



# Wireless Location Accuracy: Dispatchable Location & 3D Positioning

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TREY FORGETY  
NENA DIRECTOR,  
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# Indoor Stats

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- ~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

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- 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

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- 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?

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- 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

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- 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

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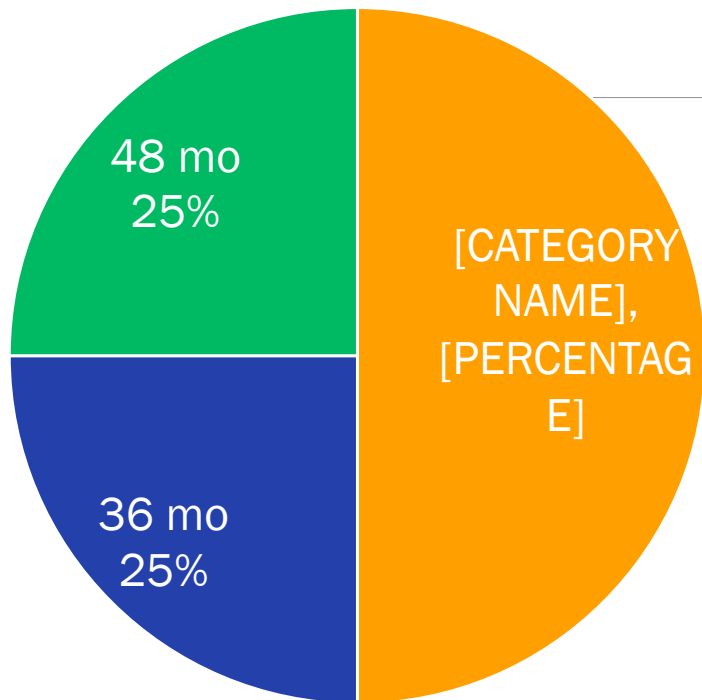
+38.806 -077.058 U=50 C=90%



