting,” often because they are technological-

ly self-sufficient and thus not hesitant to deploy a wireless LAN to save the cost and hassle of wiring their workspace.

“Hospitals and education are the two top verticals for horizontal deployments,” says Yankee Group’s Zawel, while the distribution and transportation industries lead in more vertical deployments, he says. “In retail, there’s a lot of testing.”

Lawyers and law-office staff, financial brokers, and insurance agents, and sales forces are also relatively heavy wireless adopters, notes In-Stat analyst Paulo. They tend to rely on the Research in Motion BlackBerry messaging devices, which use a paging network to transmit data and are starting to use the high-speed cellular data networks such as GPRS and CDMA2000 1XRTT.

Analysts agree that there is opportunity for more adoption in the wireless-using industries, as tests deployments are moved to the next level and as departments and pioneer firms such as UPS make significant wireless commitments after their tests prove satisfactory.

Even in established wireless-using industries, Zawel sees

opportunity for augmenting existing deployments. “A lot of transportation companies are doing something such as dispatch, but they’re not yet doing routing with GPS [Global Positioning System]. Wireless is still a hot area [for this industry] but you need to look at upgrades rather than new deployments.”

The proliferation of wireless clients — 802.11b and now even 802.11g is becoming standard in business-oriented notebooks, for example — is setting the stage for wireless adoption in the broader business community, says In-Stat’s Paulo. Users set up wireless LANs at home and then start agitating for it at the office. “Today, we’re seeing a huge uplift of laptops with 802.11 in them, but we’re not seeing similar access point uptake,” she notes, “but that will probably be a stronger trend next year.”

#### WILL HOT SPOTS COOL OFF?

Similarly, the proliferation of wireless hot spots may set the stage for business travelers, especially sales forces, to rely on high-speed wireless connections when on the road:

- Starbucks Coffee has deployed more than 2,000 hot

spots at its cafés.

- Several major hotel chains have deployed in aggregate wireless service in a similar number of hotels.

- Several dozen airports now offer Wi-Fi access in at least some locations, and a Bay Area commuter railroad is now offering Wi-Fi service, while the City of Long Beach, Calif., for example, has deployed a free wireless network in its downtown.

- Several major fast-food establishments have begun testing Wi-Fi service, including McDonald’s and Schlotzky’s Deli.

- Copy-services chain Kinko’s is adding hot-spot service to about 1,000 locations. And packaging and delivery provider The UPS Store (formerly Mailboxes Etc.) is now testing Wi-Fi service in a Chicago location.

But Ovum analyst Dinen cautions that the hot-spot phenomenon is both new and fragile, and there may be no viable business model to sustain it, no matter how convenient it is to travelers. “What is inhibiting the explosion we anticipate of hot-spot usage is usability,” he says. “Providers need to knit together their services to provide better coverage.” Currently, the

#### ■ WHERE HOT SPOTS ARE AVAILABLE

	2001	2002	2003	2004	2005
Airports	85	152	292	378	423
Hotels	569	2,274	11,687	22,021	23,663
Retail Outlets	474	11,109	50,287	82,149	85,567
Enterprise Guesting Areas	84	624	1,762	3,708	5,413
Stations and Ports	—	88	623	2,143	3,887
Community Hot Spots	2	266	5,637	20,561	30,659
Others	—	240	790	1,526	2,156
Total Market	1,214	14,752	71,079	132,486	151,768

SOURCE: GARTNER

industry has competing providers that don't support roaming, plus the client software to permit easy switching among different accounts (as well as between public services and internally managed wireless LANs) is still nascent. "It's so fragmented, so chaotic. People wouldn't go to Starbucks if the coffee were different every time," Dinen says, yet that's what hot-spot users face as they move from one provider's hot spot to another. "These issues of consistency are vital."

Furthermore, there may not be a revenue model to support true anytime, anywhere access. "There are not a lot of revenues coming in at the moment," Dinen says. T-Mobile, one of the largest providers, had to reduce its prices in spring 2003 to help stimulate usage, and then McDonald's began testing Wi-Fi hot-spot service at about half of T-Mobile's price.

In the U.K., where there are several national coffee chains like Starbucks, Dinen expects to see one make hot-spot access a free service mean to bring in more customers. After all, he notes, the markup on a cup of coffee is 100%, much higher than the profit margin on Wi-Fi access.

Although the U.S. does not have a similar set of national coffee chains, competition among fast-food providers could lead to the same result: One offering free Wi-Fi service, causing the others to follow, thus undercutting revenues from such services and making their continued investment problem-

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**27%** of total mobile phone users, or 500 million subscribers, will have 2.5G and 3G handsets by 2005.

**45%** of all mobile phones sold in 2005 — or 550 million units — will be 2.5G-capable

**14%** of the total mobile phone sales, or about 170 million units, in 2005 will be 3G-capable

SOURCE: JUPITER RESEARCH

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atic. That could result in a fragmented, unstable provider market similar to today's dial-up Internet service providers.

#### CELLULAR DATA TRENDS

"Carriers in the U.S. are largely focused on the enterprise. We're seeing the start of packages around connectivity," says Ovum analyst Michael Doherty. "For example, we're seeing Nextel and Verizon Wireless looking at specific data services. We're seeing the carriers dig their toes in the pond to construct the services to the enterprise," he adds.

"What I haven't seen is any momentum from the carriers to implementing private wireless LANs, except for inklings from Nextel. All the development has been on wireless hot spots," Doherty says. Notes fellow Ovum analyst Martin Garner, "European carriers are much more focused on data services. They do have issues on costs, reliability, and security. We're seeing pockets of experimentation."

Today, "much of the focus is

on industry education rather than customers demanding to use a hot technology," notes Doherty.

A sign of that is the more aggressive adoption of data services over pager networks, primarily from Research in Motion's BlackBerry service, as opposed to cellular data offerings. "It's true in the past two years that Mobitex [a major provider of paging services to RIM] has had its best years ever," says Garner.

Why the slow uptake by the cellular carriers? "The management of each carrier has limited bandwidth, and they are already worried about GPRS, CDMA2000 1XRTT, EDGE, and wireless LANs," says Garner.

"It's going to be hard for them to have the capacity to take on TDD as well." (TDD is the data-optimized 3G technology that would provide relatively high-speed cellular data services, as opposed to the current modem-like offerings.)

IPWireless is one company trying to get carriers to adopt its TDD technology.) "We're fairly skeptical about their ability to take this to a wide arena. Voice is very interesting to carriers, and that's the biggest benefit for consumers" from 3G technology, he says.

Another issue is wireless middleware for cellular services. "Wireless middleware will come to prominence with the carriers when they need to support multiple applications," Garner says. Until then, middleware will continue to be carrier-specific and ad-hoc. That will hinder enter-

prise deployment, since “for enterprises to get their mobile systems working properly, they’re going to need some sort of middleware,” he notes. So far, enterprise middleware is either specific to an application development platform or to an application, making it complex to introduce multiple applications for wireless access by mobile users.

### THE SECURITY ISSUE

Whether or not hot spots remain viable for the long term, businesses have clear value in adopting wireless technologies for their internal purposes.

But there are some hurdles

wireless adopters already have strong security systems in place because they deal with sensitive data (such as patient information at hospitals) or don’t have sensitive data to worry about (such as box locations in a warehouse).

In other industries, “the addition of wireless networks has stimulated many useful reviews of security that were due anyway,” notes Ovum analyst Dinen. “A secure VPN [virtual private network] is just commonsense,” he adds, whether the access is via Internet, dialup, or wireless.

To deploy wireless, “you need

or hiding in a closet or sitting in a lobby. Radio placement can minimize some of this access risk, but ultimately only strong access control will keep unauthorized people out.

Dozens of vendors now offer wireless add-ons to integrate wireless LANs securely into existing enterprise LANs. “There are the means out there” to secure wireless LANs, notes In-Stat analyst Paulo.

### POWER RELIABILITY

Beyond security and budgets, enterprises must also address a few other issues when adopting wireless technology.

One is battery life. Because wirelessly connected devices are typically mobile, they rely on batteries, and batteries have not advanced significantly in years in terms of power capacity. That’s compounded by the fact that “802.11 is very inefficient in how it manages power,” says Ovum analyst Dinen.

“There are some tweaks you can do: Change the idle mode, for example, or use more efficient processors like the Intel Centrino,” he adds, but those are just incremental steps. Dinen hopes that a year-old initiative at the IEEE, the P165 working group, will help significantly extend laptop battery life, but such standards efforts take several years to accomplish their goals.

In the meantime, mobile chargers and multi-unit charger stands may be the way to go. Dinen notes that some London subway stations now have these for cell phones.

### ■ ADOPTION OF INTRUSION DETECTION TOOLS

Organization Type	2002	2007
North American medium organizations	48%	83%
North American small organizations	38	62
French organizations	27	60
German organizations	20	54

SOURCE: INFONETICS RESEARCH

that wireless adoption must overcome. Foremost is the issue of security. Wireless LANs early on gained a reputation for being unsecure, mainly because they were deployed without basic access authentication enabled — many access points were deployed by eager but naïve users, not by IT. The new Wi-Fi Protected Access (WPA) protocol implemented in spring 2003 also addresses known security flaws in the original 802.11 access protocol, the Wired Equivalency Protocol (WEP).

Most organizations that *IT Wireless* has spoken with have not found security to be a major barrier to wireless adoption. But that may be because the early

strong authentication procedures and strong access control policies,” Dinen advises.

Not to say that deploying wireless securely merely means having a strongly secure wired network: “Wireless technology has had to make the IT manager think in different ways — it’s a very different medium from wired solutions.”

These issues focus around the ubiquitous connection points, which make physical access barriers (such as keycards to get in the building and then the need to physically connect to an Ethernet jack in a visible area) less effective. With wireless, anyone in range can access the network, whether they’re in a parking lot

**ADVICE FROM THE PROVIDERS:  
CAP GEMINI ERNST & YOUNG**

The easiest place for enterprise IT staff to experiment with wireless deployment is in the conference room, says Marv

**■ SECURITY METHODS USED BY WIRELESS DEVELOPERS**

	Bluetooth	802.11
SSL	17%	21%
PKI	19	16
WAP	16	—
Authentication	—	15%

SOURCE: EVANS DATA

Chartoff, vice president of the Critical Techniques Group at Cap Gemini Ernst & Young, which often helps clients develop their wireless architecture.

The conference room is a natural extension of the existing wired networks and typically has an Ethernet jack in which to connect an access point, he notes. Plus, conference rooms are often away from public locations, so there's little worry about signal leakage that unauthorized users might take advantage of.

Once IT is comfortable with these contained environments, Chartoff says it becomes easier to gain buy-in for larger deployments. But his experience is that the willingness to deploy wireless networks broadly tracks most strongly to those that "already have a laptop mentality" — the more that IT provides notebooks as primary PCs to employees, the more that mobility, and thus wireless, is supported. "Wireless doesn't make sense if your users are all desktop users unless they're in a totally new facility where you save on the wiring costs."

When businesses add wireless, the first step should be to set a standard technology base, even if that means throwing out wireless hardware and software that may already be in use by

departments that have gotten ahead," he says. For example, although there is a movement among vendors to 54Mbps-maximum-rate 802.11a and 802.11g technology, enterprises are usually fine implementing the 11Mbps maximum rates of cheaper 802.11b products. While 802.11b doesn't support video applications well, "it works well for email and office productivity applications."

