Spring 2015 EPICS Collaboration Meeting

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1200 Molecular Plant Science Building, Michigan State University

Book of Abstracts

Contents

ADnED - V4 Neutron Event Data in areaDetector 1

ALLEN-BRADLEY PLC-5 CONTROL WITH AN EPICS ‘SOFT IOC’ 1

Accessing NI Network Shared Variables from EPICS IOCs 1

Adding site-specific laser-shot-numbers to timestamp 2

Archiver Appliance at NSLS2 2

Archiver appliance update 2

Benchmark and Use of ElasticSearch as a EPICS Directory Service 2

CS-Studio Collaboration Status 3

Concluding Remarks 3

Connecting EPICS to a TwinCAT system 3

Controls for the Multi-bend acromat APS upgrade 3

DISCS Status 4

Deploying CS-Studio at DLS 4

Deployment process for multiple facilities 4

Developing a user interface for experiment control at the ISIS neutron and muon spallation source 5

Development Plan for Reliable Card-size IOC 5

Driver/Device Support sis3316/ip 6

Dynamic logging configuration in CS-Studio 6

EPICS Base Releases and Plans, 2015 edition 6

EPICS Base development at NSLS2 7

EPICS Independent Test Suite for PCI-based controls devices using PythonQT 7

EPICS V4 Overview 7

EPICS for Hard Real-Time? 8

EPICS integration of Raspberry Pi Monitoring System for simple applications and user trainings . . . 8

EPICS on SNS Instruments . . . 8

EPICS-controlled OWI Edge Robotic Arm using a Raspberry Pi IOC . . . 8

ESS Status . . . 9

FRIB Status . . . 9

Fast Data Storage system for PAL-XFEL . . . 9

From VME/RTEMS to Industrial PC/LinuxRT: A Migration Story . . . 10

Getting Timestamps right . . . 10

Hour Log: A system for managing facility status . . . 10

ITER and CODAC Core System - Status and Road Map . . . 10

Integration of Lua Embedded Scripting Language into EPICS Base . . . 11

LCLS Magnet Power Supply Upgrade . . . 11

LCLS-I MPS upgrade: Adding BSA (Beam Synchronous Acquisition) capability . . . 12

LCLS-II Status . . . 12

Managing BEAST alarm history . . . 12

Metadatastore . . . 13

Monitoring Dynamic IOC Installations Using the alive Record . . . 13

Moving towards Continuous Delivery . . . 13

NSLS-II BEAM DIAGNOSTICS CONTROL SYSTEM . . . 14

NSLS-II Data Management . . . 14

NSLS-II Fast Orbit Feedback System Status . . . 14

NSLSII Status . . . 15

Ophyd: Software for Data Collection, Management, and Analysis . . . 15

Overview and Status of the SwissFEL Project at PSI . . . 15

Paired Redundant IOCs with Redundant Hardware . . . 16

Past, present, and future of EPICS Qt . . . 16

Providing remote access to the LIGO interferometers with EPICS based tools . . . 17

RAON EPICS integration of SNMP and its realization at early stage . . . 17

Rare Isotope Beam Transport at 30 kV . . . 17

SNS Status . . . 18

Scan Server Update . . . 18

Software Architecture of a Remotely Monitored Dosimetry System . . . 18

Status Monitoring of the EPICS Control System at the Canadian Light Source . . . 19

Status of RAON control system . . . 19

Time source callback and attribute plugin for areaDetector . . . 19

Traveler and cable web applications at FRIB . . . 20

Updates from Data Integration In Real-Time (DIIRT) . . . 20

WebPODS: web gateway and HTML/CSS widgets . . . 20

areaDetector EPICSv4 modules . . . 21

areaDetector: What's New? . . . 21

caputRecorder: a ”macro” recorder for EPICS . . . 22

infoServ . . . 22

nED - EPICS-based neutron data acquisition and detector control software . . . 22

pvWebMonitor: post EPICS PVs to read-only (static) web page(s) . . . 23

softGlue: user programmable digital electronics . . . 23

Experimental Controls / 32

ADnED - V4 Neutron Event Data in areaDetector

Author: Matthew Pearson[1]

[1] *ORNL*

Corresponding Author: pearsonmr@ornl.gov

ADnED is an areaDetector driver that can monitor neutron event data in an Epics V4 structure that was defined for use at the SNS. An overview of ADnED is presented. It is used for experimental data acquisition and provides real time views of accumulated neutron events and neutron time-of-flight data.

