How do you use your Android phone?

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Pexels/CC0

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No. 2 - Mobile Navigation

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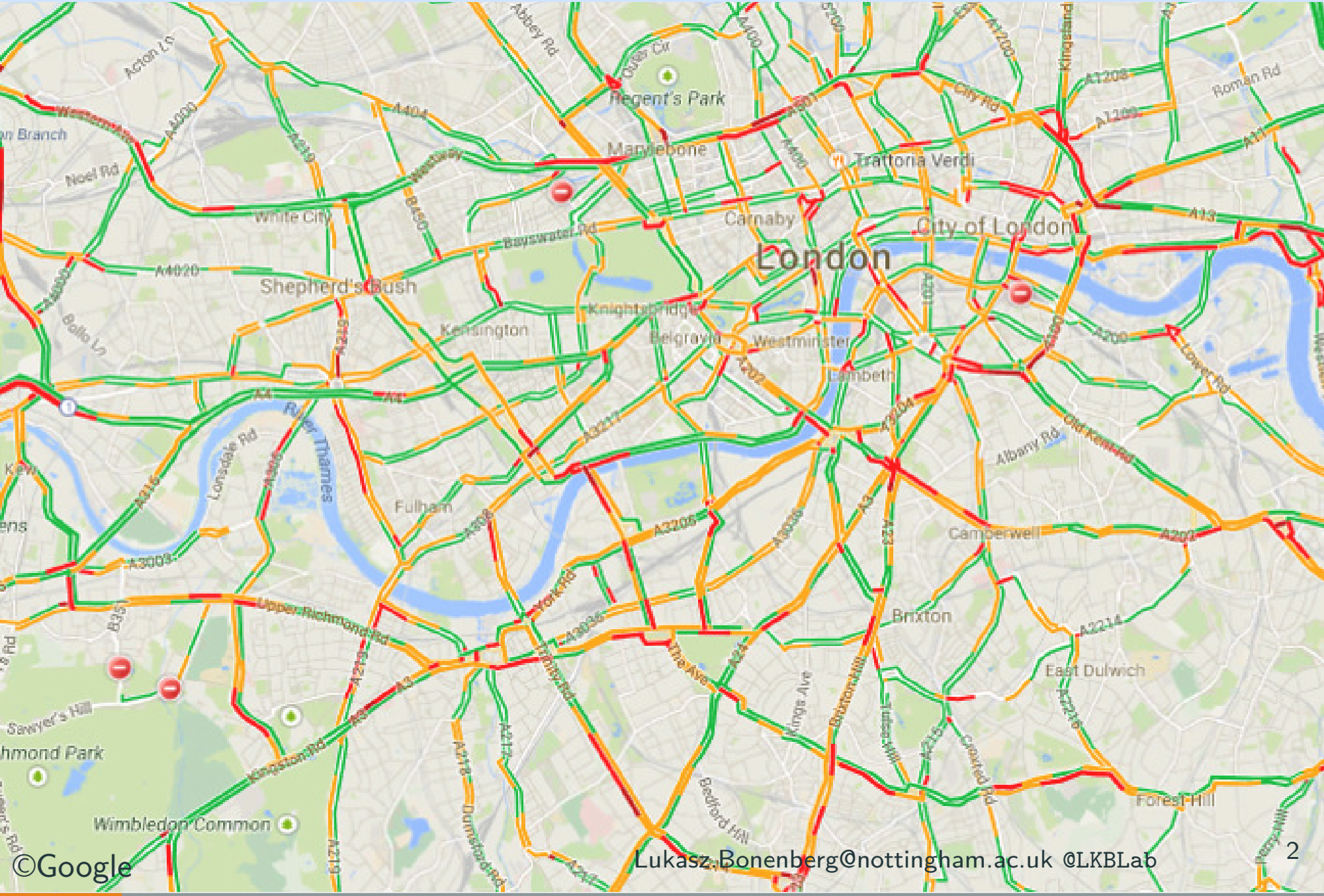