1700 Diagonal Rd Ste 500

Alexandria VA 22314

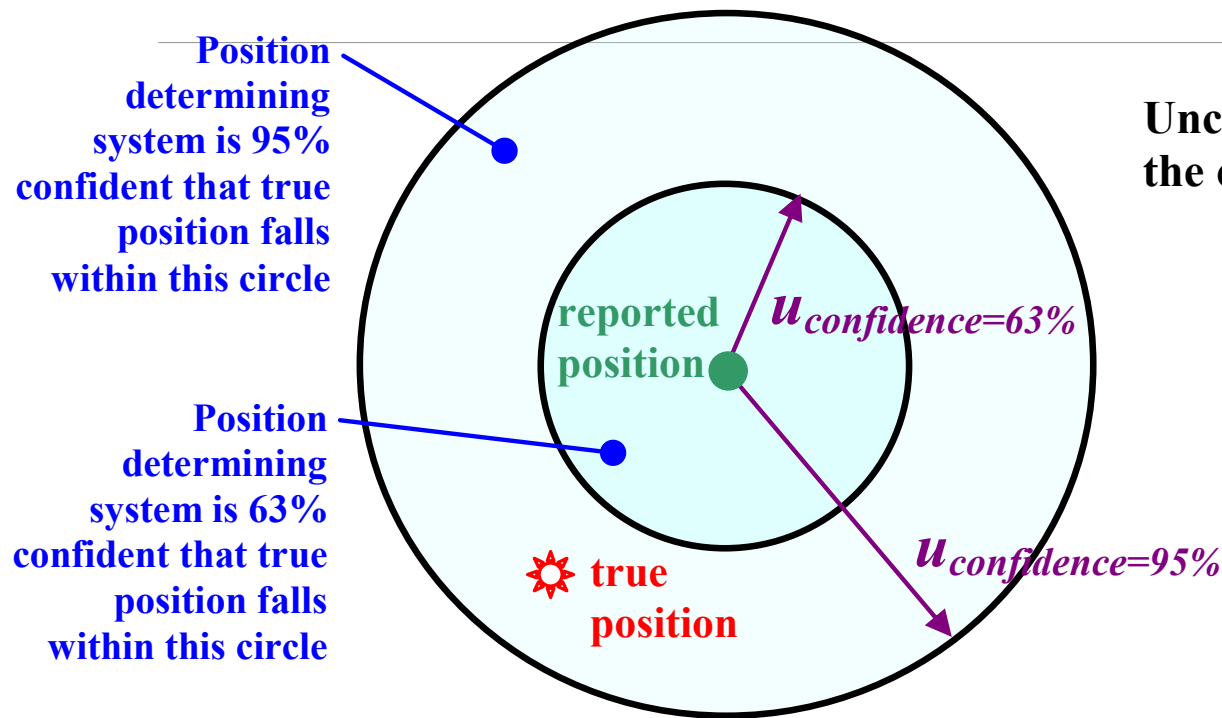
# Improving L/Lo Tech



- 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.



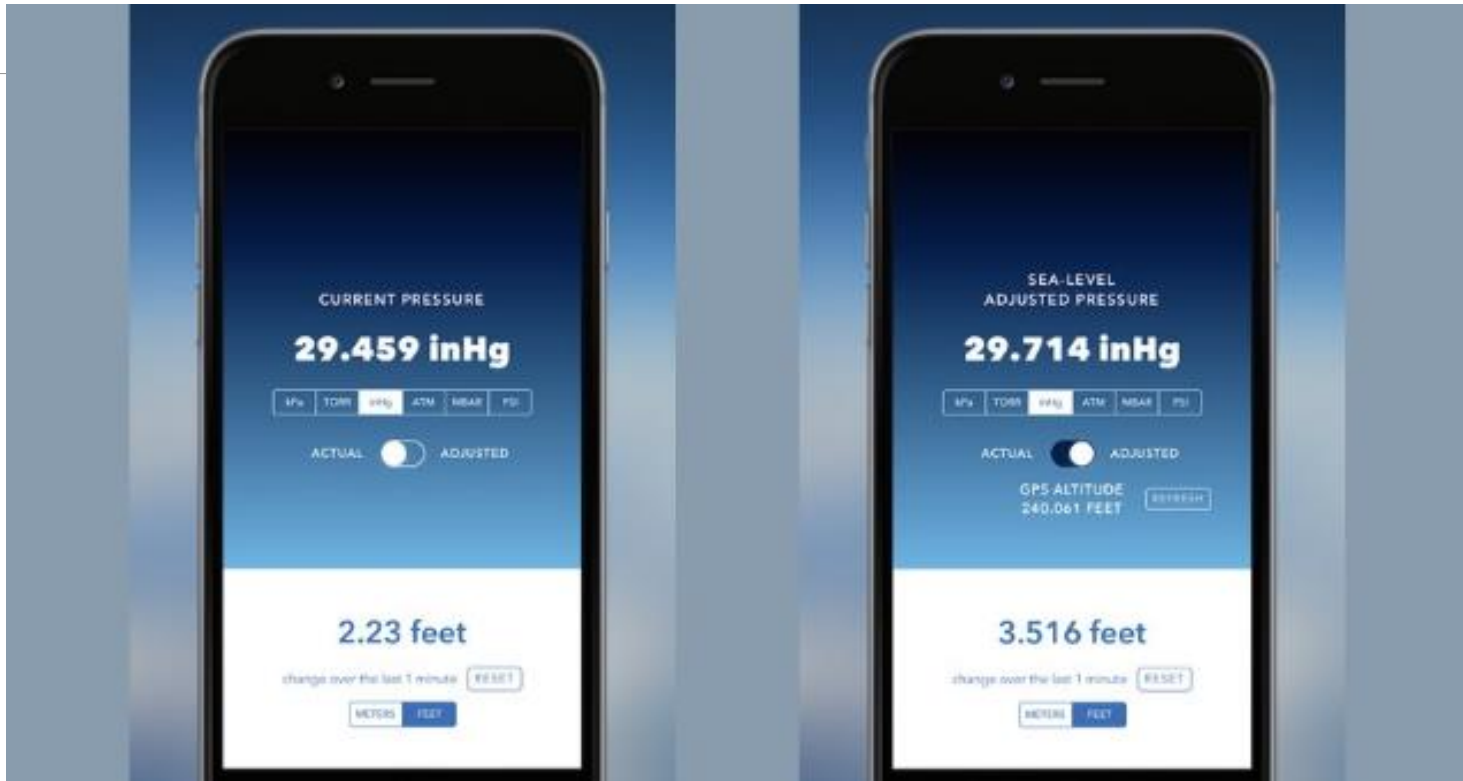
# Standard Confidence



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.