"We've seen a lot of companies struggle looking for the perfect solution. But wireless doesn't have a one-size-fits-all solution," Chartoff says. "You need to nail down the compelling benefit for considering wireless and keep to the best available solutions for it. Look for a reasonable set of solutions — get past analysis paralysis." He advises IT to determine just who will benefit — "it's not a ubiquitous solution" — and focus on their needs.

Chartoff says it's fine to buy consumer-grade client hardware from established companies like Cisco Systems, but he says enterprises should stick with enterprise-class access points and routers to gain the needed security, access-point roaming

capabilities, and network manageability that IT requires for any significant deployment.

In addition to the technology base, IT should pay attention to the user density and building layout, "so you don't have too many users trying to get onto an access point." Also, it's important to do a site survey that accounts not just for access point positioning to avoid gaps and interference, but also to account for possible interference from other devices such as cordless phones that 802.11b vendors' interference-avoidance technology may not consider.

Chartoff recommends that the wireless network be managed with a management platform such as Hewlett-Packard's OpenView rather than be managed separately. "It's just another element of your network to be managed," he says.

Security has become a lesser concern, since "people are realizing that there alternative solutions" for enterprise security needs, Chartoff says. He's found that most enterprises can satisfy their wireless security needs through 802.1x authentication and VPNs. Chartoff also recommends segmenting guest access into virtual LANs so they are firewalled from the rest of the network.

**ADVICE FROM THE PROVIDERS:  
HEWLETT-PACKARD**

"The 802.11 part of the network is the no-brainer — an IP packet will carry anything," says Bob Simmons, global director for enterprise mobility solutions at Hewlett-Packard. The com-

plexity in deploying wireless networks involves integrating the gateways, platforms, and applications that use the wireless LAN. Going beyond the campus or building into regional or national cellular or paging networks managed by carriers and other service providers adds even more complexity for organizations that “mobilize” field and sales forces using Research in Motion BlackBerry, Pocket PC, or Palm handhelds.

Simmons finds that the typical enterprise adopter today “is mobilizing one application. But when you mobilize the next application, you probably need to work with another ISV [independent software vendor],” which can lead to multiple systems. To prevent that fractious heterogeneity, “you really have to take an architectural approach and think through where you think you are going to go in the future.”

While it should be obvious to IT and business management, Simmons underscores that “you always have to start with the business problem you’re trying to solve.” His experience is that “the best return for wireless aren’t where people think they are. The first thing they think of is that they’ll deploy an email solution with BlackBerry or iPaq. That’s great, but what’s the real business return on that? Email is obviously part of the deployment, but it’s not the point of it.” Simmons recommends that enterprises ask themselves questions like the following: For mobile field service, can you do more timely

repairs? Do you gain more time with call management? Can you order parts more efficiently?

Enterprises also face the challenges of any relatively new technology: a plethora of small vendors with uncertain staying power. “Enterprises are concerned whether they will stay in

panies don’t even turn on basic security functions. We’re dumbfounded.” With VPN overlays, encryption, device management, and authentication — “a multilayered approach” — security should not be an issue, he says.

Simmons notes that IT organ-

#### ■ WHO’S PROVIDING WIRELESS LAN EQUIPMENT

Vendor	2002 Shipments	2002 Market Share
Linksys	2,860,000	14.6%
D-Link	1,881,800	9.6
Buffalo Technology	1,857,900	9.5
Symbol Technologies	1,762,000	9.0
Proxim	1,741,000	8.9
Others	9,495,400	48.5
Total	19,598,100	100.0

SOURCE: GARTNER

business,” Simmons says. At the same time, “the major ISVs are slower to respond [in delivering on newer technologies such as mobile and wireless],” he says, citing Microsoft’s backpedaling on MMIS, its mobile information server, that has been made a component of Microsoft Exchange rather than the originally envisioned platform. Simmons recommends that enterprises avoid basing their mobile and wireless platforms on individual ISVs’ solutions. “Go instead with a general platform for the architecture, so you can replace it if necessary in the future.”

With an architecture in place that isn’t locked into one vendor, Simmons recommends that enterprises next invest in “a good radio site survey” for their wireless LANs. “It’s amazing how many folks don’t check to see if antennas’ signals spill into the parking lot.” Worse, “com-

panies are rightfully concerned about provisioning wireless and mobile networks. “While there are good tools like XcelleNet’s, there is no real end-to-end management consoles for LANs, wireless LANs, and WANs. There’s no way of doing that today.”

Wireless LANs using 802.11 technology have gotten the most attention in the last two years, after initial enthusiasm for cellular-based mobile connectivity waned in 2001. Now, mobile systems are gaining a bit more attention as carriers indicate more interest in them.

For mobile connectivity, Simmons expects the first full-scale, broad deployment will be in the sales and services industries. “That’s still an extremely nascent area. [Even ERP market leader] Siebel really hasn’t gotten its act together on mobilizing its software.” A big barrier to full-scale sales and services

deployment is that “the coverage of the wide area networks is not there. It’s spotty, and there’s latency. It’s very modem-like. You’re talking about sipping versus surfing,” Simmons says.

“Plus, this stuff’s expensive. The first month I had my Voice-Stream SIM card [for mobile data access over cellular networks], I had a \$600 bill. The average IT manager is not going to expose his company to that kind of bill and vulnerability.” Simmons says that the offering of \$99 unlimited-use plans are a big step by carriers to address that adoption barrier, “but prices are still too high. Companies won’t pay all those access charges.”

#### ADVICE FROM THE PROVIDERS: IBM GLOBAL SERVICES

IBM sees the adoption of wireless by the enterprise as a powerful, natural consequence of changing business operations. “What’s driving this interest in wireless LANs is that the way many people are doing work today is different than it was before,” says Adel Al-Saleh, IBM’s general manager for its wireless/e-business solutions group. “I’m constantly roaming — attending a meeting, in the hall — that force me to be around the building, not in my office all the time. I always want to be connected.” And Al-Saleh believes this is becoming the norm for many workers.

“Driver number 2 is that you can actually use wireless LANs to run the organization in a new and different way, such as on the manufacturing floor. You

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**\$714** million is the total market in 2003 for wireless middleware software

**\$1.7** billion is the projected wireless middleware market size in 2007.

**\$421** million is the portion of this year’s wireless middleware market bought by enterprise customers

**\$294** million is the share bought by cellular carriers, and Ovum forecasts that sales to operators will ultimately supersede sales to enterprises with carrier spending growing to \$1 billion

SOURCE: OVUM

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can completely reengineer your production process. Plus as you bring in new buildings and structures, it’s much less expensive to add and maintain wireless over time than wired,” he says.

“We look at wireless LANs as a way to improve business processes. Any company can implement a wireless LAN. What’s more important is what’s on top of it, such as security. How do you deploy a fully mobile office? Remote asset monitoring is very important to start looking at, whether in manufacturing or out in the field,” Al-Saleh says. “These are the things that will transform business processes. It starts with simple things like being able to access email anywhere in the building, but it then moves up quickly in the value chain.”

Al-Saleh cites a wireless deployment at Royal Dutch

Shell, the oil company, which uses wireless to monitor assets like pumps, “which has changed how Shell manages the maintenance process.” Other businesses should ask themselves “How do you leverage wireless for the field force or sales force? Such as for schematics access, help line, or customer service.” Al-Saleh also says companies should look at how they can use their wireless deployments to take out additional costs or bring in additional revenues.

Deploying wireless today” requires multiple players — devices, access points, applications, integration services,” Al-Saleh says. And a lot of customers “are still naïve about this, but they quickly realize they don’t want to make this small in scope as they talk through it. They have to look at it from a business transition point of view. The companies that will get the biggest ROI are those that look to use it the most. ITW



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## A Hospital Goes Thoroughly Wireless

**H**ealth care is one of those industries that is perfectly suited to the use of wireless technology: Its staff is very mobile, patient data is needed fast and on demand, and there's already a ton of wires for electrical power, monitor hookups, and other equipment that leave little convenient space to plug in computer equipment.

That's why an increasing number of hospitals are going wireless, integrating wireless access to their wired networks. The Veterans Administration was a pioneer in such deployments two years ago, but now even smaller hospitals are finding they can implement wireless effectively.

Consider Memorial Medical Center in Springfield, Ill. A teaching hospital associated with the Southern Illinois University School of Medicine, it is one of two medical centers in the city of 112,000 people, and has about 2,000 staff members and physicians who access medical records.

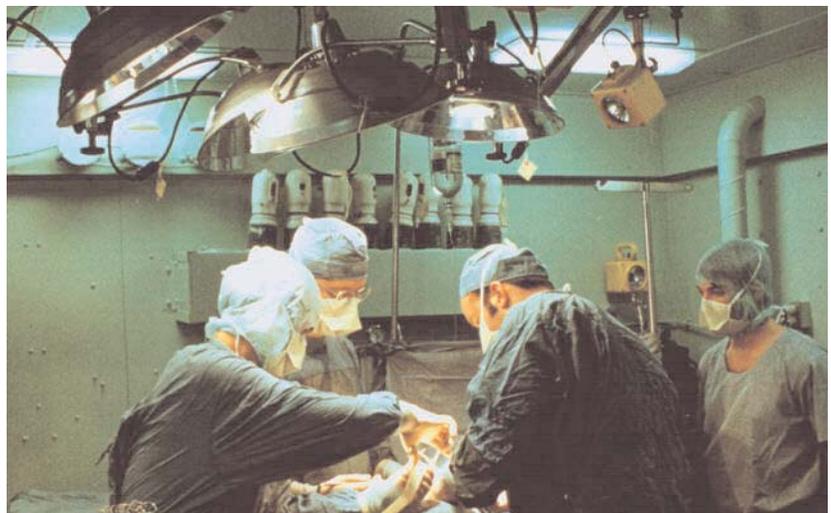
Last year, the hospital decided to introduce electronic records access to physicians, nurses, and other medical staff. The goal was to improve patient care by having standardized information and fast access to it. The hospital wanted doctors and nurses to be able to access patient information as they needed it wherever they happened to be, as well as eliminate error-prone paper documents,

prevent unintended drug interactions, and eliminate illegible handwriting with electronic forms, called order sets, that ensured procedures were documented and followed hospital, insurance, and government regulations. Even though the hospital expects the system won't lower its per-patient care costs, providing such access should improve care and patient safety, preventing potentially costly mistakes.

Part of a three-year, \$30 million effort, Memorial Memorial originally planned on having 802.11b wireless access in just a few locations that were hard to wire or where staff was very

He also wanted the full coverage so he could later implement voice-over-wireless-IP (VoWIP) phones, which he's now evaluating. In November 2002, the hospital administration OK'd his wireless-everywhere approach, which will cost \$900,000.

Wolanyk first thought he'd need about 300 access points, based on the square footage of the hospital. But his system integrator, Daow Systems, hired a spectrum-analysis firm, Consolis, that did a three-week-long spectrum analysis of the hospital to determine optimal access point placement. The result: The hospital will need fewer than 150 access points. "They paid



mobile, such as in patient wards. But CIO O.J. Wolanyk argued that it made more sense to make the entire hospital wireless — including the parking structures and cafeterias — so doctors and nurses can access information anywhere.

for themselves," Wolanyk says.

