

LoRaWAN Coverage Mapping

Workshop on LPWAN Solutions for the Internet of Things
February 17-21 Makerere University, Kampala, Uganda
Sebastian Büttrich (IT University of Copenhagen / NSRC)

This talk

- Why do we do mapping
- Devices for mapping
- Overview of (some) methods of mapping
 - TTNMapper
 - Custom built mapper software
- Links to documentation

Important: Gateway locations

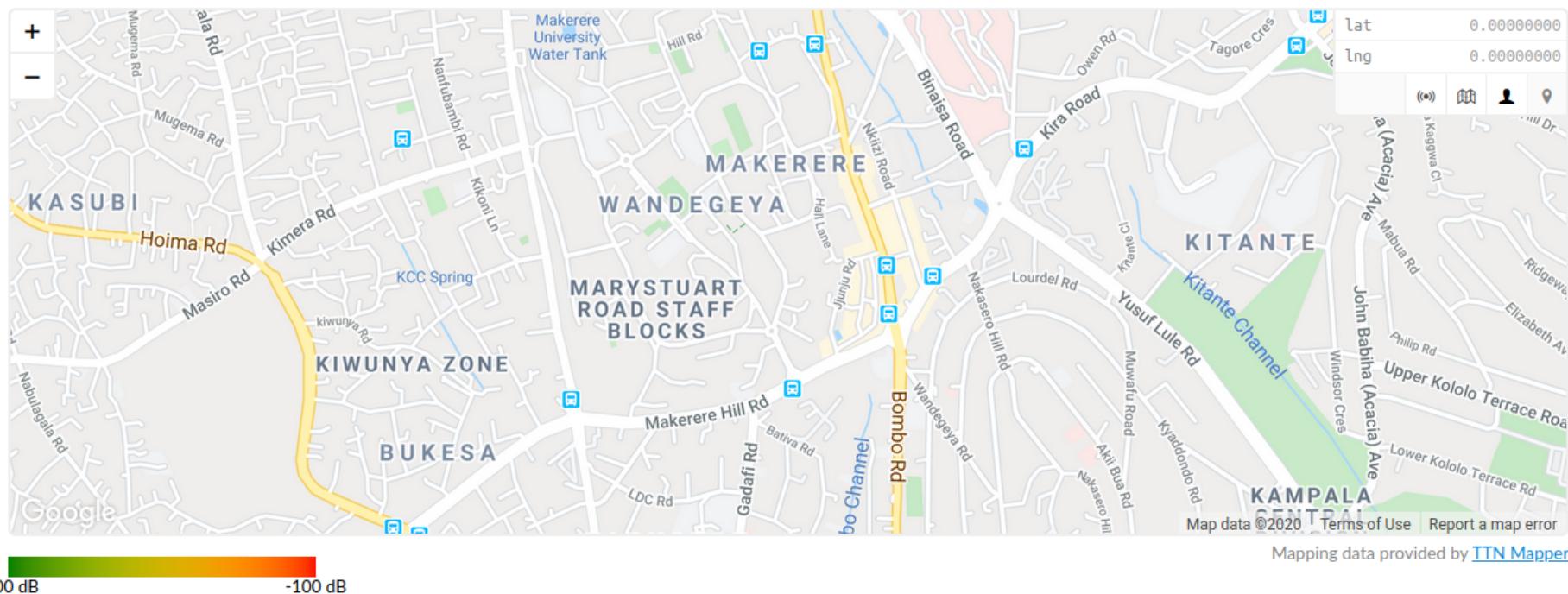
- Mapping is only as good as gateway locations!
- So make sure you set your location correctly!

Important: Gateway locations

Gateways > eui-60c5a8ffe7662d0

Antenna Placement ?

Altitude ?



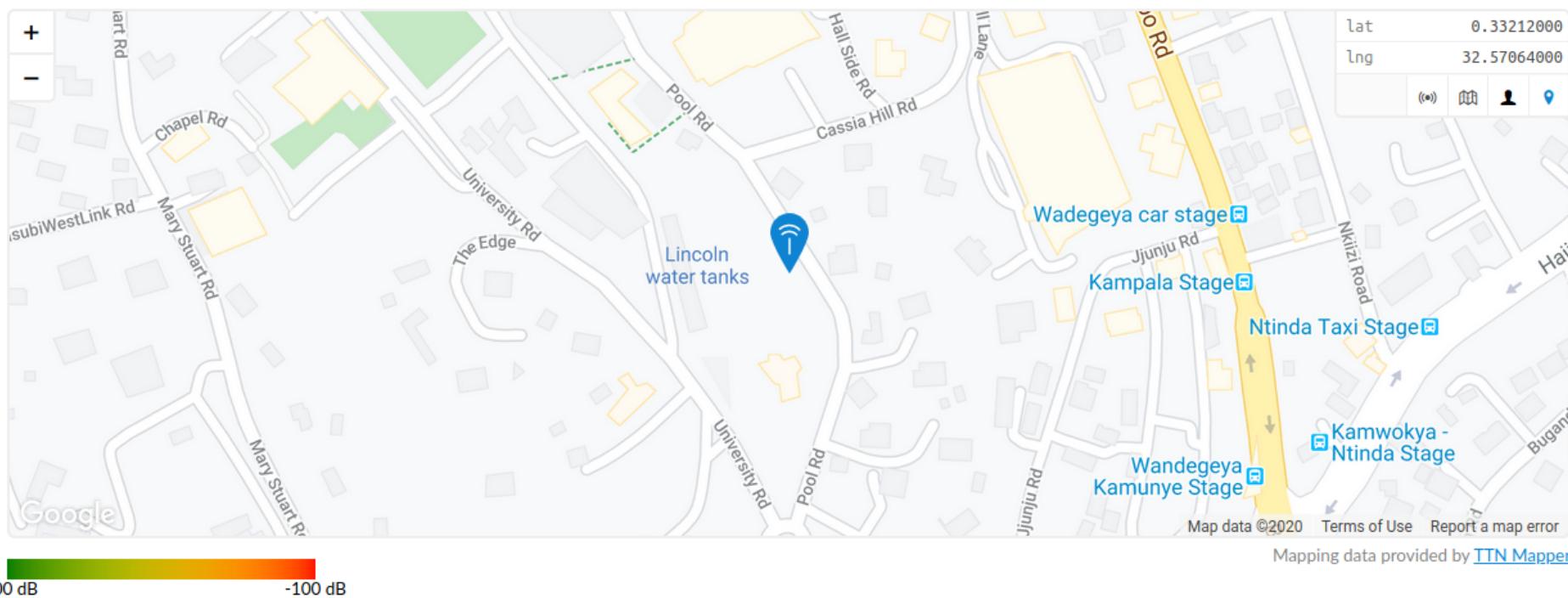
Important: Gateway locations

LOCATION

 edit location

Antenna Placement outdoor

Altitude 30m



Motivation

- Visualize coverage
- Put numbers on it – how good is the coverage?
RSSI, margins, SNR, ...
- Decide where more coverage is needed
- Map sensor readings, environmental data,
assets, ...

Devices for mapping

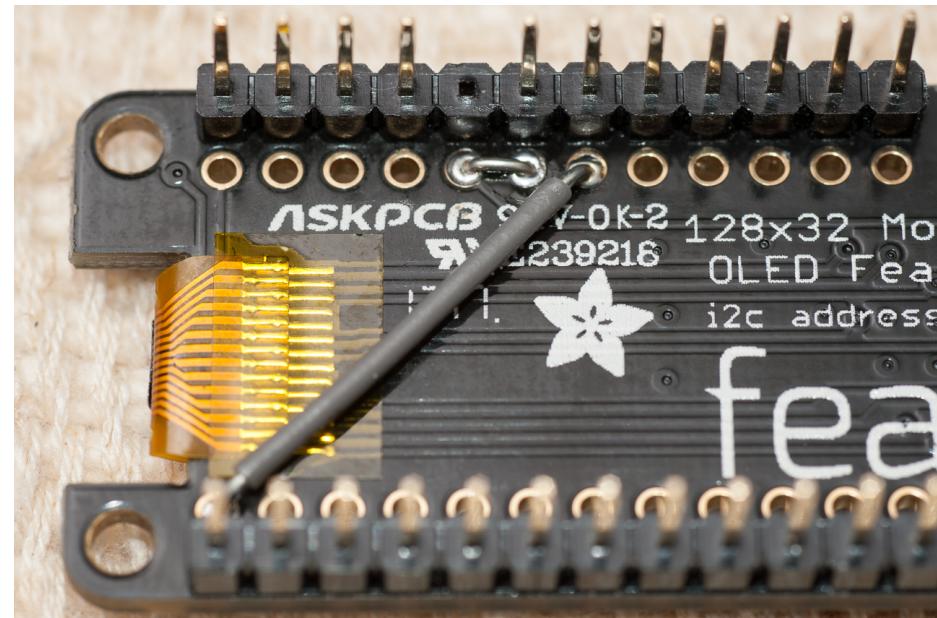
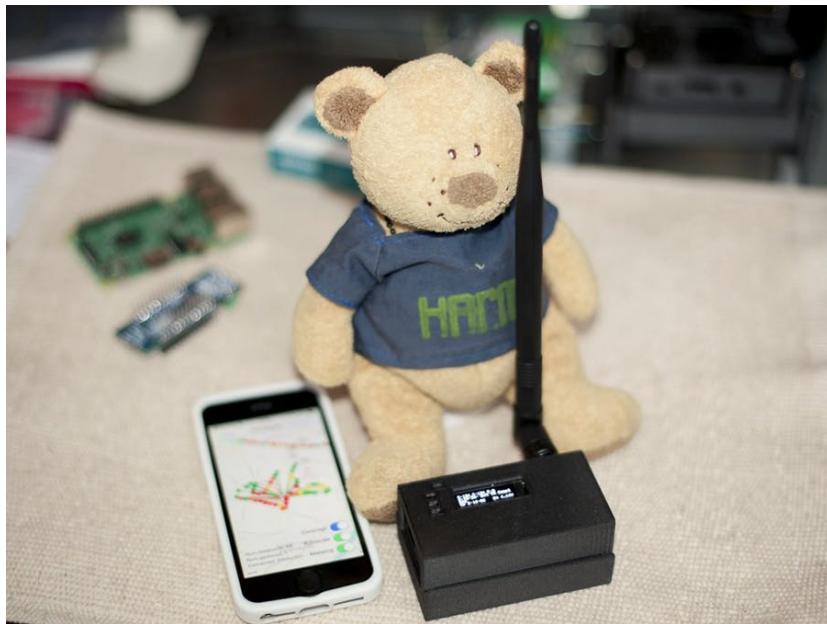
- Any LoRaWAN device that knows its location (latitude, longitude)
- If device has no location info, you may use mobile phone (--> TTNMapper App)
- Specialized mapping devices, e.g. field tester