Five Minute Talks / 71

ALLEN-BRADLEY PLC-5 CONTROL WITH AN EPICS 'SOFT IOC'

Author: James Stevens[1]

Co-authors: Cedric Putnam [1] ; Haung Van Nguyen [1] ; Richard Farnsworth [2]

[1] *Argonne National Laboratory*

[2] *Argonne National Labs*

Corresponding Author: jbs@aps.anl.gov

This talk describes how to use an EPICS "soft IOC" to control and monitor an Allen-Bradley PLC-5 through a TCP/IP link. I will explain how we converted twenty accelerator process water station PLC'S from a slow obsolete serial copper wire system to a fast network TCP/IP interface.

Summary:

How to control an Allen-Bradley PLC-5 PLC with a "soft IOC".

Five Minute Talks / 59

Accessing NI Network Shared Variables from EPICS IOCs

Author: Frederick Akeroyd[1]

[1] *ISIS facility, STFC, GB*

Corresponding Author: freddie.akeroyd@stfc.ac.uk

Network Variables are a convenient method for sharing information between National Instruments (NI) software and hardware. We have developed a configurable EPICS IOC for accessing information from such sources and exporting them as process variables, the intention being to use the shared variables as a clean interface between our EPICS control system and some specific third party provided equipment. The IOC software uses the LabWindows/CVI Network Variable Library and so can be run on Windows and several flavours of Linux.

Five Minute Talks / 4

Adding site-specific laser-shot-numbers to timestamp

Author: Heinz Junkes[1]

[1] *Fritz-Haber-Institut*

Corresponding Author: junkes@fhi-berlin.mpg.de

To keep the data obtained at the user stations synchronously with the machine data we have added to the time stamp at a particular EPICS waveform record (pyroArray) a laser-shot-number. Unfortunately we are still not sure how to handle this timestamp very sensible. Therefore, I would like to encourage a general discussion on the timing and how the time stamp should be used.

Summary:

How to use a a site-specific timestamp in the EPICS framework. A more general discussion on the timing?

Services / 82

Archiver Appliance at NSLS2

Author: Michael Davidsaver[1]

[1] *BNL*

The SLAC Archiver Appliance has been deployed for NSLS2 (BNL). This work included testing of the server and development of client tools. Performance numbers, progress on a data file converter, and other aspects of the software ecosystem will also be discussed.

Services / 33

Archiver appliance update

Author: Murali Shankar[1]

[1] *SLAC*

Corresponding Author: mshankar@slac.stanford.edu

Summary of recent changes to the EPICS archiver appliance; this has been in production in LCLS for more than a year. Support for V4, decimation and other features.

Low-level Controls / 86

Benchmark and Use of ElasticSearch as a EPICS Directory Service

Author: Evan Daykin[1]

[1] *Facility for Rare Isotope Beams*

Using Apache Camel to setup routes from FRIB IOC Info JSON Service to ElasticSearch.

Services / **1**

CS-Studio Collaboration Status

Author: Eric Berryman[1]

[1] *Facility for Rare Isotope Beams*

Corresponding Author: berryman@frib.msu.edu

CS-Studio Collaboration Status

Future / **87**

Concluding Remarks

Low-level Controls / **63**

Connecting EPICS to a TwinCAT system

Author: Torsten Bögershausen[1]

[1] *European Spallation Source*

Corresponding Author: torsten.bogershausen@esss.se

While evaluating motion control systems,
the Motion Control and Automation Group
created "The EPICS Communication Module" to connect EPICS
to a Beckhoff/TwinCAT system via TCP/IP.

EPICS Streamdevice can be used as well as the motorRecord.

Five Minute Talks / **62**

Controls for the Multi-bend acromat APS upgrade

Author: Richard Farnsworth[1]

[1] *Argonne National Labs*

Corresponding Author: rif@anl.gov

A controls centric status update concerning the various systems, the R&D and the project plans for the Multi-bend acromat (MBA) upgrade planned for the Argonne photon source. The MBA upgrade will rebuild the current third generation light source storage ring with a new lattice which, among other things will dramatically increase x-ray brightness, will reduce the electron beam emittance from the present value of 3.1 nm to under 100 pm and increase the beam current to 200 mA. To install the new storage ring, the old one will be removed and be replaced with the new one, along with the control system in a nine months window and allow three months to recommission.

Summary:

A controls centric status update concerning the various systems, the R&D and the project plans for the Multi-bend acromat (MBA) upgrade planned for the Argonne photon source.

Services / 89

DISCS Status

Corresponding Author: vuppala@frib.msu.edu

Distributed Information Services for Control Systems (DISCS) is a framework for building high-level applications for commissioning, operation, and maintenance of an experimental physics facility. It provides programmatic as well as graphical interfaces to its data and services. It is comprised of a set of cooperating services and applications, and manages data such as naming, machine configuration, lattice, measurements, alignment, cables, machine state, inventory, operations, calibration, and design parameters. The services/applications include Logbook, Traveler, Unit Conversion, Online Model, and Save-Restore. Each component of the system has a database, an API, and a set of applications. The services are accessed through RESTful and EPICS V4 interfaces.

