ChimeraTK: a control system independent software framework.

Martin Hierholzer

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4th annual MT meeting, Berlin

Overview on ChimeraTK

ControlSystemAdapter

Support multiple control systems without changing source code!

DOOCS OPC UA EPICS

ApplicationCore

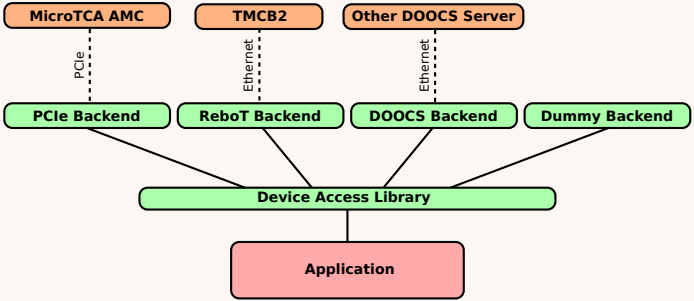
- Modular framework for control applications
- Unifies ControlSystemAdapter and DeviceAccess
- Helps writing applications which integrate well in different control systems

DeviceAccess

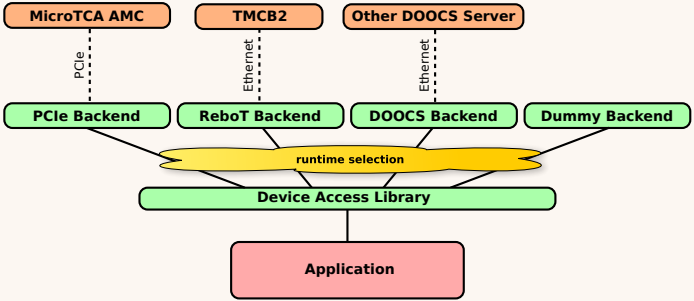
Access to hardware and other control system applications

PCI EXPRESS Ethernet DOOCS

DeviceAccess



DeviceAccess



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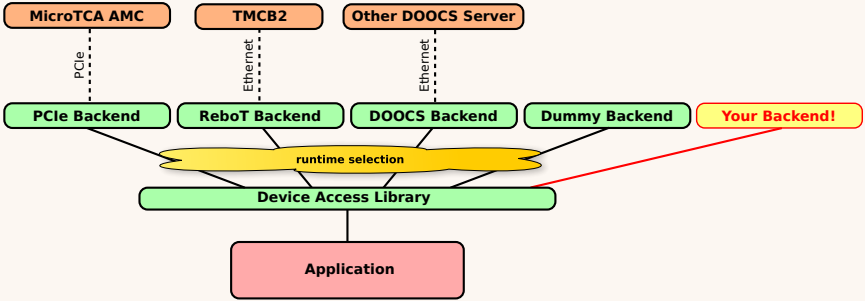

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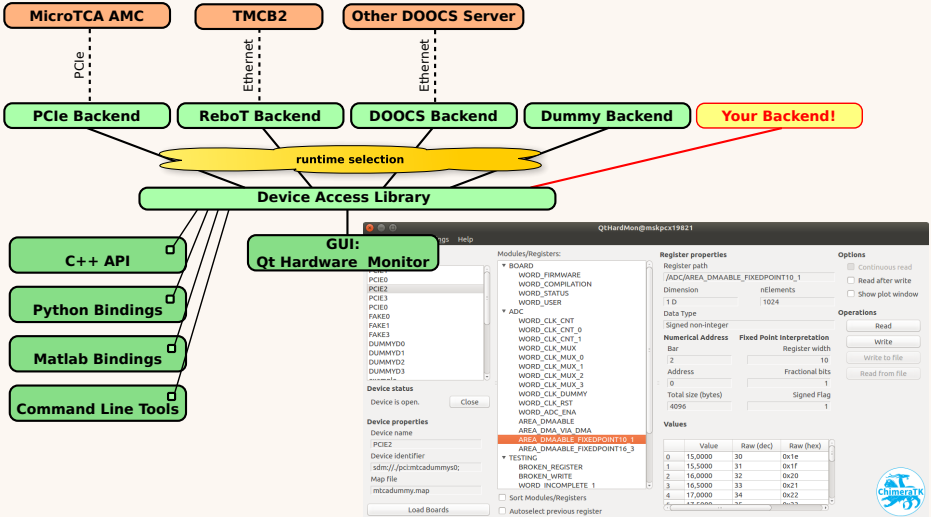

The DeviceAccess C++ API

Special emphasis on easy-to-use C++ API:

```
ChimeraTK::setDMapFilePath("devices.dmap");
ChimeraTK::Device dev;
dev.open("MyDevice");

auto current = dev.getScalarRegisterAccessor<double>("CURRENT");

current.read();
std::cout << current << std::endl;
current = 42;
current.write();
```

The DeviceAccess C++ API

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# Alias       Device URI                  MAP file (if needed)
MyDevice      sdm://./dummy=dummy.map     dummy.map
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The DeviceAccess C++ API