Devices for mapping: Custom built

- For example with pycom boards, or one of the many Arduino-type boards, such as Adafruit Feather, TTGO, Heltec, and many many more

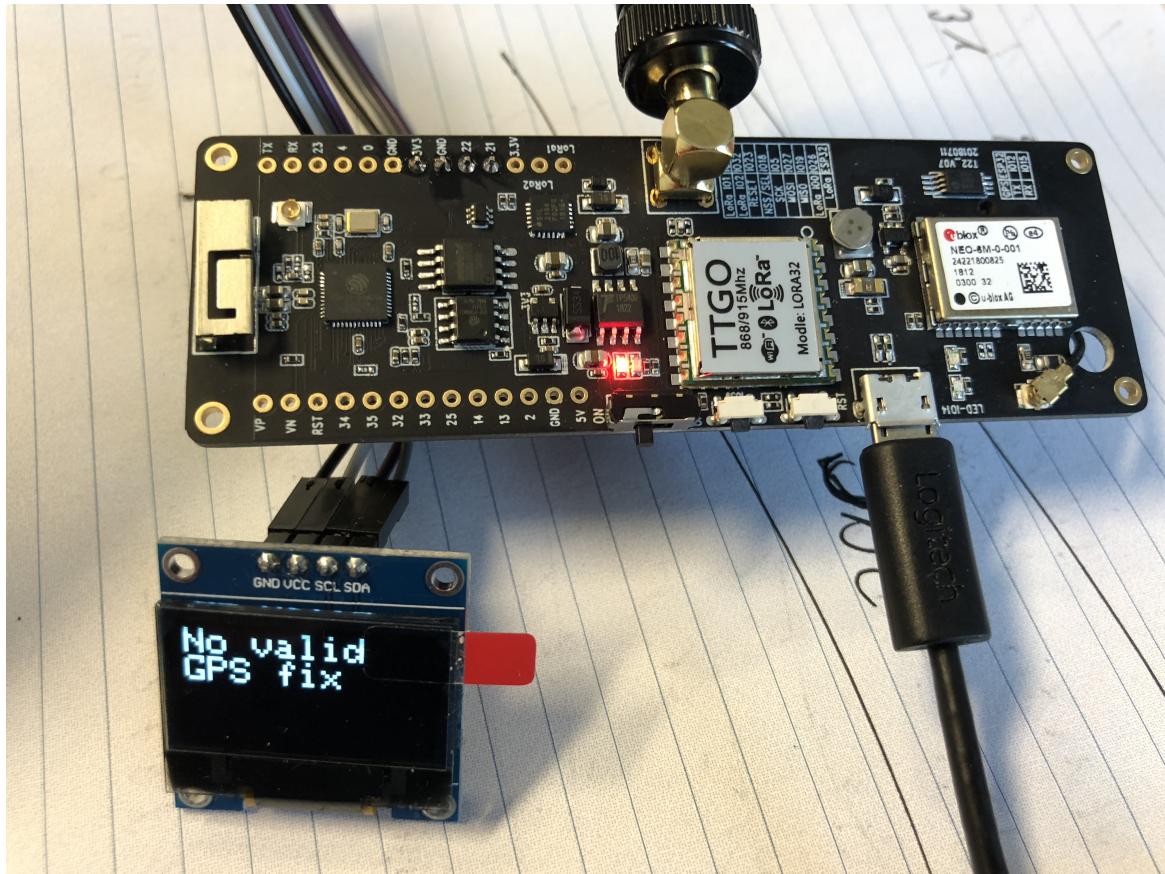
Devices for mapping: Custom built

- Adafruit Feather



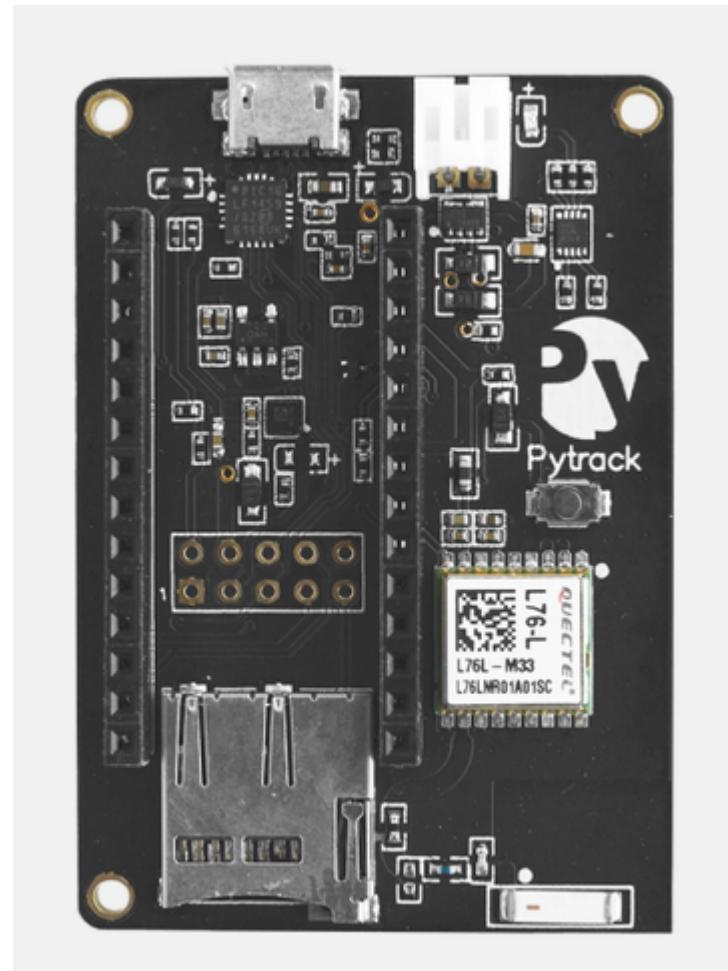
Devices for mapping: Custom built

- TTGO



Devices for mapping: Custom built

- Pycom
pytrack
+
LoPy



Devices for mapping

- Adeunis Field Tester



Devices for mapping

- RAK Tracker



Summary - Devices for mapping

- If it can send location, you can use it for mapping!
- Many choices!

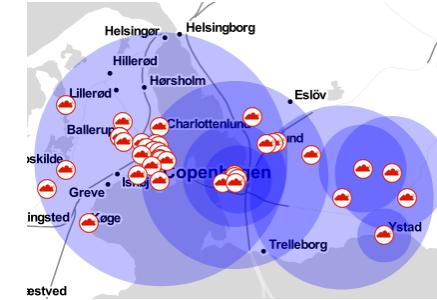
Software: Some Methods

- Using TTNMapper for The Things Network
- Using Grafana for mapping
- Using Leaflet maps
- Writing your own
- Using IoT platforms

There's more, of course.

