

EXECUTIVE SUMMARY

Cisco Systems, Arch Rock, Command Information, and pTerex have partnered to create an innovative IPv6-based solution that provides first-responders with real-time access to critical information, thereby helping to improve the communication, coordination, and cohesion of diverse departments at an emergency situation.

THE CHALLENGE

In any emergency incident, lives are at stake, the stress is high, and the environment can be chaotic – particularly when the incident requires participation of multiple departments & agencies. First-responders react to these emergency situations with extreme commitment, dedication, & expertise, even when they must face added challenges such as interoperability problems in critical communications equipment, a lack of visibility into the status of on-site and available people and equipment, & blurred lines of command over interdepartmental response teams.

As first-responders are all too aware – and as the public discovered in the aftermath of 9/11 – existing incident response solutions are not scalable enough to ensure that response personnel at a massive incident can remain in constant communication with others. Even in smaller-scale incidents, responders and their commanders do not currently have a consistently effective way of tracking when individuals may be in jeopardy due to changing physical or environmental factors. Response agencies and the public need a new incident response solution that can:

- Improve safety for all response personnel
- Improve coordination and real-time communication among response personnel and between response personnel and their commanders
- Provide responders and commanders with the ability to accurately monitor the unpredictable conditions of the environment
- Provide commanders with the ability to monitor the ever-changing vital statistics of individual responders

THE SOLUTION

Cisco Systems and its technology integration partners have leveraged their unique skills and expertise in a joint effort to deliver a new technology solution for first-responders: the Advanced Incident Response System.

The Advanced Incident Response System (AIRS) is the first commercially available IPv6-enabled solution that allows incident response personnel from various local, municipal, and government agencies to communicate seamlessly during an event while minimizing dependencies on the fixed infrastructure of the disaster site. Utilizing next-generation technologies like IPv6, network mobility, mobile ad hoc networking, and advanced sensor systems, the AIRS solution enables responders to communicate securely with each other and with their commanders in real time. Personnel at the command post are now able to monitor a variety of human and environmental statistics in real time and can convey that information to responders as needed. These statistics and other crucial data are captured and stored by the AIRS solution so teams can later review their efforts and continually improve the way they respond to situations.

There are two critical components to the AIRS solution that make it particularly valuable to first-responders: its *IPv6 Foundation* and its battery-operated, low power, *Mobile Wireless Sensor System*.

THE IPV6 FOUNDATION

Cisco and its partners decided on a next-generation IPv6 foundation for the AIRS solution because IPv6 technology provides the architecture necessary to create and organize a scalable network in any environment, at any time. It enables the immediate integration of diverse data, voice, and video-based information sources.

As the chart below demonstrates, the use of IPv6 is what makes the AIRS solution so robust and effective:

AIRS: IPv6 technology	Existing solutions: IPv4 or proprietary technologies
<p>Sensors configure themselves</p> <p>Sensors are open-standards based (IETF 6LoWPAN) and have real plug-and-play functionality, so they can be quickly deployed and continuously managed in any environment</p>	<p>System administration required to configure sensors</p> <p>Sensors generally use proprietary technologies and will not function in consistently integrated ways with the rest of the IP-based communication infrastructure.</p>
<p>Automatic communication device recognition & configuration</p> <p>Communications devices are bi-directional, which means that first responders and sensors are reachable as soon as deployed</p>	<p>Manual communication device configuration</p> <p>Communications are largely client-server based, reflecting a strict command-and-control relationship, which does not allow effective communications between all people and devices involved in a response.</p>
<p>Security is automatic and ensured</p> <p>Data security is ensured via peer-to-peer communications links, which enable the data to remain within the mobile ad hoc network created for the incident</p>	<p>Security is an add-on capability and questionable</p> <p>Data security is not ensured because, as in a traditional network, only the local data link is protected, so when data leaves the local area during the communication process no security is maintained</p>
<p>IPv6 standard is a global network standard</p> <p>Global reach of IPv6 networks allows local responder network to be linked back to any rear-area network or competency center, in a secure manner, to engage global experts for highly specialized skills (for example, allowing on-site personnel to confer with a toxicologist when dealing with a dangerous pathogen)</p>	<p>IPv4 standard has configurations that vary by implementation</p> <p>IPv4-based networks are much more likely to be limited in their global reach and thus form a poor platform for collaboration</p>

MOBILE WIRELESS SENSOR SYSTEM

Mobile sensors are part of the AIRS solution and can be internal or external. Internal sensors, such as those built directly into the gear worn by firefighters, leverage IPv6-based wireless sensor networking technology and other leading-edge technologies to enable secure, clear communication between responders and their commanders. These technologies also allow command post personnel to monitor responders' vital statistics in real time. So, for the first time ever, the information associated with each responder's safety, health, and well being can now be captured and proactively managed by incident commanders.

External sensors, which also leverage IPv6 and leading-edge technologies, are part of a mobile sensor kit that responders take with them into a location. An external sensor might be used, for example, by a firefighter who places it on a hot door that should remain closed. Command post personnel are then able to monitor that sensor in real time and immediately warn firefighters if the door opens.