Android GNSS raw data access

GeoIT WhereCamp Conference

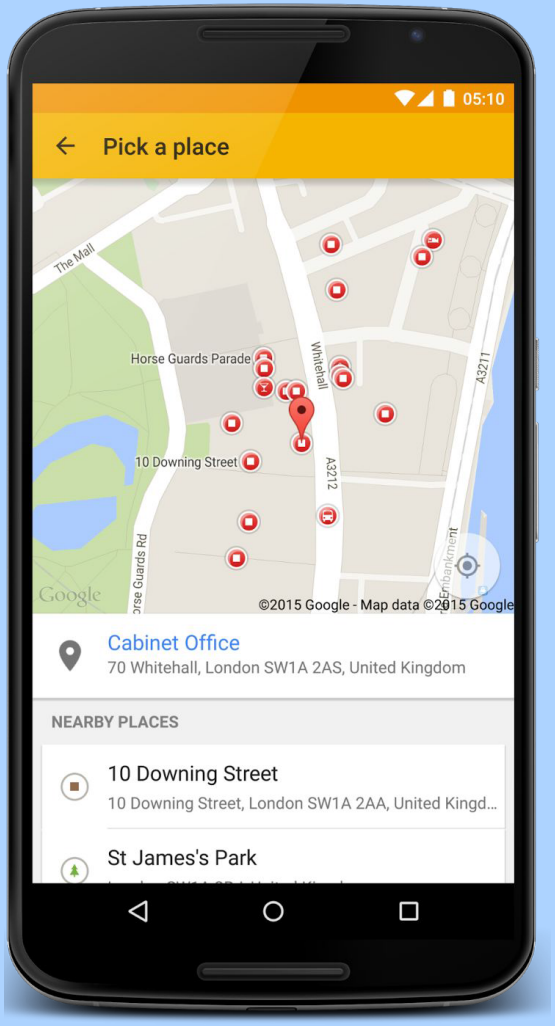
Lukasz K Bonenberg @LKBLab

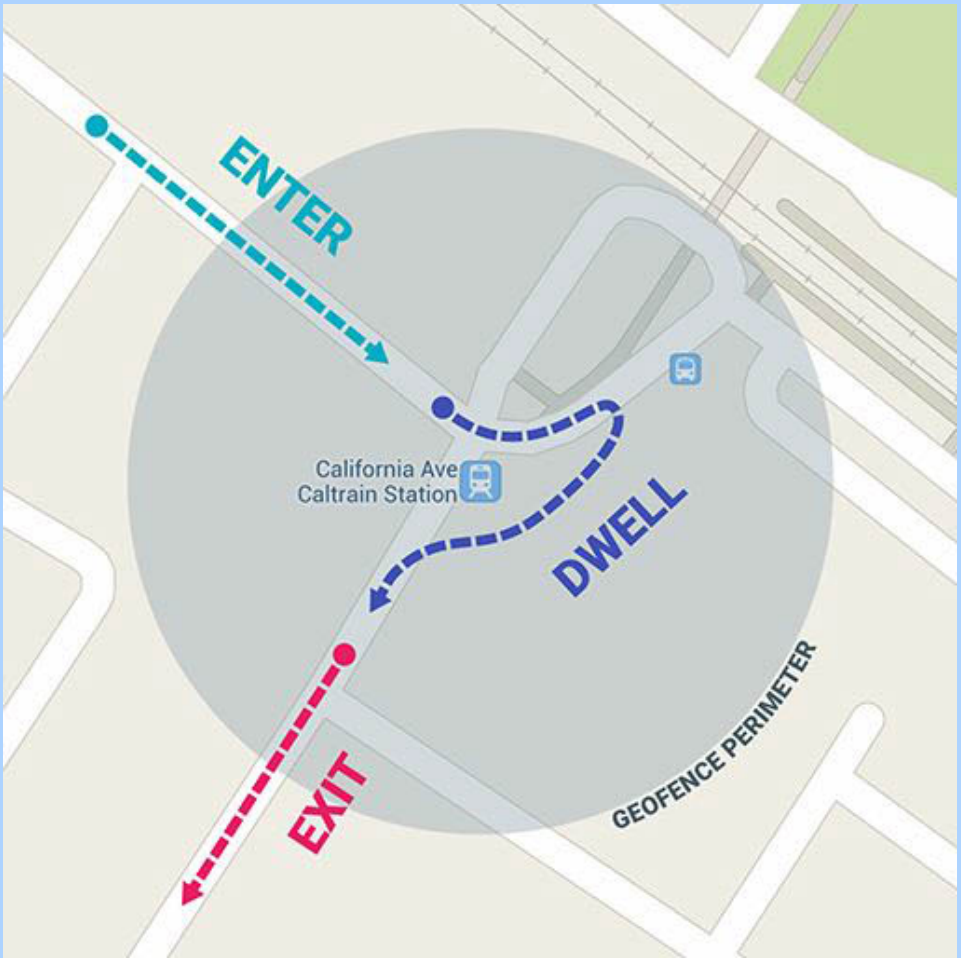
30th November 2017

Nottingham Geospatial Institute

How mobile device navigates?

