Polaris Wireless

RF Pattern Matching (RFPM) Location Technology

Overview for FCC Workshop

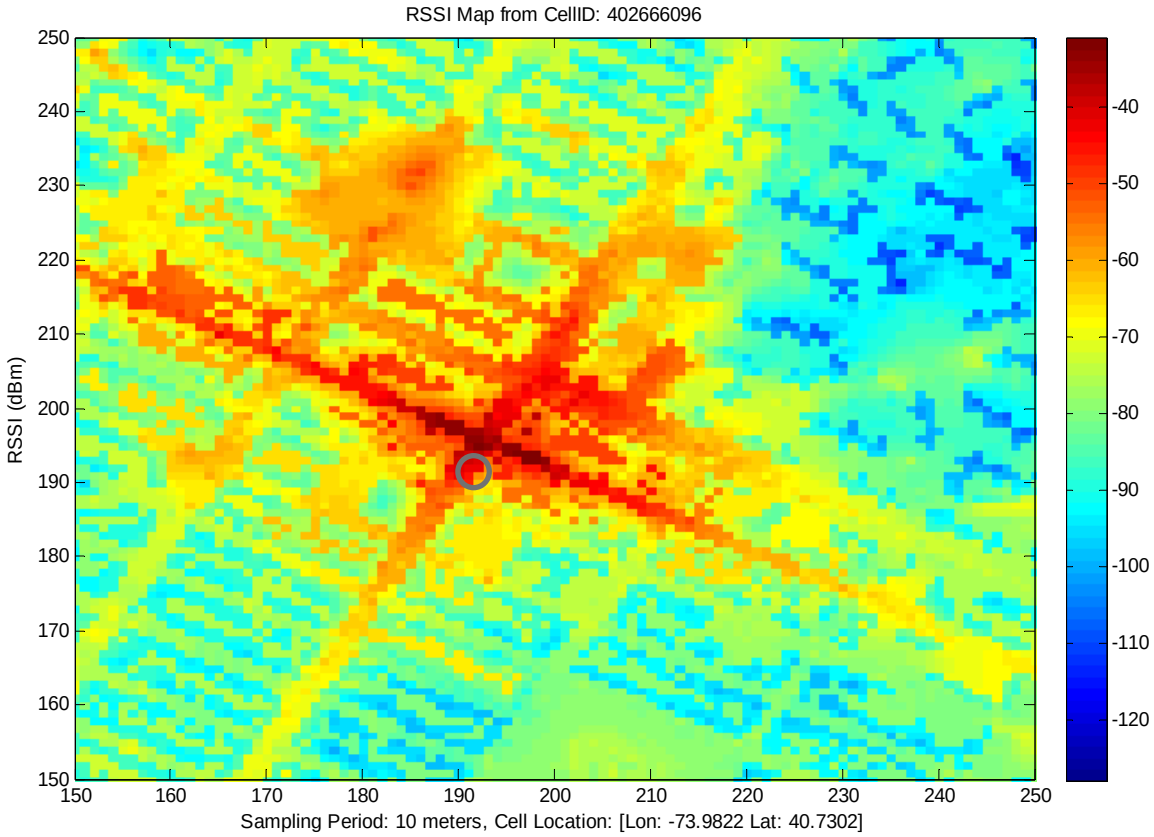
RF Pattern Matching (RFPM)

- **Signatures based on standard radio network measurements (pilot Ec/Nos, time delays from propagation delays, round trip times, etc.)**
- **Pattern match against a predicted signature database to estimate location**