TTNMapper

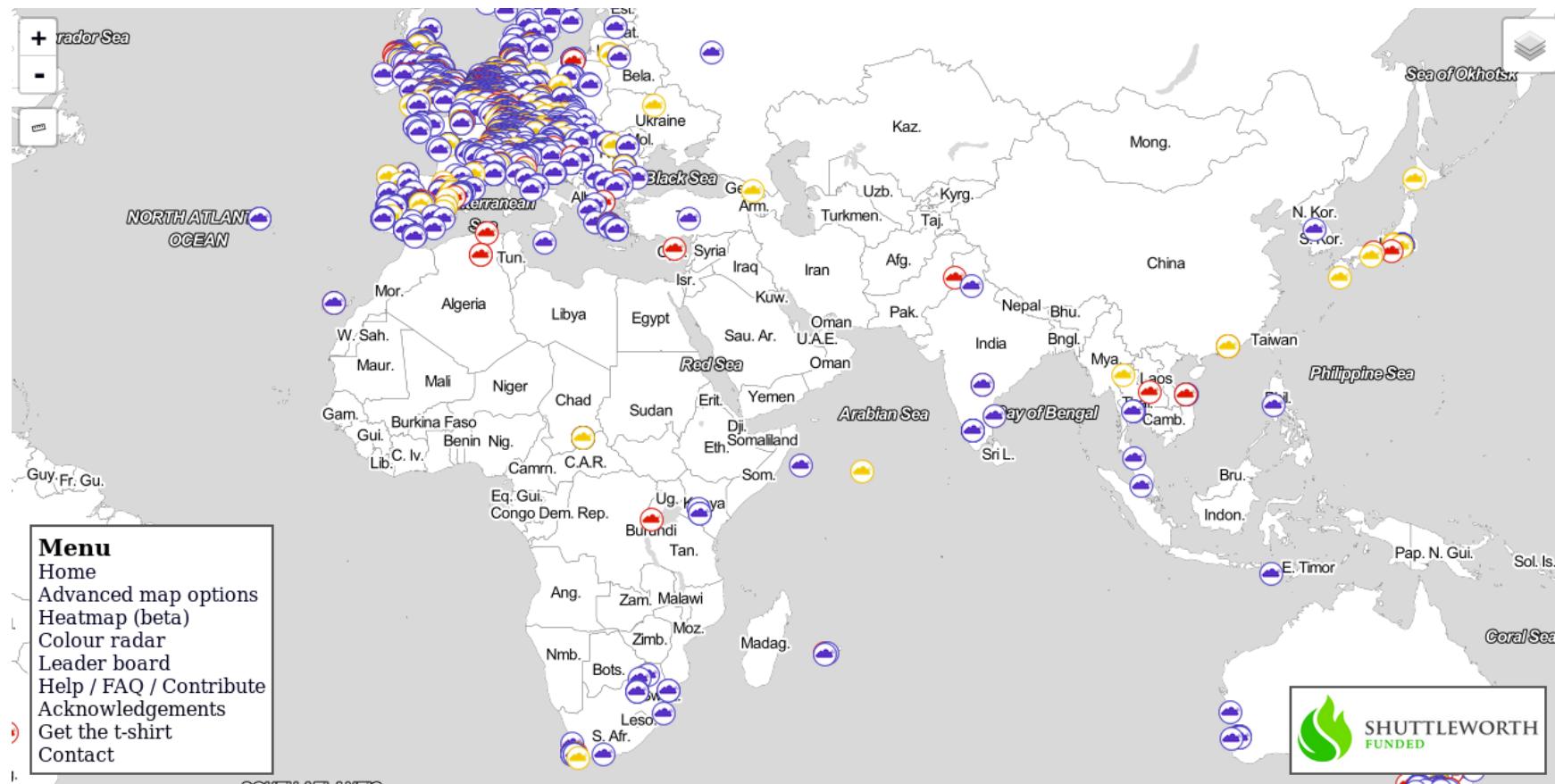
- A free service connected to The Things Network
- Creates a global map of TTN network
- Advantages: Easy to use, available as integration
- Disadvantages:
 - Not always very reliable
 - Needs active mapping
- <https://ttnmapper.org>



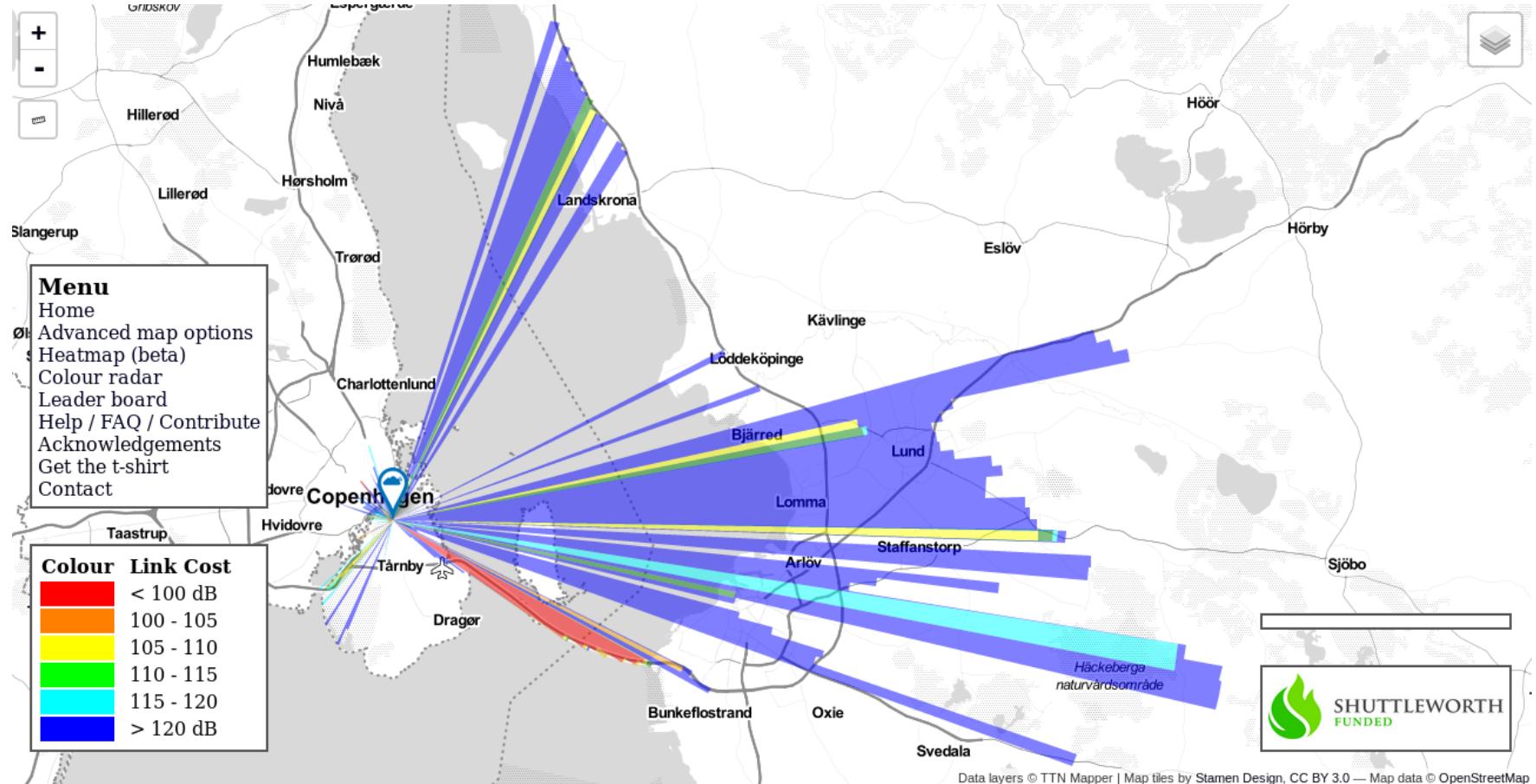
TTNMapper - how does it work?

- TTNMapper receives device's packet
- Combines with data from the TTN backend, such as Gateway metadata, location, etc
- Stores in TTNMapper database
- Separates between permanent global map and temporary experiments
- Use with GPS-enabled devices or with mobile app
(choosing device to follow, but adding GPS from mobile phone)