PCIe Backend | RebooT Backend | DOOCS Backend | Dummy Backend

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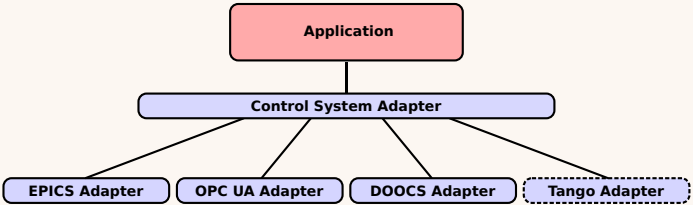
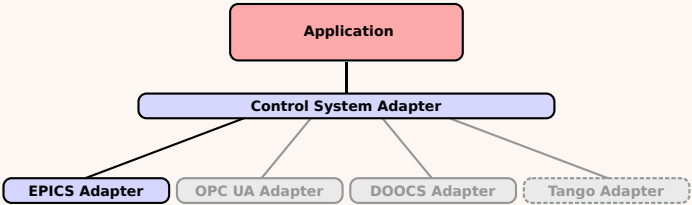
Abstraction

- make source code independent of hardware details
- Code is more readable and more generic

ControlSystemAdapter



ControlSystemAdapter



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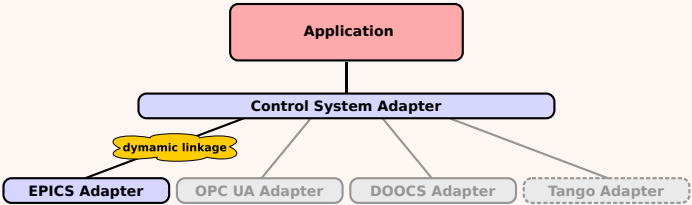

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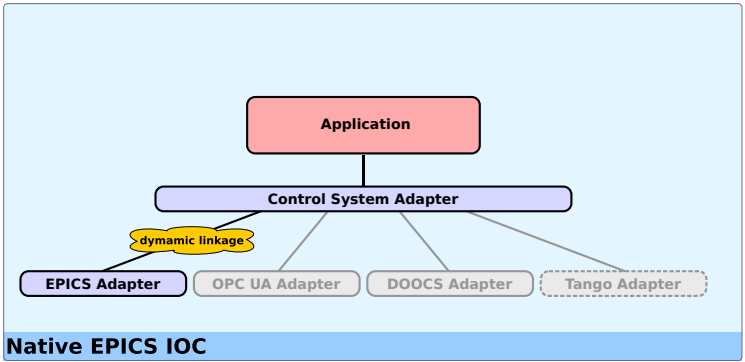
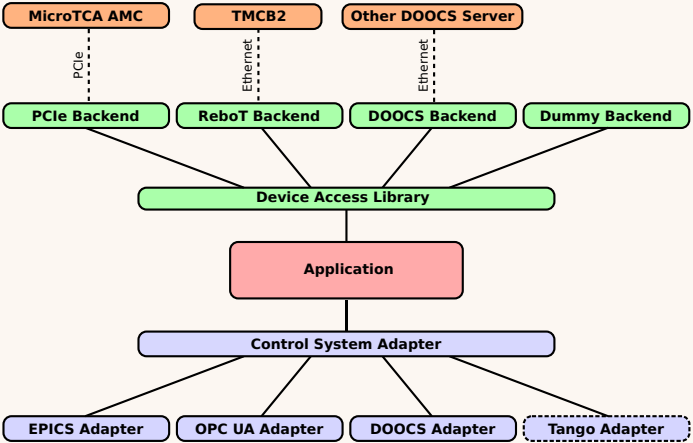


Introducing ApplicationCore



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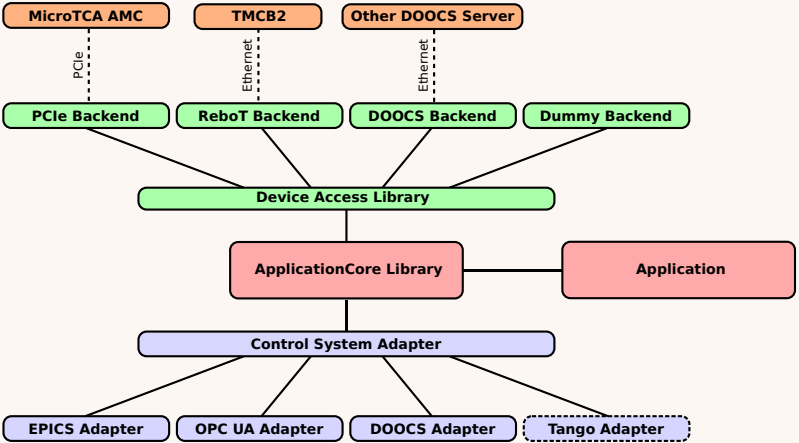
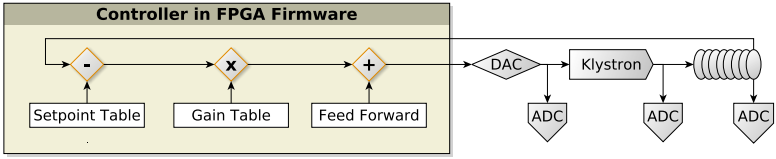


Example: Low-level RF controller server



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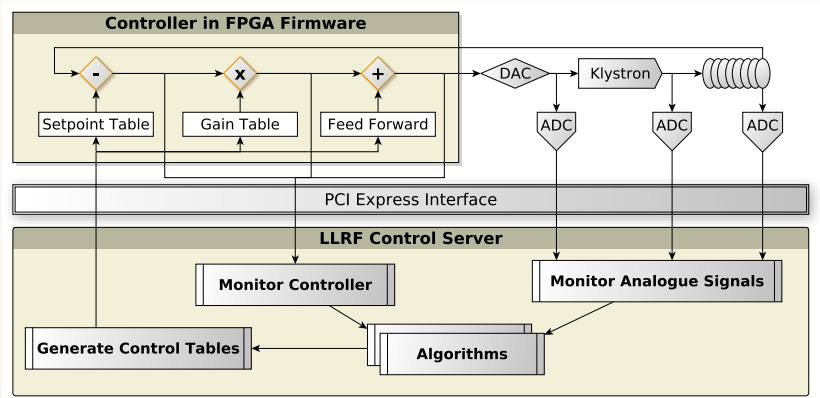

