VoIP E9-1-1

Potential Solutions and Some Lessons from the Wireless E9-1-1 Experience

Jon Metzler, Business Development Director, Rosum Corporation

First, a quick hypothesis: VoIP telephony, while generally a home application now, will eventually trace the path of wireless – you will truly be able to dial a person, not a place. That evolution is already underway, as evidenced by the launch of 802.11x-compatible VoIP terminals for the home. For now, these are essentially cordless substitutes, but they can also be taken from the home for "nomadic" use. For customers, this is a wonderful, liberating thing. For PSAPs and emergency call takers, this is yet another challenge to be addressed, and one that comes fresh on the heels on upgrades to meet the needs of Wireless E9-1-1.

The FCC issued its order for VoIP E9-1-1 compliance on May 19th. That same day, both the House and Senate introduced VoIP E9-1-1 bills. The FCC order gave carriers 120 days to comply. With that in mind, in this article, I'd like to cover potential solutions to the VoIP E9-1-1 issue. In addition, I will try to draw some lessons from the Wireless E9-1-1 experience and show how heeding those lessons could facilitate implementation of E9-1-1 capability in VoIP.

CHRISTY WHITEHEAD

A dispatcher for Little Rock, Arkansas, takes a call. Locating 9-1-1 callers originating from anything other than a landline telephone has been problematic for years - a number of solutions for wireless and now VoIP calls have been proposed.

VoIP E9-1-1: What Now?

Now that the FCC, House, and Senate have spoken, the real question is, what now? How will E9-1-1 service be delivered?

There are near- and long-term answers to that question. For example, on the long-term front, the I3 specification from the National Emergency Number Association (NENA) outlines a fully IP-enabled PSAP, which could handle a VoIP 9-1-1 call with no analog conversion. For customers, this would be a wonderful thing. PSAPs could take 9-1-1 calls with pictures, or video, or even from the instant messaging software clients. This would be very useful for people with limited English, or for people who aren't in a position to speak.

However, if Wireless E9-1-1 provides any lesson, however, it is that converting all PSAPs to IP will take a long, long time. Morever, where will that cost recovery mechanism that would help absorb PSAP investments come from? This is one of the great lessons of Wireless E9-1-1 and one that must be applied to VoIP E9-1-1. Put simply, someone has to take the 9-1-1 call, and someone has to pay for the infrastructure that can support that. Diverting 9-1-1 funds for other purposes will only shortchange those on the frontlines.

For now, the FCC is assuming that customers will provide their own location through a web browser. This method has many limitations, from typos to simple forgetfulness to lags in location updates. With that in mind, I'd like to look down the road at potential solutions that do not require manual updates by the customer. I've divided them into the same categories as Wireless E9-1-1: Network-based Solutions, and Handset-based Solutions. (As with cellular, the boundary between the two is somewhat porous.) First, let's take a look at the network and what's possible in VoIP.

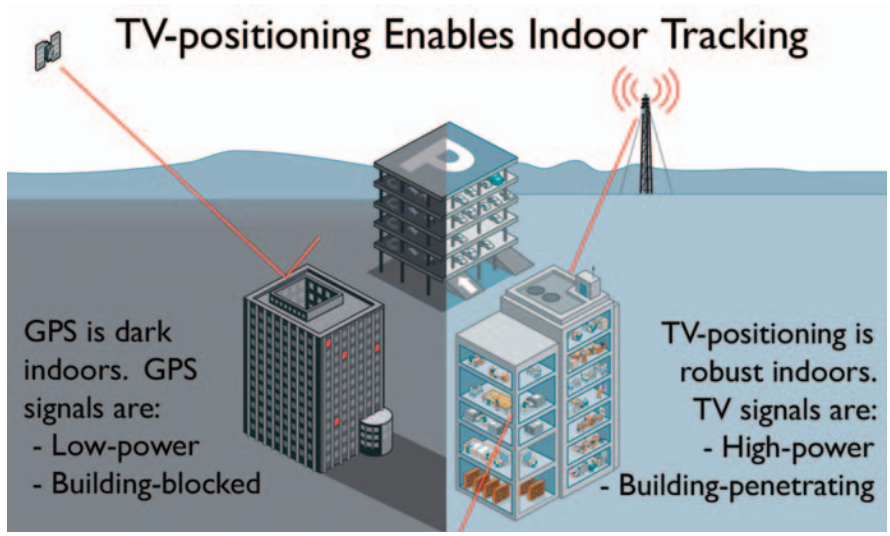
Potential "Network-based" Solutions in VoIP

