GPS Tracker

Nerves

Yann Very

@yannvery

Topics

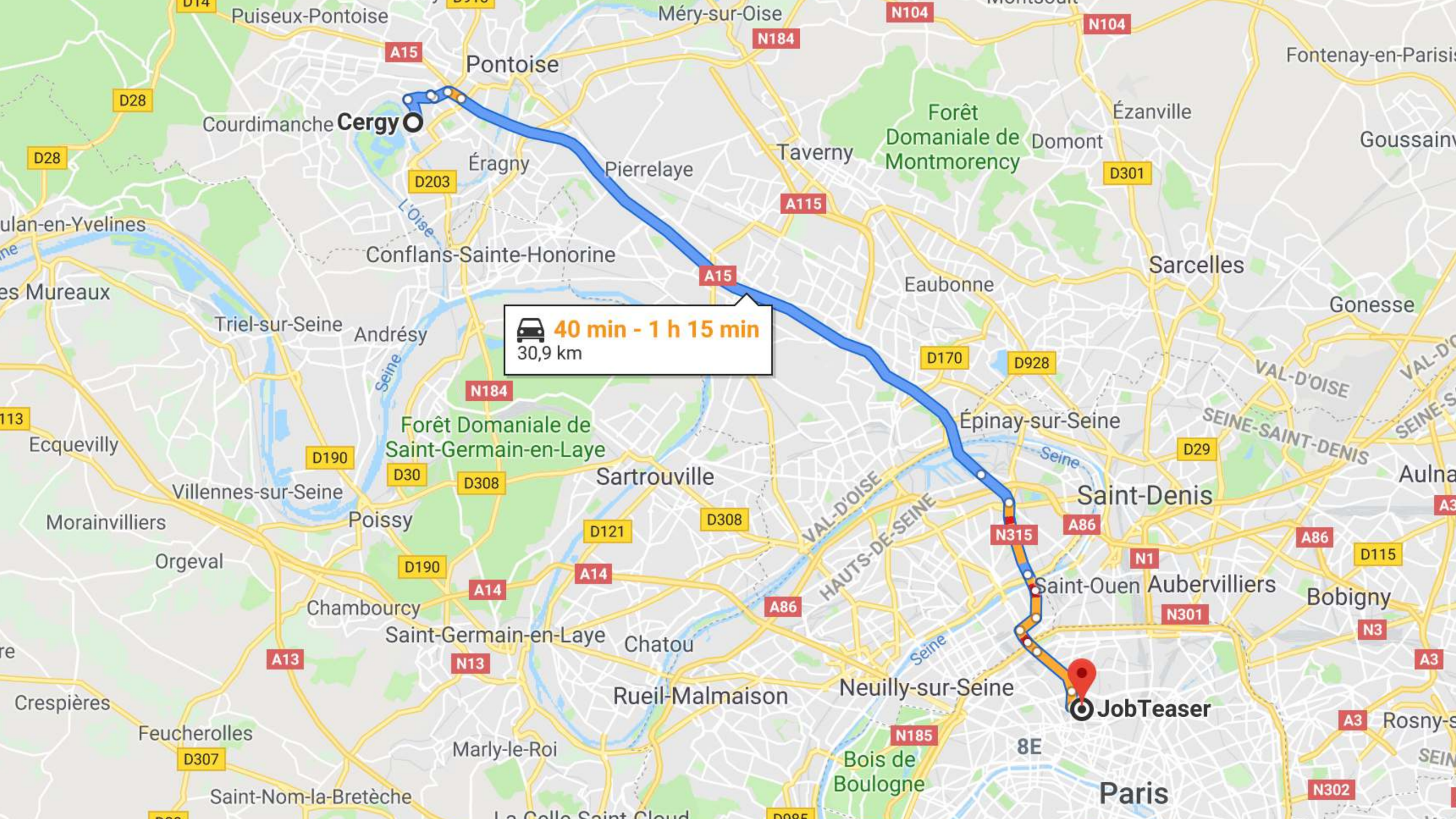
Context

Nerves

GPS / Hardware

Implementation

Why?


Cergy
JobTeaser
40 min - 1 h 15 min
30,9 km
Puiseux-Pontoise
Méry-sur-Oise
Pontoise
Courdimanche
Éragny
Pierrelaye
Taverny
Forêt Domaniale de Montmorency
Domont
Ézanville
Fontenay-en-Parisis
Goussainv
Conflans-Sainte-Honorine
L'Oise
Eaubonne
Sarcelles
Gonesse
Triel-sur-Seine
Andrésy
Seine
Épinay-sur-Seine
Forêt Domaniale de Saint-Germain-en-Laye
Ecquevilly
Villennes-sur-Seine
Sartrouville
Saint-Denis
Morainvilliers
Poissy
Orgeval
Chambourcy
Saint-Germain-en-Laye
Chatou
Saint-Ouen
Aubervilliers
Bobigny
Crespières
Feucherolles
Rueil-Malmaison
Neuilly-sur-Seine
Marly-le-Roi
Bois de Boulogne
Paris
Saint-Nom-la-Bretèche
VAL-D'OISE
HAUTS-DE-SEINE
SEINE-SAINT-DENIS
A15
A115
A86
A14
A13
N104
N184
N315
N1
N301
N185
N13
N302
D28
D203
D301
D170
D928
D29
D190
D30
D308
D121
D115
N3
A3
8E


OHMAGIF.COM


30
gobee.bike

Core Feature

- Make a GPS tracker
- Emit my position
- Provide an html page with my current position

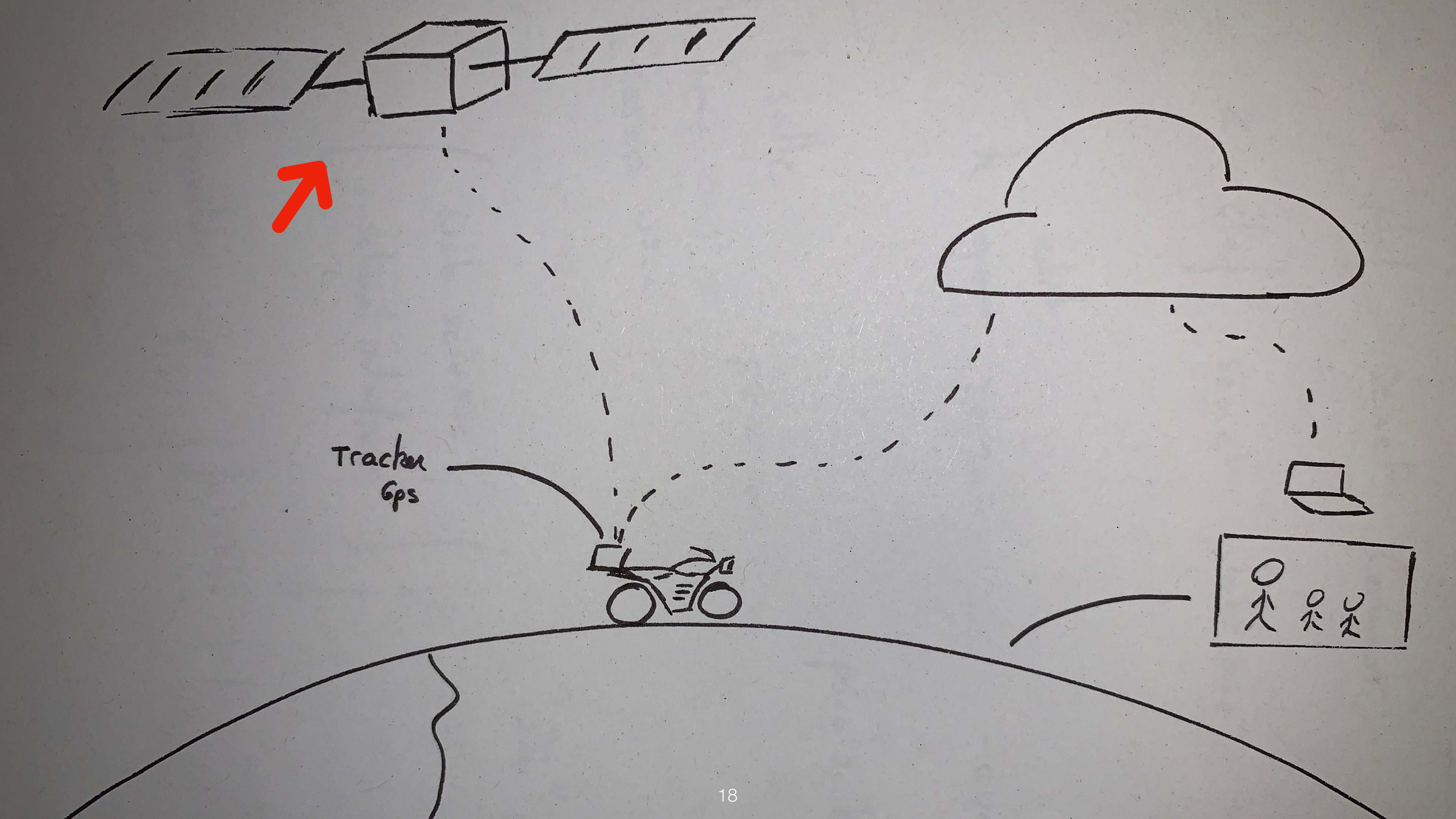
Where to begin?

