



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

Mobile

Handsets, Cameras



Handsets



Cameras



Auto

Automotive, PNDs



Infotainment



Telematics



PNDs



Home

Document Imaging,
Gaming & HE,
Health & Fitness,
PCs & Tablets,
Voice & Music

Gaming & HE



PCs



Tablets



Document Imaging



Health & Fitness



Why are we here?

Shows ~10m
uncertainty



Shows
~400m
uncertainty

CSR powered
Android phone with
SiRFstar 5xp and SiRFusion

Standard iPhone 4s with
GPS and Wi-Fi positioning

SiRFusion test – Tokyo Station

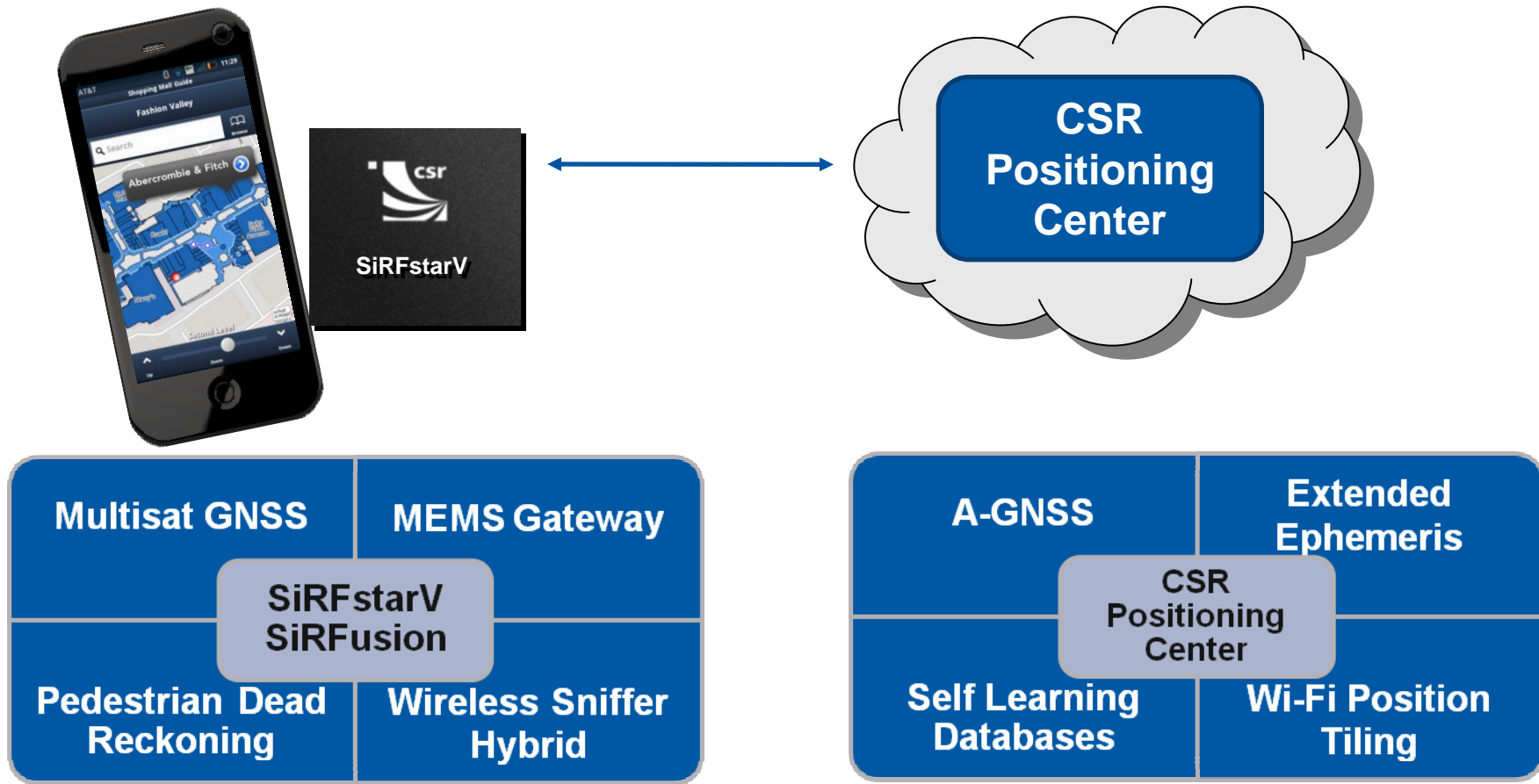


- Lower level at Tokyo station
- Google indoor maps for each level
- Environment has no GNSS signal, lots of magnetic anomaly sources (tracks, elevators, escalators), and many people causing signal variations
- Red flags mark the route walked
- Blue dots mark the SiRFusion position



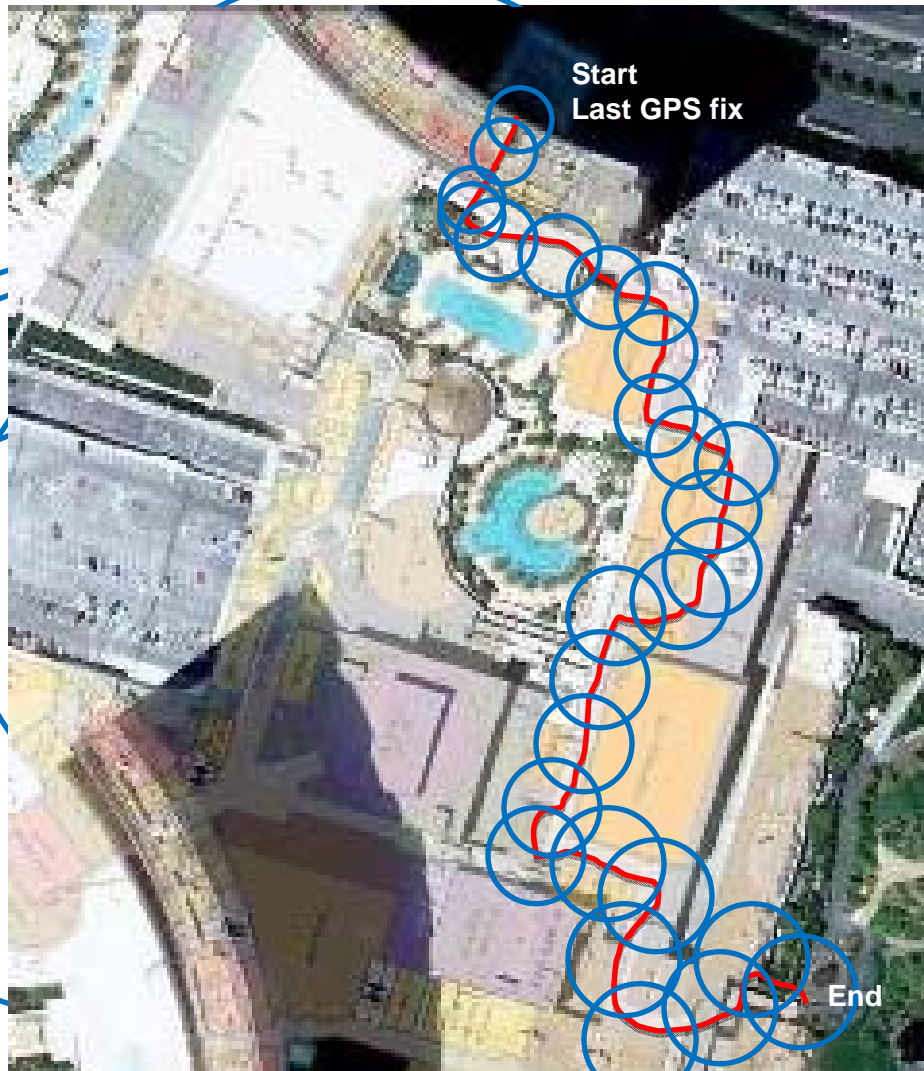
SiRFstarV™ – the next generation location platform

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?