Google Play Services (android.gsm.location)

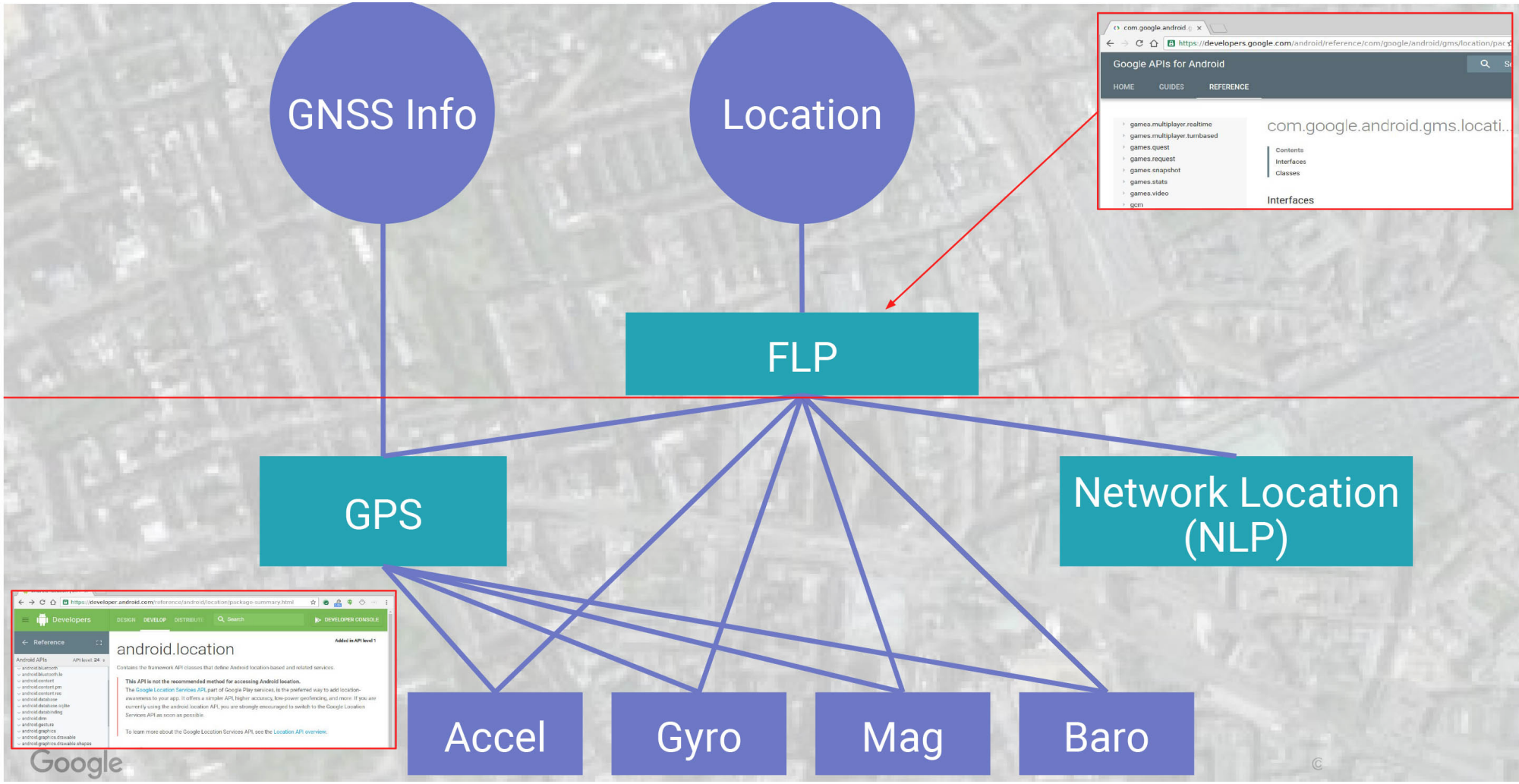




developers.google.com/awareness-location/

developer.android.com/guide/topics/location/strategies.html

Fused location provider



android.gsm.location vs android.location

Android Stack

Google Maps, Google Fit, GnssLogger

GOOGLE PLAY SERVICES

Places, Nearby
