5 Radio payload

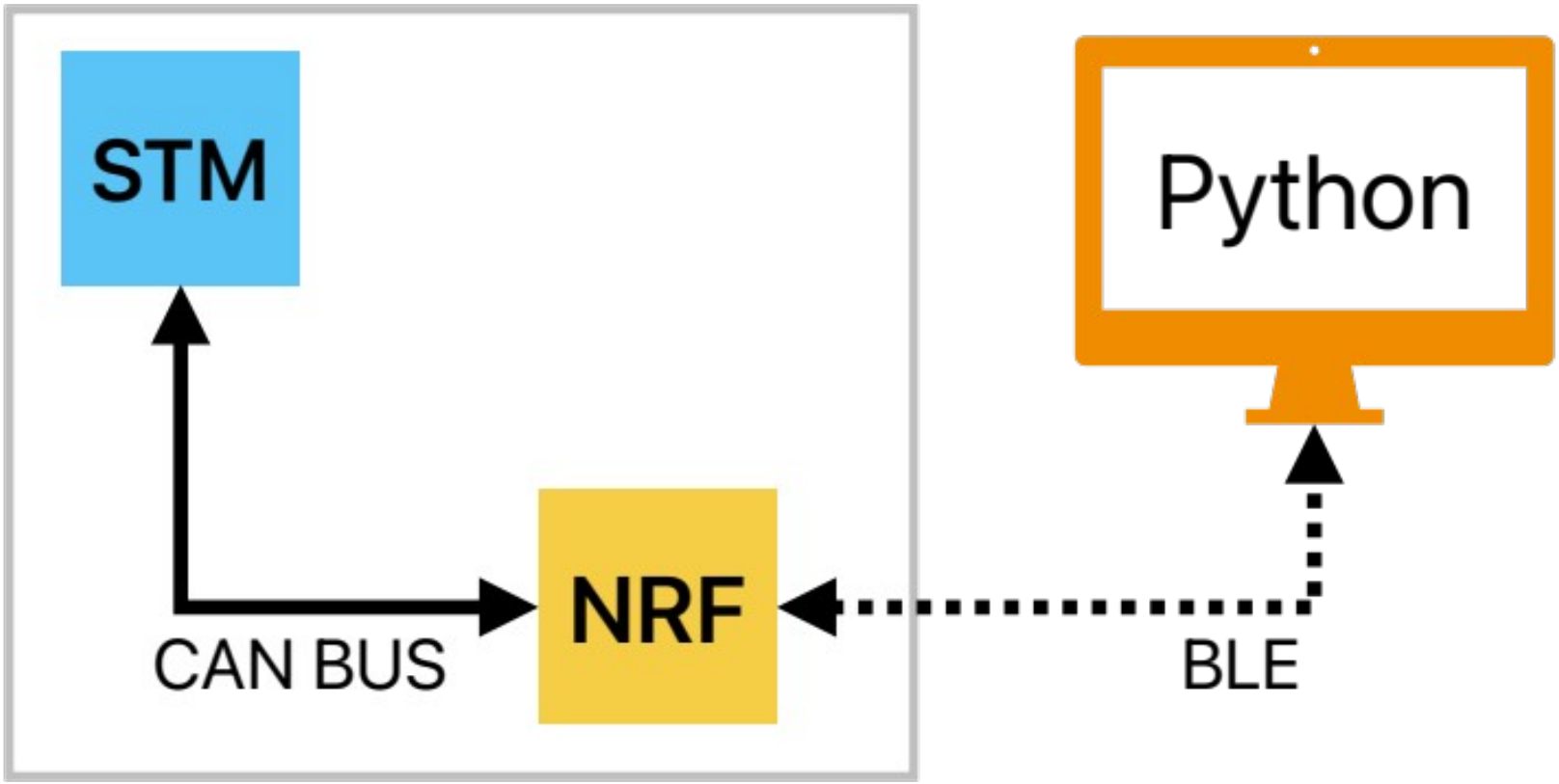
Authors : Bc. Josef Vágner, Bc. Jakub Šmíd
Advisor: Ing. Ondřej Nentvich, Ph.D.
24.12.2023

Assignment

Develop a program for the Radio payload which can handle communication for the Cubesat.