We present the current status of DISCS.

Tools & Clients / 66

Deploying CS-Studio at DLS

Author: Will Rogers[1]

[1] *Diamond Light Source*

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About one year ago, it was decided to evaluate CS-Studio as a replacement for EDM at Diamond. Since then, much work has gone into making CS-Studio and BOY a viable replacement for the many existing deployed EDM screens without disrupting existing ways of working.

This talk describes the problems and solutions found, including the new work on OPI Shells, and shows how CS-Studio may finally be deployed for both machine and beamline operation at DLS.

Tools & Clients / 45

Deployment process for multiple facilities

Author: Murali Shankar[1]

[1] *SLAC*

Corresponding Author: mshankar@slac.stanford.edu

We have improved our process for deploying IOC/high level applications/scripts to multiple facilities. We've migrated to using static builds for IOC's and making the software packages self-contained. This presentation describes cram - the tool/scripts we have collectively developed for managing software deployment to multiple facilities.

Services / 9

Developing a user interface for experiment control at the ISIS neutron and muon spallation source

Author: Matt Clarke[1]

[1] *Science and Technology Facilities Council*

Corresponding Author: matt.clarke@stfc.ac.uk

For over ten years the beamline instruments at the ISIS neutron and muon spallation source have been operating successfully using a LabVIEW-based control system. However, a range of new instruments are being built, offering the potential to implement very complex experiments. For this reason, the long-term suitability of the control system was reviewed. Based on this review, it was decided that switching to an EPICS-based system would offer many advantages in terms of flexibility, code reuse and collaboration.

Over the last two years, the ISIS Computing Group has been developing this new EPICS-based control system whilst maintaining the existing system. The new system, which is still under active development, is currently being used to commission a new instrument on ISIS's second target station.

This presentation will describe:
• The strengths and weaknesses of the existing control system and how this has fed into the design of the new EPICS-based system
• The architecture of the new system
• The development of a new graphical user interface
• The current state of the control system and thoughts about the progress so far

Five Minute Talks / 68

Development Plan for Reliable Card-size IOC

Author: Norihiko Kamikubota[1]

[1] *J-PARC/KEK*

Corresponding Author: norihiko.kamikubota@kek.jp

Recent card-size PCs, such as Raspberry Pi or BBB (Beagle bone black),
have enough performance to use as EPICS IOCs. In ERL in KEK-Tsukuba, a
few pieces of BBB IOCs with serial lines were developed to monitor
radiation-monitoring instruments [1]. However, due to lack of long-term
reliability and hardness, mass introduction to accelerator controls is
not realistic.
We have started study to develop a customized card-size PC. It will:

1) use long-term guaranteed parts, 2) has simple IOs (1 LAN, 2 serials, 8bit io), 3) be used with a hard metal-chassis, and 4) be not low-cost but …
We hope to develop a prototype by the end of FY2015. After 2016, it will be used for newly introduced devices. In addition, part of legacy VME-bus IOCs in J-PARC MR will be replaced by them.

[1] T.Obina, "Development of Compact Device Server with EPICS", PASJ2014-MOOL08, 11th Annual Meeting of Particle Accelerator Society of Japan, 2014

Five Minute Talks / **3**

Driver/Device Support sis3316/ip

Author: Heinz Junkes[1]

[1] *Fritz-Haber-Institut*

Corresponding Author: junkes@fhi-berlin.mpg.de

Driver/Device Support sis3316/ip

We have developed a driver support for the digitizer Struck sis3316 which uses the Gbit-Ethernet interface on that card. To communicate with the digitizer we are using a C-library supported by Struck. The communication is based on the UDP protocol. Within the library unfortunately error cases are not threaded properly. We had to customize the library in some places that, e. g. Packet losses are properly handled. We are still in the process to integrate the time stamp of the card into the created EPICS record.
I hope that it is possible to compare our implementation with the standard vmebus driver up to our meeting. I just ordered a MVME6100 to continue with the comparative tests.

Summary:

EPICS Driver Support for Struck sis3316 digitizer using the GBit-Ethernet interface instead of VMEbus.

Five Minute Talks / **76**

Dynamic logging configuration in CS-Studio

Author: Kunal Shroff[1]

[1] *Brookhaven National Lab*

Additional information from the logger in CS-Studio would make it easier to identify and resolve issues. It is not possible to have the logger's default configuration set to a very fine level due to the volume of messages it would produce. The logging configuration tool provides a user interface which lists all the JVM loggers and allows users to dynamically change their logging levels. This allows acquiring detailed logs for only the potentially problematic pieces.