The wireless network will have three levels of security to protect patient data and ensure only authorized users can log in: Windows NT Active Directory authentication, policy-based firewall access (to ensure that

users get only access to the information they are allowed to see), and 128-bit Dynamic IPsec 3-DES data encryption. Although federal regulations don't dictate the technology used, they are very strict in their patient-records protection standards.

Wolanyk is also using redundant servers and edge controllers from ReefEdge, whose systems allow seamless roaming and session-keeping handoff between access points, to eliminate downtime.

The system does require the use of Windows 2000 or XP, so initially only notebooks, tablets, and PCs can be used. ReefEdge is working on a Pocket PC version for handhelds, which Wolanyk expects to be available this summer. Other devices won't be supported.

Wolanyk is enthusiastic about the project, even though it means no cost savings. Having better, safer operations is pay-back enough, he says. "I want to experience this myself," he says, so Wolanyk uses a notebook as his primary computer and works throughout the hospital — he has no office — connecting wirelessly in the administration section that already had some wireless access and via Ethernet jacks elsewhere. He recognizes that doctors are not technology adopters, so it's critical that they find the system easy to use and that it make their patient care easier to deliver — a reason he's asked doctors to help design the applications and work methods, as well as why he has tried to live a mobile work-life himself. ITW

## UPS Moves into Third Wireless Generation

United Parcel Service is a wireless pioneer. Like its competitor Federal Express, the package delivery service adopted wireless technologies about a decade ago to streamline workflow, have more-updated information systems, and keep better track of the vast network of warehouses, trucks, and packages. The incentives to be early wireless adopters are clear, given the facts that their workforces are mainly mobile, whether on the road or in cavernous warehouses, that even small service and productivity improvements add up significantly for companies dealing with millions of units, and that today's customers expect immediate status information on demand.

After using various proprietary technologies in the last decade to wirelessly transmit bar-code scanner data within the warehouse and to link trucks with dispatch centers, UPS has now embarked on its third generation of wireless. The scale of UPS's effort becomes apparent when you realize the company picks up about 12 million packages a day and keeps those packages in its system typically for a day or two.

### STANDARDS-BASED APPROACH

But this time, UPS could choose to use standards-based technology for its wireless infrastructure. Such technology is

cheaper to buy, develop for, and maintain, plus it provides greater security because more vendors can support it.

"It's a great scenario for us," says Tamara Schwartz, UPS's director of global network services. Her group in Mahwah, N.J., directs the wireless technology development and installation globally for UPS. "We're trying to minimize the proprietary, customized stuff," she says. Its main supplier, Symbol Technologies, which has dominated the inventory and logistics market for wireless technology, has likewise moved its products to 802.11b and other standards from the proprietary wireless protocols it used to offer. UPS's Schwartz expects the third-generation effort to stay in place for five years, the typical life span of its previous wireless implementations.

UPS has rolled out a combination of 802.11b and Bluetooth in its distribution centers. Bluetooth connects bar-code scanners to a small belt-worn computer, which will in turn use 802.11b to connect to UPS's inventory-management and tracking systems. Schwartz estimates the new approach will reduce scanner maintenance costs by 30%, reduce downtime by 35%, and reduce the need for spare parts (for the cables between the scanner and computer that now often break) by 35%.

Schwartz's team looked at

802.11a, which runs at up to 54Mbps (versus 802.11b's 11Mbps maximum), but 802.11a's shorter transmission range became a significant hurdle, Schwartz says, especially in large warehouses. She believes 802.11a will find its place more in campus environments, where a large concentration of people in a smaller area need wireless access.

#### **OTHER UPS WIRELESS EFFORTS**

But this Bluetooth/802.11b scanner project is just part of the third-generation wireless technology plan for UPS, whose rollout will be complete by the end of 2004. Although the focus remains on wireless scanners at distribution centers, the company is also using 802.11 at some of its weights and scales, to transmit weight information automatically and to reduce wiring effort.

The company also wants to increase the connectivity between the dispatch centers and trucks. So far, that has meant reliance on the paging networks, which are also used by the Research in Motion BlackBerry service. But the paging networks are relatively slow and typically confined to urban and denser suburban areas, and UPS would like to add a faster network with broader geographic reach to the mix. In Europe, it is using data-enabled GSM networks for such transmission, and in the U.S., UPS is adopting the GSM-based GPRS technology being rolled out by several U.S. cellular providers in various regions. "We have some GPRS in the U.S. where



there's no Motient [paging network] availability and to reduce analog [cellular's] costs," Schwartz says. She also expects to bring Bluetooth into UPS delivery vehicles, so the electronic pads that customers sign when they receive packages and the scanners that delivery people use to update package status can automatically update themselves via Bluetooth to a cellular- or paging-network-connected transmission terminal in the truck.

Another wireless technology that UPS is looking at is radiofrequency identification (RFID), which uses small tags that react to a passing signal and essentially bounce back an ID signal. These are now used to mark large loads, such as truck or air cargo containers, to help find them in huge lots, or to mark expensive or sensitive loads, so their absence is immediately known. RFID does require the use of fairly close-

range transmitter/receivers, and the cost per tag is prohibitive to use widely, so Schwartz doesn't expect a major increase in RFID use at UPS until inexpensive, small tags and longer-range transmitter/receivers become available.

#### **SMALLER FREIGHT COMPANIES ALSO DEPLOY WIRELESS**

Although the big carriers, UPS and FedEx, have the most advanced wireless systems, other freight companies are following suit. For example, Old Dominion Freight Line and New Penn Motor Express, two smaller carriers, recently implemented wirelessly connected computers from Symbol Technologies in their delivery trucks, so package information could be updated via cellular connections to the dispatch center and so drivers could be alerted of any route, pickup, or other issues no matter where they are.

The logistics industry is not

confined to delivery. Warehousing and manufacturing organizations have similar needs to track items as they move through the warehouse. For example, Corporate Express, a distributor of office supplies, has put 802.11b wireless LANs into 20 of its North American centers, in spaces ranging from 50,000 to 300,000 square feet. Corporate Express uses a voice system from AccuCode that uses 802.11 to transmit computer voice instructions to workers on what items to pick up and where to move them. The use of voice means workers don't have to fumble with handhelds and small displays while working with palettes and boxes, while the ability to confirm an operation is complete gives the inventory management system real-time updates as to status and lets it quickly adjust workers' instructions based on that status. The company expects an ROI of more than 30%.

Companies like UPS, FedEx, and Corporate Express point the way, but it's clear that the logistics and transportation industries as a whole are making wireless technologies a standard part of their businesses. And they serve as a strong example to other industries that information systems can be brought to bear to whole segments of labor and services not traditionally thought of as data-based, when in fact the information about them — whether package location or manufacturing status — is a critical element of successful business process. ITW

## Hospital Starts Wireless Data Path with Voice

Many hospitals are deploying wireless LANs to give doctors, nurses, and others easier access to patient records systems, while eyeing the wireless LAN's potential for handling voice communications as well. But Rice Memorial Hospital is starting with voice-oriented wireless LANs before moving to data services. The 100-bed hospital is in Willmar, Minn. (population 19,000), about 100 miles west of Minneapolis.

Rice has had wireless voice service in place for eight years, originally using a proprietary 900MHz phone system from Spectralink. In early 2002, the hospital decided it was time to replace the aging system with one that supported IP. "My goal was to put in an IP-based system, knowing down the line we were going to support IP data devices," says Jon Barber, the hospital's telecommunications coordinator.

He expects to add patient monitoring devices, a nurse-call system, and equipment tracking via the wireless network, for example. "It just made sense to put in a system that can accommodate all of these."

In all, there are 51 voice-over-wireless-IP handsets deployed. Rice also has 10 computers on carts for bedside charting (they include an external battery pack so the notebooks can function for an entire shift), plus

three wirelessly connected Web stations for radiology image viewing in surgical theaters.

Barber chose a multifrequency radio system from MobileAccess that lets it support not just the 2.4GHz spectrum used by 802.11b but also the 850MHz spectrum used for cellular service (to add in-building coverage for cell phones, whose signals had been blocked by the building's materials and design).

When done, the wireless system will handle both IP telephony and data over 802.11b and cellular service using a Mitel 3300 switch and Ericsson 3800 gateway, respectively. It will not support 802.11a, since the chosen radio system does not extend to its 5GHz range. The total cost was about \$400,000, including about \$20,000 spent on phones that did not work well and were abandoned in favor of a new supplier.

The hospital continues to use a separate patient monitoring system that uses a 2Mbps, frequency-hopping wireless network for its patient monitoring system. Barber would love to replace it with direct spread spectrum technology such as 802.11b so it would work with the MobileAccess radios, but the vendor won't upgrade its application, which the nurses say is the best for their needs. Because it is in place in just two corridors and in the intensive care unit, the patient-monitor-

ing system is not too hard for Barber to maintain.

Barber's system integrator, Norstan Consulting, started doing a site survey in April 2002 to determine access point placement, and installation began in the fall, with the work completed in mid-November. The old system was retained so Barber could phase in users of the new system. "I'm a one-person department, and there were a lot of things to bring online."

In late summer 2003, there were still about eight users of the old system — primarily maintenance staff who go in parts of the building that Barber never anticipated would need coverage, as well as in parts of the intensive care unit, where the shielded rooms meant to contain radiation used in cancer treatments from exposing others prevent wireless signals from coming in.

"If you're designing a data network, you don't think of putting coverage in areas like the roof where you'd expect a phone to work," he notes, and such data orientation in his thinking caused some of the coverage gaps quickly uncovered by the maintenance staff. Barber expects to add access points in these locations to complete the coverage. (Barber did anticipate the needs of smokers, and had included the outside smoking areas in his original plans.)

Because the hospital had been expanded twice, it is full of double walls and various materials, making access point placement tricky — especially for voice service, which requires



very little latency and high signal strength to effectively carry voice transmissions intelligibly.

"If you try to build a wireless LAN for data and then go to a voice system, it probably won't work the way you want," Barber notes, since data-oriented applications are much more forgiving. "Voice over LAN is not just another application," he warns.

Barber also discovered that the original specification of -85dB signal strength was insufficient to transmit signals of sufficient strength to the wireless phones through the building, so his providers needed to revamp the system to -70dB, which requires eight times more power. The hospital is constructing a new building that will be built with the wireless LAN in mind, making deployment much simpler, Barber says.

Barber wishes he had not been a pioneer in his deployment, so he could have saved some effort and expense. But he has no regrets about delivering the network to the hospital staff. "This lets us respond to issues that require more immediate services, such as for patients, housekeeping, and maintenance." ITW

## Public Safety's Second Wireless Wave

Public safety departments — primarily police and fire departments — were among the early adopters of mobile wireless technology, using cellular networks from Motorola and the wireless phone carriers to transmit basic text messages to look up drivers' licenses and other basic data on suspects. In fact, such deployments have become commonplace, thanks to a steady stream of grants to local agencies from the U.S. Justice Dept. and others. Now, several years later, a second wave of public-safety deployments is occurring, this time bringing in 802.11 technology.

