Special Report

Wireless Cities: A Strategic Roadmap

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What if city employees could adjust the timing of traffic lights directly from an intersection, or law-enforcement officers could view a suspect's mug shot from their squad car? What if citizens could make an appointment with their doctor or check their children's test scores from the comfort of their own living rooms or a nearby community center? And what if cities could attract new businesses by allowing them to collaborate over a comprehensive voice, data, and video wireless network?

These examples are closer to reality than anyone might think. In fact, public wireless initiatives have sprung up in cities and communities around the world—from San Francisco to Paris to Jerusalem to Singapore—and new ones are coming online each day. According to recent research, the number of active programs in the United States alone tripled during 2006.[1] Furthermore, the number of global municipal wireless projects is expected to grow from 250 in 2006 to nearly 1,500 by 2010.[2]

Despite growth projections, many municipal wireless initiatives have stalled, changed direction midstream, or simply not gained the traction that city officials had hoped or envisioned. There are many reasons for this. For one, many cities are fascinated by wireless technology in and of itself, but do not realize that it is an enabler for a number of strategic, socioeconomic goals. For example, cities are focusing on wireless access to support the recent phenomenon of outdoor hotspots that provide public Internet access in parks, cafes, and transportation terminals, yet are ignoring the strength of wireless as a low-cost access method for homes and businesses when a wired infrastructure is not available or cost-effective.

Second, cities have adopted "me too" strategies, launching wireless programs in response to other cities' announcements without first crafting a clear-cut plan that outlines the city's long-term policy goals and answers some important questions: How will city officials and administrators use the network? Which specific activities will citizens be able to perform with the network? And, how can the network help stimulate business and economic development in the city or region? The answers to these questions compel different technology decisions and prompt additional questions about the business model: Who will fund the development of the network? Who will own it? How will the investment in a municipal wireless network become financially, economically, and socially sustainable?

Without a forward-thinking plan that clearly describes policy objectives, a city cannot make the right business model and technology decisions to help ensure the long-term success and sustainability of the wireless network. This puts the overall program at risk as soon as political, organizational, or financial issues arise.

1. *Wireless Cities Update*, MuniWireless LLC, December 2006.
2. In-Stat, August 2006.

Through its work with several pioneering cities around the world, the Cisco® Internet Business Solutions Group (IBSG) has identified a strategic, four-stage process that helps cities link policy objectives to effective wireless programs, thereby ensuring the viability of city initiatives:

Stage 1—Create a wireless city vision that identifies and clearly defines the city's long-term policy objectives for the wireless initiative

Stage 2—Conduct a feasibility study that defines the impact of the wireless network initiative in terms of the city's overall goals

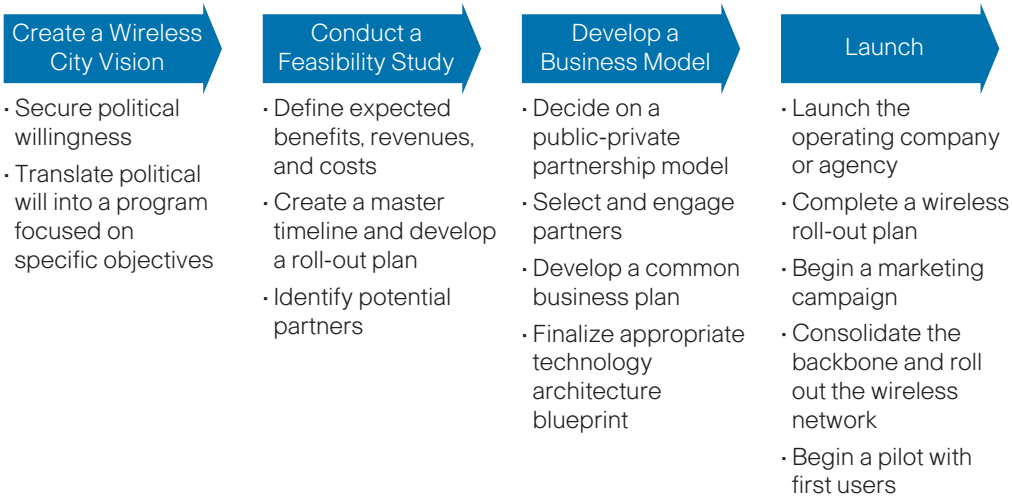
Stage 3—Develop a business model that includes not only the government itself, but also private investors who can contribute to the overall sustainability of the business model

Stage 4—Build a technology infrastructure and launch a wireless initiative that supports the policy objectives defined in the city's wireless vision

With this structured, strategic approach, municipal governments can improve the efficiency and reduce costs of internal operations, improve the quality and safety of residents' lives, and enhance the climate for economic development and tourism.