Future / **26**

EPICS Base Releases and Plans, 2015 edition

Author: Andrew Johnson[1]

[1] *Argonne National Laboratory*

Corresponding Author: anj@aps.anl.gov

Recent releases of Base and plans for future versions.

Five Minute Talks / 83

EPICS Base development at NSLS2

Author: Michael Davidsaver[1]

[1] *BNL*

Corresponding Author: mdavidsaver@bnl.gov

Progress of developments for EPICS Base undertaken at NSLS2 with the goal of improving the performance and scalability of the process database on modern hardware. Much work has also been done to expand unit test coverage in Base in an effort to maintain release quality.

Five Minute Talks / 57

EPICS Independent Test Suite for PCI-based controls devices using PythonQT

Authors: Gasper Jansa[1] ; Till Straumann[2] ; Tomo Cesnik[1]

[1] *Cosylab*

[2] *SLAC*

Corresponding Author: gasper.jansa@cosylab.com

In this paper we present the generic solution for testing PCI-based hardware devices on Linux. For simple device manipulation, EPICS provides additional layer of complexity, which is usually not desired by the people who are just interested that device works on its own. The paper presents four software modules that were developed to ease the testing of such hardware devices remotely, without the usage of EPICS. The complete solution provides a server that exposes device data on the network, client Python API to modify the data remotely, and PythonQt GUIs that enable the user to change the data easily as well as run automated Python tests and generate their reports. Implemented software package was successfully used for testing EMCOR controller at SLAC National Accelerator Laboratory. Since it has been made with reusability in mind, it can be used for any other PCI-based hardware device without additional effort.

Future / 51

EPICS V4 Overview

Author: Marty Kraimer[None]

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Services / **64**

EPICS for Hard Real-Time?

Author: Ralph Lange[1]

[1] *ITER Organization*

Corresponding Author: ralph.lange@gmx.de

The existing EPICS Database covers soft real-time applications in the range up to ~1kHz. What would it need to go beyond that? Which existing concepts would hold? Which would have to be replaced? This talk shows common features of existing real-time frameworks in the fusion community, and presents ideas for a deterministic processing engine in EPICS.

Low-level Controls / **34**

EPICS integration of Raspberry Pi Monitoring System for simple applications and user trainings

Author: Changwook Son[1]

Co-authors: Jeong Han Lee [1] ; Mi Jeong Park [2]

[1] *Institute for Basic Science*

[2] *IBS*

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The Raspberry Pi is a very small size computer and it can connect to various sensors via GPIO ports. So It can be used not only IOC but also control device itself. In this report we'd like to present how to use and integrate into epics system. The first one is environment monitoring system which is consist of temperature sensor and serviced via web browser. The next one is a raspberry pi training kit for education. Because of low cost, The raspberry pi is very good device for epics start user.

Services / **29**

EPICS on SNS Instruments

Author: Matthew Pearson[1]

[1] *ORNL*

Corresponding Author: pearsonmr@ornl.gov

The SNS is in the process of converting from a Windows/Labview based control system to a Linux/EPICS based system for our instrument controls. I will present an overview of our computing infrastructure, EPICS device control, our use of CS-Studio as the main user interface, and our plans for the future.

Five Minute Talks / **61**

EPICS-controlled OWI Edge Robotic Arm using a Raspberry Pi IOC

Author: Pete Jemian[1]

[1] *Advanced Photon Source*

Corresponding Author: jemian@anl.gov

The OWI Edge Robotic Arm is a child's toy that is built from a kit. An optional USB interface is available through which communication from a Linux computer is possible. Using the Raspberry Pi and asyn support, this hands-on IOC demonstrates how modestly a "complete" control system might be constructed, including GUI.

Status Reports / 35

ESS Status

Author: Torsten Bögershausen[1]

[1] *European Spallation Source*

Corresponding Author: torsten.bogershausen@esss.se

ESS Status

Status Reports / 36

FRIB Status

Author: Lawrence Hoff[1]

[1] *Facility for Rare Isotope Beams*

Corresponding Author: hoffl@msu.edu

FRIB Status

Services / 65

Fast Data Storage system for PAL-XFEL

Authors: Ambrož Bizjak[1] ; Matej Šekoranja[1] ; Rok Štefanič[1]

[1] *Cosylab*

Corresponding Author: ambroz.bizjak@cosylab.com

We have developed a fast data storage and archiving system for the PAL-XFEL project. The system monitors around 5000 EPICS PVs, updated at 60Hz, most of which are scalars. The system keeps, at a minimum, 5 minutes of short-term history available for retrieval at any time. On the other hand, the system allows for long-term preservation of data from specific time intervals. This includes preservation of both past buffered data as well as future data. For example, the system can be configured to preserve the last 5 minutes and the next 2 minutes of data in the event of an interlock, or upon manual request by a user. As the basic interface, the system accepts HTTP requests to preserve a specific time frame of data. There is also an option to issue such data preservation requests based on updates of PVs. The system is based on the EPICS Archiver Appliance software with modifications that implement the data preservation logic, along with various improvements related to the data storage logic and general performance.