Activity Recognition,
Geofencing, FLP,

Sensors,
GNSS Raw Measurements

Abstraction to the physical Hardware

Physical Drivers

RAW GNSS Measurements are found here

GNSS, WiFi, BLE, and Sensor chips live down here

Google

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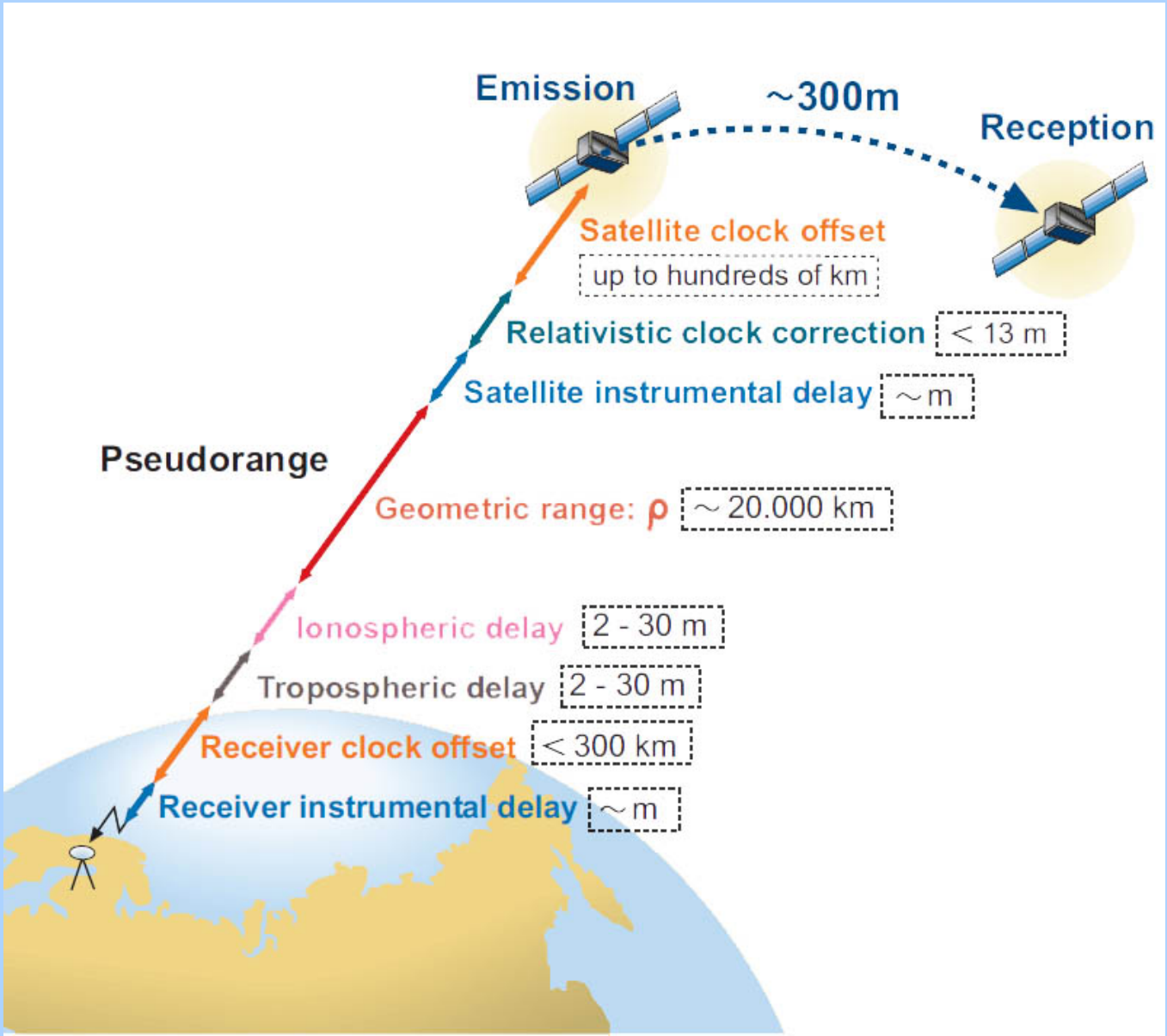
Can we improve accuracy?

