Technologies and standards, though, clearly differentiate one wireless network from another. Wireless PANs predominately use IEEE 802.15 (or Bluetooth), wireless LANs use IEEE 802.11 (or Wi-Fi), and so on. The key when deploying wireless networks is to fully define system requirements and choose the type that does the best job of satisfying requirements.

In terms of the user perspective, wireless networks are blending together. NICs for computer devices that support multiple wireless networks are becoming available. A traveler, for example, might have an advanced cell phone that interfaces with both wireless LANs and wireless WANs. This enables a seamless, wireless connection as the person interfaces with e-mail while roaming inside an airport using a public wireless LAN or travels in a taxi to a hotel while interfacing with one of the cellular-based data services.

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Wireless Network Applications

Wireless networks support many applications that benefit from user mobility and higher reliability because of less error-prone cabling. Furthermore, many wireless network applications realize significant cost savings because of increases in efficiencies and less downtime as compared to a wired network. Most wireless network technologies are license free, making them simple and cost effective to deploy.

Basic Configurations

In most cases, the wireless network is merely an extension of an existing wired network. In this case, a user is able to perform a particular task at an optimum location instead of somewhere that is less than ideal. A clerk unloading a truck, for example, can use a wireless handheld unit to scan items that the clerk removes from the truck. This is much more effective than writing down the item numbers and later entering them at a desktop terminal located somewhere inside the facility and far away from the loading dock.

Other situations involve dedicated wireless networks, which completely eliminate the need for wiring. For example, an emergency team responding to an airplane crash scene can quickly establish a temporary wireless network within the immediate area of the crash. All computer devices communicate directly with each other. This makes it possible for team members to have centralized access to important data concerning the crash.

Applications of wireless networks also fall within private or public scenarios. A company or homeowner that purchases and installs a wireless network for its own use is enabling a private application.

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Usually, private applications are made only available for company employees or home occupants. Access to the applications is not made available to the general public. In fact, companies generally implement security safeguards to ensure that only authorized people can connect to the network and access services.

Public applications, on the other hand, provide open access to anyone. A business traveler, for example, can use a public wireless LAN at an airport to access the Internet while waiting for a flight. These public hotspots are becoming widely available in airports and other areas, such as hotels, convention centers, and coffee shops where there are large concentrations of people toting computer devices.

Internet Access

One of the most compelling reasons to install a wireless network is to enable the sharing of a single high-speed Internet connection. With this type of configuration, every member of a family or small business can easily share a single high-speed connection that a cable or DSL modem offers. This is convenient and saves money because everybody can simultaneously have access to the Internet and roam anywhere in the house or office.

The wireless network in this scenario also increases the flexibility of the network because it's easy to add new workstations at any time without having to run cable. The relocation of wireless PCs, along with any printers and servers, is also painless.

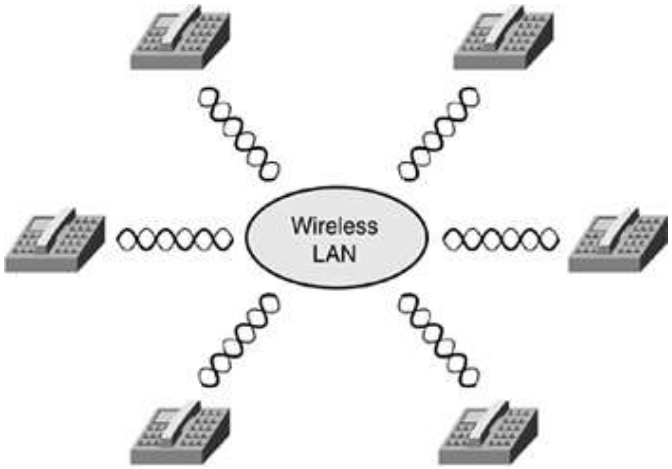
A company can implement a wireless network to allow visiting employees and guests with wireless computer devices to quickly connect to the network with little configuration. The ability to use the Internet while away from the home location can greatly enhance productivity. The visitor can just turn on their laptop and have instant access to e-mail and applications.

Voice over Wireless

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The use of wireless networks to support the transmission of voice conversations is a beneficial solution when people need to constantly stay in contact with each other. In fact, a wireless LAN designed to support voice communications can completely replace a traditional wire-based telephone system within a particular facility. (See **Figure 1-5**.) The combination of voice and data over the same wireless network provides total mobility and lower operating costs.

Figure 1-5. Wireless LAN Provides the Infrastructure for a Telephone System Within a Building



For example, employees within a retail store can locate certain clothes for a customer or check inventory by using special wireless LAN phones. The wireless LAN in the retail store can also support the transmission of bar codes when performing inventory or pricing using a wireless, handheld bar code scanner. Cost savings result because the company needs only to install and support a single communications system that carries both voice and data.

Likewise, a business can deploy their entire telephone system over a wireless LAN. This enables employees to carry their phone with them at all times, similar to a standard cell phone. Employees can accept calls within the facility at any time using a single phone.

