SIP Emergency Calling

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Overview

- PSTN emergency calling operation
- opportunities for new services
- finding the emergency calling center
- identifying user location
Current E911/112 operation

- caller dials 911 (U.S., Canada) or 112 (EU) or similar national emergency number
- local switch looks up Public Safety Answering Point (PSAP) based on address associated with phone number
- call gets delivered to PSAP or backup (“secondary”) PSAP
- PSAP is responsible for several police/fire departments (ESZ), identified by an Emergency Service Number (ESN)
- ESZ defined by Master Street Address Guide (MSAG)
- different agencies (police, fire) have different geographic reach
- cell phones must be able to reach 911 even if not a registered subscriber
- Automatic Location Identification (ALI) database maps numbers to addresses
- number is delivered even if caller has disabled caller ID delivery (CLID)
Opportunities

- multimedia communications: video medical instruction
- support for people with disabilities: TTY → text chat, video for sign language
- commodity technology ⇨ PSAP only requires an Internet connection ⇨ easy backup during catastrophes
- **Accept-Language** can route calls to operator speaking caller’s language
- universal availability ⇨ same number(s)

Separate issue: emergency communications
Opportunities

Re-use 911 location services for other things:

**User location:** location-aware services:

- find out that it’s 3 am at the caller’s *current* location
- pizza delivery
- traffic menu customization

**Service location:**

- call nearest pizza delivery place
- call closest taxi
Emergency call requirements

- similar behavior to legacy PSTN for phone devices
- must work across systems, e.g., IM/chat, conference systems, PBX
- difficult: re-use old PSAP or parallel systems?
Issues

Need emergency access for all-IP environments – tel:911 is not a solution (and may have unintended side effects...)

- emergency address (network, application)
- find PSAP
- obtain caller civil/geo address

Will focus on SIP layer issues
Emergency address

- could define address at network layer (anycast, multicast) and/or application layer
- but: anycast and multicast not widely available; multicast precludes TCP
- similar to postmaster, webmaster, etc.
- can have several, e.g., 911, 110 (Europe), help, ...
Finding the iPSAP

- should work even if only local Internet is available ➤ avoid central mapping databases
- minimize delay ➤ one translation step
- avoid need for cooperation of end system owners to track changes
- must be automatically testable
- must correspond to physical (visited) network, not logical (home) network – hotmail.com doesn’t have a fire department
- can be done either by end system or outbound proxy
- options: proxy configuration, multicast, DNS, SLP, DHCP, LDAP, SIP
- about 250,000 emergency calls/day in U.S.
Finding the iPSAP via multicast or anycast

- designate scoped multicast address to find iPSAP
- but: network boundaries don’t conform to civic boundaries, except for corporate campuses
- not much difference from using standard SIP multicast address
- doesn’t work well for other applications
Finding the iPSAP via DNS

- map civil name, e.g., leonia.nj.us.911.arpa, or postal code, e.g., 07605.us.911.arpa to IP address, as long as each town or city has one iPSAP

- geographic addressing by longitude/latitude doesn’t work since points close by may be in different states (e.g., Manhattan and New Jersey)

- use DNS SRV records to find different services

- potential difficulties with DNS availability
Finding the iPSAP via SLP

- service location protocol – local mapping from service name to set of server addresses
- same problem as multicast location – needs local configuration
- proxy can do the same operations, so doesn’t add much value
Finding the iPSAP via DHCP

- also requires local configuration
- source of IP address may be very far removed from physical location
- thus, likely to be useful only for campus networks, not consumer ISPs
User location

- if provided by end user or end system,
  - subject to misconfiguration (phone moved)
  - intentional interference
- thus, “network” needs to map station and “wire” identity to location
- for dial-in, network attachment point has little to do with physical location
- GPS is not sufficient:
  - doesn’t work in buildings or in city canyons
  - limited altitude resolution for high-rise buildings
- for 802.11b, see Microsoft RADAR project for determining location within a few feet, but coverage area is small anyway
User location: Ethernet switches

for Ethernet switches, can often determine physical port for MAC address, but

- need to track mapping wires ↔ port
- hard to find IP address for switches
- works only for (some?) managed switches
- should be queryable at layer-2
Provide caller identity and location

- use caller-identity proposal
- caller provides in SIP request
  
  GPos: 42 21 54 N 71 06 18 W -24m 30m
  GL: S3.US.45420.1910 "1425 Arbor Avenue, Dayton OH"

- use same format as wireless systems

- iPSAP queries caller
- iPSAP queries third party based on caller identity
Privacy issues

- caller doesn’t want to reveal information except to PSAP
- only include during emergency calls: sign with public key of PSAP
- if stored in end system, subject to intentional or accidental interference
location announcement for each wire

INVITE sip:911
GPos: 42 21 54 N 71 06 18 W

GPS

customer database (names, addresses)

RADIUS or private protocol

INVITE sip:911
GPos: 42 21 54 N 71 06 18 W
GL: S3.US.45420.1910

first-hop switch

user database (location, room number, ...)

geo <-> civil translation database

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Conclusion

- need to supply emergency calling for first-line services
- harder than PSTN:
  - no global identity like a calling line number
  - no trusted network
- opportunity for other location-aware services