2024 Spring EPICS Collaboration Meeting

Monday, April 15, 2024 - Thursday, April 18, 2024

POSCO International Center

Book of Abstracts

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Update on Deployment tools at BESSY II Beamlines

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With its more than 40 beamlines, BESSY II offers a multi-faceted suite of experimental opportunities. The facility is over 25 years old and in that time a mixture of very diverse control solutions has evolved. The cyberattack in June 2023 was an opportunity to review the current status and consider alternatives.

Leveraging standard open-source containerization and automation tools, the department has streamlined the deployment process of EPICS based services. This modern approach ensures the efficient encapsulation of applications and their dependencies. It is part of an ongoing effort to make use of industry standard open source tools to promote the recruitment of new IT staff and make it easier to capitalize on innovations.

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ALS-U Accelerator Controls System Status

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We present the current design and status of the accelerator control system for the Advanced Light Source Upgrade (ALS-U) project at LBNL, USA. Following successful completion of the design, the project is now in production, with simultaneous installation of the system in the new Accumulator Ring (AR) while maintaining operation of the existing ALS. This presentation will detail production progress and ongoing installation challenges, particularly integration with the existing infrastructure. The key hurdle of installing a new system in the midst of ongoing operations will be explored, along with strategies to ensure a smooth transition.

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Beckhoff PLC motor record integration at ISIS

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This talk will cover the use of Beckhoff PLCs, utilising the TwinCAT V3 framework, at the ISIS Neutron and Muon source as our next-generation motion controller. We have been able to integrate TwinCAT devices into the EPICS motor record by using a custom level-3 motor record implementation along with ADSDriver and in turn AutoParamHandler. The Beckhoffs require some standard

PLC template code to be implemented in order to map TwinCAT functions and variables to the EPICS motor record.

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PV Browser - A Web Based EPICS PV Information Query System

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The PV Browser provides the web interface to query EPICS PV information such as PV name, PV live and history value, PV host and its network information, IOC status, PV put log, PV alarm history and status, etc.

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EPICS Base –What's New

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EPICS Base 7.0.8 was released in December 2023.
This talk will briefly recap the main changes included in 7.0.7, go through the changes in 7.0.8 and outline the currently planned developments.

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OPC UA Device Support –Update

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In a collaborational effort (ITER/HZB-BESSY/ESS/PSI), a Device Support for the OPC UA industrial SCADA protocol is under development. Goals, status and roadmap will be presented.

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OACTree –High-Level Sequencing based on Behavior Trees

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ITER's operation requires complex automation sequences that are beyond the scope of the finite state machine concept that the EPICS SNL Compiler/Sequencer implements.
The Operations Applications group is developing OACTree (Operation, Automation and Control using Behavior Trees), a new sequencing tool based on behavior trees, which has been successfully used in its first production applications.

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EPICS Diode –Update

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To support ITER's remote participation plans while honoring cybersecurity requirements, we are currently developing a new implementation of an "EPICS Diode", mirroring EPICS PVs through a strictly one-directional network connection.

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epics-containers

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Containers provide the means to package up IOC software and execute it in a lightweight virtual environment. These packages are then saved into public or private image registries such as DockerHub or Github Container Registry.

An important outcome of using containers is that you can alter the environment inside the container to suit the IOC code, instead of altering the code to suit your infrastructure. At Diamond Light Source (DLS), we are able to use vanilla EPICS base and support modules. We no longer require our own forks of these repositories.

This talk will be presented as part of a three month graduate project supervised by Giles Knap and James O'Hea in the Beamline Controls team at DLS. The talk will give an overview of epics-containers, its implementation and the future of it's use at DLS.

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From Configuration to Simulation: "vd"in EPICS IOC Development

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"vd"(virtual device) is a software, written in Go, designed to accelerate the integration of devices into the EPICS (Experimental Physics and Industrial Control System). The "vd"helps when the real device is not available and one wants to start developing IOC following the delivered documentation.

The "vd"tool can simulate devices that communicate using stream-based communication, i.e., those that can be integrated using StreamDevice. Creating a simulator doesn't require programming; communication is described in a configuration file. Compared with the existing solutions, it focuses on the communication layer rather than the device's underlying physics. Currently, the tool supports only one type of communication (stream-based) but support for the next type of protocols (like Modbus or byte-oriented communication) is under development.

