Outdoor Wireless Mesh Networking Solution from HP and Cisco

Increase Government Effectiveness with Outdoor Wireless Access
Top goals for local governments around the world include protecting public safety, increasing citizen service levels, and stimulating economic development. Today, those ambitions are thwarted by a wireless network that stops at the building walls, leaving public safety personnel and mobile workers stranded without network access.

Lack of network access from the field compromises public safety. A highway patrol officer, for example, needs to know immediately—not minutes later, after a phone call—that someone stopped for a traffic violation is considered armed and dangerous. Firefighters can plan a more effective response if they have access to hazardous materials databases or building blueprints on the way to a fire. And emergency medical services personnel can accelerate life-saving treatment with access to patient medical records or the ability to videoconference with a physician from the ambulance.

Similarly, government services to citizens and businesses suffer when mobile workers—for example, building inspectors, social workers, and public works employees—need to spend part of their shifts driving to the office to check the case management system and databases and driving back in the evening to submit reports. In a Larstan Business Reports survey, 28 percent of agencies with mobile workers say that their mobile workers spend one to five hours weekly driving between the field and the office, 23 percent spend five hours or more, and 11 percent spend an astonishing 10 hours or more. Time spent driving to the network subtracts from time available to deliver citizen services. It prolongs processes like building permit approvals. And it drains the productivity of mobile workers, as well as back-office personnel who must reenter handwritten reports.

Improving safety and citizen services tends to stimulate local economies. Employers and builders prefer to establish themselves in communities with fast, easy permitting processes—made possible when building inspectors can use wireless devices to issue permits on the spot. Free or low-cost wireless access can also close the “digital divide” between society’s haves and have-nots. And it can give visitors to downtown an incentive to linger longer—and to patronize local businesses.

Now HP and Cisco Systems® offer the best of both worlds. With the Outdoor Wireless Mesh Networking Solution from HP and Cisco®, local governments and public safety agencies own and maintain complete control over their network infrastructures, while outsourcing management and operations to HP, a global leader in IT services and a provider of a broad range of secure mobile devices.

1. 2006 survey of 139 United States state and local government IT directors commissioned by Cisco Systems.
Outdoor Wireless Mesh Networking Solution Overview

The Outdoor Wireless Mesh Networking Solution is part of a larger family of offerings from Cisco and HP for wireless networking and mobility, including the pervasive indoor wireless networking solution.

The Outdoor Wireless Mesh Networking Solution from HP and Cisco securely extends the government’s IP network into the surrounding community, providing public safety and other mobile government personnel with wireless access to mission-critical applications and databases through ruggedized outdoor access points (Figure 1). The Cisco Outdoor Wireless Mesh Networking Solution provides intelligent wireless routing, creating dynamic wireless links between access points and eliminating the need for a wired network connection to each access point. Using the Adaptive Wireless Path Protocol (AWPP), the network automatically self-optimizes and self-heals, enabling adaptive response to changing network conditions while minimizing deployment and management costs. The government’s indoor and outdoor wireless mesh networks can be centrally managed. The Outdoor Wireless Mesh Networking Solution from HP and Cisco is based on the Cisco Unified Wireless Network architecture, which integrates wired and wireless networks that can be managed as one. Cisco quality-of-service (QoS) technology is built into the infrastructure, enabling agencies to use their wireless networks for voice and video as well as data.

Figure 1. Outdoor Wireless Mesh Networking Solution from HP and Cisco
The multiservice, standards-based IP wireless mesh network infrastructure from Cisco enables cities to offer much more than Internet access. In fact, cost-conscious governments appreciate that a single infrastructure investment enables a practically unlimited number of wireless applications for citizen service and public safety—now and in the future (see the sidebar “Beyond Internet Access: Applications for Outdoor Wireless Networks”). After the outdoor wireless mesh network is in place, governments can add new wireless applications at any time without having to individually cost-justify them, incrementally improving quality of life and service effectiveness. The return on investment (ROI) increases with each new application that government deploys.

