NIMS Standards Case Study: Los Angeles Regional Interoperability

FEMA

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LEVERAGING DATA SHARING STANDARDS TO IMPROVE INTEROPERABILITY

At Fire Station 4, the Los Angeles Fire Department (LAFD) receives a data message alert from sensors in a chemical storage warehouse indicating abnormal heat levels and possible agent release. A hazardous materials (HAZMAT) response team is dispatched to the warehouse. While en route, on-board data receivers are continuously updated with readings from the building sensors, allowing the responders to plan their approach for building entry and hazard containment. Once on scene, HAZMAT technicians wearing full protective gear and equipped with individual sensors/meters enter the building "hot" zone. The technicians have limited, if any, visibility in the toxic haze and cannot see their instrument's portable sensor readings. Fortunately, wireless local area network (WLAN) data messaging is being used to relay their sensor readings through a cellular gateway back to receivers on a fire apparatus in the "cold" zone. Subject matter experts (SMEs) monitor the sensor readings and alert the technicians when conditions exceed safe levels, prompting technicians to exit the "hot" zone. Readings can be pushed as needed to other locations so authorized personnel can monitor conditions for plume prediction, initiate area evacuations, pre-stage arriving units, and take other measures as warranted.

This scenario is becoming standard operating procedure for LAFD and other regional emergency response agencies as part of the full implementation of the Los Angeles Region Interoperability Project. The project illustrates field implementation of two National Incident Management System (NIMS) recommended standards: the Organization for the Advancement of Structured Information Standards (OASIS) Common Alerting Protocol (CAP) and Emergency Data Exchange Language – Distribution Element (EDXL-DE). This case study illustrates one application of the OASIS standards — bringing a wide range of disparate sensor hardware and software onto a common operating platform for use in emergency response. The use of standards provides sensor manufacturers with a set of common protocols and system requirements for communications between their sensing and receiving units. In the long run, the project holds the promise of creating seamless communication capabilities between responding out-of-county units and Los Angeles area responders and ensuring interoperability when Los Angeles area emergency response units are dispatched elsewhere.

ABOUT THIS CASE STUDY

While NIMS provides a common structure and terminology for responding to incidents and planned events, voluntary consensus standards support NIMS implementation by creating uniformity of use and practice. Such support is particularly important for interoperable communications and integrated information management systems. Standards also provide:

- Accepted and uniform criteria for measuring the adequacy of preparedness efforts and performance of emergency operations;
- Technical guidance; and
- Common resource descriptions to facilitate mutual aid—the sharing of resources among jurisdictions.

The National Preparedness Directorate (NPD), Federal Emergency Management Agency (FEMA) and the NIMS Support Center (NIMS SC) have worked in partnership with standards development organizations to identify existing industry standards that support NIMS implementation.

This article documents a case study of the Los Angeles Region Interoperability Project along with one of its component initiatives, the Tactical Information Program (TIP), which use the CAP and EDXL-DE standards as the basis for the development of a regional interoperability platform. The case study highlights how adoption of existing standards supports implementation of NIMS. Specifically, the case study illustrates to field users how the Los Angeles region is leveraging standards to connect disparate technologies to support (1) sharing information among emergency managers and responders in the region and (2) establish a common operating picture.

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This case study focuses on two important data messaging standards employed by Los Angeles County Fire, Police, Health Department, Sheriffs' units and others, namely:

- **Common Alerting Protocol (CAP), v1.1:** The CAP standard provides a general format for exchanging all-hazard emergency alerts and public warnings over a variety of networks. The CAP standard allows a consistent warning message to be disseminated simultaneously over many different warning systems, increasing the effectiveness and efficiency of the warning system. CAP also facilitates the detection of emerging patterns in local warnings of various kinds, such as information about unique hazards or hostile acts.
- **EDXL Distribution Element (EDXL-DE), v1.0:** The EDXL-DE specification describes a standard message distribution structure for data sharing among emergency information systems using XML-based EDXL. This content based routing standard specifies to whom and under what circumstances the associated (enveloped) data is to be sent and received. The primary use of the EDXL-DE is to provide standardized routing information for all types of emergency data, whether it is an XML message, spreadsheet, JPEG image, or any other type of digital data.