The vd's architecture allows it to function as a library for creating advanced simulations, making it a versatile tool for testing and validating device communication within EPICS. Additionally, it can be seamlessly integrated into CI (Continuous Integration) pipelines, facilitating automated testing and validation of device communication. This integration ultimately enhances the overall quality of the control system.

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Transition to Phoebus at the Karlsruhe Institute of Technology

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The two accelerators KARA and FLUTE at the Karlsruhe Institute of Technology have been using Control System Studio as the main GUI for over ten years. We are now in the transition to Phoebus, also using the opportunity to update internal build, release and panel distribution workflows. This presentation will report on the current status, outlook and future plans.

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Phoebus Alarm Test Environment for ALS-U

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The Advanced Light Source Upgrade project (ALS-U) will utilize a Phoebus-based alarm system for optimal control system operation. To achieve this, a virtualized alarm test environment was configured and deployed. This environment facilitates configuration of a structured alarm system using the Phoebus alarm service, which satisfies the alarm requirements of modern distributed control systems. The significance of this work extends beyond the software functionalities to encompass the systematic configuration and implementation of alarms based on a well-defined alarm philosophy tailored to the ALS-U facility. By proactively establishing a comprehensive alarm test environment, we aim to systematically define the alarm processing procedures and ensure the stable and reliable operation of ALS-U during beam commission through effective alarm system functionality.

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ALS control system status report

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ALS - The Advanced Light Source - is in operation for more than 30 years.
Despite the ALS-U upgrade project, which is on the way, the ALS is in routine operation. This pretension is focused on the recent modifications and upgrades which were introduced to the ALS controls system in order to keep it up to date with the latest technology and to make the transition to ALS-U more smooth.

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CLS advances on EPICS tools and environment

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This flash talk presents some of the current tools used in the EPICS infra-structure in the Canadian Light Source (CLS). In addition, it aims to explore some improvements that Control and Instrumentation group (CID) is currently working on, which includes adopting a new operating system and a new display manager to replace EDM.

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Portable Channel Access Server for Node.js

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In EPICS ecosystem, support for C++, Java and Python is perfect all the time. However, in Node.js environment, very few software tools are available to interact with EPICS. Therefore, some EPICS tools for Node.js have been developed in recent years, and node-epics-pcas is one of them. node-epics-pcas is an EPICS PCAS library for Node.js, it is a FFI wrapper that talks to the PCAS shared library using a third-party Node.js FFI package called koffi. The development of node-epics-pcas is inspired by pcaspy and the implementation is very similar to pcaspy. This talk will cover the implementation and usage of node-epics-pcas.

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Application and improvement of Clog 2.0

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Clog 2.0 (Compact Electronic Logbook System) is a web-based logbook system developed using JavaScript programming language for both frontend and backend in order to simplify the implementation and improve the development efficiency. It was published on September 2022 and applied to the accelerator system of HEPS (High Energy Photon Source) project on August 2023. According to the requirement of HEPS project, some improvements have been made. This talk will cover the application and improvement of Clog 2.0.

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Status of the EPICS-based control system for the 100-MeV proton accelerator at KOMAC

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KOMAC operates a 100 MeV proton linear accelerator comprising a 50-keV injector, a 3-MeV radio frequency quadrupole, a 20-MeV drift tube linac, and a 100-MeV drift linac. To meet the demands of beam users, we have established 10 beamlines: five for 20MeV and five for 100-MeV beams. The proton beam is accelerated to 100 MeV by the linac and then directed to target rooms via the beamlines. The control hardware system employs multiple architectures, including VMEbus, PXI, PLC, and Linux, to operate the linac. Furthermore, the Experimental Physics and Industrial Control System serves as the control system framework for the distributed control system and the Control System Studio is adopted as the Graphical user interface toolkit at KOMAC. This paper describes the detail of the overall control system for KOMAC linac.

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Diamond EPICS Web UI update

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A brief update on the work undertaken at Diamond to produce a CSS Phoebus-compatible web display.

Full development of the application will start later this year. It will include screen display and editing, as well as a data browser component.