Low-level Controls / 74

From VME/RTEMS to Industrial PC/LinuxRT: A Migration Story

Author: Mitch D'Ewart[1]

[1] *SLAC*

Corresponding Author: mdewart@slac.stanford.edu

Until recently VME RTEMS-based IOCs have been the platform of choice for control systems at SLAC. Cost and hardware availability make industrial PCs running Linux an attractive option for EPICS based IOCs. The CONFIG_PREEMPT_RT patch has been used to significantly improve the real-time performance of Linux. We will discuss real-time performance issues and migration experience for LinuxRT based EPICS IOCs.

Low-level Controls / 50

Getting Timestamps right

Author: Martin Konrad[1]

[1] *Facility for Rare Isotope Beams*

Corresponding Author: konrad@frib.msu.edu

EPICS control systems attach timestamps to data at the hardware or IOC level. This presentation will give an overview of available times (local time, UTC, GPS time, international atomic time), discuss their advantages/disadvantages and describe the planned implementation for FRIB.

Five Minute Talks / 88

Hour Log: A system for managing facility status

Corresponding Author: vuppala@frib.msu.edu

Hour Log manages information about current experiment, source, vault, beams, breakdowns, and shifts at NSCL. Operational staff use it to record notes and the corresponding facility status. It generates usage and breakdown reports for the funding agencies. It interfaces with Olog, Archiver Appliance, Training, and Trouble Record systems. It provides a RESTful API which is used to display current and historical facility status on hallway and experiment displays.

Status Reports / 8

ITER and CODAC Core System - Status and Road Map

Author: Ralph Lange[1]

[1] *ITER Organization*

Corresponding Author: ralph.lange@gmx.de

ITER is a large international project building a fusion facility in the South of France. Most contributions are in-kind - integration of more than 200 plant systems will be the main challenge when building the control system.
To support controls development of plant systems, ITER created CODAC Core System (CCS), a Linux Distribution based on RedHat Enterprise Linux, EPICS and ITER specific tools.

Tools & Clients / 41

Integration of Lua Embedded Scripting Language into EPICS Base

Author: Jeff Hill[1]

[1] *LANL*

Corresponding Author: johill@lanl.gov

Enhancements to EPICS Base integrating Lua Embedded Scripting Language.

Low-level Controls / 11

LCLS Magnet Power Supply Upgrade

Author: Kristi Luchini[1]

[1] *SLAC National Accelerator Laboratory*

Corresponding Author: luchini@slac.stanford.edu

The Linac Coherent Light Source is a free electron laser (FEL) facility operating at the SLAC National Accelerator Laboratory (SLAC). The controls for low current powered magnets use a multi-channel power supply controller system (MCOR) to meet the requirements for LCLS. It has a modular architecture that consists of a rack mounted crate, with 16 removable power modules and 1 crate controller. A bulk power supply provides the main DC power for one or more crates. The I/O signals are read by the control system from VME, with an MVME 6100 Power PC CPU, 16-bit, 16-channel ADC and DAC IPAC modules, and a PMC-Event Receiver (EVR) to provide timing for fast feedback over a dedicated network. The MCOR system provides long term stability of 1000ppm over diurnal range of +/-15 degrees C, and can operate up to 120Hz, to meet fast feedback requirements. The upgrade to this system is a SLAC designed slot-0 controller with 2 Gigabit Ethernet ports, USB and serial port, 4 8-channel ADC, 4 8-channel DAC, Digital input and output channels, removable COMx CPU, Xilinx FPGA, timing supporting multi-mode or single mode, and interrupts. A prototype installation has been operating in LCLS Linac for 6 months and will be used for LCLS-II. This paper presents the controls upgrade motivation and commissioning results.

Summary:

This talk will presents the magnet controls upgrade motivation and commissioning results.