Internal as well as external sensors are battery-operated for complete autonomy and mobility. Additionally, powerful IPv6-based mesh networking capabilities enable these sensors to automatically form "ad hoc" networks over standard low-power radio frequencies (IEEE 802/15/4) with no manual configuration, thus providing seamless connectivity with high levels of resiliency among first responders as well as between first responders and the infrastructure sensors deployed around them. These capabilities are ideally suited for communication in harsh and dynamically changing environments and, also for the first time ever, enable incident commanders to capture and proactively manage equipment location and status and maintain a constant awareness of environmental conditions and situations.

CAPABILITIES AND BENEFITS

Component	Capabilities	Benefits
Incident Response Personnel (IRP)	<ul style="list-style-type: none"> • Delivers real-time biometric data (heart rate, pulse, temperature, respiration, etc) about each IRP to the command post • Delivers real-time data on IRP equipment (air reserves, IRP movement, IRP location via GPS, etc.) to the command post • Delivers real-time data on possible environmental hazards such as toxic gas, chemicals, or temperature changes • Enables real-time communication between IRPs and between IRPs and the command post using VoIP and live video 	<ul style="list-style-type: none"> • Provides a scalable solution that allows multiple units to participate in the incident over a common communications platform • Enables IRPs from different units to communicate freely over the same network • Enables the command post to monitor IRPs from different units • Ensures that all critical information is readily accessible to IRPs and the command post in real time • Helps reduce the risks to IRPs while they are responding to emergencies
Mobile Sensor Kit	<ul style="list-style-type: none"> • Allows IRPs to place sensors as needed throughout a location so the command post can monitor critical environmental data • Enables IRPs to post alerts for the command post in areas that are of particular concern 	<ul style="list-style-type: none"> • Helps improve public safety • Allows teams to review data at a later time so they can continually improve the way they respond to situations
Command Post	<ul style="list-style-type: none"> • Enables speedy deployment of a secure, fully functional mobile network • Provides command post personnel with real-time access to municipal data storage facilities and emergency command central • Enables real-time monitoring of each IRP's vital statistics, equipment status etc. via an IRP Command Dashboard; Dashboard also enables real-time monitoring of environmental data and any building alerts posted by IRPs • Ensures that all data is captured and stored for later review 	

THE COMPANIES BEHIND THE SOLUTION

Cisco Systems is the industry leader in IPv6 and has played a major role in the definition and implementation of the IPv6 architecture within the Internet Engineering Task Force (IETF), the large, international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. Cisco was also a founding member of the IPv6 Forum in 1999 (www.ipv6forum.com) and continues to participate in the efforts of the national IPv6 task force and the North American IPv6 Task Force (www.nav6tf.org). Cisco's long-term involvement in such large-scale IPv6 deployments as 6NET (www.6net.org) and Moonv6 (www.moonv6.org) has added to the experience of Cisco engineers, making them highly qualified consultants on IPv6 transition projects.

Arch Rock was founded to bridge the physical and digital worlds by bringing data gathered by wireless sensor networks (WSNs) into the enterprise IT infrastructure, where it can be easily viewed, analyzed and managed. The Arch Rock commitment to IPv6 is exemplified by its industry-first support for IETF's 6LoWPAN specification and its offering of IP-based embedded web services on all sensor nodes. The company's founders came from the University of California, Berkeley, and Intel Research, where they did seminal work on three generations of wireless sensor nodes ("Berkeley motes") and created the leading operating system for sensor networks, TinyOS. Arch Rock WSN products are used in environmental monitoring, industrial automation, tracking and logistics, and many other applications. The privately-held company has venture funding from New Enterprise Associates, Shasta Ventures and Intel Capital.

Command Information is the largest agile IT solutions provider in America, offering strategic and tactical solutions for government organizations and Fortune 1000 companies seeking to move to the fast-emerging new version of Internet protocol, IPv6. The company's suite of IPv6-enabled services offers business and operational consulting, application development, information assurance (security), network architecture and operations. Command's leadership launched the IPv6 Business Council in 2004, and includes senior members of the global IPv6 community, Moonv6, Internet 2 (www.internet2.edu), and the North American IPv6 Task Force Steering Committee.

pTerex is the world's premier developer and manufacturer of self-managing, self-healing, multi-transport Mobile Tactical Edge Network products. pTerex grew out of an aggressive R&D project undertaken in 2005 by PROSOFT—a leading military systems integrator—and became a stand alone business in 2007. Since its origin, pTerex has held a laser focus on a single objective—to accelerate the rate of change in the Department of Defense's transformation to net-centric warfare and total information dominance in the global war on terror.

FOR MORE INFORMATION

For more information on the AIRS solution, please contact your Cisco Account representative or visit the following web sites:

- Cisco: www.cisco.com
- Arch Rock: www.archrock.com
- Command Information: www.commandinformation.com
- pTerex: www.pterex.com