



MTrilogix Inc

Wireless Technology Introduction

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- Intended Audience:
Project Leaders, Designers, Programmers, interested in WLAN or WWAN software solutions
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Types of Wireless Networks

Network	Coverage	Bandwidth (in flux)	Cost	Common Use	Standards/Protocols
Infrared (IR)	Line-of-sight Point-to-point < 6'	9.6 Kbps to 4 Mbps	Very low	Personal Area Network (PAN)	IrDA Radio frequency Bluetooth
Bluetooth	Omnidirectional ~30'	1 Mbps	Low	PAN	Radio frequency 2.4GHz IEEE
WLAN	<100' to >300' inside; ~1 mile between buildings Shorter range with 802.11a	11-22 Mbps w/ 802.11b ~55 Mbps with 802.11a	Low	Within buildings, between building, campus	802.11b; 802.11a coming Radio frequency 2.4GHz
Wide Area Data	Regional by major city	9.6 to 128 Kbps	Varies by application and billing plan	Major metropolitan areas; campus	Packet-switched
Cellular Telephony	National; spotty in rural areas	9.6 to 14.4 Kbps (2G) 28.8 to 128 Kbps (2.5G) 300 Kbps to 2 Mbps (3G)	Varies by application and billing plan	National coverage	GSM, CDMA, TDMA, GPRS
Paging	National	9.6 Kbps	Low	Two-way short text messages	CDPD
Satellite	Global 400 Kbps to 1.5 Mbps downlink	256 Kbps uplink	Expensive	When broadband alternatives unavailable or max coverage	Integrated terrestrial, satellite
Special-purpose (WISPs)	Regional by major city	9.6 to 128 Kbps	Low	Single purpose, Internet/e-mail access	Needed

Key

CDMA: Code Division Multiple Access
CDPD: Cellular Digital Packet Data
GPRS: General Packet Radio Service
GSM: Global System for Mobile Communications

TDMA: Time Division Multiple Access
WISPs: Wireless Internet/e-mail Service Providers

802.11a, 802.11b: A family of IEEE standards for wireless LANs. 802.11a defines 24 Mbps in the 5GHz band; 802.11b defines an 11-Mbps data rate in the 2.4GHz band.



Table: Types of Wireless Networks

A challenge for IT professionals is knowing when to jump on a new technology, and when to wait and watch. For anything that promises to change lives and reshape the way companies do business, IT organizations have to ask, Is it really ready for prime time? Wireless technology presents just this dilemma. The concept of portable devices and connections anywhere we need them is intriguing, but the wireless landscape seems tremendously complex and confusing, with a proliferation of devices, solution providers, and acronyms. Competing standards and incompatible protocols abound. Yet, behind the hype and confusion, wireless technology is much more than a new set of toys for technologists and salespeople.

Wireless applications are appearing everywhere—hospitals, hotels, executive suites, etc. They are already in the hands of delivery people, equipment installers, insurance agents, stockbrokers, physicians, and pharmacists. In a recently published survey, the Cutter Consortium, Arlington, Mass., found that 30% of polled IT organizations are currently working on wireless applications. More telling, however, was that over 70% of the organizations report that their senior executives intend to explore wireless opportunities.

Wireless is a trend that is here to stay and impossible to ignore. According to International Data Corp. (IDC), Framingham, Mass., the population of mobile workers in the U.S. alone is 40 million strong and expected to grow 9% annually. By 2004, Gartner Group, Stamford, Conn., estimates that 65% of the Global 2000 will offer their mobile workforce some type of wireless access to critical business applications. Like it or not, wireless technology will become a major and important component of IT strategies.

Wireless is hot thanks to several technological breakthroughs. Until recently, constrained bandwidths and limited devices have restricted the use of wireless technology to voice (telephony) and paging (short text message) applications. With the emergence of increasingly powerful handheld devices, wireless networks, and data exchange capabilities (spurred in part by the Internet), companies can now offer unwired workers access to the quality, quantity, and types of information formerly available only to their wired counterparts. The result? It is possible to unchain legions of workers from their desks, provide access to critical information where and when needed, and redesign a host of processes to improve efficiency and customer service. Further advances in wireless information exchange will fuel a quantum leap in the power and capabilities of these new wireless applications.