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Inventory Control

Many businesses profit from using wireless LANs when managing their manufacturing processes. This lowers operating costs. Because the connections between the manufacturing equipment and main control systems are wireless, the company can reconfigure the assembly process at any time from anywhere, saving time and money.

Through the use of a wireless LAN, a company can track and update inventory in real time, enabling efficiency and accuracy to increase dramatically. In a retail environment, as soon as a clerk purchases or stocks a product, a wireless management solution can update the inventory. In a manufacturing setting, the company can keep the raw materials and finished product statistics up-to-date. Employees equipped with wireless-enabled bar code scanners can check or change product prices or check the number in stock.

The improved accuracy provided by using a wireless LAN to manage inventory creates a chain reaction of benefits. Because the clerks enter the information directly into the main computer through handheld scanners, there is no paperwork to deal with. This significantly reduces human error when entering data, which leads to accurate financial records. This is important to manufacturing companies because accurate financial records ensure correct taxes are paid and fines (and possible law suits) are kept to a minimum.

Health Care

More and more hospitals are deploying wireless networks to improve operational efficiency and convenience. In most cases, hospitals deploy wireless LANs in high patient-traffic areas including emergency rooms, critical care wards, nursing stations, as well as in doctor's offices and patient waiting areas. Hospital staff can use mobile computer devices to increase efficiency and accuracy when caring for patients.

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Health-care centers must maintain accurate records to ensure quality patient care. A simple mistake can cost someone's life. As a result, doctors and nurses must carefully record test results, physical data, pharmaceutical orders, and surgical procedures. This paperwork often overwhelms health-care staff, taking 50-70 percent of their time. The use of a mobile data collection device that wirelessly transmits the data to a centralized database significantly increases accuracy and raises the visibility of the data to those who need the information.

Doctors and nurses are also extremely mobile, going from room to room caring for patients. The use of electronic patient records, with the ability to input, view, and update patient data from anywhere in the hospital, increases the accuracy and speed of health care. This improvement is possible by providing each nurse and doctor with a wireless pen-based computer, such as a tablet or PDA, coupled with a wireless network to databases that store critical medical information about the patients.

A doctor caring for someone in the hospital, for example, can place an order for a blood test by keying the request into a handheld computer. The laboratory receives the order electronically and dispatches a lab technician to draw blood from the patient. The laboratory runs the tests requested by the doctor and enter the results into the patient's electronic medical record. The doctor can then check the results via the handheld appliance from anywhere in the hospital.

Another hospital application is tracking of pharmaceuticals. The use of mobile handheld bar code printing and scanning devices dramatically increases the efficiency and accuracy of all drug transactions, such as receiving, picking, dispensing, inventory, and expiration dates. Most importantly, however, it ensures that hospital staff can administer the right drug to the right person in a timely fashion.

Education

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Many colleges and elementary schools are finding beneficial reasons to install wireless LANs, mostly to provide mobile network applications to their students. In fact, schools have begun using the existence of wireless LAN access as a competitive advantage. These schools are targeting the growing number of students with laptops and expectations of accessing the Internet and school resources from anywhere on campus, such as classrooms, libraries, quads, and dormitories. Students are able to readily check e-mail, surf the Web, access specialized school applications, check grades, and view transcripts. As a result, students make better use of their time.

It's expensive to establish and maintain computer labs for students to utilize for accessing the Internet and completing assignments. Students must often wait in line for using a computer in a lab, which cuts into other activities. A wireless LAN, however, gives students access to needed resources using their own laptop from anywhere on campus at any time, even after the traditional computer lab closes. This more evenly distributes network access to all students, enhancing student efficiency. Of course, the school can also save the costs of running the computer lab.

Real Estate

Real estate salespeople perform a great deal of their work away from the office, usually talking with customers at the property being sold or rented. Before leaving the office, salespeople normally identify a few sites to show a customer, print the Multiple Listing Service (MLS) information that describes the property, and then drive to each location with the potential buyer. If the customer is unhappy with that round of sites, the real estate agent must drive back to the office and run more listings. Even if the customer decides to purchase the property, they must both go back to the real estate office to finish paperwork that completes the sale.

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Wireless networking makes the sale of real estate much more efficient. The real estate agent can use a computer away from the office to access a wireless MLS record. An agent can also use a portable computer and printer to produce contracts and loan applications for signing at the point of sale.

Utilities

Utility companies operate and maintain a highly distributed system that delivers power and natural gas to industries and residences. Utility companies must continually monitor the operation of the electrical distribution system, gas lines, and water consumption, and must check usage meters at least monthly to calculate bills. Traditionally, this means a person must travel from location to location, visit residences and company facilities, record information, and then enter the data at a service or computing center.

Today, utility companies employ wireless WANs to support the automation of meter reading and system monitoring. Instead of a meter reader recording the data on a sheet of paper to later enter in a computer for processing, the meter can periodically transmit the data through the wireless WAN to the utility company. This saves time and reduces overhead costs by eliminating the need for human meter readers.

