Is Wireless Location a Dream?

Trial Illustrates FCC Location Requirements are Reachable

By Rick Jones, ENP

Editor's Note: In March 2001, NENA learned of a working network-based location service developed by U.S. Wireless Corporation. NENA asked U.S. Wireless if the Association could work with the company during a field test of its location solution.

Rick Jones, a key NENA technical expert, led a NENA delegation that participated in and observed the test, and the test data analysis for the test. Rick Jones' report is included here, and suggests that there are new several practical issues involving getting the correct coordinates.

New town, new job, long and tough day. You're walking to the car in the big, nearby parking lot, and chest pains suddenly, severely strike. You fumble for the wireless phone, you dial 9-1-1.

"Where are you, sir?" the voice asks. The pain is increasing, and talking is too difficult.

The appropriate emergency vehicles find the caller and a life is saved because wireless 9-1-1 Phase II is available in this community.

Still a dream? Maybe someday?

In March 2001, NENA served as a neutral party in wireless 9-1-1 location testing involving U.S. Wireless Corporation. The testing took place in Seattle, Washington over nine days. NENA requested a demonstration and test of U.S. Wireless' E9-1-1 solution as part of the Association's effort to evaluate and report on the availability of wireless location technologies and their ability to meet the FCC's requirements for locating wireless 9-1-1 callers.

Ron Bloom, ENP, President of Acorn Consulting, and I were invited to serve as NENA representatives, which included receiving an overview of the equipment, technology and procedures, assisting in choosing the test sites, and observing as actual tests were conducted.

As a witness to the testing, I experienced seeing the wireless call data for the first time—something that is probably true for most of us PSAP people. What I saw during the testing made me realize that, as wireless call data starts coming into our centers, our call takers will be contending with location-based information (a dot on a map, or even x/y coordinates) rather than the address-based information to which they are accustomed.

That is something to remember as you read the following selection of results from the Seattle wireless location testing.

Proof is in the Positioning

A wireless 9-1-1 test call at a downtown Seattle parking lot, with a 31-story building in one direction and a 25-story building in another, gave a location within 13 meters of the wireless phone. (For the metrically challenged such as me, that is about 42 feet.)

The current FCC rules establish that in cases of network-based location technology, wireless 9-1-1 calls must be located within 100 meters 67% of the time, and within 300 meters 95% of the time. For handset-based location technology, wireless 9-1-1 calls must be located within 50 meters 67% of the time and within 100 meters 95%of the time.

Out of 42 test calls from the exact same location in the Seattle parking lot, using a network-based solution, here are the location results:

? 27 were between 13 and 50 meters
? 13 were in the 51 to 100 meter range
? 2 were over 100 meters
? none higher than 180 meters

That illustrates that calls were located within 100 meters 95% of the time, and within 300 meters 100% of the time.

For those of you who really appreciate numbers, those 42 test calls generated 461 location checks (all calls were about 30 seconds in length, and location was rechecked about each 2.5 seconds). Two-thirds of the calls were within 55 meters or less, 95% were within 86 meters or less, 96.1% were within 100 meters and none were over 300 meters.

Getting Within the Ball Park

As a sometimes call taker and a day-to-day PSAP manager, I have never quite understood what those FCC numbers will mean for (1) routing of wireless calls and (2) assistance to the call taker when location is critical and the caller can provide minimal to no information. But here's an example from the testing that helps explain.

In Seattle, just a few blocks from a number of motels, there is a park that is about 155 meters long by 95 meters wide.

So, a business traveler is jogging through the park during the daylight hours after an exhaustive day of meetings. A violent crime in progress is seen in the wooded area nearby. The jogger calls 9-1-1 on a wireless phone. The jogger can identify the location as the center of a park, but has no clue what the park is named.

The best result of the 35 test calls done at this location (center of Denny Park, for those who know Seattle) was within four meters. This is impressive, but not typical. If the call taker was using a map display, 12 of the 35 test calls were within 50 meters or less, which meant the dot on the map would have still been within the park. Nine of the calls were

within 51 to 100 meters, with the dot still either in the park or within a half-block of its borders. Thirteen of the calls were in the range of 121 to 187 meters, with the remaining one at 326 meters. Considering that the nearest park to Denny Park was at least eight long city blocks away, the location provided should have been enough in all instances for the call taker to ascertain where the caller was.

