Wireless Location Accuracy: Dispatchable Location & 3D Positioning

TREY FORGETY
NENA DIRECTOR,
GOVERNMENT AFFAIRS

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Indoor Stats

• ~50% of households are wireless only
• >40% of population is wireless only
• >=70% of 9-1-1 calls are wireless
• >=50% of wireless 9-1-1 calls est. indoor
• >=200,000 indoor wireless calls / day
Policy Background

• FCC rules require wireless providers to transmit the location of outdoor wireless test calls, within certain parameters for accuracy.

• Outdoor rules adopted in 1996, revised in 2010.
Outdoor Accuracy Rules

• Network-Based Tech. (typically GSM providers):
 ◦ 67% of test calls within 150m, 90% test of calls within 300m.

• Handset-based Tech. (typically CDMA providers):
  ◦ 67% of test calls within 50m, 90% of test calls within 150m.

• Upon request, carriers must supply confidence and uncertainty data along with position estimates.
What Needs Improving?

• Ability to locate wireless callers indoors
• Indoor locations are 3D
• X/Y/Z regime is not ideal for built environments
• Carrier drive testing is opaque to public safety users
Consensus Solution

• Shift emphasis from L/Lo to Civic Address & Sub-Address
  ◦ Establish National Emergency Address Database to correlate WiFi and Bluetooth beacons with addresses.

• Improve X/Y performance indoors, too
  ◦ Standardize confidence at 90%; continue binned uncertainty

• Add Z-Axis capabilities
  ◦ Short-Term: Deploy uncompensated barometry
  ◦ Long-Term: Establish a vertical metric in meters & codify
Dispatchable Location

+38.806 -077.058 U=50 C=90%

↓

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Alexandria VA 22314
Improving L/Lo Tech

• Carriers will deploy O-TDOA, A-GNSS, and hybrid network-wide.
• New VoLTE phones will support both.
• Carriers crowd-sourced WiFi & Bluetooth X/Y in ~36 months.
Uncertainty \( u \) is proportional to the confidence factor \( c \).

- The smaller the confidence percentage, the shorter the uncertainty distance.
- The larger the confidence percentage, the longer the uncertainty distance.
Vertical Information
Within 6 years, carriers must, for each of the top 25 Cellular Market Areas (by population) deploy \textit{either}:

- 1 DL reference point for every 4 residents; or
- Z-Axis technology covering at least 80\% of the population.
Characterizing Performance

• Individual location technologies and carrier networks will be tested in open, transparent, controlled, randomized, and vendor-neutral testbeds in Atlanta and San Francisco.

• Carriers must certify that their networks are configured, and will perform, similarly outside the testbeds.

• Network performance will be actively monitored in 6 “monitored markets:”
Characterizing Performance

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• Network performance will be actively monitored in 6 “monitored markets:”
  ◦ Atlanta, Chicago, Denver, New York, Philadelphia, San Francisco
Characterizing Performance

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• Carriers must certify that their networks are configured, and will perform, similarly outside the testbeds.

• Network performance data will be actively monitored in 6 “monitored markets,” and available to every PSAP.
Performance Metrics

6 “Monitored Markets”
What *Isn’t* Changing

- Latitude / Longitude / Uncertainty
- ALI Formats
- MSAG / LVF Validation of Addresses
- Best estimate available from network
Dispatchable Location Defined

“A location…that consists of the street address of the calling party, plus… suite, apartment or similar information ….”

WPH2
1700 DIAGONAL ROAD
SUITE 500
ALEXANDRIA VA
WiFi MAC Address
04:0A:1A:66:BF:F1

Bluetooth LE UUID
123e4567-e89b-12d3-a456-426655440000
NEAD evolved Serving Mobile Location Center (eSMLC)

Call Time

PSAP Call Taking Display

ALI

evolved Serving Mobile Location Center (eSMLC)

MAC/UUID (From Phone)

Beacon Entry Time

MSAG (Valid/Invalid)

Validated Addresses Only

Beacon Address

Corroboration
Timeline

- 11/17/2014: Working Groups Established
- 2/15: Dispatchable Location Demo
- 5/16: Standards Work Completed (Range)
- 11/17: National Emergency Address Database Online

Events:
- 1/15
- 4/15
- 7/15
- 10/15
- 1/16
- 4/16
- 7/16
- 10/16
- 1/17
- 4/17
- 7/17
- 10/17
- 11/17/2017
NEAD Development

• The NEAD stores records that correlate WiFi MAC addresses and Bluetooth UUIDs with civic addresses, including floor, suite, apartment number, etc.

• Target on-line date is November 2017.

• NEAD Working Group established 2015. Roger Hixson is representing NENA.

• NEAD LLC has been established by the carriers and CTIA; NENA is a member of the NEAD advisory board.
NEAD Provisioning

• NEAD entries can come from three sources:
  ◦ Service-order provisioning by wireline/cable/fibre carriers when customers establish service with a carrier-provided device.
  ◦ Customer provisioning when customers supply their own device.
  ◦ Building owner provisioning for integrated (e.g., smoke detector, exit sign) devices.

• Carriers must reach a NEAD density of 1 beacon per 4 people in each monitored market to avoid a supplementary z-axis requirement.
NEAD Data Validation

- NEAD data will be validated against the best available address data standard at time of entry:
  - For E9-1-1 systems, validate against MSAG (address only)
  - For NG9-1-1 systems, validate against LVF (address & sub-address)
- NAD address data may be used by either (or both) the NEAD and the local MSAG/LVF as a “sanity check.”
- NENA will continue to be actively involved with NAD development efforts to ensure the NAD complements LVF/NEAD capabilities.
NEAD X/Y/Z Data

• NENA is working to ensure that NEAD entries include the best-available X/Y/Z data in addition to civic address.
  ◦ Some device-based corroboration may be required for “good” data.
  ◦ Reverse geo-coding quality is highly dependent on map-base data quality.

• NEAD data will follow the NENA-standard data model to ensure ALI compatibility.
NEAD Privacy & Security

• Parties to the Roadmap Agreement must develop a comprehensive privacy and security plan to ensure the NEAD is never compromised or used for a purpose other than locating emergency callers.
• The broader Roadmap Advisory Committee will be consulted as the plan is developed.
DL Roll Out

←Post-Standards Deployment of new VoLTE Handsets

• Network-wide support at standards + 24 months
• Delivery to ALI providers at standards + 48 months
Formal Evaluation

- NENA and APCO continuously evaluate carrier performance and adherence to timelines.
- Reasonable variations (e.g., standards development cycles) are expected, but will be monitored.
- At 36 months, a major assessment will determine whether the development and deployment of Dispatchable Location technology is “on track.”
- If not, carriers must supplement DL with Lat/Lon and Altitude technologies.
To learn more...

9-1-1 Goes to Washington
Arlington, VA | Feb. 21-24, 2016
nena.org/gtw

NENA2016
Conference & Expo
Indianapolis, IN | June 11-16
nena.org/nena2016
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