Incident Communications

by Andrew M. Seybold

One of the most misunderstood aspects of public safety communications is the need for peer-to-multi-peer communications when at an incident. (In Land Mobile Radio speak, this is called simplex, tactical, or talk-around communications.) It is important that those making policy in Washington, DC, those on the commercial side of wireless, and IT professionals understand exactly what this type of voice communications entails and the critical role it plays in public safety communications.

Consider this scenario: You are in a large shopping mall with your family and you each go in different directions, agreeing to meet later at the food court. You are in a store and you find a bargain that you want your spouse to see before you buy the item. You pull out your cell phone only to find that you do not have cell phone coverage in the mall, so you can't call your spouse's cell phone to ask him or her to meet you at the store. Your son or daughter is walking in the mall and sees someone fall down the stairs. He or she reaches for his or her cell phone to call 911, and again, finds there is no cell phone coverage, so the call cannot be made.

The problem in both cases is that you are out of cell site coverage, and without a cell site, your phone does not work. It is simply a great piece of technology that is useless when you are not in range of at least one cell site. To you this is an inconvenience, but for the person who fell down the stairs and is injured, the delay in getting assistance could be the difference between living and dying. This is not acceptable in the world of public safety communications where those on a scene need to be able to communicate, especially with each other, no matter where they are and regardless of the conditions.

There is a type of voice communications that enables public safety personnel to communicate among themselves even when they are out of range of a cell site or a tower site, and it is vital to the way in which public safety personnel on the scene of an incident operate. Using the same mall as an example, once the fire department and EMS personnel arrive, they switch their radios off of the dispatch channel to a channel that provides the ability for them to talk to each other over short distances. These voice transmissions are heard by all personnel at the incident. (To be clear, fire and EMS personnel can talk to each other, and the police, usually on another one or more channels, can talk to each other.)

This capability provides good communications between those on the scene, and if they need to contact their dispatcher they can contact someone in their vehicle outside the mall, who in turn can relay the request for additional assistance to the dispatcher. Further, if a fire fighter is on the second floor of a burning building and sees that the roof is about to collapse, he or she can make a call that will be heard by all personnel in the building, alerting them to the danger. And if the person making the call is in danger, they can provide assistance. Again, this type of communications is vital to public safety and it is used every day at many different times.

Yet this type of voice communications is not now available using cellular and wireless broadband networks, nor will it be well into the future. The devices we use to communicate over commercial voice and broadband networks are 100% reliant on being within range of a cell site. If two people are separated by only a few blocks, they still must dial a phone number and wait for an answer, which means they both must be in range of a cell site to be able talk to each other. First responders simply change the channel their radios are set to and instead of talking over the network, they talk directly to other units within range.

Those familiar with Citizen Band radios, or walkie-talkies that use the Family Radio channels authorized by the FCC, know how this type of communications works. It is based on push-to-talk, and units can talk among themselves without going through any relay towers or cell sites. This type of service is not available in the world of commercial wireless. While some people seem to think it will be available in the future, I don't believe any wireless broadband equipment or device vendors will be building in this type of communications capability.

There are many different reasons that this type of communications is not and will not be available: There are technology challenges, network operators want their customers to make use of their networks to provide income, and there is no demand for these types of services from the general population. But those who claim public safety's needs can be completely served by commercial-type broadband networks apparently do not understand the need for direct communications. Again, this is not a "nice to have" feature for public safety, it is a must-have requirement. Unlike the annoyance of not being able to make a phone call when you are out of cellular coverage, the inability to talk to others at the same incident can be deadly. It could result in the loss of life not only within the first responder community, but also for others involved in the incident.

I have heard several comments from those who believe broadband networks can provide all of the capabilities needed by public safety that further indicate how much this direct voice requirement is misunderstood. The first set of comments has to do with being in coverage—broadband believers suggest that there will be coverage everywhere, and where there is no coverage from a cell site, in-building communications systems will provide communications capabilities. This simply is not true. No matter how robust a network is, no matter how many cell sites it contains, there will be places where there is no coverage. Further, even if there is coverage, it does not make sense for ten, twenty, or more first responders on a scene to tie up wide-area communications channels when local-area communications will serve their needs, and serve them better.

Add to this the fact that at larger incidents that occur on a daily or weekly basis, there is also a need for multiple local channels. This is because there are a number of different groups at these incidents, all with their own set of objectives and tasks. While public safety personnel need to be able to talk within their own group, they cannot have to compete with other groups for a radio channel. A simple example of this might be a bank robbery gone bad that has turned into a hostage situation. On the scene there will be patrol officers who first responded to the incident, a swat team, a surveillance team, detectives, fire, and EMS responders. At this type of incident, each group needs at least one channel dedicated to its own team to coordinate among themselves. At the command post, the incident commander is able to follow what is going on within each

team, which enables him or her to make informed decisions about how to handle the incident. The incident commander must also have a clear channel back to the dispatch center and/or superiors who are monitoring the event from remote locations.