The use of 802.11 is a major development, since the technology has been mainly used for in-or-near-the-building deployments, not for wide-ranging areas such as cities and counties. But several factors are making 802.11 a part of these large-area networks: One is the high cost of cellular services, both legacy ones such as CDPD and new ones such as CDMA2000 and GPRS. The second is the improvement in 802.11 range thanks to better antennas and radios. Third, better routers, gateways, and switches let wireless networks integrate into wired networks without compromising traffic or security.

Consider two examples of

such second-wave deployments: Post Falls, Ida., and Oakland, Calif.

**OAKLAND:  
MIGRATING TO 802.11**

Oakland's experience is the most typical, and variations of it are playing out throughout the U.S. Several years ago, the Oakland PD implemented wireless messaging in 35 patrol motorcycles using CDPD technology, which operates at speeds of 9.6Kbps, or a fifth of what PC modems deliver. It's fine for exchanging basic text messages with dispatch and is more convenient and accurate than using over-the-air radio, which can also be picked up by police scanners and overheard by passengers in the police cars. But AT&T Wireless recently stopped supporting its CDPD network, leaving Oakland in the lurch.

Although another provider is managing the network, Oakland PD decided to rethink its wireless strategy. In 1995, it deployed Motorola's proprietary RDLAP analog cellular technology (which has two channels of 19.2Kbps service) in police patrol cars, to avoid the monthly \$50-per-vehicle CDPD fees and to gain network redundancy in case of outages, but it didn't want to invest more in such old technology when it got a grant in 2000 for wireless upgrades, says Lt. Inez Ramirez, the officer in charge of the wireless deployment.

That was two years ago. Today, Oakland PD is using its upgrade grant to add 802.11 wireless

access. "We decided to leverage newer technologies," Ramirez says. The department has added wireless access to the laptops in the patrol cars and set up four hot spots: two at the police administration building, where the patrol cars are stored, one at an east Oakland substation, and one at an animal shelter across the street from a central Oakland substation. When the cars are started, they automatically synchronize with the network, downloading case files and other information to the notebooks. Police officers can synchronize the data while driving, as long as they're near one of the four hot spots.

When the cars are outside the 11Mbps 802.11 hot spots, they are automatically switched to RDLAP or CDPD. No login is required. Each patrol car has a dedicated IP address, so the Padcom TotalRoam routing software can easily track which network the cars are on and switch them seamlessly from one network to another. Padcom also helped modify the XcelleNet software that does file synchronization to make it work automatically when the cars start up and to suspend downloads and uploads when the cars are out of 802.11 range.

Ramirez says the patrol cars have 802.11 access in a two-block radius, which gives them flexibility in how and where to approach the access points. All four access points should be live this summer; the two at the police administration building are already up and running.

The next step may be to

install 802.11 access points at the city's 35 fire stations. Because they are placed evenly throughout the city of 400,000 near San Francisco, they would give broad coverage to patrol cars as well, Ramirez says.

But before committing to the fire station deployment, Ramirez wants to make security "really, really tight." He's not concerned about people intercepting transmissions from or to patrol cars — the data is short and intermittent, so the combination of MAC address filtering, Wireless Equivalency Protocol (WEP), and client/server encryption safeguards that data. Instead, Ramirez wants to make sure people can't tap into the police department's wired network or into other city networks through the fire stations. So he's looking at installing firewalls at each access point, as well as Cisco Systems' own security tools (the department is standardizing on Cisco access points).

**POST FALLS:  
ALL 802.11, EVERYWHERE**

Unlike Oakland PD's Ramirez, Lt. Scot Hoag of the Post Falls PD didn't have a legacy wireless system. There was no CDPD service in the town of 20,000 right across the state line from Spokane, Wash. But when the city got a grant in fall 2001 to deploy a wireless system, the Post Falls PD decided to go all-802.11 rather than use the GPRS cellular service that recently became available. "Our intention was to go with GPRS, but the cellular carriers were unable to provide an all-you-

can-eat plan we could afford,” he says.

Instead, the city has covered more than 50 square miles with 802.11b access point providing 90% availability, Hoag says. The

exploit, so he’s implementing voice-over-IP, email, and video cameras over the network in the 22 patrol cars used by 31 officers. For example, officers can control security cameras at var-

pretty transparent” for the other uses, Hoag says.

Of the \$208,000 spent on the wireless system, a quarter of the money went to security, Hoag says. The Post Falls PD enabled all the built-in encryption, including WEP, and is using 128-bit software encryption using an algorithm of the department’s own choosing, dynamically rotating keys, proprietary compression, and 802.1x authentication. “I’m about 98% happy with the security of this system,” says Mel Nottage, whose Network Group consultancy helped deploy the systems. Nottage further notes, “I’m never 100% happy.”

Like other police systems, the Post Falls PD laptops all have fixed IP addresses. The department uses NetMotion Wireless’s Mobility management and security suite to handle the roaming between access points (with no need to log in again) and to handle the security. NetMotion Mobility also resumes any interrupted session, rather than require data to be resent or sessions be reinitialized.

The biggest security concern is that others will tap into the network to access police and city systems or simply to tap into a free citywide network, which could lead to congestion issues that interferes with police access, Hoag says.

Hoag is also not worried about a system that has limited geographic reach. “The only time we’d go outside the city is for a pursuit or for a meeting,” he says, “and we keep a few cell phones for that.” ITW



system uses 23 access points placed on light poles, along the highway, on mountain peaks, on water tanks, and colocated on cell-phone towers. Using a combination of unidirectional and omnidirectional antennas and amplifiers, most of the access points have a five-mile range, he notes.

With an all-802.11 network, Hoag has a lot of bandwidth to

focus on specific areas, watching the video on their laptops. “Our goals were to have all this stuff in the cars,” he says. “The wireless network becomes an extension of the wired network.” Although those using the voice-over-IP system to talk to dispatch notice some degradation when switching from one access point to another, “it’s

## Solving Campus Wireless LAN Challenges

In summer 2002, California Lutheran University found itself in a position where it had to bring in wireless LANs into student dorms. "If we don't do it, students will start providing it," says technical services director Zareh Marselian. The university also recognizes that most competing institutions are deploying wireless LANs in response to student demand and the rising popularity of laptops. Just as universities were forced to install Ethernet jacks and Internet access in dorms a few years ago, they're now being forced to adopt wireless. But campuses offer several challenges for wireless deployment, since the users and their equipment change frequently.

Marselian anticipates that most students, if not all, will be wirelessly enabled in coming years as wireless connectivity is built into both desktop and notebook PCs. That means Marselian has to build a wireless system that accommodates a wide range of wireless client adapters — the university can't enforce the use of specific hardware, as it does for its staff, especially as more computers have wireless chips built directly in rather than use an adapter or card.

Marselian would have preferred to use Cisco Systems' LEAP authentication technology to ensure that only staff, faculty, and students were accessing the wireless network, but

that requires the use of Cisco client hardware. (He has standardized the university staff and faculty on Cisco client hardware.) So he instead had to use a Radius server to link all the access points and verify the user names and passwords against the wired network's Radius server. (The wireless and wired networks share the same user names and passwords to minimize complexity and user



support.)

The university had several other challenges to support a wide range of student equipment and allow roaming across the campus:

- The university needed to use access points that have both Mac and PC drivers, which most vendors don't have, Marselian says. But Cisco does, so he standardized on its access points. There are 20 Cisco AP1200 access points deployed now, at a cost of about \$600 apiece, with 10 more expected by year's end.

The access points are also upgradable to 802.11a and 802.11g.

- The Cisco access points didn't support roaming well, however — for example, passing a user from one access point to another also overwrites settings such as the wireless channel used, "something that you definitely don't want" — so Marselian needed to look elsewhere for traffic management, ultimately choosing ReefEdge's Connect Server wireless router.

The use of that router also had the benefit of keeping all wireless traffic on a virtual LAN, which greatly simplifies

network administration, Marselian says. Using a virtual LAN cost only a quarter of what the common virtual private network (VPN) approach would have, he says, and didn't require additional personnel to manage.

Marselian hired a firm, Star-net Data Design, to map out the access point locations and help integrate the wireless network with the university's wired network. As user density increases, Marselian will add more access points to keep traffic loads under the access points'

limits. Starnet also trained his staff on how to map radio locations for future access point deployment and to detect rogue access points.

The 3,000-student university, based in Thousand Oaks, Calif., midway between Los Angeles and Santa Barbara, began its wireless network rollout with a pilot project in dorms, where some students had already started setting up their own wireless LANs, connected to the Ethernet jacks in each room. (They've been told that they'll have to get rid of those access points once the university's deployment is complete.) The university expected about 40 students to participate in the pilot deployment, but 120 signed up, says Marselian — a large percentage of the 300 dorms' laptop users.

All the dorms were wirelessly enabled this summer, and by end of year, Marselian expects all classrooms, the library, the student union, and the campus café to have 802.11b access — seven buildings in all. A new dorm whose construction will be completed in 2006 will be wireless, and may not include wired Ethernet jacks. He'd also like to bring wireless access to the university's Kingston Park.

Missing in the wireless plans are the administrative offices, for which there yet no business case, Marselian says, since they are already wired and the staff are typically not mobile. The initial phase will cost \$45,000, he says, and the complete deployment will cost between \$75,000 and \$100,000. ITW

## Niagara Falls Bridges Choose Wireless Backbone

Wireless is more than a network technology for end users. It can also replace high-speed connections between facilities, replacing T1 and other such dedicated data lines. In some situations, it's the only option for connecting facilities because the cost of running wires in rural, inhospitable, or densely built areas is too prohibitive. A good example is the Niagara Falls Bridge Commission, a joint U.S.-Canada government agency that manages three bridges that span the Niagara River between Niagara Falls, N.Y., and Niagara Falls, Ont. The bridges are several miles apart.

For years, the bridge commission has relied on the public phone network to link its bridge towers to each other and to a control center in Niagara Falls, N.Y. But increasing PBX traffic strained this network, and the cost of renting a dedicated line from the phone companies was too prohibitive, says Michael O'Reilly, head of MIS for the commission. The issue became urgent two years ago when the bridge commission decided implement video surveillance over real-time data feeds. That application requires 40Mbps of full-duplex bandwidth for both remotely controlling the cameras and transmitting the images in real time. The public phone network can't handle that kind of bandwidth need,

and leasing high-speed data lines was too expensive, O'Reilly says. Furthermore, the cost of installing its own dedicated lines among the bridge offices was also much too expensive, since on the U.S. side they are surrounded by a densely built-up urban area where acquiring rights of way and then paying for installation could run millions of dollars and on the Canadian side is a waterfront provincial park.

So the bridge commission decided to use directional wireless links that can handle 100Mbps of traffic among the U.S. offices on the bridges and the administrative office. On each bridge, the Canadian office is linked to the U.S. office on the other side using a wired link on the bridge itself and then through the wireless links to the other offices. The system has been in operation since fall 2002. The commission uses standard Ethernet networks and backbones within its facilities, which see the wireless links as just another line. "A lot of people are using wireless as an addition [to their networks], but it's a part of our actual backbone," O'Reilly says.

O'Reilly says the system delivers 100Mbps of available bandwidth for data and voice, and it has additional bandwidth for forward error correction and in-band management. The bridge commission selected

DragonWave Systems for its wireless link technology and Transwave for the systems integration after considering other vendors. O'Reilly notes that many companies have expertise in either IP or radio technology, but not both, so finding a suitable wireless vendor was tough. In fact, the bridge commission had tried another company's system and had to throw it out. The commission also had to toss \$80,000 of Cisco routing equipment because it did not support wireless IP well enough, something the commission did not realize in its earlier use of 802.11 technology within its offices because the flaw showed up only in a backbone environment.

