Deaf access to 911 via new technologies

Problem Statement

As the deaf community moves away from legacy TTY to modern text communications technologies such as cellular phone or PC-based instant messaging, they lose the ability to reliably reach 911 emergency services and have their street address or geographic location automatically provided.
Acronyms & Definitions

• Public Switched Telephone Network (PSTN)
  • Conventional wireline and cellular phones

• Public Safety Answering Point (PSAP)
  • 911 emergency call operator, typically operated by a local police or sheriff department

• Automatic Number Identification (ANI)
  • ANI shows 911 caller's phone number on PSAP operator screen

• Automatic Location Identification (ALI)
  • ALI displays 911 caller's street address on PSAP operator screen

• Enhanced 911 (E911)
  • Originally referred to 911 call with ANI, evolved to mean call with ANI & ALI

US/Canada 911 History

• 1968: First 911 call system implemented in New York City
  • Hardwired call forwarding to PSAP; was not always the correct PSAP for the caller's street address

• Mid-1970's: ANI and Selective Routing were added for 911
  • Selective Routing forwards 911 call to correct PSAP for caller's street address, based on the 7-digit calling phone number

• 1980: Automatic Location Identification (ALI) deployed in Orange County, California

• 2010: >95% of 911 voice calls provide ALI
US/Canada 911 Cellular Telephone History

- 1983: First US cell telephone service deployed by GTE (Verizon) in Indianapolis, Indiana. 911 not supported on early cell service, each state had different emergency numbers for cell callers
- Early 1990’s: FCC Phase 0: 911 cell calls supported, but routed to single state police or highway patrol PSAP for entire state
- 1998: FCC Phase I: 911 operator sees ANI and nearest cell tower location as text longitude and latitude coordinates, call routed to single state police or highway patrol PSAP for entire state
- 2001: FCC Phase II: 911 operator sees ANI, and phone geographic location on street map display, within 50 to 300 meters. Location within 125 meters for 67% of calls, averaged over all calls in entire carrier service area. Call usually routed to correct local PSAP.

911 TTY Wireline Support

No emergency operator deaf caller support from 1876 through 1990. Deaf person would ask hearing person to make emergency call.

Once ALI support became more common in the early 1990’s, deaf 911 callers were supposed to tap a pencil on the mouthpiece of the phone to alert PSAP operator. Most deaf callers and many PSAP operators didn’t know this. ALI didn’t work on all calls, so PSAP operator wouldn’t always know where to route police to respond if they did know what the tapping sound represented.

FCC mandated in the mid-1990’s that all PSAP operators be provided with a TTY and training on how to use it. TTY 911 caller was supposed to keep tapping the TTY spacebar so PSAP operator heard modem tones and knew to manually connect their TTY. Still system in use today in the US and Canada.
911 TTY Cellular & VoIP Support

• Some cell phones equipped w/ 2.5mm audio jack for external TTY

• Original analog cell system could carry TTY modem tones reliably (less than 1% character error rate)

• Original digital cell phones in late 1990s used fixed voice compression and could not carry TTY calls. Cell carriers told deaf customers to stick with analog phones, until the deaf community lobbied the FCC to intervene.

• Current digital cell phones have a TTY setting which turns off voice compression; character error rate targeted at 1%, and generally in the range of 1% to 3% for real life calling.

• Voice over IP (VoIP) phones often use voice compression which cannot carry TTY modem tones reliably (4% to 9% character error rate). Some VoIP carriers such as Vonage give customers option to turn off voice compression, enabling reliable TTY use

Issue #1: TTY “apps” on smart cell phones cannot be used for 911 calls

Many models of cell “smart phones” have a TTY software application, such as the Sidekick from T-Mobile. The user can text type from cell phone keypad, and the cell carrier network server converts to TTY modem tones for PSTN call to legacy TTY device.

US/Canadian 911 Selective Routers only use 7-digit phone numbers, so 911 calling is a “localized service,” doesn’t support 10-digit phone numbers with area codes

If cell phone TTY app used for 911 call, as far as I know the call will route to the PSAP associated where the carrier's TTY-PSTN gateway is physically located, not the PSAP where the 911 caller is located!
Issue #2: 911 calls via VRS or IP Relay are possible but have location problems

Legacy PSTN (wireline or cellular) TTY calls to a state Telephone Relay Service (TRS) include ALI to the TRS operator, who then uses ALI to route emergency call to correct PSAP, and operator will have correct street address (or geographic location for cell phone).

VRS and IP Relay customers are issued 10-digit PSTN numbers since 2008. Many VRS providers do support 911 calls (reluctantly), and use a third party E911 service such as Intrado to route to correct PSAP for the 911 caller, based on 10-digit number. However, the street address previously provided by the customer is used for routing to correct PSAP. If customer physical address changes they are responsible to update the 911 location database; many forget this.

If customer is using a mobile device away from home, this fixed address will always be incorrect. Mobile caller has to tell VRS operator correct street address. If the mobile caller does not know where they are (stuck on a rural road after dark, for example) may route call to wrong PSAP. But a voice call directly to 911 from that cell phone would provide the correct geographic location, so only a problem for deaf VRS caller, not hearing 911 caller.

Issue #3: Text messages cannot be used for direct 911 text calling

There is currently no method to make a 911 call directly with text only.

Cell phone text messaging is a store-and-forward technology dependent on cell carriers and their networks; it is not real time, nor is it possible to guarantee delivery of a cell phone text message.

FCC is considering various Real Time Text (RTT) alternatives for VoIP & cell smart phones. RTT would be supported directly by PSAP for 911 callers.

Note: It is technically easier and more efficient to send RTT messages a line at a time, i.e., send an entire sentence when the "Enter" key is pressed. However, legacy TTY send one character at a time as each key is pressed, and longtime TTY users generally prefer one character at a time transmission, as that is what they are used to.

Question: Do Generation "X" and "Y" deaf care if RTT is sent one character at a time, or an entire line at a time?
**Issue #4: Deaf individuals haven’t been educated on 911 procedures**

We asked two current NTID students how they would make 911 call in an emergency. Neither had thought about the possibility, or considered how to do it prior to our question.

#1 said they would use their iPod Facetime via WiFi for VRS 911 call. But their Blackberry cell phone doesn’t have WiFi hotspot capability, so if they were not in an active WiFi zone, couldn’t call!

#2 said “I would probably use IPRelay to call 911 if I was stranded somewhere without Internet. If I was at home I would call 911 using the videophone. I have not tried either approach and don’t know how effective they are in responding to emergency situations. I use an iPhone as a mobile device, and I believe it comes with some kind of TTY feature, but I don’t know how to use it! I’ve never used it for two reasons, first I don’t carry a keyboard in my pocket, and second I’m not sure if I would be charged voice minutes. My data plan only allows texting, Internet, email, etc., but not voice. This requires some research. I used to have several TTYs hanging around the house, but now they are all gone. I kind of like to say that TTYs now belong in a deaf history museum.”

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**For further reading:**


Intrado (one of the companies providing VoIP E911 call routing): http://www.intrado.com/main/company/government/voipdeployment/whatisintradosrole/