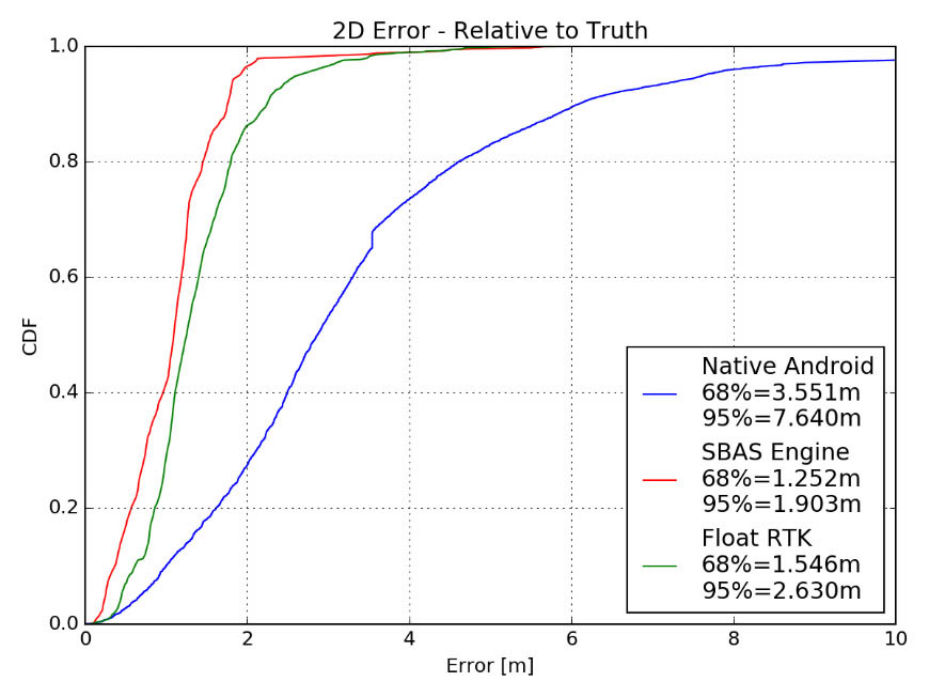
Linearly polarised antenna vs multipath

Courtesy of Ms Alina Wang

Differential solution



Android hardware performance



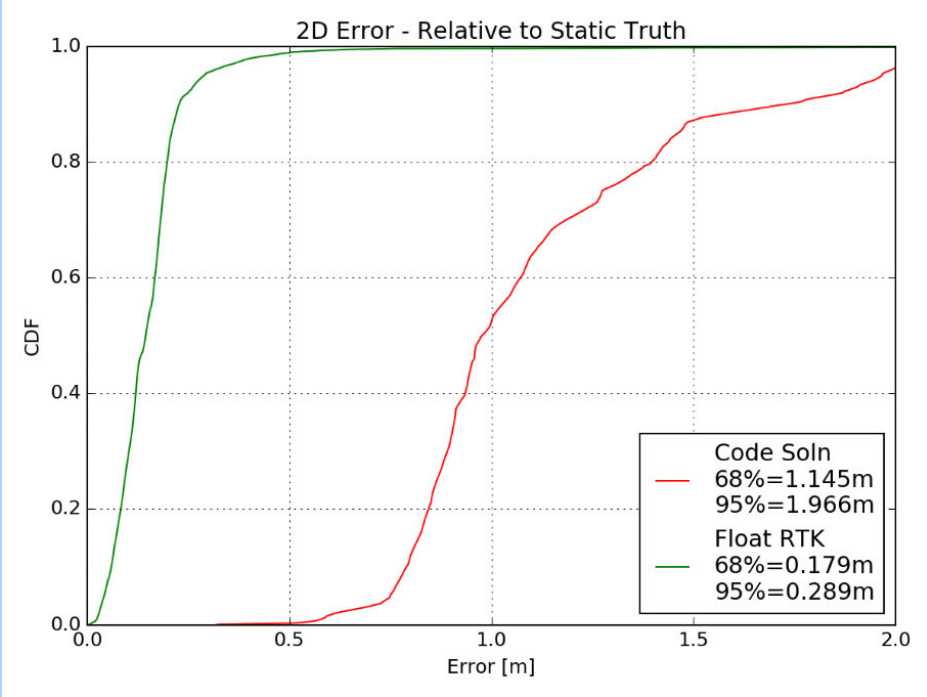


Figure 1: *Cumulative distribution function (CDF) for current (left) and upcoming dual-freq Android chpsets (right), both with mobile phone antenna equivalent.*

