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# M E M O R A N D U M

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**TO:** Task Force on 911 Oversight, Outage Reporting, and Reliability

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**SUBJECT:** Overview of 911 Technology

**Summary**

This memorandum discusses the technologies behind basic 911, enhanced 911, wireless enhanced 911, and next generation 911.

## The 911 System

911 functions as the primary way people connect with appropriate assistance during an emergency. Before the advent of 911, persons needing assistance dialed "0", or the operator, to connect them with emergency services. This created problems because emergency calls were not prioritized, and operators received no training to aid distressed callers in emergency situations. To address these issues, a system of local emergency communication grew. Eventually, 911 was adopted as the national emergency number.[1]

## Basic 911

Basic 911 allowed calls from a landline telephone to be routed to a predesigned public safety answering point (PSAP). Figure 1 on the next page illustrates basic 911 service.

[1]Wireless Communications and Public Safety Act of 1999, Public Law 106-81.

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**Figure 1**
**Basic 911**

*Source: Colorado Legislative Council.*

Basic 911 systems suffered from three major problems. First, operators could not access the telephone number of the caller in case of a disconnected or lost call. Second, there was no way to determine the caller's location. Finally, due to municipal and jurisdictional issues, operators had a hard time knowing whether the call was sent to the correct PSAP.

## Enhanced 911

Enhanced 911 addresses the problems of basic 911 through automatic number identification (ANI), selective routing, and automatic location information (ALI). ANI technology captures the number of the caller, so PSAPs have access to the callback number in case of a disconnected call. In addition, under enhanced 911, calls are sent to the basic emergency service provider (BESP) network. The BESP's selective router and selective routing database aggregates calls and delivers the call and the ANI information to the correct PSAP based upon the caller's location. At the same time, PSAPs connect with the ALI database to find a caller's address and the corresponding emergency service jurisdiction. Figure 2 on the next page illustrates enhanced 911 service.

## Wireless Enhanced 911

***Phase I and Phase II wireless.*** With the rise of wireless phones, 911 systems faced a new challenge. With cellphones, people were now calling outside of buildings and possibly far from their home area code. To address a wireless phone's lack of a fixed address, the Federal Communications Commission (FCC) initiated Phase I and Phase II wireless implementation. During Phase I, within six months of a request by a PSAP, wireless carriers needed to provide the callback number and the originating cell site to PSAPs. Phase II required wireless carriers to provide the longitude and latitude of the caller in ALI data sent to PSAPs. Currently in Colorado, all but one PSAP are Phase I and Phase II wireless capable.[2]

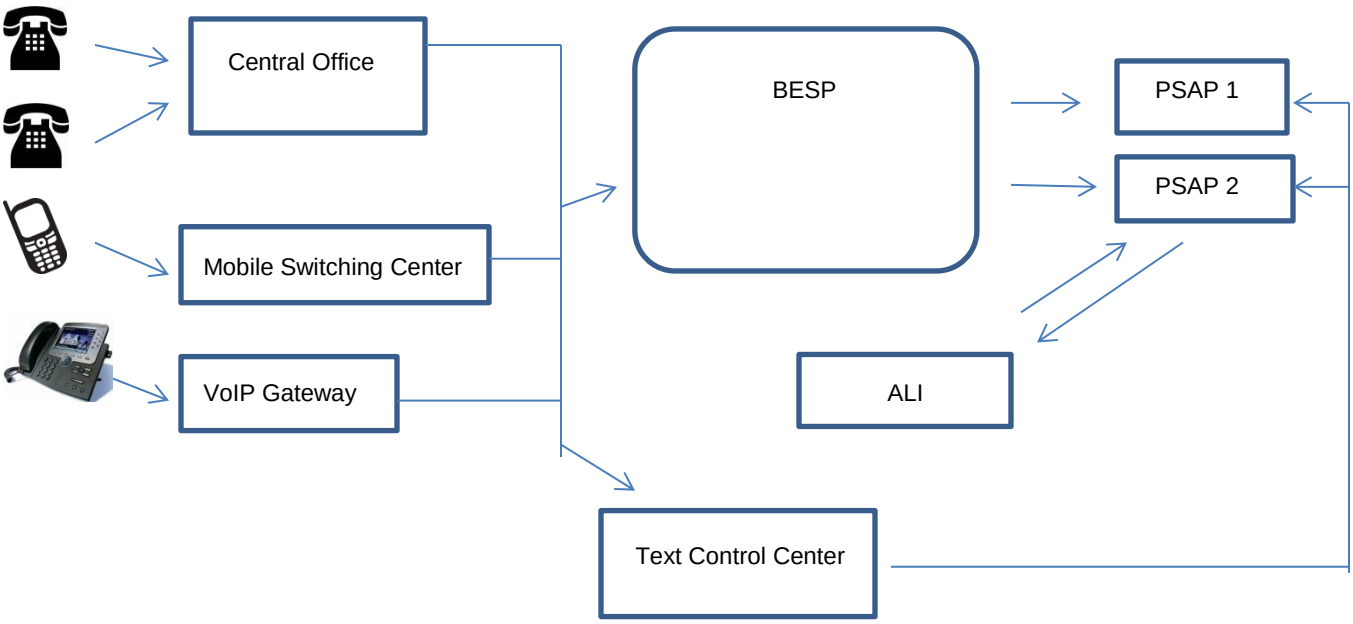
***Voice Over Internet Protocol (VoIP) service.*** VoIP allows callers to use a broadband Internet connection, instead of traditional analog phone lines to make voice calls. This led to some VoIP providers excluding 911 capabilities from their service. After customer confusion, the FCC required that all VoIP providers automatically provide 911 service to customers and make customers aware of the 911 service limitations with VoIP. Under current rules, VoIP providers must be able to transmit all 911 calls, including information on the callback number and the caller's location, to the appropriate emergency service. VoIP providers comply with these rules through a "gateway" that converts a VoIP call to regular public switched telephone network call.

