MTCA4U – The DESY MicroTCA.4 User Tool Kit

Generic software and drivers for MicroTCA.4 based Controls controls

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MTCA4U — The DESY MicroTCA.4 User Tool Kit

Goal

Provide a tool kit to facilitate the development for MicroTCA.4 based control applications.

MTCA4U comprises

- Linux drivers for PCIexpress
- Intuitive C++ API
- Tools for easy integration into control systems
- Board-specific classes for implementations used at DESY

Requirements

- Independent from the control system
- Universal and extensible
- Base version open source (compile on many distributions)
- Board-specific classes can be closed source (protection of intellectual property)

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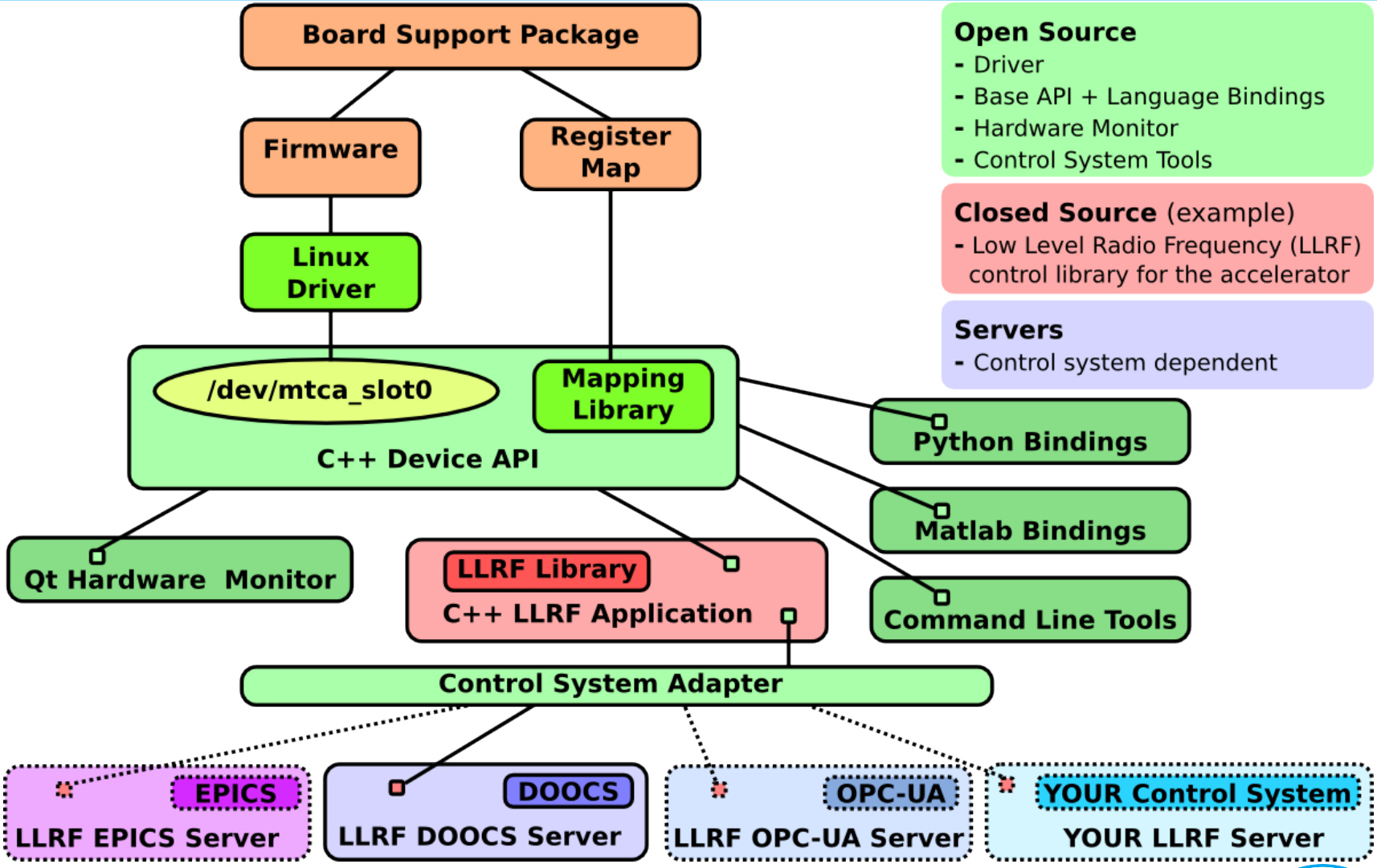
Design Concept



