An Open Platform for Collecting Data for OpenSeaMap

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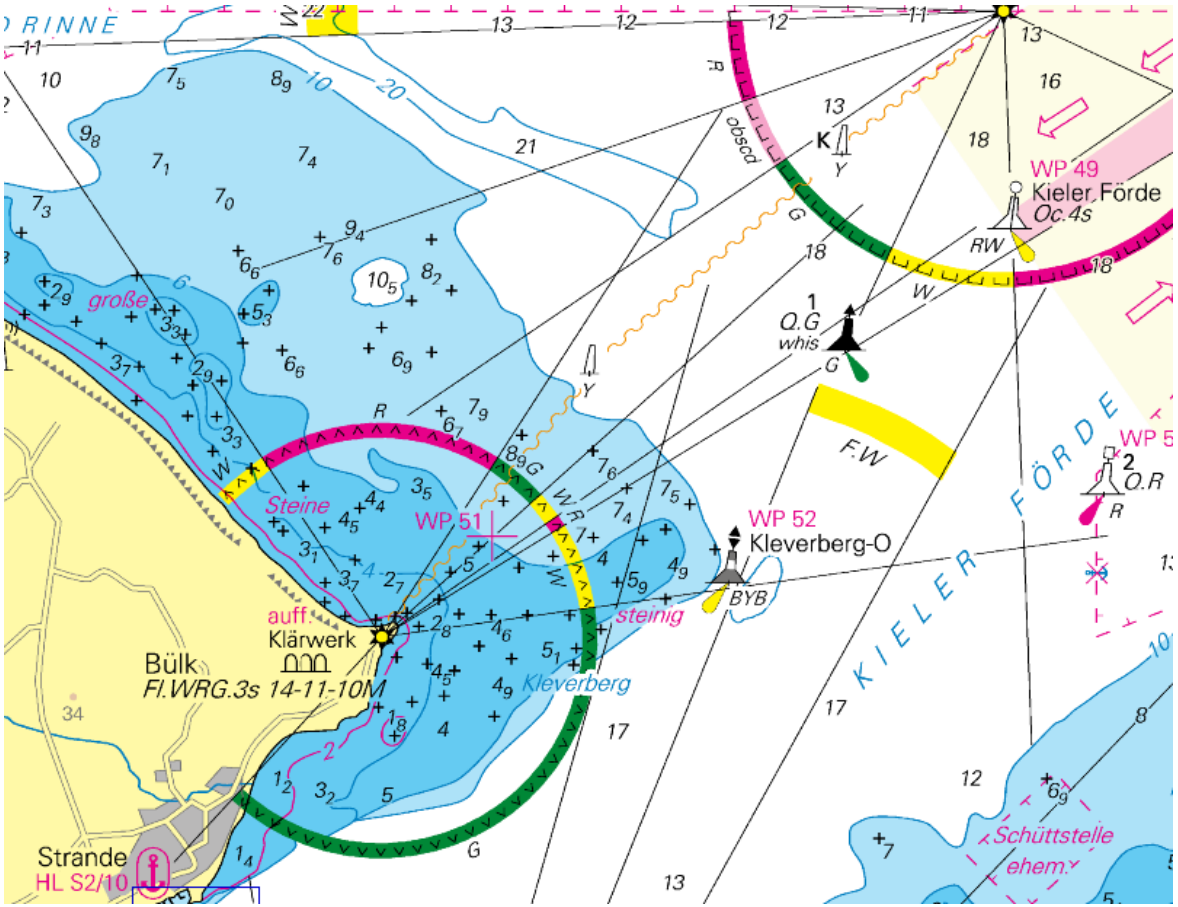
Overview

- Motivation
- What needs to be done?
  - Data Collection
  - Data Processing
- Hardware Setup
  - Requirements and Features
  - Block Diagram
  - Device Selection
- Project Status and Next Steps
- Wrap-Up

What is a nautical chart?

This is a nautical chart



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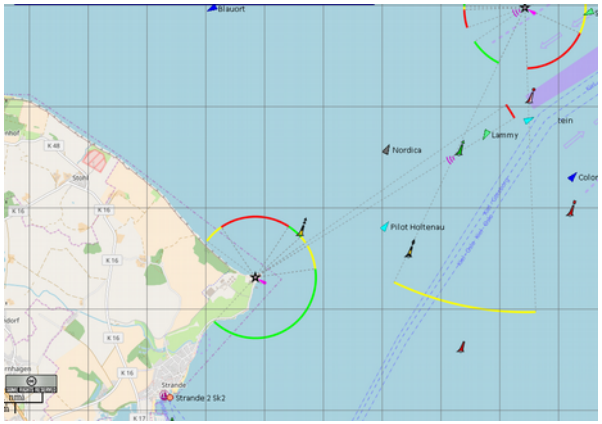
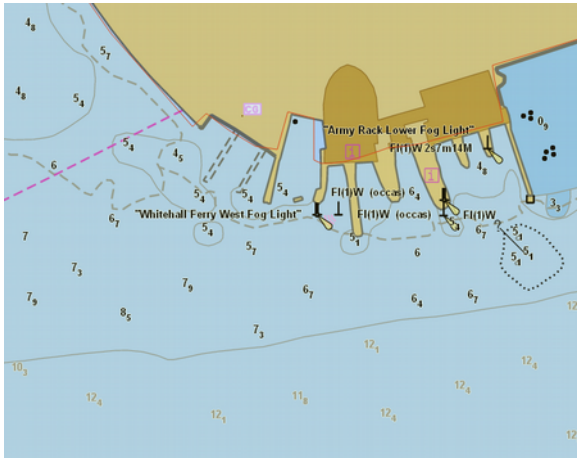
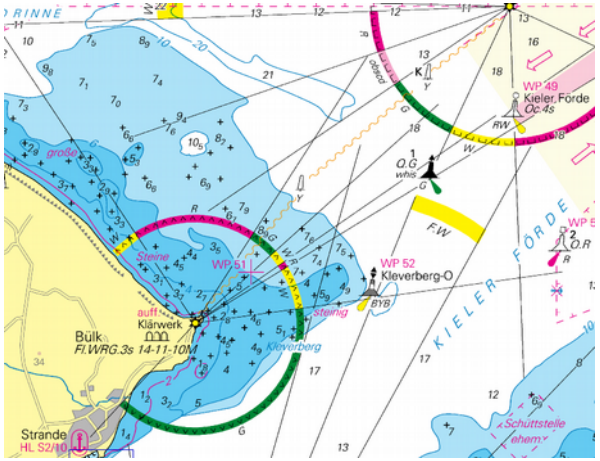
Motivation: Examples of Nautic Charts