S. Riley et al (2017)

Localised corrections and API encapsulation

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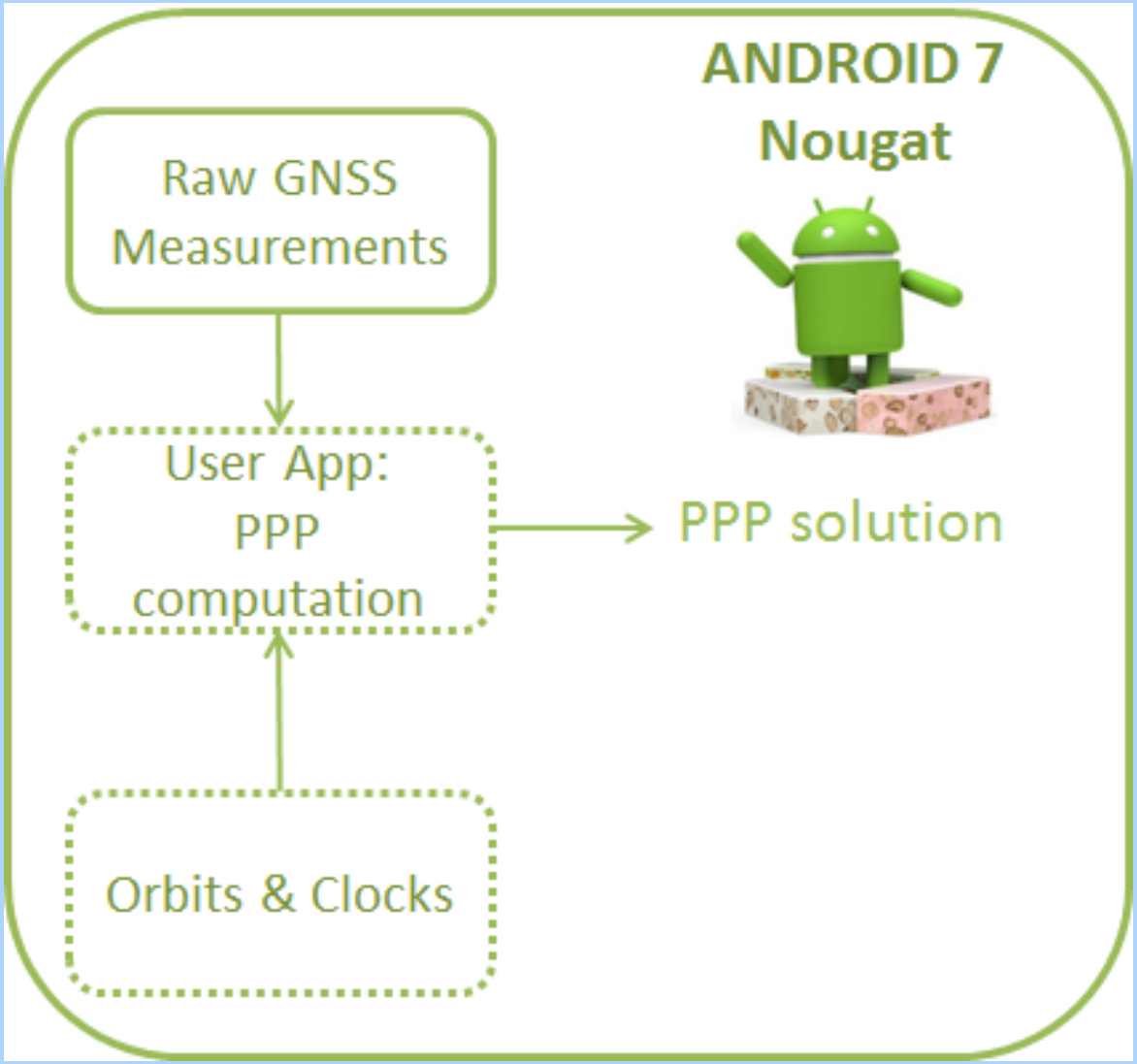
H2020-GALILEO-GSA-2017-1, FLAMINGO

