Indoor Positioning for Consumers

SiRFusion 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
- Leading supplier of location solutions worldwide

Mobile
Handsets, Cameras

Handsets

Cameras

Auto
Automotive, PNDs

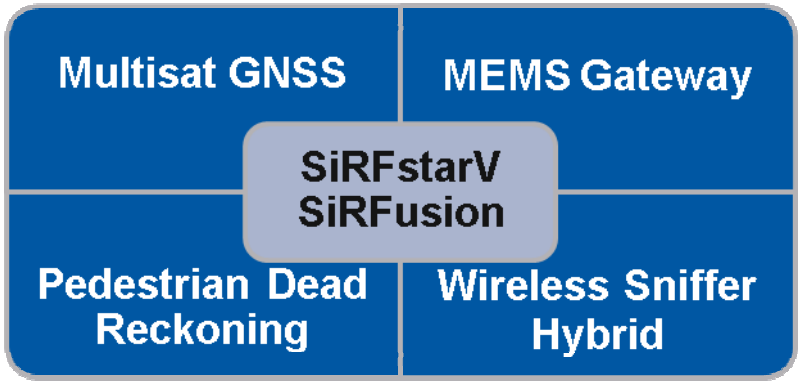
Infotainment

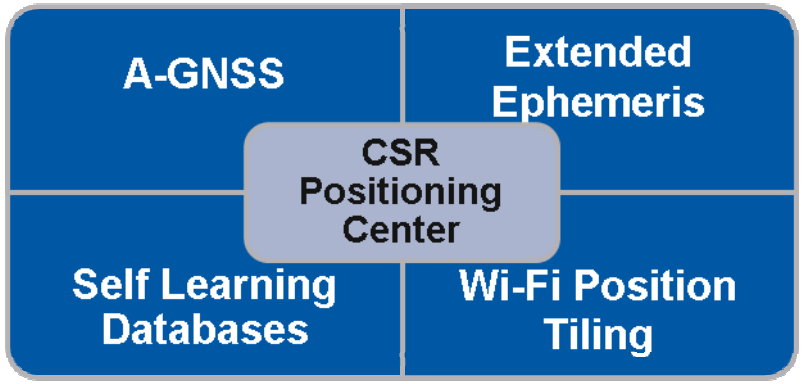
Telematics PNDs

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

SiRFstarV™ – the next generation location platform

SiRFstarV™ architecture and SiRFusion™ hybrid positioning system





Taking mobile location to the next frontiers

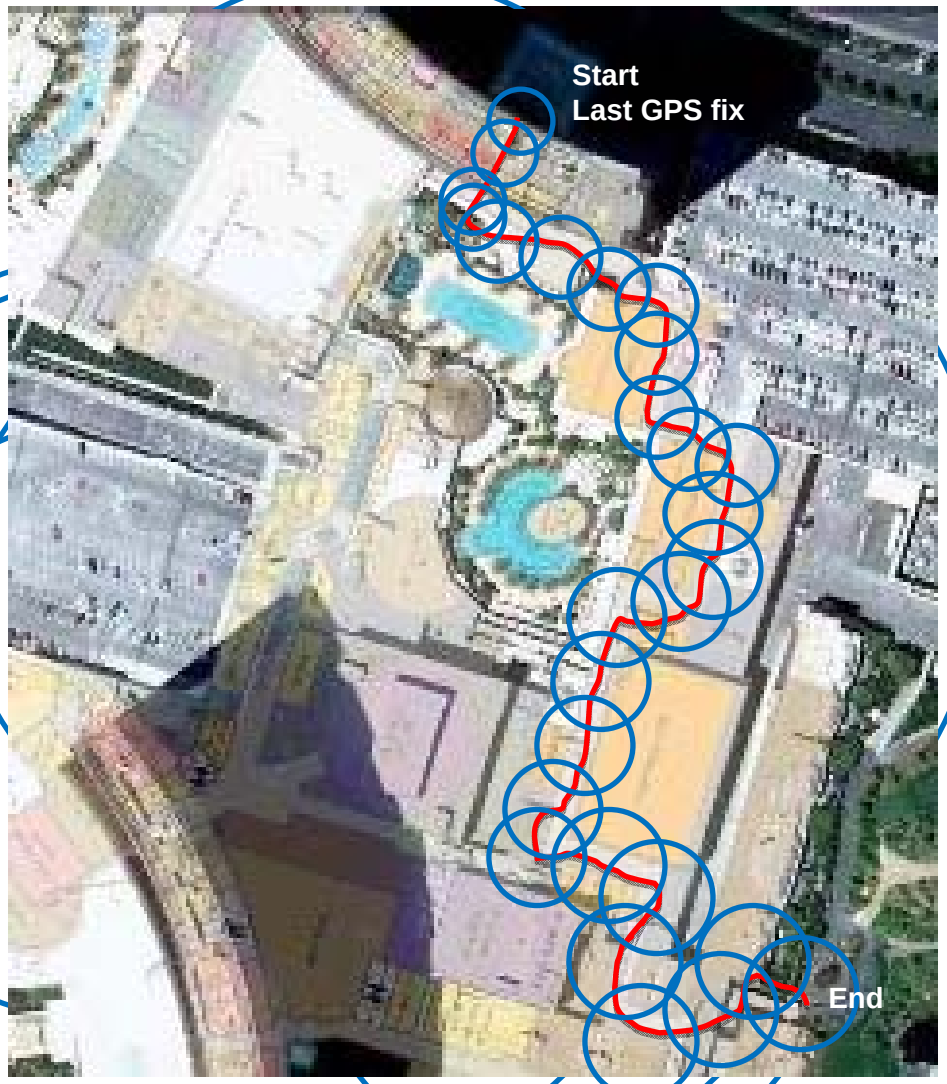
Benefits of adding constellations