- Propose communication between Radio payload (nRF52832) and Ground station (PC in this case) in S-band.
- The communication is based on CSP protocol.
- Establish communication between radio part (nRF52832) and microcontroller which will handle communication with the rest of the CubeSat (STM32F413).
- Develop a program (in Python) for ground station which will manage communication with the cubesat.
- Selected MCUs are STM32F413 and nRF52832.

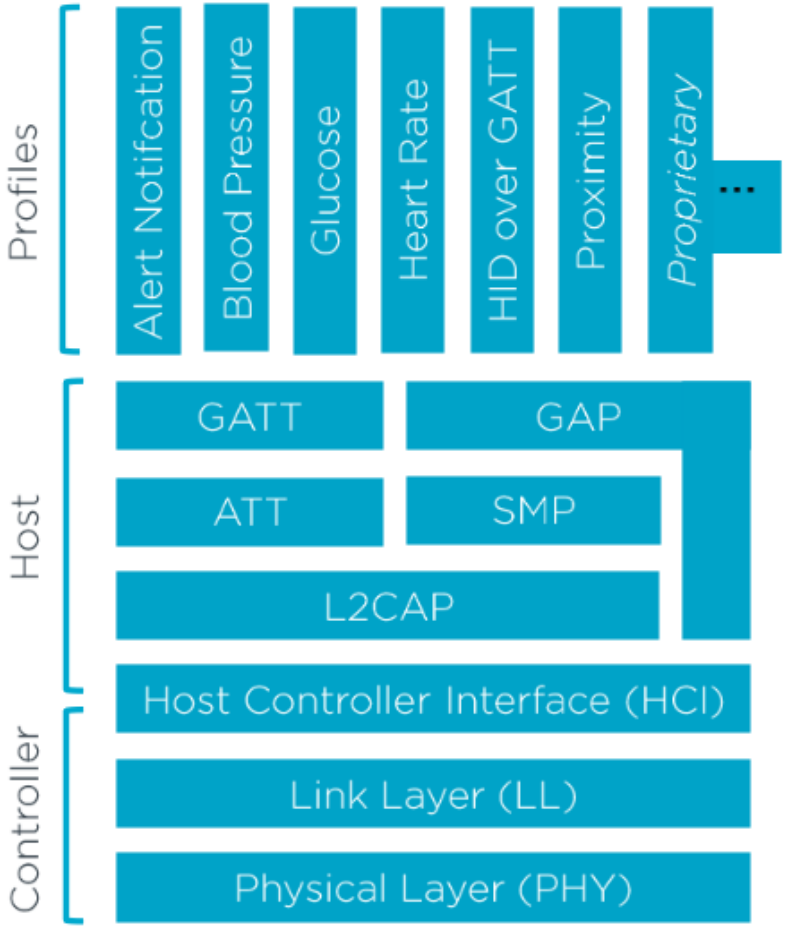
