# A Generic EGSE

Workshop Simulation for European Space Programmes
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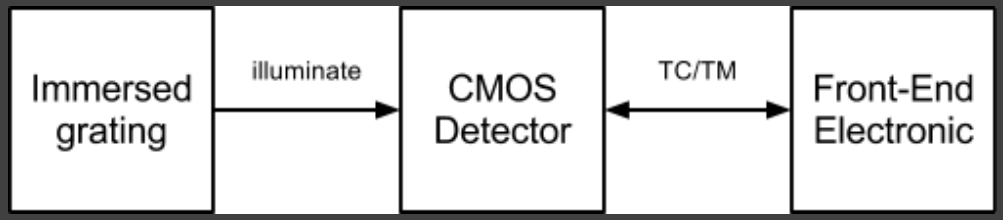
# Goal and solution

- Existing EGSEs: cumbersome to adapt to new test setup.
- Goal: new flexible EGSE to be used throughout development
  - From prototypes to Flight Model (FM).
  - Without continuous interference of SW engineers.
- Solution
  - Modular distributed architecture.
  - Hardware abstraction.
  - Standard protocol and light weight protocol conversion layer.
- Discussion of highlights of EGSE by means of TROPOMI use case.

# TROPOMI

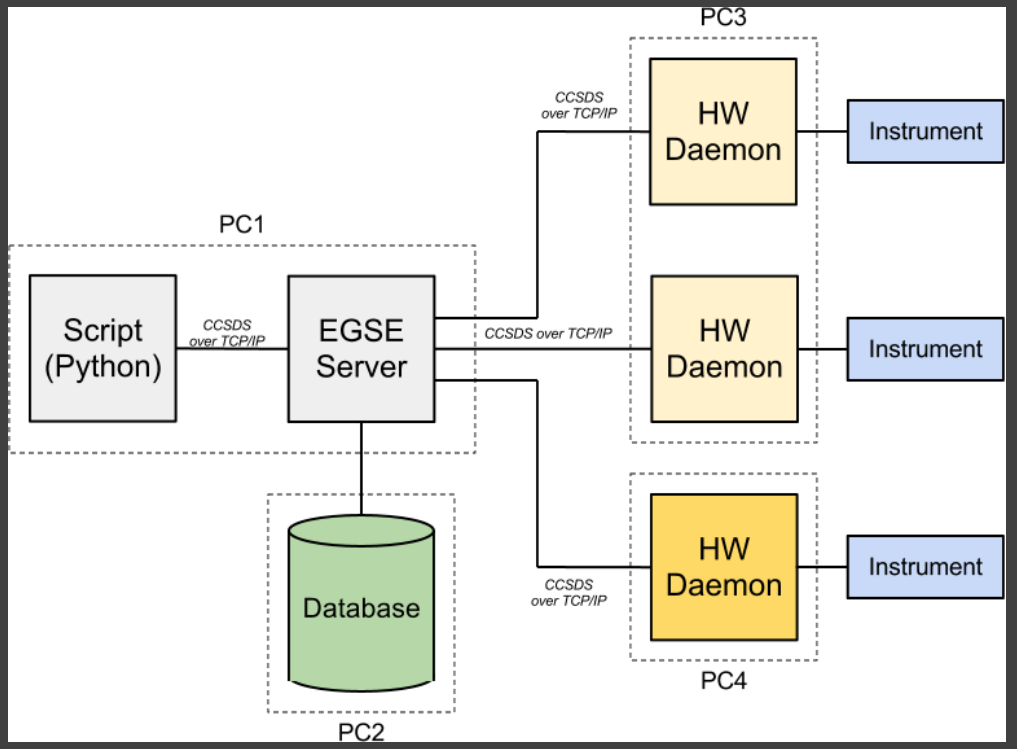
- TROPOMI: TROPOspheric Monitoring System
  - Ultraviolet, Visible, Near Infrared, Shortwave Infrared (Ozone, pollution).
  - SWIR (Short-Wave Infrared) spectrometer.

