

Cisco Mobile Network Solutions for Public Safety

Overview

Public safety agencies want to improve their effectiveness and responsiveness to incidents within or outside their jurisdiction. With increased focus on homeland security, these agencies need even better interdepartmental and interagency communications with their most important resource, police officers and first responders in the field. Information technology, device technology, wireless, and networking are improving continuously. Applications supporting police, fire, and medical response units are transitioning from simple text and voice to rich multimedia applications. Real-time video, maps with satellite imagery, Global Positioning System (GPS) tracking, and global database searches are now available in handheld devices that first responders carry with them in the field. Public safety agencies want to enable these new applications and extend their existing applications from headquarters into the communities they serve.

Addressing Communication Challenges in Public Safety

Reliable Communications

When responding to an emergency or communicating under “normal” operating conditions, first responders must have a variety of communication tools to do their jobs effectively. No longer is voice communications over radio networks the only form of communication to headquarters. Today, public safety agencies not only use ultrahigh-frequency (UHF) or very high-frequency (VHF) voice networks; they also are networking their communications with first responders to enable voice, video, and data applications. The breadth of communications offers greater situational awareness because these agencies no longer depend on one form of communication.

To offer a breadth of communications reliably, the network infrastructure must be intelligent end to end, extending from headquarters to the first responder vehicle. The network intelligence prioritizes the most important communications such as voice or video to help ensure communications happen in real time. In addition, there must be adequate network throughput to allow for secure transmission of bandwidth-intensive applications over the network.

Network Redundancy

No single wireless technology has all the performance and coverage capabilities needed. When an incident occurs, public safety agencies must have redundant network connectivity on the scene. Depending on the location of the incident, one or more of the wireless networks used to communicate between the officers in the field and headquarters might not be available. It is imperative to have a redundant wireless infrastructure with mobile clients capable of connecting to multiple networks so they can continue to communicate with headquarters regardless of their location.

Providing the redundancy of communications to remote first responders while in motion or stationary is critical for uninterrupted communications.

Survivability

Redundant communications are important not only for communicating with headquarters but also for command and control communications on site. Survivability is the ability to maintain command and control operations on scene if all wide-area connections are lost. Deploying mobile networks in police cars and other first responder vehicles provides a foundation for a scalable IP communications infrastructure on scene. An IP communications network helps ensure network survivability on site by empowering first responders to carry out their duties even if all WAN communications are lost.

Mobility

Public safety officers must communicate transparently with headquarters when the vehicle is stationary and in motion. Officers must be able to maintain connectivity to the network either in the vehicle or while on foot. Providing network coverage on scene for mobile vehicles or nomadic officers is critical for both officer and public safety.

Interoperability

Narrow-band radio communications present an interoperability challenge between proprietary existing radio networks and handsets. With the advent of Project 25, a steering committee for selecting interoperability standards for radio networks, public safety organizations are adopting standards to facilitate radio communications within and between agencies. The goal of these standards is to offer interoperability with existing radio networks but also encourage adoption of broadband standards that facilitate interoperability using voice, video, and data communications. Deploying an end-to-end IP infrastructure with Land Mobile Radio (LMR) capabilities facilitates the transition to voice, video, and data applications while bridging the communication gap between agencies.