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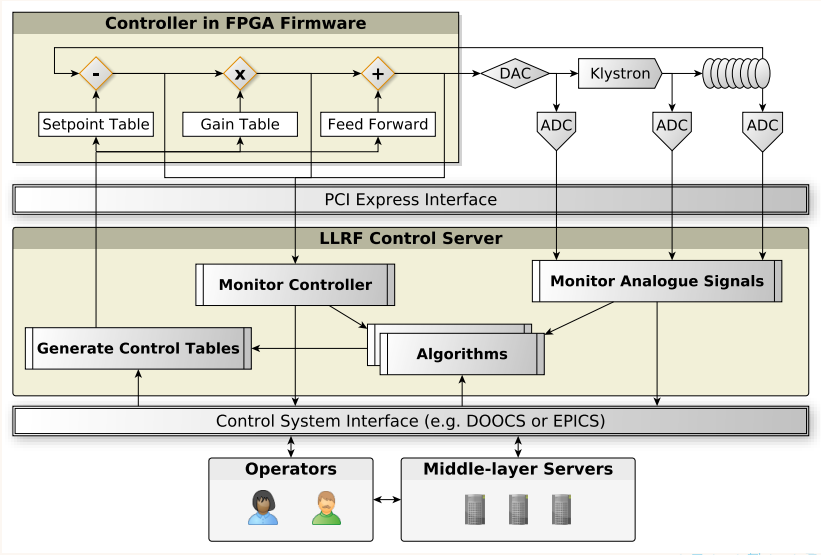

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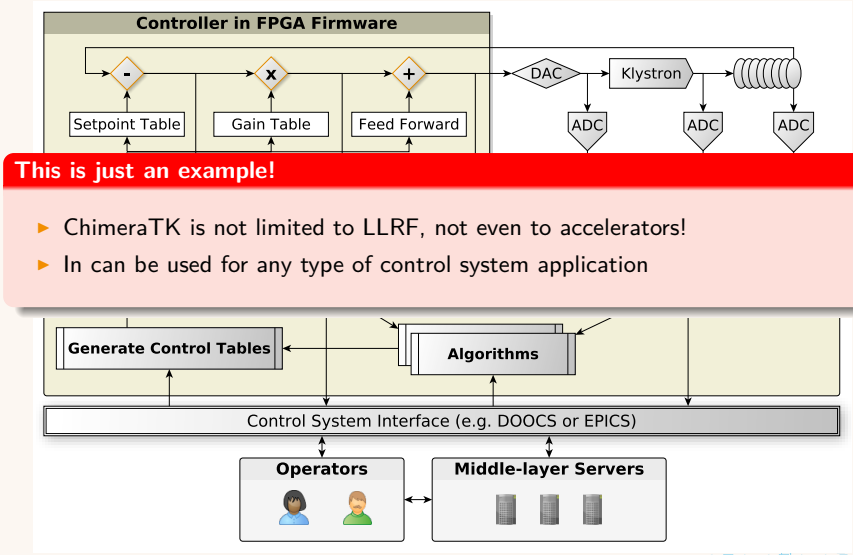

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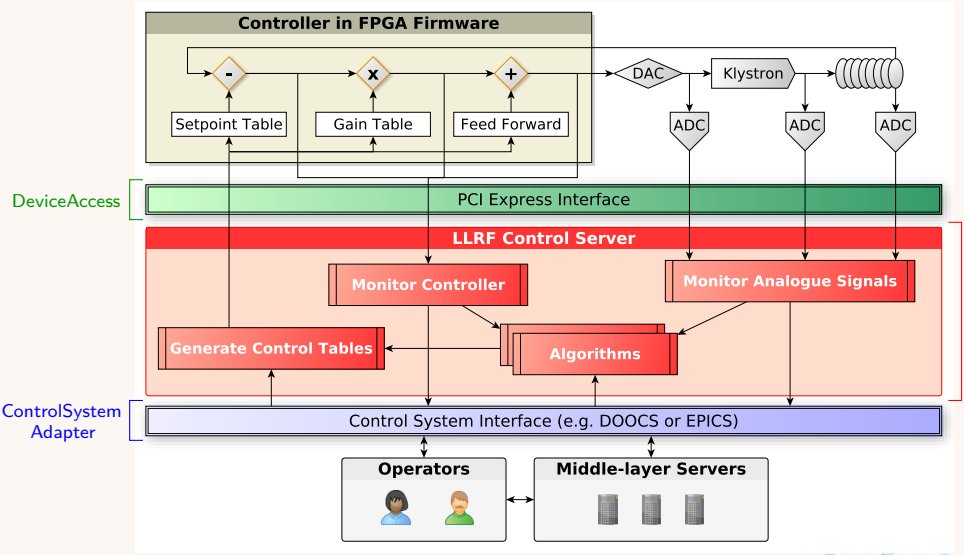
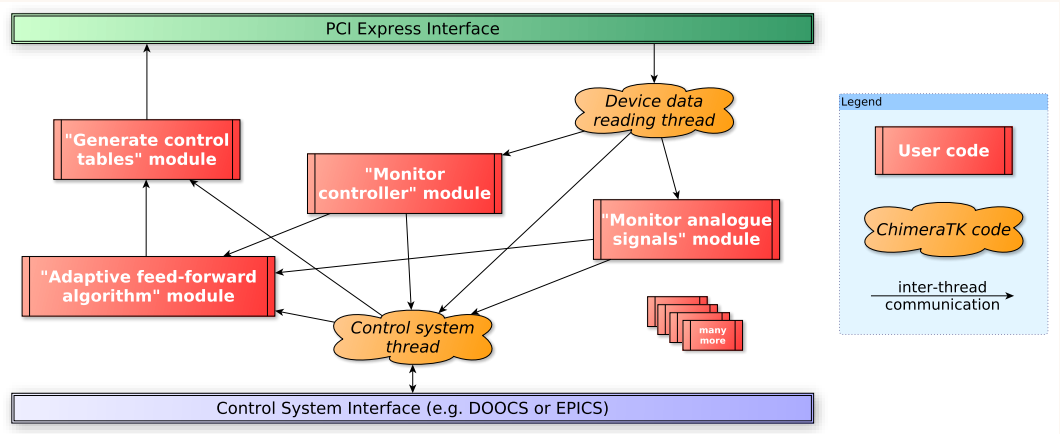