Low-level Controls / 73

LCLS-I MPS upgrade: Adding BSA (Beam Synchronous Acquisition) capability

Authors: Gasper Jansa[1] ; Jeff Olsen[2] ; Luciano Piccoli[2]

[1] *Cosylab*

[2] *SLAC*

Corresponding Author: gasper.jansa@cosylab.com

LCLS-I MPS has been upgraded by adding BSA (Beam Synchronous Acquisition) IOC running on linuxRT which is already receiving BSA data from all 6 BLM MPS link nodes. Updating the rest of the 9 PIC MPS link nodes is in progress. We will also briefly present the roadmap to add automatic rate recovery capability to the LCLS-I MPS.

Status Reports / 47

LCLS-II Status

Author: Debbie Rogind[1]

Co-author: Hamid Shoaee [1]

[1] *SLAC National Accelerator Laboratory*

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The new LCLS-II facility at the SLAC National Accelerator Laboratory is a significant addition to the LCLS-I FEL, designed to dramatically decrease data acquisition time by providing high repetition rate over a broad energy range. The new design consisting of a CW superconducting linac with bunch repetition rates of up to one MHz and beam power of several hundred kilowatts requires major enhancements to the LCLS-I controls system. LCLS-II will retain the system architecture based on EPICS while implementing additional technologies to meet the new requirements. This includes new designs for SC LLRF, timing system to allow MHz operation, data acquisition electronics for the beam position monitors and other beam diagnostic systems, and a new beam-based feedback facility. The high beam rate and power also necessitate faster beam abort mechanisms, requiring enhanced machine and personnel protection systems as well as a new radiation containment system. This talk will present an overview of the LCLS-II controls and discuss the design status of the critical systems including the development of a general purpose electronic system to serve as a common platform for several applications.

Five Minute Talks / 75

Managing BEAST alarm history

Author: Kunal Shroff[1]

[1] *Brookhaven National Lab*

Even after alarms have been addressed, maintaining the alarm history is useful to detect noisy alarms, find correlations, etc. We are using ElasticSearch, Lucene, and Kibana (ELK) along with Apache Camel to archive alarm messages and provide tools to query and visualize them.

Services / **79**

Metadatastore

Author: Arman Arkilic[1]

[1] *Brookhaven National Lab*

The beamlines at NSLS-II are among the highest instrumented, and controlled of any worldwide. Each beamline can produce unstructured data sets in various formats. This data should be made available for data analysis and processing for beamline scientists and users. Various data flow systems are in place in numerous synchrotrons, however these are very domain specific and cannot handle such unstructured data. We have developed a data flow service, metadatastore, that manages experimental data in NSLS-II beamlines. This service enables data analysis and visualization clients to access this service either directly or via databroker api in a consistent and partition tolerant fashion, providing a reliable and easy to use interface to our state-of-the-art beamlines.

Tools & Clients / **67**

Monitoring Dynamic IOC Installations Using the alive Record

Author: Dohn Arms[1]

[1] *Argonne National Laboratory*

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The alive record is part of a system used at the Advanced Photon Source for monitoring the IOCs on the experimental floor. These IOCs are spread across many subnets, are maintained by multiple people, run different versions of software, and some travel between sectors. For the beamline support groups, monitoring and maintaining these IOCs can be time-consuming as one is not sure of the current or most recent state for an IOC. The alive record allows an IOC to ping a central server across subnets, as well as provide upon demand from the server certain environment variables set at boot-time. This provides at the server an active list of IOC operational statuses, as well as configuration information about each IOC with information specific to an OS. At the APS, over 100 IOCs on the floor are in this sytem, with such systems as traditional VME-based ones as well as mobile detector computers.

Services / **49**

Moving towards Continuous Delivery

Author: Martin Konrad[1]

[1] *Facility for Rare Isotope Beams*

Corresponding Author: konrad@frib.msu.edu

The complexity of the FRIB control system requires high code quality while, particularly during the commissioning phase, short turn-around times are desirable. We will present the status of our efforts moving towards automated software builds, deploying and managing FRIB's controls infrastructure. The tools used in this process include a revision control system (Git), software packaging (for Debian), continuous integration services (Jenkins), configuration management (Puppet) and automatically installed virtual machines for development (Vagrant).

Low-level Controls / 56

NSLS-II BEAM DIAGNOSTICS CONTROL SYSTEM

Author: Yong Hu[1]

[1] *Brookhaven National Lab*

Corresponding Author: yhu@bnl.gov

A correct measurement of NSLS-II beam parameters (beam position, beam size, circulating current, beam emittance, etc.) depends on the effective combinations of beam monitors, control and data acquisition system, and high level physics applications. This talk will present EPICS-based control system for NSLS-II diagnostics and give detailed descriptions of diagnostics controls interfaces including classifications of diagnostics, electronics and EPICS IOC platforms, and interfaces to other subsystems. Commissioning results of NSLS-II accelerators, including Linac, Booster, and Storage Ring, are also presented.

