30 Years of 911, and now… Wireless 911

Jonathan Spinney, Industry Manager, Location-Based Services
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Abstract

This document explains the current focus shift in 911 from wireless carriers to PSAPs, explains the role of GIS in 911, and touches on how local government GIS may be used as a frame –of reference for application developers focused on location-based services.

Thirty Years of 911

As an American citizen I appreciate 911 services, particularly in a post-9/11 world of uncertainty. It's reassuring to know hard working and informed local authority responders are just a quick three digits away should my family or I encounter a situation that threatens our safety and security while at home or on the go. While 911 services seem commonplace to me, I have learned that they have not always been readily available, and the main stakeholders have overcome many challenges over the years to get the system running. Analyzing enhanced 911's construction over the years as a geographic information system (GIS) application may be a healthy way of understanding challenges in location-based services application development. After all, location-based services are arguably re-purposed extensions of the 911 system, building upon some of the same fundamental location and GIS technologies that have been used for over thirty years on the fixed-line side of 911 and, more recently, on the wireless side.

Fixed-line 911 services have been around almost as long as enhanced public switched telephone networks have, dating back one year before ESRI was incorporated in 1968, when "Senator Rankin Fite completed the first 9-1-1 call made in the United States in Haleyville, Alabama" (The Development of 911, NENA). Though the first call was successfully made in 1967, it took another three decades to get the entire nation wired with enhanced 911 infrastructure to serve the population. Some might say (including me) "30 years! Why did it take so long?" All legislative, bureaucratic, and budgetary issues aside, the short answer is "the 911 system is not simple."

Enhanced 911 includes a complex communications network seamlessly linked to lesser complex local respondent IT systems. The coupled system requires fixed-line carriers to have capabilities to route calls to the appropriate public safety answering points (PSAP) , where in turn, the caller's phone number and fixed location is automatically displayed for quick-response dispatching and local authority decision making. In GIS terms, this means a geocode for the call location correlated to the PSAP administrative boundary jurisdiction, and once at the PSAP via a GIS point-in-polygon operation, it also means a map rendered and route generated for use by the dispatcher and responder units at a minimum. All transactions need to occur fast enough to help dispatchers deploy responders quickly to serve the distressed caller, and all the information must be accurate because lives, or threatening situations to life, depend on it. The same is true of wireless enhanced 911. However, wireless e911 is more complex because mobility is introduced into the process.

Wireless e911

In the wireless e911 system a mobile network locates the caller and sends the phone number and location to the PSAP upon request, where the PSAP subsequently processes location in order to dispatch local responders to distressed callers? much the same way it

works in the fixed-line domain. The only difference between fixed-line and wireless e911 is that caller location determination and PSAP access to location data is more complicated given the mobility challenges. With wireless e911, a caller's location is not a fixed static address, but rather a mobile device somewhere on a mobile network. Segue to the dynamic world of location-based services…

Throughout the late 1990s and into this century several mobile location technologies were developed to solve the mobile location problem within cellular networks. To date, two location technologies have been successfully deployed within wireless networks since the proposed 1996 FCC Phase II rule, which stipulates that all wireless carriers must be able to locate users and their devices to 50 meters 67% of the time and/or 150 meters 95% of the time. Nearly all wireless carriers now claim to meet the Phase II mandate in major statistical areas serving the greater population, with a few late exceptions from U.S. GSM carriers? some who have consequently ended up paying million-dollar-plus FCC penalties due to swap-outs of E-OTD to U-TDOA location technologies (see Senator Burns' letter to FCC Chairman Powell).

Lessons From the PSAP

With mobile location determination issues more or less solved on the carrier side with A-GPS and U-TDOA, Phase II compliance onus has shifted back to the PSAP, where interfaces required to get caller location information from the carrier are now slowing compliance. In order to process caller location, PSAPs must write to the automatic location identifier (ALI) carrier interface. For some PSAPs, ALI interfacing is not easy, and it's hurting them because they don't have the technical skills or funds to sort it out. Out of the need to assist PSAPs with compliance, several federal grant programs are now offered to local governments that do not have adequate budgets to build up the IT infrastructure required to comply. For example, the Public Safety Foundation of America (PSFA) offers funds to PSAPs for building their wireless e911 systems if they meet certain PSFA grant selection criteria.

These grants are designed to help PSAPs solve the same problems that other LBS application developers have? carrier location accessibility. If you're a GIS developer of location-based applications trying to access location information from a carrier, this might sound like an all too familiar struggle? you have GIS and IT, but lack location. Perhaps these challenges may be starting to discourage you from pursuing location-based services as a viable business opportunity or as a solution to a mobility problem within your organization. Don't give up though! Federal focus back to the PSAP is good news, because it means that location accessibility problems will have to be solved. In the future, we may even find Capitol Hill lobbyists pushing for a rule that forces wireless carriers to allow subscribers access to their own locations as a natural extension of PSAP access. However, until such time, it's not likely that enterprise LBS developers will be able to do much with the infrastructure that carriers have built? with a few exceptions.

PSAPs across the country have long used GIS technologies to process fixed-line 911 call locations for GIS-based dispatching, routing, and response. The GIS technology that PSAPs use is the same that any LBS application developer can take advantage of, and they have been around a long time. There's much the average application developer can learn from local governments that use these tools successfully. With e911 compliance focus shifting back to the PSAP, the industry will be forced to figure out carrier location accessibility on a mass scale. Perhaps the impending solution will be easily extended to private sector LBS developers. It's worth keeping an eye on.