Public Warning in the Networked Age: OPEN STANDARDS TO THE RESCUE?

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The sharing of information about threats and hazards is one of humankind's most basic social activities. Warning others and—often simultaneously—enlisting help are essential functions in any community. Our aim here is to outline how modern public warning has developed and suggest some directions where it could be heading.

In industrialized societies, public warning is often seen as one-way communication: the authorities send information to the affected population about a hazard before it—"early warning"—or during it, or about its consequences afterward. The public is assumed to do as the authorities instruct. If the warning is sufficiently understandable [6] and action-oriented [5], and if it gets confirmation from several information sources [2, 3], something akin to this ideal model may actually happen.

Unfortunately, public warning was until recently headed toward specialization to the point of chaos. Public warning had been seen as a separate task for each authority or each administrative region, instead of a coherent social capability of the whole community or region. For example, although a fire chief, a flood plain manager, and a public health official have common public warning concerns, separate research, regulations, and routines for public warning had sprung from each of these domains—and others. As one result numerous technologies: sirens, colorful flags, radio, television, telephone-based notifications, email, Web-based services, and various wireless alerts are currently used to warn of particular hazards. However, experiences and best practices from one authority's domain or jurisdiction do not easily transfer to another's.

This situation parallels that in computing prior to standards-based networking. From the 1950s well into the 1970s, duplication of work was unavoidable because sharing was impractical, and local practices often resulted in incompatibility with other computing clusters' norms.

The way out from isolated computing clusters was a set of standards for data exchange general enough for reliable communication between diverse systems. The Internet protocols have vastly enhanced the value of the computers that use them and enabled several types of standard-format digital content exchanging.

An analogous development is occurring in public warning. Such efforts as Partnership for Public Warning in the U.S., the Forum for Public Safety Communication Europe, and the Internet Society's "Public Warning Network Challenge" draw attention to the value of all-haz-

ard, multi-channel, simultaneously regional and international public warning networks. Academic events, such as the annual Information Systems for Crisis Response and Management conference (www.iscram.org/), and more implementation-oriented sessions, such as the October 2006 ITU/OASIS Workshop on ICT Standards for Public Warning, gather expertise to the challenges of rebuilding the public warning patchwork toward a more coherent system of interoperable systems.

Similar to the Internet protocols that enabled the network age, an Extendable Markup Language (XML)-based data format, the Common Alerting Protocol (CAP), enables integrated approaches to public warning. Based on research into how individuals process and assess warning messages, the CAP format was designed by a global collaborative of scientists, engineers, and emergency managers. The goal was a neutral template for warning systems interoperability. As many aspects of the Internet, CAP was the product of an unofficial and non-commercial initiative [4]. Some commercial and research projects used CAP early, but only after CAP was adopted as an OASIS standard in April 2004, was it embraced by authorities in the U.S. and elsewhere [1].

Today, partly as a reaction to the near total early warning failure in the Indian Ocean tsunami catastrophe, various grassroots and other nonprofit initiatives are bringing also blogs, wikis, entire Web sites (for example, worldwidehelp.blogspot.com/, www.reallyready.org/, and tsunamilessons.blogspot.com/), and even complete information systems, such as the free and open source disaster management system Sahana (www.sahana.lk/), to the emergency preparedness and management field. Open source tools are likely to prove valuable for public warning, too. Commercial ICT-based warning services also exist, and more are being launched; their role in public warning may become important.

But why welcome these new tools that may worsen the field's fragmentation? Because public warning cannot be effective if it relies on a single technology, or addresses a single threat, or is constrained by political or administrative boundaries. Multiple channels of delivery are needed, not only because every technology has its vulnerabilities, but also because people almost always require confirmation of warnings from multiple sources before they act [2, 3]. Single-hazard systems only make sense in places where there is one overwhelmingly frequent hazard, and even then they need to be supplemented, at further expense, by systems for other hazards. Furthermore, neither natural nor man-made emergencies have respect for boundaries that exist only on maps.

One logical next step in the parallel evolution of warning systems and the Internet could be peer-to-peer warning. Official public warnings could be supplemented by emergent warnings exchanged between nearby devices in neighborhoods and other small areas, where the speed of initial alerting is important and trust in nearby people and their devices is strong. Furthermore, this is not an either-or proposition. Or would we not shout warnings and yell for help if the house was on fire, even while dialing the fire department? So why not configure the smoke detector to alert also our neighbors?

Of all the requirements [2, 5, 6] that a public warning must fulfill, understandability may be the most crucial for the warning's overall success. And here we face a daunting challenge: the Tower of Babel. The need to translate public warnings combined with widespread traveling and the potential of communication technology raise inspiring human factors issues. Could we, for example, design such open standards representations of public warning symbols (visual, auditory, and perhaps even tactile), which would be internationally understandable, clearly discernable from each other, and readily reproducible on most ICT devices? If we could, the understandability, usability, and human "interoperability" of warning messages should grow significantly stronger.

All in all, working with public warning today means living in interesting times—and we can choose whether to regard this as a curse or a blessing. C

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