What is more, by outsourcing management of a privately owned wireless infrastructure to HP, the city maintains complete control of its vital network-based services. In an emergency, the city can shut down nonessential network-based services to preserve bandwidth for critical communications and emergency services. HP provides end-to-end services for the Cisco Outdoor Wireless Mesh Networking Solution, including:

- Strategy
- Systems integration
- Network modeling
- Security
- Radio frequency (RF) assessment and analysis
- Design
- Deployment
- Management
- Monitoring and maintenance

Beyond Internet Access: Applications for Outdoor Wireless Networks

- In-field access to municipal databases: case management, public safety, transportation, and public works
- On-the-spot licensing, permitting, and inspection reports
- Parking enforcement: wireless-enabled meters that send messages to parking enforcement personnel personal digital assistants (PDAs) when vehicles are in violation
- Outdoor access to a city-services portal, where citizens can report potholes, check event schedules, and more
- Automated meter reading for gas, water, and electricity
- Video surveillance monitoring of high-crime areas
- Fleet management: collecting engine telemetry data over the IP network, monitoring passenger loads, and more
- Mobile geographic information systems (GISs) for pinpointing the location of water mains, alerting firefighters to the presence of nearby chemical facilities, and more
- Asset management through radio frequency ID (RFID) tracking
- Voice over wireless LAN
- Wireless connectivity in schools and at students’ homes, helping to bridge the digital divide
Major IT and Business Benefits

Improving Safety for Citizens and First Responders

Immediate access to up-to-date information from a laptop or PDA helps first responders make informed decisions to crucial questions that affect safety. The Outdoor Wireless Mesh Networking Solution from HP and Cisco brings the network to public safety personnel, giving them access to information, images, and video they need to make the most effective decisions. Providing network access to field personnel improves safety by increasing the speed of the decision-making loop, improving situational awareness, and enhancing the overall quality of decisions (Table 1).

Wireless video surveillance provides especially compelling benefits for public safety. Using wireless closed circuit television (CCTV) video cameras for surveillance, law enforcement personnel can monitor real-time video from the precinct or even from their vehicles, and security personnel can monitor courtrooms and security checkpoints. Installing video surveillance systems can reduce street crime—as well as community fear of crime. What is more, wireless cameras are far less expensive to install and maintain than traditional wired cameras because they do not require cabling and can be freely moved.

Improving Service Effectiveness and Productivity of Field Personnel

A single investment in an Outdoor Wireless Mesh Networking Solution from HP and Cisco supports a nearly unlimited number of services at very little incremental cost. Even outdoor wireless services that could not be individually cost-justified become possible because no new capital investment is needed: all services are delivered over the same infrastructure.

Mobile worker productivity improves as well. In communities with an Outdoor Wireless Mesh Networking Solution, mobile workers can retrieve and submit information where and when it is needed—printing out building permits on the spot, for example—greatly increasing government responsiveness. City inspectors can drive up to the closest Wi-Fi hotspot and use their laptops to print approvals, correction notices, permits, and reports—eliminating delays while the inspector drives to the office and administrators reenter handwritten forms. The agency accomplishes more without increasing headcount because workers can spend more time in the field.

Mobile workers also become more productive when they can remotely monitor and control utility meters, pollution sensors, park gates, and other equipment instead of making in-person visits. Adding inexpensive wireless connections to existing devices and sensors in the field enables agents to read water, electricity, and gas meters from the network, saving time. Early detection of significant water loss at government offices, residences, or businesses improves government service by avoiding unexpectedly high costs on monthly bills and conserving natural resources. Park doors can be shut automatically at night. Wireless sensors for traffic, pollution, noise, and flood conditions provide continuous, accurate measurements, allowing city managers to take timely actions and to publish up-to-date status alerts for citizens on the Web. In summary, local government improves its service effectiveness without increasing resource requirements.

