OUTDOOR WIRELESS APPLICATIONS GUIDE FOR ACCESS POINTS AND BRIDGES

Require fast, affordable connections. It's your network—take control.

EXTENDING NETWORKS COST-EFFECTIVELY WITH CISCO AIRONET OUTDOOR ACCESS POINTS AND BRIDGES

In a dynamic business environment, the most successful organizations will be the ones that are most adaptive to change. As they open and close offices, merge and consolidate their operations, and expand into new markets, organizations must modify their networks accordingly to keep up with the latest business changes. Extending the network to outdoor locations, new buildings over long distances, or even across a street can be especially challenging.

Business does not happen just indoors—as wireless LAN (WLAN) devices proliferate, the need to provide them connectivity extends outdoors. Applications such as hot spots, outdoor surveillance, outdoor inventory control, or outdoor baggage handling all stretch the need for WLAN access. And it is not just providing access to client devices—remote networks need to be connected as well. These networks could be in remote buildings, or mobile networks that are located outside. These applications can be deployed cost-effectively with equipment designed specifically for these environments.

Although leased lines can provide the connectivity that organizations require, costs—sometimes quite high—are involved in installing and maintaining the connections. Leased lines also introduce recurring costs that must be accounted for over the long term. Practical concerns such as rivers between sites, historic structures, right-of-way negotiations, or asbestos can make cable installation a lengthy and expensive proposition.

Many organizations are turning to wireless bridges to provide high-speed network connectivity to campus sites and metropolitan-area networks (MANs). Wireless bridges provide fixed links between two or more segments of the network, usually in different buildings. Wireless bridges offer control of the network that cannot be obtained with leased lines. Based on the industry-standard IEEE 802.11 specifications, they deliver performance that is several times faster than E1 or T1 leased lines—at a fraction of the cost.

Cisco Systems®, which has long been innovating wireless networking technology, actively participates in the development of industry standards. The acknowledged leader in networking solutions, Cisco offers a flexible portfolio of outdoor wireless solutions that deliver a solid combination of performance, reliability, network security, and usability. The Cisco Aironet® outdoor wireless portfolio helps enable organizations to meet their growth challenges quickly and elegantly, while realizing a substantial return on investment (ROI).

Wireless Bridge or Leased Lines?
It is easy to cost-justify a wireless bridge when leased-line installation or monthly costs are very high. It is even easier with the free, online Cisco® Wireless Bridge ROI Calculator. Input your specific case at the following Website and see how quickly a wireless bridge pays for itself:
http://www.ciscowebtools.com/wbridge_roi/

Wireless Myths
What happens to a wireless link when it rains? The answer—nothing. It is a common misconception that environmental factors such as rain, sleet, or snow can bring down a wireless link. Even at torrential rainfall rates experienced in the stormiest of locations, the wireless signal is negligibly degraded at the frequencies where 802.11 wireless devices operate. If you follow the suggested fade margins for your wireless bridge links (the fade margin is the amount the received signal level may be reduced while still maintaining acceptable system performance) provided by the Cisco antenna calculator tool, you should be able to deploy with the knowledge that the links will not be hampered by the weather.

ROI: WIRELESS SYSTEMS THAT PUT MONEY IN THE BANK

Because bridges have no recurring charges, savings on leased-line services quickly pay for the initial hardware investment. Self-installed private lines, and in some cases leased lines, in which copper or fiber-optic cable is used, can have very expensive upfront costs when they are separated by obstacles such as freeways, railroads, or bodies of water. Wireless bridges can be installed quickly with an excellent ROI—with payback in many cases within a year.

Outdoor WLAN deployments have an additional requirement to consider: how to environmentally protect the wireless equipment. One possibility is to use indoor equipment and purchase extra weather-proofed enclosures. Another is to place the same equipment indoors, and run coaxial cable to antennas located outside. The better and more cost-effective solution is to use wireless equipment designed for outdoor use—thereby saving the costs of the additional components.

WHERE YOU WANT IT, WHEN YOU WANT IT, HOW YOU NEED IT

Corporations are finding the need to provide ubiquitous WLAN coverage. This sometimes means adding coverage in outdoor or harsh environment locations. Typical organizations that will benefit from the advantages of outdoor wireless products include: education, enterprise, government, healthcare, military, public safety, transportation, and WLAN service providers. These organizations have a variety of possible applications, including the following (refer to Figure 1).

Campus Networks

Whether a typical college campus or corporate offices with multiple buildings, IT professionals are faced with interconnecting LANs in each of the buildings. They require cost-effective, high-bandwidth connections with the flexibility and control often not available with leased lines or cable installations that require trenching.

Nomadic Networks and Users

More and more, networks are "on the move." Vehicles such as buses, trains, ambulances, and patrol cars are being equipped with their own LAN supporting devices such as notebooks, personal digital assistants (PDAs), cameras, and scanners. These mobile networks need to be interconnected to provide information sharing for more informed decisions, improved public service and operational efficiency through more personnel time in the field, and new passenger services.