This paper outlines Cisco's four-stage roadmap for creating and implementing a successful wireless city initiative, as illustrated in Figure 1.

Figure 1. Wireless Initiative Process



Source: Cisco IBSG, 2007

Stage 1—Create a Wireless City Vision

The first step a municipal government must take in developing a sustainable wireless initiative is to determine the overall goals of the project. These goals should be linked directly to a city's long-term policy objectives. In its work with customers, Cisco IBSG has identified three common scenarios that can be implemented simultaneously or in a phased approach (that is, a city may begin with the first scenario and then expand the scope of the project to the other two scenarios):

- **Wireless government**—improve internal efficiency and reduce costs of public administration
- **Wireless public services**—extend city services to citizens and improve public safety
- **Wireless city**—ensure digital inclusion and spur economic development

The relative importance of each of the scenarios—based on a city's policy goals—will determine the overall business model and technology architecture of the wireless initiative. Focusing more heavily on digital inclusion, for example, would mean prioritizing deployments in low-income areas and working with service providers to subsidize access fees for users, rather than initially blanketing the city center—and its higher-income residents and workers—with wireless access.

Let's look at these scenarios in more detail.

Wireless Government

Often, city government looks inward first to reap benefits from a wireless network. With a wireless infrastructure, a city can improve internal efficiency and reduce costs. Typically, a city views a wireless network as a way for field personnel to access the city's information systems without having to travel to city hall to complete a transaction or process, resulting in time savings and greater efficiency. The network can also help lower the city's operational costs by reducing the need for office space through the creation of flexible workspaces. This enables city employees to work remotely without the need for a dedicated workspace at a city-owned building. And, by connecting various city buildings with a wireless network, internal processes and workflows become more efficient because employees can access information and interact with citizens and employees in other departments, from any location—in their office and around the city.

The London borough of Hillingdon successfully built a wireless network with this goal in mind. By providing access to internal information for its housing department, employee self-services, and e-procurement capabilities over the wireless network, Hillingdon realized immediate savings of US$3.7 million in office leasing costs and annual savings of $330,000 in employee time and travel costs. Department staff can now connect wirelessly from a number of flexible workspaces in city libraries, satellite city offices, and other wireless hotspots throughout the city, rather than having to travel from the field to the department's main office. Using the network, employees can, for example, log a service call or upload maintenance information about a damaged city building

directly into city applications and databases from the field, saving valuable time and money. And, city workers can order the supplies needed for those repairs—and check delivery status—at any time, avoiding wasted time spent scheduling repairs before the required parts or supplies arrive.

Wireless Public Services

Having achieved internal efficiency and cost reduction, a city may then look beyond its internal needs to the requirements of its citizens. The primary objective of this scenario is to extend city services to citizens, encouraging wider participation in city processes, easing city management tasks such as traffic and transport, and improving public safety.

The city of Berlin, Germany is at the leading edge of this scenario, implementing a wireless network to extend its city government into the community with mobile customer service offices. Equipped with Wi-Fi-enabled laptops and printers, civil servants from the public services department travel to local shopping malls or public markets to allow citizens to apply for or renew a driver's license, or request a building permit, without having to travel to city or department offices. To improve service and eliminate lengthy waits in queues, a Short Message Service (SMS)-based wait-list management system sends a message to the citizen's cellular telephone when it is his or her turn to be served, enabling the citizen to conduct other business or shop for goods in the meantime.