- SRON contribution
  - Immersed grating.
  - Front-End Electronic to communicate with the SWIR.



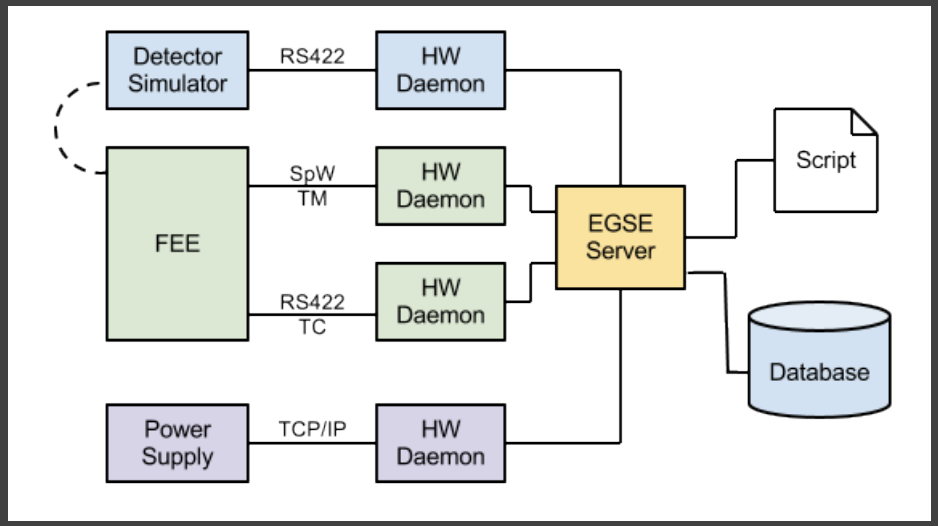
# Modular Distributed Architecture

- Distributed architecture:
  - EGSE Server
  - Database
  - Script
  - Hardware Daemons
- Modified CCSDS protocol over TCP/IP.
- Modularity.
- XML Configuration file.