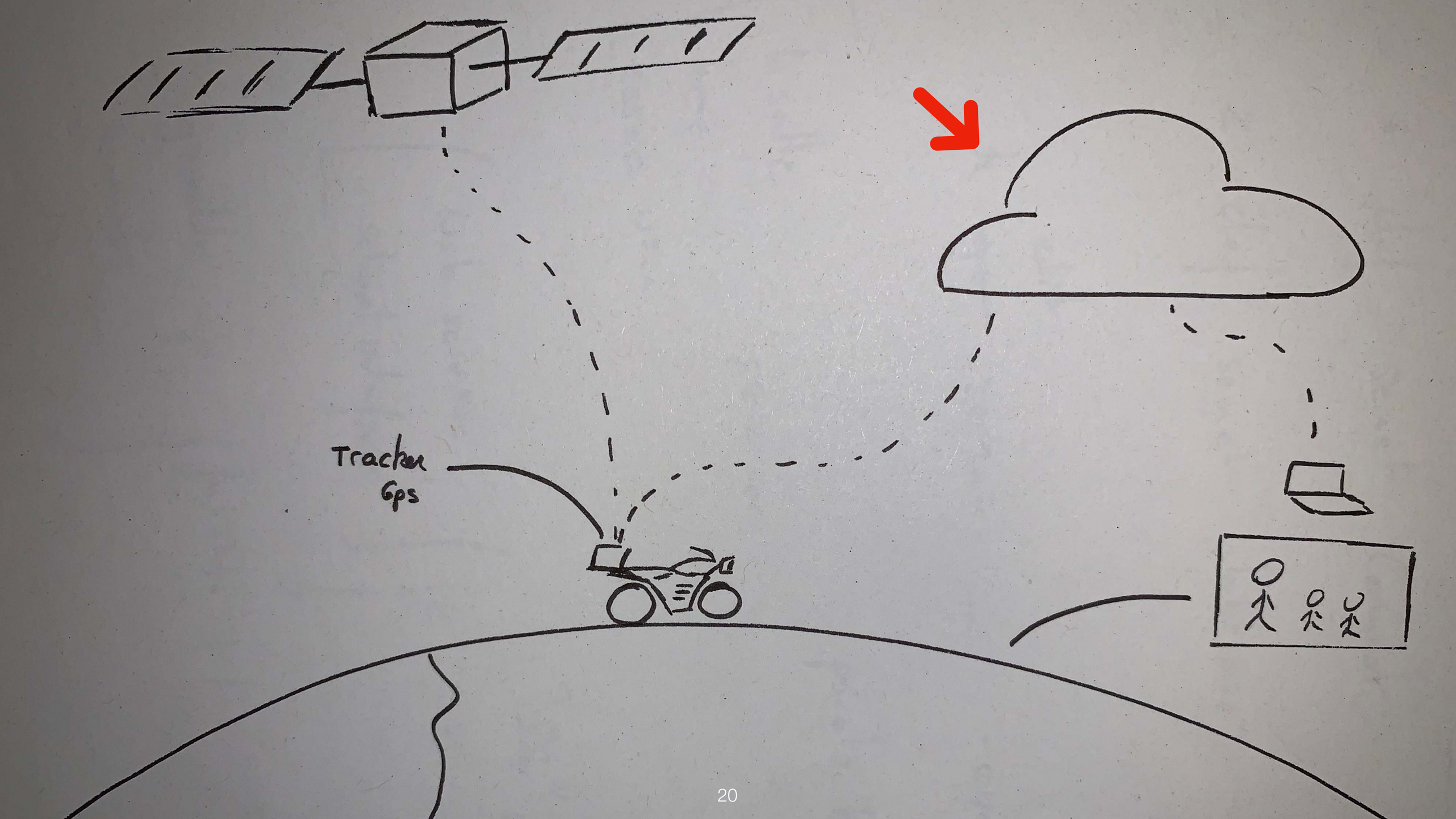
BS21 010
A
9.1 Ah(20HR)/190 CCA
ELECTROLYTE FILLED
MADE IN JAPAN

