SECOP

Simple and interoperable interface for sample environment

Nov 26, 2023 | G. Brandl, A. Zaft, E. Faulhaber | JCNS/TUM/MLZ

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MOTIVATION

- time consuming integration work for external SE equipment
  - custom protocols
  - implicit assumptions (fixed IP, system requirements, etc.)
- improve shareability/mobility of equipment
- encourage metadata tagging
- multiple in-house solutions/protocols at facilities

DESIGN CONSIDERATIONS

Goals

- plug-and-play integration
- simple, human readable
- common interface at participating institutions
- machine-readable description
- metadata availability
- syntax **and** semantics

Non-Goals

- access control
- exclusivity

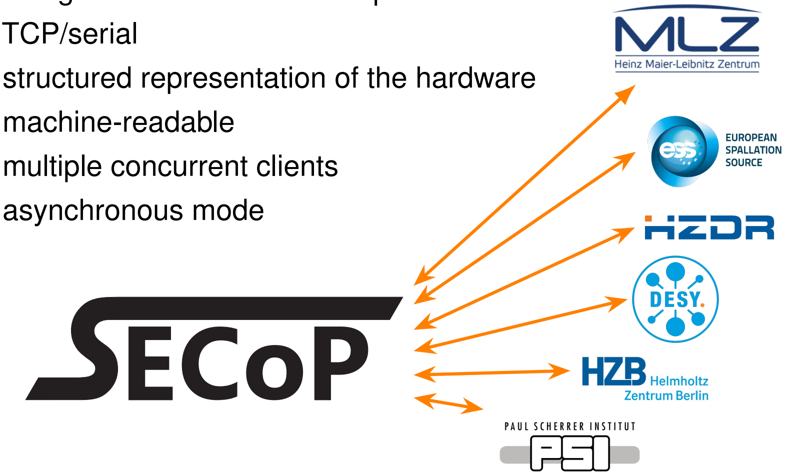
PROJECT HISTORY

- goal: protocol specification
- 2016-2020 SINE2020 project → v1.0, [1]
- since 2022: HMC project focussing on metadata

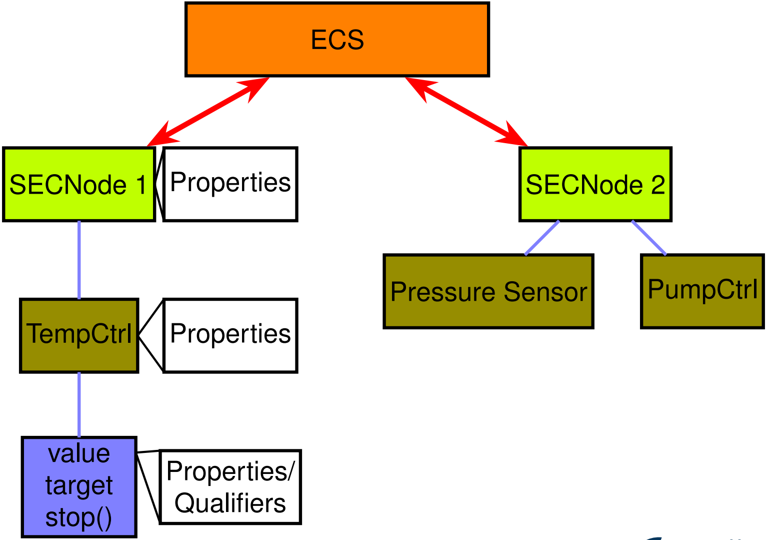
[1] 2019, Kiefer et al., An introduction to SECoP – the sample environment communication protocol

SECOP

- string based communication protocol
- TCP/serial
- structured representation of the hardware
- machine-readable
- multiple concurrent clients
- asynchronous mode


SECoP
MLZ
Heinz Maier-Leibnitz Zentrum
ess
EUROPEAN SPALLATION SOURCE
HZDR
DESY.
HZB Helmholtz Zentrum Berlin
PAUL SCHERRER INSTITUT
PSI

STRUCTURE



ECS

SECNode 1

Properties

SECNode 2

TempCtrl

Properties

Pressure Sensor

PumpCtrl

value
target
stop()

Properties/
Qualifiers

MESSAGES

All messages share a common structure:

- Command:

$$\underbrace{\text{change}}_{\text{action}}\quad\underbrace{\text{module:target}}_{\text{identifier}}\quad\underbrace{15.0}_{\text{data}}$$

- Response:

$$\underbrace{\text{changed}}_{\text{action}}\quad\underbrace{\text{module:target}}_{\text{identifier}}\quad\underbrace{[15.0,\ \{\text{”t”: }1694158513\}]}_{\text{data}}$$

