Statement of

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Introduction

Chairman Pryor, Ranking Member Wicker, and Members of the Committee, I appreciate the opportunity to appear before you today to provide an overview of the technology transitions associated with migration to Internet Protocol ("IP") as well as the challenges and opportunities confronting us as we move forward through these transitions.

As you know, what we commonly refer to as the "IP transition" is not a single transition, but consists of multiple transitions all happening at the same time.

The elements of these technology transitions are a key concern of the Commission, with public safety as one of the fundamental values that need to be protected during the transition.

We are witnessing simultaneous transitions in three technology layers, with intertwining impacts:

1. At the application layer, voice services based on Time-Division Multiplexing (TDM) are rapidly moving to voice-over-Internet Protocol (VoIP). This transition is occurring whether the network is wireless, where the technology is known as VoLTE, or for cable, fiber and copper networks. Technologically, the protocols used for these services are very similar.
2. At the network transport layer, TDM circuits served as the content-neutral conveyor of information. Internet Protocol packets are now replacing these circuits.
3. Finally, our core access networks were dominated by copper telephone wires, but are becoming much more diverse at the physical layer, with fiber, coaxial cable, wireless, and satellite added to the technology mix.

A much more diverse technological environment offers opportunities for advancing consumer welfare and public safety. For example, we can now bring IP connectivity to Public Safety Answering Points (PSAPs), the centers that handle the nation's 911 calls, in many more ways than we were able to do before. But it also offers challenges in the sense that the technology is both more complicated and lacks some of the features that we previously relied upon as part of our public safety infrastructure.

Let me turn to some of the challenges that I believe we face going forward. The challenges are related in multiple ways and also have a generational component. Much of the legacy technology that underlies our existing telecommunication voice infrastructure was designed and built in the 1970s and 1980s. This infrastructure is rapidly aging, and we are also seeing generational turnover of the individuals that have designed, built and maintained that infrastructure.

Moreover, in the last few years, PSAPs and emergency management offices have had to deal with an increasing set of challenges, many induced by the technology changes described earlier. Some of these challenges include:

- Combatting Telephony Denial of Service (TDOS) attacks, where criminals try to extort money from employees of hospitals, schools and PSAPs, and, if that fails, barrage the organization with phone calls, typically with spoofed caller ID and originating abroad. These phone calls then prevent incoming calls from reaching the business line of PSAPs, for example.
- Delivering robust and reliable emergency alerts, such as Wireless Emergency Alerts (WEA) sent to mobile phones. These alerts provide crucial warnings to deal with imminent threats to life and property, e.g., tornado warnings advising to "seek shelter now", but the alert systems are less well-suited to provide more extensive information or to support post-disaster recovery. Public safety officials seeking to provide more information to the public are often forced to improvise using cobbled-together technologies such as blogs, email lists, and Twitter.
- Preventing outages of critical communications networks. VoIP-based systems and centralized ALI databases can support a large number of PSAPs with a very small number of servers. However, recent outages have illustrated that there is a risk of increased impact when these systems fail. Designing and testing such systems carefully to avoid single points of failure and to recover quickly remains an open challenge.
- Leveraging new technologies and services. For example, many Americans now expect to be able to reach public safety by text, not just voice call. People with hearing or speech disabilities cannot readily use voice 911; victims or witnesses of domestic abuse may fear that a voice call will place them in danger. While the four major national cellular operators have voluntarily agreed to make text-to-911 available nationwide earlier last month, relatively few PSAPs are ready to receive text messages.
- Even for traditional mobile voice 911 calls, determining the caller's location has become more challenging. As mandated by Commission rules, wireless

providers need to deliver the caller's geographic location to the PSAP within specified accuracy bounds. However, the requirements were drafted when wireless phones were largely used while driving or outdoors. As has been reported extensively[1], an increasing number of consumers no longer have traditional residential landlines. Also, emergency calls may be placed from work places, using the caller's own mobile device rather than a desk phone. It is estimated[2] that about 70% of all emergency calls are now originating on mobile phones, and 56% of those mobile calls are placed from indoor locations. The most common high-accuracy technology, GPS, generally does not work indoors due to signal attenuation, except in light-duty (wood frame) construction. Thus, new location technologies are needed. I will discuss some of the options later on.

