

Cisco Wireless Mesh Networking Solution Overview

The Cisco Wireless Mesh Networking Solution makes it cost-effective for municipalities, businesses, and service providers to deploy high-performance city or campus-wide Wi-Fi networks that are easy to deploy, manage, secure, and scale.

THE CHALLENGE

In 2005, U.S. Senators McCain and Lautenberg introduced legislature to allow municipalities to offer high-speed Internet access to citizens. In announcing the bill, Senator McCain's office noted that the United States has dropped from tenth in the world for high-speed Internet penetration in 2004 to sixteenth in 2005, an unacceptable position, McCain writes, "for a country that should lead the world in technical innovation, economic development, and international competitiveness."

Municipalities, educational and healthcare institutions, the hospitality industry, service providers, and many other businesses and government agencies are eager to see widespread deployment of outdoor wireless Internet access.

Figure 1. Cisco Wireless Mesh Networking Solution Supports Cost-Effective Outdoor Wi-Fi Networks



Municipalities are interested in broadening Internet access in order to give field-based employees, including police, fire, public works, and parks and recreation departments, secure access to the information they need rather than requiring them to return to the office to access information or file reports.

Service providers recognize the opportunity to offer new levels of service to cities and towns, and to reach a broader base of subscribers with enhanced data services.

Enterprise organizations, hospitals, educational institutions, and hospitality companies are interested in expanding Internet access beyond hotspots to enable employees, staff, students, and guests to move freely through campuses and complexes and stay connected—regardless of location.

There is little doubt that consumers are just as eager to take advantage of wireless Internet access, based on the enormous popularity of Wi-Fi technology and the proliferation of wireless hotspots in airports, hotels, convention centers, malls, and coffee shops. Until now, there was no easy way to offer this broader coverage. Cellular networks lack the capacity to provide shared data services to hundreds or thousands of users, and are expensive to own and operate. Wi-Fi hotspots can provide sufficient capacity, but coverage has been the challenge because each Wi-Fi hotspot requires a wired network backhaul. This limits the reach of Wi-Fi deployment because of the expense associated with configuring, cabling, and managing a larger number of hotspots to try to create ubiquitous coverage.

With the proliferation of Wi-Fi clients and the availability of plentiful unlicensed bandwidth and new wireless routing protocols, it is now possible to provide Wi-Fi service over large outdoor venues using mesh networks.

According to a market research report by Gartner Research, “Mesh networking in various applications is becoming a low-cost alternative for municipalities. Cities and towns should evaluate mesh technologies to enhance data communications and improve public safety interoperability. Behind such deployments are productivity gains, ease of deployment, and the ability to deliver first responder interoperability at a fraction of the cost of a land mobile radio system.”

THE SOLUTION

The Cisco® Wireless Mesh Networking Solution is designed to scale from campus outdoor Wi-Fi extensions to metropolitan-scale wireless LANs. It delivers mission-critical Wi-Fi access with a ruggedized platform that is designed for high performance, ease of deployment, reliability, security, scalability, mobility, and unified policy management across indoor and outdoor networks. It is ideally suited for metropolitan networks since it can be easily installed on streetlight posts.

The Cisco Wireless Mesh Networking Solution is part of the [Cisco Unified Wireless Network](#) architecture. It is based on the Cisco Aironet® 1500 Series, an outdoor Wi-Fi mesh access point (802.11a/b/g [1510 model] and 802.11b/g [1505 model]) using Cisco's patent-pending Adaptive Wireless Path Protocol (AWPP). The Cisco Aironet 1500 Series is specifically designed for secure outdoor Wi-Fi coverage and provides route optimization, self-healing for interference or outages, resiliency, and dynamic re-optimization when new sectors are added. It supports zero-touch configuration deployment to easily and securely join the mesh network.

In a Cisco Wireless Mesh Networking Solution, access points discover each other automatically and select the best path for maximizing system capacity and minimizing latency by using intelligent wireless routing based on the AWPP. Access points continuously communicate with other nodes, evaluating the potential of each link to improve performance. If a link is degraded, the access point will determine whether a better path exists, and will route traffic through a more optimal node. A mesh network eliminates the need to wire every access point in the network, making it easier and more cost-effective to extend the reach of the network.