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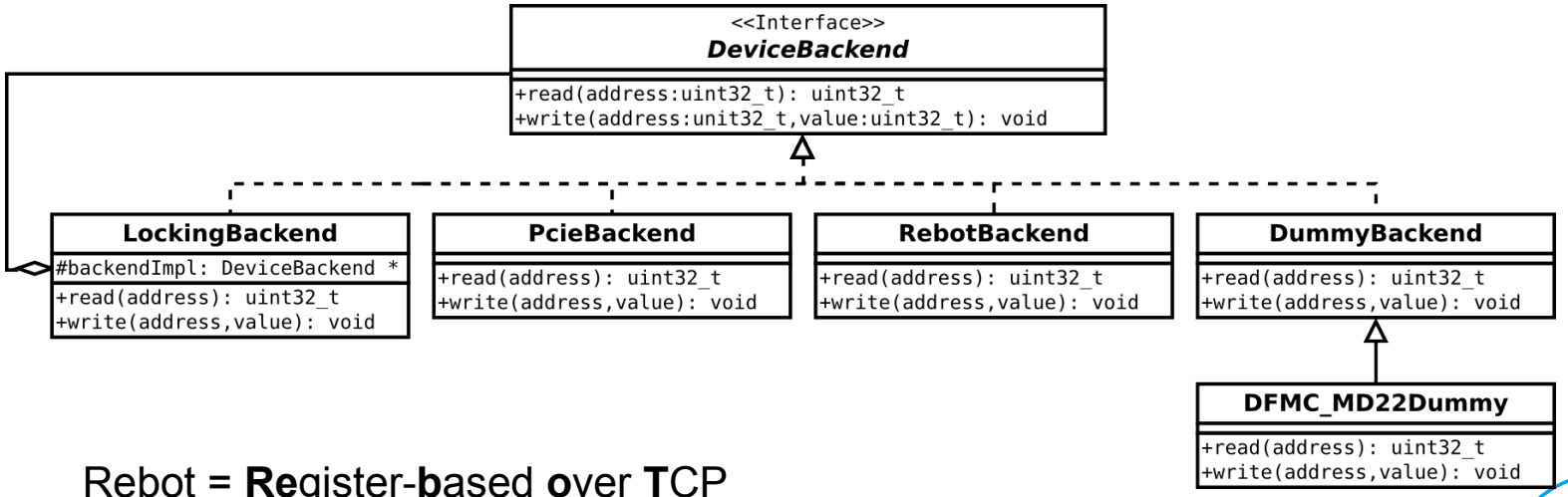
Device Backends for Hardware Access

Features

- C++ API has an abstract DeviceBackend interface
  - Different implementation for specific hardware
- Easy extensibility by adding new Backends
- Device backends can be added at run time (factory with plug-in mechanism)



