Wireless Indoor Location

John Snapp
VP, Senior Technical Officer
Intrado Inc
The value of an Address over X/Y alone

Public safety does not dispatch to a X/Y:

39° 41’ 11.93” N Latitude
104° 58’ 54.72” W Longitude
5M Point Radius Uncertainty

They dispatch to an address

Reverse Geocoding
Nearest Intersection
S Pennsylvania St & E Iowa Ave
Denver, CO

Reverse Geocoding
Address Range
1600-1650 S S Pennsylvania St
Denver, CO

Reverse Geocoding
Point Match
1615 S Pennsylvania St
Denver, CO 80210
Indoor location

• Dispatchable Location is the most useful form of location
• Addresses are most valuable if delivered with the 9-1-1 call
• PSAP systems (CAD / CPE) need to be able to accept X/Y/Z and Address together
• Cell site addresses often cause confusion for Telecommunicators
• There is no single technology that can increase the accuracy for all indoor 9-1-1 calls but rather there are many technologies that work together.
Technologies to help locate indoor 9-1-1 callers

• Residential Femto Cell
• Enterprise Femto Cell
• Geo-Relevant Wireless ALI
• Metro Beacons
• Observed WiFi access point (beacons)
• Observed BLE beacons
• Enterprise WiFi
• Handset Determined Commercial Location
• Handset Determined Beacon Location
Indoor Position Determination Technologies

- **Femtocell (Enterprise and Residential)**
  - Provides dispatchable locations
  - No changes to handset or network
  - Dispatchable location implemented today with some carriers

- **Real-time Wireless ALI**
  - Provides dispatchable locations
  - No changes to handset
  - Minimal effort to standardize
  - Minimal effort to implement

- **BLE and WiFi Beacons**
  - Provides dispatchable locations
  - Requires changes to handset and network

- **BLE and Commercial Location for 9-1-1**
  - Provides dispatchable location and more precise X/Y/Z location
  - Downloadable/preinstalled/integrated application
  - Minimal effort to standardize
  - Minimal effort to implement
• Personal cell sites installed in a subscriber's house
• Carrier offer to increase indoor coverage and offload traffic
• Contain GPS to verify location of device
• Typically cover inside of structure
• Can provide wireline level of accuracy with dispatchable address
• Requires delivery changes to utilize address information
• Some carriers are delivering address today
Femto cell – Enterprise

• Installed in enterprise by carrier or enterprise
• Often cover definable indoor spaces
  – Offices
  – Public Spaces
• Can provide wireline level of accuracy with dispatchable address
• Addresses must be managed
• May have GPS
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Providing Dispatchable Locations Through Real-time Wireless ALI

• Only provide addresses associated with emergency caller
• Associated user addresses are cross referenced with 9-1-1 location.
• Multiple possible data sources
  – Billing address
  – Customer provided data
  – Commercial data
• Could be deployed with existing 9-1-1 systems.
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Providing Dispatchable Location through BLE & WiFi Beacons

- Bluetooth Low Energy (BLE)
- Developed for retail applications
- BLE and WiFi radios existing in most new smartphones.
- Very low cost
- BLE beacons can be dedicated for 9-1-1 or shared with retail uses
- Provide wireline equivalent 1 address location
- Requires standards changes and changes to handset and network
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- **BLE and Commercial Location for 9-1-1**
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  - Carrier Provided / OS provided handset based
  - Minimal effort to standardize
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• Why can Starbucks locate me but 9-1-1 can not!
• Can provided enhanced location over network location alone.
• Commercial location uses additional technologies beyond Cell and GPS
  – WiFi
  – Beacons
  – Barometer
  – Multi sensor
• 9-1-1 can leverage commercial location to improve 9-1-1 X/Y/Z location at a low cost
• Dramatically increase accuracy and speed of implementation of BLE beacons
• Can provide dispatchable location and more accurate X/Y/Z location
• Commercial handset based location technology is the “best of breed” of location technologies today likely will continue to be in the future.
• Could follow commercial privacy model
Control Plane Location and User Plane Location

Control Plane Location (Blindfold On) (Network Determined Location)

User Plane Location (Blindfold Off) (Handset Determined Location)
Challenges for PSAPs

- Understanding uncertainty
- Differentiating between dispatchable location and cell site address
- Understanding that Phase 1 cell locations may be more accurate than Phase 2 X/Y
- Have a way to receive and utilize Z
Questions

John Snapp
+1.303.810.0600
John.Snapp@Intrado.com