In Paris, France, the Regie Autonome des Transports Parisiens (RATP), responsible for the city's bus and subway systems, uses a wireless network to improve employee productivity and customer service at the same time. Station employees use Wi-Fi-enabled PDAs to access applications related to their specific job functions, such as vehicle and train maintenance records, helping them be more productive wherever they are. In addition, they can use their PDAs to download train tables, enabling them to provide on-the-spot assistance for riders. And, in-station wireless hotspots help riders find real-time traffic reports and local maps, and create itineraries via self-service kiosks.

> **"The RATP is continuously improving the safety and the well-being of its drivers and passengers. To achieve this, we are developing professional IP applications to address the needs of increased security, passenger information, operations, and maintenance. These applications need full connectivity on the move."**
>
> Mathieu Dunant
> Travellers Department, RATP

Other cities are experiencing the benefits of using a wireless network to improve public safety. While initially implemented to monitor noise levels at cafes and restaurants using wireless sensors, the wireless network in Westminster, London is also used to prevent crime and keep city streets clean. By deploying wireless cameras on the existing network infrastructure, city officials can actively monitor high-crime areas. As a result, criminal

activity has decreased to its lowest level since April 2004. As a side benefit, the city has also improved the quality of living for its residents by proactively notifying the waste management department when garbage accumulates more quickly than normal. In the first three years of operation, the wireless network has enabled the city to save nearly £5.5 million (approximately US$9.9 million) in operational costs, and to experience a significant increase in field employee productivity.

Similarly, Renton, Washington, a thriving U.S. suburb of Seattle, implemented a wireless network to improve government services and public safety in the face of dwindling city funds. Using wireless devices installed in their police vehicles, officers can access and download photos of criminals, warrants, stolen-property and missing-person reports, and police arrest records in a matter of seconds. And, firefighters and other first responders can access incident records and hazardous materials information from their vehicles, enabling them to investigate possible hazards while en route to a fire. Plus, all public safety officers can file reports and submit time sheets from their vehicles directly into the city's records system, improving productivity and reducing operational and personnel costs.

Wireless City

The next logical step IBSG recommends is to provide open access to the network, giving citizens opportunities for digital participation and encouraging economic development. With this scenario, a city can bridge the digital divide by bringing basic connectivity to areas of the city or region lacking network access due to geographic or socioeconomic reasons. By providing access to a ubiquitous wireless network, cities can also attract new businesses that spur economic development.

For example, the population of East Manchester, England declined 60 percent in a 40-year span as a result of widespread factory and mill closures. Many of the remaining residents, unemployed and living near the poverty level, had no landline telephone service and did not own a personal computer—let alone have access to the Internet. To bridge the socioeconomic divide that existed between the citizens of East Manchester and the rest of the United Kingdom, the Manchester city council focused on bringing its citizens into the digital age. Through the Manchester Digital Development Agency, the city began by connecting local schools and public sector offices, and later provided home-based wireless Internet access. To date, more than half of the city's residents are online.

Thanks to low-interest loans offered through a partnership with a local credit union, East Manchester residents can now afford to purchase PCs to access the Internet wirelessly from their homes, participate in online skills training, make less-expensive voice-over-IP (VoIP) telephone calls, and access public services. The PC and Internet penetration rates in East Manchester are now higher than the national average. And in a recent survey of the city's residents, 45 percent of respondents requested more IT training to help them establish new, home-based services businesses.

In addition to helping its less-advantaged population access online services, a city can use the wireless infrastructure to attract new businesses and benefit tourism. For example, the Finnish city of Oulu spent nearly 10 years developing a strategy to stimulate economic development by luring leading wireless and mobile service providers and manufacturers to the city. To this end, Oulu recently launched two wireless initiatives.

The first initiative, PanOulu, is an open, wireless, metropolitan-area network that brings mobile city services—such as library reservations, parking ticket payments, and remote monitoring of elderly residents—to all citizens. Not only does the city hope to use the PanOulu network to promote usage of wireless online public services, but it also expects to stimulate the development of new mobile services by local software and IT-focused businesses that can then provide these services to other cities in Finland and export them around the world.