ApplicationCore modularity and multi-threading



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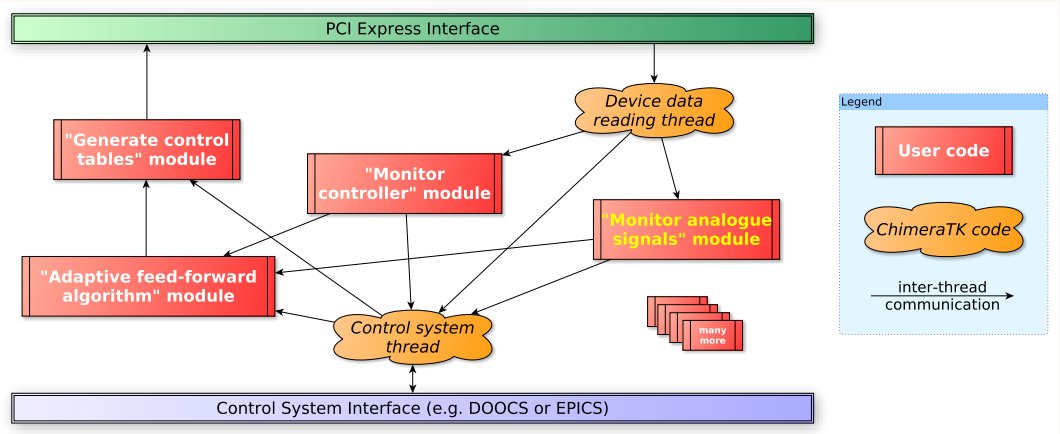

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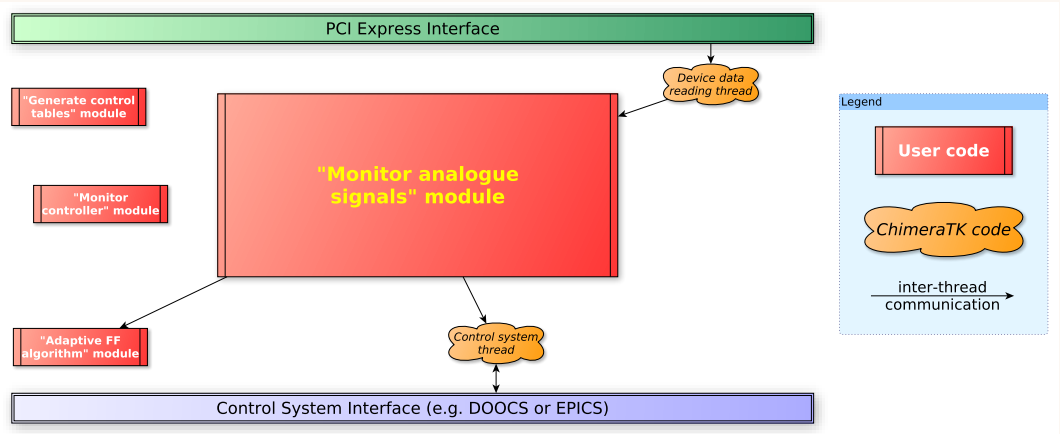

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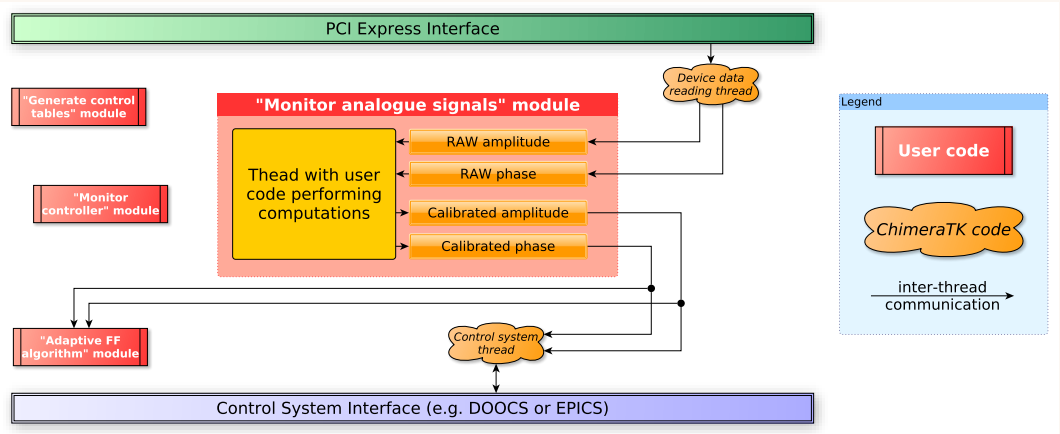