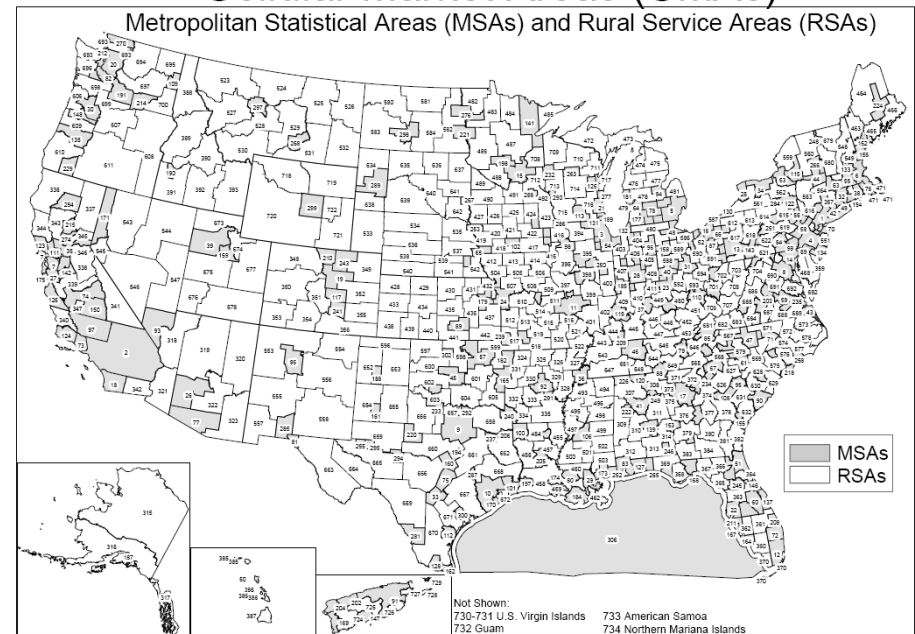
# Vertical Information



# Vertical Location Information

- Within 6 years, carriers must, for each of the top 25 Cellular Market Areas (by population) deploy *either*:
  - 1 DL reference point for every 4 residents; or
  - Z-Axis technology covering at least 80% of the population.

## Cellular Market Areas (CMAs)



# Characterizing Performance

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- 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:”

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- 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:”
  - Atlanta, Chicago, Denver, New York, Philadelphia, San Francisco