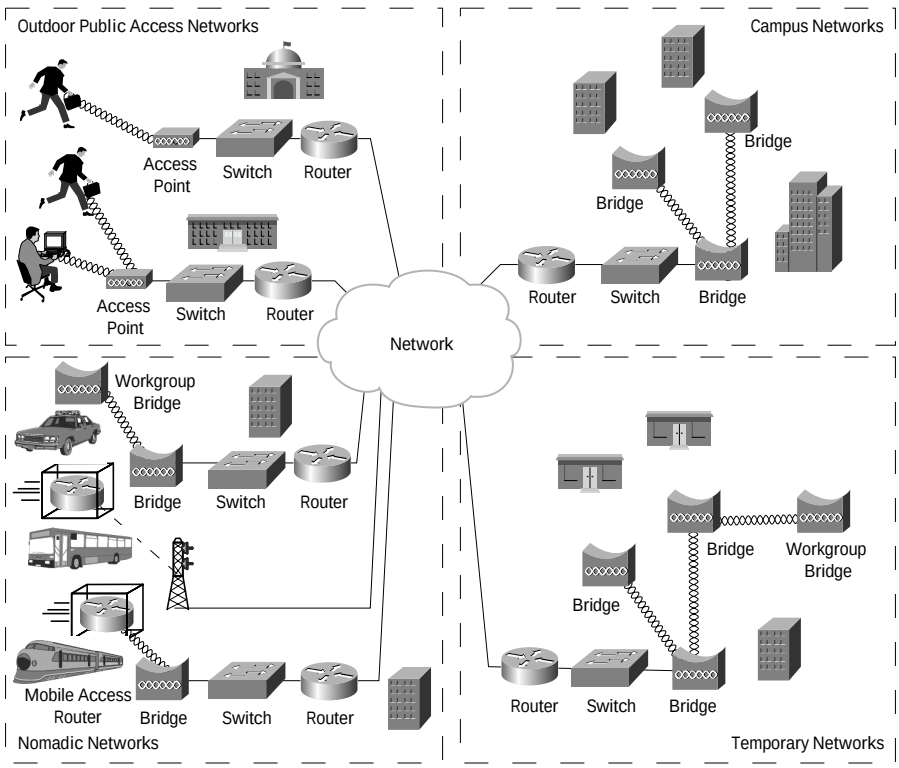
Outdoor Public Access

The proliferation of WLAN hot spots has allowed users to stay connected while in hotels, airports, and even coffee shops. As more users desire to stay connected ubiquitously, outdoor hot spots are being added—some of which include multiple city blocks or even town centers. These outdoor hot spots can be deployed cost-effectively with equipment designed for the outdoor environment.

Temporary Networks

The variety of temporary solutions is limitless, with applications such as remote military campaigns, short-term office leases, temporary buildings such as trailers, or even parking lot tent sales. These deployments require a temporary network infrastructure that is rugged, portable, easy to install, and flexible.

Figure 1
Outdoor Wireless Applications



Outdoor wireless products are useful in many other situations, including:

- Outdoor corporate WLAN access
- Facilities with harsh environments (manufacturing, warehouse, etc.)
- Voice-over-WLAN service outdoors
- WLAN access for Ethernet-enabled devices without wireless capabilities
- Disaster recovery
- Quick turnup while waiting on leased-line installation
- Connections with physical obstacles
- Redundancy (alternative path, full backup, partial backup)
- Point-to-point and point-to-multipoint configurations
- Augmenting network capacity
- Voice backhaul

Best Practices: Wireless Bridge Range

The first questions asked about any wireless bridges are “How far?” and “How fast?” It is no coincidence that these two questions go together. However, the true controlled measure of the range performance of a radio comes from the system gain that considers not only the transmit power but also the receiver sensitivity. This is the best method for comparing different radios such as the Cisco Aironet 1300 Series Outdoor Access Point/Bridge and the Cisco Aironet 1400 Series Wireless Bridge.

The system gain is defined as the transmit power minus the receiver sensitivity. Keep in mind that the receiver sensitivity is different for the different data rates—higher data rates have lower sensitivity. The system gain, plus antenna gain, less cable losses, determines the maximum allowable path loss for a given sensitivity and wireless bridge pair.

The range of a wireless link depends on the maximum allowable path loss—more allowable path loss equals more distance. For outdoor links, this is a straightforward calculation as long as there is a clear line of sight between the two antennas, with sufficient clearance for the Fresnel zone. (The Fresnel zone is an elliptical area immediately surrounding the visual path. It varies depending on the length of the signal path and the frequency of the signal.) A clear line of sight, with Fresnel zone margin, indicates that the path has no obstructions that can degrade the signal.

To assist in the planning of bridge links, Cisco provides a free path calculator tool. This simple tool can be used to calculate required antenna gains and typical antenna heights for a specific path. To use this tool, go to:

http://www.cisco.com/application/vnd.ms-excel/en/us/guest/products/ps458/c1225/ccmigration_09186a00800a912a.xls

BUSINESS-CRITICAL SECURITY AND RELIABILITY

Cisco Aironet outdoor wireless products deliver the performance and bandwidth required for business-class applications, together with the convenience and versatility of wireless networking. You can trust Cisco to provide highly available wireless solutions for your business-critical applications. For the most critical networks, hot standby or secondary bridge links can be deployed to help further ensure uptime.

