Introduction

9-1-1 telephone response systems are a critical issue for deaf and many hard-of-hearing individuals. These systems, which provide public access to emergency and information systems available to society at large, are not easily or dependably available to persons who are deaf or hard of hearing.

“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 9-1-1 emergency services and have their street address or geographic location automatically provided.”

Emergency 911 Presentation by John Combs, Cisco Systems 1/5/11

History of US/Canada 9-1-1 Telephone Response Systems

In order to better understand the issues related to the current 9-1-1 telephone response systems, it is important to be familiar with its history.

The first 9-1-1 telephone response system was rolled out in New York City in 1968. The system was able to receive and forward hardwired calls to Public Safety Answering Points (PSAP); however, the calls were not always forwarded to the proper PSAP, or the center closest to a caller’s street address. During the mid-’70s, the 9-1-1 telephone response system improved to include Automatic Number Identification (ANI) and Selective Routing. Selective Routing was able to forward calls to the correct PSAP based on the 7-digit phone number. In 1980, Automatic Location Identification (ALI) was deployed in Orange County, CA. Currently, more than 95% of voice calls provide ALI.
The first US cellular telephone service was introduced in 1983 by Verizon. At this time, 9-1-1 was not supported by cellular service providers; each state had different emergency numbers for cellular callers. To address this inherent problem, the Federal Communications Commission (FCC) imposed Phase 0 in the early 1990s. 9-1-1 cellular calls were now supported; however, the cellular calls were routed to a single state police or highway patrol PSAP for the entire state. These calls then had to be re-routed, significantly increasing response time. In 1998, the FCC imposed Phase I. This phase provided 9-1-1 operators with the ability to view the phone numbers (i.e., ANI) of cellular callers as well as the nearest cell tower location (via longitude and latitude coordinates); however, cellular calls were still routed to a single state police or highway patrol PSAP for the entire state. The FCC then imposed Phase II with a 2001 deadline. In Phase II, the 9-1-1 operator would be able to view the phone numbers (i.e., ANI) of cellular callers and the geographic location on a street map display (within 50-300 meters). On average, 9-1-1 operators were able to identify the location of the cellular callers within 125 meters 67% of the time. Due to technological difficulties, not all cellular phone carriers were able to meet the 2001 deadline. This forced the deadline of Phase II to be postponed repeatedly. As it stands today, Phase II must be fully implemented by all US cellular phone carriers by September 2012.

9-1-1 telephone response systems did not support deaf callers until the early 1990s. A deaf person in need of emergency services had to ask a hearing person to make the emergency call. After Automatic Location Identification (ALI) became more common, deaf callers were instructed to tap a pencil on the mouthpiece of the phone to alert PSAP operators that they are deaf. However, most deaf callers as well as PSAP operators were not aware of this process. Additionally, ALI did not work on all calls. As such, PSAP operators did not know where to route police even if they were aware of what the tapping sound represented. In the mid-’90s, the FCC mandated that all PSAP operators be equipped with TTY machines and provided with TTY training. Even though this technology was “in place,” deaf callers were still instructed to tap the TTY spacebar to alert PSAP operators to manually connect their TTY machines. The TTY system is still in use today in both the US and Canada.

Cellular telephones continue to increase in popularity, but only some cellular phones are equipped with a 2.5mm audio jack for an external TTY. The original analog cellular systems were able to carry TTY modem tones reliably (less than 1% character error rate), but the original digital cellular phones that were introduced in the late 1990s used fixed voice compression, making them unable to carry any TTY modem tones. In an attempt to combat the problem, cellular carriers instructed deaf customers to continue to use their outdated analog telephones. The deaf community lobbied the FCC to intervene. Current digital cellular phones have a TTY setting that turns off voice compression resulting in a similar 1% character error rate, compared to a 1-3% character error rate for real life calling. Voice over IP (VoIP) phones often use voice compression, which cannot carry TTY modem tones reliably (4-9% character error rate); however, some Voice over Internet Protocol (Voice over IP, VoIP) carriers provide customers the option to turn off voice compressions enabling reliable TTY use.

Related Resources
9-1-1 from Wikipedia
FCC 9-1-1 Service
NAD - Next Generation 9-1-1 Emergency Services
ADA - Next Generation 9-1-1
Areas of Concern

Several areas of concern have been identified with regard to deaf persons’ ability to contact 9-1-1 using current technology and their awareness of processes and procedures.