Perfect weighting WLSQ solution HPE (weight is inverse of squared range error)

Constellation	50%	67%	95%	97%	99%
GPS	27.53	40.92	130.13	172.39	329.84
GPS+1 Other	12.28	17.80	43.91	51.52	71.61
GPS+2 Other	9.05	12.86	30.69	36.19	48.75

- Simulation result over thousands of simulated points in urban/indoor environment including DOP and multipath effects
- More improvement than expected due to multipath improvement from additional satellites in solution
- But it does not solve the problem of true indoor where there are no GNSS signals.

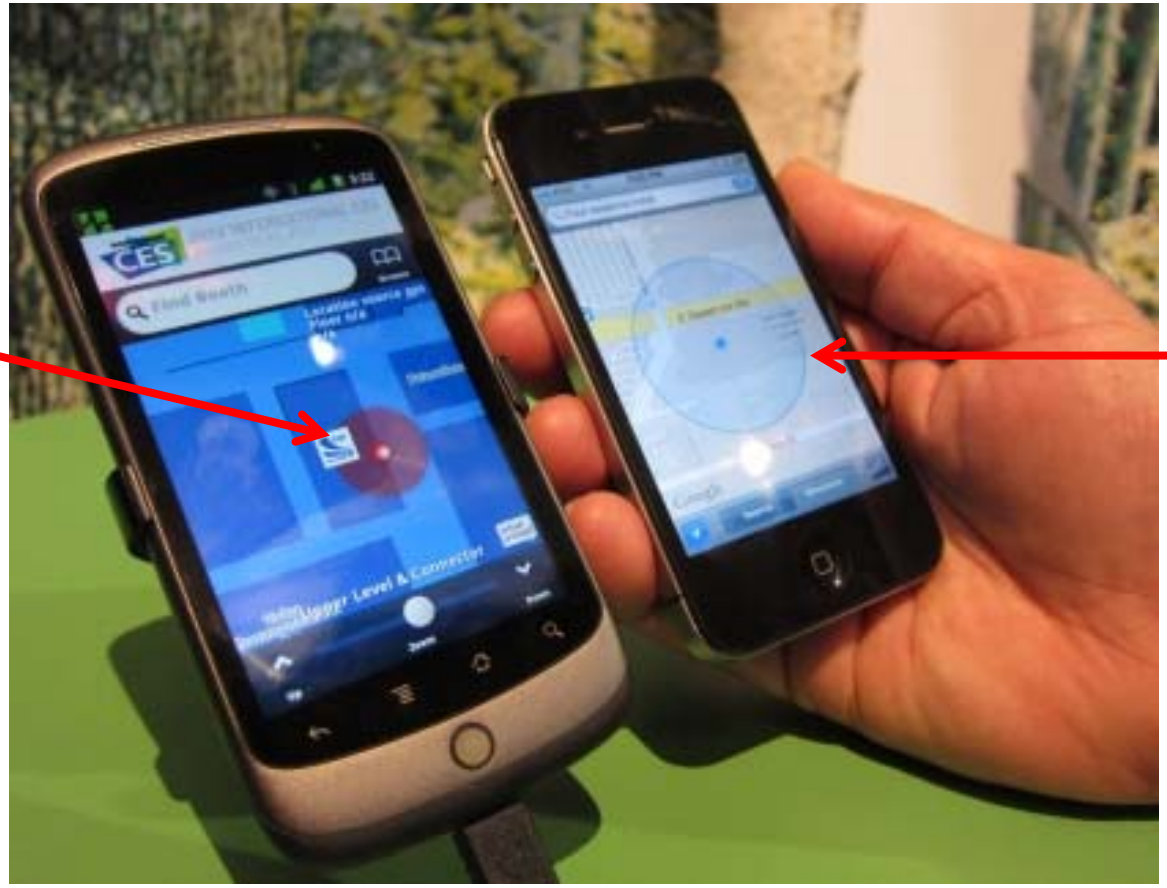
Indoor Positioning – SiRFusion PDR + WiFi