Field Service

Field service personnel spend most of their time on the road installing and maintaining systems or inspecting facilities under construction. To complete their jobs, these individuals need access to product documentation and procedures. Traditionally, field service employees have had to carry several binders of documentation with them to sites that often lacked a phone and even electricity.

In some cases, the field person might not be able to take all the documents to a job site, causing delay while obtaining the proper informa-

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tion. On long trips, this information might also become outdated. Updates require delivery that might take days to reach the person in the field. Wireless WAN access to documentation can definitely enhance field service. A field service employee, for example, can carry a portable computer that connects to the office LAN that contains accurate documentation of all applicable information.

Field Sales

Sales professionals are always on the move and meeting with customers. While on site with a customer, a salesperson needs access to vast information that describes products and services. Salespeople must also place orders, provide status—such as meeting schedules—to the home office, and maintain inventories.

With wireless access to the main office network, a salesperson can view centralized contact information, retrieve product information, produce proposals, create contracts, and stay in touch with office staff and other salespeople. This contact permits salespeople to complete the entire sale directly from the customer site, which increases the potential for a successful sale and shortens the sales cycle.

Vending

Beverage and snack companies place vending machines in hotels, airports, and office buildings to enhance the sales of their products. Vending machines eliminate the need for a human salesclerk. These companies, however, must send employees around to stock the machines periodically. In some cases, machines might become empty before the restocking occurs because the company has no way of knowing when the machine runs out of a particular product.

A wireless WAN can support the monitoring of stock levels by transporting applicable data from each of the vending machines to a central database that can be easily viewed by company personnel from a single location. Such monitoring allows companies to be proactive in

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stocking their machines, because they always know the stock levels at each machine. This enables the vending company to schedule appropriate stops for people who refill the machines.

Public Networks

Because of the significant proliferation of laptops, PDAs, and cell phones, a growing need exists for mobile interfaces to the Internet and corporate applications. Users want and expect seamless, constant mobile connectivity to all information sources with high levels of performance and availability. Wireless networks provide the infrastructure to support these needs in public areas that are away from the home or office.

A public wireless network offers a means for people on the go to connect with the Internet. In general, the places that have large groups of people that need or want network connections have wireless LAN access. Wireless MANs and WANs, on the other hand, provide coverage over larger areas having sparsely distributed populations.

Public wireless LANs are in common places such as hotels and restaurants, but all kinds of places are installing wireless LANs for public access. For example, approximately 90 percent of all boaters use the Internet regularly while at home or in the office. Many still want access to the Internet while relaxing on their boats, especially when parked overnight at a marina. As a result, marinas around the globe are installing wireless LANs to enable boaters to have access to Internet applications.

note



Refer to the following website for an extensive list of public wireless LANs: **http://www.wifihotspotlist.com/**.

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To use a public wireless LAN, users must have a computer device, such as a laptop, with a wireless LAN NIC. IEEE 802.11b (Wi-Fi) is the most common type of wireless LAN today that public wireless network providers install. The computer device's NIC automatically senses the presence of the wireless LAN and associates with the network. Before accessing the Internet, the user must subscribe to the service, generally through a website accessible from the wireless LAN. Some public wireless LANs are free, but most providers charge a nominal price for using the service.

Another form of public wireless network uses wireless MAN technologies to provide wireless communications links between subscribers (homes and offices) and the Internet. The provider mounts a small antenna dish on the home or small office and points it to a centralized hub. This point-to-multipoint system provides the last-mile connection necessary to supply Internet access to locations where DSL and cable modem connections are not available or feasible.

Location-Based Services

With wireless networks, you can make the location of a particular person or item available to a central location. The ability to track the position of moving objects brings about some interesting applications. The coordinates of users can feed into a server-based application that implements a location-based service.

For example, a public wireless LAN provider can use this concept to display pertinent information to travelers as they walk through an airport or train station. Information might include their location on a moving map, in a way that the passenger can use to find the way to the next departure gate or the nearest restaurant. The value of this location-based service could entice passengers to use the particular venue.

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A hospital might use **location-based services** to track the positions of doctors and nurses. This enables hospital administrators to dispatch the right person to an emergency. Patients end up receiving more rapid and effective care.

The usage of location-aware systems over wireless LANs is also moving to the consumer market. For example, the ability to track children is extremely valuable. Imagine being in a theme park and a toddler wandering off without the knowledge of the parent. With a location system, the parent can easily find the toddler among a large crowd. With a concealed wireless tracking tag located on the child, this type of system can aid tremendously if someone kidnaps a child.

A shopping mall might deploy a location system and send electronic flyers and advertisements to customers carrying PDAs. The system takes into consideration the physical location of shoppers within the facility and customizes actual content appropriately. Shoppers then make better use of their time, and stores make more money.

Users in this example might receive an electronic directory and advertisement flyer on their wireless PDA after entering the mall. The directory includes a map of the facility that identifies the person's exact position. As the shopper clicks on a store, restroom, or ATM in the directory, the map indicates directions that take them to the desired selection. If a spouse or shopping friend is carrying a wireless device, everyone can keep track of each other's location as well.

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