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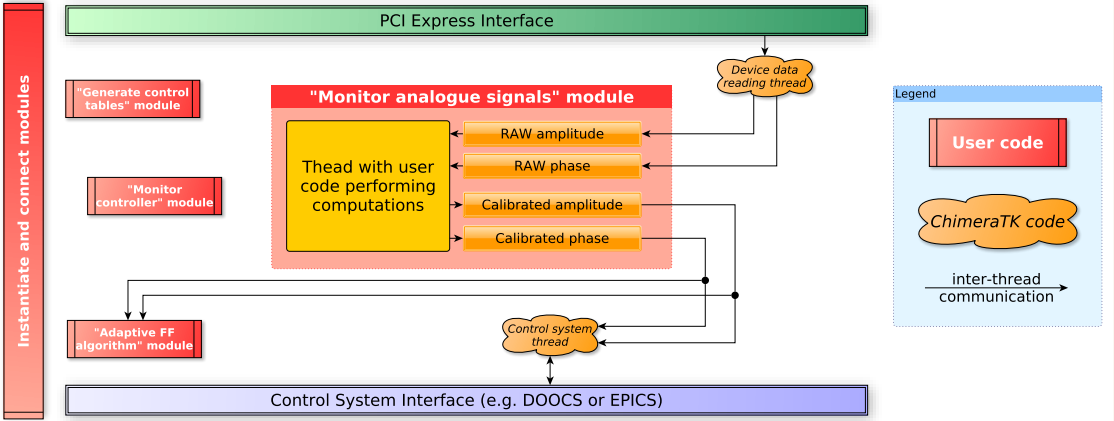

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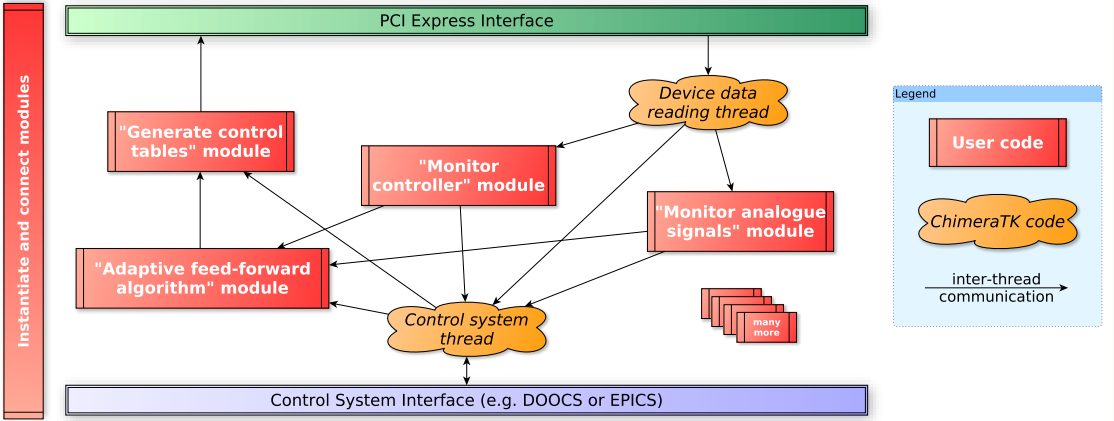

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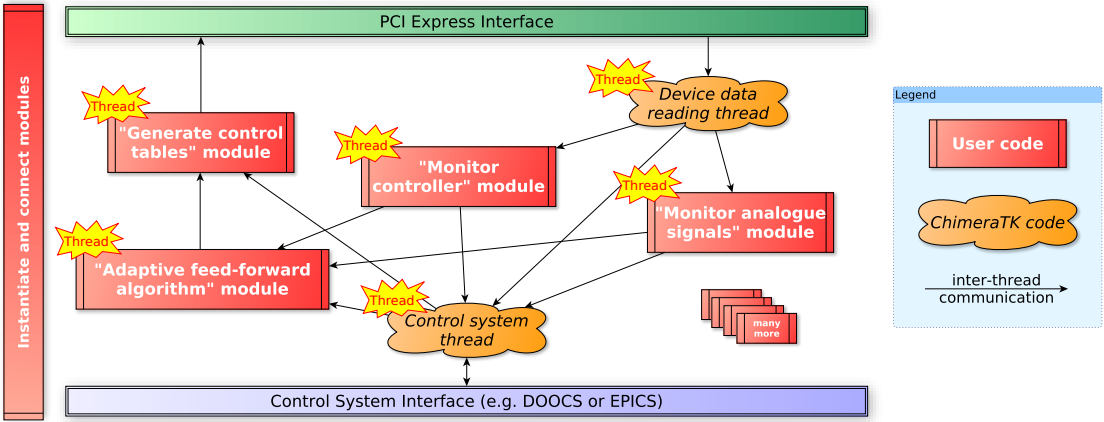