- 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

Why are we here?

Shows ~10m uncertainty



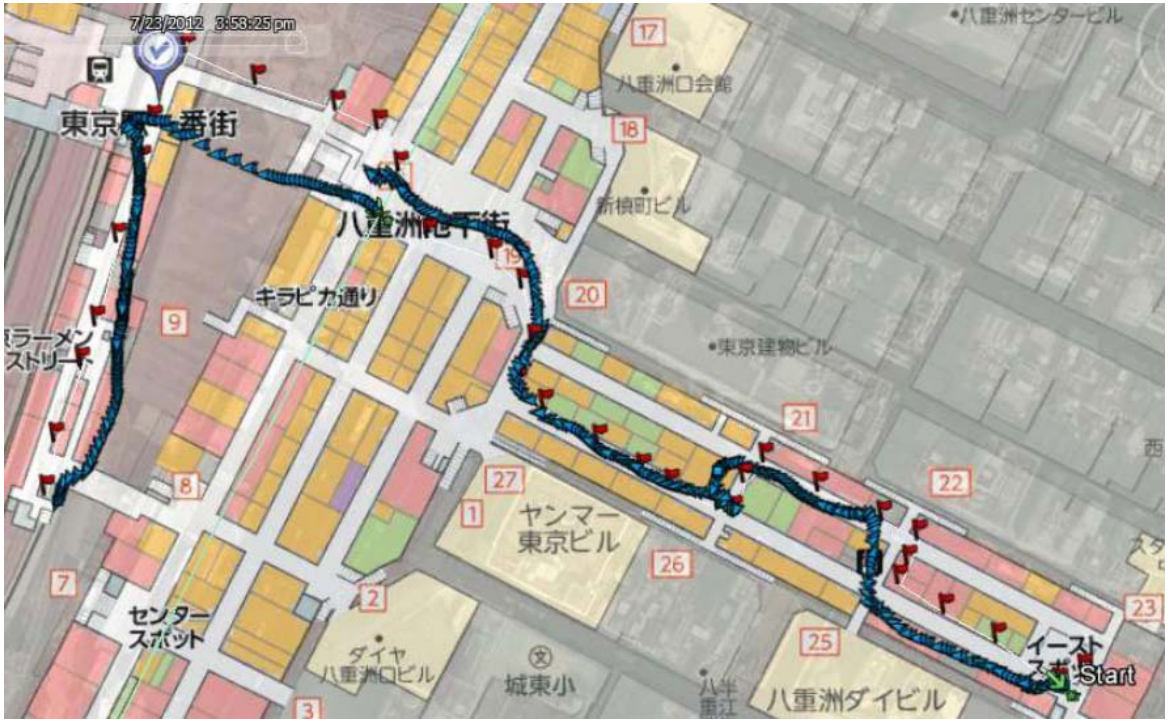
Shows ~400m uncertainty

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



Page 7

Summary

- CSR has a quad-GNSS capability today on SiRFstarV
  - Currently shipping GPS + GLONASS
  - More constellations would provide additional improvement
  - Galileo and COMPASS ready pending business case
- Ubiquitous positioning requires additional inputs
  - SiRFusion relies on adding WiFi+MEMS with a self-learning cloud based server
  - GNSS is still a required anchor technology
- Future planning requires long range information from providers
  - Support for additional frequency bands
  - Support for more complex coding schemes
  - Clear understanding of available data from satellites and ground segments