Rebot = **Re**gister-**b**ased **o**ver **T**CP

The Backend Factory

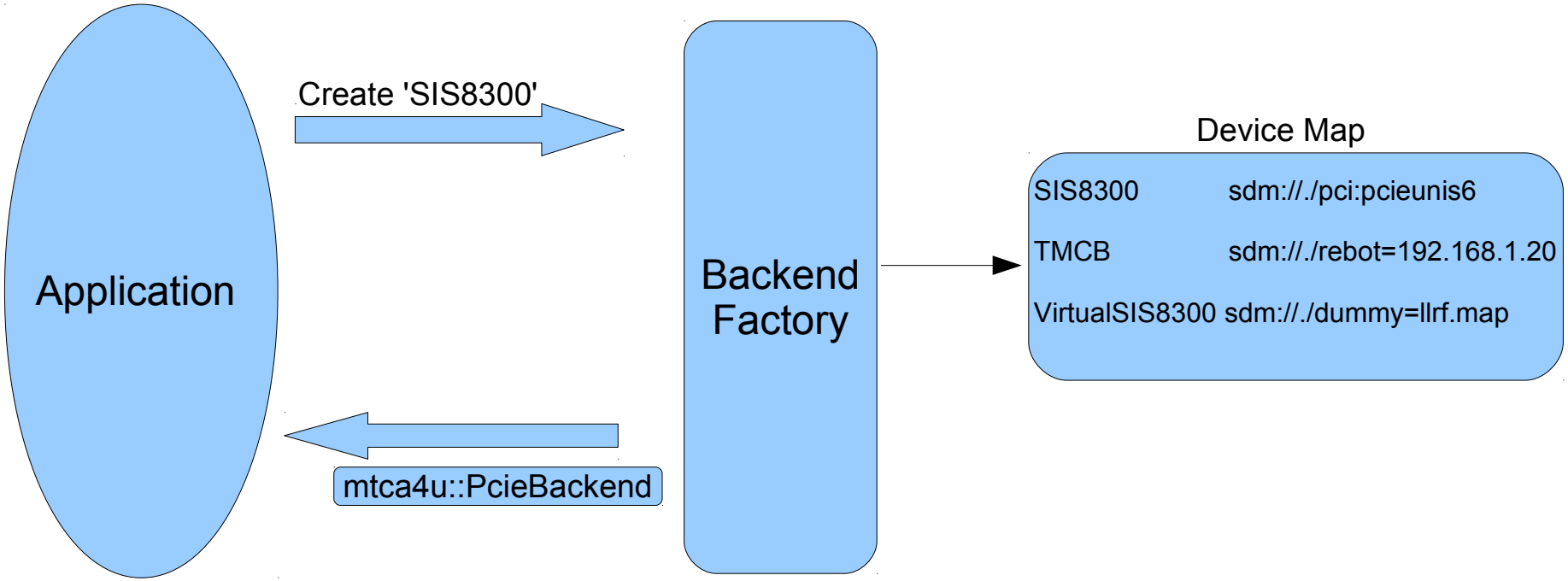
Features

- Abstract the creation of device backends.
  - Devices are created using alias names.
- New backends can be added through plug-in mechanism.
- Factory remains unchanged.
- Factory uses the URI format based on the Standard Device Model suggested by Augustus P. Lowell.
  (sdm work still in progress in the PICMG SW working group)

