# Supporting Municipal Business Models with Cisco Outdoor Wireless Solutions

## EXECUTIVE SUMMARY

Outdoor wireless networks are playing a vital role in helping municipalities deliver critical services to citizens. In addition to evaluating access technologies, governments must consider the best business model for their specific funding and support needs. This paper defines emerging business models, and identifies the managed services model as the front-runner for global municipal wireless deployments. This paper also details what municipalities want from an outdoor solution and how Cisco® provides the range of capabilities necessary to support diverse applications and user communities.

## CHALLENGE

Municipal governments around the world are taking advantage of Internet connectivity to operate more efficiently and improve service delivery to their communities. One of the great challenges for cities is that a variety of municipal services are conducted outside buildings. These services include traffic monitoring, community policing, building and fire code inspections, city maintenance, and Internet access. Using outdoor wireless networks, cities are extending connectivity beyond their building walls and wired backbones in order to deliver these vital services more efficiently and to expand information access to new constituencies.

There are several successful business models for owning and managing an outdoor wireless network. One model may be more appropriate than another based on the city's budget, IT resources, and other considerations. The business models include the managed-services model, the wholesale model, and a hybrid model. Each model has its own benefits:

- Using a managed-services model (sometimes referred to as a public-private partnership), local government partners with a private entity, such as a service provider. The service provider owns and manages the network charging fees for connectivity and value-added services. Government agencies can connect to networks for free or for a low monthly fee. The local government can also generate revenue by leasing buildings and light poles to the service provider for mounting wireless equipment.
- Using a wholesale model, a municipality owns and manages the outdoor wireless network for internal operations and may share a limited amount of excess bandwidth with citizens to connect to the Internet using guest access (usually provided free of charge). One of the values of this model is that it gives the municipality complete freedom to control, evolve, or change applications. It also gives the city the option to allow business and residential customers to work with more than one service provider.
- Using a hybrid model, a municipality owns the network but outsources most of the day-to-day operations to a systems integrator or wireless Internet service provider. One of the benefits of this model is that it gives the municipality a measure of control, but at the same

time allows the city's IT department to use the expertise and resources of the systems integrator or service provider to make system changes as needed.

At a minimum, the network infrastructure must provide manageability, security, radio performance, and reliability. But the capabilities of the network will also determine the range of services and connectivity options that a municipality can offer. The network must provide the ability to:

- Interoperate with the city's existing metropolitan-area networks (MANs) and existing wireless LANs (WLANs) in public buildings, such as city hall and the public library.
- Support all client devices and authentication schemes.
- Implement and support traffic and service management, network aggregation, and connection to one or several service providers.
- Intelligently segment network traffic and apply quality of service (QoS) to prioritize and support different types of traffic from a heterogeneous constituency of users (such as municipal workers, public access, and mobile users) and devices (such as IP-based surveillance cameras, IP-based parking meters, cell phones, and laptops).
- Track network usage by application and users in order to evolve the infrastructure appropriately and also support billing of specific user groups.

## SOLUTION

Cisco® Outdoor Wireless Solutions lead the market in their ability to deploy a variety of IP services to a heterogeneous community of users, including video surveillance, permit approval and licensing, noise and pollution monitoring, traffic management, public safety, mobility for field-based workers, transportation, and public Internet access. The flexibility and intelligence of Cisco solutions also make it easier for cities to choose the business model that best suits their budgets and deployment strategy.

Cisco Outdoor Wireless Solutions are based on a powerful, self-organizing, self-healing, and self-configuring wireless mesh access infrastructure, in-vehicle wireless products, and Cisco Compatible Extensions-enhanced clients, that, together with a scalable, flexible back office architecture, reduce the complexities of deploying, operating, and managing citywide wireless broadband services. Once deployed, these end-to-end solutions provide the reliability, high performance, and rigorous security that cities depend on to deliver services to citizens and protect confidential and private information.

Cisco Outdoor Wireless Solutions provide all the features and components needed for the complete lifecycle of an outdoor wireless project, from network deployment to private and public access, integration of mobility and real-time government applications, and expanding wireless coverage.

Cisco Outdoor Wireless Solutions deliver the following benefits:

- **Applications interoperability**—Cisco solutions allow existing applications to interoperate and integrate with new, open-standards-based applications for improved service delivery.
- **Manageability**—Cisco solutions provide easy deployment and a single-framework centralized management for both wired and wireless IP network infrastructures, reducing the cost of managing the citywide network.