During storms, wildland fires, and many other situations, the number of local channels that are needed must be available; having only one such channel is not acceptable. During the recent Southern California wildfires, between local, state, and federal fire agencies, there were 18 command channels (wide-area coverage) and 78 local-area or simplex channels in use. By the way, much of the area engulfed in flames was outside commercial network coverage and some was even outside areas covered by the existing public safety networks. However, because there were local communications capabilities, incident command was able to track everyone on the fire lines and if someone got into trouble, he or she knew that by pushing one switch on the radio and saying, "I need help" or "I'm in trouble," he or she would be heard by nearby team members.

Public safety needs broadband services, but today, voice is the primary form of communications in the field. Data services will help augment the tools available in the field and will help reduce some of the voice traffic on public safety systems. Data services will also provide a common network for broadband services as well as the ability to use the broadband spectrum for push-to-talk voice services for interagency communications at some point in the future. However, the broadband network will not be capable of handling the requirements for channelized voice services, nor will any of the commercial broadband technologies be capable of providing the type of direct voice services described above.

Those who are in the process of reviewing the requirements of public safety communications need to understand that its voice requirements are very different from those that are and will be provided over commercial technology broadband networks. They also need to realize that public safety needs three types of communications: wide-area (city or region-wide) voice for dispatch and coordination, local voice communications for use during incidents, broadband services for data and video communications, and in the future, some voice for coordination and administrative purposes. Armed with this knowledge, they will understand why the planned nationwide broadband network can only augment the capabilities in the field — not replace them.

Incident Communications Part 2

It appears as though the engineers and technologists working with the FCC's Public Safety and Homeland Security Bureau (PSHSB), some within the FCC Commissioner's office, and many staff members serving our congressional representatives do not understand the basics of wireless communications or, more specifically, the differences between commercial wireless voice and Land Mobile Radio voice systems.

This knowledge gap was evident to me during my recent trip to Washington DC and again when I saw that the PSHSB was preparing to issue a Public Notice on converting the 700-MHz narrowband voice frequencies for public safety to broadband usage. This spectrum (769-775 MHz and 799-805 MHz) was previously allocated for channelized voice communications

systems using digital technologies on very narrow voice channels. Within this portion of the spectrum there are 1920 (2 blocks of 960 channels each) voice channels for use by public safety.

Those preparing to float this Public Notice don't seem to understand several facts. First, broadband service for images, video, data, and other applications is desperately needed by the public safety community. HOWEVER, broadband services CANNOT replace all of the various requirements for voice systems, nor can LTE or any other commercial wireless technology provide all of the types of voice services needed by public safety.

Nor do these people understand that no matter how robust the broadband networks, no matter how much spectrum the public safety community has, its needs for different types of voice usage CANNOT be satisfied by LTE or any other broadband technology. Even with the best broadband system in the nation, voice will remain a critical element of public safety communications.

So let's start at the beginning:

- Public safety voice services are varied. When a call is received by a call taker (PSAP operator), it is transferred to a dispatcher who puts the call out as a voice message on the dispatch channel. The dispatch channel is monitored by field personnel and it is important that the dispatch is heard not only by the units that will be responding to the call, but also by every other unit that is in the same district or area. This type of communications is based on push-to-talk, not dialing a phone number, and while it is a directed call, it is important that everyone else on the channel, including the commanders in the field, hear the call so they know what is happening in their area of responsibility.
- The unit or units that will be responding to the call answer the dispatcher and start toward the incident. On their way, they could receive additional information either by voice or data. They might receive information about prior calls at the same address, if the subject is armed or there is a gun on the premises, or any number of other things that will help them evaluate how to approach the incident. Once they arrive on the scene, they notify the dispatcher and this communication is also heard by all others on the channel.
- After that, several things happen at the same time. If the call is for police units, the dispatcher will start a timer giving those responding a set amount of time to re-contact the dispatch center and verify their safety. Once those at the incident have had time to assess the situation, they call into the dispatch center with an initial report and if they need assistance, they request it. Since the others in the field have been listening to the voice traffic, they may have already started moving closer to the scene so they can respond faster if they are needed for backup. Once again, this is automatic based on hearing the voice traffic for the call.
- If the responders do not check in with the proper radio code within a specified period of time, the dispatcher calls them, again with the other units listening in. If there is still no answer, additional units are dispatched to the scene to check on them.
- During this time, the dispatcher may also be receiving additional information about the call and relaying it to those in the field. In many cases, another officer has some firsthand knowledge of the address or people involved and will also contact those responding to the incident or on the scene to provide that information so they can be better informed about the situation.