OpenSeaMap



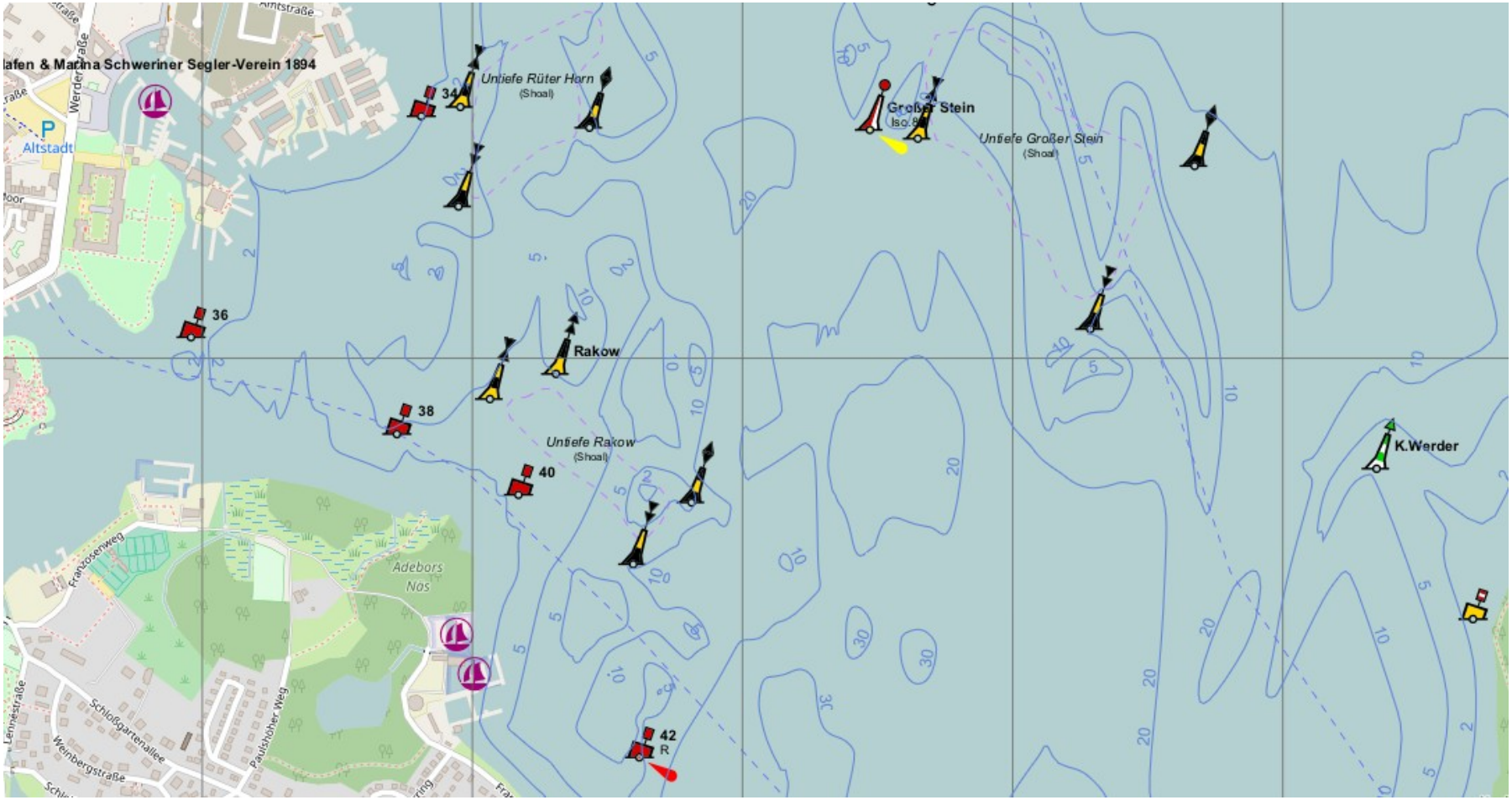
NOAA



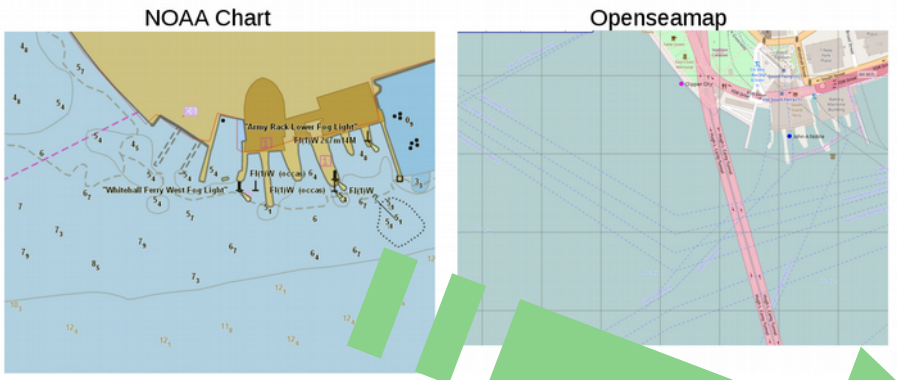


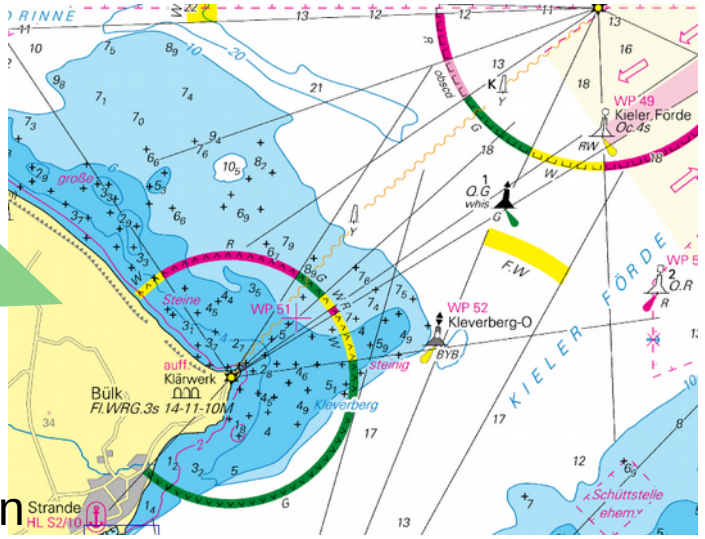
NV

Motivation: Example Lake Schwerin



Target: More detailed depth maps

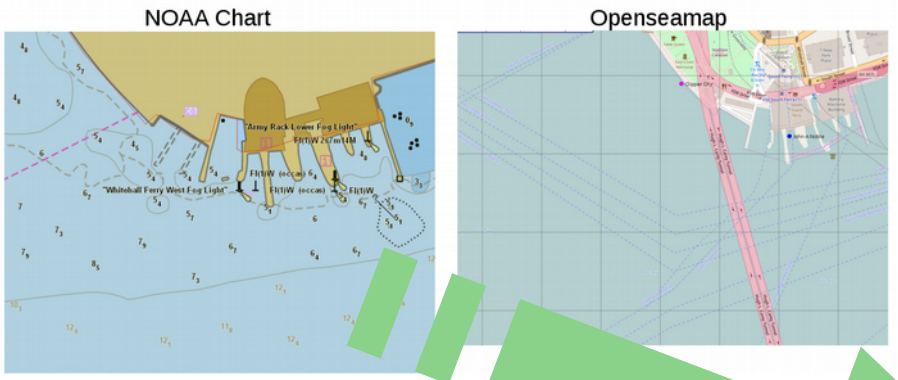


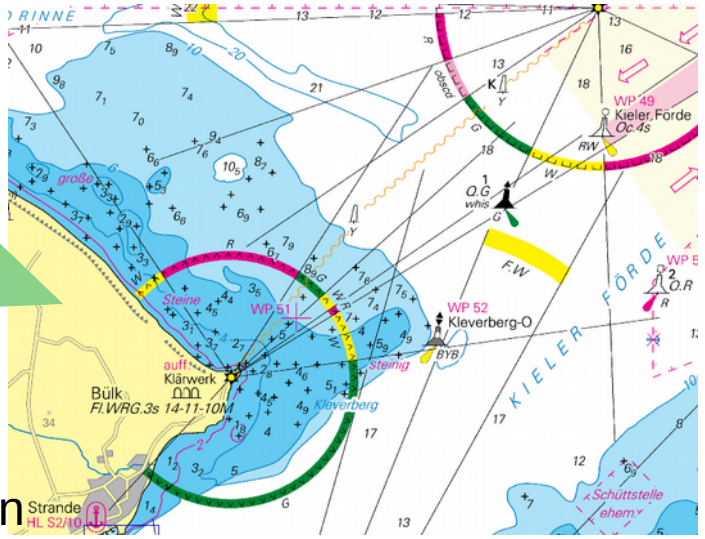


Two Issues:

- Data collection
- Data processing (algorithms) / data visualisation

Target: More detailed depth maps





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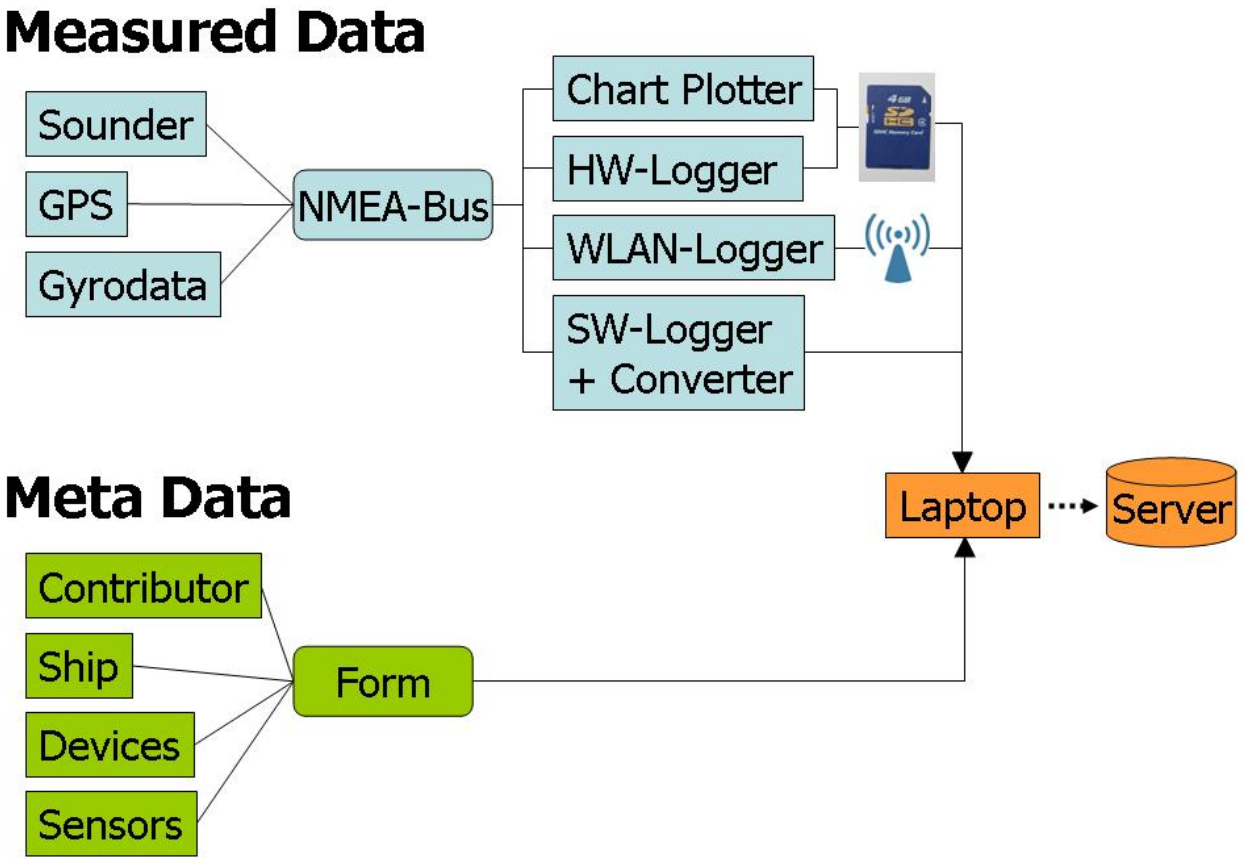
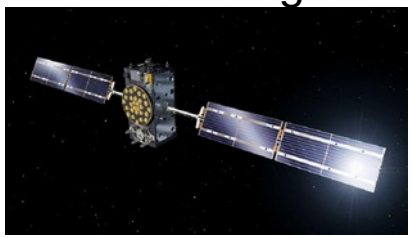
Current Data Collection Path of OpenSeaMap



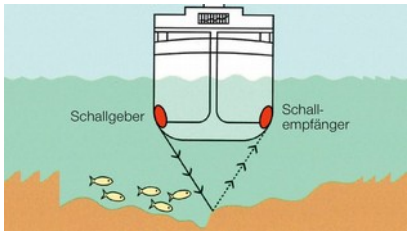
Quelle: http://depth.openseamap.org/#introduction

Data Collection

Satellite Navigation



Echo Sounder



(Bus)

Logging

PC/Laptop/Tablet/Smartphone/...

Server

- Open Source Projects
  - OpenSeaMap HW Logger (NMEA0183)
  - Raspberry Pi Logger (NMEA2000)
  - GNUBoat (NMEA2000)
- Proprietary Solutions
  - iKommunicate
  - Voyage Recorder
  - Plotter

Raspberry Pi Logger

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GNUBoat Requirements

- Tight integration
- Compact design
- Easy usability => most users are boat people, not hackers!
  - Secure and safe Operation
  - Fully automated data collection
  - At least partially automated data upload
    - Easy data transfer via WLAN, USB, Ethernet to users host
    - Upload to OpenSeaMap servers for post processing and visualisation
  - Possibly autonomous data transfer to OpenSeaMap servers?
- OpenSource design for later adaption due to boat network advances, etc.
- Adding more sensors for better compensation of boat movement (tilt, roll, pitch)