The Cisco Wireless Mesh Networking Solution makes it easy to connect an existing indoor wired or wireless network with the outdoor mesh network. The solution allows users to roam from one area to another without reconnecting and the Radio Resource Management (RRM) software optimizes radio parameters for client access. With this solution, administrators can set up one access policy that works across both indoor and outdoor environments, increasing security and making the systemwide network infrastructure more manageable. These automated capabilities reduce deployment and maintenance costs and maximize WLAN performance.

The Cisco Wireless Mesh Networking Solution delivers the following capabilities:

- **Ease of Deployment**—The Cisco Wireless Mesh Networking Solution features zero-configuration deployment. New Cisco Aironet 1500 Series access points can be added to the network without requiring onsite configuration, which helps reduce deployment time and costs. Cisco mesh access points also feature multiple power options, including Power over Ethernet (PoE), and vertical or horizontal pole mounting options.
- **Manageability**—A Cisco mesh network can be integrated with a customer's existing Cisco wired indoor network, allowing administrators to centrally configure and manage the mesh network with identical indoor and outdoor policy management. The mesh network is also easier to manage because of its self-healing capabilities in response to interference or outages.
- **Scalability**—The Cisco mesh architecture makes it easy to scale coverage as capacity needs dictate, including increasing access point density; adding wired connections, controllers, and radios; and using dual high-powered, high-sensitive radios and a selection of high-gain antennas.
- **Security**—Multilayered security is built into a Cisco mesh network, including IEEE 802.11i, Wi-Fi Protected Access 2 (WPA2), WPA, Advanced Encryption Standard (AES) encryption on backhaul links, access point authentication, secure control traffic between the access point and the controller, and IP Security (IPSec) VPNs for confidential mesh client traffic. Administrators can create security policies for different user types or location-based traffic.
- **Reliability**—Cisco mesh network equipment is based on ruggedized enclosures that protect against rain, lightning, wind, and vibration from storms or road traffic. In addition, the network features self-healing, automatic load balancing across WLAN controllers, and channel or controller reassignment in the event of conflicts.
- **Performance**—A Cisco mesh network delivers high performance using dynamic path optimization, resiliency, interference mitigation, and more.
- **Flexibility**—The Cisco Aironet 1500 Series features dual-band, simultaneous support for IEEE 802.11a and 802.11b/g and hardware support for the 4.9 GHz public safety band with options for single-band support for IEEE 802.11b/g. Multiple WLAN support allows multiple services to be offered to different user types—such as police, fire, municipal services, or public access—over a single access point.
- **Lower Total Cost of Ownership**—A Cisco mesh network is designed to lower total cost of ownership (TCO), including deployment, day-to-day management, and expansion. For example, the network self-heals in response to interference or outages, reducing maintenance time and costs. With zero-configuration access points, new nodes can be added without onsite configuration, reducing deployment costs. When additional nodes are added, the network automatically self-configures and re-optimizes itself. The outdoor wireless network can be managed using the same management platform as the indoor wireless network, saving on equipment and training.
- **Mobility**—Wi-Fi clients have Layer 2 and 3 mobility across the mesh network. Users can roam between access points on the same or different controllers as well as between the Cisco WLAN and mesh networks.