System architecture



Communication – BLE

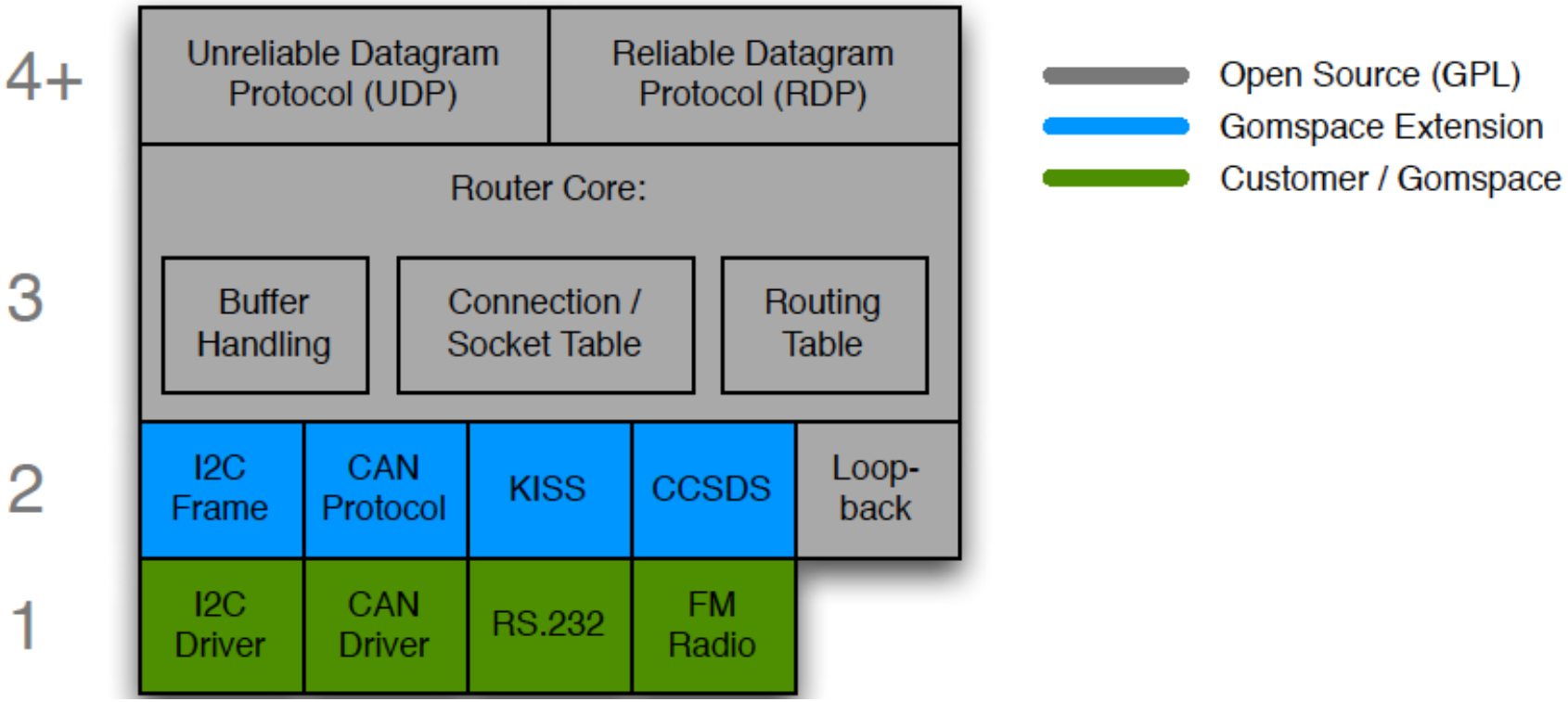
- We are using nRF **Connect SDK** which runs on top of RTOS called **Zephyr**.
- On the Ground Stations is used **Bleak**.

- Advertising, binding
- Nordic UART Service
- Max. 20 byte payload
- Tx function, callback for Rx



Cubesat Space Protocol

- Based on a 32-bit header containing both network and transport layer information
- Small – Great for embedded systems
- Implemented in C (csplib)