1. **TTY Applications ("apps") on Smart Cell Phones Cannot be Used for 9-1-1 Calls**
   The good news is that many models of “smart phones” come with the TTY software application. This software enables the user to text type from the cellular phone keypad and then the cellular carrier network server is able to convert the text type to TTY modem tones. However, US/Canadian 9-1-1 Selective Routers can only use 7-digit phone numbers, making this a localized service. As it’s understood, if a cellular phone TTY app is used to make a 9-1-1 call, the call is routed to the PSAP that is closest to where the carrier’s TTY server is physically located and not to the PSAP that is closest to the 9-1-1 cellular caller.

2. **9-1-1 Calls via VRS or IP-Relay may Experience Location Problems**
   9-1-1 calls via Voice Relay System (VRS) or Internet Protocol Relay (IP-Relay) are possible, but may experience location problems. Many VRS providers reluctantly support 9-1-1 calls by using a third party emergency 9-1-1 service, such as microDATA or Intrado, to route calls to the correct PSAP based on the 10-digit calling number. VRS and IP-Relay companies have been issuing 10-digit numbers to their customers since 2008. One problem is that VRS and IP-Relay companies use the street address that is provided by the customer at the time the 10-digit number is assigned to route a call to the proper PSAP. It is the responsibility of the customer to update the 9-1-1 location database every time he/she has a change of address. Additionally, if a customer uses a mobile device away from his/her home, the fixed address will always be incorrect. The mobile caller has to tell the VRS and IP-Relay operator the correct location. In many cases, the caller may not know where she/he is located (e.g., dark rural road). This problem exists for only deaf VRS or IP-Relay callers, and not hearing 9-1-1 callers using this same or similar mobile device.

3. **Text Messaging Cannot be Used for Direct 9-1-1 Text Calling**
   Current text messaging technology is not appropriate for direct 9-1-1 text calling even if 9-1-1 telephone response systems had the capability to receive text messaging. Cellular phone text messaging is a store-and-forward technology dependent on cellular carriers and their networks. This technology is not real time nor is it possible to guarantee delivery of a cellular phone text message. The FFC is considering various Real Time Text (RTT) alternatives for VoIP and cellular smart phones. Ideally, RTT would be supported directly by PSAP for all 9-1-1 callers. Research has shown that it is technically easier and more efficient to send RTT messages one line at a time, as opposed to legacy TTYs that send one character at a time. How would the deaf community feel about this change?

4. **Deaf Individuals Lack of Awareness of Appropriate Resources Related to 9-1-1 Procedures**
   Many deaf individuals are not aware of the appropriate resources related to 9-1-1 procedures. Many, particularly the younger generations, have not even given it much thought and view TTYs as last century technology. The procedures on how to contact 9-1-1, taking into consideration various situations and technologies, are not sufficiently communicated to the deaf community.
5. **FCC Activity Related to 9-1-1**

The FCC is in the process of revolutionizing 9-1-1 telephone response systems to allow consumers the ability to contact 9-1-1 using a variety of communication methods, including text messaging, email, video, and photos. Given the current FCC activity related to 9-1-1, where should NTID focus its influence on impending policy changes?

“The FCC today took an important step to revolutionize America’s 9-1-1 services for consumers and first responders by adopting a Notice of Inquiry (NOI) seeking public comment on how Next Generation 9-1-1 (NG9-1-1) can enable the public to obtain emergency assistance by means of advanced communications technologies beyond traditional voice-centric devices. The FCC has undertaken this proceeding in response to a recommendation in the National Broadband Plan seeking to harness the life-saving potential of text messaging, email, video and photos from mobile and landline broadband services.”

*FCC News Release, FCC Takes First Step to Help Revolutionize America’s 9-1-1 Services for Consumers, First Responders, December 21, 2010*

6. **Better Understanding and Improvement of RIT’s Emergency Communication Systems**

Rod Lezette, Assistant Director, RIT Campus Safety, explains that RIT students are able to contact campus security to report an emergency through either voice calling, TTY, or instant messaging. Similar to county 9-1-1 centers, newer communication methods such as text, email, and video are not yet supported. Lezette is aware that most students do not use instant messaging on their smart phones and understands text to be the preferred method of communication. The process for reporting an on-campus emergency is clear, however, there is an opportunity to provide students with information on how to contact 9-1-1 when they are off-campus. Further, RIT could develop “Best practices” with regard to emergency communication systems that could be distributed to other universities throughout the country that serve deaf and hard-of-hearing individuals.

