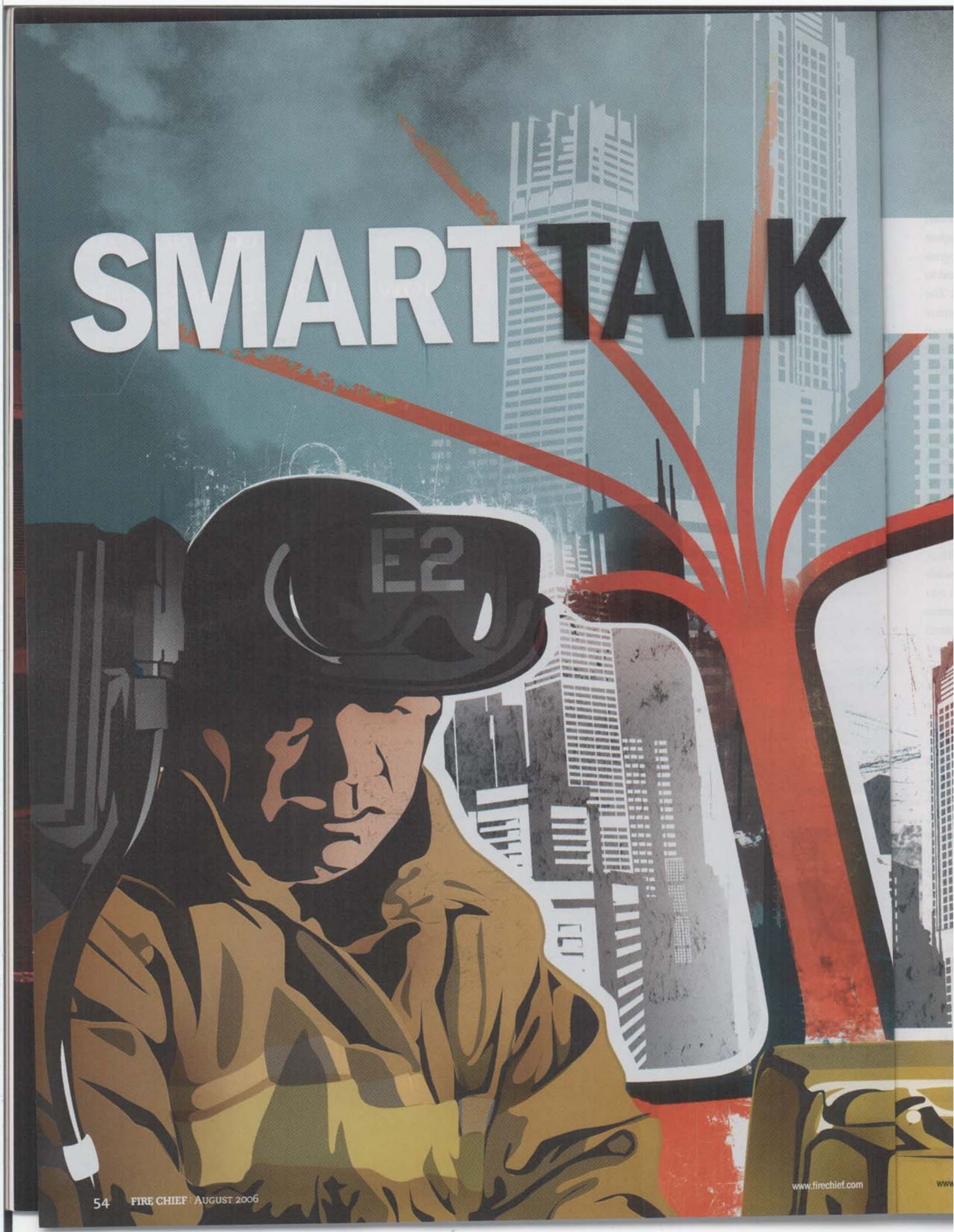
SMART TALK



By David Holmberg

With the right standards in place, sensor data collected by "smart" buildings could help emergency responders plan more efficient and effective actions.