To protect confidential business information, Cisco Aironet outdoor wireless products feature a wide range of industry-leading security features. Building on basic wireless security standards and providing award-winning Cisco innovations, Cisco Aironet outdoor wireless products support the Cisco Wireless Security Suite. To allow only authorized users access to network resources, the Cisco Wireless Security Suite includes support for IEEE 802.1X mutual authentication. Robust data encryption protects data as it travels over the airwaves, so that confidential information remains private.

For additional authentication control, Cisco Aironet outdoor wireless products offer centralized management through a RADIUS server running software such as Cisco Access Control Server (ACS) software. A recognized leader in network security issues and solutions, Cisco believes that no single point of defense can guarantee data privacy and protection. For true network security, an end-to-end approach is required across both the wired and wireless connections, and Cisco provides the full range of solutions to protect your data.

Enterprise Campuses

Corporate campuses with offices in multiple buildings are ideal settings for wireless networks. Budget-conscious companies can easily establish high-speed networks to connect a single building or an entire business park, while avoiding high monthly leased-line expenses. Cisco Aironet wireless bridges even let companies connect buildings in situations where cabling would be impossible—for example, across an area where right of way is not available.

Easy installation and powerful management tools help enable Cisco wireless networks to keep up with fast-paced business environments. As companies grow and evolve, new branch locations and sales offices can be added to the corporate network within hours by simply installing a wireless bridge at the site.

By definition, an enterprise campus has outdoor common areas between the buildings. These areas are frequented by WLAN users who could require access. Providing coverage can enhance the productivity of the users. With the availability of voice-over-WLAN devices, these users stay connected when they need to be—without the need for usage fee-based cellular telephones.

Enterprise Case Study: Eastern Bank in Boston, Massachusetts, USA

To consolidate operations, Eastern Bank planned to close four offices and relocate 450 employees into a building located approximately three-quarters of a mile (about 1.2 kilometers [km]) from the bank's operations center. A 30-day period had been established for wiring this building so that employees could move in and access the corporate data center, other branches, and the Internet. Eastern Bank soon discovered that the local telecommunications provider could not deliver the T1 lines needed to link the operations center and the new office building quickly enough. At best, it would take about 12 months to establish the necessary T1 lines.

After conducting a thorough site visit and confirming sufficient line-of-sight contact between the two facilities, Eastern Bank decided on a wireless point-to-point link using two Cisco Aironet wireless bridges. Atop the two buildings, the technicians connected both wireless bridges to a Cisco Catalyst® 6500 Series Switch and plugged them into an Ethernet port in the LAN of each building. They also set up narrow-beam antennas, whose minimal power would limit the possibility of signal interception.

Just three days elapsed between ordering the two bridges and final installation. "Performance was flawless from the start," says Aidan Garcia, a networking engineer at Eastern Bank. "We began by hooking up 30 employees in the new building and asking them to feed as much data through the wireless link as they could. We experienced throughput equivalent to several T1s."

The wireless solution has also provided a significant savings for the bank. "We determined that the T1 installation we originally planned on would have cost at least US$40,000 more than the wireless solution," says Garcia.

Healthcare

With their ability to deliver remote connectivity over several miles, Cisco Aironet wireless bridges help enable healthcare organizations to extend their services closer to the public for better, more responsive patient care. Mobile diagnostic trailers and small, remote clinics can connect to other healthcare offices quickly and reliably. And large medical centers can link multiple campuses and buildings to share diagnostic data or administrative information.

Cisco Aironet outdoor wireless products include integrated support for quality of service (QoS), helping enable healthcare organizations to prioritize and manage bandwidth-intensive traffic such as medical images without degrading network performance. And the Cisco Wireless Security Suite protects sensitive health and financial data with advanced encryption and authentication, helping enable providers to comply with government standards such as the Health Insurance Portability and Accountability Act (HIPAA).

Municipal Government

Community-based municipal networks present unique challenges for IT organizations. When government buildings throughout a city need to be connected, the installation costs associated with traditional copper or fiber-optic lines can strain limited budgets. Environmental concerns such as asbestos in older buildings can add to the budget woes.

With Cisco Aironet wireless bridges, state and local governments can create point-to-multipoint networks to connect users at city halls, schools, civic centers, and even temporary locations, with minimal installation charges. Data rates up to 54 Mbps provide plenty of speed for interdepartmental communication—without monthly line expenses. The Cisco Aironet 1300 Series and Aironet 1400 Series, with support for the high-performance IEEE 802.11g and 802.11a protocols, can even power bandwidth-intensive applications such as multiple trunked voice circuits.

Municipal Government Case Study: Dorchester County, Maryland, USA

Since its formation in February 2001, the Technology Department in Dorchester County, Maryland, has worked to create a network system that supports all county-related departments and buildings. Although hard-wired LANs were already in place within Dorchester County facilities, the Technology Department's ultimate goal was to create a single, contiguous network that would simplify communications (e-mail, Internet access, file transfers, voice- and videoconferencing, and more) between all county departments, regardless of physical building location.

According to Israel Engle, Dorchester County's IT director, the solution originally considered was to lease data lines from the local telecommunications provider. "These data lines would typically be in the form of a Frame Relay service through T1 data circuits. The lines transfer a typical regulated bandwidth speed of 768 kbps with a maximum capacity of 1.53 Mbps," Engle says.