BENEFITS

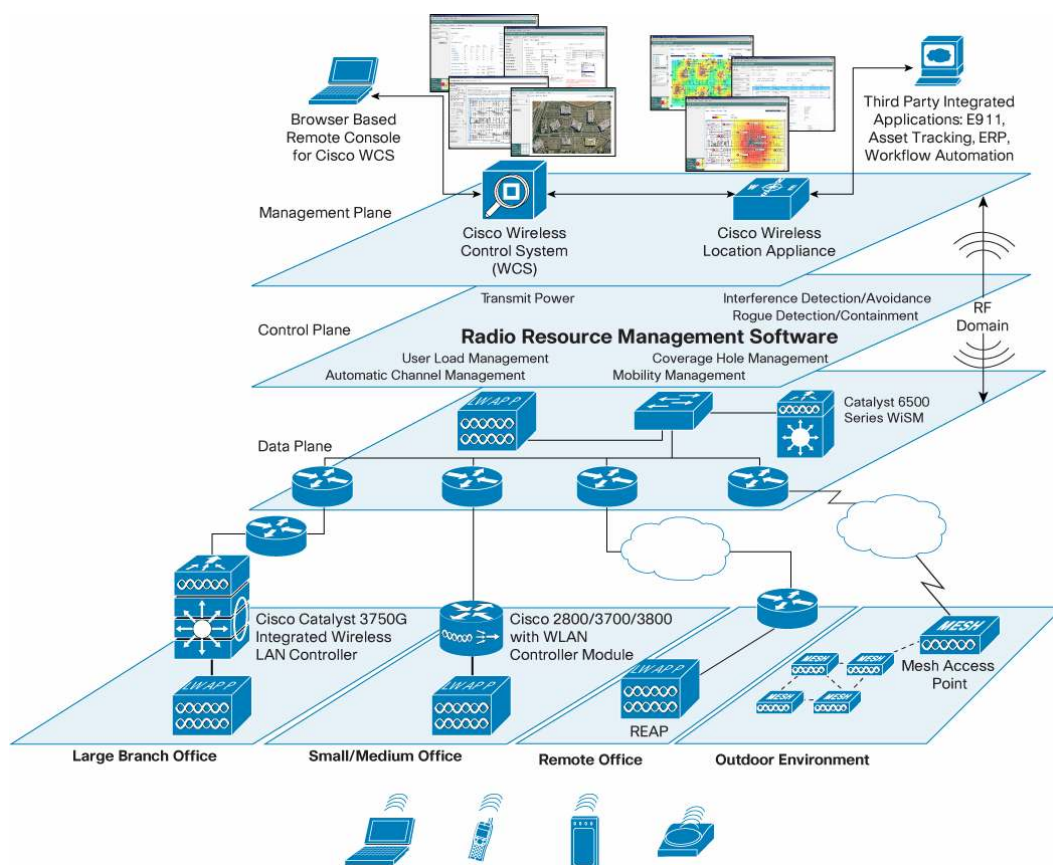
The benefits of a Cisco Wireless Mesh Networking Solution include:

- Improved public safety by giving police and fire departments the ability to access and disseminate information from the field
- Greater operational efficiencies and productivity
- Savings on network infrastructure capital equipment and operating expenses
- Expanded economic and educational opportunities by extending Internet access to inner cities and rural communities
- Voice services that allow Wi-Fi clients to roam throughout the WLAN, minimizing capital expenditures and management costs
- Increased employee, staff, and student productivity in campus environments by providing secure Internet access to roaming users
- New and improved community services by providing wireless data access to public works, parks and recreation, and other field-based officials
- Improved first responder readiness, such as giving firefighters access to blueprints online before entering burning buildings, or giving EMS workers access to life-saving medical records before treating people at the scene

CISCO UNIFIED WIRELESS NETWORK

The Cisco Wireless Mesh Networking Solution is part of the [Cisco Unified Wireless Network](#) architecture. The Cisco Unified Wireless Network is the industry's only unified wired and wireless solution to deliver cost-effective indoor and outdoor wireless networks for business critical mobility. This innovative solution brings mobility to endpoint devices and users, providing them with anytime, anywhere network access. The Cisco Unified Wireless Network is composed of five interconnected elements that work together to deliver a unified enterprise-class wireless solution. The five interconnected elements are client devices, access points, network unification through Cisco wireless LAN controllers, world-class network management, and mobility services. (Figure 2)