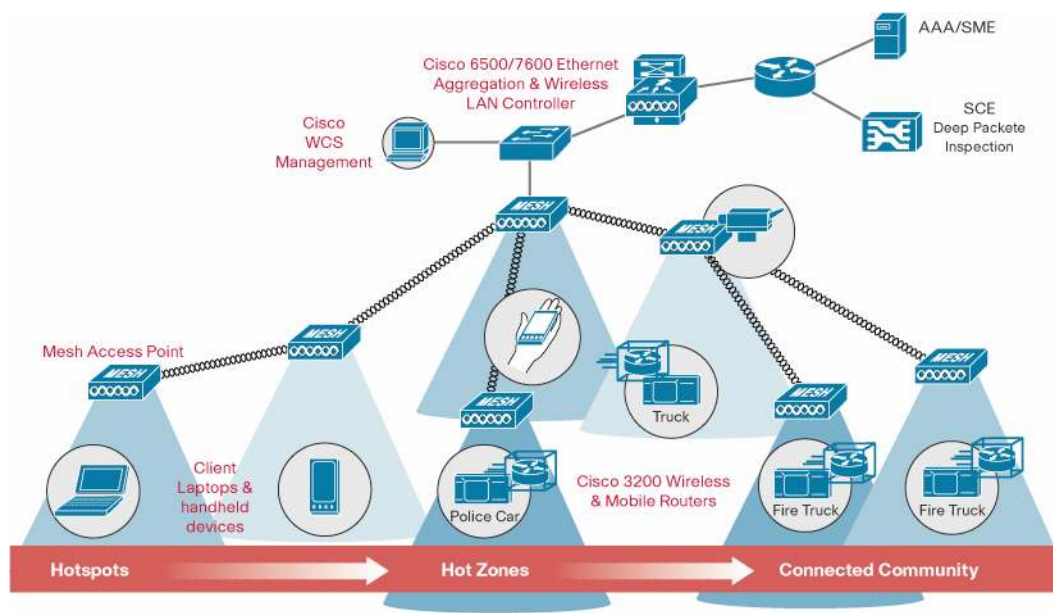
Cisco Outdoor Wireless Network Solutions

The Cisco® Outdoor Wireless Network Solutions use wireless mesh technology, wireless bridging, and mobile networks to allow government, public safety, and transportation organizations to build cost-effective outdoor wireless networks for private or public use. These technologies are designed to provide secure, high-bandwidth, and scalable solutions to enable access to fixed and mobile applications across metropolitan areas.

The Cisco Wireless Network is a wireless mesh solution that is easy to deploy, operate, and manage across a large metropolitan region. Solutions can be deployed in the city infrastructure at government and public buildings, along streets on lampposts, and at intersections on traffic signal control systems.

Figure 1 shows a metropolitan mesh deployment providing secure, broadband wireless access for public safety, municipalities, and public wireless LAN users. The mesh network offers public safety organizations secure, licensed, 4.9-GHz broadband communications for transmitting rich multimedia applications. The Cisco 3200 Series Rugged Integrated Services Routers deployed in police, fire, and emergency response vehicles use the outdoor mesh network as a wireless connection to other vehicles or headquarters. In addition to utilizing the mesh network, the Cisco 3200 can also connect to other wireless networks, including cellular, satellite, and other narrowband networks.

Figure 1. Cisco Outdoor Wireless Network Solution for Public Safety



Cisco Mobile Network Solutions

Cisco offers a mobile networking platform that addresses the communications challenges that public safety and homeland security agencies face. Police, fire, and emergency first responder organizations require a network communications infrastructure that can securely transport the rich multimedia applications to and from an incident. Public safety vehicles become a network extension to headquarters, offering access to network resources that were once available only when at headquarters. By creating an “office in a vehicle,” the remote police officer can make better decisions more quickly using network resources in real time.

The cornerstone of the Cisco Mobile Network is the Cisco 3200 Series Rugged Integrated Services Router (Cisco 3200). The Cisco 3200 is a fully functional Cisco IOS[®] Software router in a ruggedized enclosure that is mounted in a vehicle and can be customized to support a variety of applications and multiple networks (Figure 2). The router includes multiple mobile interface cards that comply with the industry-standard PC/104+ form factor. Cisco standardized its component design on the PC/104+ form factor to encourage third-party component vendors to build modules that could work in conjunction with the Cisco 3200.

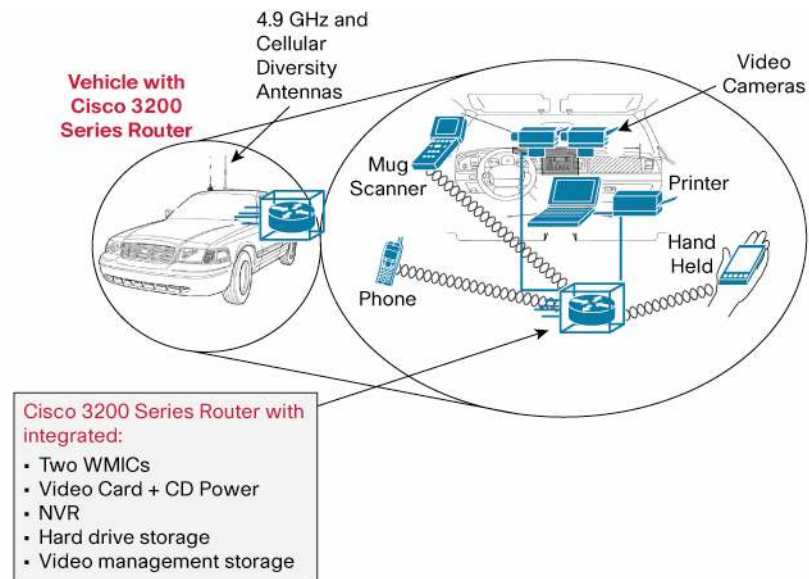
Figure 2. Cisco 3200 Series Rugged Integrated Services Router