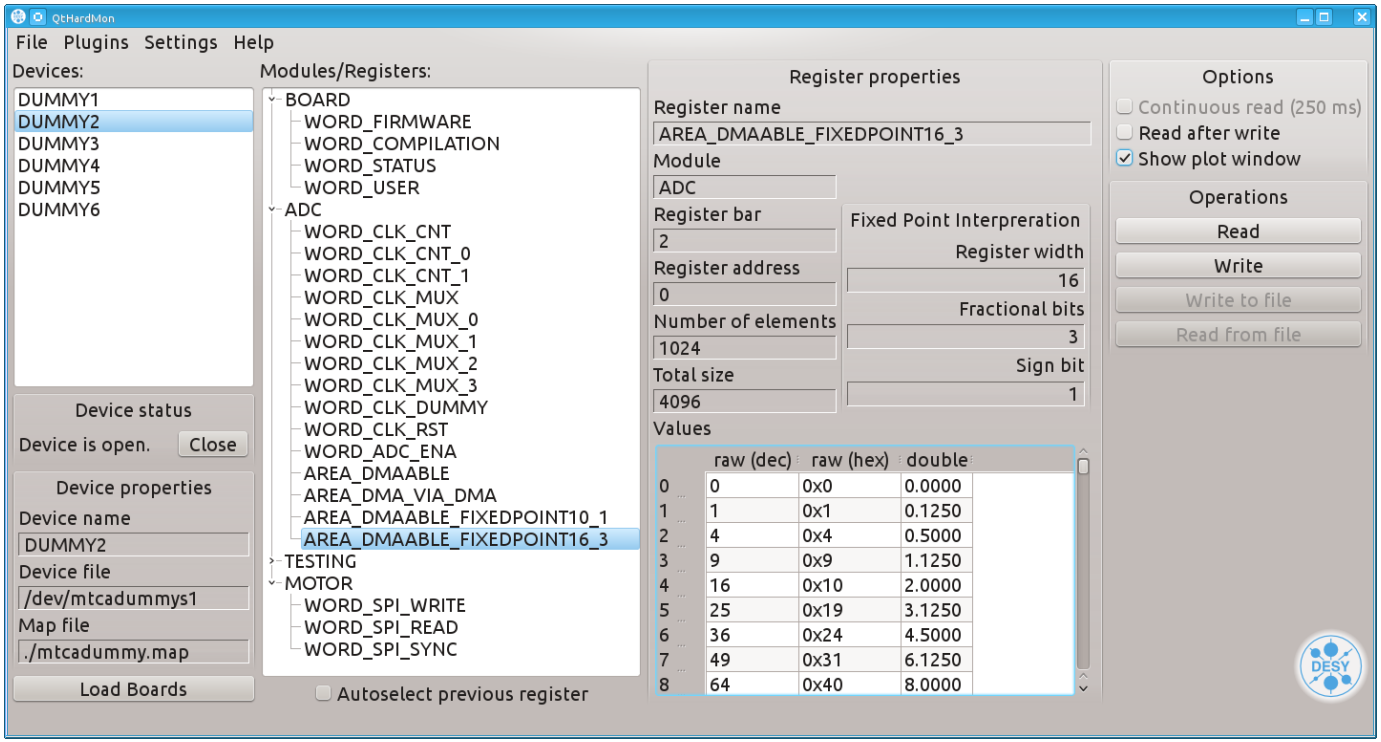
URI Scheme To Describe Backend Types

- Device Name Mapping
- Common format for portability across different platforms
- Specify interfaces, instances and parameters to access the hardware

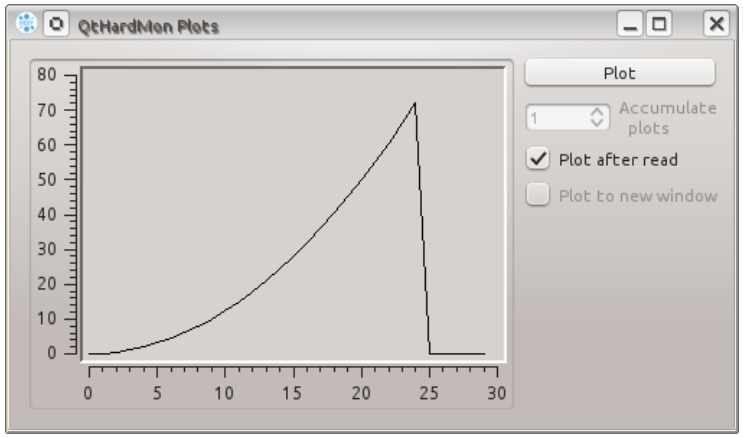
Backend Factory in Action



QtHardMon — A GUI for the Basic API



- Display devices and registers by name
- Show and modify register content
- Basic plotting functionality



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Command Line Tools

Features

- Uses new Device Factory.
- Easy monitoring of device from command prompt.
- Fast application development through scripting.
- All mtca4u device functions including reading and writing to registers

```
mskpcx18356% mtca4u help

mtca4u command line tools, version 00.07.00

Available commands are:

  help                                                    Prints the help text
  version                                                 Prints the tools version
  info                                                    Prints all devices
  device_info    Board Module                             Prints the register of devices
  register_info Board Module Register                     Prints the register infos
  register_size Board Module Register                     Prints the register infos
  read           Board Module Register [offset] [elements] [raw | hex]   Read data from Board
  write          Board Module Register Value [offset]                    Write data to Board
```

Matlab Tools and Python Bindings

Matlab

```
>> struck_adc = mtca4u('SIS8300');
>> struck_adc.read('BOARD','WORD_COMPILATION')

ans =

     9

>> struck_adc.write('ADC', 'WORD_ADC_ENA',1)
>>
```

Python

```
In [1]: import mtca4u

In [2]: struck_adc = mtca4u.Device("SIS8300")

In [3]: struck_adc.read('BOARD', 'WORD_COMPILATION')
Out[3]: array([ 9.], dtype=float32)

In [4]: struck_adc.write('ADC', 'WORD_ADC_ENA', 1)

In [5]:
```

Virtual Lab

Features

- Developed as part of MTCA4U package
- A virtual device can be implemented and inserted in place of the actual device.
- Automated test can be performed to ensure software quality.
- e.g, a simple cavity model can be connected for realistic tests.