- **Performance**—Wireless coverage must be reliable and RF bandwidth must be optimized to help ensure maximum performance. Cisco achieves this through solid quality of service (QoS) for voice and video, real-time capacity management, support for high-capacity deployments, and self-healing wireless access for high availability. A patent-pending Adaptive Wireless Path Protocol takes the RF path characteristics into consideration when making route path choices. In addition, radio resource management (RRM) algorithms mitigate network radio interference in outdoor environments and increase network availability and resiliency for optimal performance.
- **Reliability**—Self-healing architecture automatically selects an alternate path through the network if a link fails and also automatically avoids congested areas.
- **Security**—Cisco's wireless mesh network incorporates integrated security technologies to maintain the confidentiality of private information, protect against the spread of viruses by denying access to infected computers, prevent connection of rogue access points, and provide different levels of access to municipal entities and constituents. The Cisco solution supports the full suite of security standards, including IEEE 802.11i, Wi-Fi Protected Access (WPA), and WPA2.

  Security features beyond the wireless access network are as important as wireless security when considering the deployment of a municipal wireless network. For this, Cisco solutions provide captive portal authentication, access control lists, deep packet inspection, and even traffic shaping (to shut down network threats and abusers before service is degraded).
- **Support for all client devices**—The Cisco Compatible Extensions program ensures that a broad range of WLAN client devices interoperate with innovative features of Cisco WLAN infrastructure products. As a result, the wireless mesh network can be deployed confidently, even when WLANs serve a variety of client devices. With more than 90 percent of shipping client devices certified as Cisco Compatible, almost any client device that is selected will support Cisco's powerful advanced features.

  The Cisco 3200 Series Mobile Access Router provides the unique advantage of allowing municipal broadband services to extend to moving, in-vehicle applications. Police vehicles can become mobile security command stations. Internet access can be extended to trains and buses. Even emergency vehicles are transformed into mobile, IP-based command centers by leveraging the connectivity to the Cisco 3200 Series router and the backhaul of the wireless mesh infrastructure.
- **Scalability**—Using the Cisco wireless mesh network as the access network provides scalability in several dimensions, including:
  - **Capacity optimization**—The Cisco solution uses different channels for access and backhaul, as well as directional antennas to get the best spectrum usage.
  - **Ease of expansion**—Wireless access points configure themselves for optimum performance, eliminating the need to manually configure each new device. Cities can build and expand outdoor wireless coverage incrementally, from a small footprint (such as hot zones and hotspots) to pervasive coverage (a network mesh), without reconfiguring the installed base.

- **Mobility**—As mobile users access applications, they can roam smoothly between outdoor locations in the city, with user traffic based on policy and authentication.
- **Return on investment (ROI) and investment protection**—The Cisco solution provides a lower total cost of ownership and a migration path for future technology upgrades.
- **Community-friendly access to services**—Web portal interface support gives the public convenient access to all of the community services and resources available on the network.

## BUSINESS BENEFITS

With the deployment of an end-to-end Cisco Outdoor Wireless Solution, cities can choose the business model that allows them to most cost-effectively manage their resources and improve operational efficiencies and responsiveness.

### How Cisco Outdoor Wireless Solutions Support a Managed-Services Model

Municipalities that are considering a managed-services model want to be confident that the service provider they work with can deliver and support all of the services that the city requires. To address this, Cisco provides the Cisco ServiceMesh Solution—a validated end-to-end network architecture that provisions subscriber access and value-added services across wireless mesh networks. Service providers using the Cisco ServiceMesh do not have to build their own back end to deliver capabilities such as time-based billing, subscriber management, VPN services, bandwidth management, or QoS. These features are important because they allow the service provider to provide, manage, secure, and bill for different types of services for different users. In addition, the Cisco end-to-end solution can reduce network costs, as well as accelerate deployment, because the service provider does not have to contract with multiple vendors for the wireless network, wired IP network, and data center.

### How Cisco Outdoor Wireless Solutions Support a Wholesale Model

Choosing a wholesale model requires the ability to control subscriber connections to multiple service providers. The Cisco network provides the mechanisms required to support this level of flexibility and control, including:

- Per subscriber access control
- RADIUS authentication, authorization, and accounting (AAA) proxy for integration with external systems of multiple service providers
- Transparent roaming across multiple service provider networks