- **Software-only approach – No radio hardware network overlay**

RF Maps Incorporate Site Specific Information

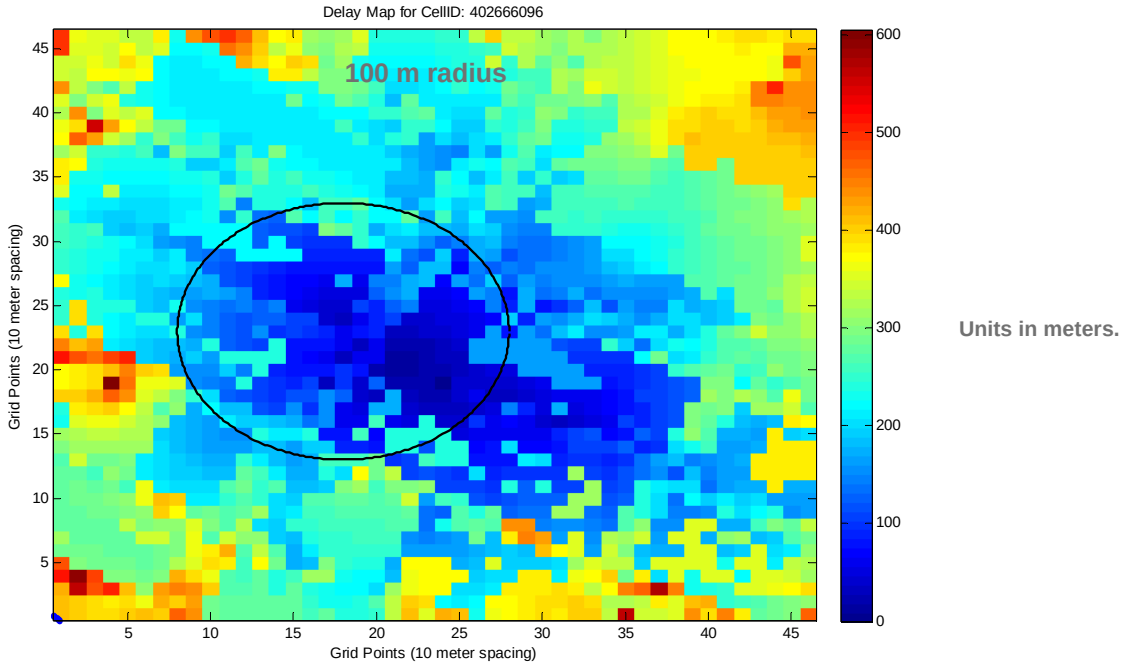
- **Signal strength measurements possess significant structure and should be an integral part of location determination**



Sample RF Map from New York City

RFPM incorporates Delay Maps for Time Measurements

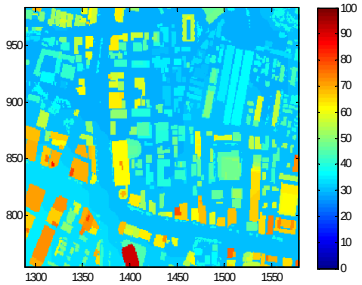
- High levels of non-line of sight can be predicted and use of time measurements can be enhanced by RFPM maps
- This technology feature is particularly important in “indoor” environments



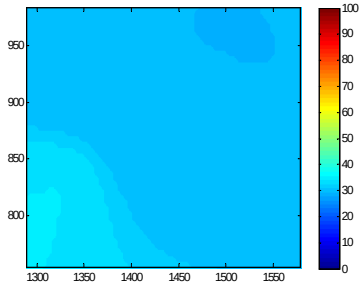
Sample Delay map from New York City

RFPM – Radio Network Modeling

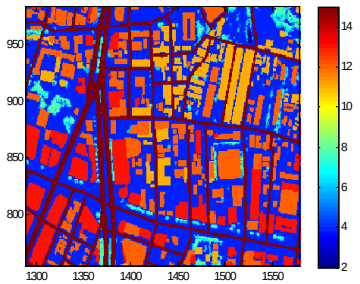
Inputs to the propagation engine:



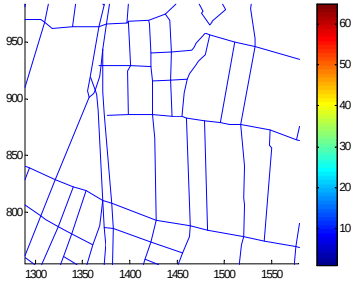
Canopy



Terrain



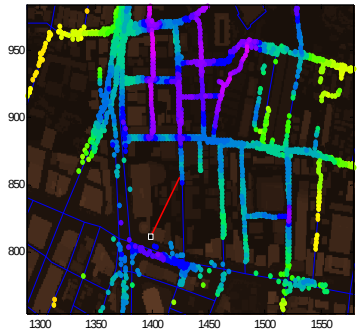
Clutter



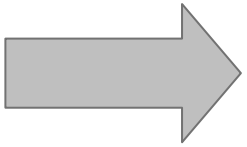
Roads

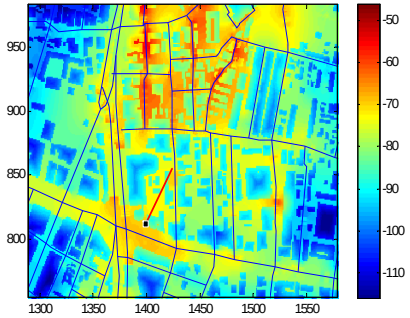
```
      id: 3141
  cellID: 3141
     lon: 139.7075
     lat: 35.6921
  height: 49
 azimuth: 30
    tilt: 0
rotation: 0
    freq: 2000
```