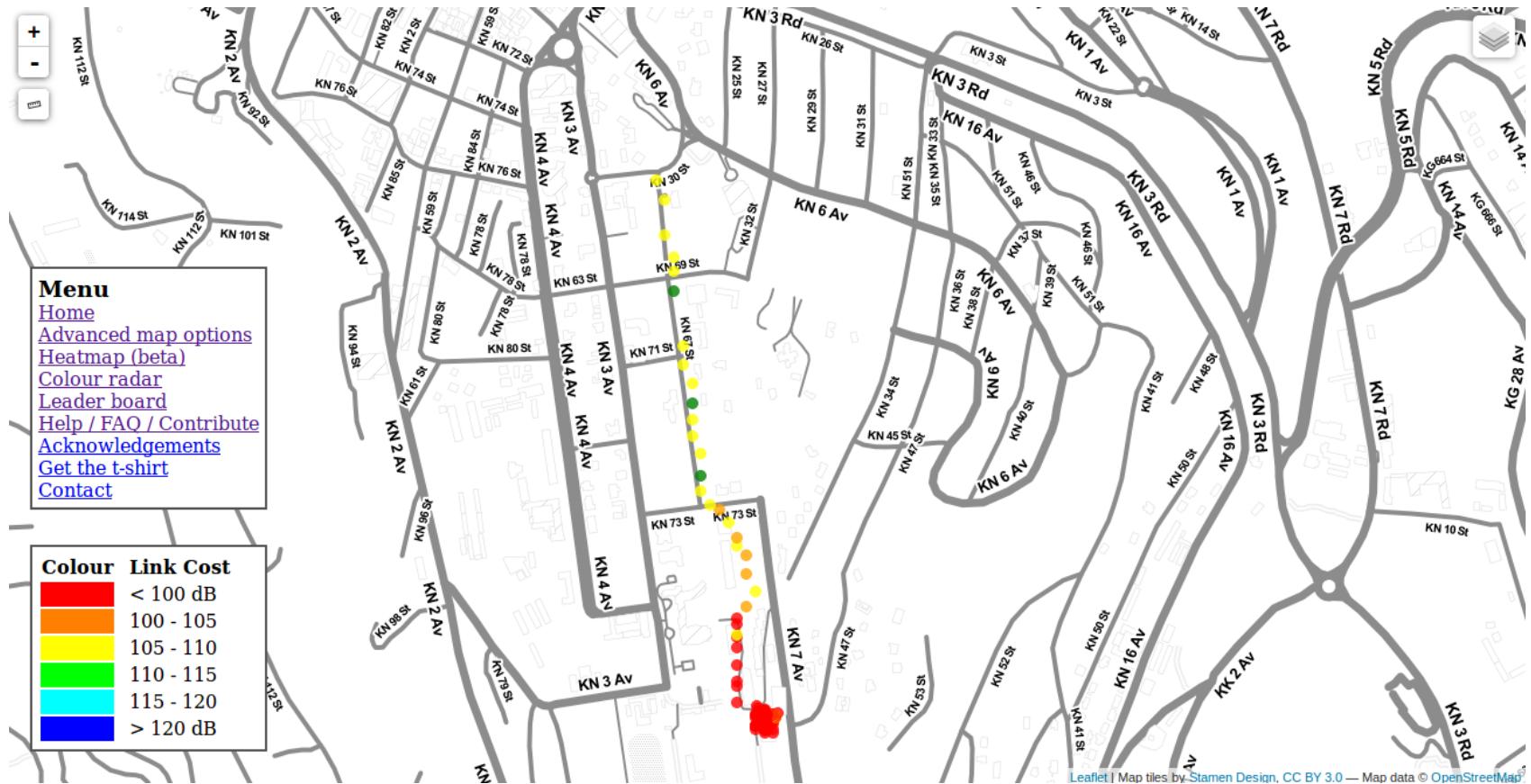
TTNmapper examples

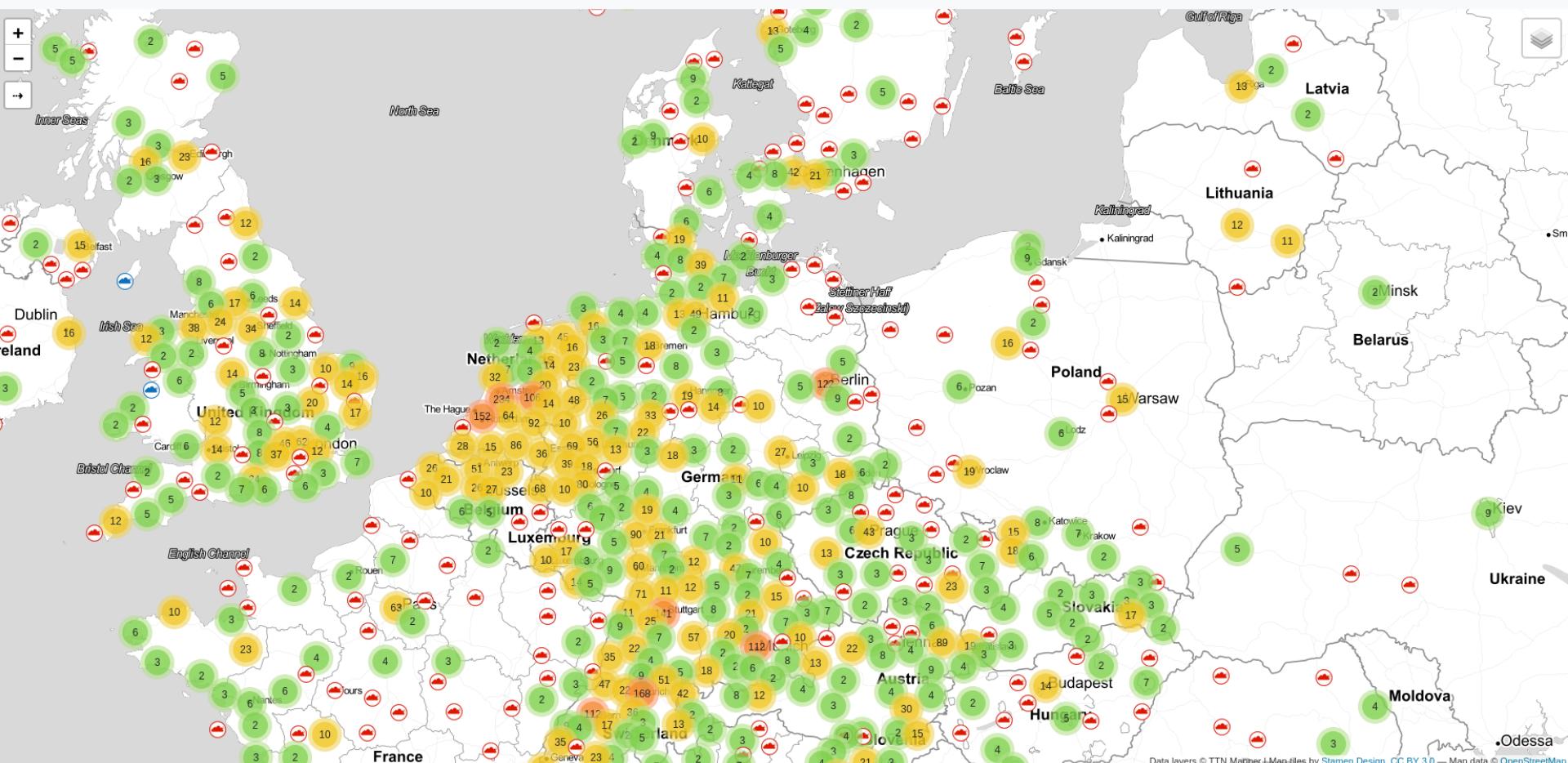


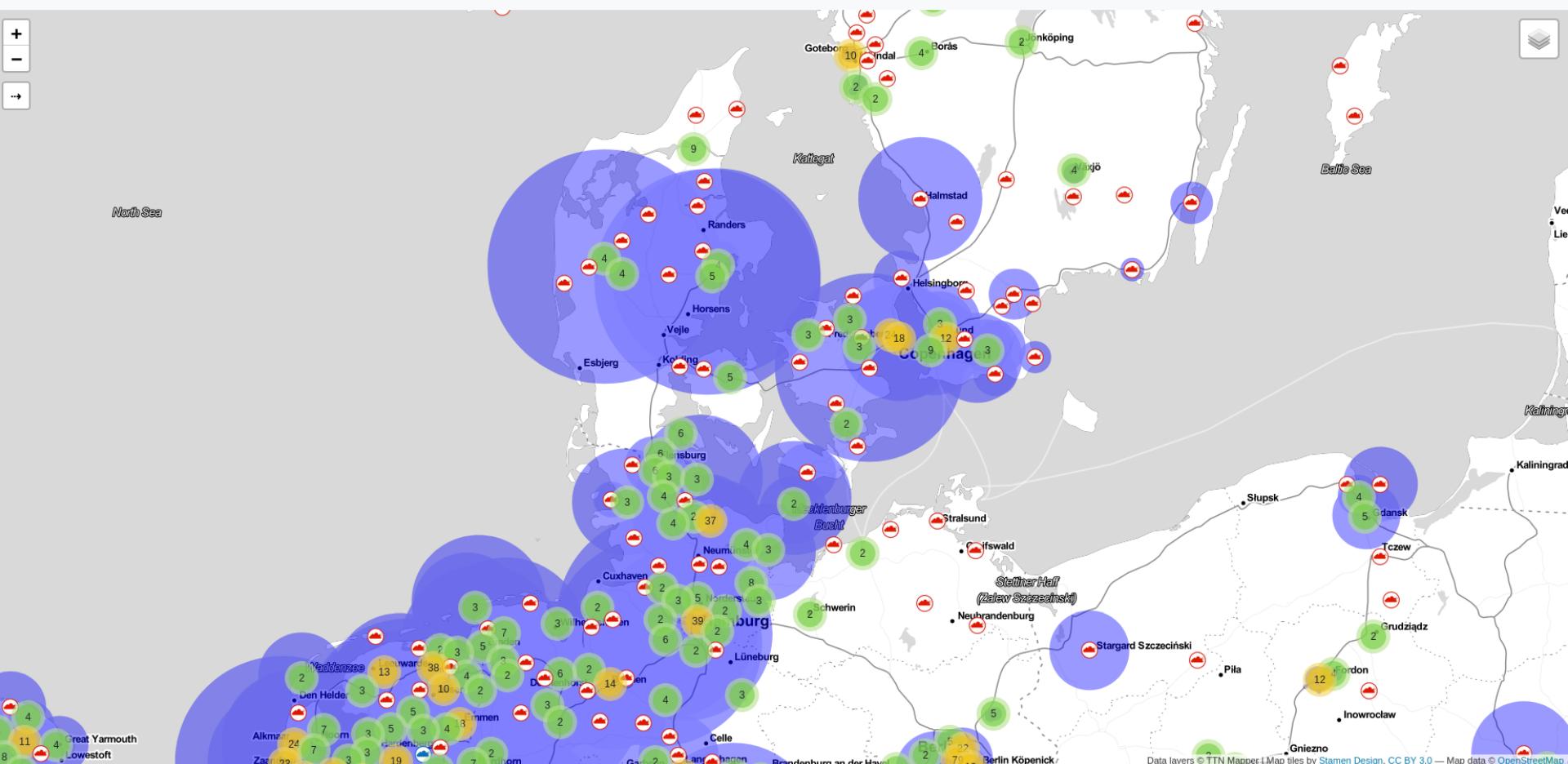
TTNmapper examples

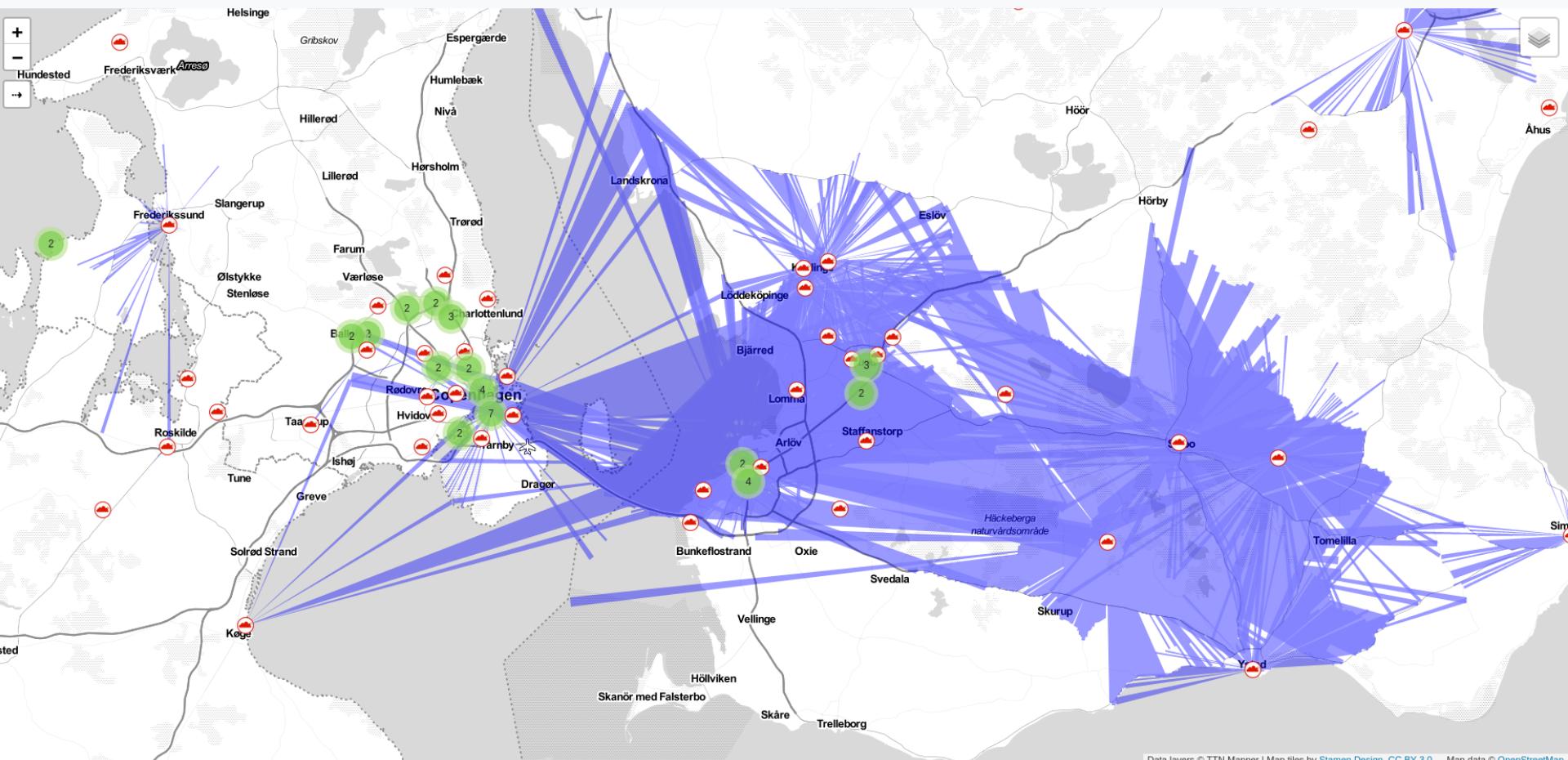


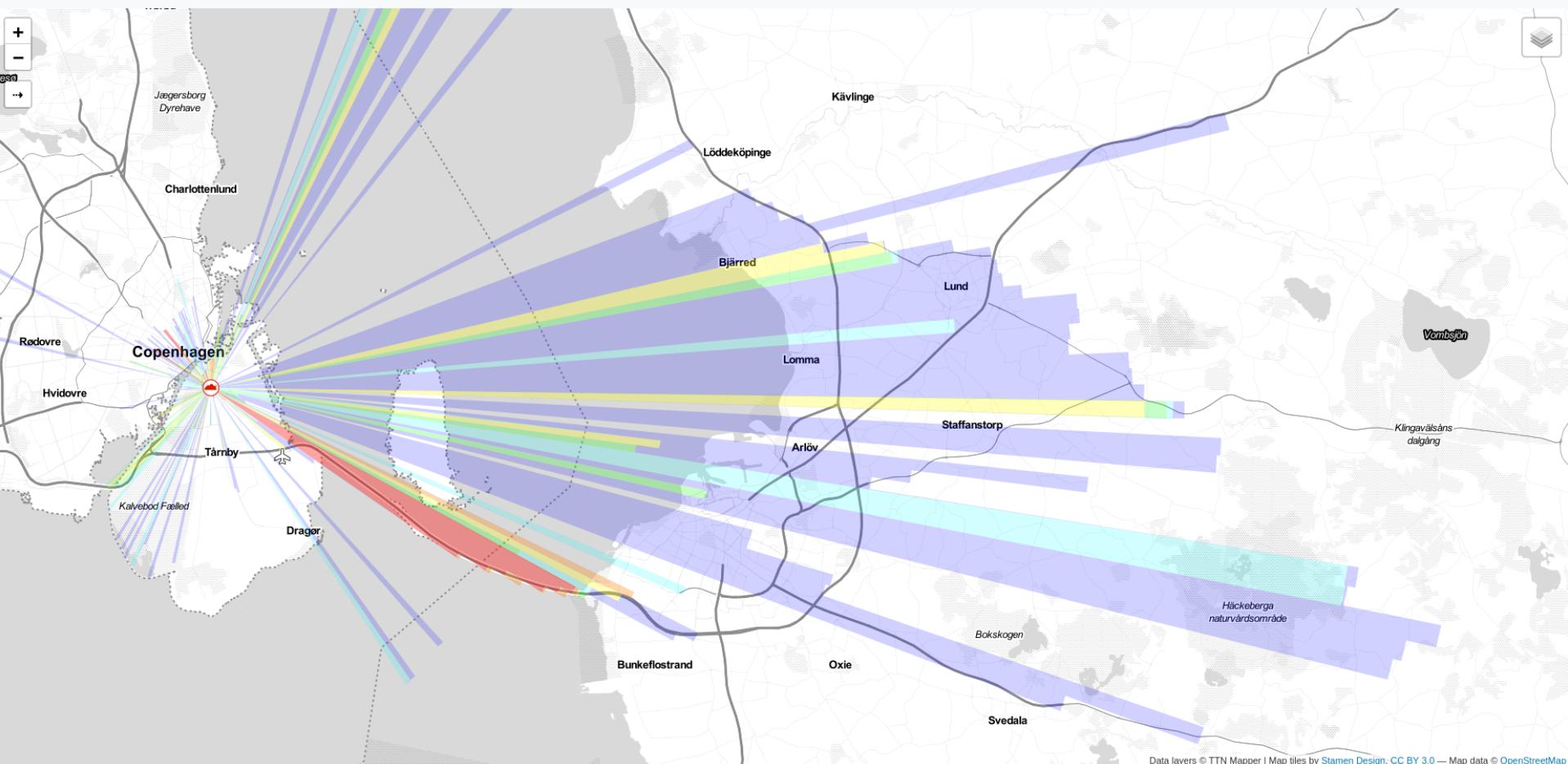
TTNmapper examples

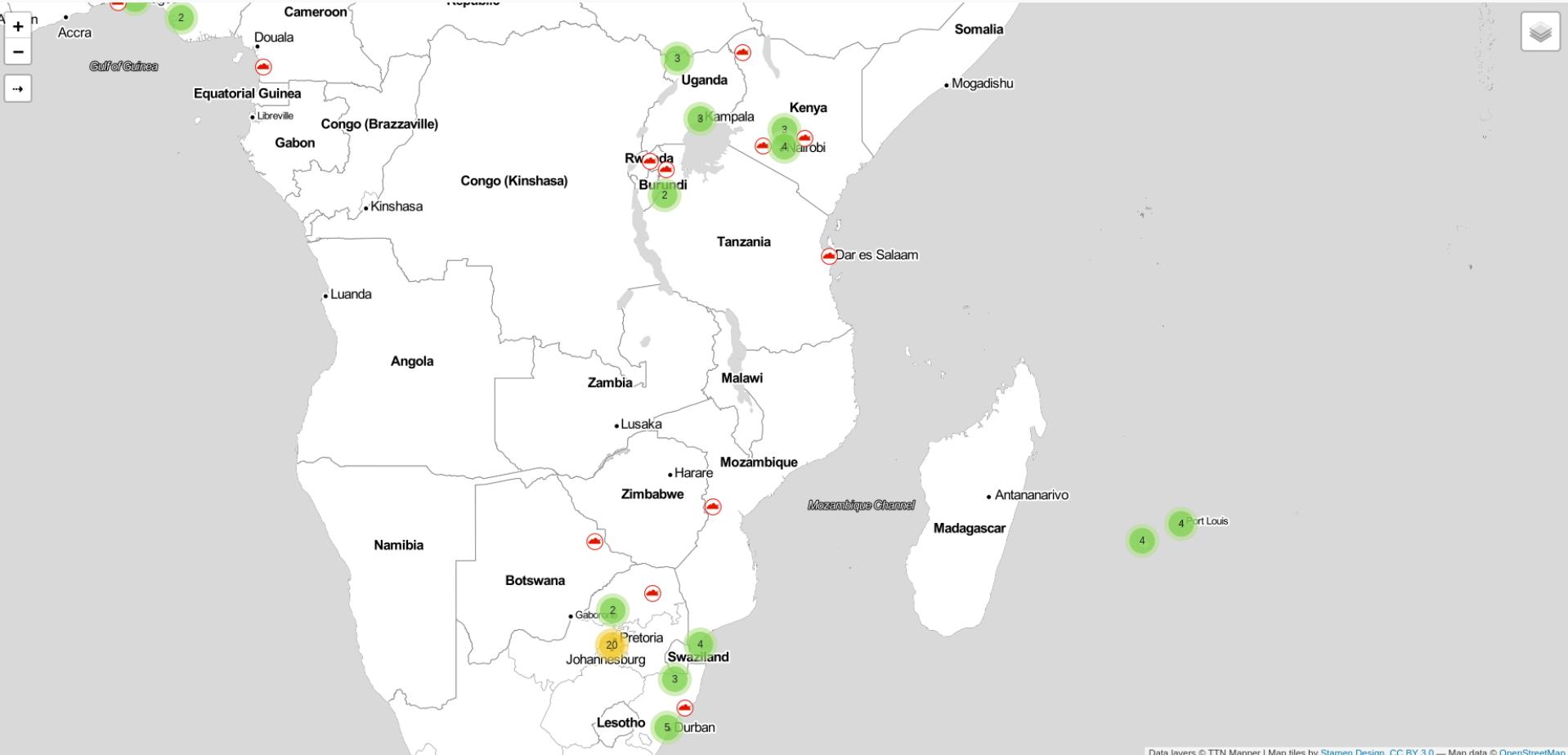












Data layers © TTN Mapper | Map tiles by Stamen Design, CC BY 3.0 — Map data © OpenStreetMap

TTNMapper Mobile App

- LoRa messages from device,