Summary:

NSLS-II beam diagnostics control system is completely EPICS-based. Utilization of commercial off-the-shelf hardware as well as in-house BPM electronics development is deployed to meet NSLS-II project requirements and schedule. Diagnostics and control system has been playing a vital role during NSLS-II accelerator commissioning and operation.

Services / 80

NSLS-II Data Management

Author: Arman Arkilic[1]

[1] *Brookhaven National Lab*

Corresponding Author: armanarkilic@gmail.com

Each NSLS-II beamline can generate 72,000 data sets per day, over 2 M data sets in one year. The large amount of data files generated by our beamlines poses a massive file management challenge. In response to this challenge, we have developed filestore, as means to provide users with an interface to stored data. By leveraging features of Python and MongoDB, filestore can store information regarding the location of a file, access and open the file, retrieve a given piece of data in that file, and provide users with a token, a unique identifier allowing them to retrieve each piece of data. Filestore does not interfere with the file source or the storage method and supports any file format, making data within files available for NSLS-II data analysis environment.

Five Minute Talks / 78

NSLS-II Fast Orbit Feedback System Status

Author: Yuke Tian[1]

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We will present the NSLS-II fast orbit feedback system commissioning results. It includes the system architecture, the system characteristics measurement and system performance. In the system architecture section, we will describe the overall hardware architecture of the system and the communication between hardware. In the system characteristics section, we will present the measurement in real space and in eigenspace. In the system performance section, we will present the orbit long term drift, the orbit stability results from BPM SA data and the orbit stability results from the BPM FA data. We also discuss the spike issues we observed in the system, and how do we find the noise source using noise locator algorithm.

Status Reports / 39

NSLSII Status

Author: Bob Dalesio[1]

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NSLSII Status

Services / 84

Ophyd: Software for Data Collection, Management, and Analysis

Author: Daron Chabot[1]

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Ophyd is a Python-based framework for experiment control under development at Brookhaven National Lab and deployed for use on NSLS-II beamlines. The software supports device control, data collection and distribution, reciprocal space operations, integration with electronic logging, and more. Ophyd is coupled with searchable back-end storage and retrieval components, which together form an end-to-end data management architecture for the NSLS-II. An overview of Ophyd's architecture and its accompanying data management infrastructure will be discussed.

Status Reports / 48

Overview and Status of the SwissFEL Project at PSI

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Recently, the installation of the components for the free electron laser SwissFEL has started at the Paul Scherrer Institute (PSI). In February 2016, beginning of the injector commissioning is planned and first lasing is foreseen a year later. New hardware, like VME64xboards (IFC 1210, an P2020 based intelligent FPGA controller from IOxOS) and crates (Trenew), timing system (from MRF with advanced features), motion controllers (Power PMAC from Delta Tau, and MDrive from Schneider), among others, as well as modern field buses, pose great challenges to the controls team. The close interaction of machine and experimentcomponents require advanced software concepts for dataacquisition, distribution, and archiving. An overview of the project will be presented and the different HW and SW solutions based on the experience gained from preliminary implementations at other facilities of PSI will be explained. First results of the HW commissioning at the SwissFEL will be reported.

Services / **2**

Paired Redundant IOCs with Redundant Hardware

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Last year we installed a dual redundant master timing system at LANSCE. A fiber-optic fanout concentrator module acts as a switch to select which timing generator is used to control the accelerator. Each generator consists of two IOCs, which must fail over as a pair. We modified the redundant IOC software from DESY to be able to synchronize some PVs but not others, and allow both IOCs to control hardware simultaneously. If the master stops generating timing signals, our software on the slave first commands the switch and then tells the IOCs to follow suit. I will discuss the modifications we made, and our experience in operating these IOCs.

Services / **42**

Past, present, and future of EPICS Qt

Author: Emmanuel Mayssat[1]

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A serious drawback that exists today is the lack of comprehensive frameworks on which to develop high level applications on top of EPICS. The lack of modern alternatives to antiquated codes has stalled progress in control systems development and presents impending difficulties for both private and public users to maintain EPICS. In the past few years, controls engineers from different accelerator facilities have proposed to extend code-reuse to higher level applications by advocating a modern framework, Qt. The goal of this presentation is to communicate the recent progress of the EPICS Qt collaboration. The EPICS Qt framework is Python, C/C++, and Qt environment. Unlike MEDM and

EDM, EPICS Qt is modern, well-documented, and backed by a healthy community. Like Tk, EPICS Qt is free and open source. EPICS Qt offers the potential of seamless integration of MATLAB-like software. Like LabVIEW, EPICS Qt allows for fast prototyping. EPICS Qt's many-language bindings offer existing facilities a smooth transition to a modern high-level framework. EPICS Qt will be viable alternative to CSS through the involvement of the EPICS community and the development of open source tools, ultimately providing a strong foundation for many types of control systems across DOE labs as well as private industries that use DOE accelerator technology.