Using the IP Address. Using the device's IP address to geolocate the device is one possible option. However, using the customer's IP address has two major shortcomings from a reliability standpoint. A customer could be tunneling into a remote office through their company's Virtual Private Network (VPN). Their IP address might look like they're in the home office in Seattle when they're really in Dubuque. Secondly, IP addresses are subject to spoofing [A technique used to gain unauthorized access to computers, whereby the intruder sends messages to a computer with an IP address indicating that the message is coming from a trusted host. – www.webopedia.com]. (For residential VoIP customers, this is admittedly rare.) Further, there is no central repository for IP addresses, meaning no one database (say, provided by the FCC) that associates IP addresses with known locations.

What's more, IP address-based location does not provide necessary accuracy. To use an analogy, it may give you the right exit from the highway, but won't give you the street address. Four services I tried gave me the coordinates of ISP collocation facilities about five miles away from my home and office. At least that's the right metropolitan area, and it might even get you inside the right PSAP boundary. But in the end, it's not accurate enough to tell personnel where they should go.

IP Address Improvements. Organizations such as the Internet Engineering Task Force (IETF) have proposed changes to Internet address protocol (DHCP – Dynamic Host Configuration Protocol) so as to include geographic (latitude, longitude, and altitude) information and civil address information. This is obviously quite compelling. What is uncertain is whether these will be implemented, and how. Will the proposed changes be standardized in the future? When will that be? All of this is uncertain. If it's a matter of getting new standards approved, then this could take years.

Port Mapping in the Enterprise. Another possible method is mapping Ethernet ports. This is mainly an enterprise-focused solution. If done successfully, this could route rescue personnel to the right room, not just the front door.



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Rosum's VoIP E9-1-1 solution takes advantage of existing TV broadcast signals to triangulate device location, locating 9-1-1 callers using IP-based telephones in a manner similar to GPS.

The issue here is maintaining a current database that reliably maps devices to geolocated ports, and maps the ports themselves. Even today, port mapping can be a manual exercise. Further, reflecting what enterprise IT managers call Moves, Adds and Changes in real-time is not a trivial task. Mapping calls to the last router in the hierarchy will still leave potential errors of hundreds of meters. Using "smart jacks" that can be pinged to give their own location is one option, but one that requires updating a huge installed body of Ethernet ports. Last but not least, port mapping is mainly an enterprise solution that doesn't apply to homes.

WiFi Access Points. WiFi (802.11 networks) access point-based location is another option. If there are enough access points, triangulation of device location is possible. This is being done in some enterprise environments. However, WiFi access points are highly subject to moves and changes. And in non-business environments such as homes or cafes, there usually aren't three access points, and access points usually aren't geolocated in the first place. Further, access points outside of the enterprise, such as in a home or hotel, are provided as a good-faith exercise, and may move or even go out of service. Lastly, WiFi access points are often located by near-volunteer "warfinders," who essentially drive around looking for access points, then log their coordinates with a handheld GPS device. This is a wonderful service, but not robust enough for safety-of-life applications.

That all said, the immense number of WiFi access points out there is of some value. Perhaps of themselves, they are not a solution robust enough to provide E9-1-1 coverage. But in conjunction with other solutions, they may provide some value, particularly as VoIP handsets compatible with WiFi networks become more common.

Handset-based Solutions

Now I will take a look at potential handset-based solutions for location of VoIP 9-1-1 calls. Again, I have focused exclusively on those that don't require customer interaction.

Device MAC Address. The MAC address on a VoIP adapter is basically like a serial number that is unique to the device. This is how the cable companies deal with the 9-1-1 issue – set-top boxes have MAC addresses that are assigned to a physical address.

Set-top boxes don't move much, so this is a workable solution. However, for pure-play VoIP services to the home such as Vonage or CallVantage or Primus that don't have a fixed line into the home, be it cable or copper wire, using the MAC address is subject to the device portability issue discussed above. Keeping the location associated with a nomadic VoIP adapter – in real-time – would be an immense task.

