OpenAGPS – Open Source GNSS Assistance1

Alexander Richards

-# whoami

- **My name is Alexander Richards**
  - On the internet, I normally go by electrode
- **I’m a university student**
  - I study mechatronics
- **Contributed to:**
  - Managarm
  - UBports

Agenda

- What OpenAGPS is
- How OpenAGPS came to be
- How GNSS systems work
- How GNSS assistance via SUPL works
- Why SUPL isn’t private and how to work around it
- How OpenAGPS works
- The current state of the OpenAGPS project

What OpenAGPS is

- **GNSS assistance data server**
  - Crowdsources GNSS data (among other sources)
- **Goals:**
  - Implement SUPL-compatible server for A-GPS use
  - Act as a data source for other projects or self-hosted SUPL servers

How OpenAGPS came to be

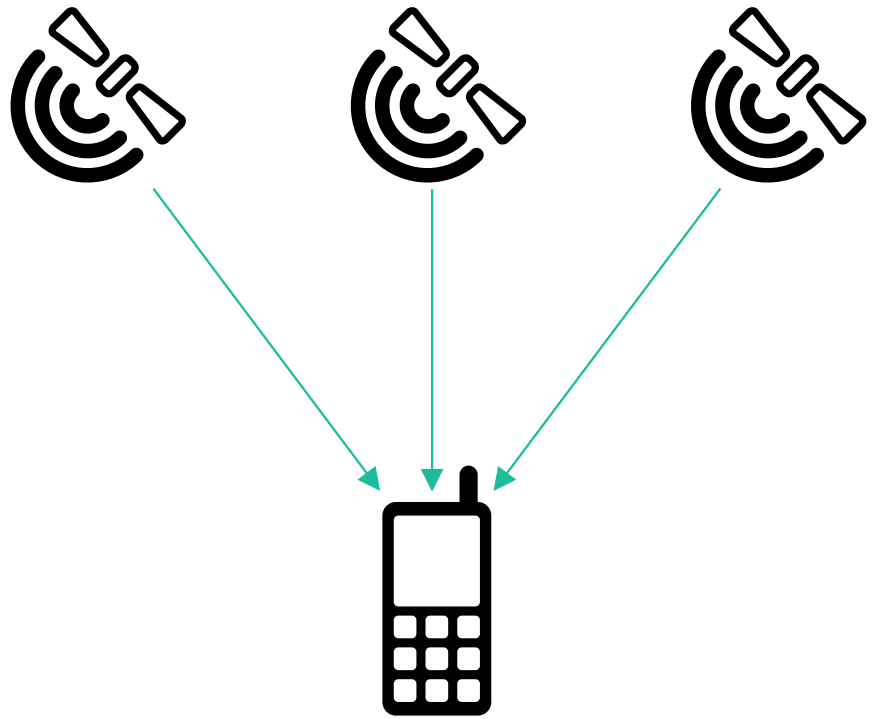
- **I switched to Ubuntu Touch a while ago**
- **I noticed GPS was slow…**
  - Many, many forum posts about A-GPS not being available for various different reasons
- **Issues for FOSS devices:**
  - Privacy
  - Potential licencing issues when using Googles' SUPL service
  - The fact that the main SUPL service in the West is from google
  - No FOSS server-side implementation exists

