Next Generation Indoor Location for Public Safety

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The Challenge:
Locating a caller to 9-1-1 using their cellphone while indoors

- By design the cellphone network device location architecture is built for outdoor location (i.e. GPS).
  - Most people used their wire-line phone while indoors
  - Now, 40% have ‘cut the cord’
- 70% of all 9-1-1 calls come from cellphones
  - It’s the go-to device
- GPS, however, doesn’t work well indoors
  - Particularly acute in dense urban environments

Leveraging “Baked-In”Technologies

- Improved GPS technology
  - Universal, but incremental, improvement for indoor 9-1-1
- Residential Wi-Fi
  - Important for calling 9-1-1 from “where we live”
- Enterprise Wi-Fi
  - Important for calling 9-1-1- from “where we work”
  - Important for calling 9-1-1 from “where we learn”
  - Important for calling 9-1-1 from “where we play”

Today’s discussion

Enterprise Wi-Fi Collaboration Has Already Begun

TCS engineers are working with Aruba engineers to integrate AirWave Wireless Management System into this solution.

In early talks with Ruckus Wireless to integrate their cloud-based solution.

What is the FCC's Role?

- Don't foreclose this approach with a different decision
- Allow dispatchable location to count toward compliance
  - Dispatchable location should be the "gold standard"
  - Providing dispatchable location should meet highest FCC criteria
- Explore need for enterprise network-specific public safety requirements