[2]Colorado 9-1-1 Resource Center, "*2015 Report on the State of 9-1-1 Services in Colorado,"* http://tinyurl.com/z27jwbz

***Text-to-911 service.*** With advent of text messaging, the FCC now requires wireless carriers and providers of interconnected text messaging applications to provide text-to-911 service to PSAPs that request it. Currently, 76.5 percent of Colorado's population, encompassing 34.3 percent of the state, is able to text 911.[3]

Figure 2 below illustrates enhanced 911 and wireless enhanced 911.

**Figure 2**
**Wireless Enhanced 911**



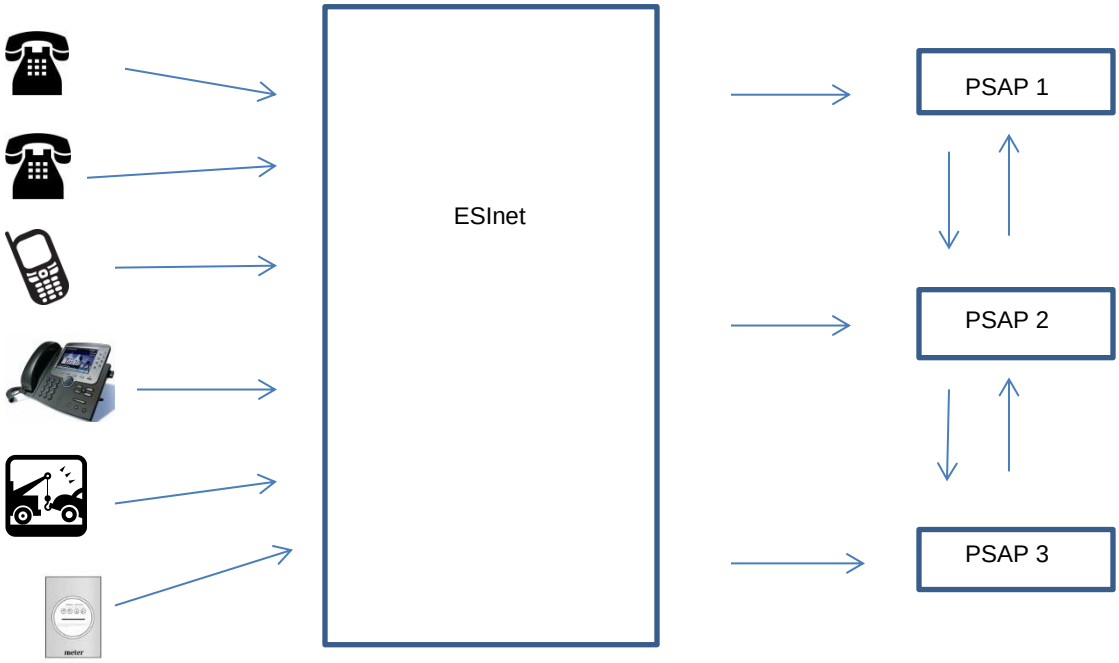

*Source: Colorado Public Utilities Commission.*

## Next Generation 911

Next Generation 911 (NG911) replaces analog 911 systems with digital, broadband networks. NG911 works by creating an IP-based network, called an Emergency Services Network (ESInet), which replaces the BESP. An interconnected ESInet interfaces with external entities, transports information, and supports advanced abilities. ESInet can route information between different platforms and over a diverse type of transmitters: fiber optic cable, coaxial cable, twisted copper cable, or the radio spectrum. The system utilizes geographic information systems (GIS) and GIS data to replace the ANI and ALI functions. ESInet and GIS data provide call routing, location validation, and mapping. Since NG911 is IP-based, ESInet can receive a wide range of data from a variety of devices and technologies: voice, text, video, image, medical records, etc. In addition, NG911 allows greater communication and automatic re-routing between callers, PSAPs, dispatchers, and first responders due to the interconnected nature of the IP-based system. Figure 3 on the next page illustrates the NG911 system.

[3]Colorado 9-1-1- Resource Center, "Text-to-911," https://sites.google.com/site/co911rc/resources/text-to-911

**Figure 3**
**Next Generation 911**




*Source: Colorado Legislative Council.*