Leasing the Frame Relay circuits would have cost the Dorchester County Board of Education approximately US$500 per month per 768 kbps line. Based on Engle's plan to interconnect 12 targeted public buildings, using the leased-line solution would have cost Dorchester County approximately US$6000 per month. Additionally, approximately US$36,000 in hardware would have been required to use the T1 lines. These monthly costs substantially exceeded the limited operating budget provided by Dorchester County commissioners.

"When compared to typical leased T1 Frame Relay lines, the wireless option provides a much higher level of bandwidth—approximately 6 Mbps versus 1.53 Mbps maximum for the T1—at a fixed-capital purchase cost with no monthly recurring charges," Engle says. Calculating the cost of building a leased-line system and ignoring the significant difference in bandwidth, they concluded that the Cisco wireless system would completely pay for itself within six months.

The Technology Department designed a wireless WAN to connect individual LANs already in place at county facilities. Cisco Aironet wireless bridges were installed at each county building. The resulting increase in bandwidth allowed remote users to use a more centralized server farm, providing additional cost savings for the county by reducing the number of servers needed in remote locations.

"Dorchester will not be mandated to add a minimum of US$75,000 to the Technology Department's annual operating budget," Engle says.

Engle handled most of the installation on his own before contacting his local Cisco representative with questions about expanding and enhancing the wireless WAN. "It was very easy to set up. I think that people with just a basic level of technical experience could easily work with this product," he says.

"Even with the recent severe storm cell, including a tornado, no equipment was damaged and the system remained operational," Engle adds. Despite several snowstorms and periods of dense fog, users have had continuous network access.

"Previously, when a county worker wanted to get information from one building to another, it had to be either faxed or hand-delivered. Sure, there were LANs, but they were not linked together. In a widespread rural county, this can cause delays. Now data is sent much more easily and quickly through the unified network," Engle says. "Everybody I talk to has commented favorably on the difference this has made in the way they work."

Education

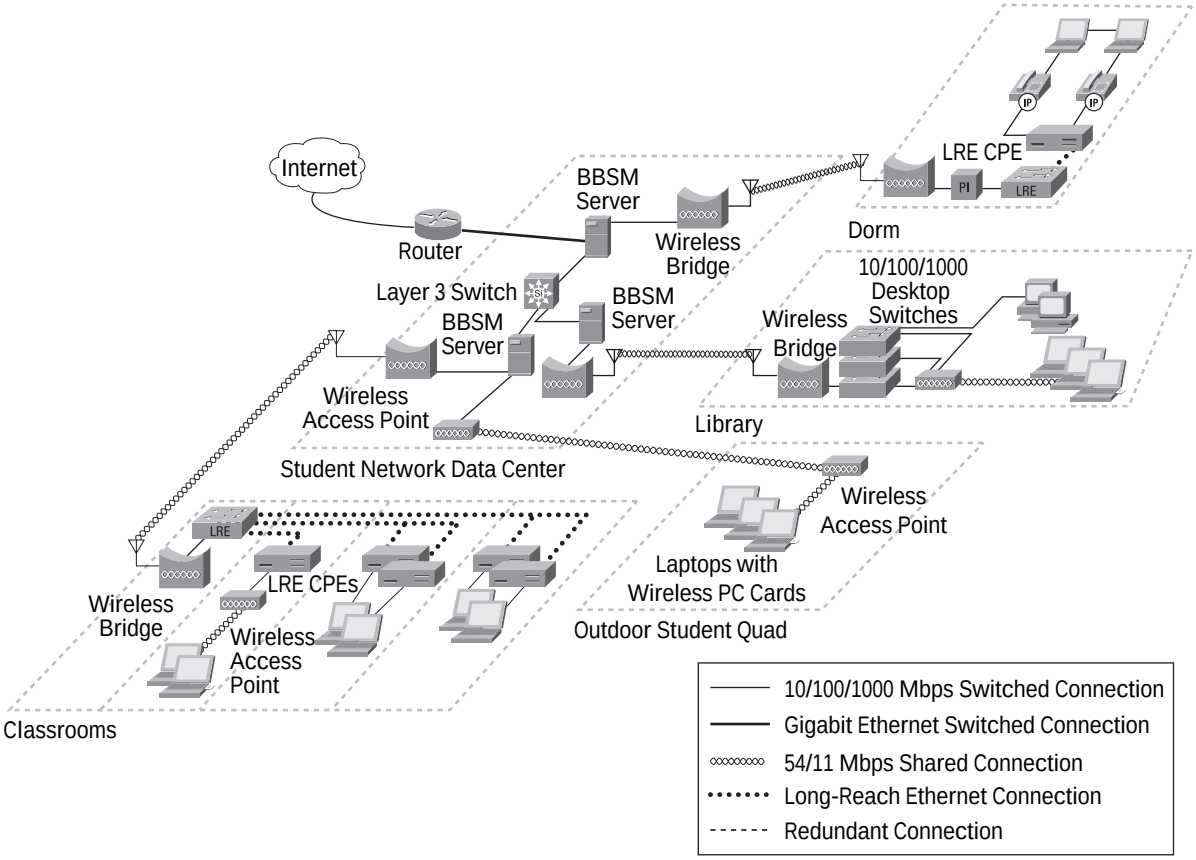
Schools and universities adapt easily to wireless connectivity. On a large college campus, buildings are sometimes miles apart or located in metropolitan settings where it is not feasible to lay cable. And budget-restricted school districts find it desirable to avoid the expense of leased lines and instead use wireless bridges to connect libraries, administrative offices, temporary buildings, and classrooms.