Embedding Location Technology on the Device. Many cellular carriers met

LAUREN BAMBERGER

Dispatcher Heather Montgomery tones out a fire call to volunteers in Little Compton, Rhode Island. New methods of receiving 9-1-1 calls, including Voice over Internet, are providing new challenges to dispatchers, especially in a solo-dispatcher facility like Little Compton.

the FCC's specifications for Wireless E9-1-1 issue by adding GPS to their cellphones. This is an effective solution outdoors, but has shortcomings indoors and in urban areas. Even cellular-assisted GPS (A-GPS) falls short in urban environments, and the cell tower fallback that it provides is very coarse in accuracy terms.

The Broadcast TV Alternative

TV-GPS, a new system pioneered by Rosum Corporation that uses unmodified broadcast television signals to triangulate device location, much as you would with GPS. The broadcast TV infrastructure essentially becomes a location infrastructure on the ground – rather than using 28 satellites in the sky, TV-GPS uses 4500 TV channels from 2800 transmitters right here on the ground. TV signals were designed to be receivable indoors in the first place – they are high in power, and low in frequency, which enables them to punch through walls in a way that GPS signals cannot.

Whereas WiFi access point-based positioning requires maintaining and updating a massive database of access points, the TV broadcast infrastructure has already been built. Their locations are provided by the FCC. As such, TV-GPS represents one potential solution to the issue of locating VoIP 9-1-1 calls, both indoors and out.

Moving Forward

In an E911 Institute panel in May, a Vonage representative mentioned that the company would move further in a mobile direction – handsets will look and behave more like cellphones. This is what the CRTC and FCC classified as "nomadic" VoIP. It's not "mobile," per se, in that customers probably won't be able to use handsets while driving. They could, however, make a call from one WiFi café, and then a different call from another. In a nomadic scenario like this, where the customer hops from location to location, on-device automatic location determination capability that doesn't require customer interaction is the likely ideal solution.

Finding a PSAP Cost Recovery Mechanism

VoIP is a cost-sensitive, cost-competitive service. Lower pricing is one reason for its extraordinary growth. As we move ahead to address the challenges of VoIP E9-1-1, what is crucial is to develop a solution that avoids an unnecessary cost burden on customer, carrier, and PSAP, and one that is in keeping with expectations of reliability that come with the three numbers "9-1-1." .

VoIP service has relatively minimal upfront costs, which has enabled startup carriers to move into the market. Should integrating with the native 9-1-1 infrastructure prove costly, this may price them out of the market, or at least force consolidation. With regard to PSAPs, they have already borne one cost burden in achieving Phase II Wireless E9-1-1 compliancy. A cost recovery mechanism to offset the added costs that come with handling VoIP 9-1-1 calls must be established.

The Joint Program Office proposed by the members of the Congressional E9-1-1 Caucus represents a potential oversight and funding body. While $250 million in funding has been authorized by the House (HR 5419), at present, the office has not been funded. What funding is available will come from the National Highway Traffic Safety Administration.

Another option is using Homeland Security funds, which, to date, have generally not gone towards 9-1-1. DHS funding seems the most intuitive – PSAPs are the first line of response in any disaster event, small or large. It is unclear whether this need will be reflected in future federal budgets. For now, DHS funds are generally at the discretion of the local program manager.

While these potential funding organs are being established, existing mechanisms, such as state 9-1-1 funds raised by Wireline and Wireless 9-1-1 tariffs, must be used for their original purpose. Making sure they are not siphoned off by budget-hungry state governments will be imperative.

The interconnectors such as Intrado will play a key role in helping mitigate this cost burden. All-analog PSAPs should be able to receive calls translated into the MSAG and appropriately respond without infrastructure upgrades.

Asking the customer to manually update her location was a best-effort first step at a time when access to the native 9-1-1 infrastructure wasn't available. However, user errors, update lags or simple forgetfulness mean that we shouldn't stop there. Solutions that require standards-building or expensive infrastructure upgrades will leave customers underserved and PSAPs financially strapped. An on-device, automatic location solution delivered by the interconnectors to both digital and analog PSAPs will allow the current 9-1-1 infrastructure to be leveraged, and more importantly, will save lives. 9-1-1

Jon Metzler is the Director of Business Development for Rosum, focusing on handset and government markets, as well as building the company's presence in Asia. More information on Rosum is available at www.rosum.com. Jon Metzler can be reached at jmetzler@rosum.com.