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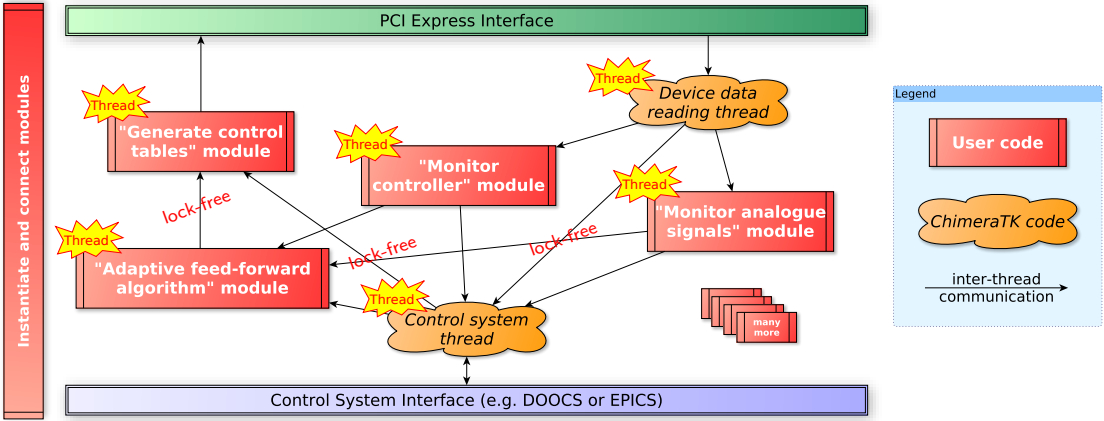

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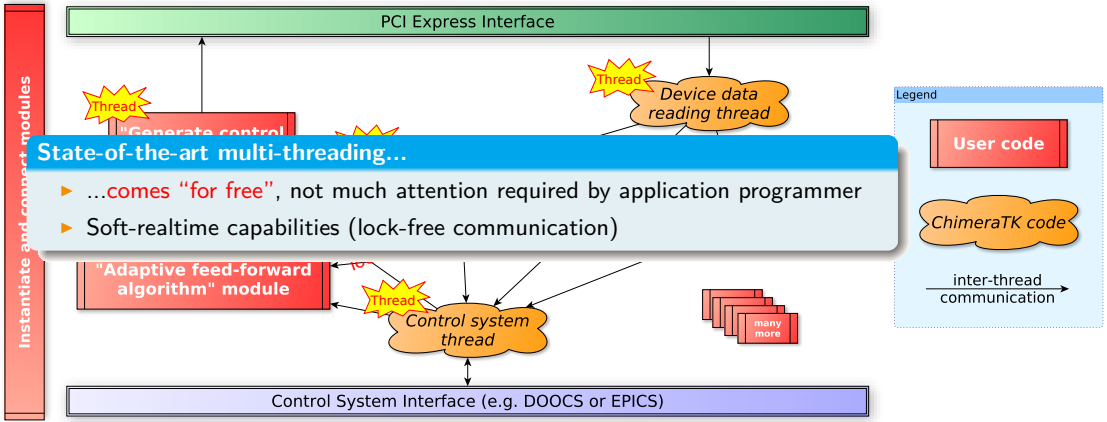
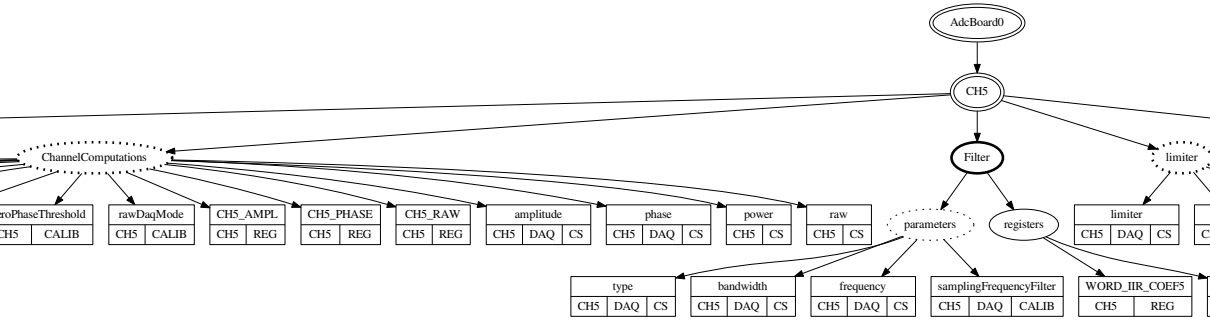


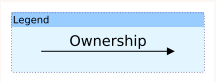
State-of-the-art multi-threading...

- ...comes "for free", not much attention required by application programmer
- Soft-realtime capabilities (lock-free communication)

Application data model

Example: “Monitor analogue signals” module for channel 5 of the ADC board in the LLRF system





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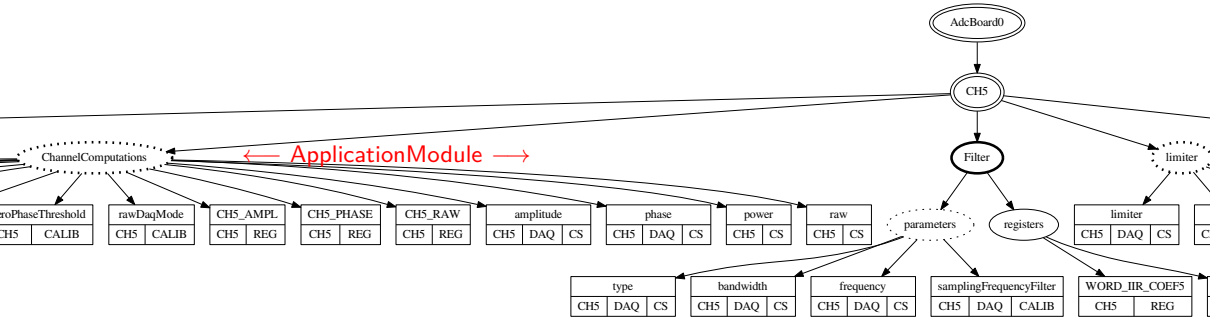