Network Information



Measurements (if available)





Output: RF map

Pattern Matching as opposed to Trilateration/Triangulation

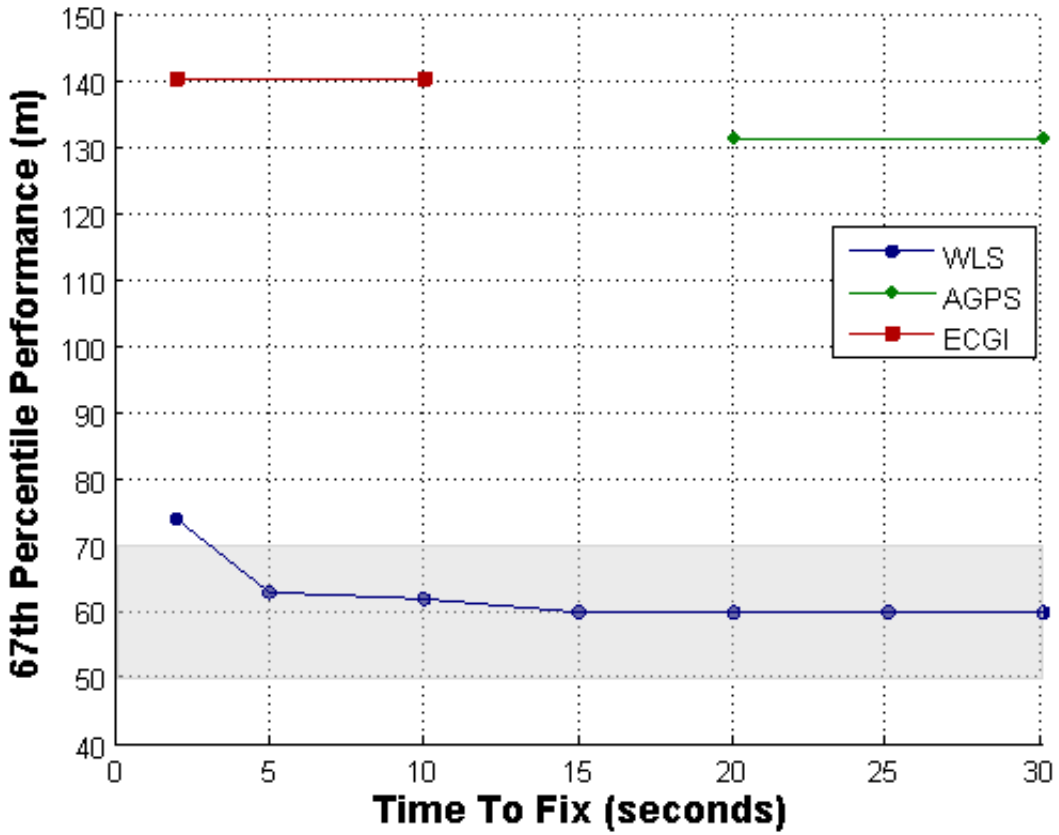
Polaris Wireless

Pattern Matching	Trilateration/Triangulation
• Performance is enhanced in complex RF environments	• Performance degraded by complex RF environments
• multi-path, non-line-of-sight, shadowing, etc.	• multi-path, non-line-of-sight, shadowing, etc
• Utilizes site-specific GIS information	• Ignores geographical information
•Takes full advantage of reported and unreported NMR data	• Makes no use of unreported NMR information

As a result of the above mentioned characteristics of pattern matching, this technology is particularly suited to performance in the in-building and dense urban environments

Time-to-Fix (TTF) and accuracy for Challenging RF Environments

Urban Indoor Performance vs. Alternatives



- Indoor test points in Tokyo urban area
- Shaded area is the desired accuracy
- A-GPS performance marked in **Green**
- ECGI (Enhanced Cell Global Identity) marked in **Red**
- RFPM performance indicated in **Blue** for different time-to-fix with 100% location yield