Using Cisco Aironet wireless bridges, schools and higher-education institutions can cost-effectively connect an individual building to the main network with point-to-point connectivity, or use point-to-multipoint networking to interconnect all their campus buildings. And because Cisco Aironet wireless bridges include advanced QoS, educators can confidently deploy collaborative applications, streaming video, distance learning, and other bandwidth-intensive applications.

Students congregating in outdoor locations is a familiar sight at universities. Without a dedicated office, students often sit in pleasant outdoor locations to study. Providing outdoor WLAN access increases the locations where they can work while remaining connected.

Figure 2 shows an example of network architecture for a university deployment. Bridges connect the wired infrastructure of the remote building. Common areas, such as an outdoor courtyard, can be served by either an access point or a Cisco Aironet 1300 Series Outdoor Access Point/Bridge.

Figure 2
Example of University Network Diagram



Education Case Study: East Carolina University, North Carolina, USA

Founded in 1907, East Carolina University (ECU) is a constituent institution of the University of North Carolina, with more than 20,000 students. Because of its urban setting, the university is pressed for expansion space and has drafted plans to move many of its support entities off campus and into the center of the city of Greenville. This will make many buildings previously used for administrative and other support purposes available for academic use.

However, the move takes 150 support personnel beyond the range of the school's wired and wireless communications networks. It also takes them outside the range of the voice-over-IP (VoIP) system that ECU is deploying. Working with technical advisors from Cisco, ECU has installed four Cisco Aironet 1400 Series wireless bridges, two on the campus and two next to the New Greenville Center in downtown Greenville.

"We put up two bridges side by side at each location, one pair functioning as the 'hot' link and the other as the standby," says Drew Sutton, ECU computer network coordinator. "We had intended to install fiber as the primary link in the office building, but we could not get the cable on time, whereas the Cisco Aironet product was readily available, and we had no trouble setting it up."

The two Cisco Aironet 1400 Series wireless bridges on the ECU campus are mounted on a roof-mount tripod atop the Belk Allied Health Center. The wireless signal travels approximately a mile and a half (about 2.4 km) to the New Greenville Center, where the other two Cisco Aironet 1400 Series wireless bridges are mounted on each end of a T-bar that sits on top of a 65-foot (approximately 20-meter [m]) pole next to the building. The signal then uses the supplied dual coaxial cable to provide the building link.

"We are really pleased with the success of the bridges. They give us the trunking capabilities we need, with plenty of throughput from both voice- and data-connectivity standpoints," says Sutton. "We have used 100-Mb microwave dishes in the past, but they are nowhere near as robust as the 54-Mbps solution that the Cisco Aironet 1400 Series provides. And the Cisco Aironet 1400 Series is much less expensive."