The CAP is intended to work independently of the particular network and distribution elements, while EDXL provides a standard message distribution framework which carries the CAP messages. The Los Angeles region has also integrated the Open Platform for Emergency Networks (OPEN) interoperability backbone in these efforts.

OVERVIEW OF LOS ANGELES TIP PROJECT

First responder agencies in the Los Angeles area have a history of working together to respond to large emergencies that exceed the capabilities of a single jurisdiction, most notably in the response to large wildfires. However, these multi-agency, multi-jurisdictional response efforts have not been without complications. With agencies and jurisdictions relying on disparate equipment and communications platforms, responders have had difficulty integrating various public safety agencies for a combined response. Drawing on these experiences, HAZMAT response agencies in the area began a grassroots effort to foster more effective multi-agency response by overcoming interoperability issues. The first phase in this process was to develop a uniform platform to communicate data from HAZMAT teams operating in the field to technicians/SMEs in a safe zone.

> "The benefit of this pilot initiative is to give responders in a HAZMAT zone the capability to push back their sensor readings to monitors in a safe zone. The responders like the aspect that somebody is watching their back. The overall goal is to use standards to get the various vendors to use common data exchange formats."
>
> – Battalion Chief Robert L. Cramer, Homeland Security Division, LAFD

HAZMAT responders in Los Angeles County have historically used hand-carried sensors (meters) with visual displays when probing HAZMAT environments. Typically, they read the integrated display meters' readings over voice radio links to their deployed mobile communication centers. The difficulty of this operation is that they have to manually initiate voice calls to SMEs at the communications center and relay sensor meter readings via voice radio. The HAZMAT SME interprets these readings to detect the agent(s) present and determine if the environment is dangerous for the sensor-equipped personnel or any human, plant, or animal potentially threatened by the incident, as depicted in Figure 1.