What Happens at the PSAP

Let's take a break from the numbers for a moment. Even though every test call generated several location results (average of 30 seconds per call, location check every 2.5 seconds), I am using the first location check of each call. That to me is critical, since it could be used to route the call and it is what will be immediately available to the call taker when the 9-1-1 line is answered and the information is displayed (hopefully on a map, but could also just be latitude/longitude data).

It is my understanding that the location technology we witnessed at work can be improved in two ways. First, if Phase I data was also included, the system could better pinpoint which cell sites/faces to attach more importance to and this would apparently reduce some of the larger errors and also improve most responses. Second, before implementing the location technology, it goes through a calibration process using special equipment while driving around the covered area. If the process is done to a finer detail (more labor, more driving, etc.), accuracy can also be improved.

Back to the testing.

The next wireless 9-1-1 call tested was in a motel parking garage. The underground area that we had hoped to test was not good because the wireless phone wouldn't work there. So, the aboveground area was the test site.

Thirty calls were made from this site. The best result (which was given in 11 calls) was within 8 meters of the exact location. Out of all 30 calls, 29 ranged from within 8 to 50 meters. One call location was way off at 903 meters.

The testing that NENA and U.S. Wireless conducted indicated that, while perhaps not perfect, the ability is there to locate wireless 9-1-1 callers. Having said that, with 9-1-1 and the wireless industry honing in on making wireless location happen, perhaps the next challenge will be to ensure all 9-1-1 call takers are extensively trained as to how wireless 9-1-1 is different than wireline/address-based 9-1-1.

Still a dream? Maybe someday? Maybe soon…

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Thirty stationary tests--parking area at motel

	First	Last		First	Last		First	Last
1.)	38	38	11.)	38	8	21.)	32	8
2.)	8	8	12.)	38	8	22.)	38	38
3.)	8	8	13.)	8	38	23.)	8	8
4.)	49	8	14.)	8	8	24.)	8	38
5.)	8	8	15.)	8	8	25.)	8	38
6.)	38	38	16.)	38	38	26.)	38	38
7.)	38	903	17.)	38	8	27.)	32	32
8.)	38	926	18.)	38	38	28.)	49	32
9.)	8	38	19.)	32	32	29.)	49	38
10.)	8	38	20.)	903	38	30.)	38	38

Figure 1. Stationary site tests, motel parking area, 30 calls. Column labeled "First," shows difference from actual location in meters for the initial location determination, the data which could be used to route the call and which would be deliverable to the 9-1-1 call taker. Column labeled "Last," shows difference from actual location in meters for the location determination done approximately 30 seconds later, the data which could be deliverable to the 9-1-1 call taker if utilizing a 'refresh location' button/key.

Thirty Mobile Tests--NENA-selected route

	First	Last		First	Last		First	Last
1.)	22	31	11.)	85	79	21.)	8	50
2.)	755	43	12.)	7	26	22.)	12	7
3.)	34	11	13.)	9	69	23.)	18	47
4.)	24	46	14.)	168	40	24.)	16	18
5.)	38	26	15.)	27	82	25.)	47	26
6.)	34	28	16.)	16	93	26.)	12	46
7.)	58	49	17.)	32	41	27.)	12	8
8.)	12	26	18.)	36	35	28.)	25	58
9.)	24	61	19.)	43	15	29.)	15	41
10.)	27	68	20.)	53	46	30.)	48	28

Figure 2. Mobile route tests, major streets, Seattle urban area, 30 test calls. Column labeled "First," shows difference from actual location in meters for the initial location determination, the data which could be used to route the call and which would be deliverable to the 9-1-1 call taker. Column labeled "Last," shows difference from actual location in meters for the location determination done approximately 30 seconds later, the data which could be deliverable to the 9-1-1 call taker if utilizing a 'refresh location' button/key.