Illustration by Aravind Kaimal

Today's modern buildings function with multiple control systems programmed to run different building systems. Network communications carry commands from controllers to actuators and switches, and a host of sensors feed data back to controllers.

For the most part, however, all this information is bottled up in the building even though it could provide tremendous situational awareness to those outside the building — telling them where a fire is, where smoke is, where occupants are, which devices are operating, which lights are on, or which doors are open.

Why should first responders need to do a size-up at the scene to find out what's happening inside? Real-time information regarding building systems should be available while they're en route to the scene. Why can't a dispatcher "see" into the building from the start of an incident, even before the apparatus is dispatched? That day is coming.

Lacking now is a standard method of moving real-time building data out of the building and into the hands of emergency responders. But things are changing steadily. Building automation systems have been the subject of continued development over the past few decades. Early building control systems were isolated entities attached to heating, ventilation and air-conditioning equipment and separate fire protection systems. With the development of computers came the move toward digital control with computers talking across the wire to tell motors to start and stop, reading sensor values, writing set-points, and more. This was still done within separate systems and using proprietary protocols, with each company developing its own data messages.

The advent of the Internet, combined with standard communication protocols, has brought about great opportunity for new applications. No longer does the HVAC system operate in its own world; the temperature sensors in a room, for example, also can provide data to the fire protection system. The access control system might note the identity of an entering building occupant and provide that information to the HVAC and lighting systems so the ventilation and lights are turned on in an office. This kind of information sharing within the building is beginning to happen. With the coming of connected intelligent control, building automation systems can provide greatly enhanced functions.

Beyond the internal data sharing within a building are opportunities to share information outside of the building, such as with util-

ity services, financial partners, building automation system contractors — and certainly to emergency responders. Modern building automation systems monitor many sensors in different subsystems. The data from these sensors could be collected and delivered outside the building to first responders and other public safety officials during an emergency event. Such building intelligence would help tremendously in improving the safety and performance of their response.

Building intelligence

A modern fire system in a large building has fire sensors in every room to report alarms when the smoke level or temperature crosses a set threshold. Some newer systems can report sensed values, such as temperature readings themselves, rather than just simple "alarm" signals; that is, they communicate digital signals with sensor values in data messages rather than simply closing circuits to indicate alarms.

These same fire signals could be processed by a computer program — a decision-support system — to identify the growth and progress of a fire. That information could be passed to firefighters before they arrive on scene. The HVAC system also might give temperature inputs to these fire models. Likewise, the HVAC system could be programmed how to react to best isolate smoke from a fire. The lighting system could identify rooms with lights on as locations where occupants might be. The elevator system could report elevator position, as well as the presence of smoke and/or high temperatures that indicate the elevator should not be used. The access control system could identify forced entry as well as be able to provide live video feeds of different parts of the property and building.

Today, most large commercial buildings, and many industrial and special-use buildings, have some collection of automation systems with digital control and each subsystem with a master controller. The access control system ties back to the security office and generally is a separate system. The lighting system, if there is centralized lighting control, ties back to the facility engineer's office along with the HVAC controls interface. The fire protection system, with control at the fire panel, is generally a stand-alone system, even though it has the potential to provide data to other systems or receive other system data. Elevator controls also are still proprietary stand-alone systems, although there is a movement to tie elevator systems into the fire panel.

The reality is that modern buildings have intelligent systems that might be tied together, and many building owners and building controls manufacturers see the benefits of sharing information and are working toward making that happen. Although most small buildings don't have sophisticated controls, those with the greatest number of occupants are the ones with the greatest potential for supplying information about an incident to those responding to an incident.

The main goal is situation-specific information — real-time, "right now" information. While many fire departments are working on aggregating preplans and collected informa-

tion from different data sources into an organized, uniform computer-based system, the end result is still only presituation data.