The second initiative is Octopus, a citywide wireless test network that enables IT companies, mobile operators, and research and educational firms to develop and test new applications and services in a controlled environment before selling them to other municipalities in Finland and abroad. By locating in Oulu and investing in the development and testing of applications and services across the wireless network, companies can gain important insights that may translate into a competitive advantage when extending their software or services to an international customer base. To date, several mobile services companies, including Nokia and Ericsson, now have R&D offices in Oulu to take advantage of Octopus.

Finally, in Jerusalem, the wireless network not only improves the quality of life for the city's businesses and residents, but also benefits tourists visiting the Holy City's attractions. With free wireless access to e-mail and the Internet throughout central Jerusalem, citizens and tourists alike can stay connected and pinpoint destinations and sites of interest at cafes, museums, public squares, and even bus stops.

> **"Seeing visitors, residents, and students using the system to interact and communicate in the city's squares and cafes is a wonderful thing. It sends a clear message that we are a thriving, fully modern community in this ancient city."**
>
> Uri Lupolianski
> Mayor of Jerusalem

Stage 2—Conduct Feasibility Study

Once a city selects the scenario with which it would like to start (wireless government, wireless public services, or wireless city), Cisco recommends that the city government conduct a comprehensive feasibility study outlining the following three areas:

- Expected benefits for public sector organizations, citizens, and businesses
- Potential revenue-generating opportunities to sustain the network and offset costs
- Timetable for a rollout, including a pilot program and a staged roll-out plan

Expected Quantifiable Benefits

The first step of the feasibility study is to develop metrics that quantify the benefits of the wireless network for each of the constituencies it will serve—public sector organizations, citizens, and/or businesses—based on the scenario the city chooses.

For cities pursuing the wireless government scenario, quantifiable benefits would be viewed and measured in terms of productivity improvements, such as less time spent on administrative tasks or faster access to information, and in overall cost reductions, including savings on office space, overhead, or travel.

For projects focused on extending city services and improving public safety with wireless networks, metrics would include increased citizen satisfaction due to faster and more effective access to services; time savings by citizens due to instant wireless access to services; and an overall decrease in crime rates.

For cities building a wireless network to promote social inclusion and economic development, PC and Internet penetration rates—both before and after deployment of the broadband wireless network—are key metrics. Other measurements can illustrate the impact of the wireless network:

- Citizens registering for e-learning courses
- New community services that have moved online
- Increase in gross domestic product (GDP)
- Decrease in unemployment rate
- Net new businesses located in the city

Potential Revenue-Generating Opportunities

Generation of multiple revenue streams is critical to the sustainability of a city's wireless network. There are three primary sources of revenue: the general public, the business community, and the government. Additional revenue can result from the provisioning of basic connectivity services, such as Web browsing and e-mail, as well as from value-added services such as high-speed Internet access or VoIP calling. Services can target mobile workers (logging on to public Wi-Fi hotspots) or residential and business users (using wireless to connect homes and offices directly).

The feasibility study should look at the possibility of selling wireless services to the general public for connectivity at home and elsewhere in the city by gauging the potential size and value of the market. After comparing the cost of current broadband services and assessing the advantages of the city's wireless or wired offering over commercial services, the city should approach existing broadband service providers to evaluate potential partnership opportunities. Often, these partnerships can be very lucrative, with the government receiving a percentage of the revenue generated by the service provider from operating the network. *(More information on public-private partnerships can be found in the "Stage 3—Develop the Business Model" section of this paper.)*

The city should also evaluate how to attract the business community to use and pay for its wireless network. This revenue stream provides both the city and its partners with the potential to generate income not just from companies already located in the city's boundaries, but also from new businesses that can profit from the infrastructure.

Finally, the government should look at itself as a stream of revenue. By becoming an "anchor tenant" of the network—that is, the government runs its own business and services on the wireless network—the government guarantees future revenue flow. *(See the "Stage 3—Develop the Business Model" section for more detail.)*

Timetable for Widespread Introduction

At the early stages of planning for the wireless infrastructure, it may be difficult to project timelines, but the feasibility study should attempt to do so. The estimated timetable should include potential pilot programs and phased roll-out plans. It should also evaluate how a staged process can minimize risk by allowing project sponsors and constituents to review the impact of the project before additional investments are made.