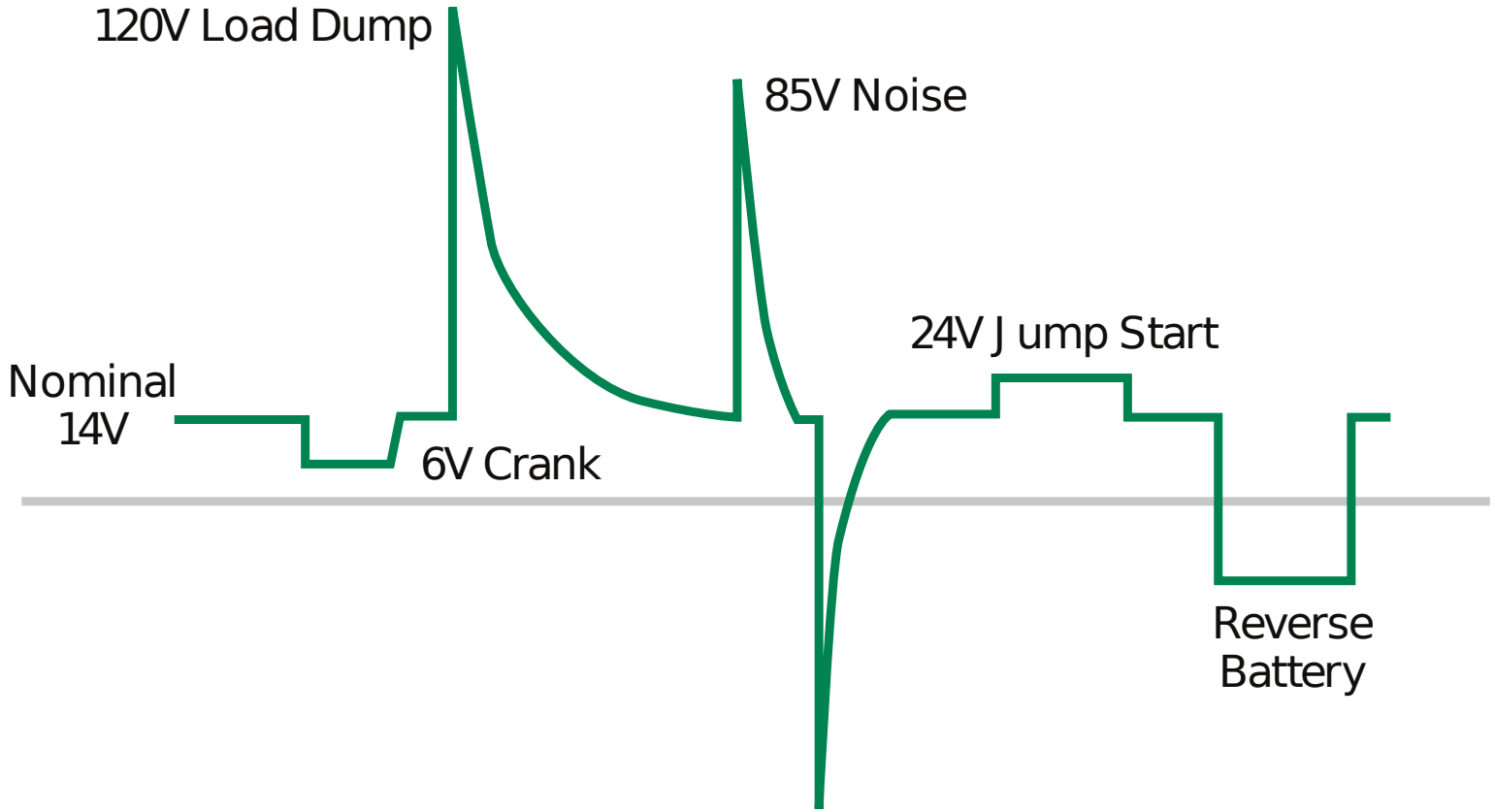
GNUBoat Additional Features / Services

- Mooring
  - Weather Condition and Swell Monitoring
  - Position and Drift Monitoring
  - Alarm or push messages
- Turn plot creation
- Internet access point / firewall within marina WLANs
- Battery Health Monitoring => Power is a crucial resource on a boat!

GNUBoat Challenges

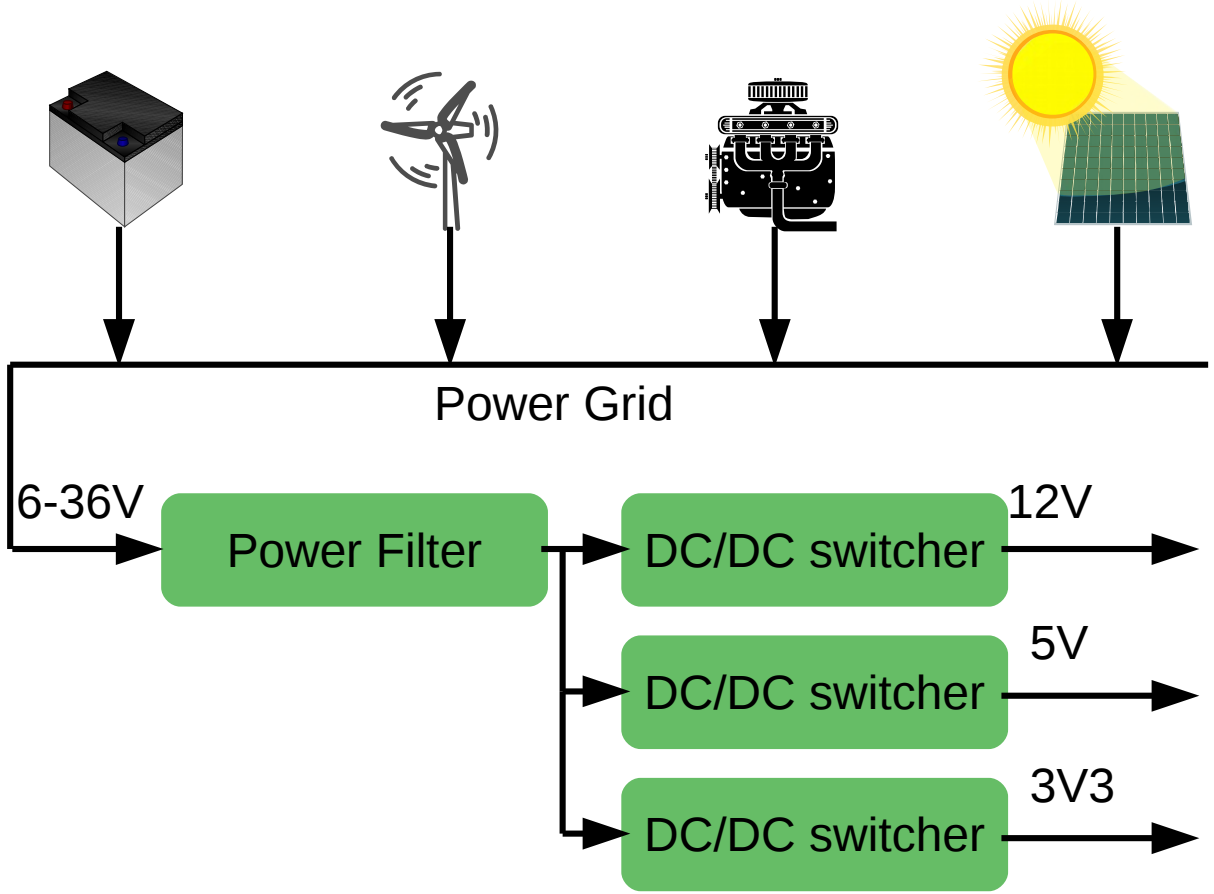
- Automotive Grade Power Supply for powered boats
  - Complex EMI conditions with RX & TX RF signals
  - Engine starter EMI / undervoltage and overshoot conditions
  - Generator ripple
  - Ground shifts
  - Delayed power-off to safely switch off devices without data corruption
- Battery backed stand-alone operation for sailors without power supply
  - Needs to supply all sensors, including echo sounder (pulsed power load ~ 2 Hz)
- CAN interface decoupling (EMI/ESD/...)
- Multiple sensors integrated into one node