The Cisco 3200 has a modular design that includes expansion slots that accept a variety of PC/104+ components such as video server cards, video storage, and GPS. Support for different types of wide-area wireless connections includes network connections such as General Packet Radio Service (GPRS), evolution-data optimized (EVDO), high-speed downlink packet access (HSDPA), satellite, 802.11a/b/g, and licensed 4.9-GHz connections for public safety use.

The Cisco 3200 also includes multiple LAN connections. As shown in Figure 3, a typical police car has a notebook or tablet PC, a video camera, printer, and other devices that are mounted in the vehicle and connected to a wired Ethernet network. Using its integrated Ethernet switch, 802.11b/g, and 4.9-GHz access points, the Cisco 3200 creates a wired network within the vehicle and a wireless network in and around the vehicle to support mobile clients in the field. The components are packaged together in a single, rugged enclosure available from Cisco. The Cisco 3200 connects in-car video cameras using a video encoder card that stores video traffic locally or sends the video streams over IP multicast for real-time evidentiary purposes.

Figure 3. Cisco 3200 Mounted in a Police Car Connects Multiple Devices in the Vehicle



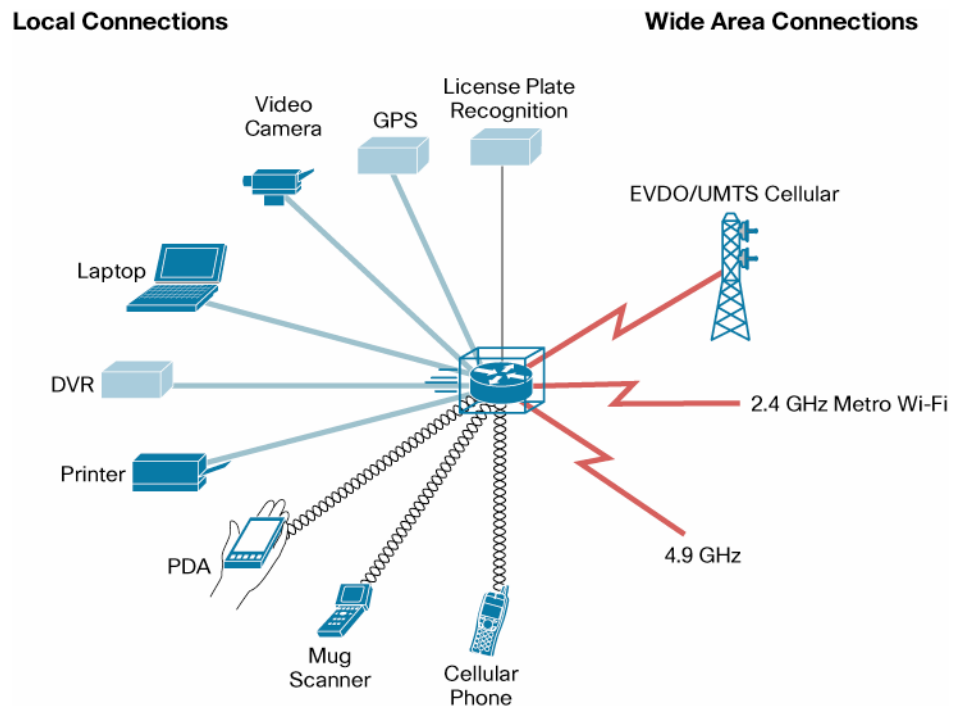
The Cisco 3200 provides transparent mobility for networked devices in public safety vehicles. The router supports standards-based mobile IP, allowing the vehicle network to roam across more than one wireless network while remaining transparently connected.