Stage 3—Develop the Business Model

On the basis of the feasibility study, a city can take the next step and determine the business model and underlying technological infrastructure that will make the network sustainable. At a high level, the infrastructure of a wireless network consists of four layers:

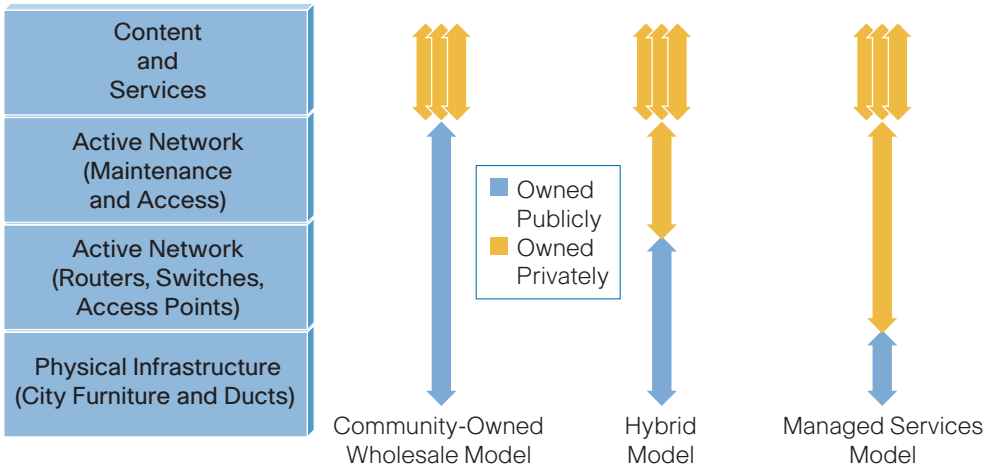
1. **Physical infrastructure**—such as lamp posts, telephone boxes, and towers
2. **Active network infrastructure**—comprising network hardware such as routers, switches, and access points
3. **Network services**—including operations, support, and maintenance
4. **Content and services**—such as data, voice, and video

For many cities, the actual implementation of these layers is still evolving as decisions are made based on a variety of factors:

- Size of the wireless initiative (neighborhood or citywide, municipal or regional)
- Primary policy objectives of the public administration (internal efficiency and cost reduction, extension of city services, or social/geographic inclusion and economic development)
- Availability of public financing (local, regional, national, and international)
- Local presence of private investors and knowledgeable service providers

Figure 2 shows the various combinations of public and private ownership and management, and lays out the three business models that are gaining traction for municipal wireless networks.

Figure 2. The Landscape of Public-Private Wireless Networks



Source: Cisco IBSG, 2007

Community-Owned Wholesale Model

In the community-owned wholesale model, the wireless infrastructure is entirely publicly funded. This is a common model for cities or municipalities that have decided to pursue digital inclusion and economic development in areas without a market investor to provide connectivity to a given segment of the population. Often, these initiatives put a premium on free or subsidized access to wireless services; occasionally, the government plans to partner with commercial providers or even divest itself of a part of the infrastructure once geographic coverage and sufficient usage are achieved.

Some cities and regions that have used this model to implement their wireless networks include East Manchester, United Kingdom; Singapore; Oulu, Finland; and Montreal, Canada.

Hybrid Model

In the hybrid access model, the city government begins to work with the private sector at the outset of the project, but retains ownership of the physical infrastructure and invests directly in the hardware for the active network. This model is often used when the local government has access to regional, national, or international infrastructure funds to purchase hardware—such as access points or wireless routers—but does not want to be responsible for the operational and management aspects of the infrastructure. The government then outsources the network services layer to a third-party private sector provider.

Actual implementation varies greatly. The government can pay one or more service providers to operate the network on its behalf, especially if the policy objective is to provide free access. Alternatively, in instances where users are charged for accessing the network, the government can arrange revenue sharing, working with a service provider that pays the government either a per-user fee or a lump sum to operate the network and sell services to users.

Cities that have achieved success implementing this model include Brescia, Italy, and Prague, Czech Republic.