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<thead>
<tr>
<th>Public Safety Agency Goal</th>
<th>Sample Benefit of a Wireless Mesh Network</th>
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<tbody>
<tr>
<td>Increase speed of the decision-making loop</td>
<td>Law enforcement officers can consult booking photos or restraining orders that help them make more timely, more informed decisions.</td>
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<tr>
<td>Improve situational awareness</td>
<td>First responders on the way to a hostage situation, fire, or other incident can begin planning their response and gain valuable time by studying real-time video captured by a wireless camera at the incident scene.</td>
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<tr>
<td>Enhance the quality of decisions by providing access to more resources</td>
<td>Firefighters on the way to a hazardous materials spill can consult hazardous materials databases and building blueprints to plan actions for the best outcome.</td>
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Table 1. How In-field Access to Data, Images, and Video Helps Public Safety Agencies Meet Their Top Goals
Stimulating Economic Development

For residents and visitors, free or low-cost wireless access can enhance quality of life, helping to attract and retain residents and employers. Some cities provide free or low-cost outdoor wireless access in downtown areas to encourage people to linger during lunch hours and after work—and spend money at local businesses—rather than rushing home to read e-mail or check out entertainment options. Others use outdoor wireless access to help bridge the “digital divide,” giving all students the same access to the Internet-based educational resources and providing adults with more convenient access to the distance-learning and job-search tools they need to improve their employment prospects.

Economic vitality receives a further boost when communities use their outdoor wireless mesh network to increase their appeal for residential and commercial development. If a business narrows its list of new sites to two communities, all else being equal, it will likely choose the community with the friendlier, faster permitting process—something that e-permitting makes possible.

Municipalities can also transform their outdoor wireless mesh network into a new source of revenue, accelerating return on investment, by selling advertising to local businesses or leasing use of the infrastructure to commercial service providers. In this arrangement, a service provider uses the infrastructure to provide premium wireless broadband services to residential and mobile users. The service provider benefits by avoiding capital expense to build its own infrastructure, and the municipality gains a new revenue stream. HP can handle settlement arrangements with participating service providers so that municipalities do not need to add staff.

Delivering Low Total Cost of Ownership and Predictable Costs

Governments pay a single monthly fee for the comprehensive lifecycle services from HP, per wireless access point. Converting a variable cost—with unpredictable service costs for problem resolution—to a fixed monthly cost makes it easier to budget and plan for expanding the coverage area. HP charges a very competitive rate because the Cisco solution is easy to deploy and maintain, requiring less time and fewer resources. For example, Cisco Aironet® wireless access points configure themselves for optimum performance, eliminating the need for HP personnel to manually configure each device. The management software correlates events from multiple access points so that HP can identify and remediate potential performance bottlenecks or security breaches before harm is done. In addition, the solution is “self-healing,” avoiding congested areas and selecting an alternative path through a network if a link fails.

Other factors contributing to the low total cost of ownership (TCO):

- Cost avoidance for enabling client devices, such as laptops and PDAs, for wireless networks because HP client devices have 802.11 technology built in
- Low capital equipment costs because agencies can use volume discounts through Cisco and HP
- Option to replace mobile workers’ cellular phones with wireless IP phones, reducing cell phone bills
- Elimination of leased line costs—often US$300 or more per month per line—because city offices can connect to the network through the outdoor wireless mesh