BS21-010
A
Poire
9.1 Ah(20HR)/190 CCA
ELECTROLYTE FILLED
MADE IN JAPAN

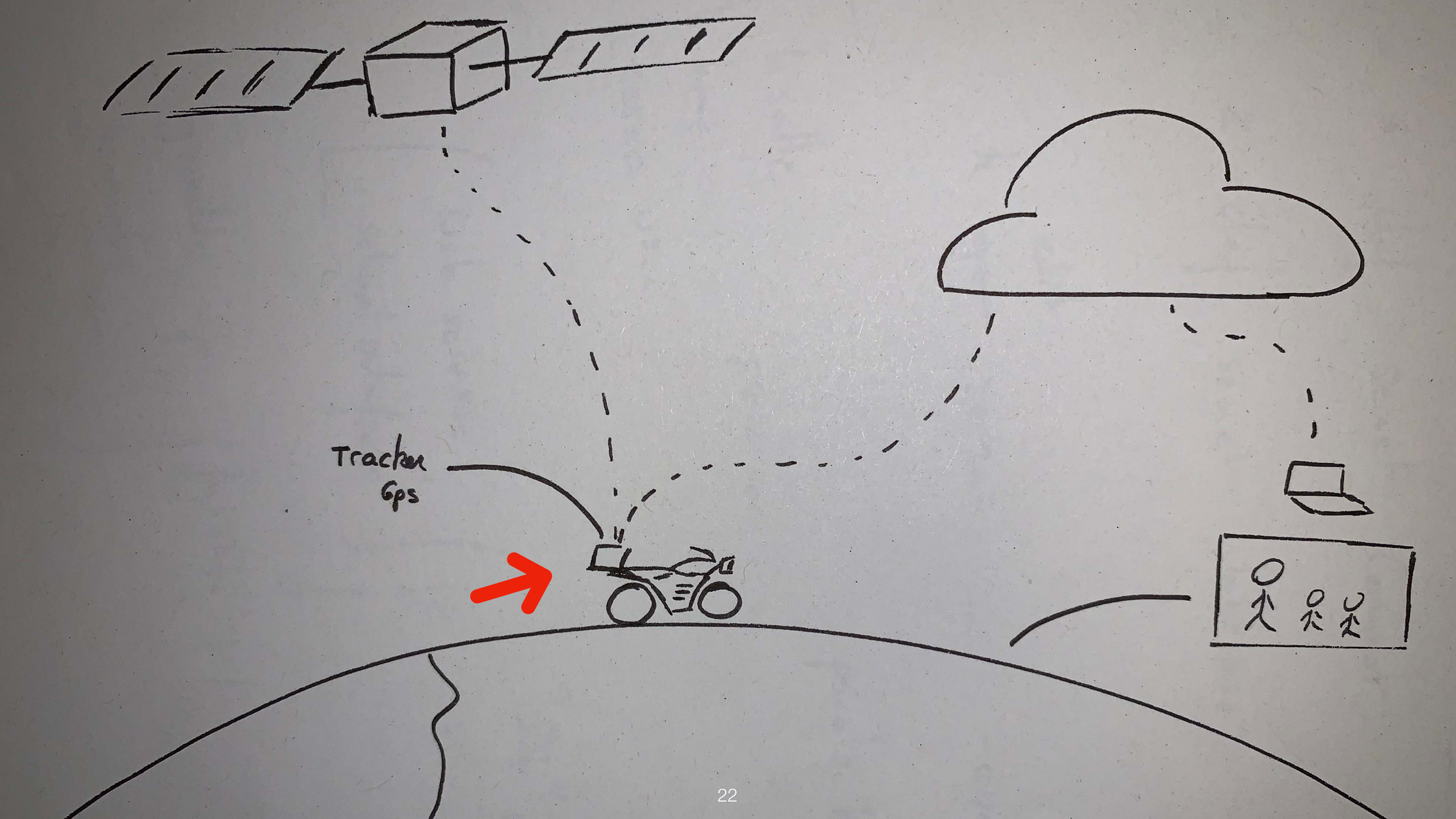
Identifying the unknown

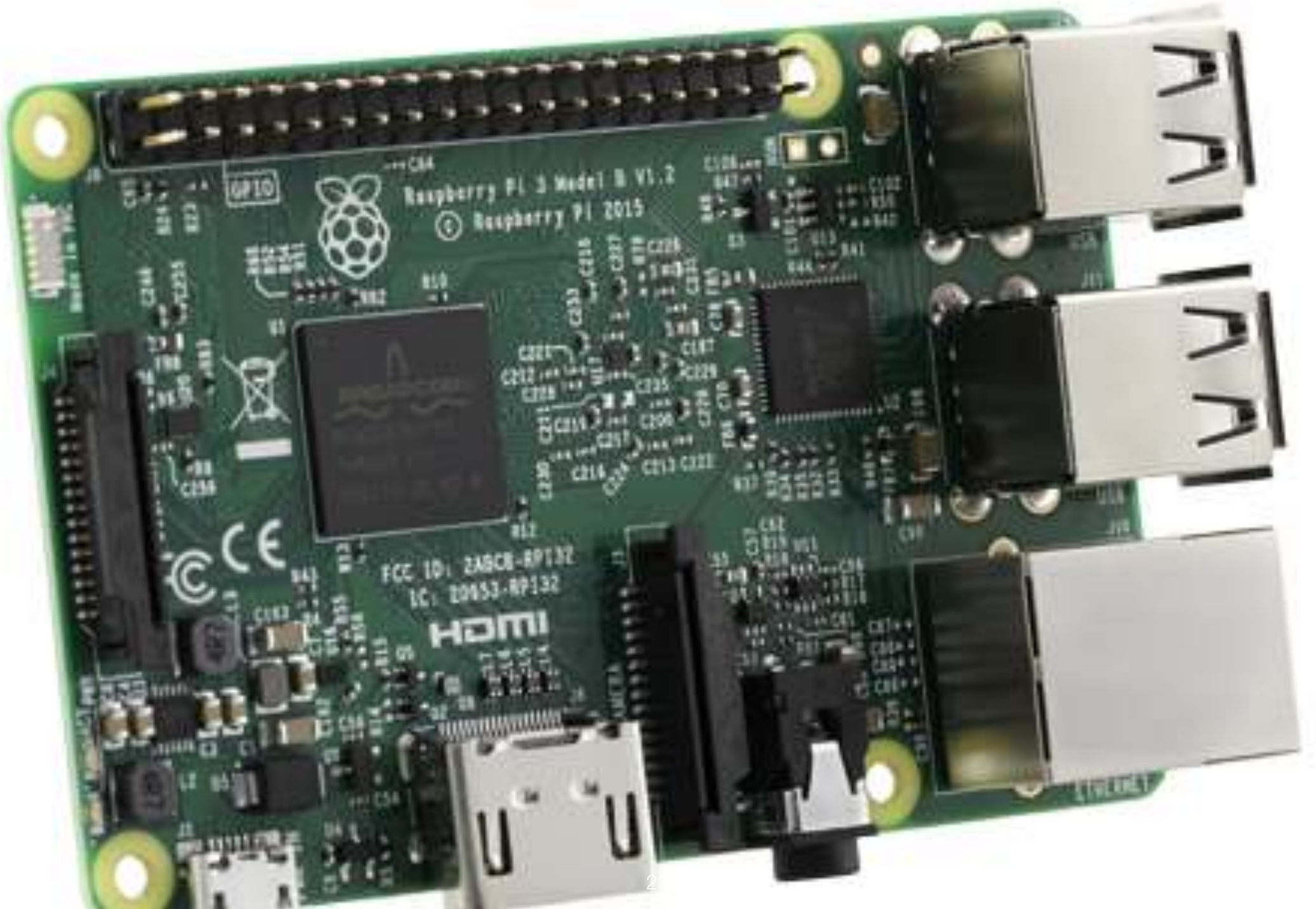
By making a plan


Tracker
Gps

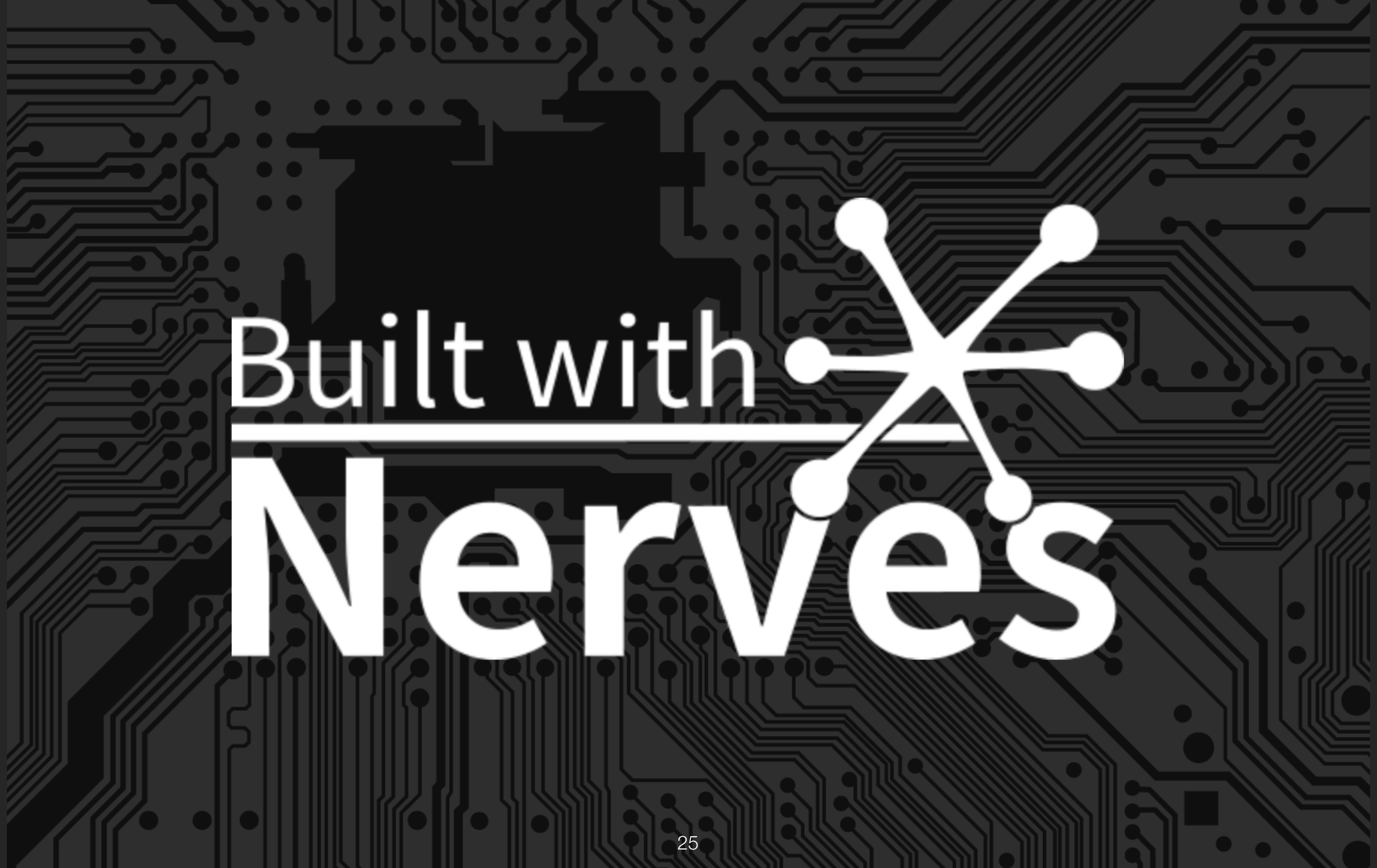

Tracker
Gps

A web app


Tracker
Gps


Raspberry Pi 3 Model B V1.2
© Raspberry Pi 2015
FCC ID: 2ABCB-RPI32
IC: 20953-RPI32
HDMI


He was twitching because
he's got my axe EMBEDDED
IN HIS NERVOUS SYSTEM!


Built with
Nerves

nerves-project / nerves

Watch 52 | Star 1,200 | Fork 96

Code | Issues 20 | Pull requests 1 | Projects 0 | Wiki | Security | Insights

Craft and deploy bulletproof embedded software in Elixir http://nerves-project.org

elixir nerves embedded

802 commits | 3 branches | 54 releases | 59 contributors | Apache-2.0

Contributors

This project exists thanks to all the people who contribute.

Nerves

Platform

Framework

Tooling

Platform

Supported Targets and Systems

TARGET	SYSTEM	TAG
Raspberry Pi A+, B, B+	nerves_system_rpi	`rpi`
Raspberry Pi Zero and Zero W	nerves_system_rpi0	`rpi0`
Raspberry Pi 2	nerves_system_rpi2	`rpi2`
Raspberry Pi 3 B, B+	nerves_system_rpi3	`rpi3`
BeagleBone Black, BeagleBone Green, BeagleBone Green Wireless, and PocketBeagle.	nerves_system_bbb	`bbb`
Generic x86_64	nerves_system_x86_64	`x86_64`

Framework

Ready to Go Elixir libraries:

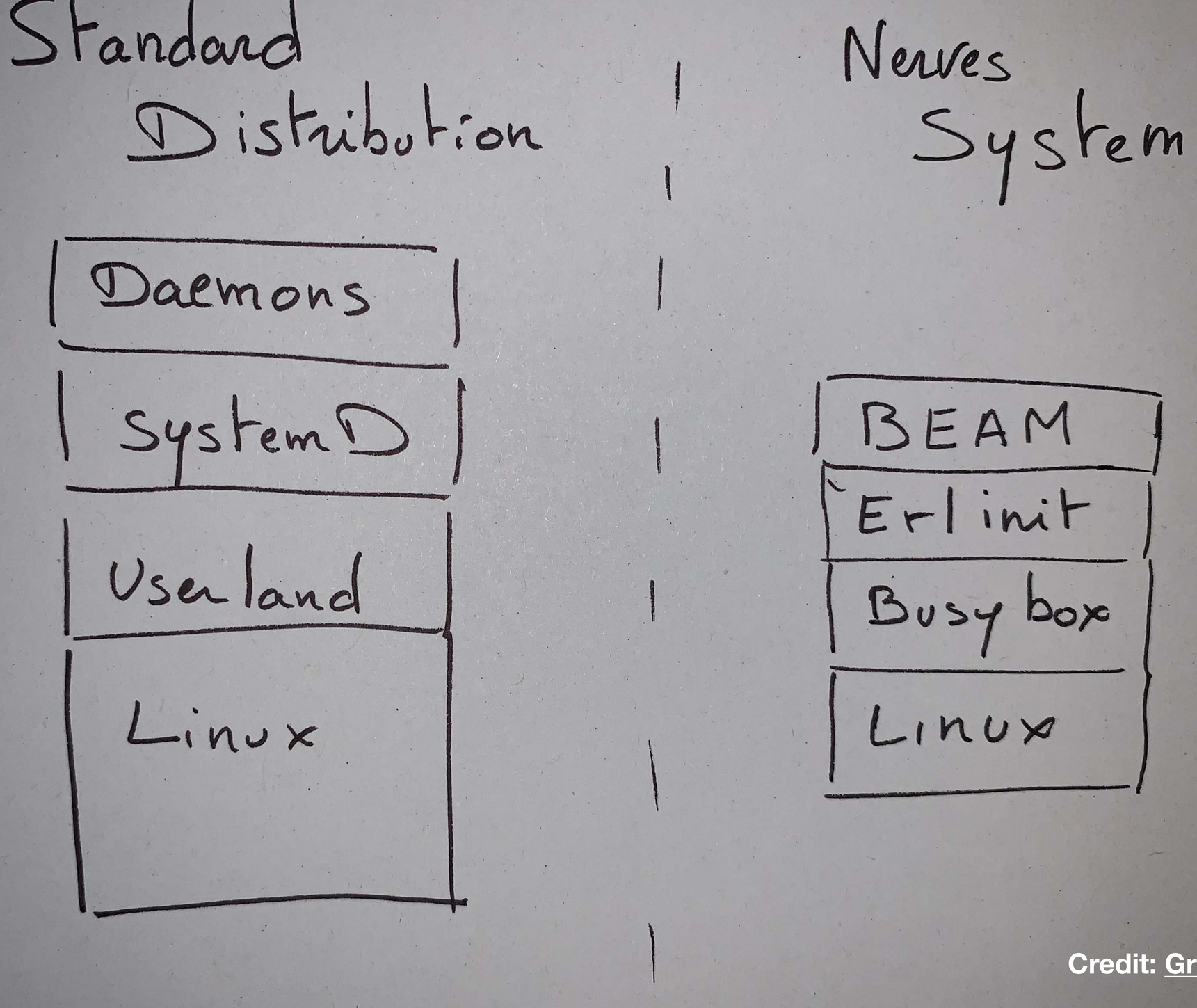
- Network

- Interacting with the hardware

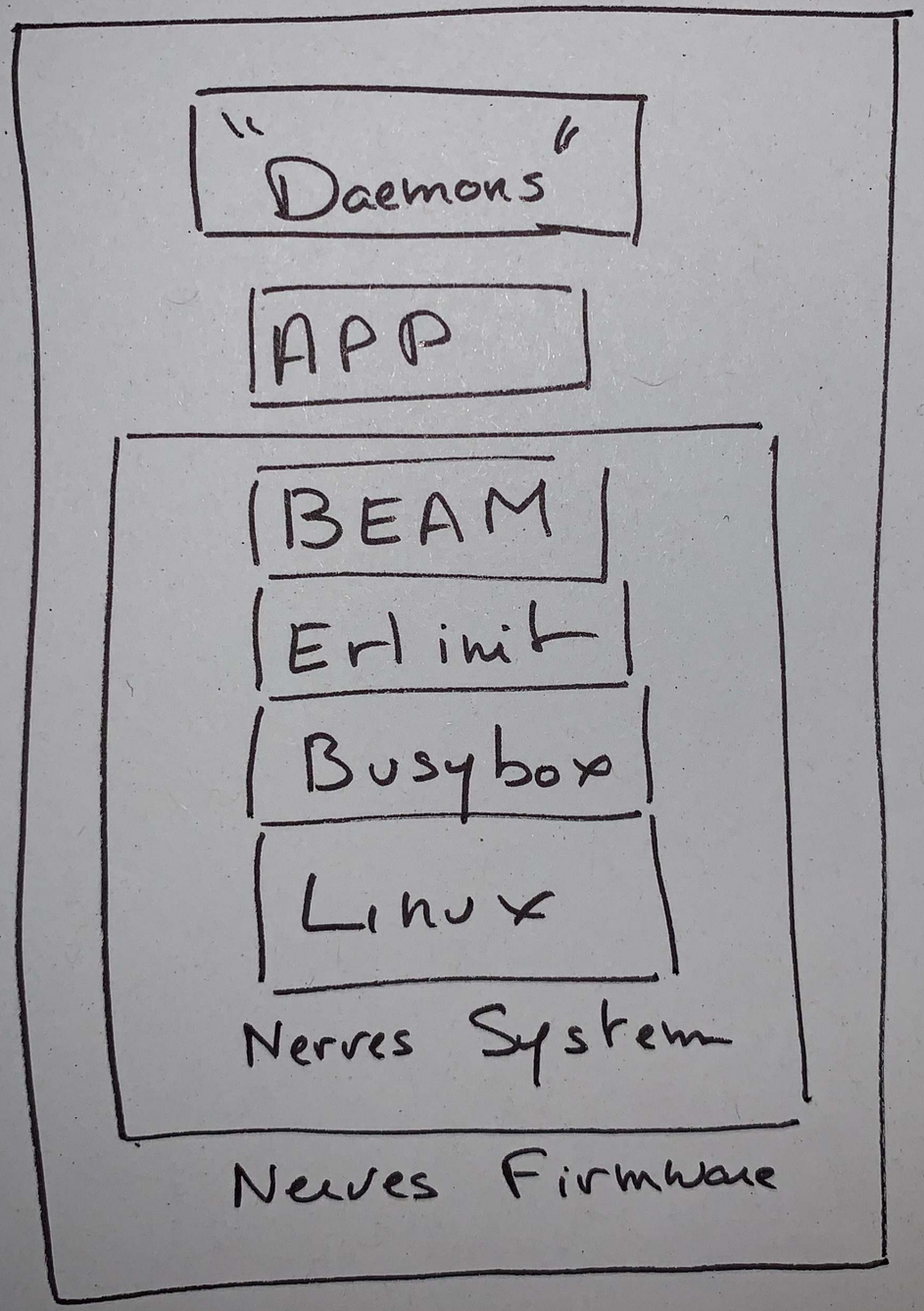
Tooling

CLI which allows to:

- Create a project
- Build firmware
- Configure a release



Credit: Greg Mefford



Credit: Greg Mefford

Create a Nerves Project

```
# Create a Nerves project
mix nerves.new gps_tracker
```

nerves-project / **nerves_examples** Nerves Examples

Watch 17 | Star 211 | Fork 79

Code | Issues 2 | Pull requests 2 | Projects 0 | Wiki | Insights

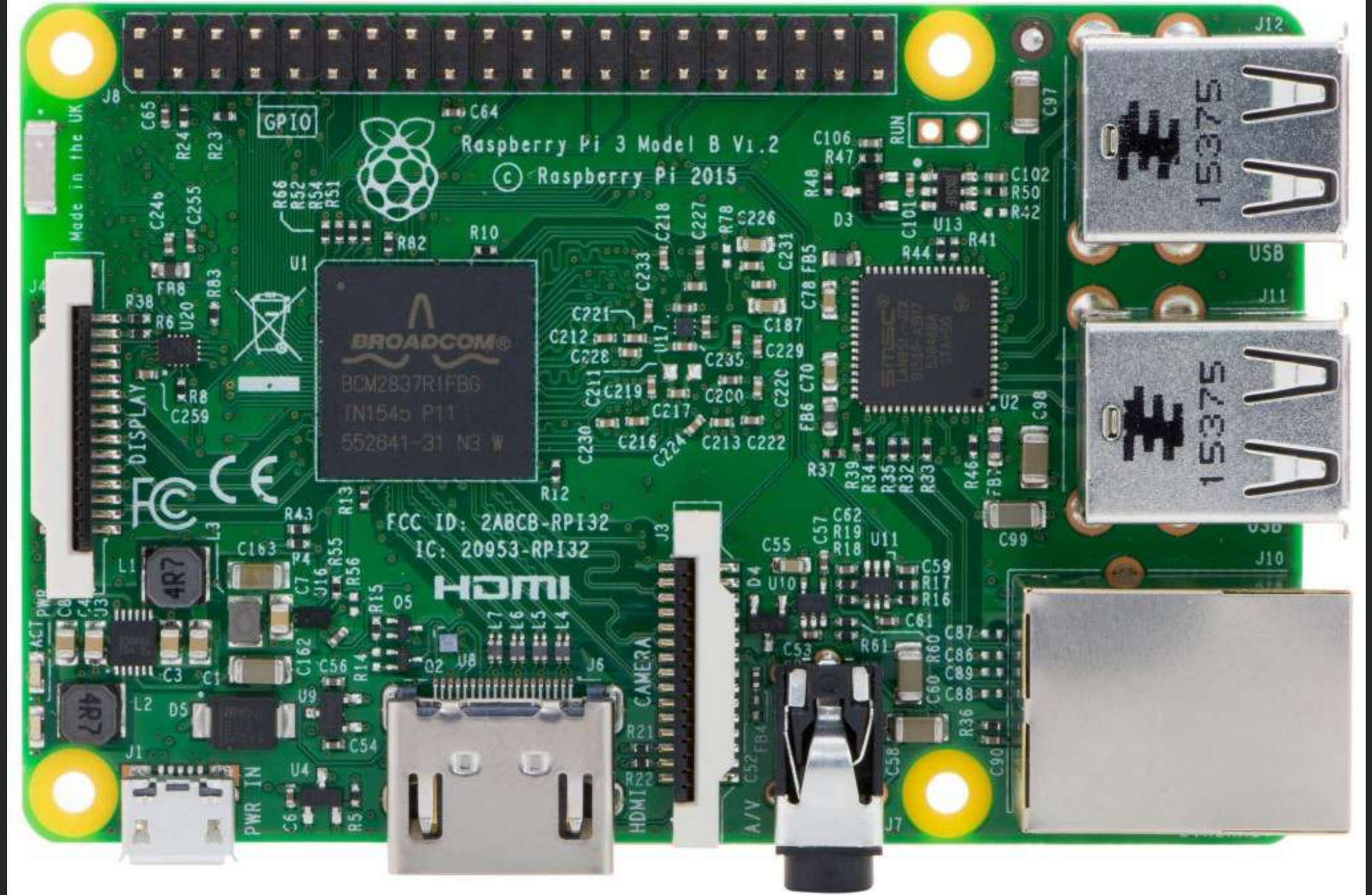
A couple small examples to demonstrate using Nerves

262 commits | **5** branches | **0** releases | **36** contributors

Branch: **master** | New pull request | Create new file | Upload files | Find File | Clone or download

GregMefford and **fhunleth** Consistently assume rpi0 target by default — Latest commit d9a21ca on Feb 21

.circleci	Upgrade to Elixir 1.8 in CI	3 months ago
blinky	Consistently assume rpi0 target by default	3 months ago
hello_gpio	Consistently assume rpi0 target by default	3 months ago
hello_leds	Consistently assume rpi0 target by default	3 months ago
hello_network	Consistently assume rpi0 target by default	3 months ago
hello_phoenix	Update for Elixir 1.8 and Nerves 1.4	3 months ago
.gitignore	Synchronize various files with latest template	7 months ago
CODE_OF_CONDUCT.md	Add links to contribution guides	9 months ago
CONTRIBUTING.md	Add links to contribution guides	9 months ago
ISSUE_TEMPLATE.md	Add links to contribution guides	9 months ago
README.md	Update for Elixir 1.8 and Nerves 1.4	3 months ago

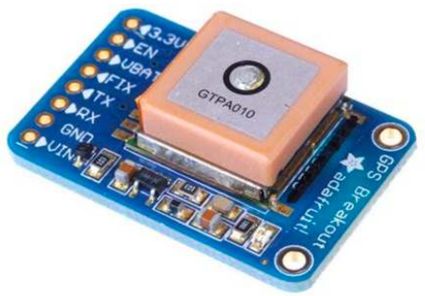

Raspberry Pi 3 Model B V1.2
© Raspberry Pi 2015
BROADCOM
BCM2837R1FBG
FCC ID: 2ABCB-RPI32
IC: 20953-RPI32
HDMI
CAMERA
DISPLAY
PWR IN
A/V
USB
GPIO
RUN
Made in the UK