NIMS Standards Case Study: Los Angeles Regional Interoperability

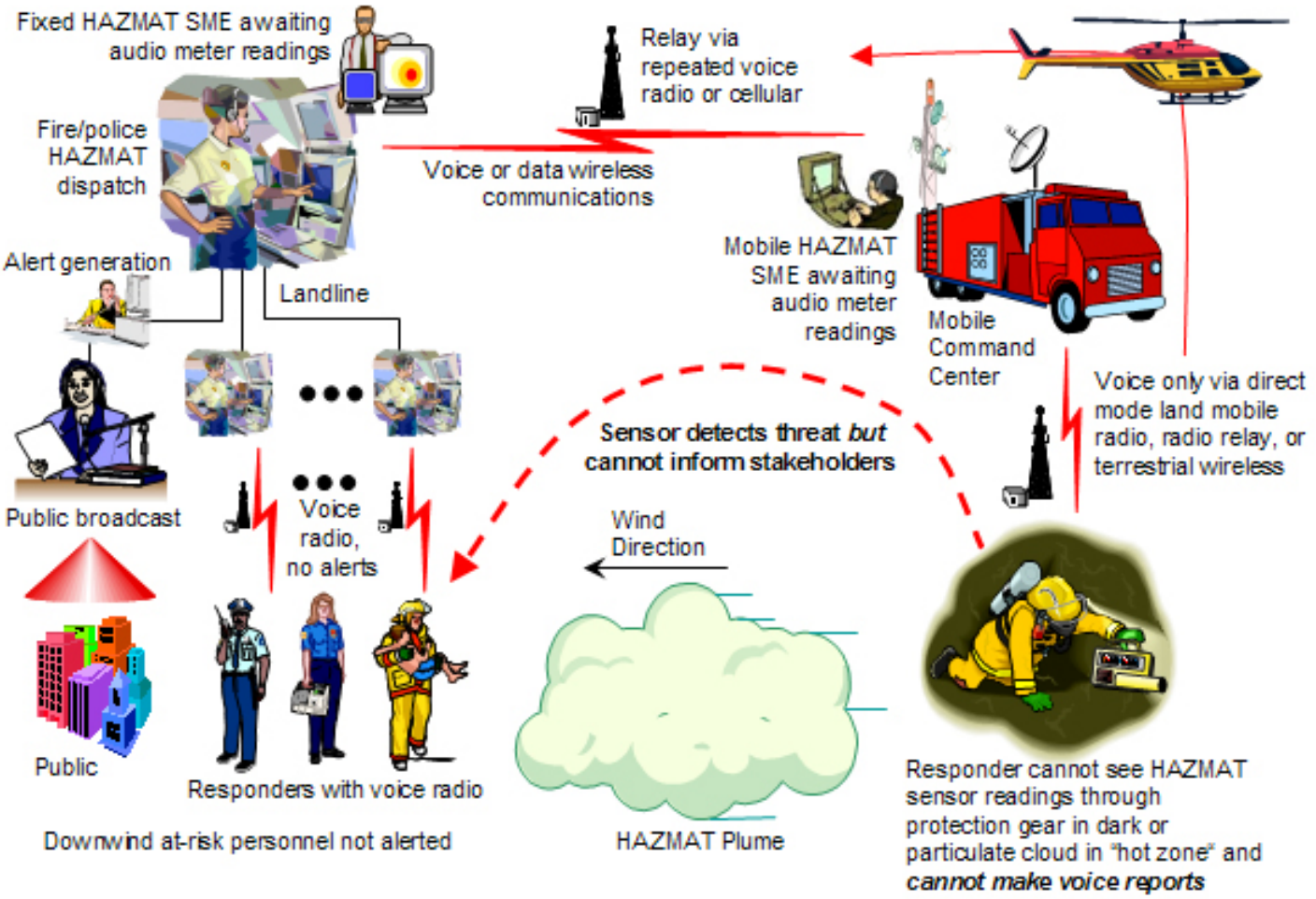

Figure 1. Legacy HAZMAT sensor operation

Los Angeles HAZMAT responders wanted the capability to automatically transmit sensor data from responders operating in a "hot" zone to an apparatus located in a "cold" zone. In researching potential sensors, the region discovered that each sensor was putting out data in a different format, complicating efforts to attain a common operating picture amongst various response organizations. Rather than requiring each response organization to purchase new software from a single vendor, Los Angeles HAZMAT responders identified the use of common communications and information standards, CAP and EDXL-DE, as the solution to ensure common data was produced from all monitoring devices.

Los Angeles County HAZMAT officials added an 802.11 WLAN and cellular capability to their sensors and sensor networks. By formatting with CAP in the EDXL-DE framework, a continuous standardized data feed has been provided from the sensor to the nearby mobile command center. The HAZMAT SME aboard the vehicle is then able to monitor the sensor output without relying on the engaged responder and can warn them via voice radio. This data can also be distributed over wireless networks to provide wide-area situational awareness, enabling greater responder safety awareness, better-informed command decisions, and timelier public alerting. Figure 2 shows the significantly improved operations that result due to the use of a standard format for encoding and communicating the meter readings.