Protecting Private Citizen and Government Data

Protecting the privacy of sensitive data ranks high among local government’s priorities—particularly in today’s climate of citizen concern about identity fraud. The Cisco Outdoor Wireless Mesh Networking Solution incorporates integrated Cisco security technologies to maintain the confidentiality of private citizen and government information, protect against infection and attack, and provide different levels of access to government and citizens. The comprehensive set of wireless LAN authentication and encryption features closely resembles the security services in a wired LAN. All transmissions are encrypted for privacy, using dynamic per-user, per-session encryption keys. Every packet can be encrypted with a different key, using the Advanced Encryption Standard (AES), and thereby thwarting attempts to hack into the network by deciphering the key for an intercepted packet. Cisco Aironet wireless access points support all 802.1X Extensible Authentication Protocol (EAP) types, including EAP Cisco Wireless, also known as Cisco LEAP. Users can access the network only after their credentials are authenticated. Information is protected in transit using a unique 128-bit cipher and Temporal Key Integrity Protocol (TKIP) enhancements from Cisco Systems. Governments that want employees to have network access from other hotspots—for example, at coffee shops, airports, or hotels—can use Cisco IP Security (IPsec) VPN solutions, which meet stringent security requirements with Triple Data Encryption Standard (3DES) encryption and authentication through digital certificates, one-time password tokens, and preshared keys.

3. In the Larstan survey, 45 percent of the respondents said that within the last 12 months, the ability to find out earlier about an infrastructure condition such as a water leak would have prevented waste, loss or inconvenience.
Solution Components

**HP MetroScale WiFi Services**

HP provides a complete lifecycle services portfolio for public sector wireless mesh projects, including strategy, systems integration, networking modeling, security, RF assessment and analysis, design, deployment, management, monitoring, and maintenance. HP can also provide help desk assistance for end users—both government personnel and citizens using the network for Internet access. To help ensure availability and optimum performance for the government network, HP uses management tools including HP OpenView, CiscoWorks, the Cisco Wireless Control System, and the Aptilo WiFi Service Management Platform application. By outsourcing management of the wireless mesh network infrastructure, IT groups remain free to develop new services to increase service effectiveness and enhance public safety.

**Cisco Outdoor Wireless Mesh Networking Solution**

HP deploys and manages all aspects of the Cisco Outdoor Wireless Mesh Networking Solution. Cisco Aironet 1500 Series Outdoor Wireless Mesh Access Points support dual-band 802.11a and 802.11b/g. They use the Adaptive Wireless Path Protocol to form a dynamic wireless mesh network between remote access points and deliver secure wireless access to any Wi-Fi-compliant client. The Cisco Wireless LAN Controller, based on Lightweight Access Point Protocol (LWAPP), treats all access points as part of a unified wireless network system and enables HP to provide centralized management of device configuration, security policies, and RF parameters. HP remotely configures, controls, and monitors the outdoor wireless mesh network using the Cisco Wireless Control System, simplifying operations and reducing TCO.

**Aptilo Metro Wireless Service Management System**

The Aptilo Metro Wireless Service Management System is a world-leading platform for managing broadband services in citywide public, semipublic, and private access zones based on wireless mesh, Wi-Fi, and Worldwide Interoperability for Microwave Access (WiMAX) infrastructures. The system includes all needed functionality for authentication, authorization, and accounting (AAA); provisioning; prepaid and postpaid billing; roaming; and customer care.
Why HP and Cisco?

The Outdoor Wireless Mesh Networking Solution from HP and Cisco combines HP Services expertise with Cisco technological leadership in outdoor wireless mesh. Municipal customers gain the benefit of HP’s extensive knowledge base in wireless mesh networking, accumulated since 2003, when the technology was first introduced. A comprehensive services portfolio is delivered by HP’s skilled consultants and engineers, who offer expertise in systems integration, program management, and project management.

Cisco provides a proven, reliable wireless mesh infrastructure with extraordinary ease of management because of its centralized intelligence. Cisco is recognized as a leader in outdoor wireless mesh networking, with public sector customers around the world, including the City of Madison, Wisconsin; City of Dayton, Ohio; City of Lebanon, Oregon; and City of Fredericton, Canada. Outdoor Wireless Mesh Networking Solutions from HP and Cisco provide industry-leading security—integrated into the solution—as well as centralized management, both of which translate to lower total cost of ownership.

For more information, contact your Cisco or HP account managers or reseller or visit us on the Web at: www.cisco.com/go/wirelessmesh or www.hp.com/go/wireless.