GNUBoat Power Supply Challenge



http://m.littelfuse.com/~/media/electronics/application_notes/littelfuse_tvs_diode_automotive_circuit_protection_using_automotive_tvs_diodes_application_note.pdf.pdf

GNUBoat Power Supply Block Diagram



GNUBoat Raspberry Pi Node

Remote Sensors

Local Interfaces

Local Sensors

Raspberry Pi

GNUBoat Raspberry Pi Node

Remote Sensors

Local Interfaces

Local Sensors

Echo Sounder

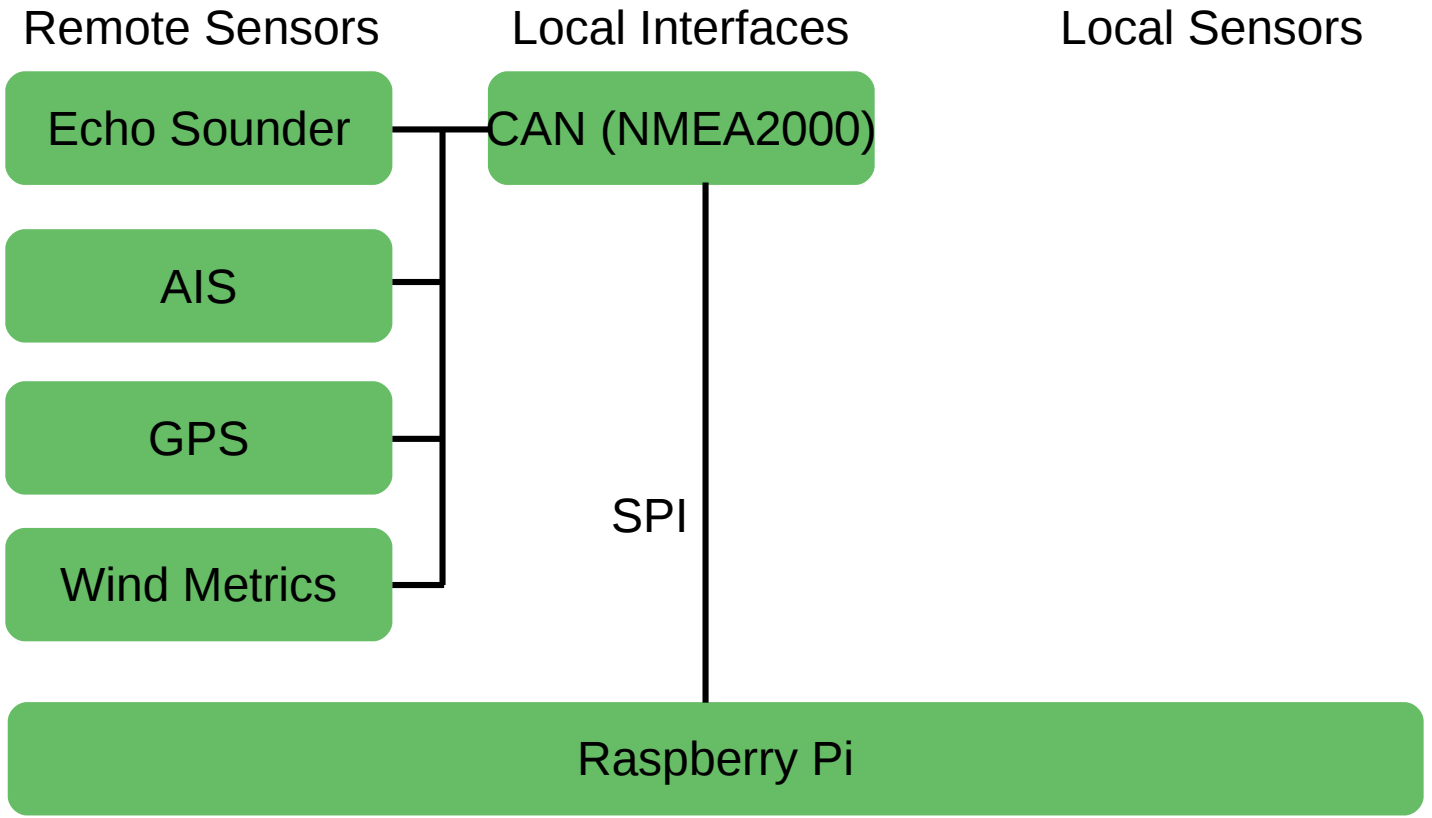
AIS

GPS

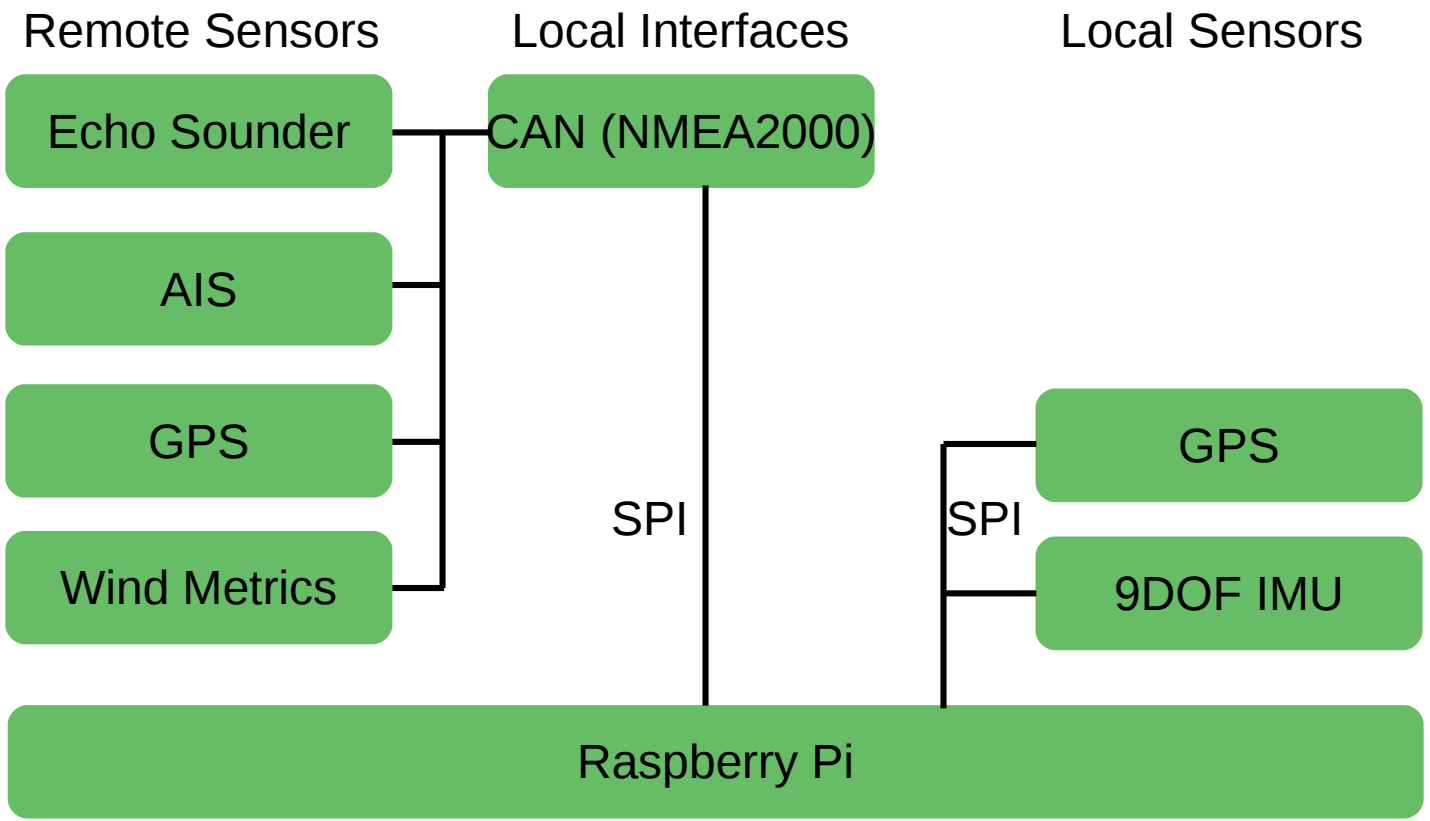
Wind Metrics

Raspberry Pi

GNUBoat Raspberry Pi Node



GNUBoat Raspberry Pi Node



