Why cellular 911 has location problems

Most calls to 911 come from wireless callers, yet the system for locating those callers can't handle them

Over the past two decades, the personal communications habits of Americans have profoundly changed. CTIA – The Wireless Association reported that the penetration of cellular devices surpassed 100 percent in 2012, and as of the latest 2014 report, penetration is now at 110 percent.

With so many mobile devices deployed, it isn't surprising that the majority of calls to our nation's 911 emergency public safety answering points (PSAP) originate from those devices. In fact, most U.S. dispatch agencies will tell you that wireless callers are responsible for at least 80 percent of their emergency call volume. Likewise, in the European Union, that number is well into the 90 percent range in many locations.

The general public does not perceive location accuracy on cellular devices to be a problem. After all, the devices commonly being used have Internet connectivity and GPS. Additionally, the applications and services used regularly, e.g., Uber and Google, seem to know the exact location of the device with uncanny accuracy.

That ability to zero-in on a location encourages the public to pose the question: "If Uber knows where I am, why is location so problematic when making a 911 call?"

The answer is simple: "It's all about the app."

How Uber finds you

When Uber, or any other app on your device, needs to communicate location information, the servers it communicates with have a direct peer-to-peer connection to location information on your device.

In reality, Uber doesn't know where you are. But the Uber app sends your location information from your smartphone—latitude, longitude and accuracy factor—to the Uber server. The server then crunches the data, queries location calculation services such as Skyhook and returns the result. That process is extremely accurate because several points of information are being examined, including GPS, cellular and Wi-Fi access points.

What happens when you call 911

Alternatively, when you place a call to 911, the one and only piece of information the phone transmits to the PSAP is Caller ID, officially known as automatic number

identification (ANI). Most people are shocked to learn there is no direct connection between the originating cellular device and the PSAP.

For initial location information, the 911 call taker is presented with Phase 1 location information, representing the cell tower address that is connecting the call. The 911 operator can issue a request to update the location information, known as a "rebid," to obtain an updated and more accurate caller location.

Despite this being more precise, there is still no direct connection to the cell phone. The information is coming from the cellular network, not the device. Only by questioning the caller about landmarks and other correlating information can public safety officials be certain they have accurate location data.

A common denominator covered in almost every story on this subject is the innovative technology that "solve the location problem." Those stories, however, are often misleading. When pulling back the curtain, typically you find an app extracting location information and providing it to 911 agencies via some non-standard method.

Why is that a problem? First, instead of callers dialing 911, they must utilize the app to initiate the session. That alternative connection is not a real 911 call into a real 911 center. Often, that session is passed through a third-party call center that hosts the server side of the app.

Calls must then be transferred, often on nonemergency lines, to the appropriate PSAP. Any information collected by the call taker has to be verbally conveyed from person to person, leaving much room for error.

Showing accuracy improvements while using the app compared to making regular 911 calls often makes great TV. The dramatic location improvements are astonishing to viewers, yet the underlying details are never well explained, nor are the technical caveats and the fact that the app must be used to initiate the 911 communications session. Those details are complicated and not sexy to consumers. Because of that, they are dropped from the storyline.

How to fix the location problem

The fix for this issue is to extract the same location information from devices that Uber does but do so without an app. While that initiative is moving forward based on the [National Emergency Number Association i3 NG911 Framework standards](), some carriers and service providers enjoy retaining revenues produced by legacy 911 networks, as that stream of income is rarely questioned.

Nearly any enterprise network administrator will tell you that IP technology and converged data centers have streamlined the IT industry, producing huge savings while delivering advanced capabilities to their users. It is not surprising that cell phone users in the U.S. assume that our national public safety networks have progressed with similar capabilities when, in fact, these systems struggle to deliver even basic text to 911.

Less understood is why investments continue to be made into a deteriorating network that is expensive to operate, provides minimal functionality and is not functionally equivalent when compared to other communications used every day.

How is the problem to be corrected? As usual, first, there is the need to admit the problem exists. Then, the Next Generation Emergency Services IP Network and FirstNet, which will be able to bring our first responders into the future of unified communications with 911, must be built with the resiliency, reliability and redundancy that our commercial modern communications environments deliver every day.

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