Managed Services Model

In this model, the city develops a comprehensive public-private partnership, whereby the government assumes the role of orchestrator, much like an anchor tenant in an office building or shopping mall. The government offers service providers the right to use its physical infrastructure for a fee and agrees to act as the initial, largest customer of the network, running its own digital services on top of the infrastructure. In this way, the government ensures a revenue stream strong enough to mitigate the service provider's risk of an insufficient customer base among other businesses and citizens.

For its part, the service provider invests in and installs its access points, routers, and antennas on the city's physical infrastructure. In cases where the city's goal is to bring connectivity to underserved areas of the city, the government may give the service provider access to the physical infrastructure with the help of subsidies.

A number of municipalities in the United Kingdom have implemented a managed services model, including Birmingham, Edinburgh, Leeds, Liverpool, Cardiff, and Westminster, all of which have agreements with British Telecom, the national incumbent service provider.

Commonly, the government's role in the wireless network changes over time. For example, the government often acts as the sole investor or as the promoter of pilot deployments in limited areas or neighborhoods during the initial phase of wireless implementation. It uses the community-owned wholesale model, and develops a vertically integrated model across the four infrastructure layers shown in Figure 2. Once the initial implementation or local pilots have been launched and services gain momentum, the government shifts its focus to the citywide scalability of the network and the overall financial sustainability of the business model. Its role changes to that of orchestrator, acting as a partner with business investors, and limiting its direct investor role to the area of the physical infrastructure.

Stage 4—Build the Infrastructure, Launch the Initiative

To build their wireless infrastructures, cities can choose from several technologies, including Wi-Fi, WiMAX, and cellular. While each has specific strengths and weaknesses, Wi-Fi has become the *de facto* standard for cities investing in wireless technologies today. This is, in part, because Wi-Fi operates in an unlicensed spectrum and, therefore, is free of charge. Wi-Fi has also become ubiquitous in the mobile computing space and is spreading to the consumer market. This means that cities don't have to buy special-purpose end-point devices for their wireless applications, but rather can use a broad range of affordable, off-the-shelf devices including laptops, dual-mode GSM/Wi-Fi handsets, digital cameras, and PDAs. According to the Wi-Fi Alliance, more than 2,600 products have been certified to date.[3]

Wi-Fi also enables cities to use the same devices for indoor wireless LANs and outdoor coverage, allowing users to move transparently from one space to another without changing devices, losing connectivity, or re-registering.

Choosing the Right Technology Foundation for Your City

Choosing the right network infrastructure gives cities the flexibility they need to support their specific policy priorities and business models today—and in the future. When making their technology decisions, cities should consider which network capabilities are most important in meeting their policy and operational priorities. Examples include the following:

- Implement and support traffic and service management, network aggregation, and connection to one or several service providers
- Intelligently segment traffic and apply quality of service to prioritize different kinds of traffic over the network
- Track network usage by application and users to support billing of specific user groups
- Reduce the total cost of ownership of the network, including acquisition, operations, and incremental growth

Here are some important requirements cities should consider when selecting a wireless technology for their network foundation:

- **End-to-end solutions.** Ensure that the network encompasses wired and wireless indoor spaces and wireless outdoor and network backbone coverage, and that it provides a service-delivery platform for functions such as identifying end users and the applications and resources they access.
- **Standards-based.** Ensure that the network supports security standards, such as IEEE 802.11i, Wi-Fi Protected Access (WPA) and WPA2, and both licensed and unlicensed frequencies, including 802.11a/b/g.