O'Reilly shrugs off the cost, though, since the alternative — paying millions to install dedicated wired lines — simply was-

n't an option. The high-speed wireless link system cost about \$20,000 per link, excluding the towers that the commission had to construct for the directional antennas. O'Reilly says that the total cost of the wireless system is less than it would cost to rent a fiber-optic line from a telephone company for just two years.

The next step may be to bring in standard 802.11 access points to the bridge plaza areas, to connect bridge employees more easily to the commission's information systems. But first, he's working with his engineering team on the video surveillance system. While the wireless backbone delivers the needed high-speed connection, O'Reilly has found that video delivery over IP, regardless of the transport medium, requires more maturation. ITW

## Wireless Connects the Kansas Lottery

Every time someone buys a lottery ticket, the ticket data is transmitted to a central computer system. Traditionally, that transmission has occurred via standard phone lines.

But these days, more and more lottery terminal connections are made over wireless connections, using a combination of ISM radio spectrum and satellite links. Kansas is the first of the 24 states with lotteries to go all-wireless. It made the switch in January after a six-week deployment to about 1,800 locations throughout the state, in both urban and rural areas.

Although Kansas is the first state to have an all-wireless lottery communications system, it's hardly the only state using such connections. Nebraska, Missouri, New Mexico, Minnesota, and Arizona are among the 16 other states that use wireless in some areas.

Kansas, which is grappling with a strong budget downturn, is saving significantly by going wireless — the lottery agency has trimmed about \$1.6 million off its \$4 million communications costs — and has seen up time go from 97.98% on analog land lines to 99.98% using wireless links, says Ed Van Petten, the Topeka-based



Kansas Lottery's executive director.

The lottery didn't plan to go all-wireless — it just worked better that way. "When we bid this system, we allowed analog, digital, wireless — with the budget crisis, we had to go for the bottom dollar," Van Petten says.

Wireless cost less because it eliminated the hassle of dealing with lots of telephone companies, especially the smaller ones serving rural areas. "That's a big issue for us," Van Petten says. That sped up deployment at new lottery sites, bringing in new revenue faster, Van Petten says. It takes 15 calendar days to connect a new lottery site via wireless, versus 30 business days for the lowest land-line bid-



der, he notes, so even though the monthly costs for the wireless system are greater than the lowest-cost landline system, the increased revenues more than compensate for that. The system also allows multicast transmissions from the central operations center in Topeka to all the lottery terminals, so updates can be pushed to them all simultaneously, saving time.

Gtech, which won the Kansas Lottery communications bid, uses satellites for most lottery locations, mounting antennas either on the sides of buildings or places them on the roofs (it

does not attach them to the roofs with any hardware, since building owners are very touchy about roof modifications). In some cases, it uses ISM radios to transmit the signal to a satellite antenna elsewhere, clustering multiple locations to a single satellite link. This approach is particularly common for facilities inside buildings or in basement locations. The Kansas Lottery's contract allowed up to 5% of connections to be landline, anticipating areas that would be hard to install satellite dishes in, but Gtech was able to make all of them wireless.

Van Petten sees the wireless infrastructure helping the state serve its constituents more effectively and more inexpensively. For example, he notes that when he goes to neighboring Missouri to fish, he can get or renew his fishing license from lottery terminals. Kansas officials are exploring bringing multiple departments onto the lottery communications network so they can use the terminals and their printers to issue fishing licenses, hunting licenses, welfare checks, and so forth.

The new wireless system is IP-based, so connecting other departments would not require any conversion to proprietary protocols. Because the current lottery communications contract runs until 2008, the state may hold off on any serious efforts to using the infrastructure until the next bid cycle — such contracts typically run for 10 years, so changes usually take a while to implement, he notes. ITW

## Marriott Tries Public Hot Spots

While many enterprises are busy deploying wireless technology for staff use, Marriott International is installing the technology as a revenue-generating customer service at about 400 hotels. The hotelier began the effort in January and completed the deployment by May.

Adding Wi-Fi hot spots to both the hotels' public lobbies and to convention floor space was a simple proposition, since Intel donated the hardware as part of its promotion of its wireless-equipped Centrino mobile processor and Marriott already had high-speed Internet connections installed at most hotels for its in-room landline hookups.

STSN, which installed those in-room hookups and manages Marriott's Internet service, installed Wi-Fi access points in the 400 hotels and connected them to the existing high-speed network, as well as to the billing system that meters patrons' usage and bills their room or credit card. (Customers who use both the in-room and wireless high-speed access pay separately for both services; there is no combined billing or access package available.)

For customers who want to connect to corporate email and intranet systems via a wireless connection, the STSN service supports several virtual private

network (VPN) standards.

Marriott is by no means the only hotel chain to offer public Wi-Fi service. Among the others that do are Wyndham Resorts, Summerfield Suites, Four Seasons Hotels, and Starwood Hotels & Resorts (operator of the Sheraton, Westin, and W brands) do as well.

At Marriott properties, the wireless access points connect directly into the high-speed Internet network, along with the in-room connections, rather than through a separate LAN segment, because the only users of the high-speed Internet connections are other guests and visitors. There's no private corporate network traffic to worry about breaching, and Marriott has no plans to provide hotel employees with wireless devices to, for example, update house-keeping progress or provide security staff with voice-over-IP service.

The Wi-Fi installation takes about four days at a large facility such as the San Francisco Marriott, which also serves as a convention center located across the street from the city's Moscone Convention Center, and as little as one day in a Courtyard by Marriott hotel, whose nearly identical designs make installation predictable, notes Rom van der Zee, STSN's account manager for the Pacific Northwest.

Marriott's San Francisco event technology sales manager, Jim Chamberlain, declined to discuss the system's implementation costs, but he says that in high-traffic locations

such as the San Francisco and Santa Clara hotels, it takes just a few months to pay back the investment. He estimates that less-tech-oriented locales break even within a year.

Marriott is finding that the human support costs to be low, Chamberlain says. "We get more folks trying to figure out how to launch their PowerPoint presentation," he notes. If preprinted network setup

corporate preferences, but he doesn't expect that phenomenon to be widespread.

Marriott provides essentially two separate Wi-Fi businesses. One is for individual users, whether guests or visitors, who come into a hotel lobby and sign up for pay-as-you-go wireless access (for \$15 per hour, billed to a credit card by the minute, after the initial \$2.95 15-minute period). The other is for con-



instructions (available for older versions of Windows only) and live staff instructions can't help customers connect, STSN's technical support staff is available to help customers connect.

He does recall that when the Santa Clara Marriott rolled out Wi-Fi this winter (Chamberlain was then working at that facility), he had to contend with technically savvy users who insisted that Marriott change its public access settings to match their

convention holders, who can choose to foot the bill for access within the convention floor or offer the service to exhibitors and/or guests; this service is billed to the conference organizer, who handles any secondary billing with exhibitors and convention-goers. Chamberlain says that about half of large convention groups are choosing to link exhibitors via Wi-Fi, though usage is less among smaller groups. So far, no one has

required the use of wireless, although he says it is often a plus when customers discover it is available. At some point, he expects it will be a standard hotel offering — “like a pillow on the bed.”

Some Marriott properties are adding Starbucks cafés, which will pose a challenge for some customers. Starbucks has deployed T-Mobile’s hot-spot service in more than 2,000 locations, but Starbucks cafés within a Marriott will use the STSN service instead, and there is no roaming permitted between the two providers, so Starbucks Wi-Fi users within a Marriott can’t use their T-Mobile accounts.

This highlights an issue I believe will affect more providers as deployments progress, since there are two main classes of providers that also often team up in other areas: venues (hotels, airports, etc.) and eatery chains (Starbucks, McDonald’s, Schlotzky’s Deli, etc.). It’s not uncommon to find Wi-Fi-providing fast-food restaurants in the same venues that will offer their own Wi-Fi services. Roaming agreements seem like a better answer than forcing customers to change service providers based on their location.

Chamberlain also expects to use wireless receivers in Internet- and email-access kiosks that the hotelier is installing across its properties for users who don’t bring their computers with them — some will use wired connections if they’re in static locations, while others for which mobility is key will use wireless, he says. ITW

## Beverage Distributor Regains Connections over Wireless

Fewer and fewer pay phones made it increasingly hard for Alaska Distributors’ mobile sales force to call in orders, making the company’s expensive Telzon devices — portable order-entry that connected to analog landline phones using acoustic couplers — increasingly useless.

With orders due in by 4:30 p.m., salespeople came under increasing pressure to get their orders in on time to meet their customers’ deadlines. (The analog device does not work over PBXs, so salespeople for the Seattle-based beverage distributor couldn’t usually use customers’ phone systems either.)

Plus salespeople had to carry a bulk binder with pricing and SKU numbers for the 5,000 products distributed by the company, which serves customers throughout Washington, Idaho, Oregon, Idaho, and Alaska, although 75% are in the Seattle-Tacoma area.

The answer, says IS manager Bob Chester, was to replace the salespeople’s Telzons, bar-code scanners, cell phones, and pagers with two devices: an NEC 790 Pocket PC-based PDA and a Handspring Treo. The sales force uses the NEC 790 for order entry and transmission. “It has six hours of battery life, and battery life is very important to us, which is why we didn’t go with a laptop. Plus they needed a keyboard,” Chester

says. Alaska Distributors was hoping for a device that could also double as a cell phone, but PDAs that could handle the data input and display needs were too cumbersome for use as a phone, he says. “It’s too ungainly,” he says.

That’s why the sales force also uses Treos, which serve as standard voice phones and as pocket organizers — plus as an email device. “The Treo works better for email, at least for a non-tech-savvy staff,” Chester says, noting that “a lot of people don’t have PCs at home.”

But the Treo’s screen is simply too small to use it as the order-entry device, so Alaska could not use it to replace the NEC 790, he says.

To connect the salespeople’s devices to Alaska’s systems, the company uses Sprint PCS’s CDMA2000 network, which provides data coverage in most of the company’s service territories outside of Alaska.

Although the data service costs more than the company’s previous cell-phone service, Chester says the new approach is still cheaper overall, since the company no longer pays for pager service, which had totaled about \$5,000 per month. Chester estimates his monthly costs are now 25% lower than before. Plus, his staff can now submit orders easily and on time.

To implement the new system, Chester decided to treat

the devices as standard Web-based connections. That means no virtual private networks (VPNs) or other special technologies. Instead, Chester relies on the devices' IP addresses and standard login security, just as if the user were connecting from a PC at home via the Internet. "I wanted to leverage the Internet for everything," he says.

Chester was also concerned that if he made the technology too complicated, the salespeople wouldn't be able to use it. "These people can't handle any sort of difficulty." To ensure the system worked for the sales force, Chester and his staff did extensive testing in the field. "You've really got walk a mile in their shoes and see how it really works out."

For email, Chester is using Sprint PCS's email service, which routes email through a Sprint server before connecting to Alaska's Microsoft Exchange server. "We were skeptical about using Sprint's email services," since tests with other carriers revealed significant delays in message delivery as the email went through multiple networks and gateways within the carriers' system. But with Sprint, "we haven't seen any latency issues."