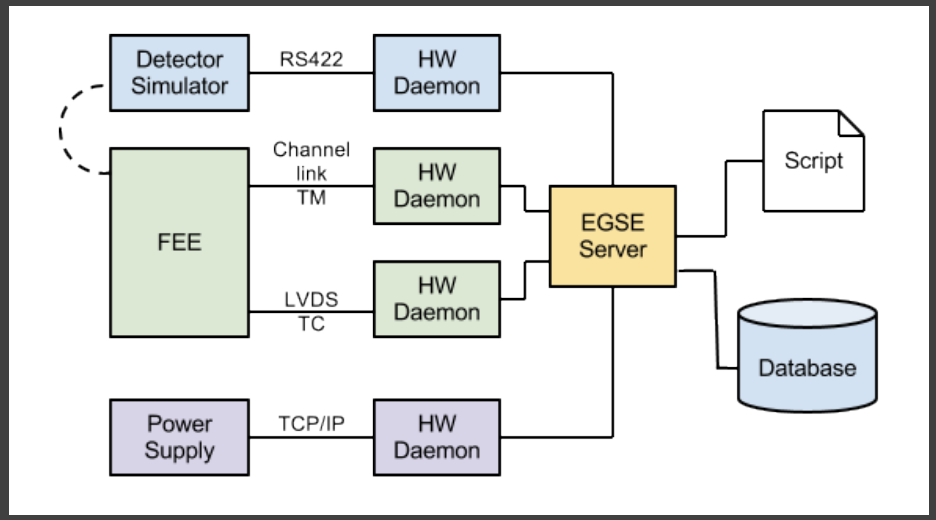


# Modular Distributed Architecture - TROPOMI

- Engineering Model
- FEE has two interfaces:
  - TM: SpaceWire
  - TC: RS422



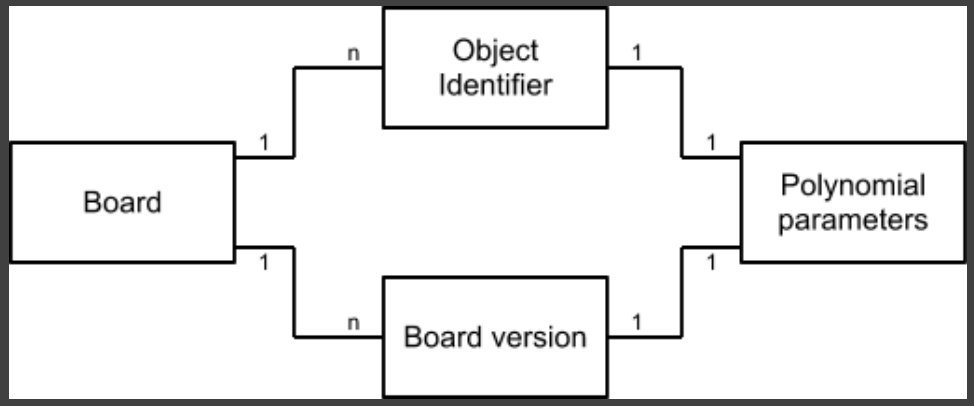

- Qualification/Flight Model
- FEE has two new interfaces:
  - TM: Channel link
  - TC: LVDS