Wireless E9-1-1 Call/Data Flow: A Baseline

1: Person dials 9-1-1

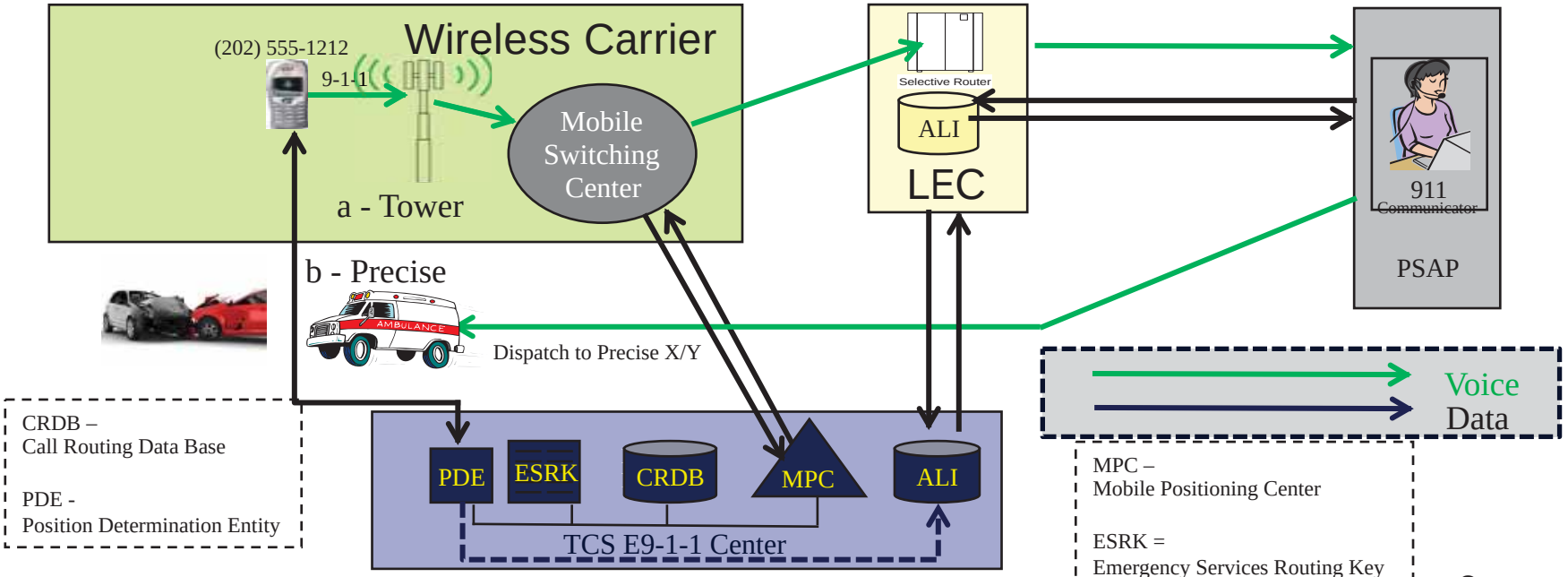
2: MSC requests routing instructions

3: MSC routes call to PSAP

4: E9-1-1 Center gets precise location

5: PSAP queries for precise location