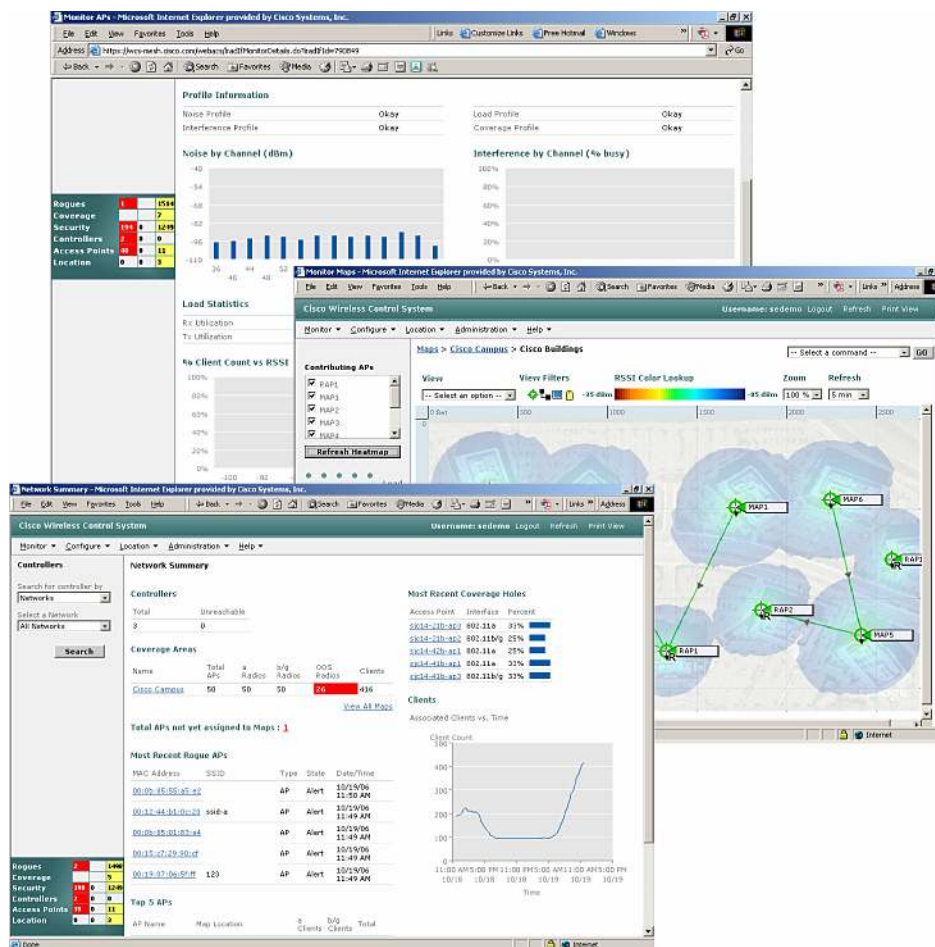
Figure 2. Cisco Unified Wireless Network



The Cisco Wireless Mesh Networking Solution derives system-level management information on device configuration, security policies, and RF parameters from Cisco wireless LAN controllers. Cisco's controllers use Lightweight Access Point Protocol (LWAPP) to define an innovative architecture for large-scale wireless LANs that centralizes certain functions of the 802.11 protocol and considers individual indoor and outdoor access points to be part of a larger system.

The Cisco Aironet 1500 Series and Cisco wireless LAN controllers are managed by the Cisco Wireless Control System (WCS). Cisco WCS provides an easy-to-use, intuitive graphical user interface (GUI) that displays key network statistics, including traffic statistics, link characteristics, and client information. Simple Network Management Protocol Versions 1, 2c, and 3 (SNMPv1, v2c, and v3) support interfaces to other management platforms. Network maps provide an easy-to-manage, easy-to-understand view of the mesh network deployment and operating state. (Figure 3)

Figure 3. Cisco WCS Management Display



The Cisco Unified Wireless Network supports seamless operations throughout the WLAN—both indoors and outdoors. Security is ensured through advanced networking features and support for differentiated security policies by different user types.

INTELLIGENT WIRELESS ROUTING

The Cisco Wireless Mesh Networking Solution can be installed anywhere power is available, without the need for a network connection. Intelligent wireless routing based on Cisco's patent-pending AWPP, which was designed specifically for wireless environments, enables a remote access point to dynamically optimize the best route to the wired network within the mesh network. Deployment and management costs for the Cisco Wireless Mesh Networking Solution are reduced through support of zero-touch configuration deployments and through the Cisco Aironet 1500 Series' ability to self-heal in response to interference or outages. Intelligent self-forming, self-optimizing, and self-healing algorithms minimize network convergence time, reduce network downtime for isolated outages and maintenance, and help ensure high network capacity.