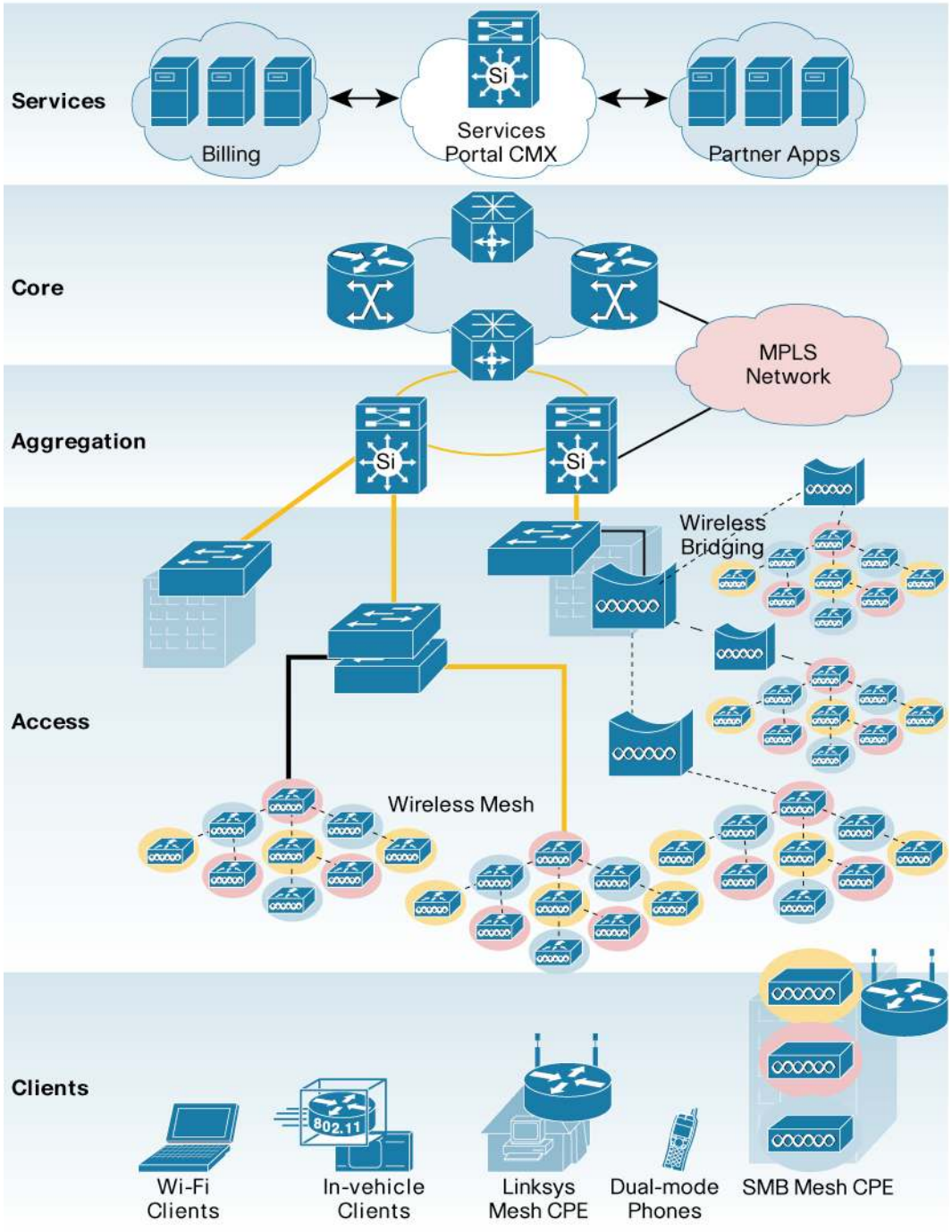
### How Cisco Outdoor Wireless Solutions Support a Hybrid Model

With the flexibility and range of product offerings to support either a managed-services or wholesale model, cities can easily select a hybrid model, which combines elements of both the managed services model and the wholesale model.

## ARCHITECTURE OF A MANAGED MODEL

Cisco ServiceMesh (Figure 1) is a network solution that allows service providers to implement outdoor wireless services as a managed model to extend their current metropolitan broadband services or create entirely new services. An end-to-end solution, Cisco ServiceMesh provides outdoor wireless coverage, the network backbone, and service delivery for all back office functions, such as identifying, segmenting, authenticating, and tracking end users and the applications and resources that they are allowed to access.

**Figure 1.** Cisco ServiceMesh




The following sections describe some of the specific technologies that make up the Cisco ServiceMesh Solution, as illustrated in Figure 1.

### Clients

One of the advantages of the Cisco solution is that it supports the widest range of users, device types, and applications. Specific features that allow this include:

- **Cisco Compatible Extensions program**—This program ensures the widespread availability of client devices that are interoperable with a Cisco WLAN infrastructure and

that take advantage of enhanced security, mobility, quality of service, and network management.

- **Cisco wireless mobile routers**—Routers such as the Cisco 3200 Series Mobile Access Router provide vehicle networking capability, ubiquitous wireless coverage, and uninterrupted roaming between different wireless technologies.