GPS

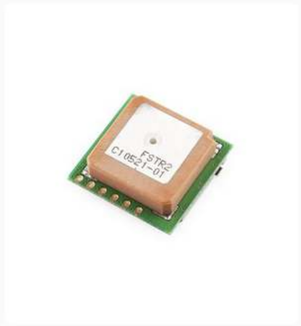

VCC RX TX GND

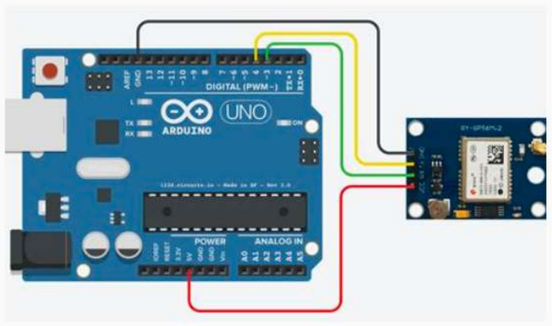


PARALLAX


GTPA010
GPS Breakout

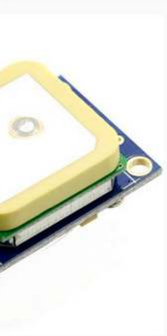

uBlox GPS Module



E3TR2
C10651-01


DIGITAL (PWM~)
UNO
ARDUINO
POWER
ANALOG IN

GPS
ANTENNA

U1
GPS-L80-M39-V1
D2
1PPS
J1
2.7 cm





DIGITAL (PWM~)
UNO
ARDUINO
POWER
ANALOG IN

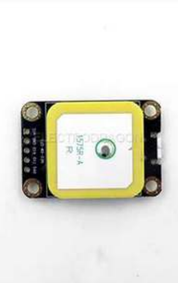





PARALLAX
GND
T_P
RXD
TXD
VDD
SCL
SDA
uBlox GPS Module

AEM
GPS
MODULE
PN: 30-2207
5Hz GPS/GLONASS
CAN 2.0B Output
AEMnet
Green: Fix Acquired
Red: No Signal



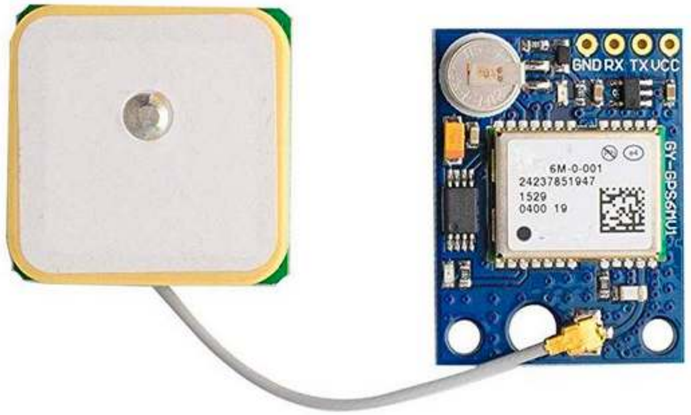
RX TX GND



NEO-6 GPS



Neo 6m GPS



DIYmall 6M GPS Module with EEPROM for MWC/AeroQuad with Antenna for Arduino Flight Control Aircraft

★★★★☆ 25

$16.50

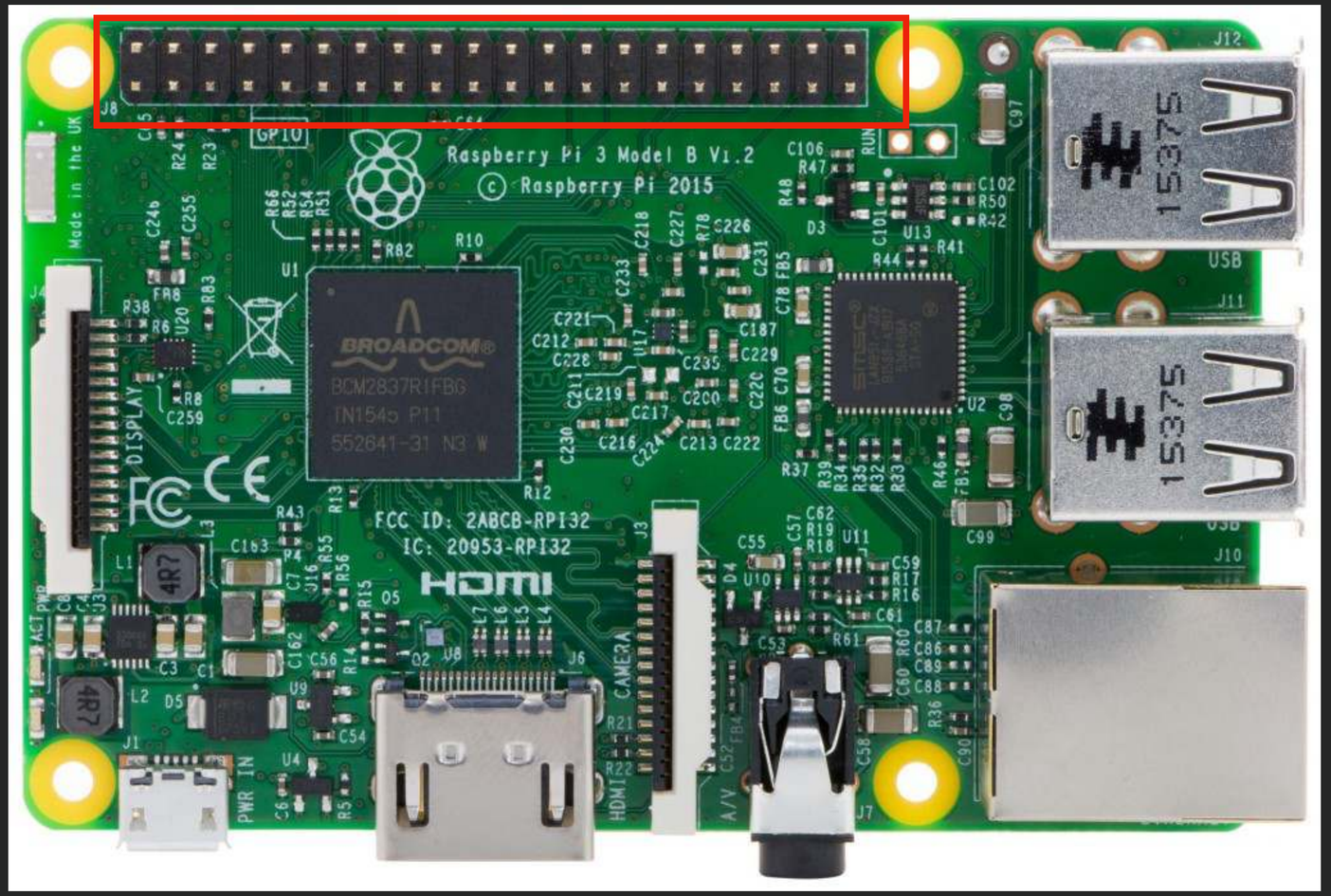

Ca marche pas !!
RTFM !!

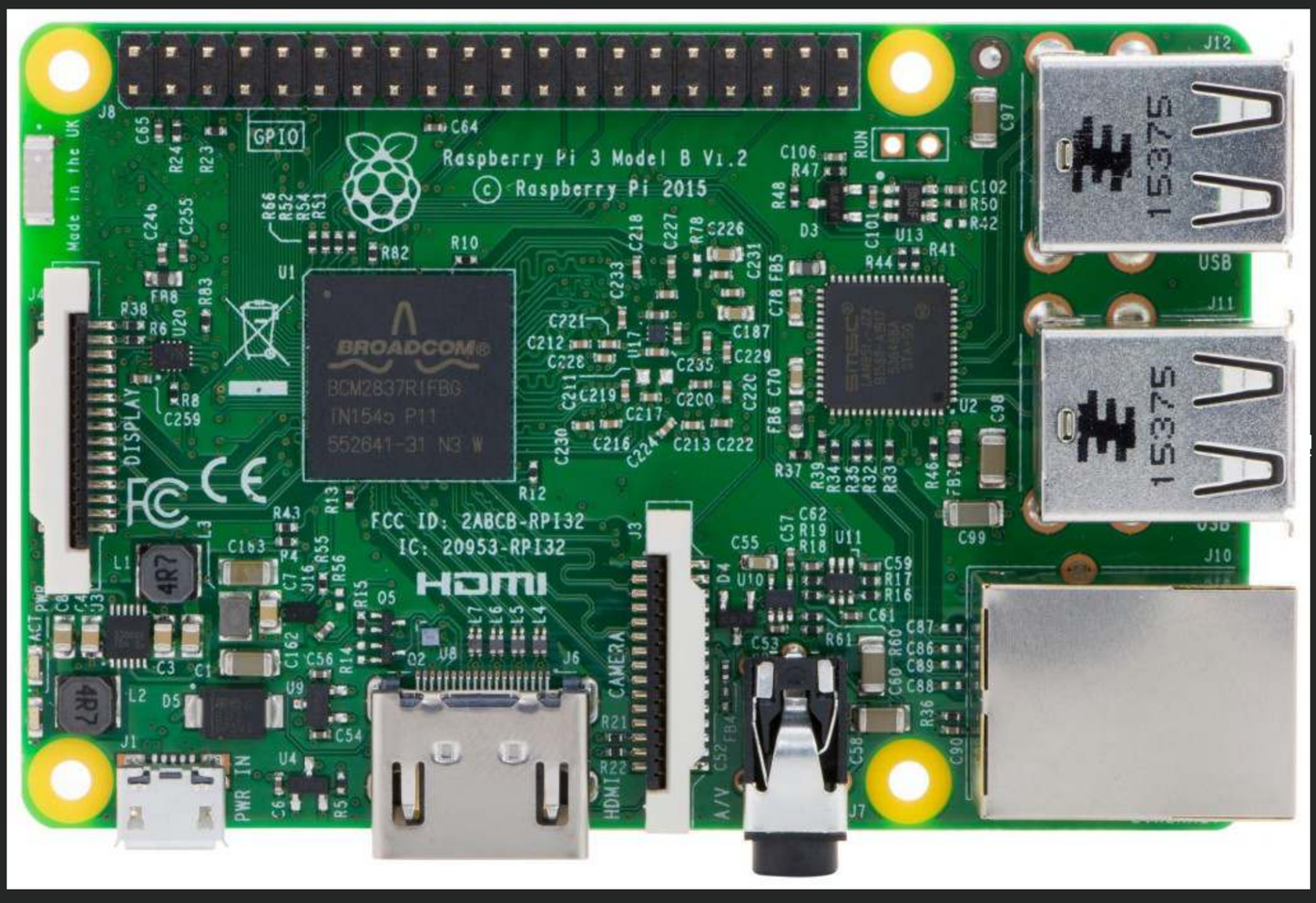
https://www.terraelectronica.ru/pdf/show?pdf_file=%2Fz%2FDatasheet%2FU%2FUART+GPS+NEO-6M+User+Manual.pdf

How to use

1. Connect the UART GPS NEO-6M module to a serial module. FT232 is applied as the serial module in this document.
   The connection between the GPS module and the serial module is listed as the table below.