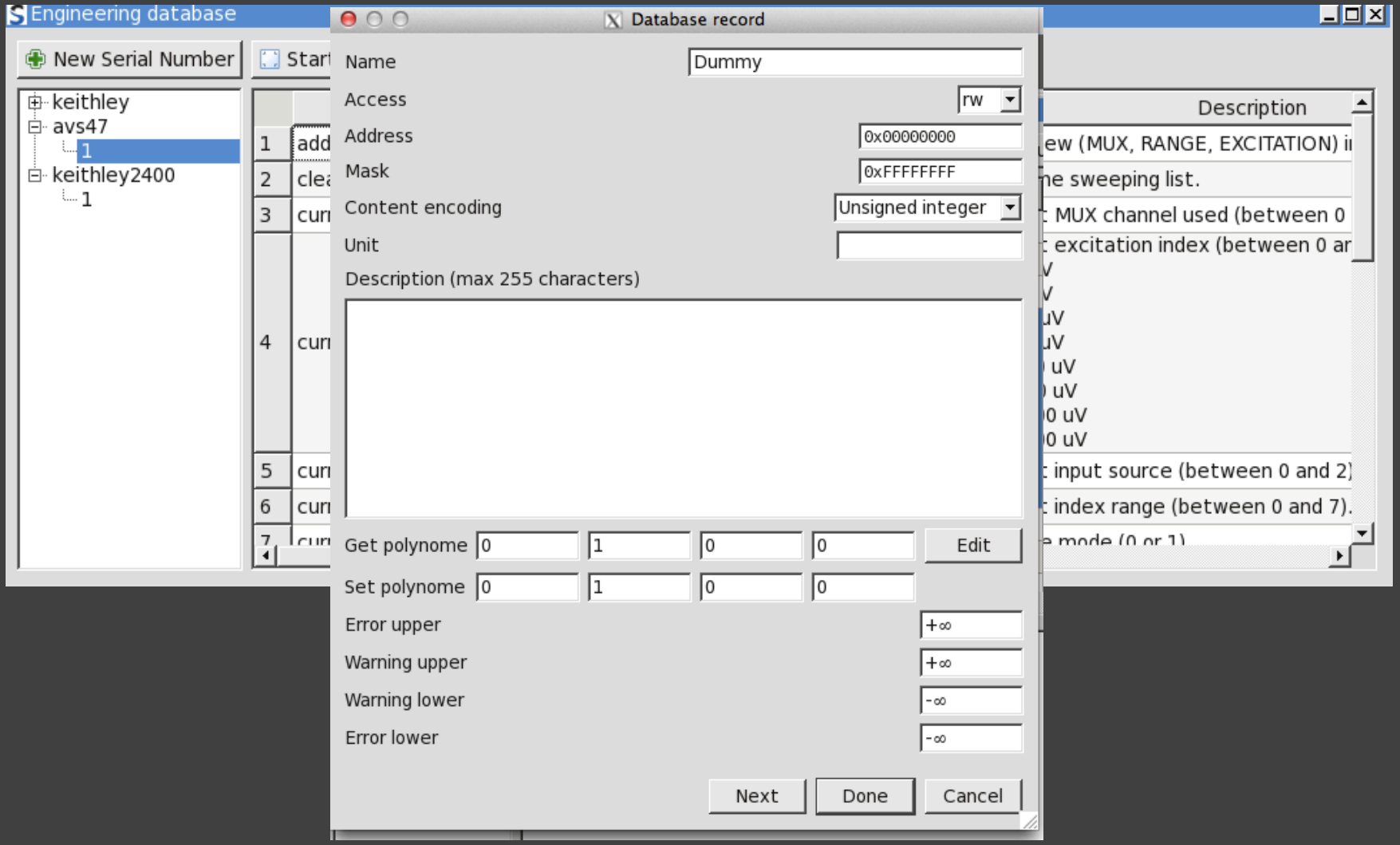
# Hardware abstraction

- All hardware in SUT described in fairly simple database.

- The database contains:
  - boards: describe a hardware entity
  - object identifiers: describe a functionality in the HW
  - polynomial parameters: conversion RAW ⇔ ENG values