6: PSAP dispatches assistance



Wireless E9-1-1 Call/Data Flow: Indoor 9-1-1 Call

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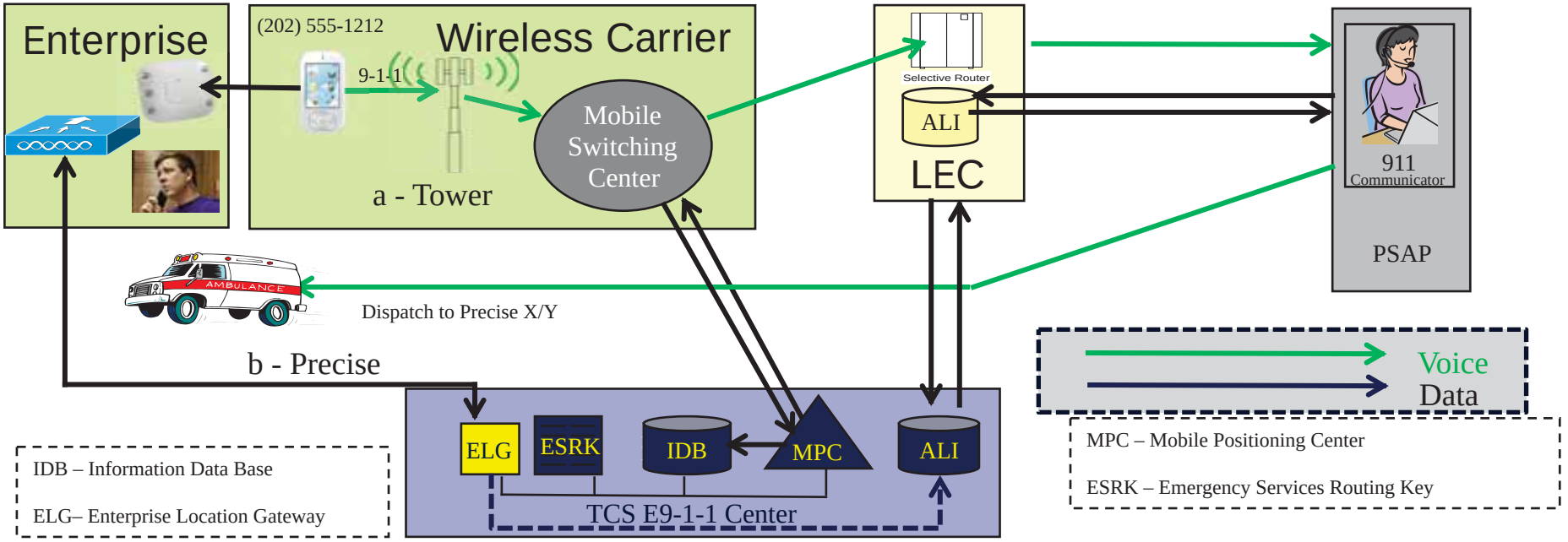
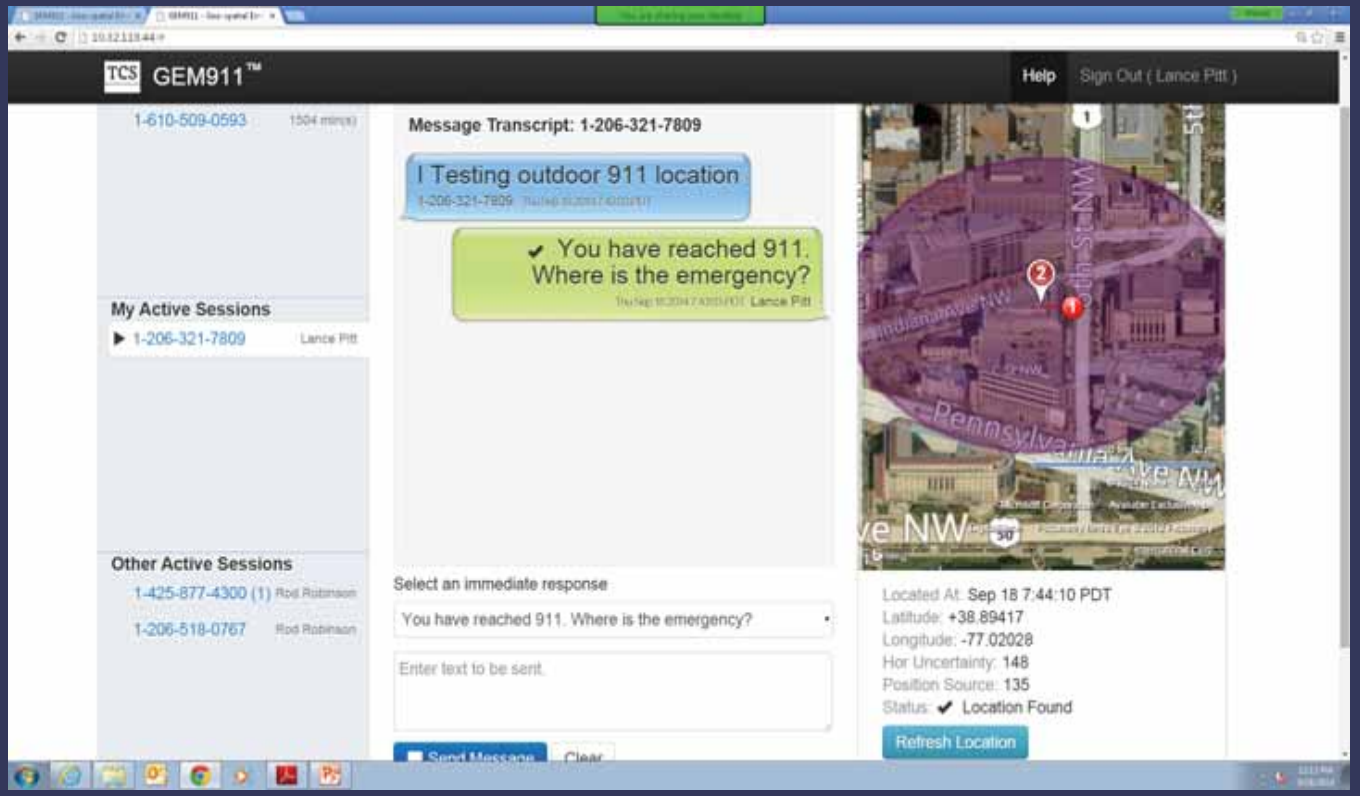


Where’s the 9-1-1 caller?