Important messages: **IDN?*, *describe*, *read*, *change*, *do*

DESCRIPTION

```
describing . {
  "equipment_id": "denim_example.frappy.demo",
  "interface": "tcp://10769",
  "description": "example SECNode for DENIM XII",
  "modules": {
    "TempCtrl": {
      "description": "Simple example temperature controller",
      "implementation": "frappy_demo.talk.TemperatureControl",
      "interface_classes": [ "Drivable" ],
      "accessibles": {
        "value": {
          "description": "current temperature",
          "datainfo": { "unit": "K", "min": 0.0, "type": "double" },
          "readonly": true
        },
        "target": {
          "description": "target temperature",
          "datainfo": { "unit": "K", "min": 0.0, "max": 400.0, "type": "double" },
          "readonly": false
        },
        "stop": {
          "description": "Cease driving and go idle.",
          "datainfo": { "type": "command" }
        },
      },
      "group": "",
    }
  },
}
```

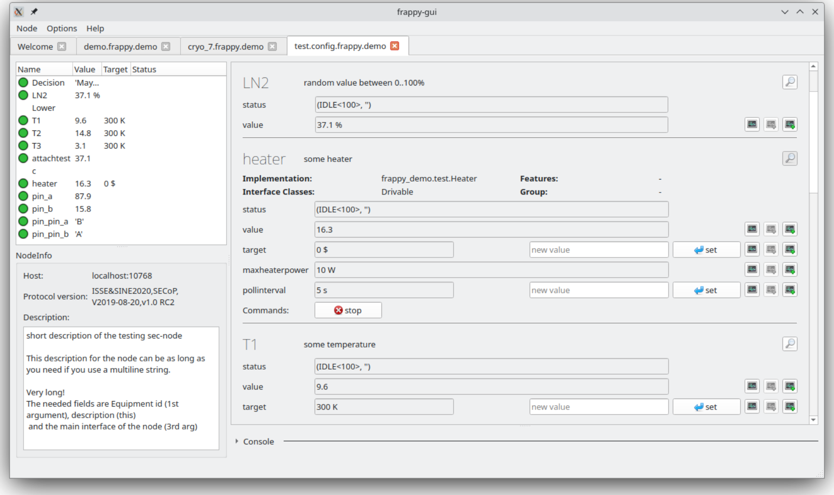
IMPLEMENTATIONS

- **Frappy**: Python framework, developed at MLZ/PSI.
    - SECNodes
    - clients
    - GUIs
- **SHALL**: C++ library from HZB.
- **Octopy** (work name): Python implementation focused on integration with EPICS (ESS).

- integrated into NICOS

NICOS
Networked Instrument COntrol System

GUI



Name	Value	Target	Status
● Decision	'May...		
● LN2	37.1 %		
Lower			
● T1	9.6	300 K	
● T2	14.8	300 K	
● T3	3.1	300 K	
● attachtest	37.1		
c			
● heater	16.3	0 $	
● pin_a	87.9		
● pin_b	15.8		
● pin_pin_a	'B'		
● pin_pin_b	'A'		

NodeInfo

Host: localhost:10768

Protocol version: ISSE&SINE2020,SECoP, V2019-08-20,v1.0 RC2

Description:

short description of the testing sec-node

This description for the node can be as long as you need if you use a multiline string.

Very long!
The needed fields are Equipment id (1st argument), description (this)
and the main interface of the node (3rd arg)

LN2 random value between 0..100%

status (IDLE<100>, '')

value 37.1 %

heater some heater

Implementation: frappy_demo.test.Heater **Features:** -

Interface Classes: Drivable **Group:** -

status (IDLE<100>, '')

value 16.3

target 0 $ new value

maxheaterpower 10 W

pollinterval 5 s new value

Commands:

T1 some temperature

status (IDLE<100>, '')

value 9.6

target 300 K new value

CURRENT STATE

- ongoing work on details: NeXus mapping, standardization, . . .
- cryo, magnet and others moved from MLZ to PSI
- tensile rig from MLZ to ILL
- SEOP experiment at Oak Ridge (without dedicated SECoP client)
- we use **Frappy** as implementation (MLZ/PSI)
- can be deployed on any ControlBox
- usable for exchanging equipment!
- future: new SE deployed with SECoP first/only

QUESTIONS?

More Information:

- https://www.sampleenvironment.org/secop
- K. Kiefer et al.: An introduction to SECoP – the sample environment communication protocol 2019, Journal of Neutron Research 21(3-4):1-15, DOI:10.3233/JNR-190143