  - board versions: describes multiple version of a board



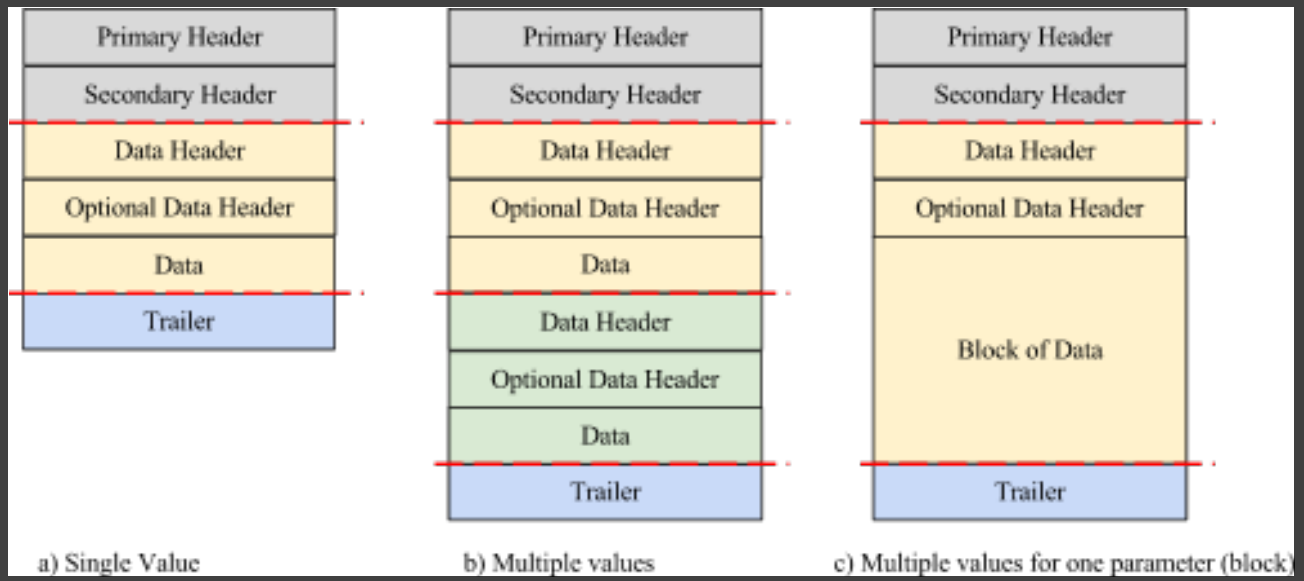
# Hardware abstraction - TROPOMI



# Protocol and physical interfaces

- Internal protocol: CCSDS based

- A CCSDS packet contains:
  - An action (Set/Get)
  - A object identifier
  - One value or more