CSRIC III Testing – Using outdoor mechanisms to locate devices that are indoors

The dense urban buildings used for indoor testing in this stage of the test bed were:

- Bldg. 1: Marriott Marquis Hotel, SF
- Bldg. 2: One Front Street, SF
- Bldg. 3: 201 Spear Street, SF
- Bldg. 14: The Hearst Office Building (699 Market Street), SF
- Bldg. 15: The Omni Hotel, SF
- Bldg. 16: One Embarcadero Plaza, SF

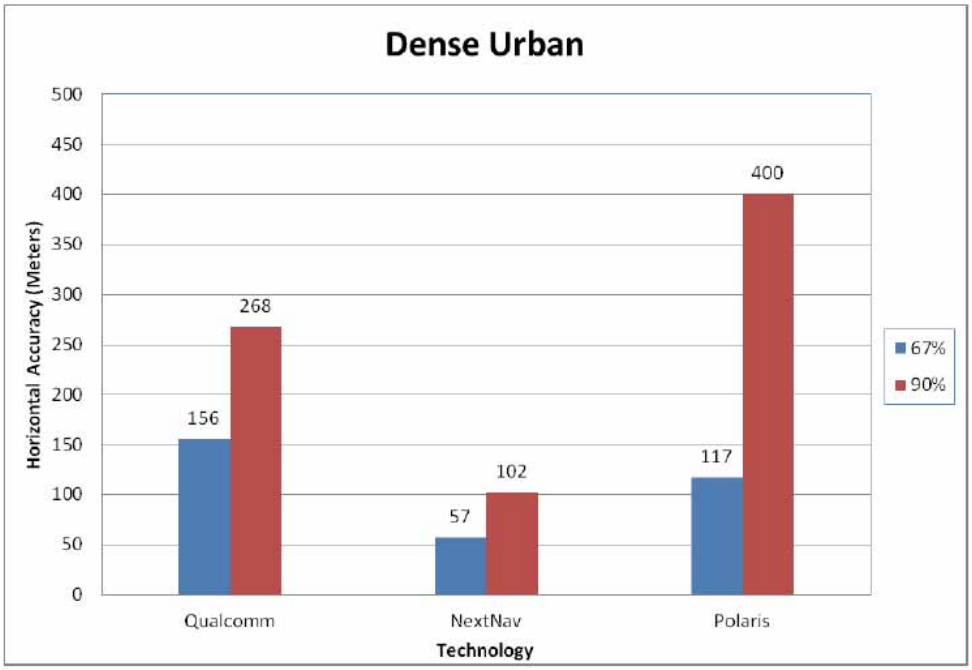


Figure 7.3-2 Accuracy Percentiles in the Dense Urban Environment

A "*dispatch-able*" location?

- Current and tested technologies deliver an X, Y, Z coordinate
  - Requires reverse geocoding for dispatch
  - How does the Z coordinate equate to a floor number?
- X, Y, Z is good for outdoors, but not indoors
- Cisco office at:
  - 601 Pennsylvania Avenue, N.W. North Building
  - Suite 900
  - Washington, District of Columbia, 20004
- Public Safety would get:
  - 38 53.599' N 77 01.216' W
  - Elevation 149'

Alternative Approach: Enterprise Wi-Fi

Enterprise Wi-Fi becoming ubiquitous

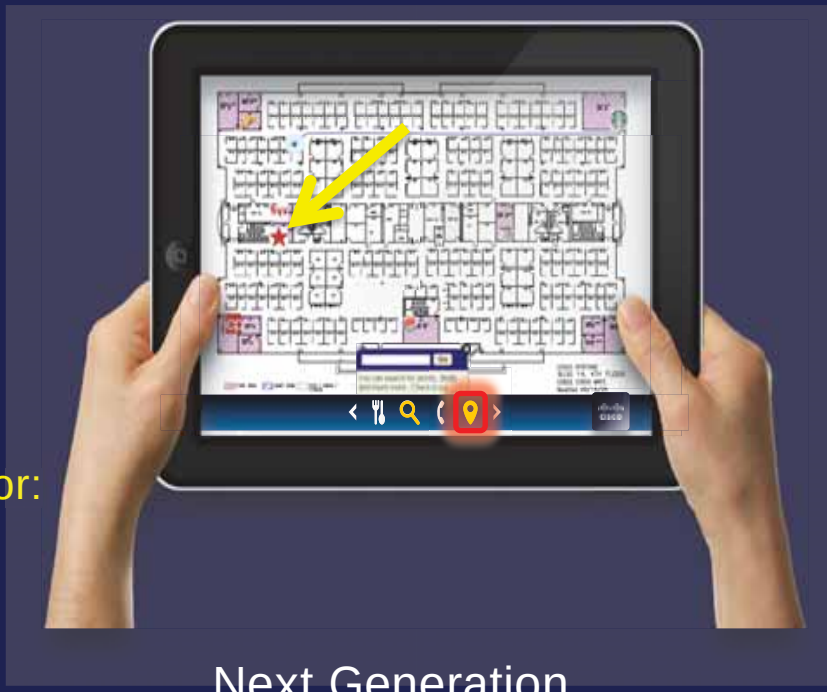
- 60% of cellphones now smartphones w/WLAN interfaces
- Up from 40% just a couple of years ago
- Device location is built-in (802.11)