NIMS Standards Case Study: Los Angeles Regional Interoperability

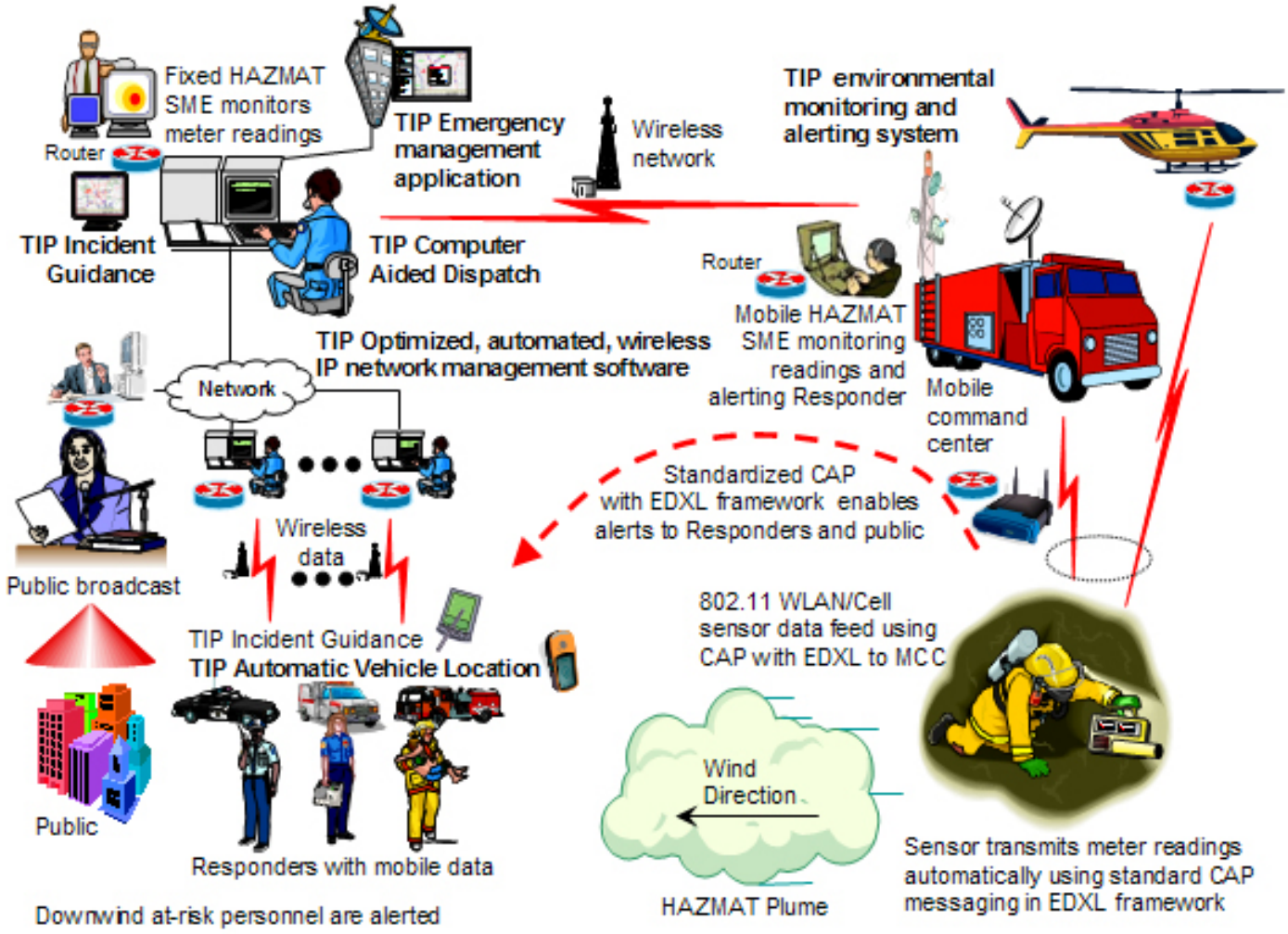

Figure 2. Standards augmented HAZMAT sensor operations

These anticipated benefits of CAP are being realized within the scope of the Los Angeles County HAZMAT data networking implementation. Responders have reported a substantial increase in their operational capability as a result of this effort. As Michael "Mick" Kelleher, Supervisor, HAZMAT Unit of the Los Angeles Sheriff's Department noted:

> "Five years ago the HAZMAT was an oral tradition. Now we are light years ahead. I can go into a 'hot' zone, turn my meters on and the data is transmitted back to the 'cold' zone where my two chemists can read the meters and tell me what the readings are and what to do. We can also push that information out to other organizations."

Formatting the sensors around the CAP and EDXL-DE platforms has also facilitated information sharing between Los Angeles's HAZMAT organizations; response agencies are able to publish to a common server and access each other's meter readings. While information sharing has been expanded by the program, the CAP and EDXL-DE standards allow users to maintain information security and control over information flows. As Firefighter Michael Westhoff of LAFD HAZMAT noted, one advantage of using the CAP and EDXL-DE standards is that "security could be maintained and dissemination of information could be properly controlled."

From the success of the HAZMAT sensor monitoring project, interoperability efforts expanded with the TIP, leading to a multi-phased effort integrating six components: an automated vehicle location system; a computer-aided dispatch system; a fire and police incident guidance application; an environmental monitoring and alerting system; an emergency management application; and an optimized, automated, wireless Internet Protocol network management software. The TIP effort uses many different vendor products and will also use the CAP and EDXL-DE standards to ensure common data formats amongst response agencies. As the developer of this capability points out:

> "Standards are critical to the success of this project. In many cases vendors don't even have standardization between different components of their proprietary project. So if that is the case you can see how lack of standardization can be magnified between products of different vendors."