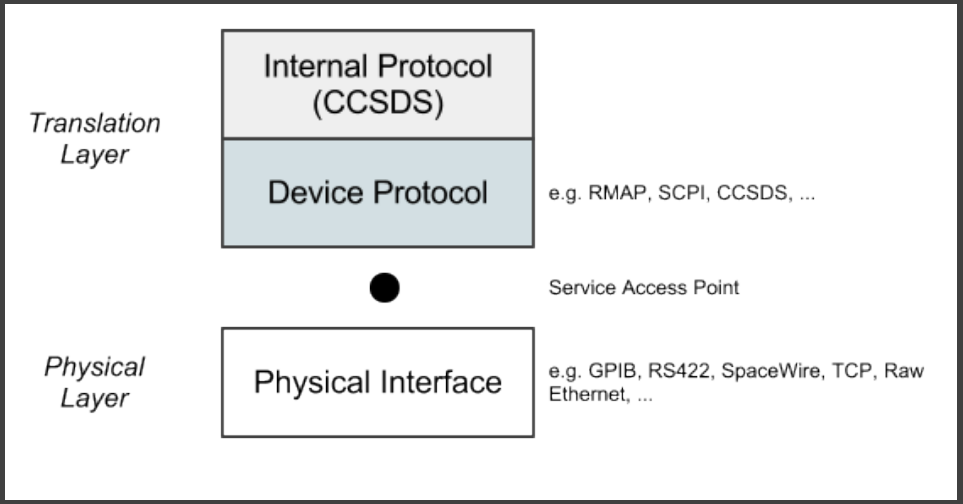


# Protocol and physical interfaces

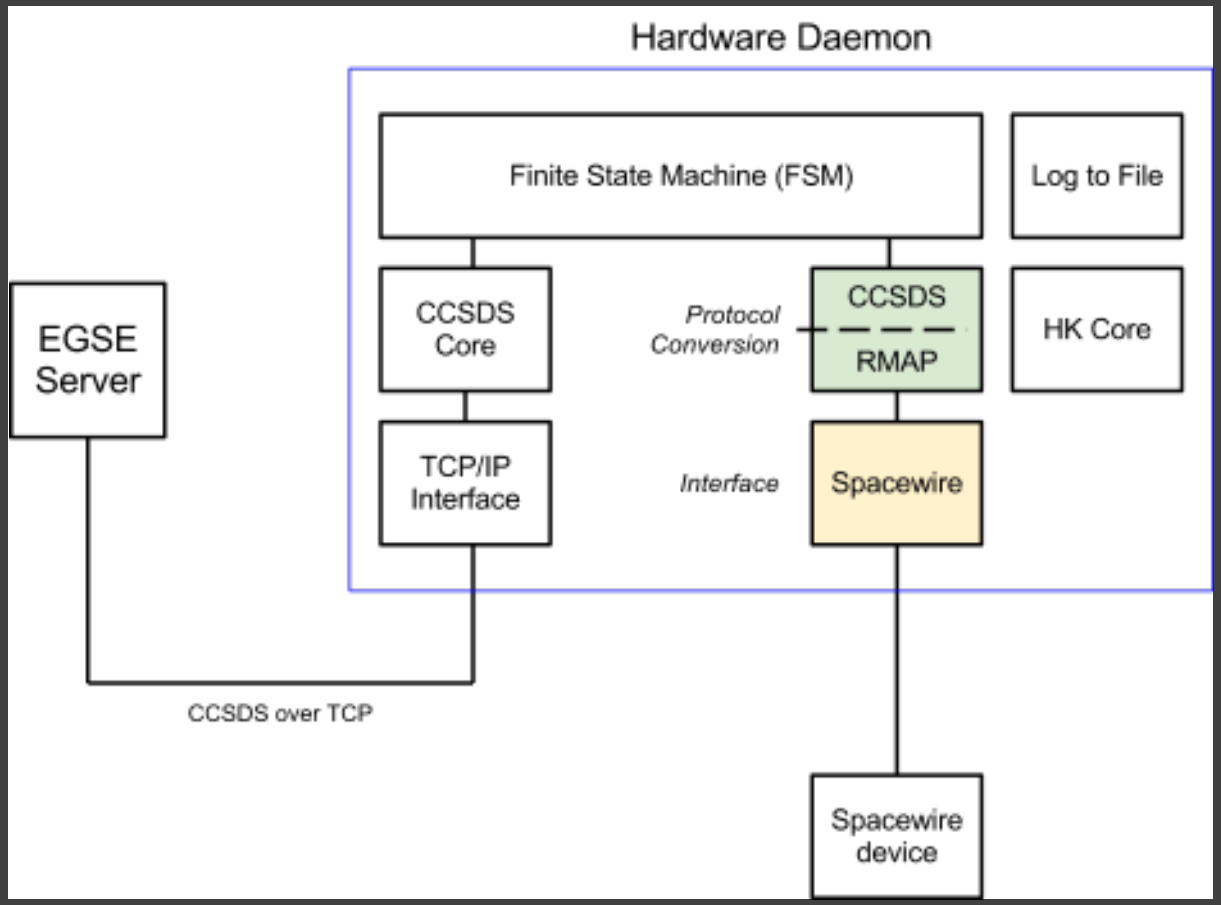
- Most HW uses different protocol over different physical interface.