APPLICATIONS

The Cisco Wireless Mesh Networking Solution can be implemented in conjunction with a solution provider or independently by a municipality or business. Applications for the solution include the following:

- **Municipality and city employee applications**—Providing wireless access to field employees such as public works, public service, and parks and recreation departments can streamline workflows, reduce manpower requirements, reduce city expenses, and increase employee productivity because an outdoor WLAN allows employees to remain in the field for longer periods of time without having to return to the central office to send and receive data. Automatic meter reading (AMR), a time-intensive task, can also use the outdoor WLAN to send and receive metering data.
- **Public safety applications**—A broad range of public safety organizations such as police, fire, emergency medical services, 911 centers, airports, and transit agencies can use the outdoor WLAN for day to day and emergency operations. These agencies can use the outdoor WLAN to quickly access data such as DMV records, warrants, mug shots, criminal records, high-priority bulletins, streaming video, and digital images for video surveillance. They can also use the outdoor WLAN to gain immediate access to building schematics and floor plans for search and rescue operations and to quickly deploy ad-hoc wireless networks during an emergency.
- **Public use applications**—The outdoor wireless LAN can be used to provide free or fee-based high-speed broadband wireless access in city centers for businesses and the public. Cities that implement fee-based structures can use the outdoor WLAN to generate revenue through daily or monthly WLAN access subscriptions.
- **Enterprise campus applications**—Companies, organizations, and educational institutions can extend the WLAN outdoors by adding wireless mesh throughout the campus. An outdoor WLAN provides employees, vendors, and partners with access to voice, video, and data while they work outside and roam between buildings. Adding an outdoor WLAN can help increase employee responsiveness, collaboration, and productivity.

SUPPORTING SOLUTIONS AND PARTNERS

Cisco partners are trained to manage the entire solution, from planning to deployment, through on-going maintenance. In addition to our global network of qualified resellers, Cisco provides comprehensive design and support through Cisco CCIE® professionals and the Technical Assistance Center (TAC), both of which are recognized as the best in the industry, with expertise in voice, video, and data communications for wired and wireless networking technology.

WHY CISCO?

Cisco Systems® is the worldwide leader in networking technologies, with a 20 year track record supporting customers of all sizes, around the globe. By working with the established industry leader, municipalities and businesses can benefit from:

- More than two decades of experience building large-scale routing and RF networks
- Proven performance, reliability, and security
- A broad range of technical experts and engineers who understand the unique requirements of government agencies and enterprise customers

- Award-winning customer support services that help companies get the most out of their investments and extend the life of their network assets
- Ongoing investments in R&D initiatives benefiting municipalities and businesses
- Sustained value with upgradable, standards-based solutions
- A phased approach to support the integration of new technologies or respond to new government mandates or regulations
- Best practices based on showcase network deployments

SUMMARY

The Cisco Wireless Mesh Networking Solution enables cost-effective, scalable, deployment of secure, metropolitan-scale outdoor wireless LANs for public access, public safety, managed services, or enterprise campus outdoor Wi-Fi extensions. It delivers mission-critical Wi-Fi access through a ruggedized platform that is designed for high performance, ease of deployment, reliability, security, scalability, mobility, and unified policy management across both the indoor and outdoor networks.

The Cisco Wireless Mesh Networking Solution provides municipalities with an enterprise-class solution that streamlines workflows, reduces manpower requirements, reduces city expenses, and increases employee productivity. This solution makes it cost-effective for municipalities, businesses, and service providers to deploy high-performance city or campus-wide outdoor wireless networks.

For more information about Cisco Wireless Mesh Networking Solution, visit

<http://www.cisco.com/go/wirelessmesh>

For more information about Cisco Unified Wireless Network, visit

<http://www.cisco.com/go/unifiedwireless>



Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Europe Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: +31 0 800 020 0791
Fax: +31 0 20 357 1100

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

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