Public Safety

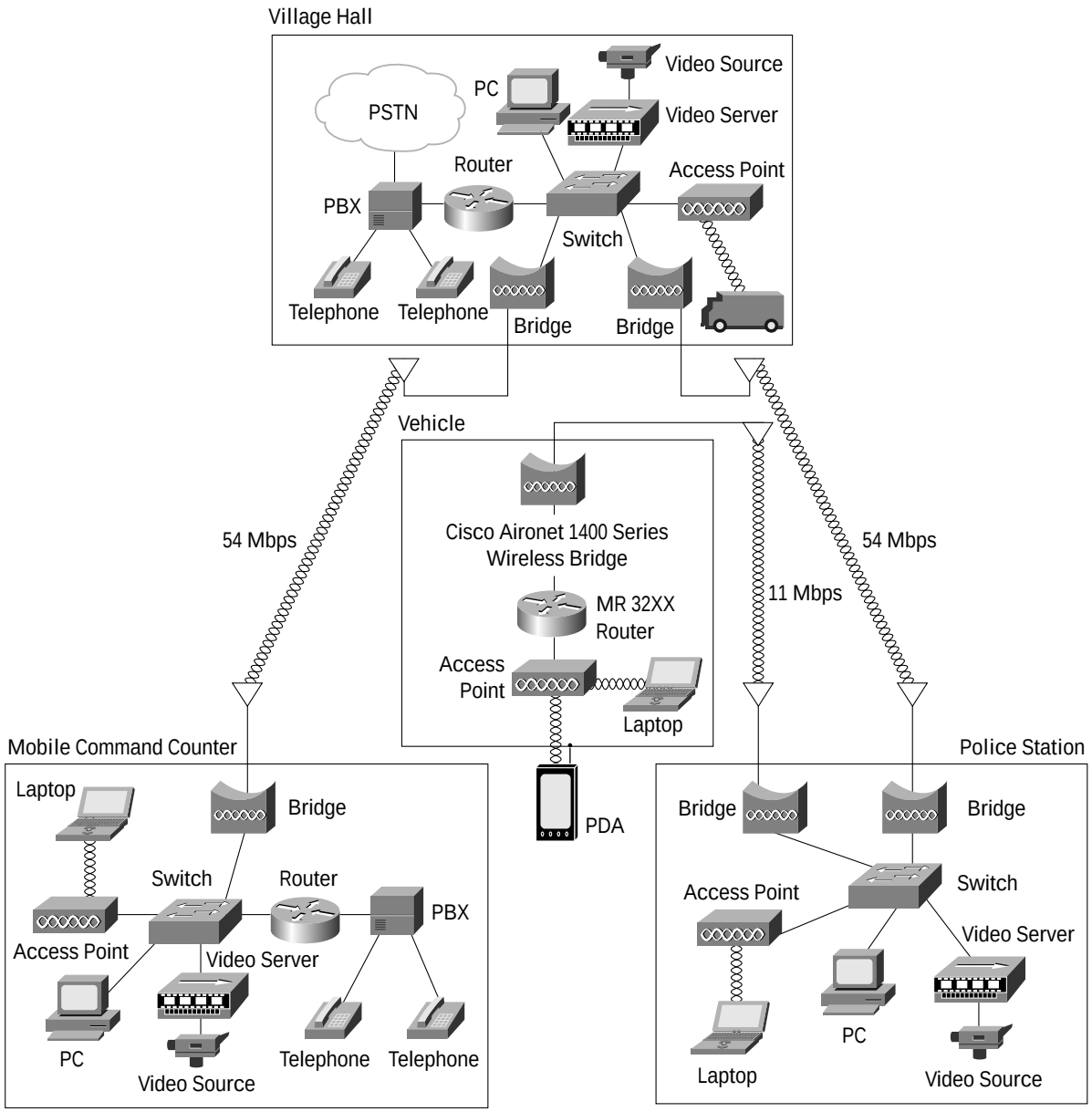
Communication is especially vital to public-safety organizations. Mobile police, fire, medical, and rescue crews must be able to share information quickly in an emergency. It is critical that the WLAN and bridge solutions they deploy offer enterprise-class performance and reliability. Cisco Aironet wireless solutions allow organizations to build highly resilient and available WLANs with fault-tolerant configurations. Using hot-standby capabilities, for example, the network can be designed so that a backup wireless bridge will take over immediately in the rare event of a primary link failure.

Using Cisco Aironet wireless bridges, public-safety agencies can cost-effectively extend high-speed wireless network connectivity to mobile users in zones throughout a city or region. Wireless bridges can be used to create network-access "hot spots" in areas far beyond the reach of a WLAN, because unlike access points, they do not need to be physically plugged into the network. All they require is a power source and a link to the network through another wireless bridge. Public-safety vehicles outfitted with WLAN devices can then connect to the hot spots to access vital data.

Public-safety entities have found wireless bridging to be an effective backhaul technology for video surveillance of ports, highways, railroads, or any location that might be a target and where it is not economically feasible to provide wired links out to the video cameras. The Cisco Aironet 1300 Series and Aironet 1400 Series, with high throughput and the ability to be deployed almost anywhere outdoors, have proven to be quite effective because they can be placed in close proximity to the video source and then used to beam the information back to a central location for analysis and post processing.

Typical public-safety deployments have both fixed and mobile nodes on the wireless network. Figure 3 depicts the wireless bridge providing a two-tiered network with both high-capacity backhaul and medium-capacity access—in this case, to a vehicle.

Figure 3
Example of Public-Safety Network Diagram



Public-Safety Case Study: The Village of Buffalo Grove, Illinois, USA

Located 35 miles (56 km) northwest of Chicago, the village of Buffalo Grove initially took a traditional approach to mobile communications. A WAN solution provided remote access to Police Department data, and patrol cars were equipped with notebook PCs containing basic information about license plates and vehicle registration. Still, the officers remained highly dependent on headquarters for other critical data while on patrol and had to return to the station to write up incident reports. Illegible handwriting, misplaced paperwork, and an inability to quickly retrieve data added to their frustrations. "Our officers were spending countless hours tethered to a desk writing reports instead of out on the street, helping our citizens," recalls Robert Giddens, the village's director of managed information services.

To solve these problems, the village deployed a high-speed wireless network based on Cisco Aironet solutions. Using wireless hot spots located outside fire stations and police headquarters, officers were able to transmit reports directly from their squad cars. Next, "replication centers"—areas where officers could remotely access the Cisco network— were designated. These are areas within the village where officers can transmit reports directly from their cars.

With the wireless network in place, Buffalo Grove's police officers are spending more of their shift time out in the community. If an incident or arrest report needs to be written up, officers need to drive only a few miles at the most to transmit their reports back to headquarters. Not only is the police force more available for Buffalo Grove's citizens, but the wireless network is saving the department more than US$4000 every month, which would otherwise have been spent on T1 and ISDN lines for its four links.