So what does the wireless trend mean to IT organizations? This article provides a quick primer on wireless technology, focusing on what IT organizations need to get started. Remember, forewarned is forearmed: A little knowledge will go a long way in preparing IT organizations for the inevitable influx of wireless applications.



What Is Wireless?

At its simplest, wireless involves transmitting data between devices that are not physically connected. These devices may be anything from a personal digital assistant (PDA), to a laptop, a two-way pager, a global positioning satellite (GPS) antenna, to a remote sensor. The communication can occur at short range using infrared technology, at a wider range using a high-speed wireless LAN within a building, or at extraterrestrial distances using satellites.

To date, the number one wireless application is voice transmission—making telephone calls using cell phones.

Wireless technology aims to give mobile professionals and end users access to information anywhere. It fosters information exchange and collaboration where physical co-location is not feasible. And wireless technology has long aided in tracking, locating, and managing valuable, movable assets such as cargo containers, laboratory equipment, and even taxicabs.

All wireless technology is designed with mobility in mind. However, people frequently confuse the terms "mobile" and "wireless." Mobile workers, devices, and applications do not necessarily use wireless capabilities. Many mobile laptop users rely solely on dial-up connections to download and upload data, and PDAs are prized primarily for their information organization capabilities. Likewise, being mobile is not a prerequisite for using wireless technologies. Office workers can use wireless LANs as part of their jobs, and may place and receive calls on a cell phone while sitting at a desk.

To date, the number one wireless application is voice transmission—making telephone calls using cell phones. This application hasn't had much effect on IT organizations per se. But the burgeoning demand for data-based wireless applications, and the imminent build out of wireless networks to better support these applications, promise to create a wireless mania within IT organizations over the next few years.

The possibilities for data-based wireless applications are endless. Industries pioneering wireless efforts include transportation, healthcare, and financial services. The transportation industry is using wireless data applications to monitor and convey shipment status. Bar code scanners, dashboard computers, and satellite links permit real-time tracking of individual packages. Within the healthcare industry, administrative staff use wireless LANs for patient intake, ER doctors use PDAs to review patient status and lab results, and physicians use e-prescription applications to verify drug dosages and transmit prescriptions directly to pharmacies. Brokerage firms send stock alerts and order confirmations wirelessly to their clients' handheld devices.

Wireless implementations within an organization can run the gamut from simple to complex. It may mean installing a wireless LAN in key areas, such as conference rooms and training centers, to give employees access to corporate intranets and e-mail programs without having



to worry about plugging in devices. It may call for the installation of infrared technology to enable short-range synching of data between device types. It may involve outfitting salespeople with a variety of handheld devices, writing custom wireless applications for data access, and negotiating wireless service agreements with multiple carriers. It may mean equipping purchasing agents with wireless applications so they can receive and approve purchase order requests, no matter where they are.

What Wireless Means to IT

Wireless technology gives IT another medium in which to extend its influence and increase its value to the business. It allows IT to reach a wider audience inside and outside the corporation, bring automation and efficiency to a new range of processes, and deliver data wherever needed. IT can use wireless technology to build new applications or extend existing ones. From a career perspective, wireless technology offers challenging projects and interesting assignments at all levels of the organization.

Wireless technology brings to IT organizations a series of design, development, deployment, and support challenges. New servers and middleware applications are needed to connect wireless networks and devices with critical corporate data. Application architects and designers will have to work within the constraints imposed by device sizes and network data exchange rates while meeting the expectations of users looking for portability with just as much functionality. Security takes on a new meaning in an environment where signals can be intercepted in the air and devices are easily lost or stolen. And new processes are needed to support and manage myriad devices that can be anywhere, literally.