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Enhancing Performance in EPICS Control Systems: Leveraging asyn/portDriver with Custom Device Support

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The adoption of asyn/portDriver as a standard interface for EPICS (Experimental Physics and Industrial Control System) records has been integral to various control system projects at SLAC. Renowned for its stability, well-documented behavior, and reduced incidence of bugs, asyn/portDriver offers a straightforward and efficient means of developing EPICS drivers without necessitating extensive programming for device support. However, our endeavors revealed the necessity of crafting custom device support for specialized cases, such as the processing of records for Beam Synchronous Acquisition (BSA) and its associated services which requires EPICS IOC (Input/Output Controller) to manage and update a large volume of records with rapid rates. Consequently, we encountered heightened CPU load and performance degradation when operating numerous EPICS IOCs on a single server.
Our investigation into the elevated CPU load, memory footprint, and other performance metrics pertaining to BSA Process Variables (PVs) and their associated services involved a comparative analysis between asyn/portDriver and customized device support. Our findings demonstrated that custom device support yielded superior performance, with reduced CPU load and a smaller memory footprint. As a result, we transitioned to utilizing custom device support specifically for BSA and its related services, while retaining asyn/portDriver for most other generic records due to its myriad benefits.
In this presentation, we share detailed insights gleaned from our test results and performance enhancements achieved through the adoption of custom device support. Additionally, we recount our successful experiences with asyn/portDriver, underscoring its continued relevance and efficacy in EPICS control systems.

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Tutorial: EPICS 7

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Tutorial: Bluesky

Authors: Luca Porzio[1]; Marcel Bajdel[1]

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Tutorial: Bluesky

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Tutorial: areaDetector

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Tutorial: Motion Control

Author: Torsten Bögershausen[None]

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Tutorial: Phoebus (With 10 minute break time)

Author: Georg Weiss[None]

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Development Status of PLS-II Beamline Data Acquisition Software Using Bluesky

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The PLS-II beamline's Data Acquisition (DAQ) software has historically been operated using a variety of platforms, including SPEC, LabVIEW, and beamline-specific custom software. As the need for performance improvement and convenience has arisen, there has been a shift away from the policy of each beamline independently developing its DAQ programs. Instead, there is a growing need to adopt a development environment that utilizes a common framework, enabling uniformity, code reusability, and continuous upgrades. Since 2019, the introduction of Bluesky for development during beamline upgrades has been underway, and it has been applied to XAFS (5), Imaging (2), and HRPD (1) beamlines. This presentation aims to introduce the current status of the DAQ programs in use at the beamlines.

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NSLS-II Bunch by Bunch (BxB) BPM update and Hypervisor VM-based EPICS interface

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The new RFSoC-based advanced BxB was installed after the beam test and provided advanced capabilities for measuring BxB beam transients, multi-bunch coupling, injection transient, efficiency, ion instability detection, and single/multi-bunch motion analysis.
For BxB BPM integration, the control system employed high-performance IOCs and clients based on a hypervisor virtual machine (VM) system. The VMware Type-1 bear-metal hypervisor supports NSLS-II accelerator control IOCs and clients.
In this talk, I will introduce the new BxB hardware architecture, FPGA data processing, beam performance measurement results, and VM IOC and EPICS interfaces for the NSLS-II control system.

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Current Status of the 4GSR Control System

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A new Fourth Generation Synchrotron Radiation source (4GSR) is scheduled to be constructed in Ochang, South Korea. Serving as a critical facility for large-scale scientific experiments and research, the technical design review of the 4GSR is currently underway and anticipated to be completed by mid-2024. The control system for the 4GSR accelerator is of paramount importance for ensuring stability and reliability in facilitating extensive scientific endeavors. It is structured as a distributed

control system based on EPICS (Experimental Physics and Industrial Control System), comprising operator interfaces, networking, and hardware interfaces. Operator interfaces are controlled via Graphical User Interfaces (GUIs) on workstations running on Linux or Windows platforms, positioned flexibly throughout the facility's network. EPICS Input/Output Controllers (IOCs) provide direct control and I/O interfaces for subsystems within the accelerator, enabling users to directly control and monitor these subsystems. The group responsible for implementing 4GSR control aims to design a system embodying high interoperability, availability, stability, usability, scalability, and flexibility. Consequently, ongoing hardware and software development efforts are being pursued, with plans to report on the system's design progress and discuss future initiatives.

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KOREA-4GSR Accelerator Overview

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Status of RAON Heavy Ion Accelerator

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Status of PAL-XFEL

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