How GNSS Works

Skipping over a bunch of complicated stuff…

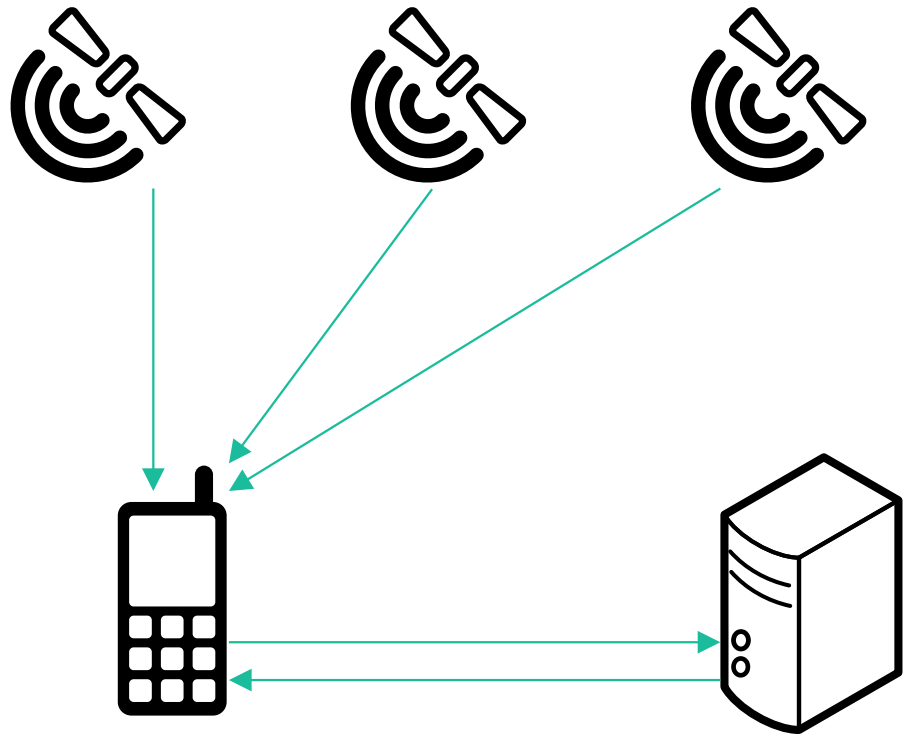
How GNSS Works

- **Each satellite is basically a very precise clock**
- **Position is calculated by time of flight**
- **Satellites send ephemeral and almanac data to receiver**
  - → This is super slow!
  - 25 bits/s for GPS CNAV



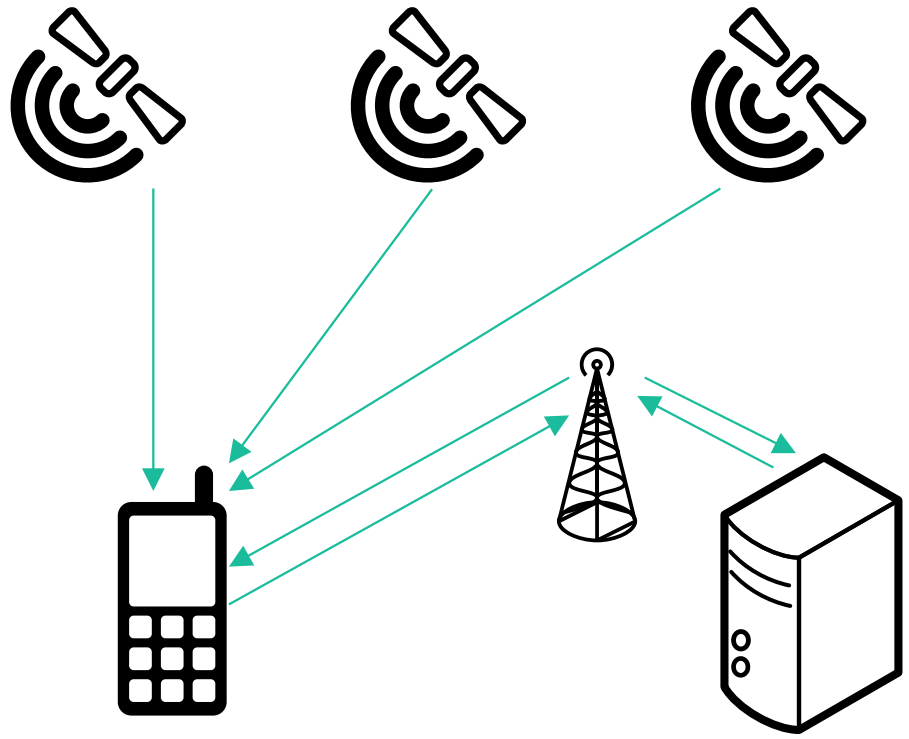
How GNSS Works (with assistance data)

- **Ephemeral and almanac data is downloaded from the Internet**
- **Standardised Protocol: → SUPL (Secure User Plane Location)**
- **Needs a approximate receiver position**



How GNSS Works (with assistance data)

- **Cell towers are used for positioning**
  - SUPL has cellular network heritage
- **Privacy issue #1: SUPL sends the receivers' IMSI number**
  - Which is uniquely identifiable to a specific SIM card