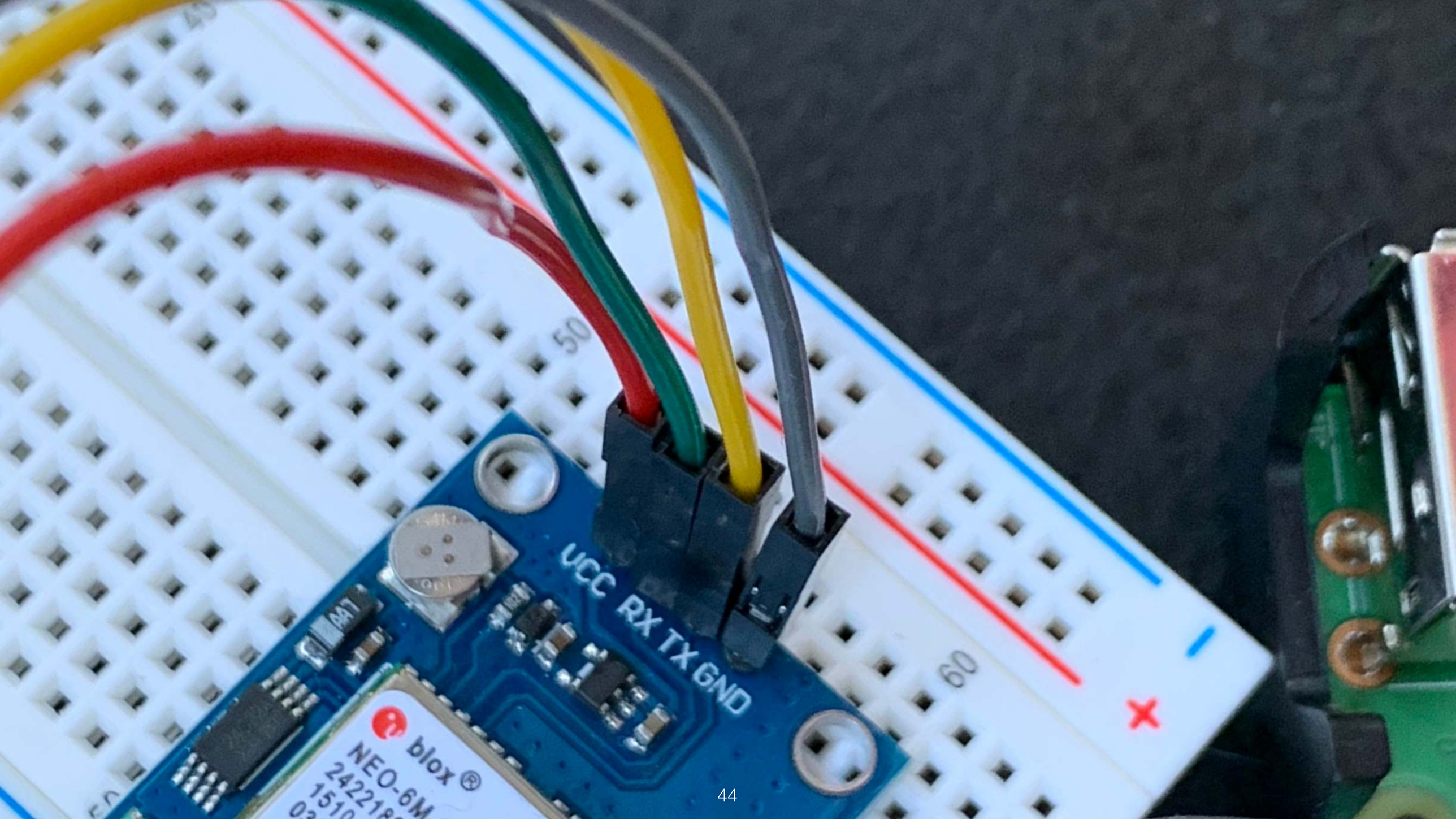
UART GPS NEO-6M module pins	Serial module pins
VCC	3.3V/5V
GND	GND
TXD	RX
RXD	TX
PSS*	
* PPS should be connected to the clock pulse output (CPOUT) of a MCU. However, this pin is unconnected, in the case that the GPS module is connected to a computer.	


Raspberry Pi 3 Model B V1.2
© Raspberry Pi 2015
BROADCOM
BCM2837R1FBG
FCC ID: 2ABCB-RPI32
IC: 20953-RPI32
HDMI
CAMERA
DISPLAY
PWR IN
USB
USB
GPIO


GPIO
Raspberry Pi 3 Model B V1.2
© Raspberry Pi 2015
BROADCOM
BCM2837RIFBG
FCC ID: 2ABCB-RPI32
IC: 20953-RPI32
HDMI
DISPLAY
CAMERA
HDMI
A/V
PWR IN
USB
USB
RUN
Made in the UK

Raspberry Pi 3 GPIO Header

Pin#	NAME	NAME	Pin#
01	3.3v DC Power	DC Power 5v	02
03	GPIO02 (SDA1 , I²C)	DC Power 5v	04
05	GPIO03 (SCL1 , I²C)	Ground	06
07	GPIO04 (GPIO_GCLK)	(TXD0) GPIO14	08
09	Ground	(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)	(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)	Ground	14
15	GPIO22 (GPIO_GEN3)	(GPIO_GEN4) GPIO23	16
17	3.3v DC Power	(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)	Ground	20
21	GPIO09 (SPI_MISO)	(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)	(SPI_CE0_N) GPIO08	24
25	Ground	(SPI_CE1_N) GPIO07	26
27	ID_SD (I²C ID EEPROM)	(I²C ID EEPROM) ID_SC	28
29	GPIO05	Ground	30
31	GPIO06	GPIO12	32
33	GPIO13	Ground	34
35	GPIO19	GPIO16	36
37	GPIO26	GPIO20	38
39	Ground	GPIO21	40


VCC RX TX GND
ublox
NEO-6M

UART MODULE

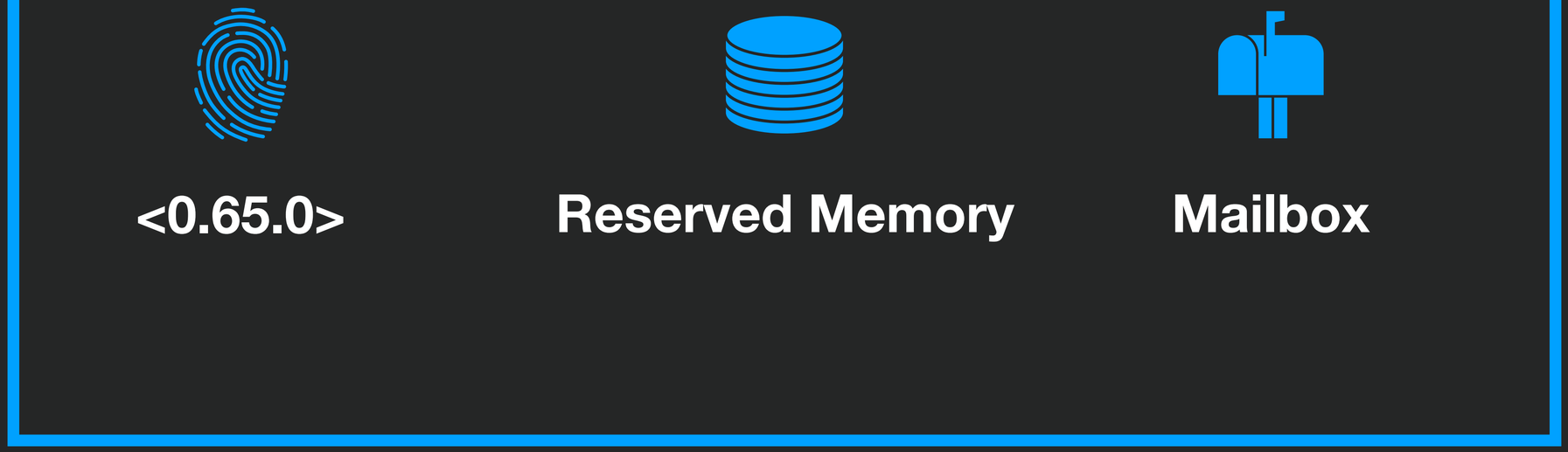
```
 # mix.exs file - Update dependency

defp deps do
  [
    # …
    # UART
    {:circuits_uart, "~> 1.3"}

  ]
end
```


4GIF

Process Elixir



UART MODULE

```
# Start UART GenSserver (process)
{:ok, uart} = Circuits.UART.start_link()

# Ask to the UART process to open the serial port 0
Circuits.UART.open(uart, "ttyAMA0", speed: 9600, active: true)

# UART sent informations to the current process
flush()

{:circuits_uart, “ttyAMA0",
"$GPGGA,064036.289,4836.53750,N,00740.93730,E,1,04,3.2,200.2,M,,,,0000*0E"}
```