- Solution implemented in HW Daemons:
  - Translation layer which converts internal protocol into protocol of instrument/hardware.
  - Service Access Point connects device protocol to physical interface.
  - Physical layer with multiple physical interfaces.

- Protocol/Interface configured via XML.



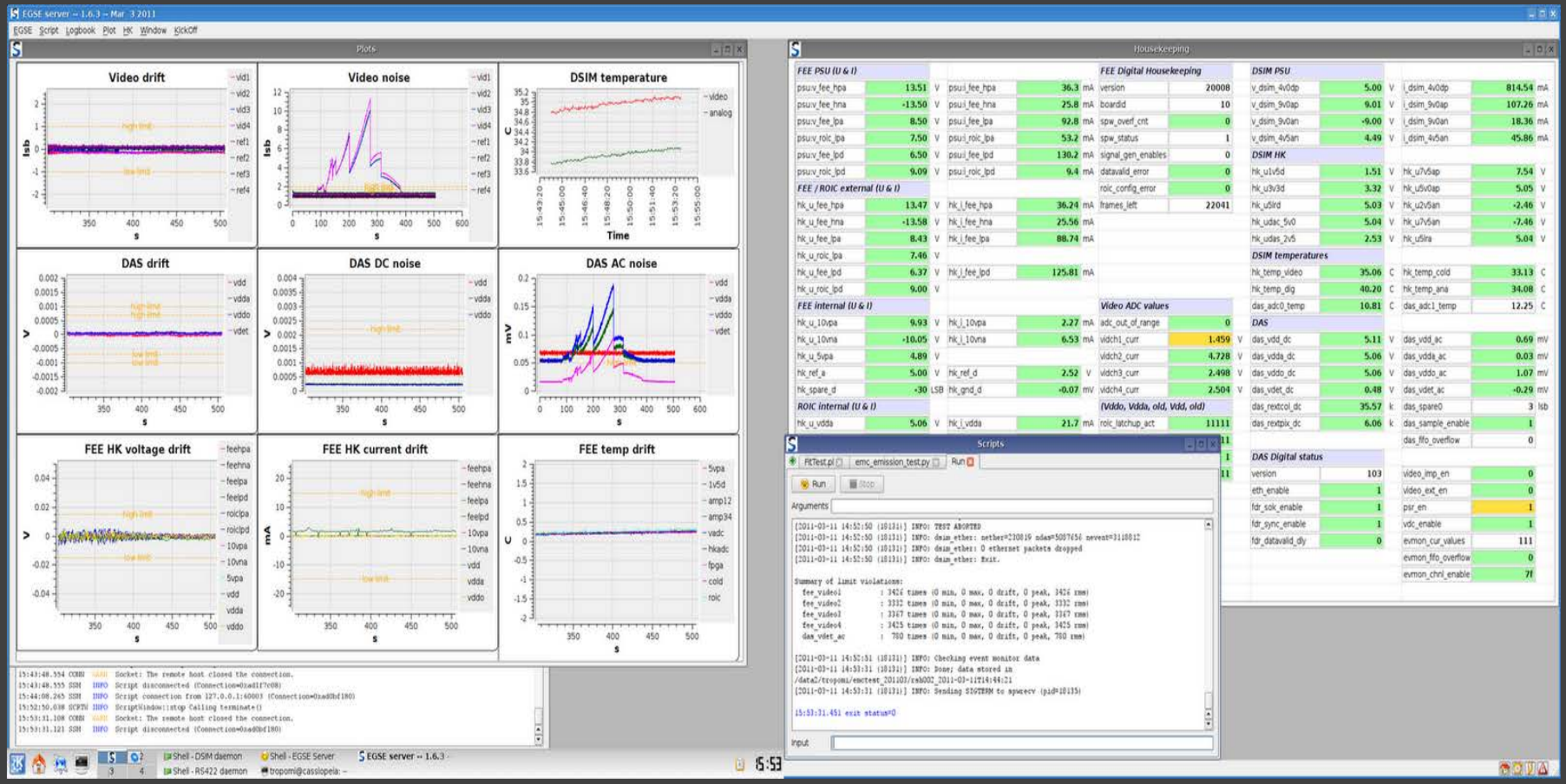
# Protocol and physical interfaces



# EGSE server

- Serve as router to all HW daemons.
- Visualisation of HK, plots, database, scripts, …
- Logging.
- No adaptation necessary for any project.
- Performance
  - Reached sustained 320 Mbit/s, including plotting, HK
  - Might be even better, not fully tested

# EGSE server - TROPOMI



# Script – Measurement of TROPOMI

- Set power supply on
- Set configuration to FEE
- Set HK enable
- Get telemetry
- Manipulate telemetry
  and push back to EGSE server

```
import egselib
import numpy

edb = egselib.EDB()
egse = egselib.EGSE(edb)

egse.set('digif:1:asltm_em', 1)
egse.set('fee:chnl_pwrup', 1)

egse.pauseHK(0)

simpleVal = egse.get('fee:heat')
blockVal = egse.get('fee:input')

result = numpy.fft.fft(blockVal)
magnitude = abs(result)
egse.plotPacket('plot:mag', magnitude)
```

# Generic EGSE in use (since 2009)

- TES Detector development Eureca (Xeus/IXO/Athena)
- MKID Detector development (IRAM/APEX)
- Readout development SHAMROC (EXOMARS)
- Optical Delay Line controller (Darwin)
- Calibration source control (Astro-H)
- TROPOMI
- Safari (Spica)
- Multiple PEP/PIPP projects

- Platform
  - Linux, OSX, Windows
  - C++, Qt/Qwt
  - Python/NumPy/PyQt
  - MySql

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# Conclusion

- One EGSE to rule them all

- By means of built in flexibility at different levels
  - Control via script by user
  - Control of SUT by user
  - Control of consequent actions by user
  - HW abstraction via database by user

- Online analysis of level 0/1 telemetry immediately possible

- Really intuitive to use
- New project supported within hours

# Thank you for your attention !