

Building Emergency Response Scenario

Following is a use case scenario of a building fire incident and covers alert generation and propagation to dispatch followed by the first responder use of building data. In addition, a table is presented that collects previous work with public safety representative in defining useful building data. This table categorizes the building data.

Building Automated Alerts

The scenario begins in a large commercial building at 321 Prince Street, in a section of the third floor that is undergoing renovation. Contractors left out some vapor-producing chemicals that have ignited after-hours, producing a small explosion and starting a fire. The explosion disables the smoke alarm in the room, but this generates a trouble condition at the fire panel. The fire panel generates a Common Alerting Protocol (CAP) alert that is passed to the BISACS Base Server (BBS). The alert is then passed to the subscribing central station alarm (CSA) company that monitors the building. Upon receipt at the CSA, a representative attempts to contact the building personnel to verify the alert (smoke alarm trouble in room 310). While the CSA representative follows procedures to verify the alert, another alert arrives reporting a smoke alarm from the hallway outside 310. The CSA representative then immediately transmits these two alerts to 9-1-1 dispatch electronically, with both CAP alerts grouped together in a message.

The 9-1-1 dispatch center receives the CAP alerts with data fields from the message loaded into form fields in the Computer Aided Dispatch (CAD) software interface. At this point the dispatcher will see that there is a suspected fire in a commercial building at 321 Prince Street with smoke alarm trouble and alarm signals on the third floor. This likely indicates a working fire. The dispatcher will follow procedure to dispatch the jurisdiction's standard fire response to the building address. The CAD system will internally authorize each of these units to have access to building alerts and access to additional building incident data directly from the building BBS. The CAD system will transmit the building alert data on to responding units who will have the alert data presented visually and/or audibly.

Mapping Alerts to Floorplans

At this point, the responders are in their vehicles and know that a commercial building at 321 Prince Street has reported smoke alarm trouble activation in room 310 and smoke alarm activations in the adjacent hallway. The officer in a responding fire apparatus will be focused on getting to the building, and will likely pull up the pre-loaded building pre-plan on his mobile data computer (MDC) that orients him to the streets around the building and building access locations. He may also be able to view a floorplan for the third floor of the building. The CAP alert will include location information that allows the MDC on the apparatus to present real-time alarm data on the floorplan. The responder will see a flashing icon in room 310 and thus be more quickly oriented to the situation location and incident progress.

During the time of the initial dispatch and subsequent minutes of enroute response for the first units, the fire has grown and smoke has spread to additional spaces in the building causing several more smoke and high temperature alerts. These alerts are passed from the fire system to the BBS and individually received at the CSA Company and subsequently at dispatch where they are connected to other related alerts based on alert source address and then routed on to responders for that incident.

External Alerts

In addition to these fire system alerts, there are independent calls via cell phone from concerned citizens who observe smoke at the building exterior prior to the arrival of the first fire truck. The Public Safety Answering Point (PSAP) call taker enters the address information and the CAD system connects the report with the existing incident based on the address. One cell phone caller takes a picture of the side of the building with smoke visible and attaches it to a text message that is sent as a 9-1-1 incident report. This message is bound to location information at the phone, either location based on cell tower triangulation or based on GPS receiver. The phone company packages the text message with photo and location information into a CAP message to send to 9-1-1 dispatch. With assistance from the phone location information (GPS or triangulated) and knowledge of the new 321 Prince Street incident, the 9-1-1 call taker receives this message, attempts to find the building address (if that information is not provided in the text message) and enters a new incident report into the CAD system if necessary or connects the new information with the existing incident (based on address information).

Incident Assessment

Meanwhile, as the fire responders arrive at the building, the focus shifts from navigation to incident assessment (size-up). This is where building system data can be most useful, providing information on: the location, size, and movement of the fire; smoke conditions; temperature conditions; water requirements and presence and status of sprinkler systems; elevator availability; best path to attack the fire and identification of stairwells that access the roof, etc. The types of information that would be most useful are listed in Table 1 below. Some of this information is static data that would be deduced from a floorplan (location of stairwells, doors, fire fighting equipment), while much of it requires real-time connection to sensors or to software agents that are analyzing the data to provide decision support.