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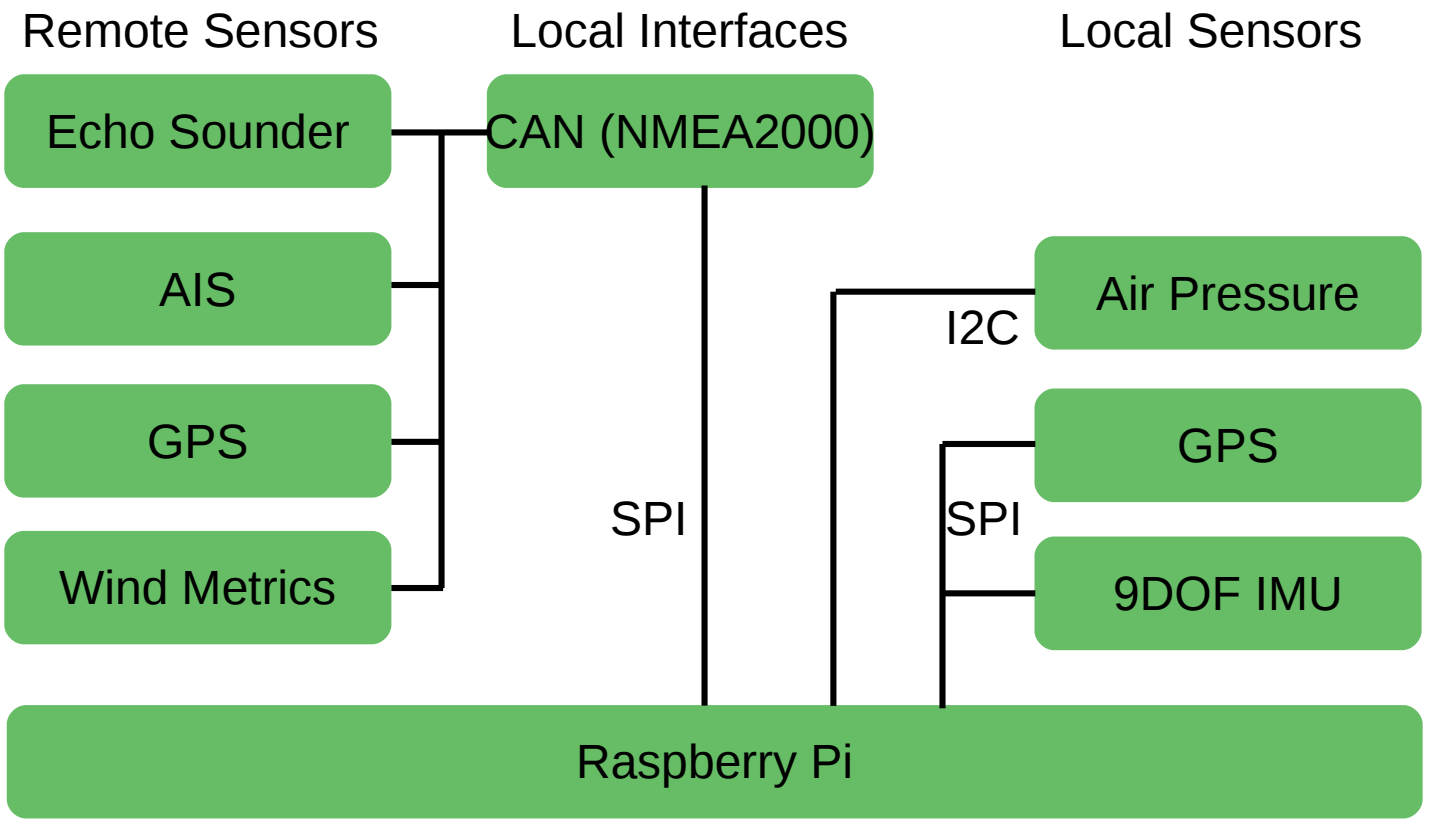
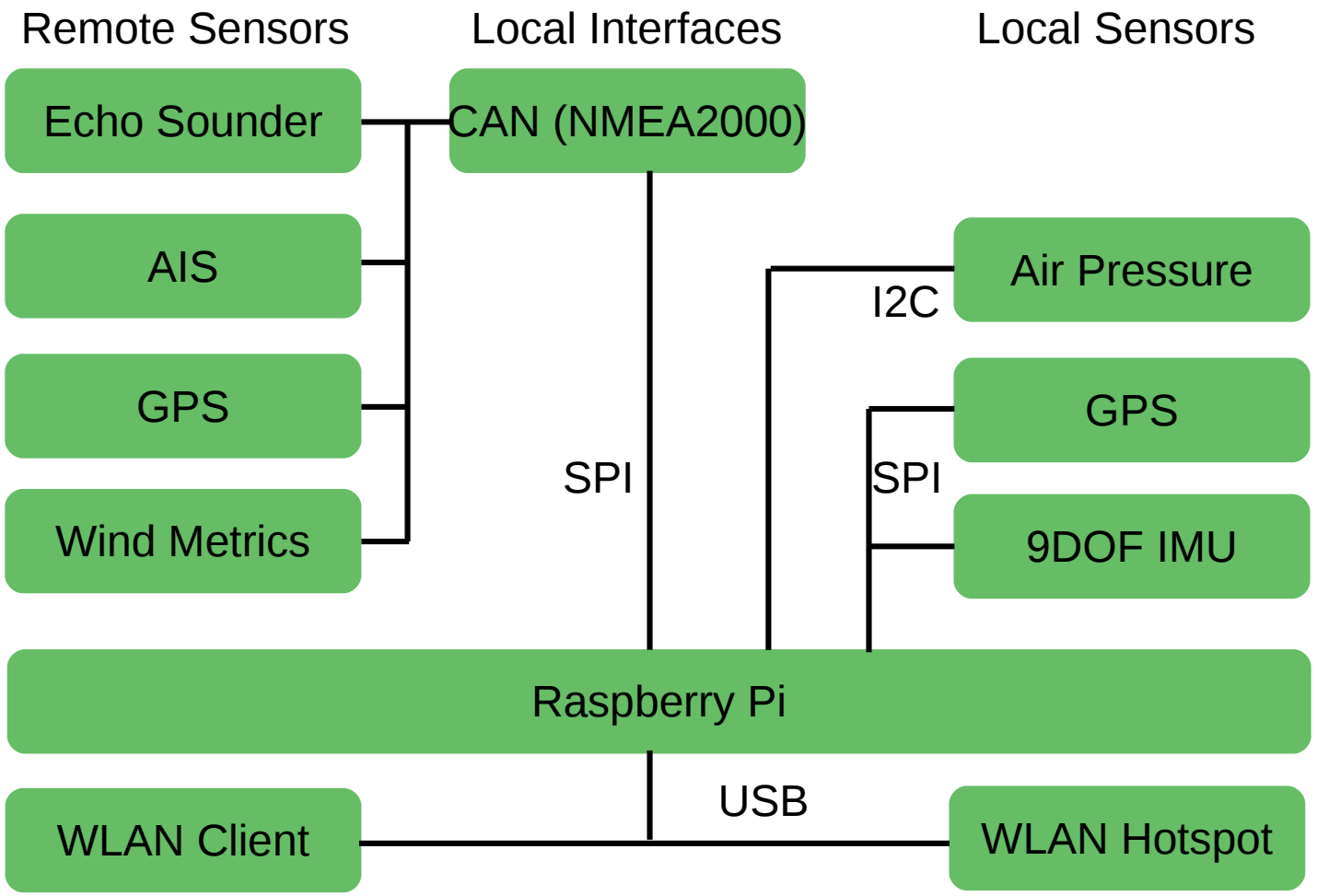
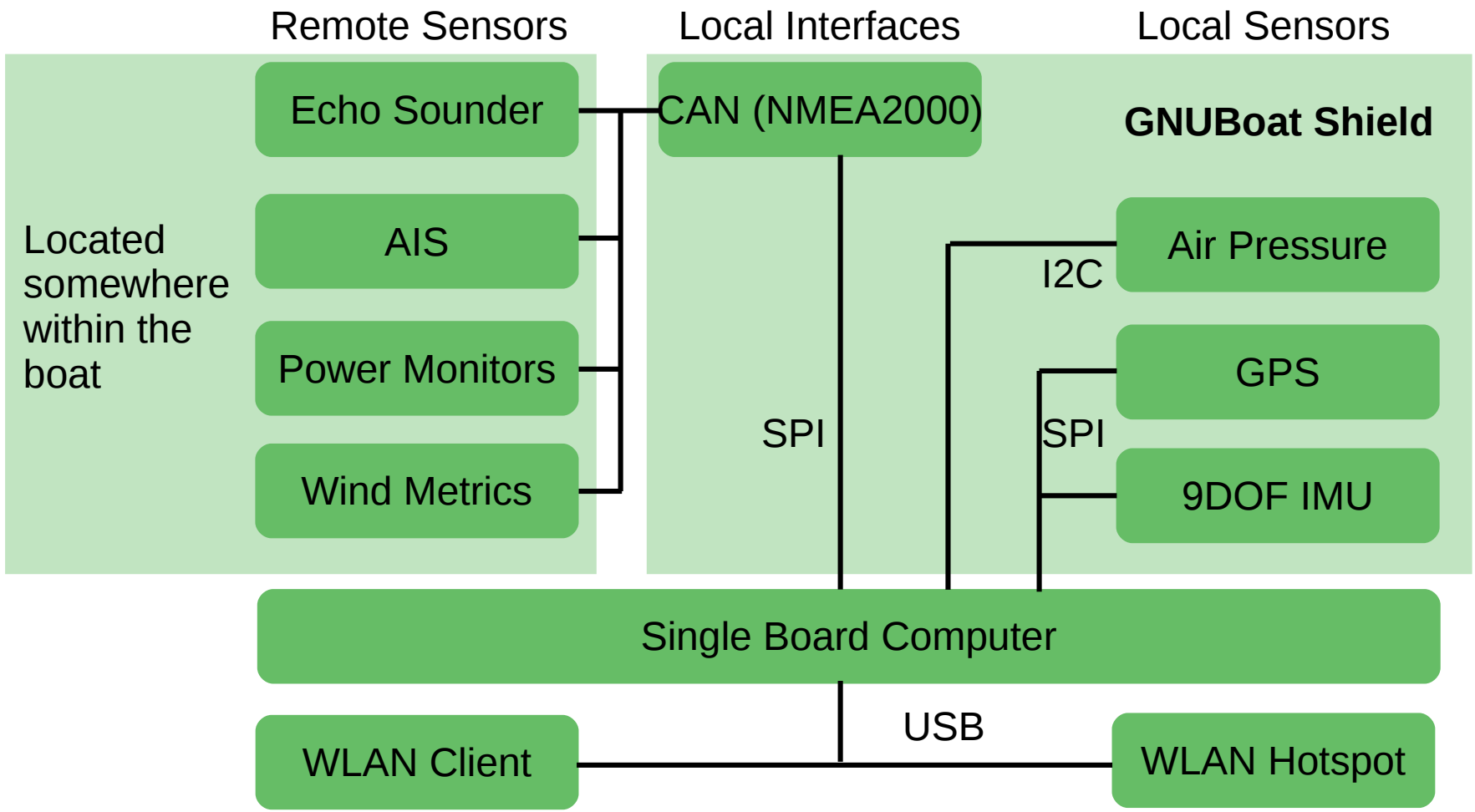


GNUBoat Raspberry Pi Node



GNUBoat Raspberry Pi Node



GNUBoat device selection (1)

- **Single Board Computer: Raspberry Pi**
  - Widely used and good availability
  - Established OS distribution
  - Supported by a lot of libraries / projects
  - Highly active community
  - Highest probability for reuse of the development

- **CAN Interface: MCP2515 SPI-CAN interface / MCP2562 (CAN transceiver)**
  - Widely used, e.g. PICAN2
  - Well understood
  - Good availability

GNUBoat device selection (2)

- **Barometric Sensor: MPL3115A2**
  - Reasonable accuracy (0.5 m)
  - Good availability
  - Prototyping via sparkfun breakout
- **GPS: TBD (possibly sparkfun Venus or XA1110 breakouts)**
  - Use breakout module => no RF PCB design needed
  - Needs external antenna connector due to housing and mounting position
- **9DOF IMU: TBD (possibly LSM9DS1)**
  - Fully integrated system in package
  - Good availability
  - Prototyping via sparkfun breakout

GNUBoat device selection (3)