3. The Wi-Fi Alliance, www.wifialliance.com/news/pressrelease-031306-wpa2mandatory/en.

- **Easy to deploy.** Check that the wireless access points configure themselves for optimum performance, eliminating the need for personnel to configure each device manually.
- **Highly reliable.** Look for a solution that is "self-healing," meaning that it automatically selects an alternate path through the network if a link fails and also automatically avoids congested areas.
- **Unified, easy management.** Verify that the network enables management of the wired and wireless outdoor networks and wireless indoor networks as one unified network. This will allow mobile users to roam without having to reauthenticate as they travel from indoor to outdoor areas, and without having to reconfigure their computers or PDAs. The network should also provide the ability and intelligence to segment and manage traffic, assign different priorities to traffic based on applications or users, manage subscriber-service access control, and support billing, traffic analysis, data mining, and more.
- **Scalable.** Validate that the network enables the city to build and expand outdoor wireless coverage incrementally, from a small footprint, such as hot zones (a collection of wireless hotspots), to pervasive coverage (a network mesh), without reconfiguring the installed base. Scalability of a mesh network is a function of the number of channels available, which is why the network should use different channels for access and backhaul ("backhaul" refers to the process of transmitting voice and data traffic from a cell site to a switch, i.e., from a remote site to a central site). Scalability is also dependent on the ability to use directional antennas to get the best spectrum usage (this is the same capacity optimization used in cellular networks).
- **Secure.** Check that the network incorporates integrated security technologies to maintain the confidentiality of private information, protects against the spread of viruses by denying access to infected computers, and provides different levels of access to municipal constituents. In addition to supporting the latest industry standards for security, such as 802.11i, WPA, and WPA2, the network should protect against imitation access points.

Scalable, Multi-use Systems: the Future of Wireless Infrastructures

Wireless, like most technologies, is developing rapidly. It is not hard to envision that the municipal wireless system of the future will be a single infrastructure that supports different wireless access technologies, including Wi-Fi, WiMAX, cellular, and the 4.9-GHz public safety band. The infrastructure will include a mix of licensed and unlicensed technologies; some of the services will support city applications, and some will be commercial wireless services.

Both cellular and WiMAX are wide-area wireless technologies. They are deployed with a macrocell architecture and use base stations and antennas mounted on towers that typically cover a few square miles each. Third-generation broadband data services are already straining the cellular network infrastructure. As these systems attract more

users, they will need to deliver increased capacity, especially in dense urban areas. Capacity can be increased by having more, smaller cell sites in high-traffic areas. These microcells would be mounted lower, on streetlights instead of cell towers. The wireless mesh techniques that we use today for stretching Wi-Fi to cover an entire town can complement WiMAX and cellular networks by enabling practical deployment of micro-cells (or picocells) in dense urban areas.

Ultimately, all of these technologies will be combined into a common, citywide wireless infrastructure, but this will take time. These technologies are evolving independently at different rates. Combining the different technologies is a complex process. Economic forces are already encouraging convergence on the client side. Dual-mode Wi-Fi cellular handsets are now coming to market. When mobile WiMAX arrives on the client side, it will usually be combined with a Wi-Fi client.

As the demand for mobile data increases, tri-mode clients—combining cellular, Wi-Fi, and WiMAX technologies—can't be far behind. It is only natural for the citywide wireless infrastructure to evolve into a converged, multiservice infrastructure.

Clear Planning Defines Success

While cities around the world are evaluating and implementing wireless networks, the rate at which these networks are being abandoned or put on hold is making it clear that to succeed, a city must approach its wireless strategy with a clear, forward-thinking plan that first outlines the city's policy objectives. The most successful strategies focus on either correcting a market failure or encouraging a market transition. For example, a city may provide Internet access to low-income families or launch a wireless program to stimulate wide use of broadband connectivity and services.

In addition, prior to engaging with partners to implement the wireless initiative, the city must have a clear exit strategy in the event that the policy issue is solved and the business model moves toward self-sustainability, without the need for government support. Only then can the city make the right business model and technology decisions to help ensure the long-term sustainability of its wireless network.

Establishing partnerships with the right technology vendors to minimize risk is a critical piece of this strategy. Because wireless technologies are developing quickly, the city should not focus on the specific technology decisions itself; rather, it should depend on its partners, whose core business is platform and technology implementation, to determine which technologies are the right ones to realize the city's objectives.

Cisco's four-stage process has helped cities and municipalities link policy objectives to effective wireless programs, thereby ensuring the viability of city initiatives. With this structured, strategic approach, municipal governments can improve efficiency and reduce costs of internal operations; improve the quality and safety of residents' lives; and enhance the climate for economic development, while minimizing the risks associated with the rapid evolution of technology.

More Information

The Cisco Internet Business Solutions Group (IBSG), the global strategic consulting arm of Cisco, helps Global Fortune 500 companies and public organizations transform the way they do business—first by designing innovative business processes, and then by integrating advanced technologies into visionary roadmaps that improve customer experience and revenue growth.

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