Growing subset of Enterprises use Device location for:

- Asset Tracking
- Customer Habit Awareness
- Facilities Planning

Location technology can be accessed by Public Safety

- “Dispatch-able” Location
- Initially: Civic address & floor number (for legacy)
- Next Gen: Floor plans and real-time data

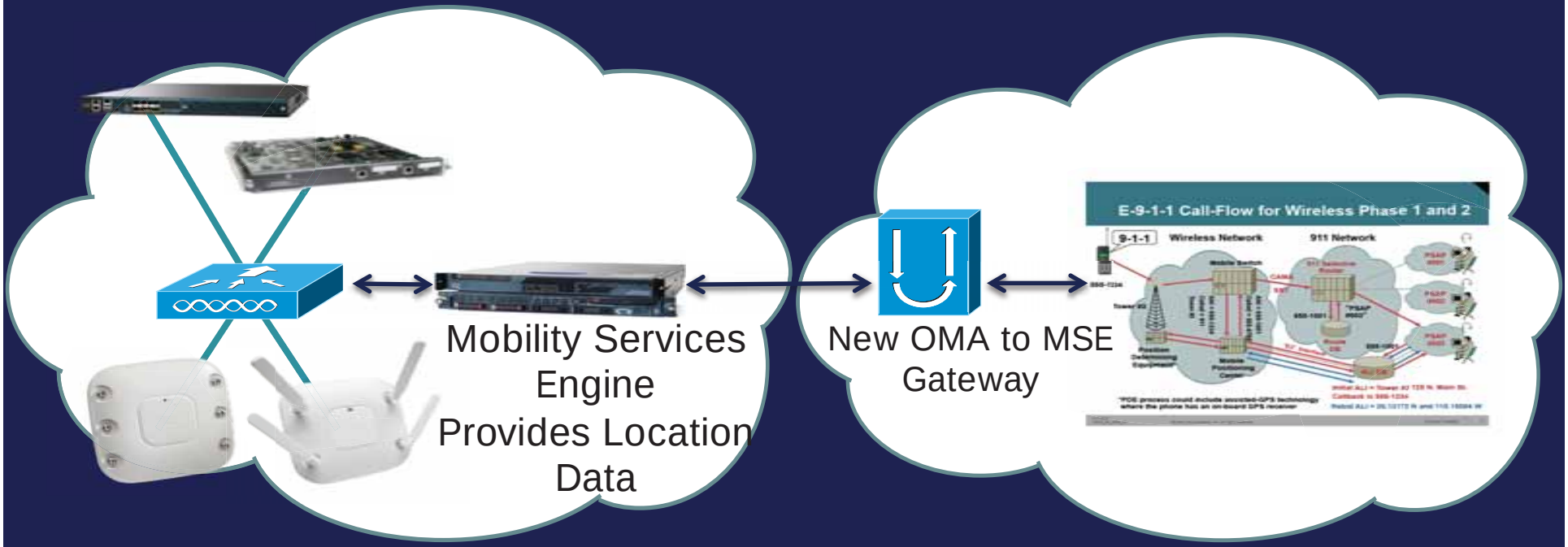


Next Generation

802.11 location – *"Connect the Dots"*

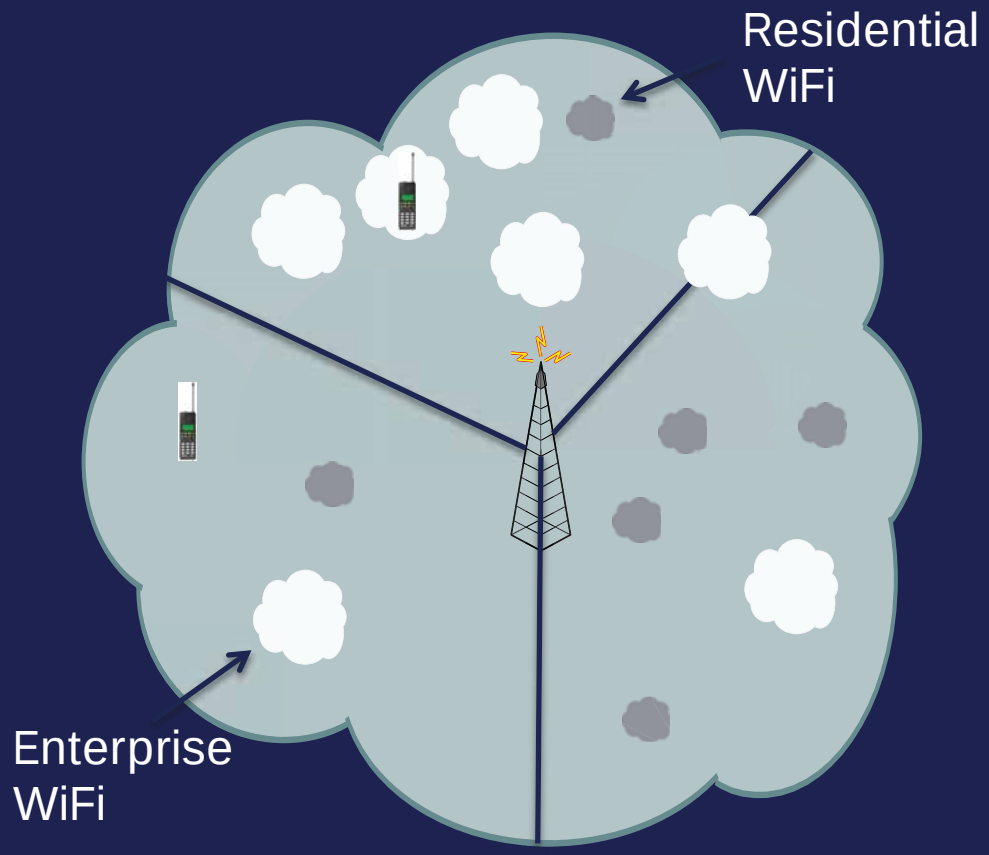
- We just need to connect the existing Enterprise Wi-Fi to the cellular location infrastructure
  - Needs to be done securely
    - We know how to do that!
  - Enterprises need assurance this is only for emergency calling
    - We know how to do that!
  - PS need assurance 802.11 location is trustworthy and accurate
    - Enterprises deploying LA networks do so for their own benefit
    - Enterprises manage and maintain their location infrastructure as it's $$ to them.
- No new hardware – uses existing devices and infrastructure

Enterprise Owned/Operated Location Aware Infrastructure



How does it work?