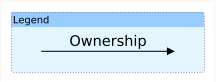

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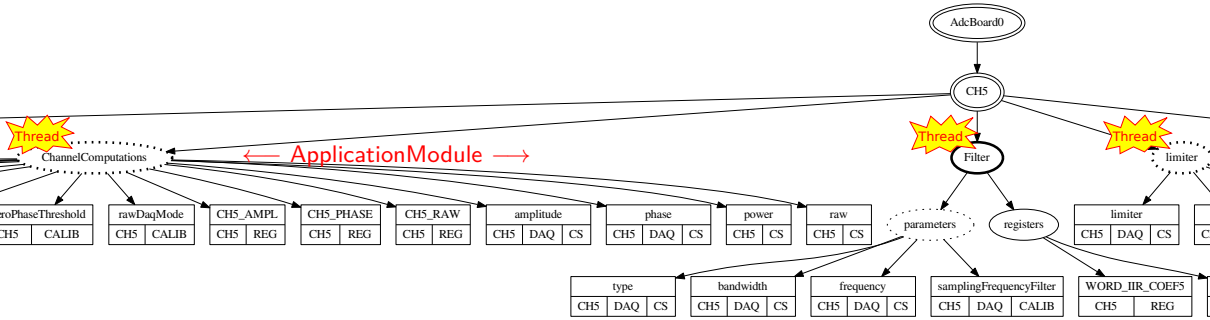

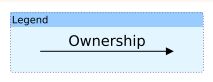

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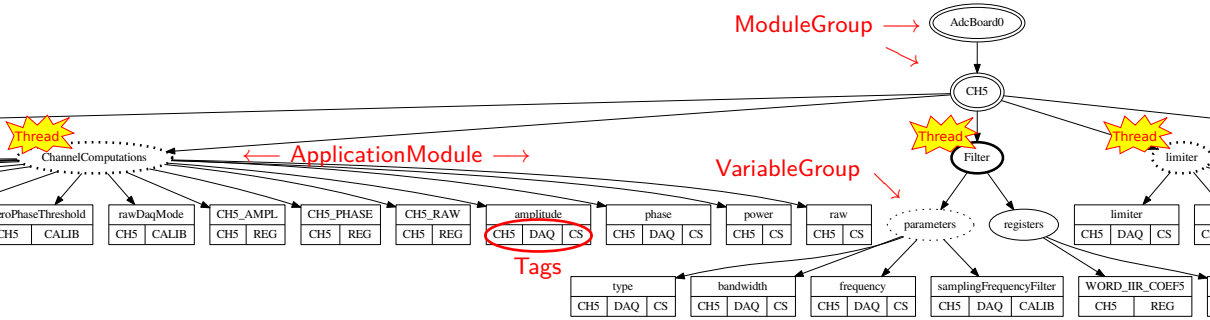
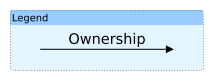
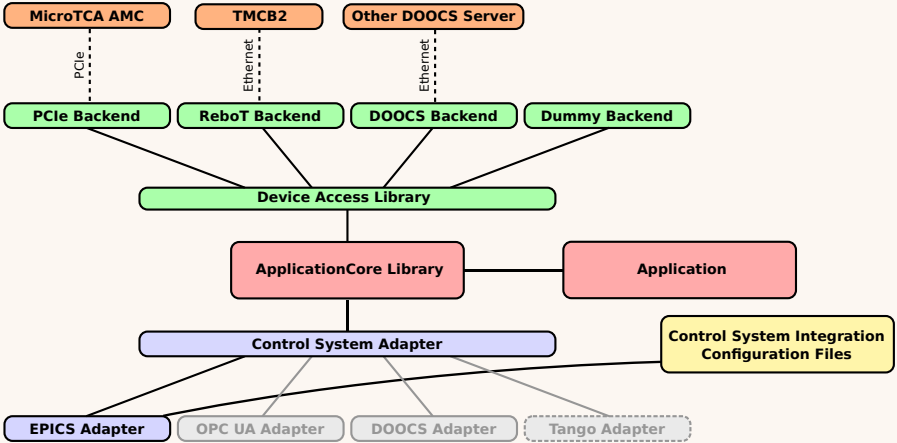




System Integration



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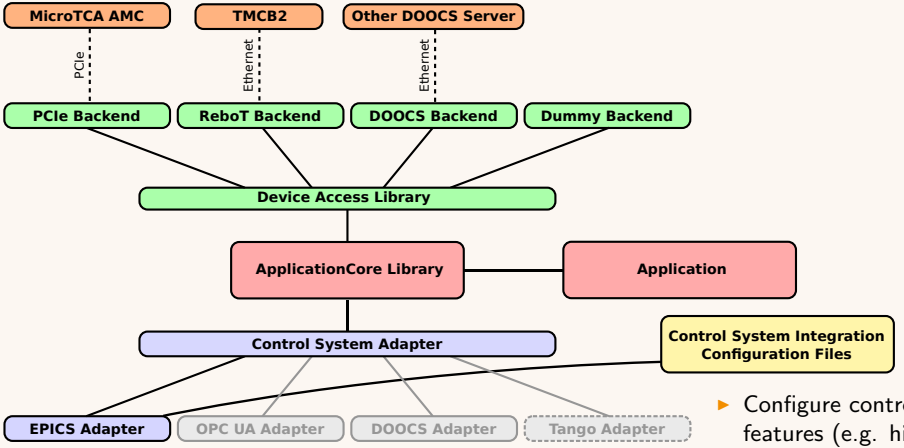