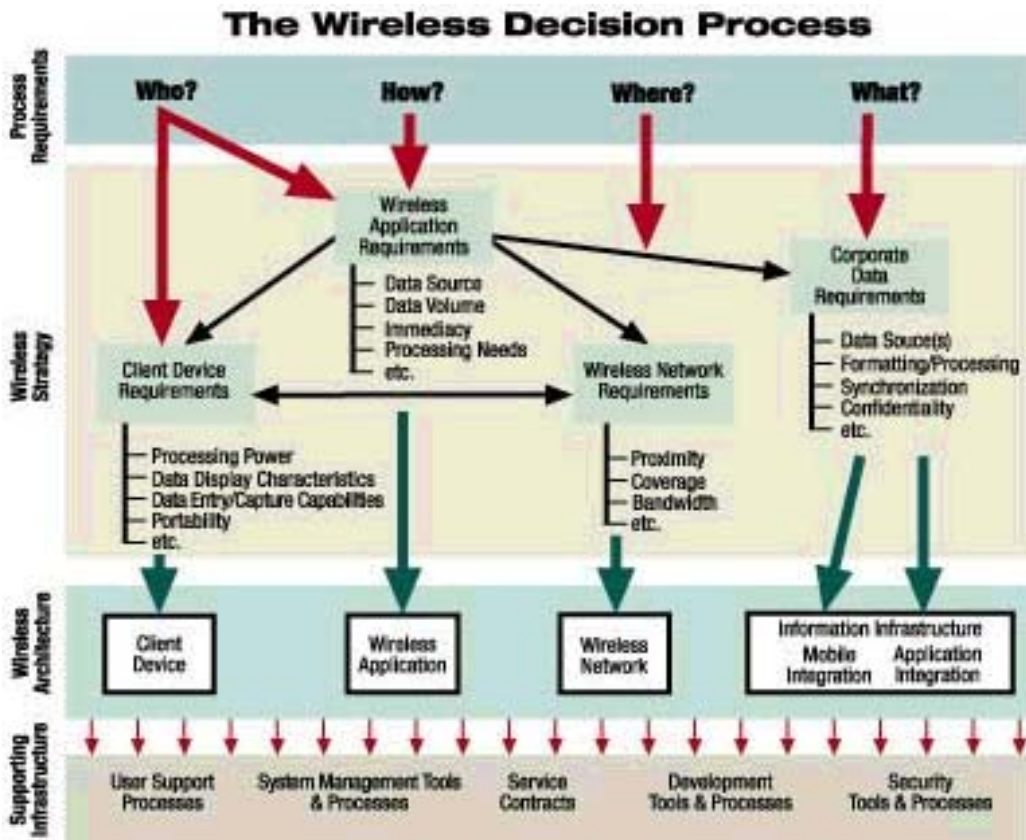
In the long term, wireless technology may have as much impact on IT infrastructures, processes, and application development methods as the arrival of the Internet and Web applications. Fortunately, unlike the radical upheaval occasioned by the Internet, the impact will be much more evolutionary. Many wireless applications will begin as extensions or adjuncts of existing Web applications. The true explosion in wireless applications will occur over the next few years as standards converge, bandwidths expand, and better development tools arrive. In the meantime, IT organizations can gain experience by focusing on the high-payback applications the current generation of technology enables. This experience will allow IT organizations to build the skills, strategies, infrastructures, processes, and internal standards needed to support larger-scale wireless efforts.

The biggest benefit of wireless solutions is the ability to reshape business processes for greater effectiveness.

Start With Business Processes!

The biggest benefit of wireless solutions is the ability to reshape business processes for greater effectiveness. A wireless solution can improve patient care by providing an emergency room physician with instant access to laboratory test results, enable more efficient routing of deliveries, or allow a service worker to print and present an invoice at the end of a service call. Implementing each of these solutions requires a different set of wireless devices, networks, and application architectures. An architecture that works perfectly for one solution may be hopelessly limited for another. Given the magnitude of capabilities, options,

and limitations in wireless components, there will never be a one-size-fits-all wireless solution that can be applied to any business requirement.



The right way to pursue a wireless effort is business process first. The needs of a business process identify data requirements and drive the wireless application design, which in turn drives the selection of the appropriate device and network options (see figure, above). The resulting wireless architecture then has its own implications for security, support processes, development tools, and service contracts with network and software providers.