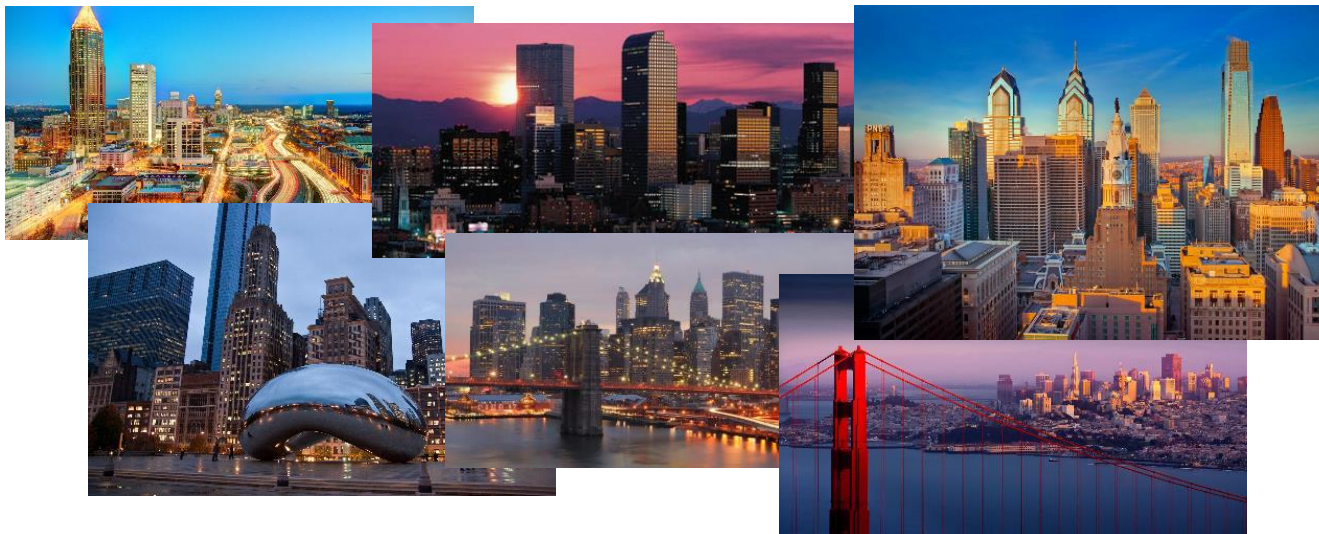
# Characterizing Performance

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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

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## 6 “Monitored Markets”

# What *Isn't* Changing

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



# Dispatchable Location Defined

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

”  
....