Differential navigation provider

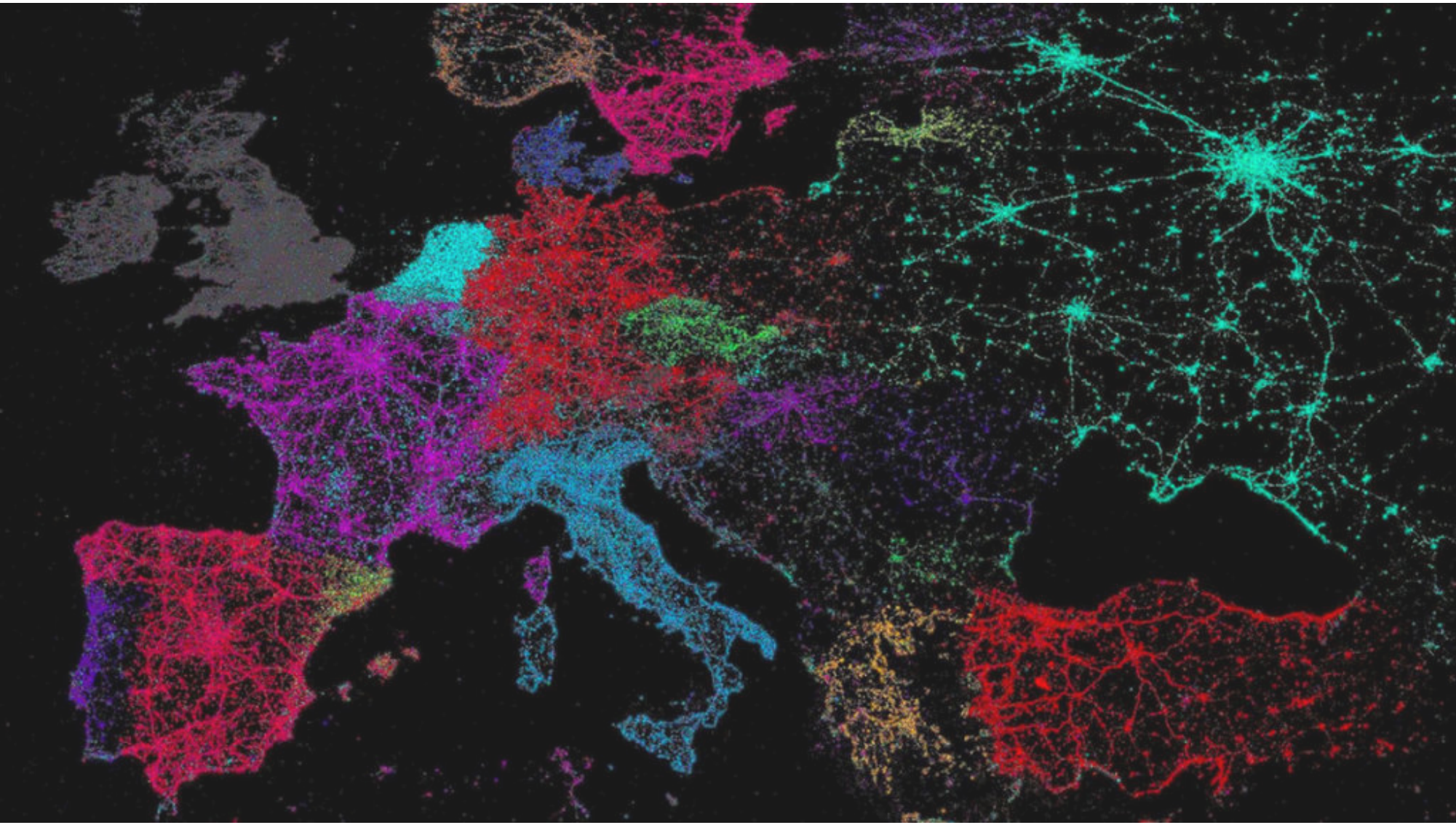


Courtesy of Moises Navarro-Gallardo

Is this all about accuracy?