Household Habits and Communication Resources are Changing

For many decades, emergency communication professionals could safely assume that households had a common set of communication resources: a landline phone, with the central office able to power the phone over the copper line to the home when commercial power to the home was disrupted; a television with an antenna, tuned to a relatively small number of local stations; and a transistor radio supporting both AM and FM, with the capability to run on battery power.

Newer households look very different: most likely, they won't have a landline phone and, if they do, the cable or fiber-to-the-home VoIP service is likely to only provide a few hours of standby service on a local battery if there is a power disruption. Today's houses may also not have a television or use it much less frequently, relying on a laptop or tablet for watching video. Thus, Emergency Alert System (EAS) alerts broadcast via radio and television may not reach such households. The Internet, whether delivered via a home Wi-Fi network to a tablet or home PC or via a mobile wireless network to a smartphone, is often the primary means of keeping up with news and communicating with family and friends. These technologies may also rely on battery back-up options than are time-limited. For example, a smartphone battery may only sustain device operation for eight to 12 hours.

Emergency communication, in particular, has not always kept up with these changes. Many communities have set up automated "reverse 911" systems, but these typically only reach landlines. The Wireless Emergency Alert (WEA) system can only transmit 90 characters and cannot contain web links; thus, messages generally advise recipients to tune to local media — using a television set or radio

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[1] CDC, *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July–December 2012;* at http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201306.pdf.

[2] See sources cited in *FCC Acts To Help Emergency Responders Locate Wireless 911 Callers,* February 21, 2014; at http://www.fcc.gov/document/fcc-acts-help-emergency-responders-locate-wireless-911-callers

that the household may not have. Communities seeking to convey information to their constituents often use commodity services, such as community mailing lists, Twitter feeds, Facebook pages, or local web pages to convey emergency-related information.

The development of IP-based networks may create opportunities to improve emergency communications. For example, agencies such as the Federal Emergency Management Agency (FEMA) could provide common, cloud-hosted emergency management systems to communities. Since Internet advertising is typically localized, the potential exists to provide emergency alerts via ad delivery networks that would complement EAS or Integrated Public Alert Warning System (IPAWS) alerts without requiring communities to make expensive technological upgrades.

Indirect 911

Currently, the most common way to reach the PSAP is by a human-initiated voice call. However, in the IP environment, other home safety devices, e.g., network-connected smoke detectors, may provide alternative means of reaching emergency assistance. Currently, many alert monitoring services rely on operators in call centers to contact PSAPs. With NG911, there are opportunities for such monitoring services to convey much more information to the PSAP, but common standards and operational procedures are needed.

Technology Opportunities in all-IP networks

One of the most promising opportunities for IP-based emergency management networks is the ability to separate the provision of technology services from answering calls. Thus, instead of each PSAP or county provisioning their own NG911 services, they can share communication services, while deciding separately what the most efficient PSAP size is.

If emergency calls provide more information, it may also be much easier to prioritize calls, and recognize calls or messages that are reporting a known emergency, as often happens for fires or accidents.

Indoor Location

Probably the most immediate challenge for emergency calls is to maintain the location accuracy that has existed for 9-1-1 landline calls since the 1980s. As I noted earlier, as consumers have dropped landlines in favor of mobile devices, this capability is no longer assured. As the Commission recently acknowledged, people are making more wireless calls to 911 from indoors, and these calls are more difficult to locate. There are, however, new and promising indoor location technologies emerging. And the Commission is currently looking at new rules that would improve indoor location accuracy.

Conclusion

The technology transitions offer both unprecedented opportunities and challenges to emergency communication. As I have tried to illustrate, emergency services can

leverage the new technologies to improve efficiency and effectiveness. I look forward to exploring many of these issues along with others to see how we can use the technology opportunities, not just those offered by classical emergency response and alerting technologies, but also by consumer technologies to make everybody safer, make public safety more efficient, and ensure networks are responsive to both the cultural and technology changes that our citizenry is undergoing.

Thank you very much.