LIBERA INSTRUMENTS INTEGRATION WITH CONTROL SYSTEMS

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Abstract

Libera instruments have been used with various control systems for several years. In line with the latest security and functionality upgrades, Libera control system interfaces have also been upgraded. EPICS interface in Libera instruments has been upgraded to support the latest EPICS BASE version 7.0.9, which enables users to use the PVA protocol and retrieve more signal data in a single call. Group PVs, allowing atomic access to all signal components, were also added. Furthermore, similar parameters, such as sensors, can be grouped on the Libera side already and provided to PVA clients in a single PV. The TANGO interface has been upgraded to version 9.5. It supports flexible configuration where device classes can be configured for each board type individually. The interface has also been extended with TANGO alarm and logging functionalities. Both interfaces, EPICS and TANGO, can run on the Libera instrument or they can now be compiled and run from an external server station. This network architecture enables easier maintenance and upgrades. This paper details all recent updates and improvements to the Libera control system interfaces and presents possible use cases.

INTRODUCTION

Instrumentation Technologies has developed Libera family of instruments, which offer remote access and data acquisition through dedicated tools. Various adapters were introduced to simplify integration of Libera instrument into control systems. In particular, *libera-ioc* and *libera-ds* were created for the two primary frameworks, EPICS [1] and TANGO [4], respectively. Both adapters provided stable means for integration of Libera instruments into control systems, they received only several updates until lately.

The adapters can now run either directly on the instrument or remotely on an external system. This is especially beneficial for less performant instruments with lower CPU processing power and lower RAM capacity.

LIBERA IOC (EPICS ADAPTER)

The libera-ioc was updated to support the latest EPICS BASE release (7.0.9) In addition to the existing Channel Access interfaces, PV Access interfaces were also enabled to improve performance, scalability, and support for modern EPICS features. This enhancement allows for more efficient data communication and better integration with current control system infrastructures.

The two key challenges were successfully addressed:

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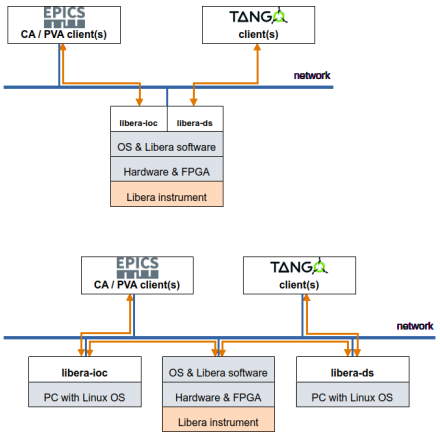

Figure 1: Control system adapters can be deployed locally or remotely.

- atomic acquisition of multiple signal components,
- enabling archive (log) monitors.

The atomic acquisition of multiple signal components ensures consistent and synchronized data capture that improves performance and enhances system reliability and analysis. Enabling archive monitors greatly simplifies the integration of Libera instruments with EPICS archiver services, such as the EPICS Archiver Appliance.

Atomic acquisition is enabled via new group PVs which are automatically instantiated for each signal when IOC is built with PV Access support - no changes to database files are required. Group PV uses standard `epics:nt/NTTable:1.0` layout [2].

Further customizations can be done via usual group entries in customized database files [3].

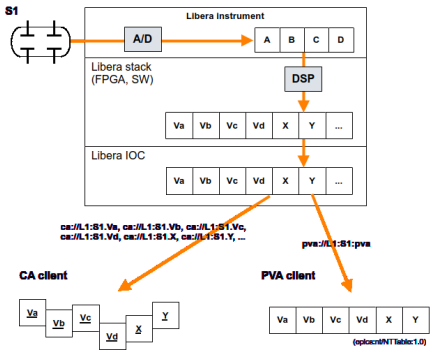

Figure 2: With PV Access group PV, atomic acquisition of signal components is much simpler.

To simplify integration into custom IOCS, Libera device and record types support were separated. This allows IOC

maintainers to extend their own IOCs with support for Libera device and record types in the same manner as with any other EPICS extension.

Default libera-ioc is still included as a software IOC application and can use either QSRV or pvxs (QSRV2) as PVA implementation.

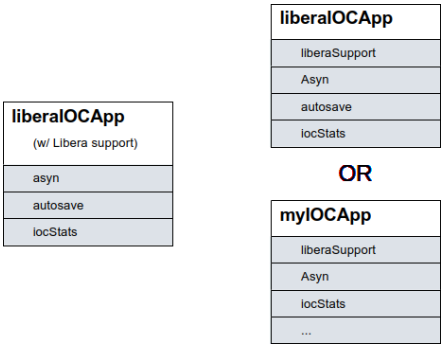

Figure 3: Libera IOC has been split into Libera support extension and default IOC application.

LIBERA DS (TANGO ADAPTER)

Libera-ds received update in terms of new TANGO 9.5 using TANGO IDL version 5 and omniORB 4.3.0. Device server configuration was improved and can now be done using TANGO device setup wizard.

Support for multiple device classes on the same device server was introduced allowing more flexible representation of Libera instruments in TANGO control system.

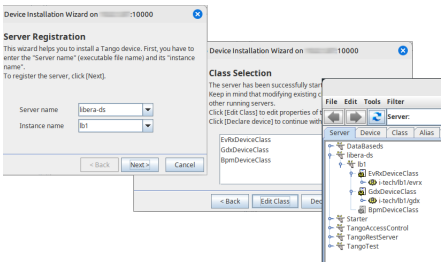

Figure 4: Configuring devices via wizard and of different classes is possible.

Support for FAULT and ALARM device states was added — FAULT is triggered by issues such as a faulty configuration file, the application not running at startup, or the application becoming inaccessible, while ALARM indicates errors during read or write operations to the register node.

Libera-ds configuration file path can now be set through a free property in the TANGO database.

Libera-ds now uses the TANGO Logging Service (TLS). Logging is handled via the appender base class, with all settings (log level, file, console) managed through the device's logging property. Logs are accessible via TANGO "LogViewer" and the custom "log" attribute in libera-ds.

Multiple issues and bugs were resolved, including timeouts during scalar attribute writes, faults when properties are undefined, and other minor problems.

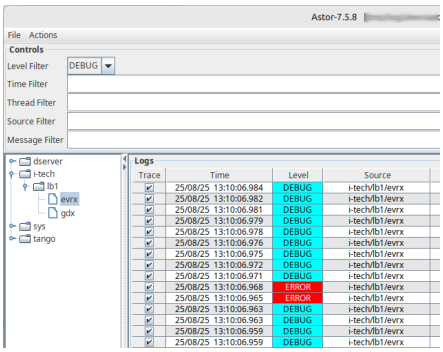

Figure 5: Logging via TANGO logging service.

Planned Updates

- Improve the user-friendliness of the libera-ds configuration file
- Add support for alarm and warning min/max properties in the configuration
- Enable archive events for archiver support
- Use two-dimensional data types for signal attributes

CONCLUSION

The latest updates to Libera adapter software introduced improvements for various aspects of instruments' control system integration. Improvements include more flexible deployment (both EPICS and TANGO), improved data acquisition interfaces and simpler customization (EPICS), as well as improved status reporting and logging integration (TANGO). This makes integrating Libera instruments into control systems simpler and more user friendly.

REFERENCES

[1] EPICS, https://epics-controls.org/

[2] EPICS Normative Types Specification, https://docs.epics-controls.org/en/latest/pv-access/Normative-Types-Specification.html

[3] QSRV Configuration, https://epics-base.github.io/pva2pva/qsrv_page.html#qsrv_config

[4] TANGO, https://www.tango-controls.org/