Virtual Lab at Work

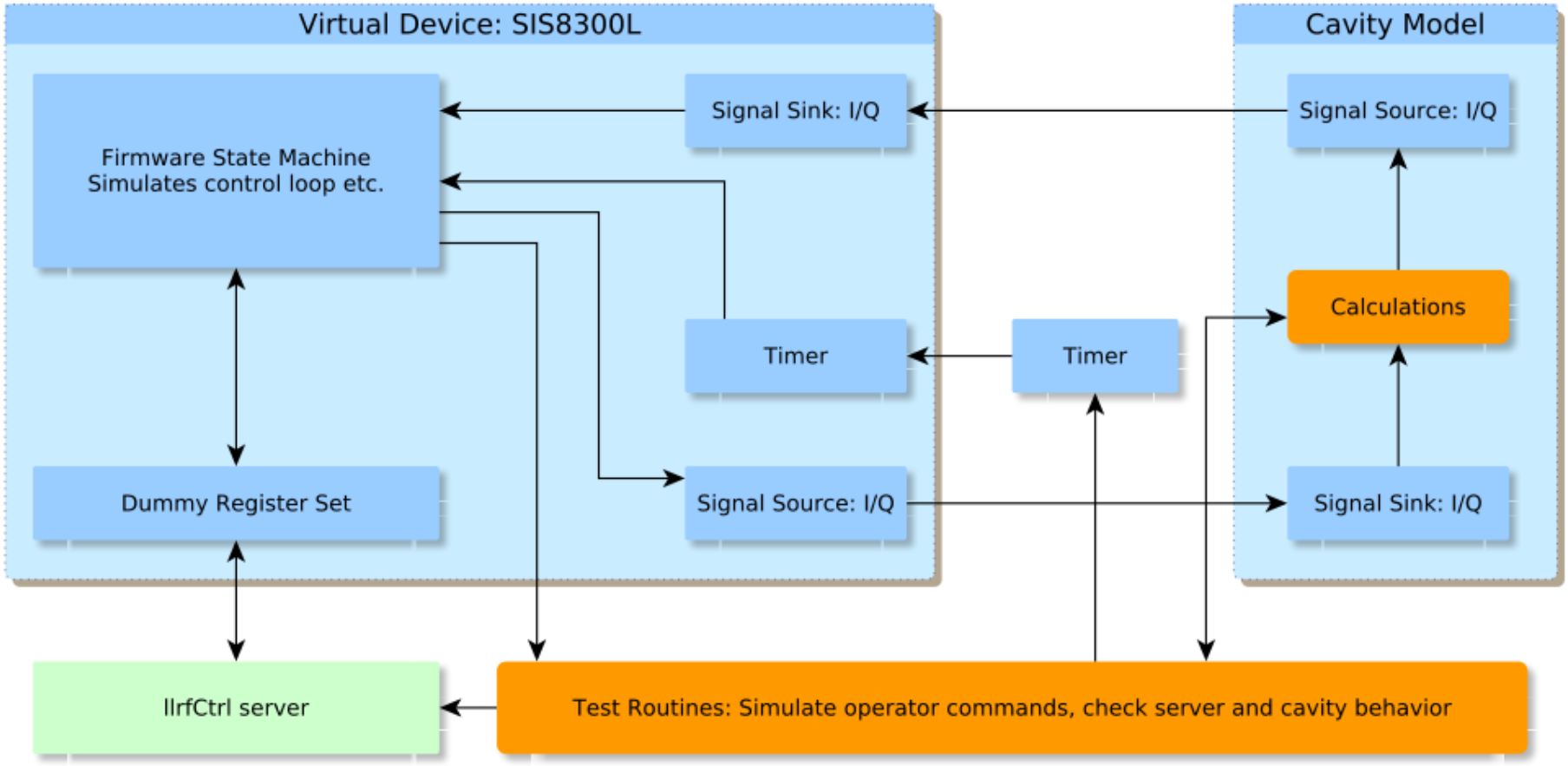

Image Courtesy: Martin Hierholzer

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Control System Adapter

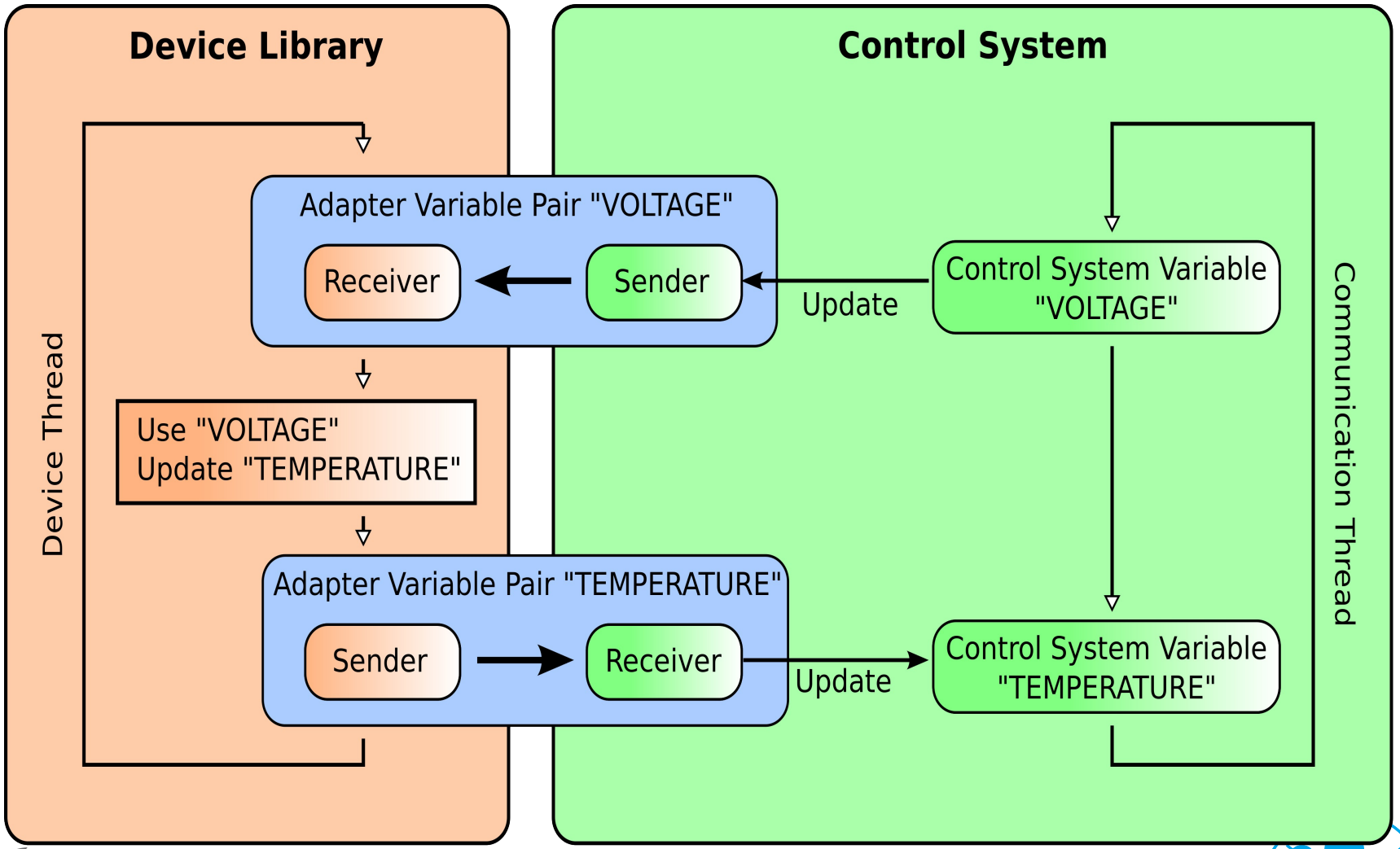
Goal

Make use of complex control algorithms with different control systems.

Features

- Allows application code to access process variables independent of control system.
- Thread safe.
- Real Time compliant.
- Implementations for DOOCS and EPICS are ready to use.
- Planned: support for UPC-UA

Control System Adapter Design



Summary

MTCA4U

- Easy hardware access for MicroTCA.4
  - C++ API
  - GUI and bindings to scripting languages

- New BackendFactory
- Virtual Lab Framework
- Control System Adapters for DOOCS and EPICS are ready.

SVN repository:
https://svnsrv.desy.de/public/mtca4u