Chester has also seen an unexpected bonus using Palm-based devices for email: "It cut my virus problem by a huge amount." That's because most viruses are written for Windows systems because they are so widely deployed. The viruses can't interact with the Palm, so they can't infect the Treos, Chester notes. ITW

## Managing Sales Wirelessly

The use of 802.11 technology has reinvigorated wireless, providing fast access within defined areas. But before 802.11 became the rage in the last two years, another form of wireless was touted to help the most mobile workers — salespeople, traveling executives and consultants, and in-the-field support and technical staffs. Today, such cellular data services are struggling for attention and adoption, but there is a promising development.

The Research in Motion BlackBerry service, as well as the competing service from Good Technology, uses pager networks to transmit data in an always-on mode, and the BlackBerry has attracted a loyal user base of several hundred thousand people who sometimes call their email-oriented devices "CrackBerries." Unlike cellular-based services, users aren't charged based on access time or bytes used, which can make cellular data services very expensive very fast.

Research in Motion has tried for several years to get beyond the email market so it could reach more than traveling executives. Newer BlackBerries support application installation, in hopes of making the BlackBerry a more widely usable platform, more akin to a PDA than to a messaging device. But screen limits and keyboard limits hamper the use of messaging devices and PDAs as alternatives to the laptop.

Dejima is using natural language query tools to overcome these limits, and the its technology has been picked up by Salesforce.com as part of its sales force automation offering. Salesforce.com subscribers can now access sales data over their BlackBerries using email-based queries. It also works with wirelessly enabled PDAs.

Mark Smith, vice president of global sales at NetScreen, a security software provider, is a true believer. "I found it to be really intuitive, especially because they give you a list of 50 to 100 queries. I just started using it — no training." For Smith, a key benefit is "being able to look at a salesperson's pipeline and forecast for the quarter" as he travels throughout the country. "And being able to walk into accounts and be able to look at the historical trends and what we're going to do is huge." Smith says it takes about three minutes to complete a query, less time than booting a notebook and finding a place to connect it to the Internet with.

The Dejima technology also supports a menu-driven mode so users don't have to remember queries, but Smith never bothered to install it since he makes the same queries all the time. But Salesforce.com spokesman Tien Tzu says that mode permits users to fill out forms, which is useful for sales reps updating client orders and records while on the road. Because Sales-

force.com offers its sales force automation tools as a hosted, subscription-based service, there's no IT effort involved in connecting the sales systems to the wireless devices; an administrator simply enables the wireless option in a Salesforce.com user profile screen — and no setup is required for email-based access. For customers paying \$125 per month, Salesforce.com doesn't charge extra for the wireless access to its Internet-based sales databases; it costs \$20 per month extra for the \$65-per-month service.

802.11-based applications tend to be standard Windows or Macintosh applications that



simply use 802.11 as a network transport, perhaps with additional login and authentication, which is fine for high-bandwidth connections. But in the low-bandwidth cellular world, another approach is needed.

While the Dejima interface approach is more like DOS than Windows, the technology demonstrates that the slower paging and cellular networks can be used to access critical data efficiently, with the benefit of accessibility almost anywhere in populated areas. ITW

## Pitney Bowes Gains Better Connections

**P**itney Bowes has hundreds of technicians in the field at customer sites managing their mailing systems. That led to massive communications problems, since technicians had to find phones — often nowhere near the equipment — and then rely on finding the right person at headquarters to get answers to any technical or other issues. “We used to spend a lot of time calling for information — basic information,” recalls Ralph Nichols, Pitney Bowes’ service program manager.

That's why Pitney Bowes implemented a wireless system for its 560 technicians in the Document Messaging technologies division, which places about two thirds of those technicians on site for large customers. (The rest go where needed to handle service calls.) The company is planning to deploy the system globally to about 6,000 employees, with the Global Mailing Systems’ 2,300 employees next on the list.

The Pitney Bowes system uses the Mobitex paging network to transmit data to Research in Motion BlackBerries, using access software from Antenna Software that connects the technicians to Pitney Bowes’ legacy systems. The system is actually Pitney Bowes’ second version; it used Motorola terminals on the Motient network, but found that the coverage was spotty, especially inside buildings and that

the data-access software could not reliably access corporate data. “Technicians didn't trust a lot of the information, so they'd call to confirm. What a waste of time,” Nichols says.

One key issue for Pitney Bowes was keeping the devices and interfaces simple. “A lot of [proposed] technology was glitz, and our users just weren't interested — it didn't have any value to them,” he notes. For example, Nichols says that technicians did not want the ability to look up diagrams and so forth from service manuals, which would have required a faster, pricier wireless network and more sophisticated device such as a notebook computer. “They just figured, ‘We have to know what we're doing’ ” when working on equipment, he notes. The technicians knew how to fix the equipment; what they needed from their wireless devices was easy access to customer and parts status information, as well as to filing status reports and confirming service orders.

While Nichols declines to say how much the new wireless system costs, he does say that the company reached break-even point within a year. The company expects its inventory costs to shrink 15%, and emergency orders to fall 90%, since technicians will have reliable access to parts inventory. It also expects to have 10% fewer callbacks of service technicians. ITW

## Wireless Eliminates Time-Sheet Cheating

Like many employers that have on-the-road employees, cheating on time sheets was a big issue at Elyxir Distributing, a beer and soft-drink distributor in Watsonville, Calif., about 100 miles south of San Francisco in the agricultural Salinas Valley. Employees were supposed to start the clock when they arrived at a job site (just as office employees do when they get to the office), but some employees would instead start the clock at home. Others would claim a customer visit they did not make.

But Dave Webb, the company's operations manager, recently found a way to get accurate time sheets and tracking of employees' on-the-road activities using a wireless service combining cellular data and Global Positioning System (GPS) technology. Best of all, the service — using Xora's Web-based TimeTrack software and Nextel cellular phones equipped with GPS transponders — costs only about \$46 per month per employee and had minimal setup fees and no maintenance fees. That was more than affordable for a small business with 44 on-the-road staff — delivery people, staff who regularly clean customers' dispenser spigots to ensure beer and soda on tap continue to taste fresh, and merchandising staff who work with customers to maximize product display.

Elyxir rolled out the system in late February.

Webb can't quantify the ROI — “we don't know how much time we were losing” — but he's convinced it averages more than \$46 per employee per month that the wireless tracking service costs. “It doesn't take a lot



of time to recoup that amount of money.” The system works simply: Employees use a menu option to indicate when they start a job, when they take lunch, when they're done with a job, as well as indicate which client they're servicing. The TimeTrack software then transmits that plus the GPS location data to a Web-based application that Webb and other managers can view and download for further analysis in Microsoft Excel to verify employees' locations and activities. “You know not only when they start but where they are.” Webb acknowledges that many staff members did not react too well to the new system, since it prevents falsified time sheets and even lets managers uncov-

er habitual speeding, excessive breaks, and so forth. “[The new electronic record] is their time sheet, that's what they're paid on. ... It has significantly improved the integrity of their time sheets. Now we know.”

But for Elyxir, there are many business benefits: It can now track how customers are being serviced, ensure time sheets aren't late to payroll, spot service gaps or discrepancies, determine high- and low-maintenance customers more easily, and verify phoned-in complaints about driving or delivery problems (trucks have a sticker with an ID and a number to call about driving complaints, and employees have been both exonerated and proven guilty based on the GPS data, “so it works both ways,” Webb says).

Webb says that in the three counties he serves — Santa Cruz, Monterey, and San Benito — he's aware of no competitors using similar technology, so he expects a competitive advantage in terms of greater operational efficiency and better customer service. He's also looking to integrate the Xora software and data with the UPS logistics software he uses to determine optimal driving routes — by linking them, he can determine which staffers are following the best routes, which change throughout the day, and help guide drivers to better routes as circumstances change. Plus, Webb and other staff are still “playing” with the TimeTrack data to see how they can use it to identify both problems and opportunities. ITW

## Retail's New Wireless Push

Although transportation and logistics are the leaders in wireless deployment, the retail sector is close behind. That's partly due to the logistics and distribution issues that retailers face, the same ones as transportation and logistics companies.

So it's no surprise that many larger retailers — some estimates are as high as 90% — have deployed wireless LANs in their receiving and storage facilities at their outlets and stores. Their staffs can then scan goods using wireless handheld scanners as they come in to automatically update inventory and verify deliveries are complete and accurate.

"More and more, they're not building a store without building a wireless infrastructure," says Frank Riso, director of business development for retail at Symbol Technologies, the dominant provider of wireless handheld scanners.

But retailers are finding that wireless can do even more than serve the back rooms. And with the wireless LANs already in place, adding wireless access points and devices in the rest of the store is simple. Symbol Technologies, which has the vast majority of the wireless scanner market (at least two thirds), sees strong movement to wireless deployment in two key areas:

- Registers, which can be

made mobile for better customer service as traffic changes within a store's departments and sectors.

- Kiosks, which can help provide more customer self-service options, such as bridal and gift registries, online configuration for apparel and electronics, and even checkout.

Riso estimates that about a quarter of midsize and large retailers have at least pilot programs to test these front-of-store wireless applications. For example, Macy's department store in New York's Herald Square uses mobile registers — they're on wheels — to add cashiers quickly as needed during sales and other customer peak times.

Riso expects supermarkets and discount stores to use the same kind of registers for sidewalk sales and for temporary springtime garden and December Christmas tree "departments" set up in front of the store or in the parking lot. The cost is small, about \$300 to \$500 to add the client bridge hardware to the register.

In Europe, several large grocers are testing wireless self-checkout, where customers use a PDA to scan items, then have the total deducted from a checking account. This approach has gotten little acceptance in the U.S., Riso says, because while Europeans are used to bagging their own groceries and don't expect any checkout service, Americans are long accustomed to being waited on at the checkout. Europeans are also more used to using PDAs and data-enabled cell phones, though



even there usage beyond text messaging is low.

In the U.S., Kmart has a more amenable approach: self-checkout kiosks, which use the same kind of price-code scanners as a standard checkout stand and the same kind of debit terminal — it's just the customer rings up the sales and bags the goods. No mobile device needed, whether yours or the store's. Naturally, store staff monitor the checkout kiosks to make sure no one bags goods that haven't been paid for — that'd be harder to monitor if customers could use mobile devices.

Self-service gift-registry and custom-configuration kiosks — sometimes wired, sometimes wireless — are used in many stores, including Target, several electronics retailers, and several music retailers. These could also be used for customer price checks if scanners were attached.

While Riso says that retailers "were very concerned about security" for wireless systems that handle customer transaction data, most of those concerns were addressed last year through the deployment of access and data security protocols such as Kerberos. So most existing wireless networks' implementations are already set up to protect customer transaction information.

An emerging area for retail wireless deployment is the use of handheld sales terminals, which can process credit and debit cards (ones that include cash-drawer attachments are

rare, Riso says, because of bulk and theft concerns). While an obvious technology for ballpark food sales, farmers markets, and flea markets, these can also let companies quickly handle sudden increases in customers, as well as make sales in areas such as garden centers and car-rental lots that involve bulky items and large floorplans. Movie and event ticket sales are another obvious venue.