SUPL Privacy issues

- **It is not designed to be private**
  - In fact, it is specifically designed to *not* be private
  - IMSI number from the SIM card is often identifiable to a specific person
- **Most SUPL (or RRLP) connections are initiated by the handset, but “Network Initiated” connections are possible**
  - Used by emergency services, to get the position of a specific handset
- **Main SUPL provider for Android phones in the western world is also by Google**

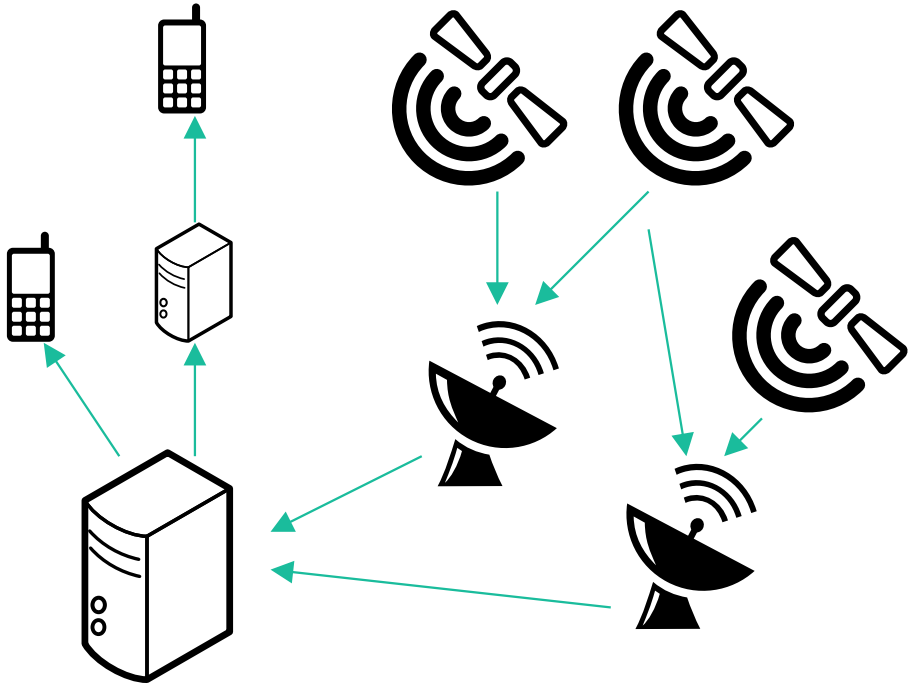
Working around un-private protocols

- **SUPL is here to stay**
  - Most (Android) GNSS receiver drivers support only it
  - Assistance requests are sometimes made directly by the chipset, and can’t even be seen by the running OS
  - Chipset firmware will always respond to SUPL requests by emergency services through the cellular network

- **Workaround: fully open source SUPL stack, with self hosting capability for the paranoid**

