Indoor Positioning with SiRFusion for NextGeneration E-911
End-to-end solution for ubiquitous location
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Who is CSR?

- Global company headquartered in Cambridge, UK
- Approximately 1200 people worldwide
- Approximately $800M annual revenue
- Location team acquired from SiRF in 2009
Why are we here?

CSR powered Android phone with SiRFstar 5xp and SiRFusion

Standard iPhone 4s with GPS and Wi-Fi positioning

Shows ~10m uncertainty

Shows ~400m uncertainty
SiRFusion test – Tokyo Station

- Lower level at Tokyo station
- Google indoor maps for each level
- Environment has no GNSS signal, lots of magnetic anomaly sources (tracks, elevators, escalators), and many people causing signal variations
- Red flags mark the route walked
- Blue dots mark the SiRFusion position

Starting point determined using Wi-Fi only
SiRFstarV™ – the next generation location platform

SiRFstarV™ architecture and SiRFusion™ hybrid positioning system

Taking mobile location to the next frontiers
Indoor Positioning – SiRFusion PDR + WiFi

- The MEMS sensors drift and the error accumulates at a growth rate of 10% of distance travelled.
- Wi-Fi access points are used to determine approximate position once every 20s but have large uncertainty.
- Combining MEMS and WiFi gives a unified solution with better accuracy and bounded uncertainty.
CSR Role in CSRIC

- CSR invited to join CSRIC WG-3 in January
  - How to bring indoor location as seen by the user on Google maps to the PSAP?
- Helped define the testbed methodology similar to work done on Lightsquared testing
  - Goal is to get data that everyone agrees was collected properly
  - But interpretation of the data is always subjective
- CSR decided NOT to participate in Phase I testbed
  - Current e911 test procedures are not compatible with commercial operating mode of SiRFusion
  - Position is available continuously in most smartphones today
  - E911 test procedures do multiple trials at a single point
    - In order to maintain independence, each trial must ensure it does not use any data from previous fix – no MEMS PDR data
  - Testbed methodology also assumes no prior knowledge of test points
    - This prevents our crowd-sourced WiFi database from being learned effectively
- Results would therefore look similar to A-GNSS only with a default WiFi database.
  - CSR chose to wait to test SiRFusion in Phase II
Things to consider for Phase II

- Operating mode of location in smartphones today is very different than feature phones of 2000
  - Location is often available continuously in the phone for applications (Facebook check-in)
  - GNSS power consumption is less than 1/3 from 10 years ago
  - Other sources of location information available in the phone
    - WiFi and MEMS
  - Most commercial location services run over SUPL

- What should happen when a user dials 911?
  - Get existing location currently used?
    - Ping the location API in OS
  - Start a dedicated location determination session?

- Many impacts to consider
  - Can the location be trusted?
  - How does the operator ensure QoS over different UE?
  - How do test procedures have to change to efficiently validate performance?
  - Should we expect e911 performance to match commercial applications?