**Related Resources:**
- FCC – Recommendations for Improving 9-1-1 Call Center Operations
- FCC – Deployment and Operational Guidelines for Next Generation 9-1-1/E 9-1-1 Systems Summit Summary
- FCC – 9-1-1 System Timeline
- Intrado - Role in 9-1-1 System
- Motorola Announces Alliance With Intrado to Deliver Next-Generation 9-1-1 Text Messaging Products and Services
- Verizon and Intrado Join Forces to Deploy Next-Generation 911 Services Nationwide
- microDATA – We Know NG9-1-1
- Informa Cast 7 New Feature Highlights
- NAD Testifies at Department of Justice Hearing
- Dispatch Magazine Online – Next Generation 9-1-1
- National Telecommunications and Information Administration Website
- National Broadband Plan Website
- FCC – Best Practices for Reliable 9-1-1 and E9-1-1
NENA – NG9-1-1 Project
NENA – 9-1-1 and NG9-1-1 Current Issues and Initiatives
4Gs Americas – Texting to 9-1-1 Examining the Design and Limitations of SMS
991.gov - Strengthening Americas 911 Systems
RITA – Next Generation 9-1-1
Datatracker – Emergency Context Resolution with Internet Technologies
City of Rochester – Voice Over Internet Providers
110114 FCC EAAC Presentation
110114 FCC NG911 Tech Presentation
110114 FCC PSHSB NG911 NOI Presentation
110114 Reach 112 Presentation
110114 Richard Ray TRS Presentation

Rochester Emergency Communication Department

There are more than 6,200 9-1-1 call centers in the United States. On average, each center employs 31 individuals. In comparison, the City of Rochester Emergency Communications Center employs 200 individuals. The City of Rochester Emergency Communications Director, John M. Merklinger, stated Rochester’s 9-1-1 center receives “approximately 280 hearing impaired calls per month compared to a typical 9-1-1 call center that receives 1-2 TTY or deaf/hard-of-hearing calls per month.” At this time, most interactions with deaf or hard-of-hearing callers are through third parties. Merklinger expressed concern for accurately documenting and recording all of the information that comes into the 9-1-1 center from third-party vendors.

Merklinger acknowledged that Rochester also experiences problems relating to the usage of VoIP. He explained that any IP device is able to connect to 911, but VoIP systems like Vonage are not tied to local addresses. Local communication provider, Time Warner, registers customers’ telephones, but they have to rely on the customer to update any change of address. The majority of cell phones, on the other hand, are not registered with Rochester’s 9-1-1 center. Merklinger estimates that out of 375,000 cell phones in the area, only 18,000 are registered. Further, the general public is not aware that texting to 9-1-1 is currently not possible. During a recent emergency at Canandaigua high school, hundreds of students attempted to inform 9-1-1 of the emergency via text messaging. Merklinger expressed concerns regarding common text messaging abbreviations carrying over to TTY calls, and operators accurately interpreting the abbreviations and having to take extra, valuable time to understand and verify messages.

It will take a very significant amount of time and financial resources for Next Generation 9-1-1 (NG911) to be fully implemented at the national, state, and local levels. There is a need in the Rochester/Monroe County area to address the ability of the deaf and hard of hearing to be able to communicate with the 9-1-1 Center. As a stop gap measure until NG911 is in place, the Rochester Emergency Communications Department is researching real time text messaging as a strategy. Merklinger mentioned that Rochester researched the Intrado system, but determined that it is too expensive. Rochester is also investigating a new product by INdigital Telecom
called “Texty 911.” This product is an “innovative text and Instant Messaging system designed to meet the needs of the speaking and hearing impaired.”

Merklinger concludes that voice is the preferred method for communicating with 9-1-1 centers at this time. TTY and text calls and other text messages are much slower, averaging 3-4 minutes a call whereas voice calls average 1.5 minutes. Even if/when the technology becomes available, the time it takes to respond, decipher, and confirm a text message dramatically increases response time.

Note: Merklinger has agreed to participate in our community focus group and share information with other 9-1-1 organizations throughout the state. He also mentioned a 9-1-1 statewide coordinators conference taking place May 10-12, 2011 in Alexandria Bay, New York. Various vendors for E9-1-1 systems will be on hand.

**Related Resources**
- City of Rochester Emergency Communications 911
- INdigital Telecom
- New York State 911 Coordinators Association

**RIT’s Unique Perspective**

RIT provides a unique perspective, with more than 1,200 mainstreamed deaf and hard-of-hearing students and more than 100 deaf faculty and staff on campus. How can we contribute to the policy recommendations and/or technology innovations?

The NTID Center on Access Technology (CAT) has been commissioned by Cisco Systems to investigate access solutions for deaf and hard-of-hearing individuals related to 9-1-1 telephone response systems. CAT will be hosting a national discussion on 9-1-1 telephone response systems in May 2011. The purpose of this preliminary discussion is to identify agenda items for, and request your participation in, this upcoming conference.