Sensors everywhere

Interconnected



Atomic time in your pocket

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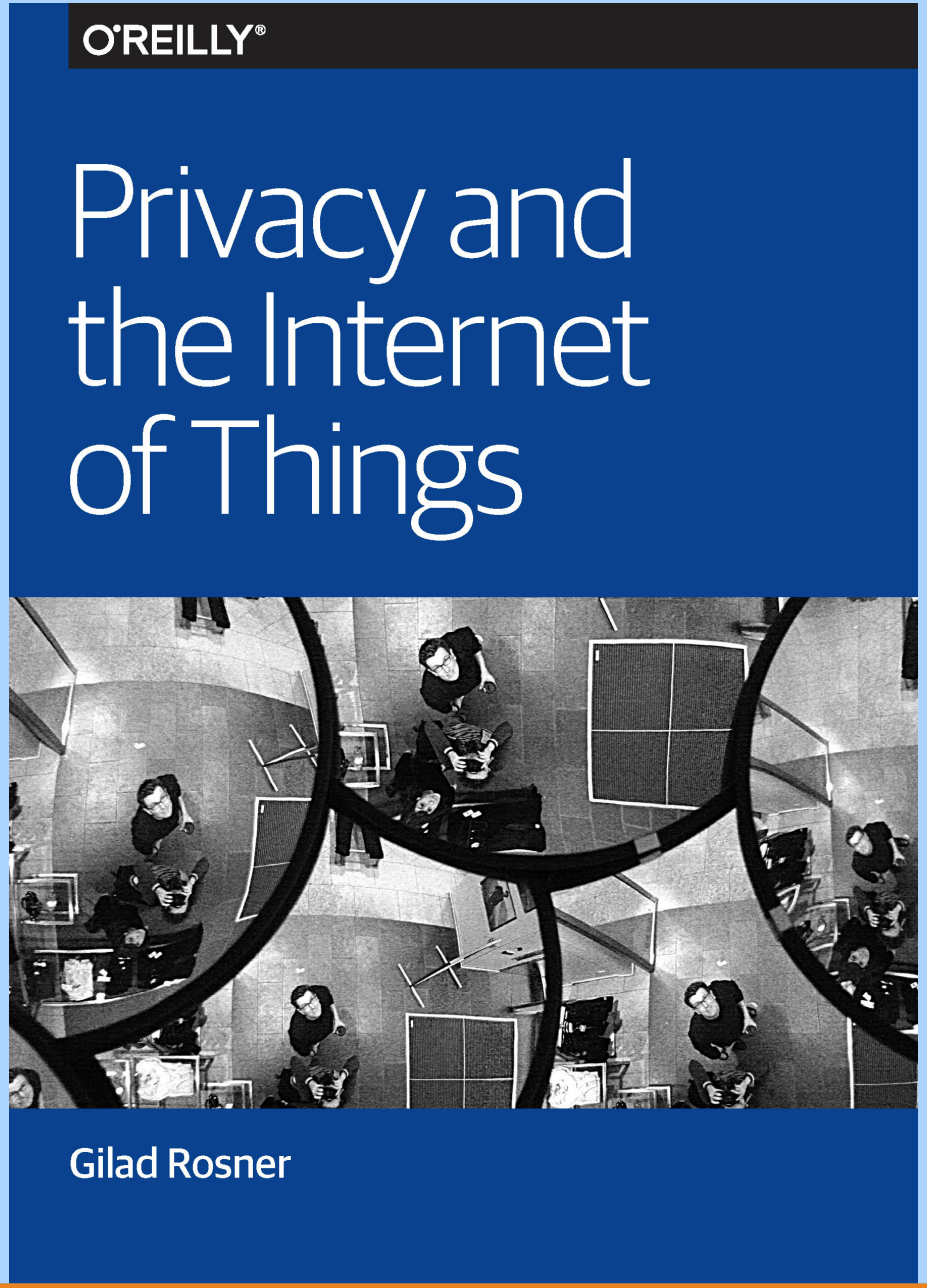
Do we always need best accuracy?



Outlook and Summary

What we discussed

1. How mobile device navigates?
2. Can we improve accuracy?
3. Is this all about accuracy?
4. Outlook and Summary

Take away

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- The raw measurements[1] can be used to improve integrity and confidence in our position[2].
- Differential corrections[3] can improve accuracy.
- For GNSS, position is not everything. Think outside of the box.
- Do we always need the most precise location? Think privacy.

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[1] For raw GNSS observations use *android.location* native library; for other sensors use *android.hardware*. Always check against chipset solution.

[2] Current hardware is not perfect, future dual frequency chip-sets and external antennas will be a large improvement.

[3] GNSS knowledge required as *android.gms.location* encapsulation is missing. We are addressing this in FLAMINGO H2020 project.

Knowledge is the key... Useful links

- Using GNSS raw measurements on Android devices (GSA white paper)
- GSA user report `http://bit.ly/2i36aRj`
- "Privacy and IoT" Gilad Rosner
- Google GNSS tools website `http://g.co/gnsstools`
- My introduction to calculating pseudoranges at `github.com/DfAC/AndroidGNSS`