GPS from phone



08:24

Experiment name
The name under which this experiment will be saved on ttnmapper.org

Custom server
When selected also uploads data to your own server using an HTTP POST

Custom server address
The URL of the API endpoint where you want to POST data to. This has to be HTTPS.

Linked device

Application ID
The ID of the application. This is also the MQTT username.

Application Key
The Access Key of the application. This is also the MQTT password. ex: ttn-account-v2.a...

Device ID
The ID of the device you are mapping with.

MQTT URL
The MQTT URL of the TTN message broker. ex: eu.thethings.network:1883

Log in to TTN and choose a device

[Settings](#) [Map](#) [Stats](#)

Building your own mapping

- Using Grafana for mapping
- Using Leaflet maps
- Writing your own

Grafana

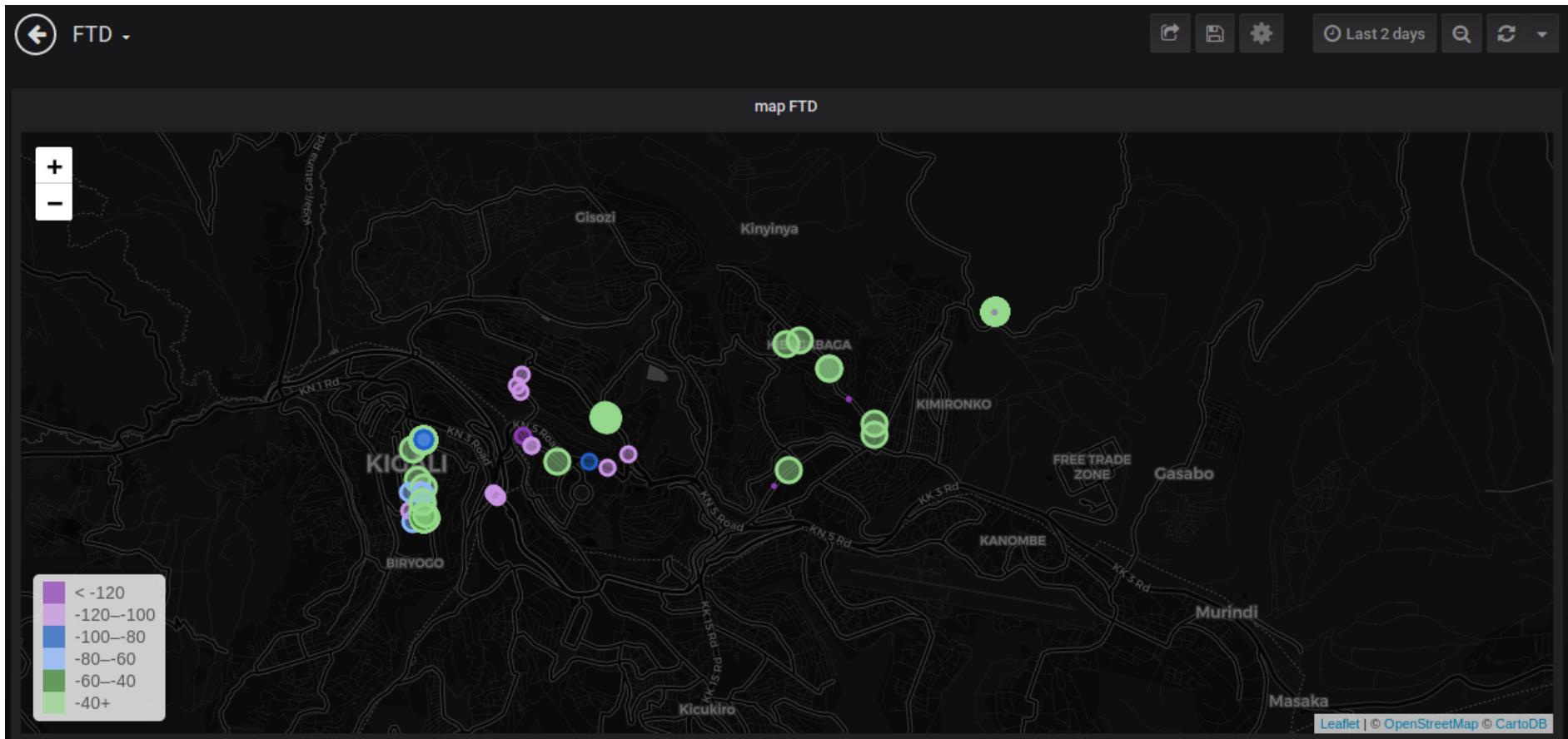
- Open source data visualization and analysis