"The system assists me with my business of resolving problems and protecting my personnel and my city. We now have the capability to receive data transmissions from sensors, such as RAD monitors back at our station, rather than having to rush to the scene, which takes time, an issue might be resolved in a more efficient manner."

- Sergeant Mark Hurley, LAPD HAZMAT Unit

The TIP project represents an ambitious effort to expand the communication capabilities of first responders in the Los Angeles area. The LAFD is currently testing a system capable of transmitting and receiving CAP alerts and, if successful, will expand this capability to all 600 vehicles in its fleet. The region is also testing its capability to receive radiation sensor transmissions from ships operating as much as 27 miles offshore, as radiation detection on ships accessing the Port of Los Angeles is an area of concern, and is also hoping to establish ship-to-shore video link capabilities. Moving forward, Los Angeles hopes to deepen regional interoperability by expanding the scope of regional jurisdictions participating in the TIP and coordinating interoperability efforts with other California Urban Area Security Initiative (UASI) areas.

CONCLUSION

The Los Angeles TIP Program has fostered a successful pilot of an interoperable data communications capability, using 802.11 and cellular radio links to relay HAZMAT "hot" zone sensor readings directly to technical SMEs in the "cold" zone or anywhere they may reside. This capability highlights two benefits of the CAP and EDXL-DE. First, it demonstrates the expanded capability to share information among emergency managers and responders in the region, as both on-scene responders and remote management facilities can receive the same HAZMAT sensor readings and alerts and distribute situational awareness as appropriate. Second, the use of common standards assists response agencies in Los Angeles by establishing a common operating picture, critical for coordinated and timely response from different HAZMAT units.

The use of CAP with EDXL-DE enabled the Los Angeles HAZMAT units to:

- Probe "hot" spots more safely, accurately, effectively, and quickly than using problematic voice reports by using continuous WLAN wireless reports from the sensors themselves to command centers (fixed or mobile) and beyond.
- More rapidly disseminate situational reports to other responders for environmental monitoring, pre-staging resources, and up-to-date situational awareness.
- Use data networking to distribute filtered information to Federal, State, regional, and local officials as conditions warrant.
- Provide well-defined requirements for vendors responsible for manufacturing sensors and software to ensure they are interoperable with other systems.

The major lesson learned from this pilot is that that the CAP and EDXL-DE standards provided a common information sharing platform to meet regional needs. Strong pre-existing partnerships created the demand for information sharing, but responders needed to overcome the data incompatibilities resulting from agencies' use of various proprietary communications systems. The use of data standards such as CAP and EDXL-DE provides a solution to these compatibility issues,

ensuring that equipment utilized and purchased by response agencies in the Los Angeles region are interoperable with those of neighboring jurisdictions. The success of the HAZMAT sensor project provides momentum for building future communications systems around common standards.

The partnerships borne of necessity in fighting wildfires created the demand for standards-based information sharing and communications capabilities in the Los Angeles region. The availability of data standards, such as CAP with EDXL-DE, makes it possible to achieve cost-effective and timely information sharing for situational awareness.

> "An important part of this network participation concept is that as an organization buys hardware and software to enter into the network, standards must be met to allow their connection. This is very important because in the last several decades in public safety, the mindset has been 'I've got my money you have your money and we can each buy what we want without regard to interoperability.' Now it is getting different; standards will be used to ensure that our equipment can work together."
>
> – Captain Thomas Gikas, LAFD

RESOURCES

National Incident Management System (NIMS) Standards
http://www.fema.gov/emergency/nims/nims_standards.shtm

Common Alerting Protocol, Version 1.1
http://www.oasis-open.org/committees/download.php/15135/emergency-CAPv1.1-Corrected_DOM.pdf

Emergency Data Exchange Language – Distribution Element, Version 1.0
http://docs.oasis-open.org/emergency/edxl-de/v1.0/EDXL-DE_Spec_v1.0.pdf

REFERENCES

NIMS SC staff obtained information for this case study through interviews with key personnel from the respective case study locations, as well as online research. Unless otherwise cited, all information presented in this study is drawn from these interviews.