Symbol is also investigating the use of wireless LANs to push sales messages and discount offerings to customers that scan in items while shopping. The idea is to offer the benefits of today's club cards — providing discount coupons at the register in return for tracking customers' purchase habits — during the shopping act itself, where the reward is more connected to the purchase or expression of interest.

I'm dubious about such wireless marketing, as it requires work on the shopper's part — scanning items — in hopes of getting a discount, and will inevitably result in more rejected offers than accepted ones. I think most customers will treat it as an annoyance, as they did those flashing coupon boxes that some supermarkets installed in the aisles during the 1990s.

However dubious the wireless marketing future is, it's clear that wireless brings strong point-of-sales and self-service benefits to retailers, who already have most of the infrastructure to take advantage of them. ITW

## A Guide to Wireless Security

It's clear that security concerns are one of the biggest barriers IT organizations see when they consider whether and how to deploy 802.11 wireless networks in the enterprise.

Wireless's biggest advantage — open access for people that come and go — is also its biggest security disadvantage. Unmanaged, a wireless access point can be like a unsecured modem, Ethernet jack outside your building, or server accessible over the Internet to anyone.

Based on interviews with security vendors such as NTRU and Psion Teklogix, as well as wireless connectivity vendors such as Symbol Technologies and IBM, here are basic issues that IT and networking administrators should consider when addressing security aspects of wireless LANs. "You want to treat all your wireless connections as hostile," says Daniel Lieman, cofounder of wireless security provider NTRU.

The basic advice is to treat your wireless network like an Internet or dial-up connection and use firewalls, virtual private networks (VPNs), authentication, and encryption to secure wireless access as you would access through the Web or dial-up.

### USING BUILT-IN SECURITY

Wireless access points and routers — the entry points into



the wireless network and eventually to the enterprise network — come with at least basic encryption built-in, the 40- and 128-bit Wireless Equivalency Protocol (WEP).

At the very least, this should be turned on, since it requires that users' wireless radios use an IT-issued authentication key. For low-security information, WEP is fine. While someone can snoop the wireless network to try to capture the encrypted key, it requires several hours to get enough traffic to analyze what part of the data stream are the keys. (For specific details of how WEP encryption can be broken, see the University of California at Berkeley Web

report ([www.isaac.cs.berkeley.edu/isaac/wep-faq.html](http://www.isaac.cs.berkeley.edu/isaac/wep-faq.html)) that revealed the flaws.)

For internal company wireless networks, such as in training centers and conference rooms, that don't leak outside the environment, the chances that someone can snoop on that much traffic is very small.

Most of the stories about intruders scanning for wireless access points and then entering people's networks involve access points for which WEP has never been turned on, making them huge security holes.

While such unsecured access points are common in people's home wireless LANs, they typically occur in the enterprise

only for unauthorized access points installed by end users. If that's a concern, many vendors offer "rogue access point detection" hardware that can find such unauthorized access points. Another WEP weakness is that many employees have the key and could share it, on purpose or accidentally, with outsiders.

For wireless access points in public areas, WEP alone won't do. The Wi-Fi Alliance, a vendor consortium, has developed the Wi-Fi Protected Access protocol (you can download an overview paper in PDF format; [www.weca.net/OpenSection/pdf/Wi-Fi\\_Protected\\_Access\\_Overview.pdf](http://www.weca.net/OpenSection/pdf/Wi-Fi_Protected_Access_Overview.pdf)) to overcome WEP's weaknesses. WPA is an early, pre-release version of the IEEE's 802.11i standard meant to replace WEP.

But WPA has two significant deficits: One, it requires that you get all new access points and client radios (some existing products may be flash-upgradable). Two, it will be replaced about a year later by 802.11i, so many IT organizations will decide there are too many security changes to support and simply want to delay any wireless deployment until the 802.11i standard is finalized.

#### BEYOND WEP AND WPA

Many vendors of enterprise-class wireless access points, routers, and radios offer additional security in their products beyond WEP. Typically, these provide VPN capabilities and perhaps additional encryptions such as Kerberos or FIPS 140-2

(a federal security standard; <http://csrc.nist.gov/cryptval/140-2.htm>).

FIPS specifies the use of a gateway between access points and the LAN and requires a higher level of encryption than WEP. FIPS essentially codifies good security practice that enterprises should have already deployed for Web and dial-up users. The federal National Institutes of Standards and Technology has put together a PDF white paper ([http://csrc.nist.gov/wireless/S05\\_NIST-tk2.pdf](http://csrc.nist.gov/wireless/S05_NIST-tk2.pdf)) on best wireless security practices.

Some companies, such as Psion/Teklogix, offer closed-loop wireless LANs that require all clients to use that vendors' equipment and client software — this minimizes the chances that an unauthorized user could gain access, even if they had the right authentication codes.

The other issue to consider if you set up firewalls is the architecture of your firewall setup, notes NTRU's Lieman. "Do you have one firewall for each access point or a common firewall that separates the access points as a group from the rest of the network?"

Both approaches require ongoing, hands-on management, just as would a series of Internet firewalls. Wireless security vendors all come to this point: Securing wireless LANs is essentially the same as securing Internet connections. While there are some wireless-specific issues related to the 802.11 standards, good basic network security practices will overcome most concerns. ITW

## What Is Bluetooth's Place in the Enterprise?

The short-range wireless technology known as Bluetooth has started to appear: Microsoft offers Bluetooth mice and keyboards, Motorola and Belkin offer Bluetooth headsets, 3Com and TDK Systems offer Bluetooth cards and adapters for PCs and PDAs, and an increasing number of cell phones have Bluetooth embedded.

A key attribute is Bluetooth's ability to create on-the-fly, ad-hoc networks that require no router or other server, so devices can easily be linked together for data exchange or pass-through.

Bluetooth offers a nominal 30-foot range and 725Kbps to 1Mbps speed, so it's not designed for large-scale wireless networking.

That's reflected in the first offerings, which focus on so-called personal area networks, such as wireless synchronization of a PDA to a desktop, or using a cell phone to be a wireless modem for users that have GPRS cellular data service (mainly in European countries), or as a cable replacement for various devices.

Also displayed at this year's Bluetooth Developers Conference were Bluetooth-enabled luxury cars that link cell phones to hands-free microphones and speakers and could serve as a conduit for PDAs and laptops to GPRS-connected Internet-based data systems in the car.

### WHY IT CAN WAIT

These uses don't sound very enterprise-oriented, and in fact they're not. The first crop of Bluetooth devices are more personal in nature and use, and Bluetooth vendors expect them to stay that way for the foreseeable future. "Bluetooth now is user-driven, not IT-driven," says Matt Maupin, Motorola's Bluetooth product manager for the semiconductor unit. It will enter the enterprise much the same way that PDAs did, he says: in the hands of individuals.

In addition to the consumer focus of Bluetooth vendors, enterprise IT has two other reasons not to pay much attention to Bluetooth right now, says Brent Nixon, 3Com's Bluetooth product line manager and a member of the Bluetooth Special Interest Group's marketing committee. One is that the tight economy limits experiments with new technologies, and the other is that Bluetooth still has a black eye from compatibility problems that surfaced in the first products a year ago.

But while such individual, white-collar Bluetooth uses may not reach IT's standards or needs, Bluetooth could be quite useful to a whole segment of the enterprise.

One possible Bluetooth use for the enterprise is in location identification, says Motorola's Maupin. A network of Bluetooth access points could be set up to register when people or items

come within their 30-foot range, allowing quick location tracking. Of course, this would work only in contained environments where the items being located had a manageable number of places to be.

It also requires a controlled technology environment, because one of Bluetooth's weaknesses is its use of profiles to determine a particular device's capabilities. The idea was to let Bluetooth serve all sorts of needs and use profiles to hone into specific needs for specific uses.

But devices with different profiles may not be able to communicate, causing compatibility problems even for equipment with like usages. "Bluetooth was designed to do so many things, so it's harder to agree on a single profile à la the Wi-Fi Alliance," says 3Com's Nixon. (The Wi-Fi Alliance added its own certification to the IEEE 802.11b standard to ensure interoperability.)

Still, the Bluetooth SIG is working on an iconographic way of indicating profile support on device packaging and is encouraging vendors to avoid needless incompatibility in their profile definitions and use, Maupin says.

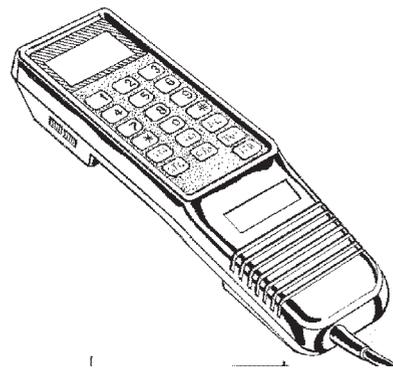
**WHERE BLUETOOTH MAY AID IT EFFORTS**

Also of note to IT, Bluetooth's ability to pair specific hardware to other hardware can ensure that only authorized devices can talk to other devices; in addition, several levels of token-based access security are avail-

able, Nixon says.

Another area is in industrial automation, using Bluetooth instead of cables for increased flexibility and to minimize corrosion and contamination through cable receptacles. The Bluetooth Industrial Automation Study Group forecasts that the market for Bluetooth wireless industrial sensors alone could reach \$1 billion by 2006 and \$3 billion by 2008.

For a stronger ROI case, consider what United Parcel Service is doing: Over the next two years, UPS is deploying both Bluetooth and 802.11b technology in its shipping centers, replacing earlier proprietary



wireless systems. UPS will use Bluetooth to link the handheld scanners that warehousing staff use to scan boxes as they are received and shipped to the data terminals that the staff wear on their belts. The terminals connect to the inventory and shipping databases via 802.11b connections.

"We're using Bluetooth to replace cables, lighten up the device, and reduce the cost," says Tamara Schwartz, UPS's director of global network serv-

ices. The current system use scanners wired to the terminals, and those wires often get pulled out or snapped, which brings significant replacement and downtime costs when multiplied over the thousands of units each year that get broken.

Schwartz estimates that the use of Bluetooth will save 30% in maintenance costs, 35% in spare-parts costs, and 35% in reduced downtime. And because Bluetooth is a standardized technology with many vendors supplying components, the scanner and terminal prices go down as well compared to the costs of the proprietary devices. "It's a great scenario for us. It's a simplistic deployment for us — we don't have many device varieties or public access issues to manage," she says.

**WHERE BLUETOOTH AND 802.11 COLLIDE**

While UPS avoided the profile-incompatibility issue by having a defined set of equipment in use, and it avoided the security issue by the nature of its private facilities, the one significant IT deployment issue that UPS had to wrestle with was interference between Bluetooth and 802.11b. "It was a significant issue for us," Schwartz says.

UPS's solution was to use time-division multiplexing, essentially reserving 20% of transmission time for Bluetooth and the remaining 80% for 802.11b. Bluetooth and 802.11b both use multiple channels in the 2.4GHz spectrum and then lock on to an available channel.

UPS's solution works when the devices are designed in tandem and come from one or two cooperating vendors, but in locations where a wide variety of wireless devices were in use, something else needs to be done.

That's why Motorola is working on Bluetooth chips that will scan the spectrum continually and hop from one band to another to avoid interfering with other wireless sources such as 802.11b, Maupin says, once the Bluetooth SIG approves a standard for such frequency hopping.