Implementation problems

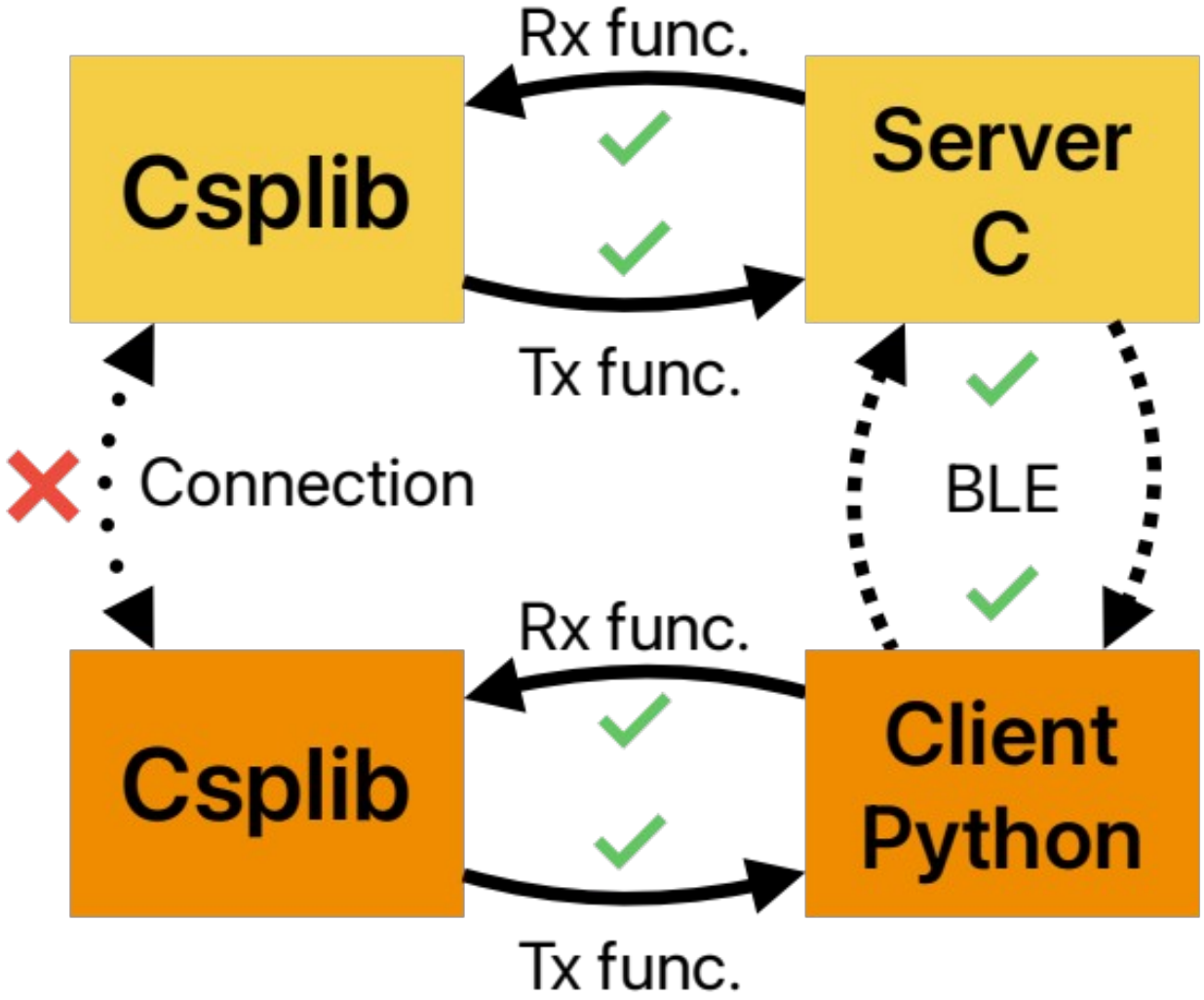
- Poor documentation of csplib
- Python bindings – GIL – Python can’t call functions from csplib
- Missing BLE – Interface

Implementation problems – solutions

- GIL – Threads communicate through localhost ZeroMQ socket
- We implemented new interface – basic
  - When data is received or ready to send the client script either sends received data to basic interface or csplib calls provided function for transmit.

Current state

Both devices receive packet, but the csplib don’t response to message



Thank you for your attention