WPH2

1700 DIAGONAL ROAD

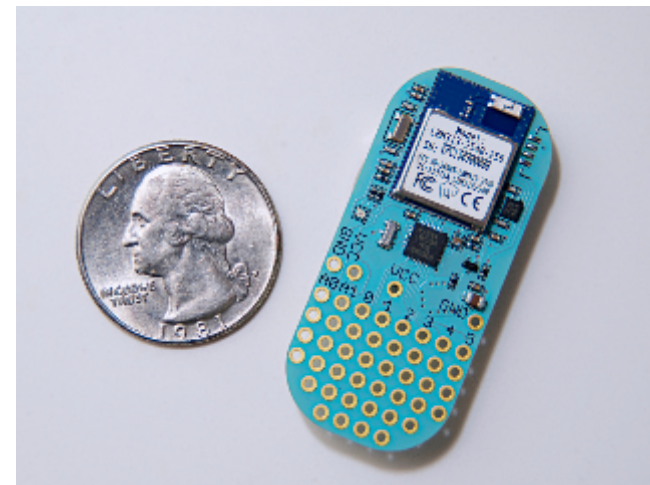
SUITE 500

ALEXANDRIA VA

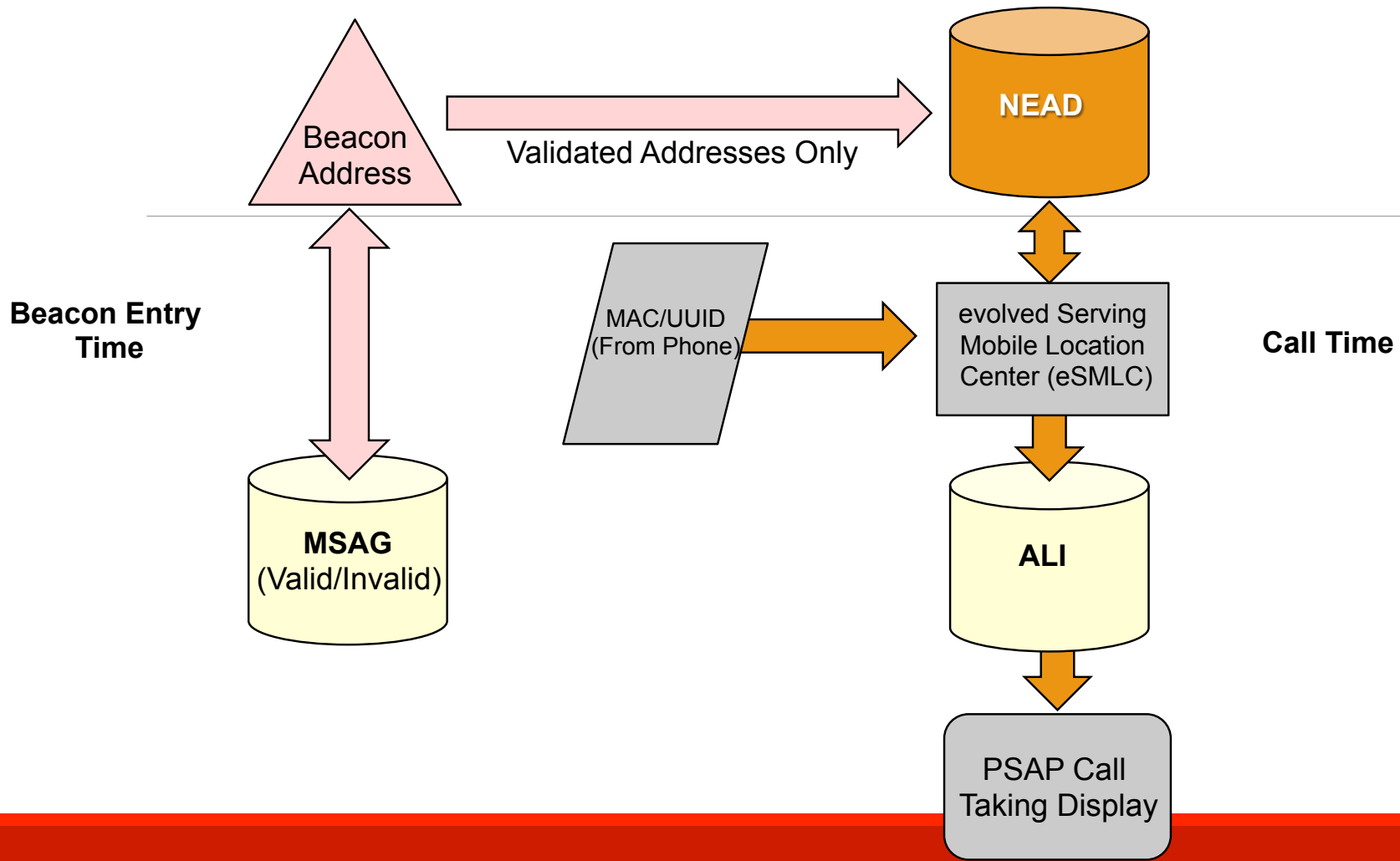
# DL Tech



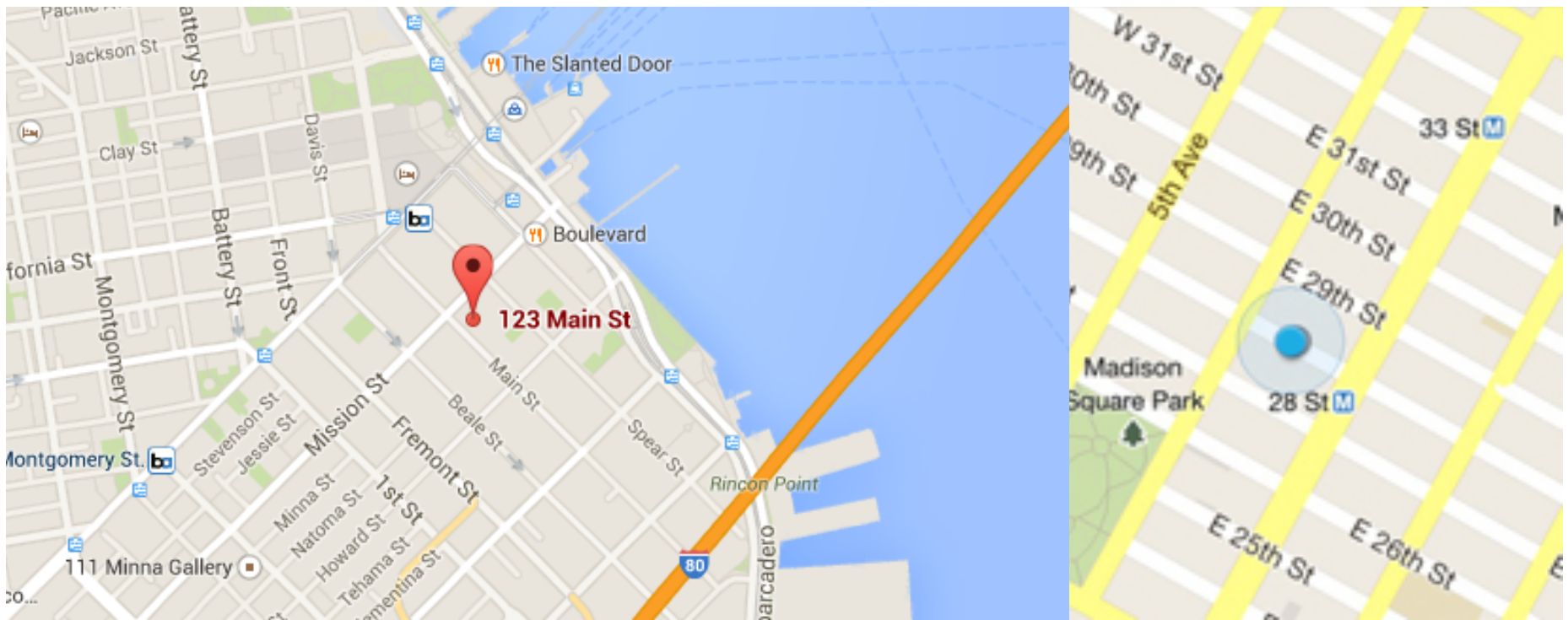
WiFi MAC Address  
04:0A:1A:66:BF:F1



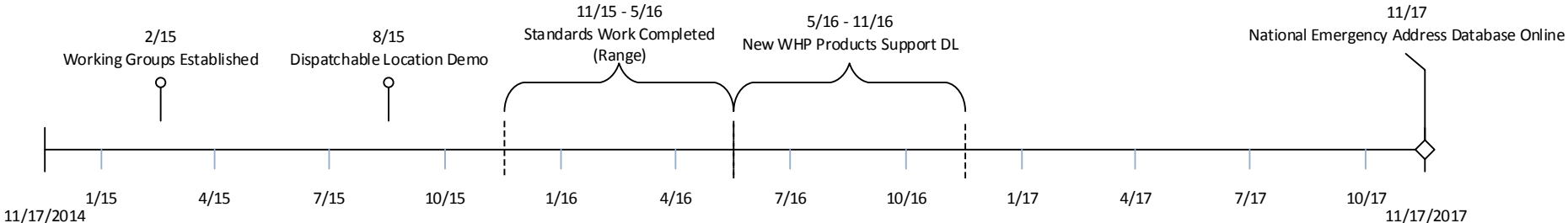
Bluetooth LE UUID  
123e4567-e89b-12d3-a456-426655440000



# Corroboration



# Timeline



# NEAD Development

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- 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

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- 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

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- 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