Key questions to ask when selecting a wireless strategy include:

Who will be using the application? The device and application needs of a harried emergency room physician are very different in terms of information immediacy and ease of use than those of a quality assurance inspector using a forms-based system.

How will it be used?

A stockbroker may require instant notification about fluctuations in stock prices, while an order status application may require only periodic updates. Serving the stockbroker requires



real-time processing and an always-on connection, while automatic hourly synching can support the order status application.

Where will it be used? A system for registering guests inside a hotel can use a short-range wireless LAN, but an application connecting mobile workers operating anywhere in North America will need to use a digital cellular or satellite network.

A customer information system supporting a field service worker may need to access information from various customer and support databases. Access to this information has numerous implications, from application integration and data security to transmission bandwidths.

It is possible to make significant process improvements using current-generation wireless technology.

Making Progress Today

While wireless capabilities will continue to improve rapidly over the next few years, it is possible to make significant process improvements using current-generation wireless technology. As organizations seek opportunities for wireless technologies, consider the following:

Automate a manual process.

Any process that requires a mobile worker to collect data on paper forms is a potential candidate for wireless automation. A wireless application can increase data-collection speed and accuracy while eliminating the effort and expense of re-entering manual notes, forms, and reports. Automation possibilities include laboratory notebooks, prescriptions, inspectors' reports, and trip logs.

Provide mobility to a deskbound process.

The need to access data from wired computers ties many professionals to their desks. If they could perform those functions using a wireless device, it would free more time for them to spend on mobile tasks such as negotiating contracts, meeting customers, or performing on-site repairs. Potential applications include wireless approval of purchase requisitions, mobile check-in within hospitals and hotels, wireless dispatch, and reporting for field service workers.

Streamline a process.

The ability to provide data where needed enables an organization to move or eliminate process steps. For instance, allowing a field worker to calculate the bill and produce the invoice upon the completion of a service call simplifies the billing process, shortens the cycle time to collect payment, and increases customer satisfaction.

Technology Solutions

When assembling a wireless solution, an IT organization will generally draw on four categories of technology: its own information infrastructure, wireless networks, client devices, and wireless applications. A complete solution combines items from each category. For instance, a wireless tracking system may incorporate handheld bar code scanners with



built-in software, a dashboard computer, a synching cradle, a wireless LAN, and satellite transmission capabilities.

Information Infrastructure.

Every company has extensive applications, databases, voice and e-mail systems, middleware, Web servers, and other components comprising its information infrastructure. A wireless solution incorporates many of these components. For example, wireless applications may use data created by legacy applications, or require integration with Web-based applications. Mobile employees may want to retrieve e-mails or tap into a corporate intranet using a variety of handheld devices, from Research in Motion (RIM) Blackberrys to Palm PDAs. Integrating the existing infrastructure with wireless solutions may require new middleware products, mobile application servers, and security software, to name a few.

Wireless Networks. Wireless networks serve as the conduit, or transport mechanism, between devices or among devices and traditional wired networks (corporate networks, the Internet, etc.). Factors such as coverage, bandwidth, and cost influence the wireless network(s) used in the solution. Again, application requirements and constraints will largely dictate the choice of wireless network(s). The table [Types of Wireless Networks](#) shows the most widely available types of wireless networks. A complete solution may use several different networks, from a wireless LAN to a wide-area data network. The network landscape is changing rapidly as manufacturers regularly introduce new chipsets and equipment capable of greater coverage and higher throughput. Cellular telephony networks, in particular, are in the throes of an expensive upgrade, as discussed later in this article.

Client Devices.

There are myriad mobile devices, ranging from cell phones to pagers to PDAs (see table, Representative Wireless Devices). A company likely has several types in use. Executives may rely on RIM Blackberry devices for real-time e-mail access, while sales staff may use Palm PDAs to synchronize corporate information. Standardizing on a single device type throughout the enterprise is difficult. Personal preferences may be difficult to overcome, and depending on the particular wireless application, a given device may or may not be appropriate. Adopting a device-agnostic approach to development ensures that a wireless application will run across the broadest range of devices. The downside is that wireless applications must be coded to the lowest common denominator. Conversely, applications designed for a particular device can fully exploit its capabilities, but trade off longer-term flexibility. Many devices have overlapping capabilities. For instance, e-mail-specific devices and two-way pagers also have personal information manager (PIM) capabilities, and PDAs are starting to include Internet/e-mail access capabilities.