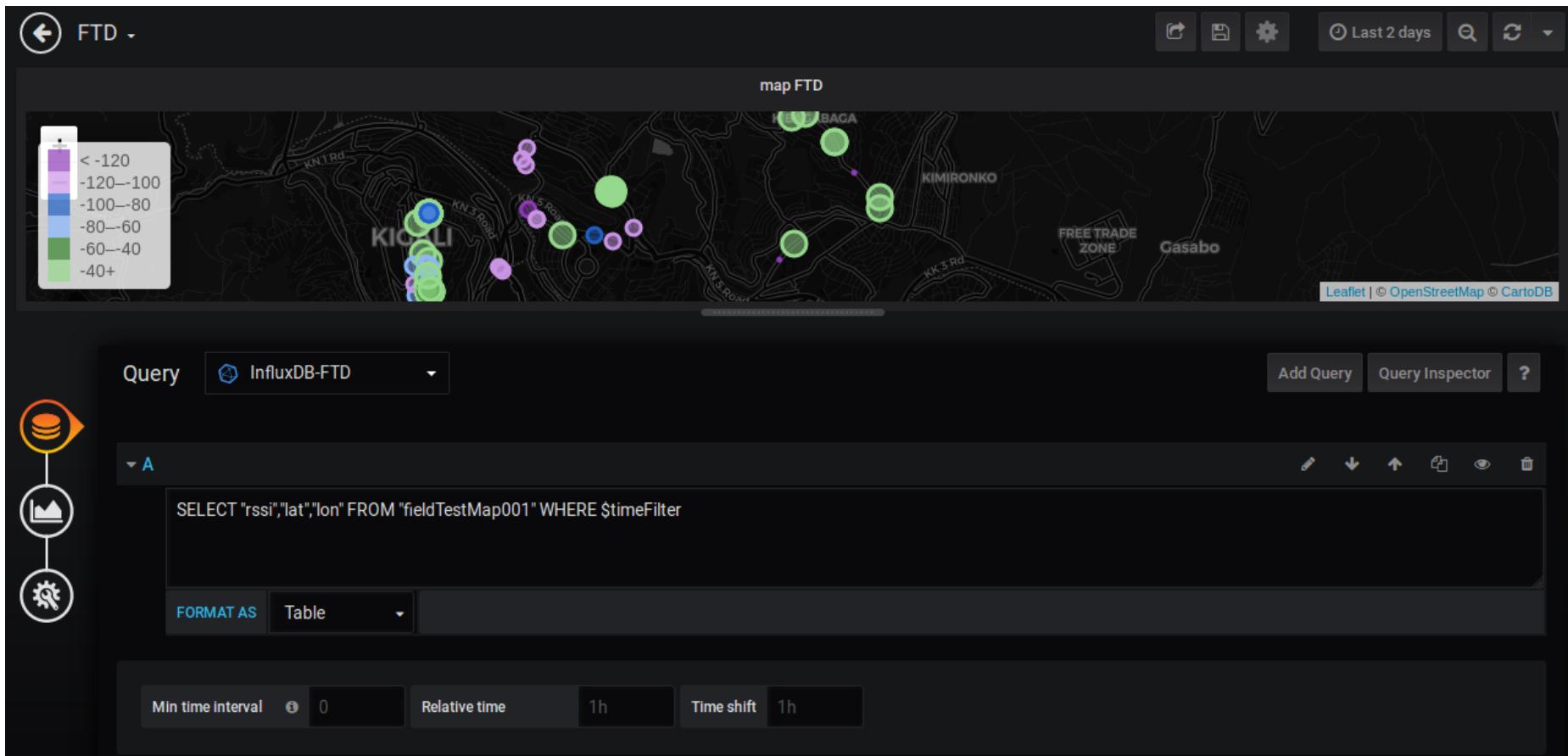
Grafana

- Using plugin *Worldmap panel*
- Can map any type of data source, as long as it provides latitude/longitude or geohash
- Advantages: Strong integration, many data sources, connection to additional data
- Disadvantages: limited to what is preconfigured
- More: <https://grafana.com/plugins/grafana-worldmap-panel>
- <https://github.com/MartinKemper/LoRaWAN-Mapper>