Communicating with the Building

At this point, the mobile data computer (MDC) needs a connection to the building BBS to enable the fire responder to request all current alarms in addition to specific information from building systems (for example, elevator status, room temperature data, or smoke control system status). This could be enabled via a connection across existing public safety networks using a radio system data channel, or it could be enabled via a direct incident area wireless network connection. The direct connection will likely provide higher bandwidth compared to a typical radio system data channel, thus allowing faster data transfer speeds and even the option of moving floorplan data to get the most recent version rather than relying on the floorplan pre-loaded on the MDC.

The MDC is pre-authorized by the CAD system to access the building BBS and the fire responder is able to authenticate to the BBS and request data related to the incident. The most important data for the fire responder is the floor plan view with icons that help communicate the fire situation. An incident commander can use this information, which is updated regularly, to track the fire and guide his fire fighters. This basic information is supplemented as needed by additional building system queries.

In future applications we foresee the incident commander having authority to implement some remote control actions. These would be clearly limited to the commander and limited to specific actions as approved by the building owners. Envisioned control actions are listed in the last row of Table 1.

Table 1 Building Source Data Classification for Emergency Response Purposes (RT = real time)

Data elements	Where useful	Data class	Also classify as	alerts
Building name and address	Enroute/ on-scene	Bldg static/ bldg metadata/ bldg ID	Metadata/ bldg ID	
Compass directions and Building side labels (A,B,C,D)	Enroute/ on-scene	Bldg static/ bldg metadata/ compass	Metadata/ compass	
Building info: occupancyType, numberOccupants (day/night), buildingUse, commissioningDate, stories, sprinklered/not sprinklered, numberBasements, noEntry/letBurn/exteriorFireFightingOnly	Enroute/ on-scene	Bldg static/ bldg metadata/ info	Metadata/ info	
Contact Info: building owner, facility manager, building engineer, HVAC contact, gas company contact, power company contact, water department emergency contact, State Hazardous Materials Duty Officer	On-scene	Bldg static/ bldg metadata/ contacts	Metadata/ contacts	
First alarm: time of event, location, type of alarm	Enroute/ on-scene	Bldg RT/ Alarms/ incident status/ fire status/ first alarm	Alarms/ first alarm	
Most recent alarm	Enroute/ on-scene	Bldg RT/ Alarms/ incident status/ fire status/ most recent	Alarms/ most recent	
Fire extent (progression of fire alarms, although this is not defined in SB 30 draft)	Enroute	Bldg RT/ Alarms/ incident status/ fire status/ fire extent	Alarms/ fire extent	
Alarm List (time, loc, type, supervisory/trouble)	Enroute/ on-scene	Bldg RT/ Alarms/ incident status/ fire status/ alarms	Alarms/ alarms	Alert on all fire alarms
Floor plan data a. Walls (location and construction: firewall or not) b. doors (location, construction, normally open/closed/locked status) c. window locations d. stairwells (note roof access) e. Elevators (range of floors indicated) f. Exits (fixed display) (not enroute)	Enroute/ on-scene	Bldg static/ floor plan	Floor plan	