**Access**

The Cisco solution enables cities to build and expand outdoor wireless coverage incrementally, from a small footprint (such as hot zones and hotspots) to pervasive coverage (a network mesh), without reconfiguring the installed base. The components of the solution are:

- **Cisco Aironet® 1500 Series Lightweight Outdoor Mesh Access Points**—With dual-band, simultaneous support for IEEE 802.11a for backhaul and 802.11b/g standards for access, the Cisco Aironet 1500 Series employs the patent-pending 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 Aironet 1500 Series is based on the Lightweight Access Point Protocol (LWAPP) standard, which enables the wireless access infrastructure to provide seamless and secure Layer 2 (802.11 MAC layer) and Layer 3 (IP) roaming to any wireless 802.11b/g mobile device. The Cisco Aironet 1500 Series access points also support options for 4.9-GHz public safety spectrum as well as a single-radio configuration for smaller scale deployments that don't require the higher bandwidth achievable with a dual-radio mesh access point.

**Aggregation**

Cisco Outdoor Wireless Solutions are part of the Cisco Unified Wireless Network, the only solution that provides an integrated, end-to-end solution for wired and wireless networking. Cisco Outdoor Wireless Solutions integrate with and also extend service provider metropolitan networks. Integrating Cisco Outdoor Wireless Solutions with the metropolitan area network edge allows service providers to extend data and Wi-Fi broadband service to cities for public safety and municipal services, as well as to provide citywide hot zone access for consumers. Aggregation of the wireless broadband access is performed by the Cisco Wireless LAN Controller and managed by the Cisco Wireless Control System (WCS). The aggregation technologies in the Cisco solution are designed to manage hundreds of Cisco WLAN controllers (part of the aggregation layer), which in turn can manage thousands of Cisco mesh access points.

- **Cisco Wireless Controller Module**—Cisco WLAN controllers are responsible for systemwide wireless access functions, such as wireless security policies, intrusion prevention, RF management, QoS, and mobility. Controllers work in conjunction with Cisco Aironet 1500 Series and the Cisco Wireless Control System software to support mission-critical wireless applications. Centralized wireless controllers provide tighter integration for both wired and wireless networks.
- **The Cisco Wireless Control System (WCS)**—Provides a powerful foundation that allows IT managers to design, control, and monitor outdoor wireless networks from a centralized location, simplifying operations and reducing total cost of ownership.

**Core and Services**

The Cisco ServiceMesh Solution is designed, tested, and validated with a comprehensive back end architecture that offers advanced user and service management capabilities. From access to

back office, the Cisco solution is the only end-to-end offering integrating all elements of the value chain. Specific features include:

- **Service Selection Gateway (SSG)**—Cisco SSG, integrated into the Cisco Intelligent Services Gateway, supports the ability to bill users at different rates for different network services, based on a predetermined policy. SSG dynamically maps subscribers to different subnetworks, making it easier to set up the network for free or to provide “open garden” services (such as services for municipal workers) and fee-based or “walled garden” services (such as Internet access for the general public). SSG also supports security enforcement on the network by monitoring behavior and limiting bandwidth in the event of unapproved use of network resources.
- **Service Control Engine (SCE)**—Provides deep packet inspection for application-level IP traffic on a per-subscriber basis. This allows cities to monitor a wide variety of applications on the network and ensure that service providers are provisioning and tuning the performance and capacity of the network to actual usage. This can help reduce capital and operational expenditures, as well as improve the quality of the user experience.

## WHY CISCO

Cisco Systems® has a 20-year track record supporting municipalities of all types and sizes around the world. By working with the worldwide leader in networking technologies, municipalities benefit from:

- Unique qualifications to extend IP networks to outdoor environments, integrating wired and wireless networks
- Standards- and IP-based (nonproprietary) solutions, allowing for interoperability and integration with existing and new applications
- Proven performance, reliability, and security
- An end-to-end solution with wired and wireless integration for a low total cost of ownership
- Best-in-class products for every point in the network solution architecture
- A set of solutions that encompass numerous deployment scenarios with diverse requirements, including innovations in the areas of scalability, mobility, security, and management, as well as convergence between 802.11 and cellular technologies
- Investment protection that allows for migration to future technology
- Industry-leading service and technical support through certified systems integration and channel partners, or from the Cisco Advanced Services team and Cisco SMARTnet® onsite service programs

## FOR MORE INFORMATION

For more information about the Cisco Wireless Mesh Networking Solution, contact your local account representative or visit: http://www.cisco.com/go/wirelessmesh

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Printed in USA C11-377398-00 10/06

 