This highlights the two fundamentally different building information classes: static and real-time. Static information is preincident preplan-type information, such as floor plans, equipment location and hydrant output. Real-time information is the output of sensors inside the building: fire sensor status, elevator locations and availability, sprinkler activation, power and other utility status, HVAC and smoke control system status, room temperatures, video feeds, occupant location and identity, and so forth. Many jurisdictions already are linking building floor plans to their graphical information system databases so some static information is available to responders. But there are no automated building-to-public safety network connections that provide real-time building data to emergency responders.

Obviously, fire response could be greatly assisted by knowing progress and location of a fire before arriving at a building. Likewise, if chem-bio sensors are present in the building, there could be some warning of the presence of airborne danger. But it's not only fire and terrorist action leading to fires that can be addressed. This kind of real-time information is useful to police as well. Even medical responders can benefit from elevator and security information, as well as basic floor plans.

The role of NIST

The National Institute of Standards and Technology has been involved in building communications for many years. In the 1980s NIST helped spearhead the development of what has become the leading building automation protocol, which allows different building control systems to communicate and share information. This standard protocol, called Building Automation Control Network (see ***www.BACnet.org***), has been in use for 10 years and is rapidly being expanded and implemented all over the globe.

More recently, NIST has tackled the challenge of moving information from the building out to first responders. In May 2004, NIST researchers convened a meeting of fire and police personnel to better identify the needs of first responders when responding to building incidents and what building information is of most use to them. The results of that workshop are available from NIST (NIST Interagency Report 7193, "Workshop to Define Information Needed by Emergency Responders during Building Emergencies"). NIST is now working on addressing the challenge of developing a standard means of getting building information out of the building and into the hands of fire and police.

There are a growing number of smart buildings with sensor data that would be useful to emergency responders, but there is as yet no standard way of collecting these data within the building and then getting them to responders on the outside. There must be an agreed-upon standard that allows any build-

ing equipment manufacturer adhering to the standard to offer data to be collected, to have a standard building server that can collect these data and offer them up in a standard interface to the public safety network, to deliver standard messages for communicating the data, and to offer standard interfaces for public safety end users to see the data. Then any company's fire protection system, as well as other building systems, can get its data out to any public safety department on the public safety network.

Under the direction of the federal government since the events of Sept. 11, 2001, the job of coordinating efforts to enable public safety communications interoperability has been centralized within the SAFECOM office of the Department of Homeland Security. Although SAFECOM has focused on radio interoperability, NIST is working with SAFECOM to address the building aspect of the issue. With NIST's experience with building controls standards and data communications in general, and its knowledge of first responder information needs, it is in a position to tackle the bigger problem of moving building data out to first responders.

Data-path standard

NIST is working with various companies and industry and standards organizations to identify appropriate technologies to link the building to the emergency responders. As NIST identifies the technologies that are most likely to be accepted by stakeholders in the effort, agreement can be reached and lead to a consensus standard.

As part of current research efforts, NIST has demonstrated one technical solution for the data path that moves data from building to first responder. A simulated emergency in the NIST virtual cybernetic building testbed was connected to an information server that passes building real-time data to a first responder's user interface, allowing fire and police to see what's happening inside the building as the incident progresses. (A video of this demo is available on CD or online at the Intelligent Building Response Web site at ***www.bfrl.nist.gov/ibr.***) Moving forward, NIST will continue to work on standardizing the data path with the input of the many stakeholders who have some part in a future connection to emergency responders.

NIST is working toward an interoperable public safety network that includes standard access to building information. There's information in buildings that can aid first responders. If we have a smart building with a means to move its "smarts" out, then any incident response — fire, police, hazmat, and so on — will be safer and more efficient. Lives will be saved and property protected with the potentially earlier detection of a problem. What we lack now is a standard for moving building real-time data out of the building into the hands of emergency responders. NIST is working on that. [FC]

David Holmberg is an engineer in the Building and Fire Research Laboratory of NIST. He is working on building network security and issues related to moving building data out of buildings. Holmberg may be contacted at *david.holmberg@nist.gov*.