- During the incident, those on the scene are reporting back to the dispatcher and the conversations are being heard by others in the field as well as the commanders who are on duty and usually also on patrol.
- Once the incident is cleared, those in the field respond to other incidents in the same manner. On a busy night, the dispatcher may be handling up to 50 or 75 cars or more on a single radio channel and making sure all of the calls are being handled in order of priority.

This scenario is standard operating procedure for public safety. If the incident had been a fire, the first unit on the scene would report a condition such as: two-story residence, flames showing on the second floor. Those responding in other units would hear the report and begin preparing to take directions from the incident commander (IC) as they approach the scene. In the meantime, the incident commander has heard the initial dispatch and knows what equipment is heading toward the scene. He or she sizes up the situation and may order a second alarm, but in any event, the IC knows how many and what types of apparatus are inbound and starts giving orders over the voice network. Perhaps one engine will come to the scene, the next engine will hook up to a fire hydrant to provide water, the rescue company will come onto the scene and be prepared to search the house, and the ladder company will also come to the house and set up to gain access to the second floor or to use its hose from above the roofline to battle the fire. The EMS vehicle might be next in and positioned so it can provide medical services to anyone injured, including firefighters.

Such scenarios are standard everyday occurrences and this is the type of voice activity the FCC and others believe can be handled by broadband networks in the future. This may be the case, but the issues will be how to enable the broadband network to provide one-to-many voice communications covering only a specific area, but having the additional instant ability to broaden the area of coverage for larger incidents. Further, the devices MUST have push-to-talk in them, and they must have speakers so the handheld can be worn and used with a single hand. Even when it is not being held, the voice messages coming from the handheld's speaker have to be heard by the person in the car or wearing the device. So now this begins to sound a little different from standard broadband communications services.

In the standard broadband world, the voice devices are designed for handheld operation and you must dial a number in order to communicate. Dialing a number connects you to a single person to talk to and does not connect you to many people at once. Further, you must use two hands to dial the number. You cannot expect a public safety first responder to use two hands for any form of communications unless it is to quickly turn a knob to change channels. There is no way a public safety field officer is going to use a device that takes two hands to operate. Next, of course, is the time it takes to dial a call. You have to select the number or remember its speed dial position and then dial, wait for the network connection and then the ring, and then wait some more until the person answers the phone. Compare this to today's public safety communications where you depress a push-to-talk switch and talk, and within less than one-half of a second, your voice is being broadcast not only to the dispatch center, but to every field officer in your district or area.

If you are being shot at or are inside a burning building, you have time for one call for help. You need to make it quickly AND you need to know it was heard, not blocked because the network was busy at that moment. Dropped calls are NOT acceptable in public safety communications. This is one reason there are rules governing radio usage and the dispatcher or incident commander is charged with maintaining what is called "network discipline," making sure traffic gets through all of the time, every time. They cannot tolerate a single dropped or blocked call; it could cost someone their life.

Will LTE be able to address these issues in the future? The answer is probably yes since the LTE specifications address the use of push-to-talk and Voice over IP (VoIP), and the specs refer to one-to-many or broadcast communications, although it is not yet clear if the LTE broadcast mode could be limited to only certain cell sites within a given city. The systems would need to be set up to support multiple broadcast sessions simultaneously since most public safety agencies use multiple dispatch channels based on geographic or other sets of boundaries.

A typical major city might have eight or ten different dispatch channels, each designed to provide coverage in a given segment of the city, and another citywide channel for commanders. All of this consumes bandwidth and all of these systems have to be up and running 24/7 with instant or near-instant push-to-talk capabilities.

The field units need to be able to move from one coverage area to another. The way this is handled today is to manually switch the channel or, in some cases, listen to one or more channels all of the time by scanning them. With the main channel set for priority, if they are listening to voice traffic on another channel and a call is received on their primary channel, the radio automatically reverts to the primary channel so the transmission can be heard in its entirety.

There are those who believe that public safety can make do with other ways of communicating, but they must understand that field personnel might have only a few seconds to call for help in an emergency, and they need to know with 100% certainly that their call will be heard. It makes more sense to use LTE voice capabilities when they become available in a few years for administrative and non-mission-critical voice communications while leaving the existing voice systems in place. One advantage a public safety broadband network will provide is that some of the voice traffic that can overload the system at peak hours can be moved to data requests and responses. This includes running license plates and drivers' licenses, uploading accident reports, and receiving additional information while in route to an incident.

There is much more to public safety voice communications that cannot be addressed using a broadband network. It is in these areas where the lack of understanding of the public safety community's needs could result in reducing effectiveness even when adding more capabilities.

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