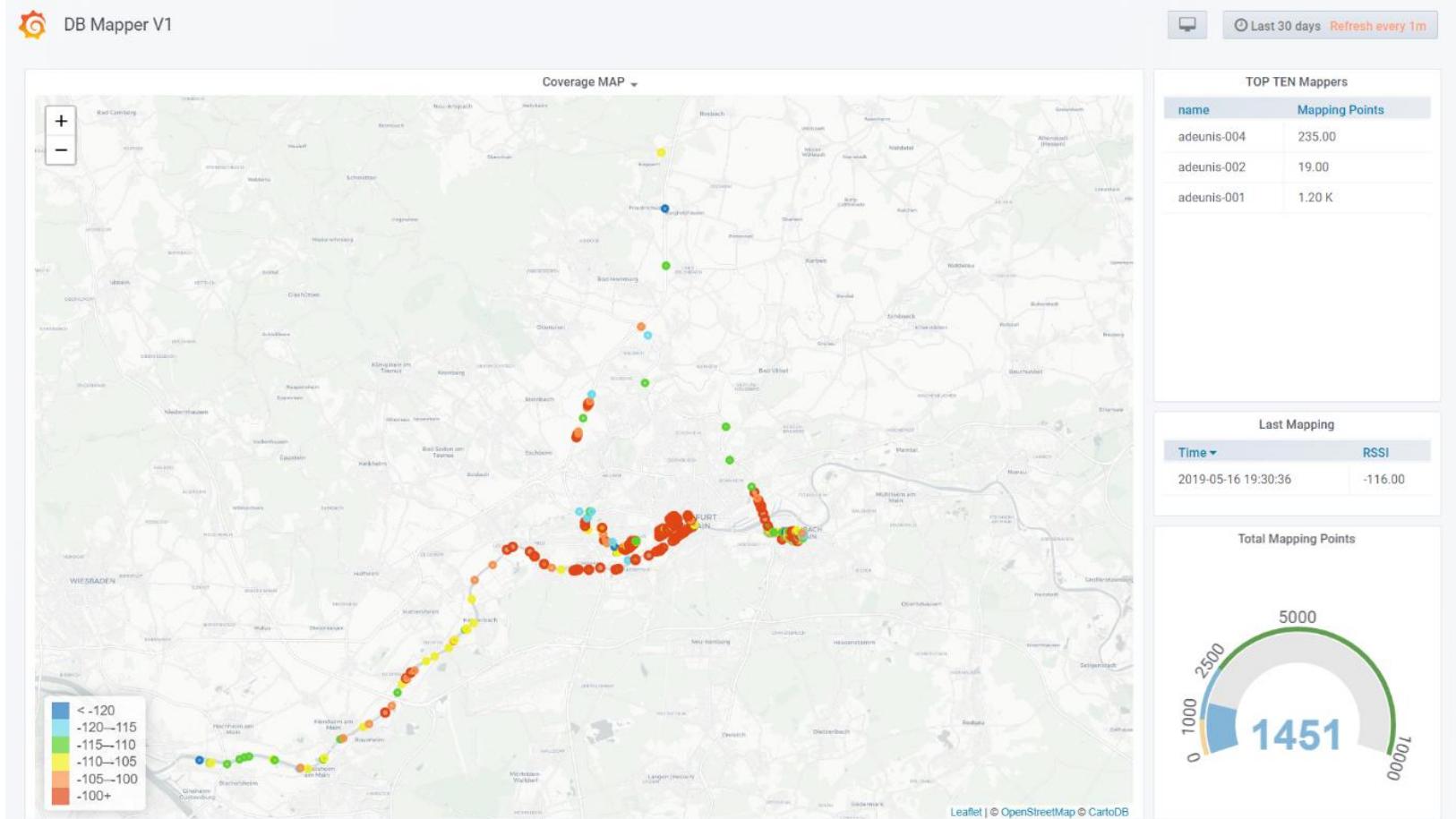
Grafana Worldmap examples



Grafana Worldmap examples



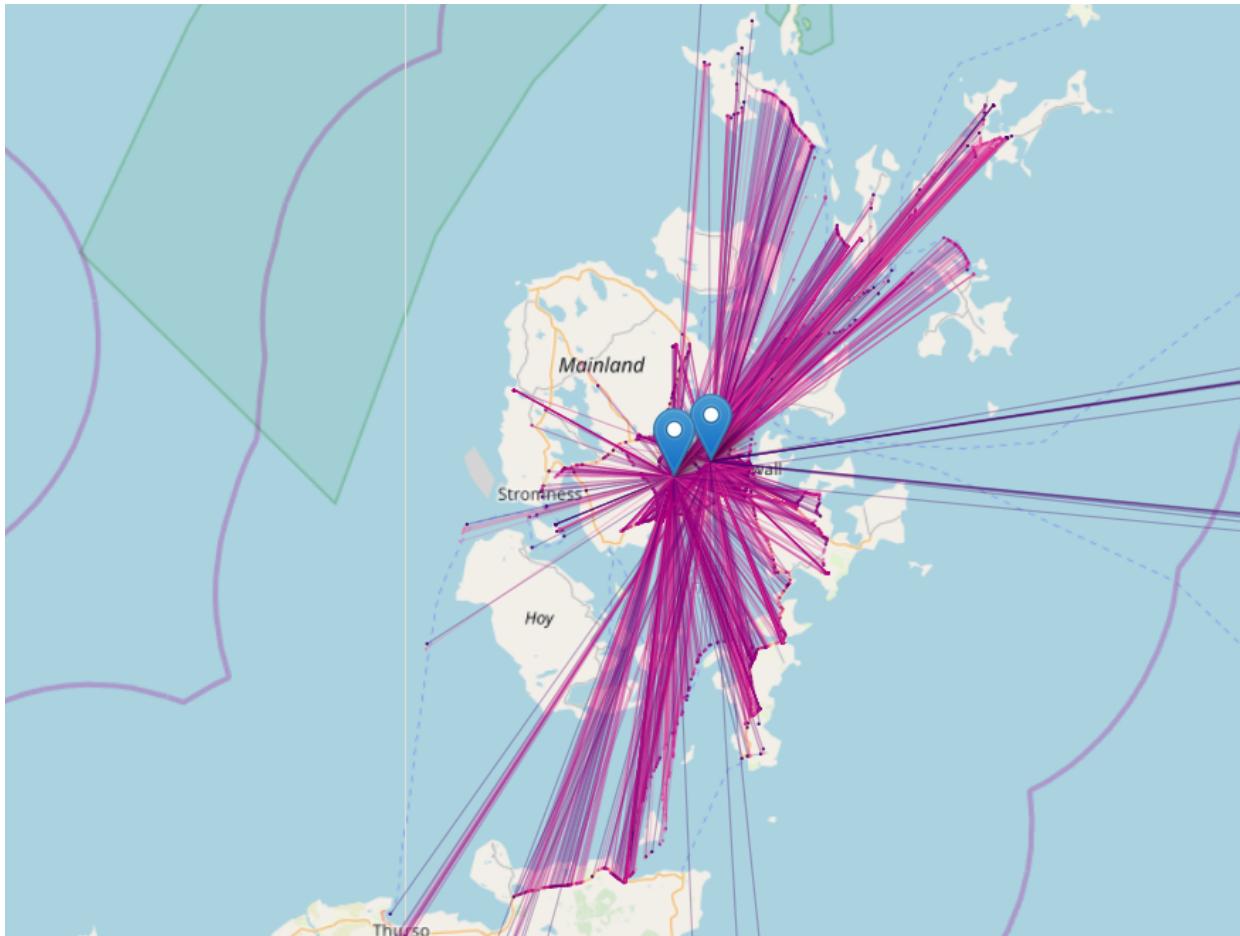
Grafana Worldmap examples



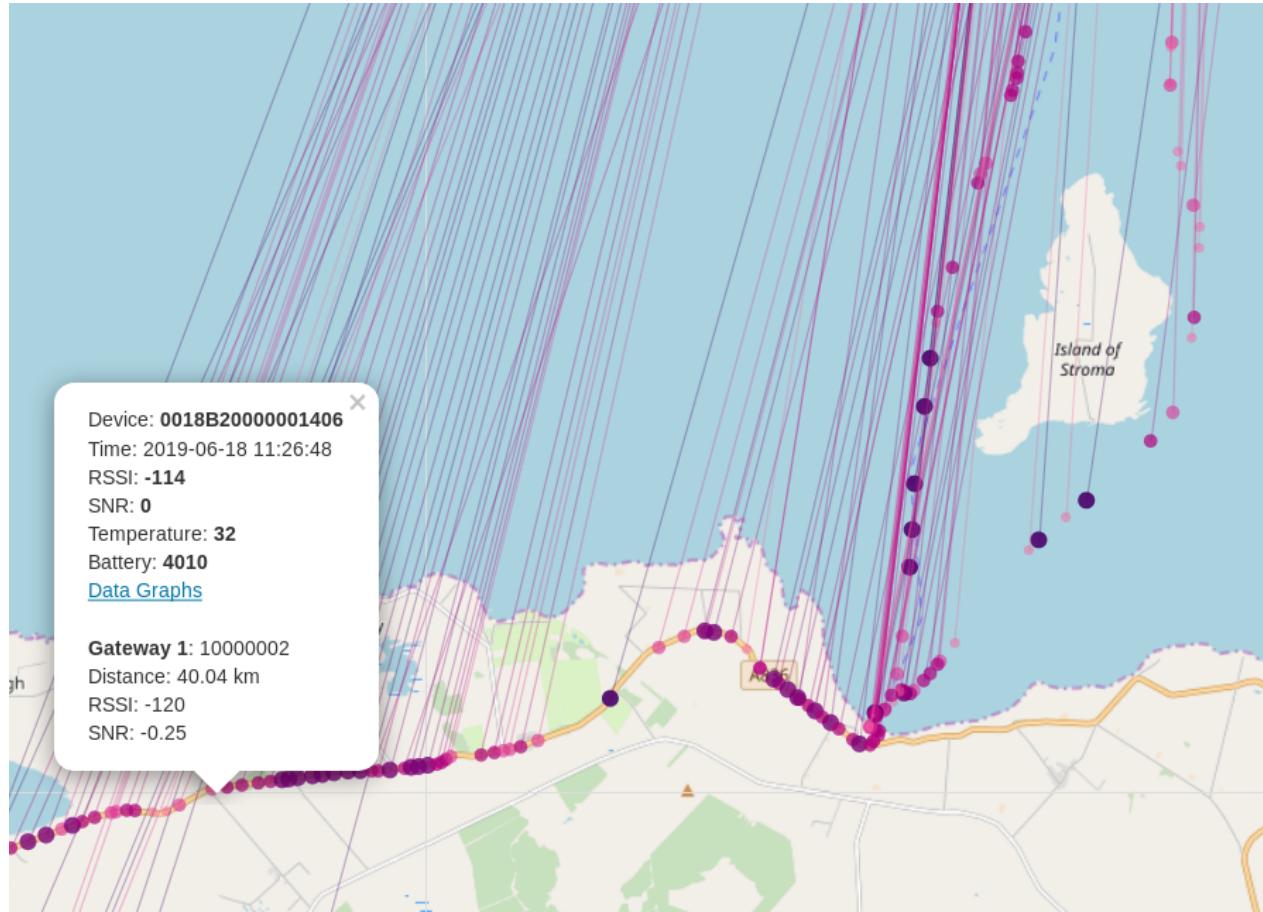
Leaflet maps

- A free open source javascript library for mapping
- Reads or receives e.g. json objects and creates map objects
- Advantages: very flexible - you can do pretty much anything
- Disadvantages: takes longer to learn
- <https://leafletjs.com/>

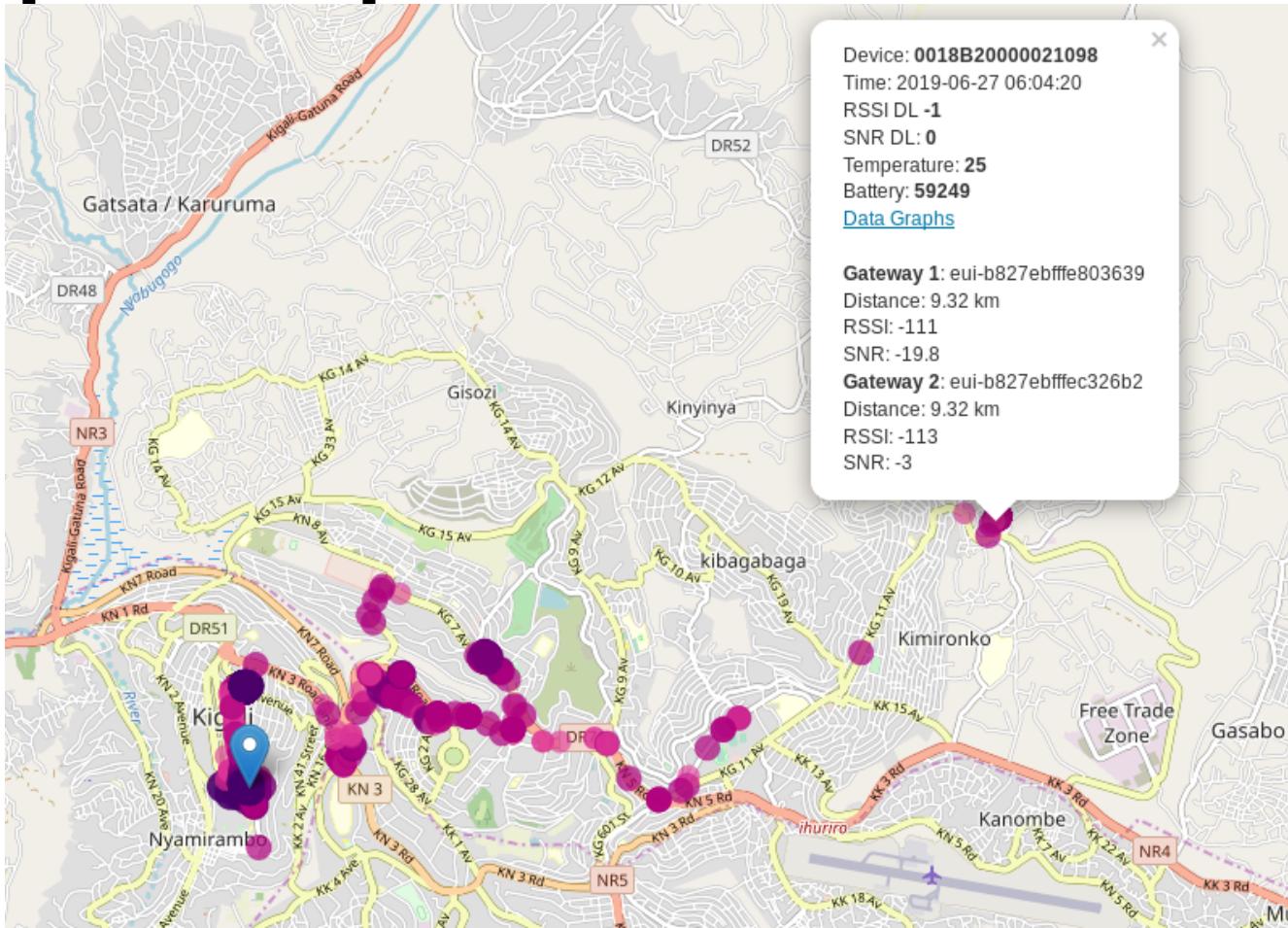
Leaflet maps examples



Leaflet maps examples



Leaflet maps examples



Write your own

- All LoRaWAN network servers offer data streams via e.g. MQTT, http APIs, and many more
- Free map sources, e.g. <https://www.openstreetmap.org>
- Connect these to your favorite programming language or environment, e.g. python, ruby, go, php, js ...
- Advantages: as strong as your coding skills :)
- Disadvantages: more work for you :)

Using IoT platforms

- All big IoT platforms, such as Azure, AWS, Google, IBM Watson, Cisco, Artik, Bosch, Siemens ... (and 100s more), offer some form of mapping
- Specialized mapping and visualization engines
- Advantages: integration
- Disadvantages: risk of lock-in, loss of real data ownership
- More: search the web!