NMEA Data

```
"$GPGGA,064036.289,4836.53750,N,00740.93730,E,1,04,3.2,200.2,M,,,,0000*0E"
```

NMEA Data

```
"$GPGGA,064036.289,4836.53750,N,00740.93730,E,1,04,3.2,200.2,M,,,,0000*0E"
```

`$GPGGA`	**Global Positioning System Fix Data**
`064036.289`	**Time**
`4836.53750,N`	**Latitude 48 deg 36.537’ N**
`00740.93730,E`	**Longitude 07 deg 40.937’ E**
`1`	**Quality**
`04`	**Number of satellites being tracked**
`200`	**Altitude, Meters, above mean sea level**

NMEA Module

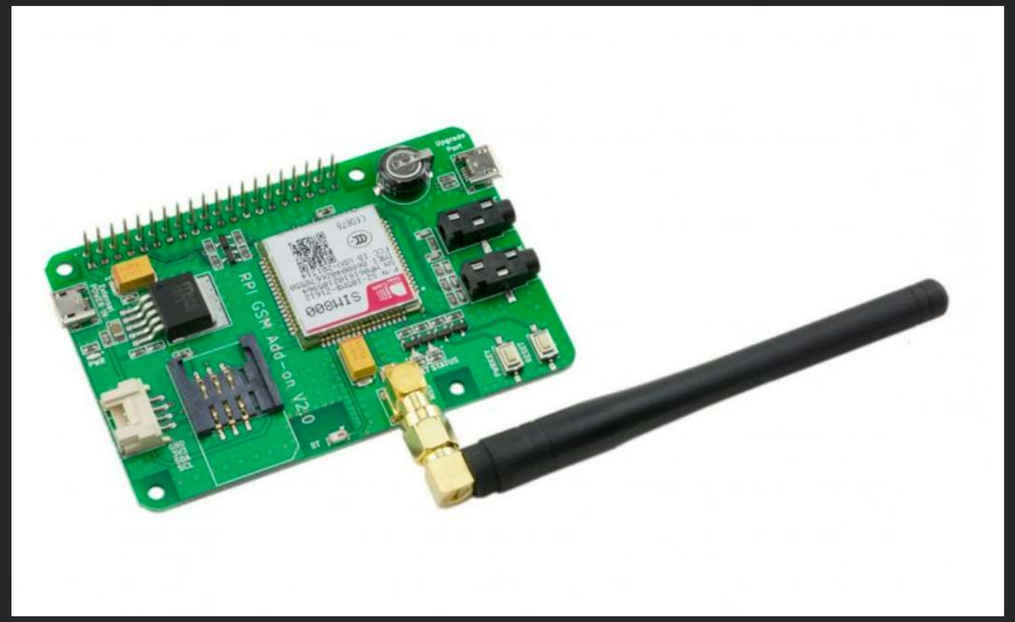
```
defmodule GpsTracker.Nmea do
  def parse("$GPGGA," <> data) do
    data
    |> String.split(",")
    |> extract_time()
    |> extract_latitude()
    |> extract_longitude()
    |> compute_coordinates()
  end
end
```

```
iex> GpsTracker.Nmea.parse(
    “$GPGGA,064036.289,4836.53750,N,00740.93730,E,1,04,3.2,200.2,M,,,,0000*0E"
  )

  {
    :ok,
    %{time: "064036.289", latitude: 48.608958333333, longitude: 7.682288333333}
  }
```

How to send position?

GSM Board



Sigfox

Wireless Chip

Nerves Network

Nerves Network

```
# mix.exs file - Update dependency

defp deps do
  [
    # …
    # Wifi
    {:nerves_network, "~> 0.5”}

  ]
end
```

Nerves Network

```
# config/config.exs
config :shoehorn,
  init: [:nerves_runtime, :nerves_init_gadget, :nerves_network],
  app: Mix.Project.config()[:app]

# …
config :nerves_network, :default,
  wlan0: [
    networks: [
      [
        ssid: "Iphone de Yann",
        psk: "Foobar",
        key_mgmt: “WPA-PSK”
      ]
    ]
  ]
```

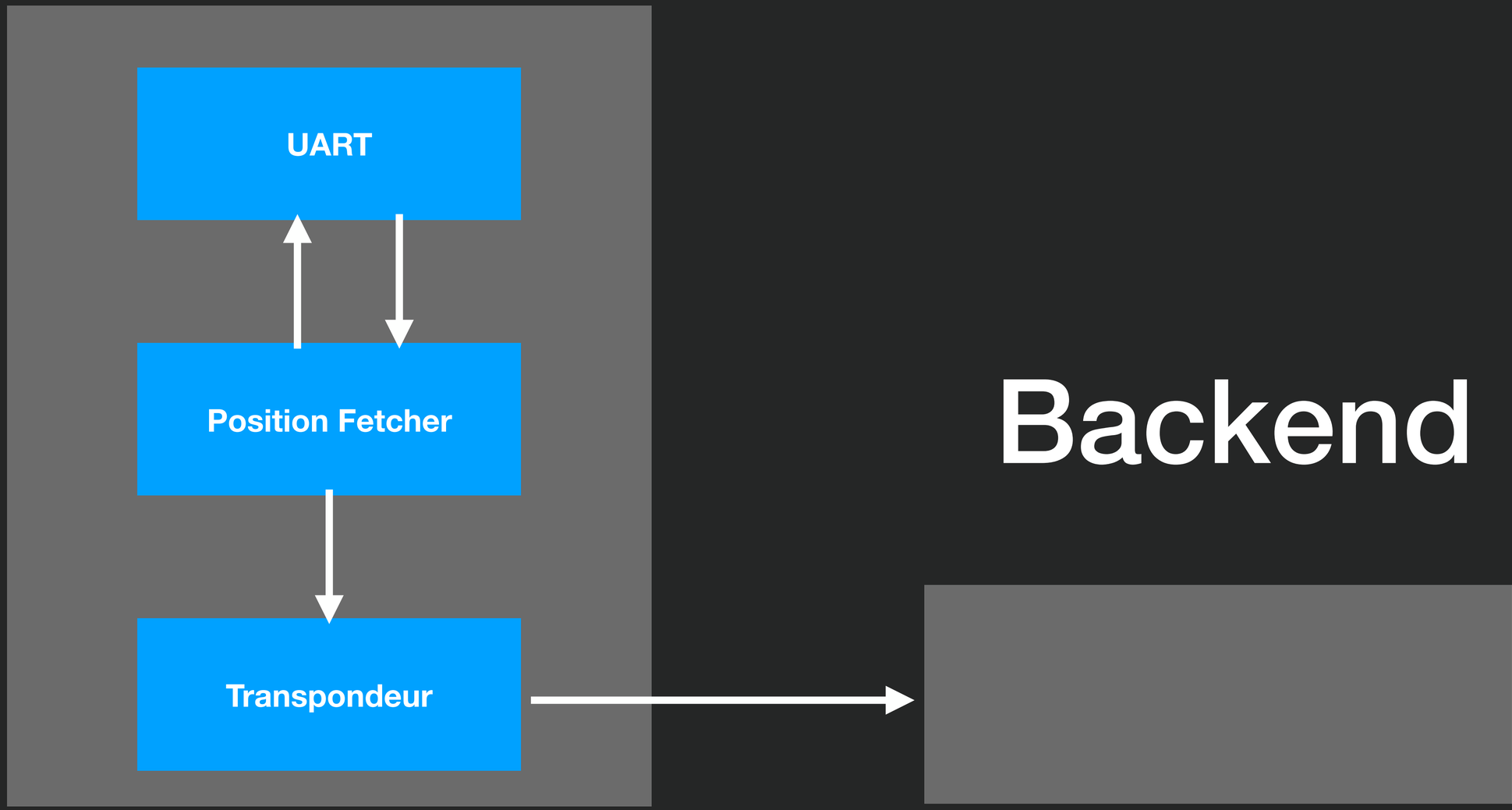
```
defmodule GpsTracker.Transpondeur do
  use GenServer
  # Some Other Stuff here

  def handle cast({:emit, position}, endpoint) do
    {:ok, json} = Poison.encode(position)

    HTTPotion.post(endpoint,
          body: json,
          headers: ["User-Agent": “Beacon", "Content-Type": "application/json"]
        )

    {:noreply, endpoint}
  end
end
```

Tracker



Backend

Backend

Leaflet

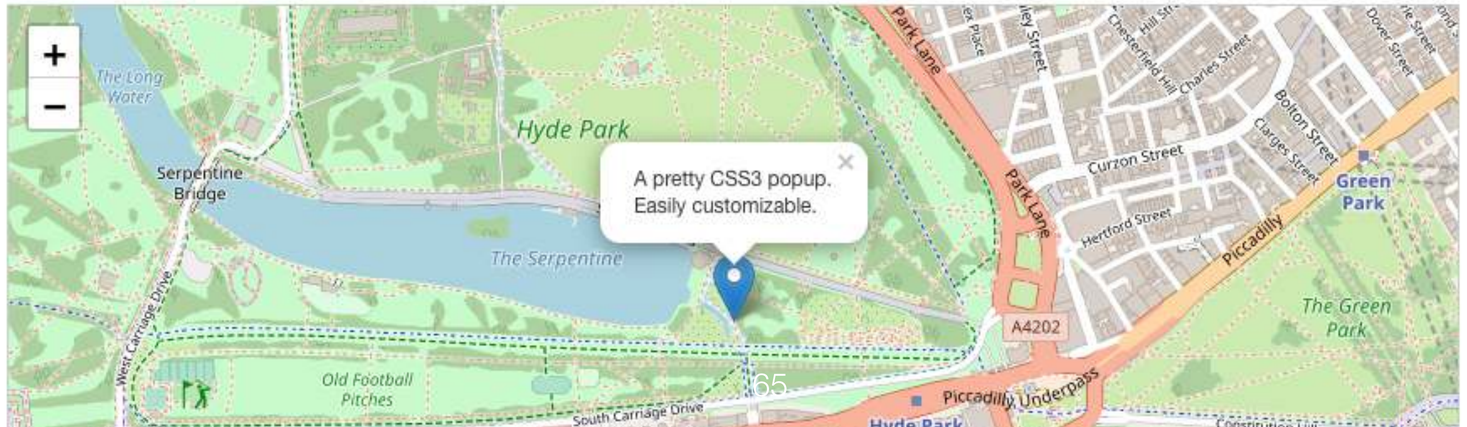
an open-source JavaScript library
for mobile-friendly interactive maps