When the basic network was operational, the technology was extended to the village's mobile incident-command vehicle, complete with a 53-foot (16m) pneumatic mast, much like those used by mobile television-broadcast trucks. The mast has a directional antenna that links into the village's wireless network with a Cisco Aironet wireless bridge. Inside the truck are a hub and a computer with a hard-wired network; the bridge connects the wired network to the wireless network. With this bridge link, the truck responds just like any other building on the network. A wireless access point was also placed on the vehicle to provide network access to patrol cars. In addition, a camera is mounted atop the mast, allowing the department to capture video. As a result, the fire and police incident-command vehicles can look down on developing situations, such as a burning building or a crime in progress. Finally, an IP video server was added, so that the stations can connect to the truck using a browser and view live video.

The village plans to provide wireless connections to the schools and the park system. "We have teamed with one school district so far, and our intention is to team with the other three in the near future. Our municipal wireless infrastructure ultimately will include about two dozen public building sites throughout the town. There also will be video cameras at fixed points, facilitating police crime-prevention programs," Giddens says. The enhanced system, he says, will also rely on Cisco Aironet access points and wireless bridges.

Transportation

For transit agencies, wireless networks help enable rapid and efficient communications with transit operations or depots. Wireless technology provides a single point of communication to vehicles that can be used for critical information, including telemetrics, passenger load, route changes, and revenue-collection data. The WLAN capabilities provide a foundation from which transit agencies can offer new services that benefit customers and generate additional revenue.

Service Providers

WLAN saw its beginning in the enterprise in the late 1990s. Early adopter enterprises began deploying the technology in order to solve business problems, streamline processes, and enable the mobility of their workforce within the campus. During the rapid growth of the Internet, numerous Greenfield service providers emerged that envisioned another potential for WLAN—public access or public WLAN (PWLAN). These providers became known as wireless Internet service providers (WISPs). Their business model was to provide untethered Internet access at public locations by taking advantage of the unlicensed wireless spectrum of 802.11b. In-Stat/MDR estimates that Internet hot spots are now available at 12,000 airports, hotels, and other public venues worldwide, representing a fivefold increase in the last two years alone. In-Stat/MDR predicts that the number of worldwide Internet hot spots will reach nearly 56,000 by 2004, and grow to more than 113,000 by 2006. These venues are not restricted to indoor-only coverage. As WLAN users come to expect service from these providers, they also expect ubiquitous coverage—including outdoor locations. Providing this extended coverage requires products designed for outdoor deployments.

For service providers with significant backhaul expenses, Cisco Aironet wireless bridges can be used to reduce costs by providing an alternative mechanism for distributing data to cellular towers and wireless access nodes. For service providers, using a wireless bridge to connect from their points of presence (POPs) to customers without having to lease or build a wired infrastructure results in a lowered cost of deployment, reduced operational expenses, and quicker profitability.

Cable operators have successfully taken the lead in the residential broadband data market but have a relatively small share of the business, or commercial, broadband market. The high costs of laying fiber or coaxial cable to extend the cable plant into most commercial and industrial areas have prevented many cable operators from offering access services to commercial business customers. Industry observer Dan Sweeney, a writer at *America's Network* magazine, noted that although deployment costs are highly variable, the cost of laying fiber underground generally ranges from US$100,000 per mile (1.6 km) for an outlying area to more than US$1 million per mile in large city centers, with the average for a midsize city about US$500,000 per mile ("Cities of Light" by Dan Sweeney, *America's Network*, August 2001). Aerial installations also have the same high variability in cost but are usually about one-tenth underground, at an average cost of about US$50,000 per mile.

Fixed wireless bridging presents an attractive alternative to deploying coaxial cable or fiber as a way to extend the cable data network into commercial areas using both point-to-point and point-to-multipoint architectures. Fixed wireless bridging is attractive to the cable operator from both cost and time-to-market perspectives.

Best Practices: Interference

Operation in the unlicensed bands provides the benefits of rapid deployment and no licensing fees. However, it is important to remember that you are not legally protected against interference from other devices. But with proper site surveys and good deployment practices that take advantage of interference-mitigation features, you should be able to confidently commission your wireless bridge links. Because of the newness of the band and the lower reflective properties and higher absorption properties of 5 gigahertz (GHz) relative to 2.4 GHz, you may find that 802.11a provides less interference. With directional antennas and strategic antenna placement that considers the obscuring properties of environmental features such as buildings and trees, you can significantly reduce the amount of interference and the directions from which it can enter your system. Finally, you should remember that 802.11 was designed for the unlicensed band, and even when you are not able to physically engineer around interference, your links will likely still be able to operate because of the resilient nature of 802.11.

Choosing the Right Technology

If your application requires providing outdoor access for WLAN clients, then the Cisco Aironet 1300 Series is the right choice for you. The superior range available with higher-gain antennas coupled with the outdoor enclosure make the Cisco Aironet 1300 Series the preferred option when compared to other Cisco Aironet access points. The Cisco Aironet 1300 Series also features the added flexibility of being able to be configured as a workgroup bridge—providing outdoor connectivity for nonwireless, Ethernet-enabled devices such as video surveillance cameras.