- **USB WLAN interface**
  - Good driver support
  - HostAPD support

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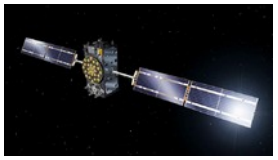
GNUBoat Prototype Hardware

RPI A+

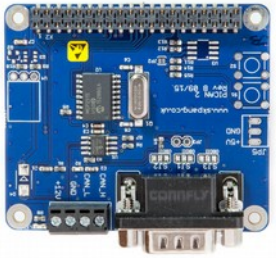
USB Hub



GPS

WLAN Hotspot

WLAN Client



PICAN2

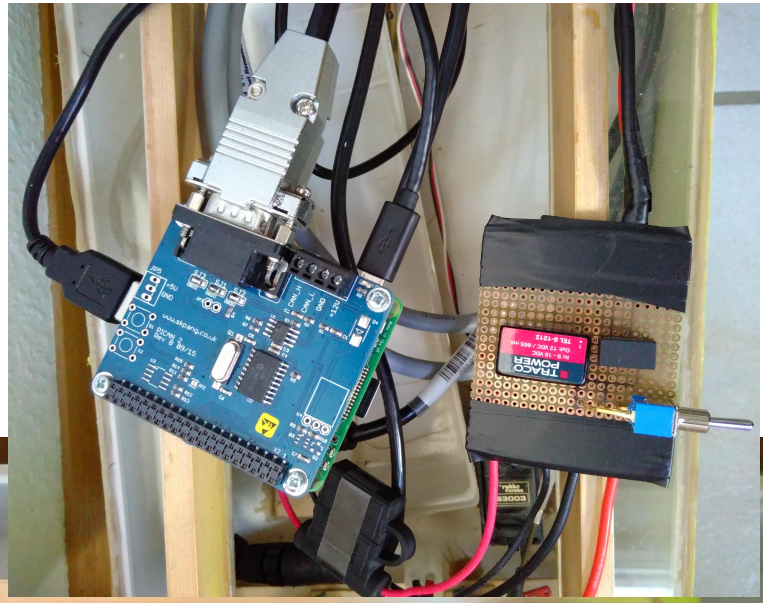
6,5 – 36V to 5V

9 – 18V to 12V

NMEA 2000

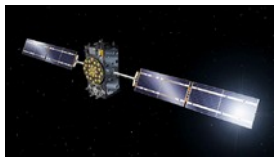
Airmar DST800 Echo Sounder

GNUBoat Prototype Hardware

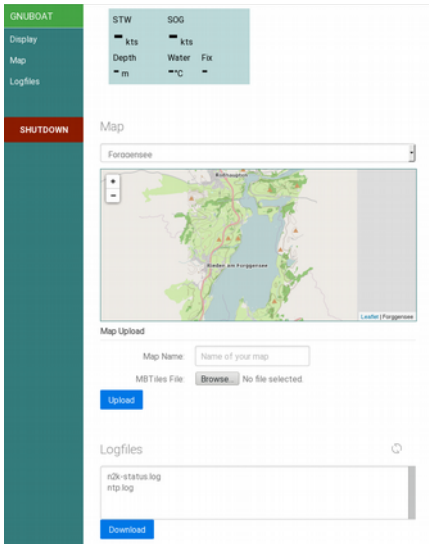


Puppet Configuration

GNUBoat Software Stack



NMEA 2000



gpsd

canboat

Webclient

Daemon

RRD

Webservice

NMEA 0183 Logfile

GNUBoat Project Next Steps

- **Running Demo**
  - Prototype hardware vailable
  - Software stack for prototype components available
  - Continues integration infrastructure and configuration management setup
- **Block diagram level planning done**
- **Power supply planning in progress**
- **External module for battery health monitor schematic started**
  - CAN interface reference
  - Power supply filter
  - Design reference and testing
- **Due to daytime job implications looking for support!**
  - Schematic and PCB design, mechanics, ...

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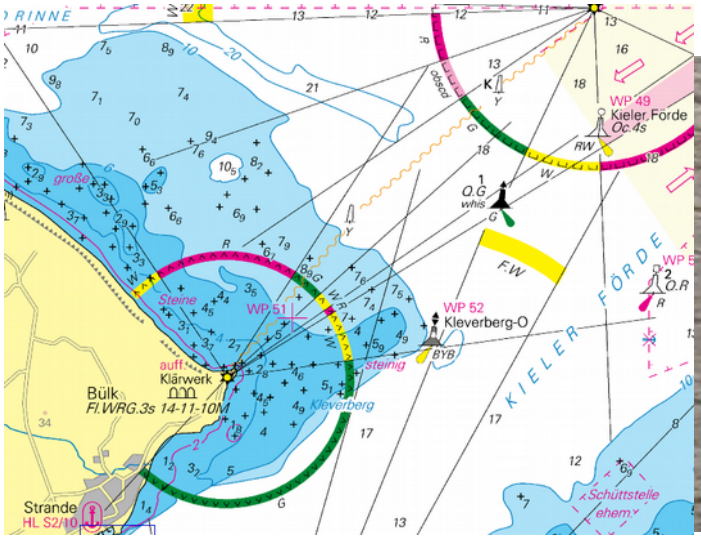
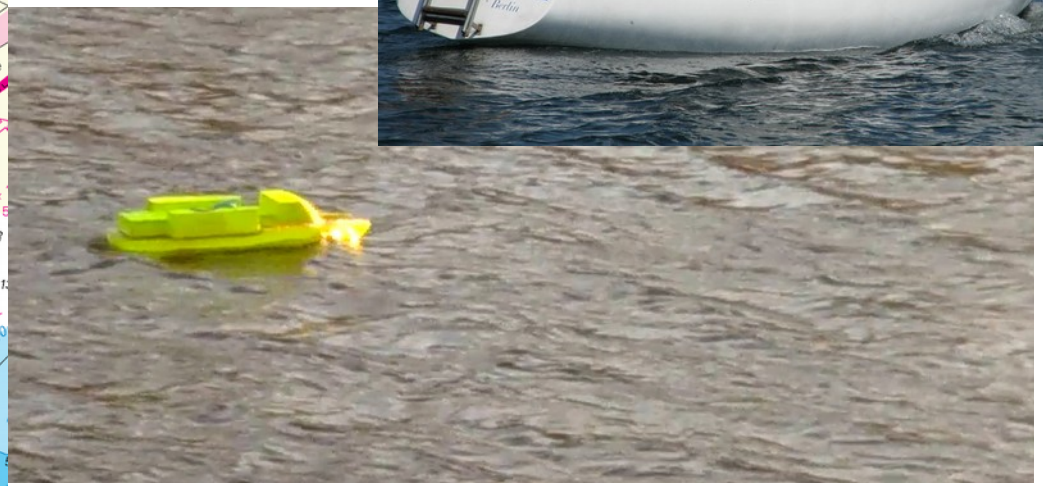
GNUBoat Wrap-Up

- **GNUBoat aims at providing an open nautic data collection platform**
  - Real world applicable
  - Testing may be done with small prototypes
  - Deployment on real yachts
- **GNUBoat wants to help create better charts**





Thank you very much!

Have fair winds and following seas!

Contact: info@engsas.de

- **Web: https://trac.engsas.de/gnuboat/**