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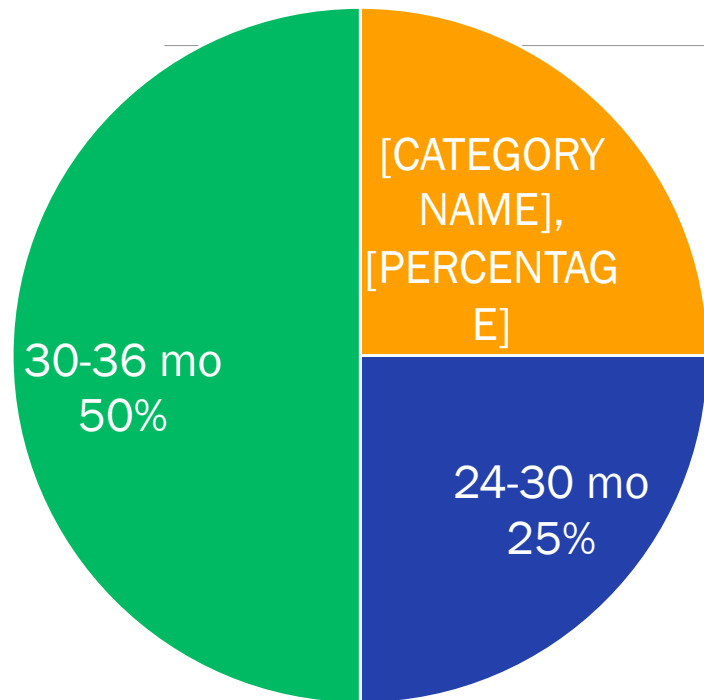
- NENA is working to ensure that NEAD entries include the best-available X/Y/Z data in addition to civic address.
  - Some device-based corroboration may be required for “good” data.
  - Reverse geo-coding quality is *highly* dependent on map-base data quality.
- NEAD data will follow the NENA-standard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

# NEAD Privacy & Security

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- 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

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- 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...

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