When trying to decide whether 802.11a or 802.11g is the right technology for your wireless bridge deployment, the first step is to determine which products are available in your country. The latest information can be found at the Cisco Aironet Compliance Status Website at http:// www.cisco.com/warp/public/779/smbiz/wireless/approvals.html. Assuming that you have the option of choosing either the Cisco Aironet 1300 Series or the Cisco Aironet 1400 Series, you now need to assess your bandwidth and range needs in addition to any other requirements, such as size, portability, or environment. For longer-range applications where high throughput is required, the Cisco Aironet 1400 Series is the product of choice. However, if your bandwidth needs are more modest or if the deployment space is limited, such as on a vehicle, the Cisco Aironet 1300 Series may be a better solution. Essentially, the Cisco Aironet 1400 Series is the high-performance leader, whereas the Cisco Aironet 1300 Series is the more flexible, lower-cost, and more compact product offering.

FLEXIBILITY, EASY INSTALLATION, AND INTUITIVE MANAGEMENT

Cisco Aironet wireless bridges are designed specifically for ease of installation and operation, minimizing administrative costs. The Cisco Aironet 1300 Series and Aironet 1400 Series products use the same Cisco IOS® Software as wired networks, providing network managers with a familiar experience and minimizing training and administrative costs.

Delivering the flexibility required by network operators today, both the Cisco Aironet 1300 Series and Aironet 1400 Series products are deployable in outdoor or harsh environments—saving the added expense of NEMA enclosures. Both support a variety of configurations, such as point-to-point or point-to-multipoint, as well as a choice of external or integrated antennas. To further meet deployment needs, the Cisco Aironet 1300 Series also can be configured as either an access point or a workgroup bridge (a workgroup bridge provides wireless connectivity to wired devices with an Ethernet port).

Unlike leased lines, which require a visit from a service provider, Cisco Aironet wireless bridges can be operational right out of the box. Furthermore, organizations do not have to rely on the phone company's technicians to maintain the lines in case of problems, because there are no lines to maintain. Cisco wireless solutions are designed to be flexible in order to meet continually changing business requirements. Cisco Aironet outdoor wireless products offer the following benefits:

- Scalability—Users can add additional channels for more capacity.
- Resilience in harsh environments
- Support for remote power for the Cisco Aironet 1300 Series and Aironet 1400 Series outdoor units
- Multiple mounting options
- Multiple antenna choices
- Intelligent networking features such as QoS and VLAN support

A SOUND, SCALABLE INVESTMENT

Cisco Aironet outdoor wireless products offer a compelling alternative to indoor wireless products, expensive leased lines, redundant backup, or traditional cable where it is too expensive or impractical. Their industry-leading performance, advanced network security, and easy installation and management provide support for critical business-class applications. And their rugged design, together with award-winning Cisco service options, provides a substantial ROI that continues well into the future.

SERVICE AND SUPPORT: THE BACKING OF A WORLD LEADER

From initial installation to future upgrades, Cisco makes it easy for organizations to complement their existing communication systems with secure, reliable, high-speed wireless networking solutions.

- For organizations that need deployment assistance, the Cisco Total Implementation Solution provides skilled, global installation and implementation support. And for those requiring extended technical support, Cisco SMARTnet® and SMARTnet Onsite service programs provide access to the Cisco Technical Assistance Center (TAC), as well as online tools, software updates, and technical assistance.

EQUIPMENT

The Cisco Aironet 1400 Series Wireless Bridge features industry-leading range and throughput, supporting data rates up to 54 Mbps. Its high-performance radio is based on the advanced 802.11a wireless standard and offers the industry's highest receiver sensitivity. The Cisco Aironet 1400 Series includes installation tools to assist in bridge placement, plus a choice of optional high-gain antennas that help enable organizations to extend 54-Mbps wireless networking over greater distances.

A data sheet for the Cisco Aironet 1400 Series is located at:

http://www.cisco.com/en/US/products/hw/wireless/ps5279/products_data_sheet09186a008018495c.html

The Cisco Aironet 1300 Series Outdoor Access Point/Bridge based on the IEEE 802.11g standard, delivers 54-Mbps wireless connectivity at an economical price. Like the Cisco Aironet 1400 Series, the Cisco Aironet 1300 Series is also an outdoor product. The Cisco Aironet 1300 Series has the added flexibility of supporting both access point and workgroup bridge roles.

A data sheet for the Cisco Aironet 1300 Series is located at:

http://www.cisco.com/en/US/products/ps5861/products_data_sheet09186a00802252e1.html.

Cisco Aironet antennas and accessories are available to complete the solution. With the industry's widest selection of directional and omnidirectional antennas (2.4 or 5 GHz), low-loss cable, mounting hardware, and other accessories, organizations can create an outdoor wireless solution that meets the needs of even the most challenging applications.

Data sheets for Cisco Aironet antennas and accessories are located at:

http://www.cisco.com/en/US/products/hw/wireless/ps469/products_data_sheets_list.html

Cisco 3200 Series mobile access routers allow public-safety personnel to maintain secure data, voice, and video connections while their vehicles are in motion. These compact, high-performance devices offer easy mobility and interoperability, so automobiles, aircraft, and boats can stay connected while roaming between radio, cellular, and satellite networks. Support for industry-standard IP helps enable the Cisco 3200 Series to accommodate any type of standard wireless connection, with IP traffic remaining independent of the wireless transmission medium.

A data sheet for the Cisco 3200 Series is located at:

http://www.cisco.com/en/US/products/hw/routers/ps272/products_data_sheet0900aecd800fe973.html

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