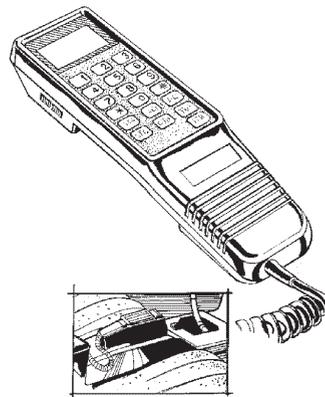
3Com's Nixon doesn't see interference as a big issue, since Bluetooth transmissions tend to be short, and 802.11b can handle interruptions and other contention like other packet-based networks. But I suspect that, for enterprises like UPS that have a tremendous amount of wireless data transfer occurring all the time, interference is likely to be a real concern.

Despite the likely need to deal with interference and the possible issue of unmanageable profiles, UPS's Schwartz believes that other logistically oriented businesses could benefit from Bluetooth in similar situations, including transportation, retail, medical, manufacturing, and warehousing.

She's right, even if most vendor and user attention is now mainly focused on personal productivity and convenience gadgets that IT will leave to individuals — as long as they don't cause IT any headaches, of course. ITW

## Which Carriers Are Serious about Cellular Data?

802.11 technology, especially the 802.11b Wi-Fi variety, has gotten most of the attention this past year as the hot wireless conduit that opens up new business benefits and possibilities. But whatever happened to the so-called third-generation (3G) cellular technologies that carriers promoted just a few years ago?



After all, the networks that deliver data at modem-like speeds of 50Kbps to 120Kbps — CDMA2000 1XRTT and GPRS — were finally rolled out last summer and fall in most populated areas of the country. While not nearly as fast as 802.11, cellular networks are close to ubiquitous, allowing connections almost anywhere, not just within relatively narrow hot spots.

Today, the new data networks seem to be used mainly to send digital pictures between camera-equipped cell phones — a very consumery, faddish use. While this is also useful to

industries such as insurance claims adjustment, real estate, and security, the carriers' emphasis has been very much on consumer users. In fact, it's hard to find any cellular carrier actively pitching data services to the enterprise.

Still, several carriers are offering basic data services — essentially email/calendar and basic Internet access — via cell phones and PDA/notebook modems. Verizon Wireless, Cingular Wireless, T-Mobile, and Sprint PCS all offer these basic services under various calling plans. The first adopter of cellular data, Nextel Communications, goes further in offering Java-based applications for a variety of industries, such as construction, insurance, and transportation. (Ironically, Nextel has been focusing more on consumer users in the last two years, now offering wireless games in addition to business utilities.)

AT&T Wireless, Cingular, and Sprint PCS both offer telemetry services via cellular — a very logical application for businesses with mobile assets, from fleet rentals to delivery firms. And all three offer custom services for enterprise application integration, so you can, for example, allow PDA access over the cellular network to a sales force automation application.

But the cellular carriers compete here with paging network-based providers such as Re-

search in Motion, Palm, and Good Technology, whose always-on email networks (especially RIM's) have a solid track record.

T-Mobile says it will have more — but unspecified — business offerings in the future, since it recognizes that its Wi-Fi hot-spot service naturally attract business users and thus provide a conduit to businesses who may consider going beyond the hot-spot range via cellular data, with the added attraction of a common account for both login and billing.

Sprint PCS also sees some synergy between Wi-Fi and cellular, though in my conversations with its marketing team, the Wi-Fi support seemed to be a reluctant nod to its popularity rather than a fundamental part of the carrier's data strategy. But Sprint PCS says that the fact that its cellular arm and landline arm belong to the same company means that it can serve enterprise users with a complete data solution, including dedicated landlines such as T1, 802.11 LANs and WANs, and cellular data/voice services.

Still, Sprint PCS expects to promote its data services through intermediaries — such as IBM, Accenture, Ingram Micro, and Siebel Systems — rather than emphasize the integration of enterprise solutions itself.

Overall, carrier support of cellular data for business use remains tepid, with Nextel, AT&T, Cingular, and Sprint more in the warm range. But no one is close to a boil.

At the same time, cellular data faces a price issue: It's costly to access data over the cellular net-

works, even with recent price reductions by most carriers. Access charges can easily be \$50 to \$200 per month for someone on the road much of the time.

In recent conversations with public safety, education, and hospital IT directors — the first two admittedly very price-conscious — everyone said they were trying to move to 802.11 technology and limit, if not eliminate, cellular systems because of their high ongoing costs. That'll throw ice on any aspirations the cellular carriers may have for business data services.

In the meantime, cellular data services are now widely available for specific tasks such as email and limited corporate data access, including telemetry data.

Some businesses will find the high costs and limited bandwidth to be easily outweighed by its near-universal accessibility. As carriers improve their 3G networks, the paging network-based service providers will feel more pressure, since those networks are inherently limited in their data speeds. (Already, RIM, Good, and Palm offer their services over 3G networks from a variety of cellular carriers.)

But emerging technologies such as UMTS-TDD and metro-area broadband wireless (802.16a) may outperform 3G networks while offering similar ubiquity.

For the time being, simple data services delivering concise information on handy devices almost anywhere seems to be cellular data's place in the wireless world. The wireless Internet so far resides just in the 802.11 world. ITW

## Does Voice over Wireless Make Sense?

For several years, enterprises have been pitched voice over IP (VoIP) systems to replace their Centrex-based private branch exchange (PBX) phone systems. Given the huge investment in PBXs, most companies ignored the VoIP entreaties, since the benefits of having centralized network management for both voice and data traffic didn't justify the expense of replacing such a core system.

However, VoIP has soldiered on and is gaining acceptance in new offices, where companies don't have to replace an existing system. VoIP systems are no longer the province of untested startups, and instead are now supported by major providers such as Nortel and Cisco, and the interfaces between VoIP and traditional PBXs have made such piecemeal integration easy.

### INSIDE VOWIP

Because of this groundwork, another variant of VoIP — voice over wireless IP (VoWIP) — is gaining traction. The idea is simple: For workers who are not at a desk — nurses, doctors, technicians, retail managers and customer-service staff, warehousing staff, security guards, teachers, maintenance staff, and so on — but need to be accessible quickly, use wireless LANs

as the transport mechanism for voice communications.

Because these employees work within a defined geography, companies can dump pagers and cell phones that cost money every month for a system that uses free radio spectrum and instead just requires lower, annual software maintenance fees. (Note that VoWIP handsets typically cost twice as much as a standard wired phone-and-headset.)



Unlike other free-air alternatives such as walkie-talkies, VoWIP systems can integrate into the corporate phone system, so users can contact anyone, not just those on the same walkie-talkie system, and anyone can contact them as well. Plus, users get to use telephony features such as call forwarding, extension dialing, and distribution lists for leaving messages with multiple recipients, as well as the ability to connect to any PBX-connected public address

(PBA) system.

There's also a level of security possible with the basic 802.11 Wired Equivalent Protocol (WEP) standard and much better security through add-on technologies like the long-established Kerberos protocol.

#### DIFFERING APPROACHES

Although the fundamental benefits are the same, VoWIP providers do have a some difference in their approaches:

SpectraLink focuses on offering a complete business phone that happens to be mobile. This means it has the handset features that a typical full-function business desktop phone would have. SpectraLink also touts its ability to integrate with almost any PBX system.

Symbol Technologies tends to look at VoWIP as an extension of the wireless LAN infrastructure and applications it already provides to various markets, essentially as an additional

application. It also provides two-way paging in addition to voice. In addition to mobile phones with business-phone functionality, Symbol also offers devices that integrate data features such as barcode scanning and simple database access so, for example, warehouse staff can check inventory on the same device they talk on.

Startup Vocera focuses, as its name implies, on voice commands. More a communicator than a phone, the Vocera device is a badge clipped to a shirt or jacket that the user controls via voice commands, à la *Star Trek*. The idea is to be extremely mobile (and thus easy to wear or carry). Like Symbol, Vocera sees the most opportunity at companies that have already invested in wireless LANs and want to leverage that for new applications, says marketing vice president Brett Lang.

#### CAUTIOUS BUT GROWING MARKETS

The benefits seem obvious, so why isn't VoWIP more common? In-Stat/MDR estimates that there were 20,000 VoWIP users in 2001 and earlier this year it projected there would be 80,000 in 2002. That's individual handsets, not companies. But that 80,000 number hasn't happened, at least not according to the two top providers of VoWIP systems, Symbol Technologies and SpectraLink. Both say that while interest and pilot deployments are running at a fevered pitch, sales have remained basically flat this year, due largely to that bad economy.

There are signs the market will increase, as the utility of VoWIP and its relatively low deployment cost — especially for companies that have already invested in wireless LANs — provides sufficient ROI benefit to get funding. Cisco Systems entered the market in spring 2003, and Mitel, Avaya, and Nortel were already in it at the premises-equipment/PBX end. Plus, the major enterprise wireless access point providers — Cisco, Symbol, Proxima, LXE, Intermec, and Interasys — have incorporated SpectraLink's quality-of-service provisioning technology for voice, to prevent audio cutouts during conversation. The big names are moving in.

Across all user segments, typical payback is 12 to 18 months, says Rich Watson, Symbol's directory of telephony product marketing, with a faster ROI for organizations that are adding VoWIP to an existing wireless LAN infrastructure.

VoWIP vendors are seeing very strong interest in the retailing sector, especially at home-improvement chains such as Home Depot and Lowe's, in addition to mall-based retailers like Barnes & Noble and Toys 'R' Us.

Medical facilities are also a key market, since having nurses, doctors, technicians, and others able to communicate no matter where they are is critical. While doctors may always need to have pagers since they usually work at several hospitals, the other health care workers tend to work in one location.

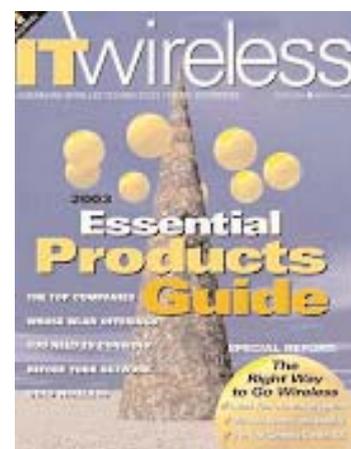
A new market opening up in the aftermath of the Columbine

student massacre in Colorado a few years ago is the education market, where security concerns are prodding schools to invest in VoWIP phones for teachers, maintenance staff, school nurses, administration, and security guards. Although schools typically have limited monies, districts and foundations are providing funds for security technologies, says Watson.

VoWIP is a no-brainer, even for companies that aren't using VoIP for their wired phone users. The number of workers who aren't at a desk is large — about 15%, says SpectraLink marketing director Ben Gudarian. Symbol's Watson estimates that about 5% to 10% of the workforce in VoIP-adopting companies is mobile, making VoWIP a significant extension to VoIP deployments. Vocera's Lang says that the 5,400 acute care facilities in the U.S. alone provide a \$1 billion market, while the top six "big box" chain stores like Target and Sears represent another \$500 million in possible market.

While the enterprise couldn't care less what a vendor's possible market size is, these figures show that there are enough possible users to ensure that vendors will invest in VoWIP technology. And that means more choice and better products for the enterprise. The benefits of VoWIP are obvious, and as companies look for strong ROI on their technology investments in these tough times, many will put VoWIP in their short list. ITW

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