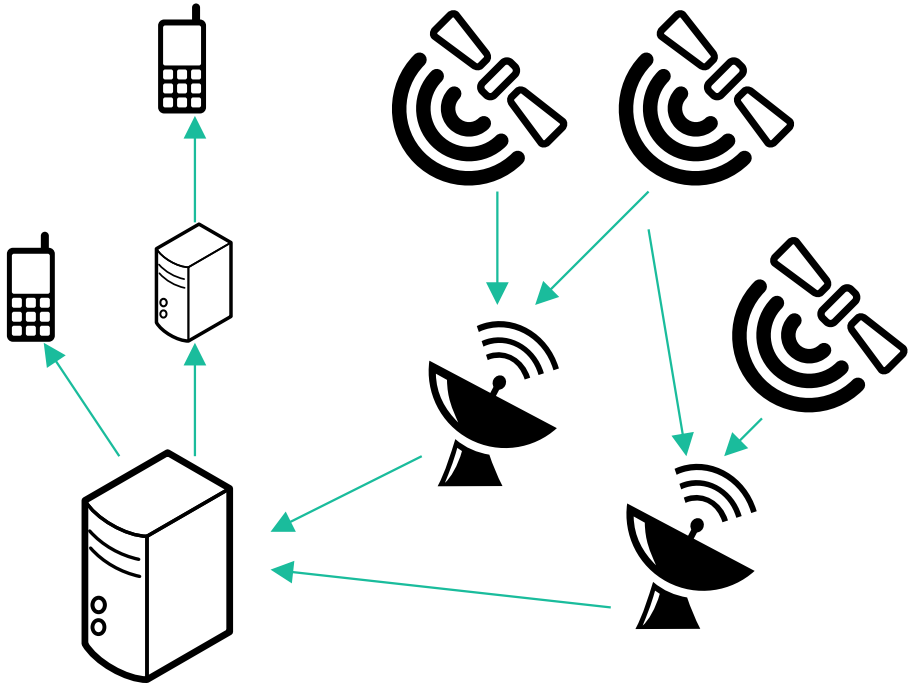
How OpenAGPS works

- **Satellite data is crowdsourced**
- **Data could also be collected/imported from other projects**
  - We are working with galmon.eu to try and achieve this
- **Basestations collect GNSS data**
- **Server handles requests**
  - or acts as data source for self hosted SUPL servers



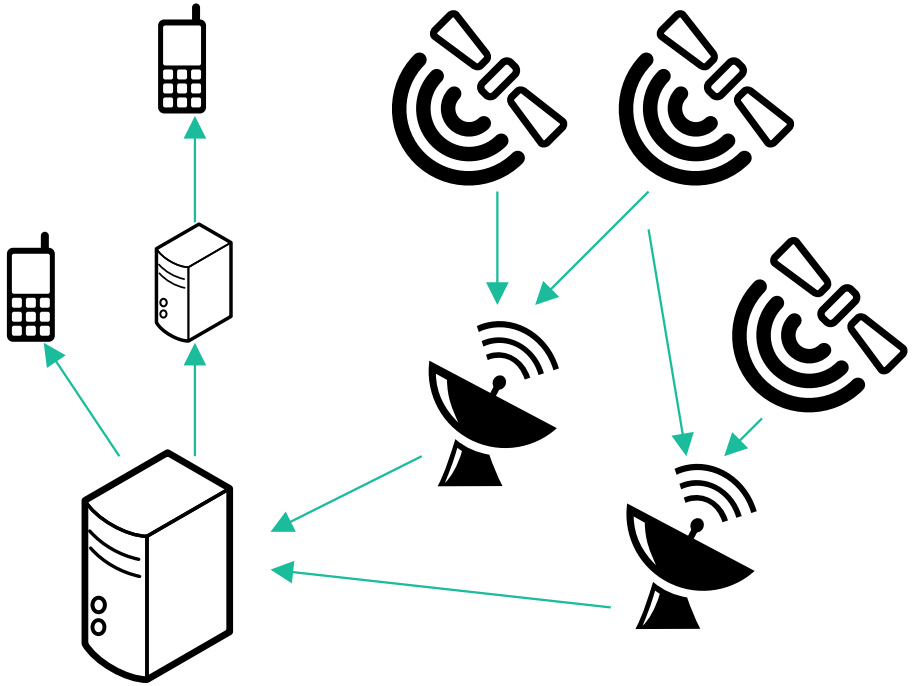
How OpenAGPS works

- **All of the server code we have written is stateless**
  - All basestation push requests are over HTTPS
  - Makes scaling/containerizing things easier
  - Would allow, in theory, services handling SUPL to be diskless



How OpenAGPS works

- **We still have not fully settled on what services to use, but:**
  - We are currently working with MariaDB
  - Server backend (currently called Porygon) written in Python
  - Basestation code written in C++



Where things stand right now

- **Basestation code is basically complete**
  - ESP32-C3 + Ublox
  - Designed to be as cheap as possible, basically

Where things stand right now

- **Work on backend has begun**
  - Backend will include the SUPL server and GNSS collection server
- **Originally, we hoped to have a very basic SUPL server ready for a demo here…**
  - We were a bit *too* optimistic on the timeline
  - Getting slightly sidetracked a few too many times (and uni) didn’t help

Demo Time!

We still have a demo though!

(just not as impressive of one as we hoped)

Thanks for listening!

- **Supported by:**

Thanks for listening!

- **Website at https://openagps.net**
- **Sourcecode at https://gitlab.com/openagps**
- **Contact me at:**
  - Matrix: @electrode:matrix.org
  - Discord: electrorb
  - E-Mail: electrodeyt@gmail.com