Wireless Applications.

As with any development project, there are many alternatives for acquiring wireless application functionality, each with trade-offs. One fast approach, for example, is to "repurpose" an existing application using middleware that translates existing protocols into wireless ones, such as HTML to Wireless Markup Language (WML). Packaged, wireless



business application software, while available in certain industries such as field service or transportation, is not yet abundant. Custom development is often the only option for unique requirements or when a packaged solution is unavailable. There are few development environments or tools to assist developers in creating wireless applications. Given the complexities of designing a solution, most IT organizations will need outside consulting assistance.

Developers must design wireless applications using completely different paradigms to accommodate device limitations.

Issues and Considerations

Designing, developing, and testing applications represent the hallmark of most IT organizations. Years of hard-won experience have taught IT professionals how to navigate the minefields that can derail a development effort. With wireless application development, the opposite is true. Few IT organizations have implemented wireless applications on a grand scale, little formal guidance is available, and standards and options are evolving seemingly overnight. Wireless architectures are often quite complex. Device limitations and network constraints add another layer of confusion.

In many ways, wireless application development harkens back to the early days of IT. Applications and implementation environments are complex, fraught with arcane detail, and filled with low-level programming concepts. Tools are practically nonexistent. Standards are in disarray. Everyone is learning by trial and error. Listed below are considerations and issues that every IT organization can expect to confront when deploying a wireless application.

Bandwidth.

Wireless network bandwidth varies considerably and seldom approaches the speeds to which wired workers are accustomed. Throughput is increasing, however, particularly in wide-area networks (WANs) and wireless LANs. Nevertheless, widespread deployment of mobile applications outside the four walls of a building won't be achieved until 3G cellular networks are built out, estimated for 2003 in the U.S. In the meantime, IT must design applications for efficient data exchange.

Coverage.

Like bandwidth, coverage varies among networks. The type of wireless application often dictates the coverage needed, as does location. Rural or restricted areas (hospitals, airport terminals) have narrower network and coverage choices. Solutions will often combine several types of networks to reach the level of coverage desired. Network aggregators can help bridge carriers and provide extended coverage.

Standards.

An immature and evolving technology, wireless is full of competing standards and acronyms. Palm OS battles with Windows CE. Bluetooth, an open standard for short-range transmission of digital voice and data between mobile devices (laptops, PDAs, phones) and desktop devices, will take a run at 802.11b. (The Bluetooth Special Interest Group was founded in 1998 by Ericsson, IBM, Intel, Nokia, and Toshiba.) And 2G cellular networks



offer three different standards—Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA), and Global System for Mobile Communications (GSM). Wireless applications must be designed to work with one or more of these standards, but accommodating multiple standards limits functionality.

Security.

Wireless data, traveling over open airwaves, is easily intercepted. Mobile devices are susceptible to theft and misuse, and pose security risks if they contain sensitive data or have persistent connections to a company network. A combination of techniques, from cryptography to authentication servers, firewalls, biometrics, and virtual private networks can help protect wireless applications, data, and devices from security breaches.

Tools.

IT organizations are accustomed to having robust management, development, and testing tools at their disposal. In the wireless world, these tools are rare. Some vendors are adapting existing tool sets to wireless environments, but these offerings are immature. Managing large-scale wireless deployments is problematic. Device configuration, software provisioning, change management, backups, and network testing have the potential to present significant administrative challenges.

Device Limitations.

A typical mobile device will not be able to support the types of robust applications found on a desktop. Developers must design wireless applications using completely different paradigms to accommodate device limitations. Display size and resolution determine the volume and information type that can be presented effectively. Keyboard size or handwriting-recognition schemes direct the types of interactions possible. Memory and processing power affect the application architecture. Size, weight, and useful battery life affect the device's portability and convenience.