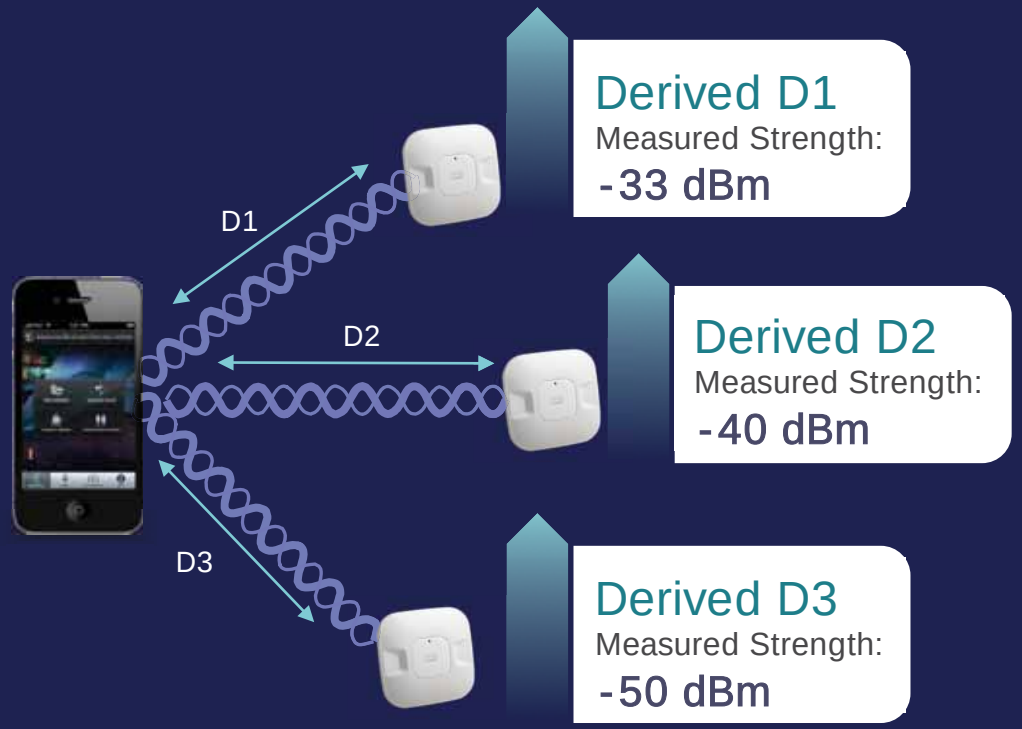
- Cellular 9-1-1 calls are routed based on cell sector
  - A PSAP assigned to each sector
- Overlay the enterprise WLAN coverage on the sector polygon
- Send to each enterprise, *"do you see this device?"*
  - Very fast query
  - Scalable to hundreds
- If you get a positive response, query further for accurate location and floor plans/map.



How Location Is Calculated with FastLocate

Higher Scalability: Device Probing and Data Packets

- Access points detect mobile devices or tag signals and measure received signal strength indication (RSSI) from all frames sent over Wi-Fi.
- Controllers send RSSI information signal to the MSE for location calculation.
- RF fingerprinting and triangulation, based on signal strengths, are used to calculate device location.



This Merits a Collaborative Approach

- Need to bring together ‘all’ the players
  - Cellular Service Providers
    - System Service Providers
  - Enterprises
  - Wi-Fi Equipment Providers
  - Smartphone Vendors
  - Public Safety
  - Government

Next Steps

FCC

- Don’t foreclose this approach with a different decision
- Allow dispatchable location to count toward compliance
- Explore need for enterprise network-specific public safety requirements

Industry

- Technical Special Interest Group
  - Requirements gathering
  - Standardization
- Standardize public safety interfaces for dispatchable location
- Policy Special Interest Group
  - Collaborative process to examine policy framework

Thank you.

Veracity of location data received

- Public Safety is nervous about using device OS derived location
  - Can be spoofed
- The trustworthiness of location data follows a hierarchy, most to least trusted:
  - SP Network determined location
    - Including on-device GPS
  - Enterprise Network determined location
  - Crowd-Sourced Location
    - Google
  - BB SP determined location
  - End device OS-based location determination