- Configure control system specific features (e.g. history logging)
- Rename variables
- EPICS: just st.cmd and db files

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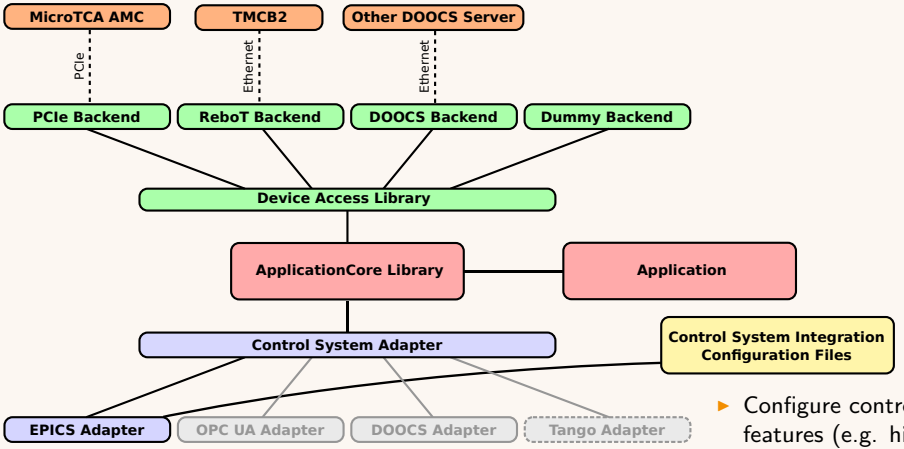

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Conclusions and outlook

- ChimeraTK core libraries: DeviceAccess, ControlSystemAdapter, ApplicationCore
- Control system independent LLRF server in use at multiple facilities:
  - REGAE at DESY (with DOOCS)
  - ELBE at HZDR (with OPC UA / Siemens WinCC)
  - FLUTE at KIT (for now DOOCS, soon with EPICS)
  - TARLA at Ankara University (under construction, EPICS)
  - soon: bERLinPro at HZB (EPICS)
- Other (also non-LLRF) applications in development

Outlook:

- DeviceAccess: More backends, e.g. EPICS channel access client
- ControlSystemAdapter: More adapters, e.g. Tango
- ApplicationCore: Automatic exception handling (e.g. connection broken)

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  - soon:
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Availability

- Open source under LGPL: https://github.com/ChimeraTK
- Documentation, tutorials and support: https://chimeratk.github.io
- Ubuntu 16.04 binary packages available

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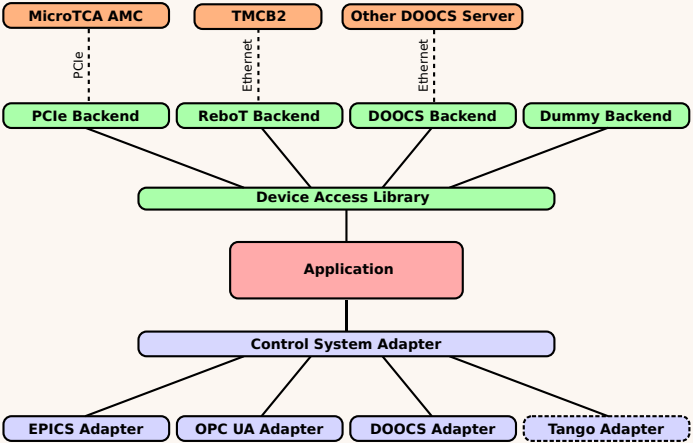
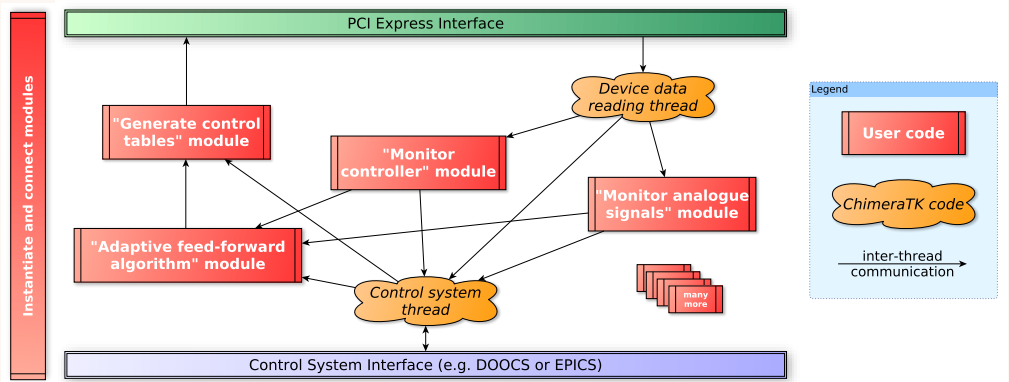
(backup)

ControlSystemAdapter



- Build application against ControlSystemAdapter to make it independent from control system middleware
- Just linking against e.g. EPICS adapter makes the application a native EPICS IOC
- No source code change necessary
- Works also for future adapters

ApplicationCore modularity and multi-threading



- One permanent thread per module
- Modern and efficient synchronisation with lockfree mechanism
- No dynamic memory allocation (soft realtime)
- Efficient multi-threading comes “for free”, not much attention required by application programmer