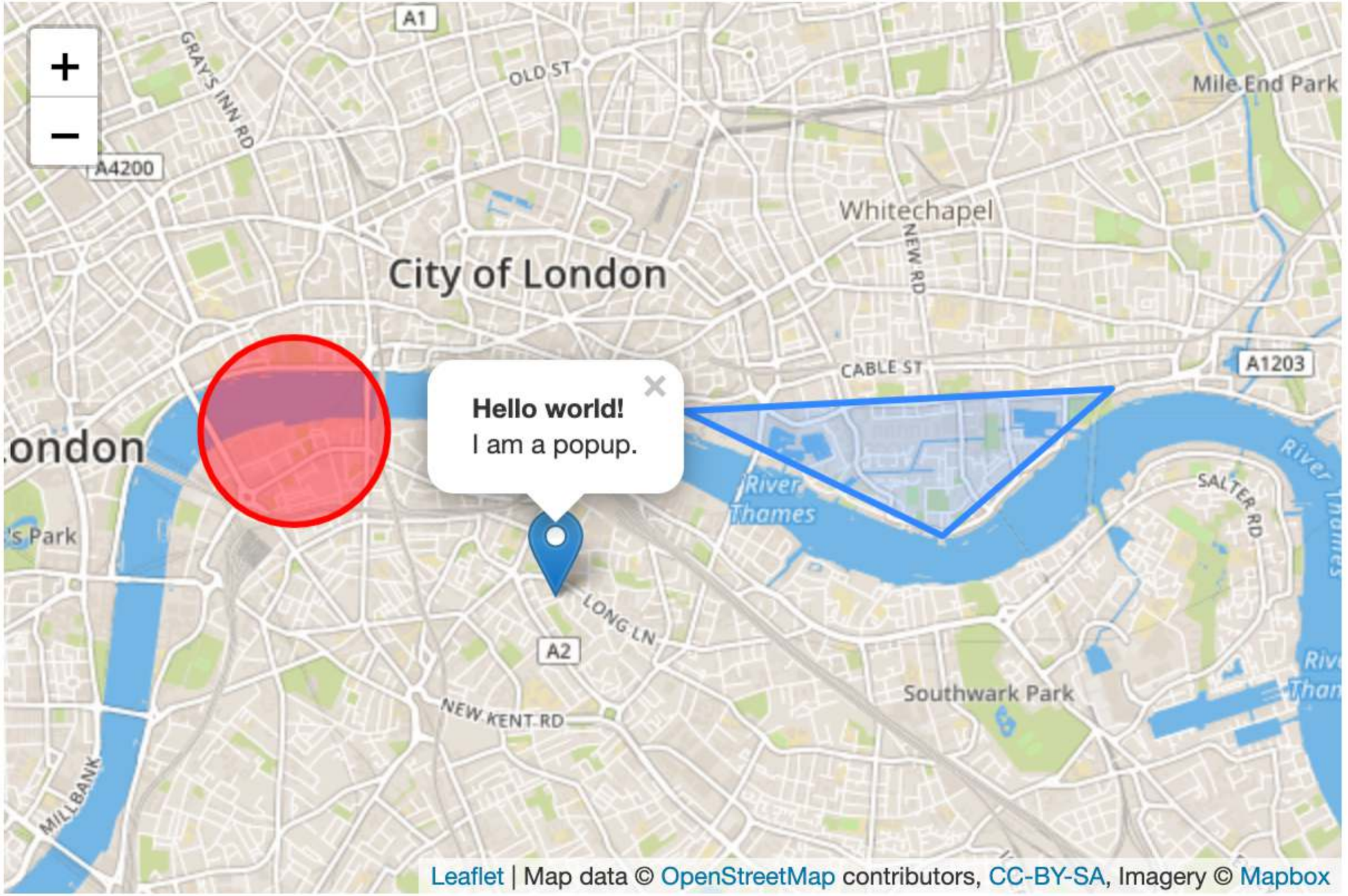
Overview Tutorials Docs Download Plugins Blog

May 8, 2019 — Leaflet 1.5.1 has been released!

Leaflet is the leading open-source JavaScript library for mobile-friendly interactive maps. Weighing just about 38 KB of JS, it has all the mapping features most developers ever need.

Leaflet is designed with *simplicity*, *performance* and *usability* in mind. It works efficiently across all major desktop and mobile platforms, can be extended with lots of plugins, has a beautiful, easy to use and well-documented API and a simple, readable source code that is a joy to contribute to.




A1
OLD ST
GRAY'S INN RD
A4200
Mile End Park
Whitechapel
NEW RD
City of London
CABLE ST
A1203
Hello world!
I am a popup.
River Thames
SALTER RD
LONG LN
A2
Southwark Park
NEW KENT RD
MILLBANK
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

GeoJson

```
{ "type": “Feature",
          "geometry": {
            "type": "Point",
            “coordinates": [102.0, 0.0]
           }
}
```

API EndPoint

```elixir
defmodule GpsServerWeb.Api.PositionController do
  use GpsServerWeb, :controller


  def create(conn, params) do
    {:ok, position} = GpsServer.create_position(params)
    {:ok, geo_point} =
       position
       |> GpsServer.Position.to_geojson()
       |> Jason.encode()

     conn
     |> put_resp_content_type("application/json")
     |> Plug.Conn.resp(201, geo_point)
     |> send_resp()
  end

end
```

Feedback

It’s easy

How Long ?

Hard to Debug

N

Nerves Init Gadget

ware Upgrade

Material

Raspberry pi 3

SD Card reader

GPS MODULE **X2**

Wires

Soldering Iron kit

1 battery


SBURG
Now What ?

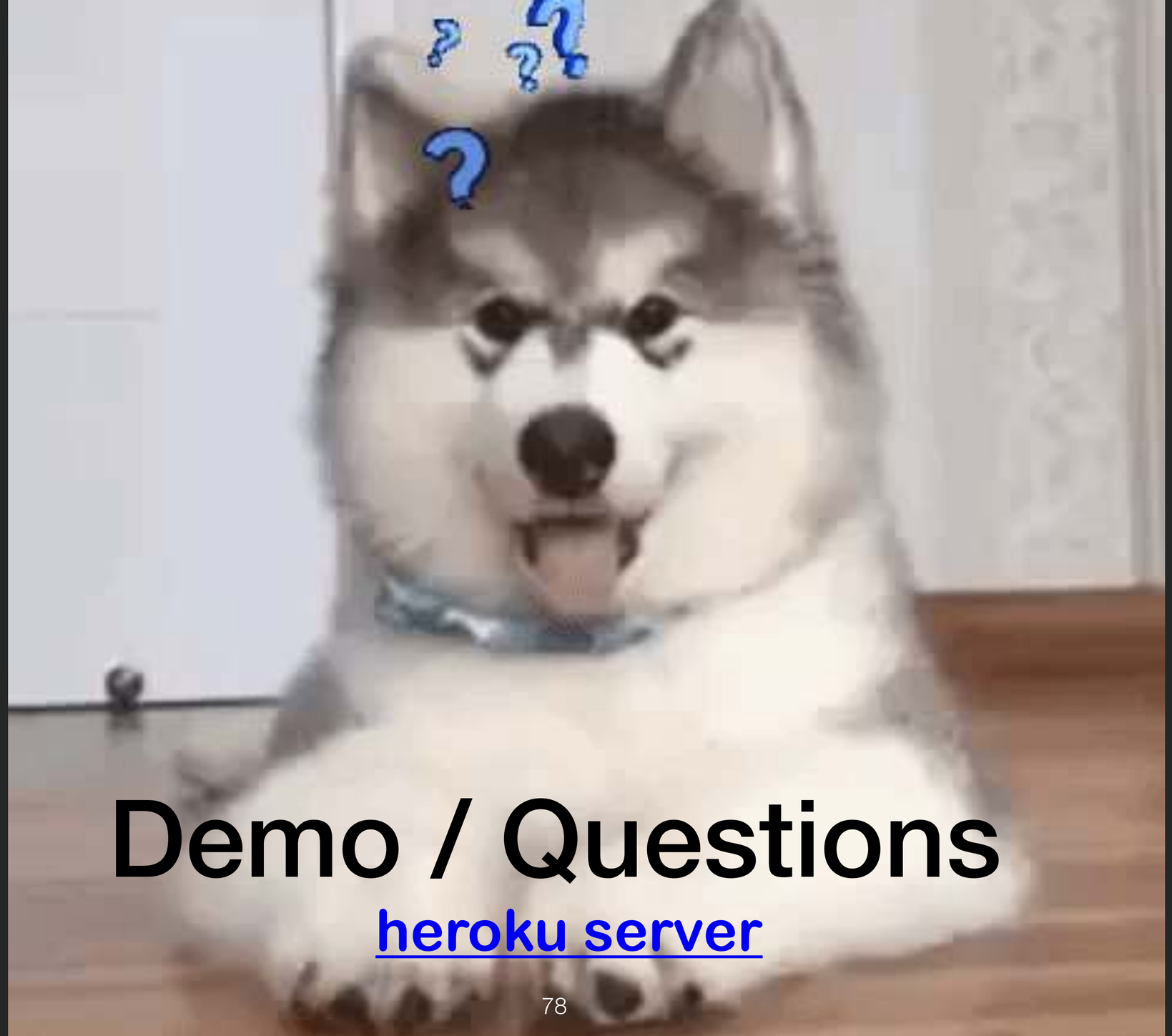
Future - Tracker

Optimizations

- power consumption
- Data consumption
- Space

Future - Backend

- Login
- History
- Notification



Demo / Questions

heroku server

git@github.com:yannvery/gps_tracker
git@github.com:yannvery/gps_server