The Cisco 3200 aggregates multiple networked devices in the vehicle and keeps them connected to the main agency network across different wireless links while the vehicle is in motion or parked at the scene of an incident. Effectively, the router extends the main agency network into the car. The applications on the notebook PC and other networked devices in the car operate the same way as they do when attached directly to the wired network at headquarters.

In addition to transparent mobility, helping ensure a secure network connection is critical for public safety applications. Police, fire, or other public safety agencies must maintain their own security policies for all devices accessing their network. Like other Cisco routers, the Cisco 3200 runs Cisco IOS Software, which provides integrated network security features, including authorization and authentication, stateful firewall, intrusion detection, and VPNs, allowing public safety agencies to manage and enforce their security policies to the mobile devices in the vehicle using the same management tools they run at headquarters.

Figure 4 shows the type of network devices deployed in public safety vehicles. The Cisco 3200 is the network platform for managing security policies, access, and device management for clients connected to the mobile network.

Figure 4. The Cisco 3200 Aggregates Multiple Wide-Area Connections for Multiple Devices in a Vehicle

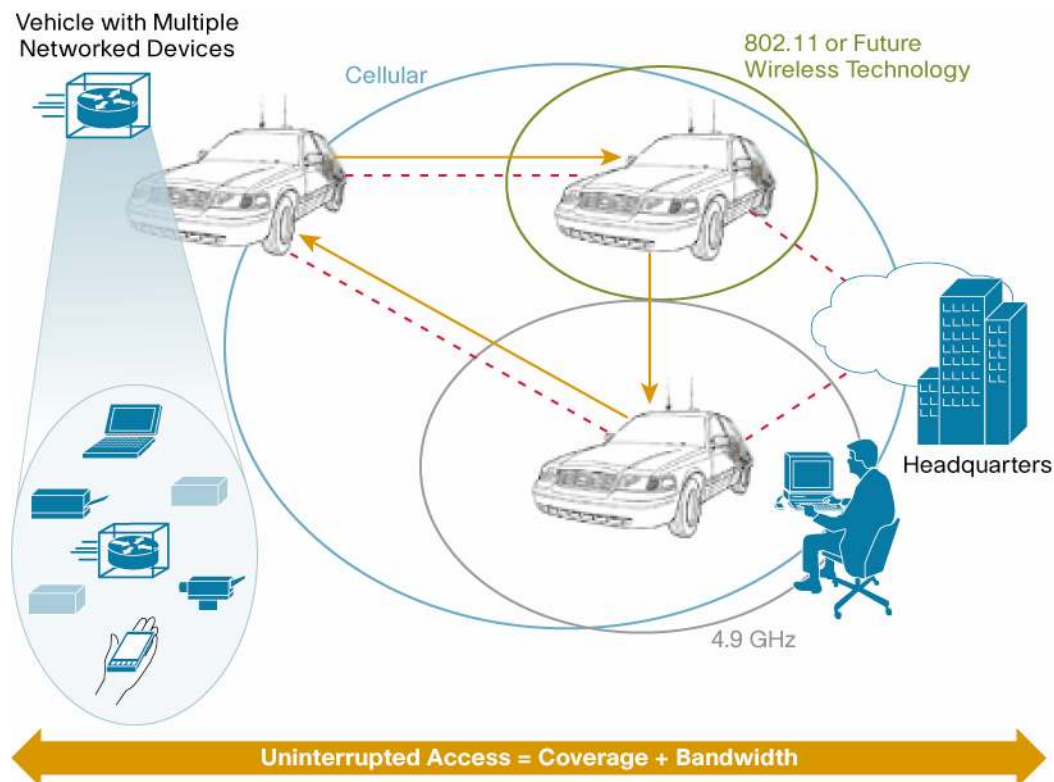


Mobile Network Benefits

Benefits of the Cisco Mobile Network architecture include:

- Wireless broadband integration:** The Cisco 3200 Series Rugged Integrated Services Routers support 802.11b/g, licensed 4.9 GHz, third-generation (3G) cellular, and satellite networks that provide high-bandwidth connections capable of supporting the quality of service required for multimedia public safety applications.
- Network security:** The Cisco 3200 provides a secure extension of the agency network into the field. It implements end-to-end wireless and IP security, including authentication, confidentiality, intrusion detection, and VPNs. Common security policies between headquarters and vehicles reduce the need for managing and maintaining new network components.
- Redundant networks:** Wireless broadband technologies such as 802.11b/g (Wi-Fi) or 4.9-GHz public safety networks support high data rates that are suitable for streaming video and transferring high-resolution maps and photos. However, ubiquitous coverage is not always available, so many agencies augment Wi-Fi networks with cellular data service in order to maintain connectivity anywhere within their jurisdiction. As the vehicle moves around, the Cisco 3200 maintains a connection to the headquarters network through the best possible wireless link. Figure 5 illustrates how the Cisco 3200 keeps the vehicle connected to the main network as it switches from one wireless technology to another. The Cisco 3200 maintains an always-on, continuous connection with the main agency network regardless of location.

Figure 5. The Cisco 3200 Keeps the Vehicle Connected as It Transitions from One Coverage Area to Another



- **Network coverage:** The Cisco 3200 Wi-Fi and 4.9-GHz radios are high powered and can be configured with roof-mounted high-gain antennas, allowing much greater wireless reception range than a laptop or personal digital assistant (PDA) with a direct connection to the citywide infrastructure. Whenever the broadband wireless is not available, the Cisco 3200 reverts to an alternative wireless technology to keep a continuous connection.
- **Smooth migration:** The Cisco 3200 provides a network platform to integrate peripheral devices onto an IP network. The network platform does not require disposing of proprietary radio handsets or use of existing narrowband networks. Public safety agencies can still use their narrowband radio networks, adding a platform to allow migration to enable broadband network applications such as real-time video.
- **Multiagency interoperability:** The Cisco 3200 provides a standards-based network infrastructure for communicating among agencies or within an agency. The vehicle node becomes the network for communicating between standards-based clients that share WAN links.

Application Examples

Mobile Video for Police

One of the largest counties in the United States has deployed a 4.9-GHz public safety network in strategic areas throughout the county. To maximize coverage, the county uses a cellular EVDO network for traditional dispatch applications and as backup in areas with no coverage from the 4.9-GHz network.

Police cars are equipped with Cisco 3200 Series Rugged Integrated Services Routers that include the following integrated components:

- Video server card connecting two in-car cameras

- Hard disk drive for video storage
- Two 4.9-GHz wireless cards (one for vehicle hotspot and the other for a 4.9-GHz uplink)
- Ethernet switch
- EVDO modem
- Linux PC supporting custom video applications

The video from cameras in the police cars is usually stored to a digital video recorder (DVR) in the trunk. The video is saved for a period of time, making it available to be examined later and used as evidence. A broadband mobile network makes it possible to also use that video in real time to help first responders and incident commanders through the broadband wireless connection. When an accident or other incident occurs, the cameras send real-time video streams back to headquarters over the network, and the police department redistributes the video streams to remote police cars using the same wireless broadband network. Incident commanders can also review the contents of a DVR in a police car without any intervention by officers on the scene.

Fire Department

One city has a broadband wireless network that supports both police and fire departments. Along with the wireless infrastructure, the departments deployed fixed video cameras at important locations around the city. The police department uses video cameras at major intersections in town to support remote video surveillance, license plate identification, and remote incident monitoring. The fire department uses the video feed to find optimal routes for trucks responding to a fire. It also sends maps and building floor plans to fire trucks while they are in transit to the scene.

Cisco Outdoor Wireless Services

Cisco and our Wireless LAN Specialized Partners can help state, local, and central government organizations build a secure, scalable outdoor wireless infrastructure with a unique lifecycle approach to services.

Conclusion

The Cisco Outdoor Wireless Network Solution architecture addresses many of the communications challenges facing public safety departments today. The Cisco 3200 provides a secure vehicle network platform, allowing real-time access to data, voice, and video applications from a moving or stationary network. With access to rich multimedia applications, public safety officials have greater situational awareness and therefore are equipped to make better decisions more quickly. Improved decisions lead to improved public safety and a safer first responder community.



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