<ul style="list-style-type: none"> g. Plans of all floors from basement up to and including roof. h. Roof plan (fixed display) (not enroute): <ul style="list-style-type: none"> i. Access doors and locked/unlocked ii. Roof construction (steel bar joist or tensioned concrete) iii. Heavy objects (towers, generators, AHU) iv. Air/smoke evacuation vents 				
<p>Fire fighter building features (4.1) (top items hear are enroute/fixed/IC)</p> <ul style="list-style-type: none"> a. Standpipes b. Firefighter connections (and optionally areas served by each connection) c. Areas of refuge d. Firefighter elevators (also under elevator category) e. Firefighter entrances f. Location of fire panel 	Enroute/ on-scene	Bldg static / features/ fire fighter features/ enroute	Fire features/ enroute	
<ul style="list-style-type: none"> a. Fire fighter building features, not enroute utility shutoffs <ul style="list-style-type: none"> i. Gas ii. Electric iii. HVAC iv. Master sprinkler b. Location of fixed display c. Fire phones d. Pre-positioned firefighting gear e. Air-pack refilling station f. Halon suppression system 	On-scene	Bldg static / features/ fire fighter features/ IC	Fire features/ IC	
<p>Building features not enroute (useful to police)</p> <ul style="list-style-type: none"> a. Hazardous structures (tanks/ heavy loads)/ materials/ MSDS (MSDS on fixed display only) b. Security guard location c. Video camera locations 	On-scene	Bldg static / features/ fire fighter features Bldg static / features/ law enforcement features	Features/ IC	
<p>Site features:</p> <ul style="list-style-type: none"> a. Hydrants (standard, large volume) b. Access streets, driveways, parking c. Other emergency vehicle accessible locations around building perimeter d. Egress pathways/sidewalks e. Vehicle restrictions (height, width, weight) f. Key box location g. Triage area (optional) 	Enroute/ on-scene	Building static/ site	site	
Sprinkler status: (flowing, trouble)	Enroute/ on-scene	Bldg RT/ sprinkler	Sprinkler	Alert on sprinkler flowing
Building occupants (#, location, certainty)	Enroute/ on-scene	Bldg RT/ occupancy sensors	occupants	
Smoke control system status: on/off, summary text (e.g., “vent floor 3, pressurize stairwells”), pressure sensor list (location and pressure)	On-scene	Bldg RT/ smoke ctrl	Smoke ctrl	Alert on ON/OFF status change

First Responder status: location, ID, qualifications, physiological condition, remaining time on air-pack. (alarm on man down)	On-scene	First responder status		Alert on man down
Elevator status (for each elevator): a. Location, building elevator ID, floors served b. Status (operating/disabled/ in use by fire command/ in use for evacuation) c. Alarms (if any) d. Current floor, direction of movement, destination	On-scene	Bldg RT/ elevator	elevator	Alert on any elevator alarm
Utility shutoffs (fixed display) a. Gas: loc, On/Off, building engineer contact, gas company contact info b. Electric loc: On/Off, building engineer contact, power company contact info b. HVAC: loc, On/Off, building engineer contact c. Master sprinkler: loc, On/Off, building engineer contact	On-scene	Bldg RT/ utilities Bldg static also (except on/off)	utilities	Alert on change in ON/OFF status
Fire Decision Support a. Fire heat release rate b. Visibility c. Flashover potential d. Collapse warning	On-scene	Bldg RT/ fire decision support		Alert on warnings of flashover, collapse, other danger
Temperature, CO, other sensors	On-scene	Bldg RT/ sensors/ temp, or /CO	Sensors/ temp	Alert on chem/bio
Video data	On-scene	Bldg RT/ video	video	
Room info: room ID, phone numbers, use, occupant info, any local sensor data	On-scene	Bldg RT/ room info		
Security Info: locations of physical security alarms, security office, contact information	On-scene	Bldg static/ security		
Security system alarm	On-scene	Bldg RT/ security		Alert on alarm
Lighting info: lights on/off per room	On-scene	Bldg RT/ lights		
Control functions (SB 30 section 5.3) a. Notification appliance silence b. Fire event acknowledgement c. Fire alarm system reset d. HVAC and smoke control e. Elevator controls to override Phase 2 control and initiate Phase 1 recall of protected elevator systems f. Gas and power shutoff g. Sprinkler shutoff h. Emergency voice communications paging system	On-scene	(not building data, just here for reference)		