Five Minute Talks / 54

Providing remote access to the LIGO interferometers with EPICS based tools

Authors: Jonathan Hanks[1] ; Keith Thorne[2]

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A review of how the EPICS tools are used to provide remote access to the LIGO interferometers. This will include discussion of the current tools being used, the customizations that we have made, and the effort to easily package and distribute the tools to a distributed user base.

Tools & Clients / 31

RAON EPICS integration of SNMP and its realization at early stage

Author: Mi Jeong Park[1]

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The Rare Isotope Science Project (RISP) at the Institute for Basic Science (IBS) constructs the rare isotope accelerator facility in South Korea. The accelerator control system uses various Ethernet-based devices and equipment, and most Ethernet-based devices support Simple Network Management Protocol (SNMP). Therefore, SNMP is useful to build a unified Network-based control system. In this presentation, we will present our trials and the status for EPICS integration of SNMP.

Five Minute Talks / 77

Rare Isotope Beam Transport at 30 kV

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[1] *Michigan State University*

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The stopped-beam system at NSCL provides rare-isotope beams for precision measurements and for reacceleration. Controls for beam transport and isotope selection are described

Status Reports / 69

SNS Status

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SNS Data Acquisition and Instrument Controls Status

Services / 6

Scan Server Update

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Addition of 'parallel' commands.
Ongoing work on Python client library.
Update on how it's used at SNS.

Services / 85

Software Architecture of a Remotely Monitored Dosimetry System

Author: Garth Brown[1]

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A study of absorbed dose in undulator magnets at SLAC's Linac Coherent Light Source (LCLS) was performed using RADFET dosimeters. An extrapolation of the dose rate observed with the present LCLS, at 120 Hz, to the 1-MHz rate planned for LCLS II suggests the new system's permanent magnets could have an unacceptably short useable lifespan. In order to study factors affecting integrated dose rate in real time, a networked system was designed to monitor up to 168 RADFETs, with the accumulate/read cycle implemented in Keithley's Test Script Builder (TSB). TSB is an extension of the Lua language, used for local control and serial communications. Thus we had the opportunity to design and implement both a streamdevice based EPICS IOC and the device it controls. Design of both sides of the system and the overall system will be presented. Functionality is divided by where it can best be performed, with a minimal and specialized protocol to bridge the parts.

Tools & Clients / 70

Status Monitoring of the EPICS Control System at the Canadian Light Source

Author: Glen Wright[1]

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The CLS uses the EPICS Distributed Control System (DCS) for control and feedback of a linear accelerator, booster ring, electron storage ring, and numerous x-ray beamlines. The number of host computers running EPICS IOC applications has grown to 200, and the number of IOC applications exceeds 700. The first part of this paper will present the challenges and current efforts to monitor and report the status of the control system itself by monitoring the EPICS network traffic. This approach does not require any configuration or application modification to report the currently active applications, and then provide notification of any changes. The second part will cover the plans to use the information collected dynamically to improve upon the information gathered by process variable crawlers for an IRMIS database, with the goal to eventually replace the process variable crawlers.

Status Reports / 30

Status of RAON control system

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The Rare Isotope Science Project (RISP) at the Institute for Basic Science (IBS) constructs the rare isotope accelerator facility in South Korea. Since the facility uses stable ion beams and rare isotope beams dependently, independently, or both, possible operation modes and its combination could be a complex of different accelerator sub-systems. Therefore it will be a challenge to build an integrated control systems for the rare isotope accelerator named as RAON. In this report, we will present current status of the overall RAON control systems based on EPICS.

Experimental Controls / 72

Time source callback and attribute plugin for areaDetector

Author: Kukhee Kim[1]

Co-authors: Ernest Williams [1] ; Spencer Gessner [1]

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Timestamp tagging to data and aligning data to individual beam pulse are important part of data acquisition system for pulse machine. We have utilized Beam Synchronous Acquisition (BSA) for LCLS, FACET and other accelerator facilities in SLAC. BSA provides a common interface for the timestamp tagging and aligning data to beam pulse. Unfortunately, we could not get benefit from the BSA for camera image data due to the image is an array data and it should be stored as image

file format. BSA only supports scalar type epics PV. Our timing system in SLAC has 360Hz granularity. Most of image processing and acquiring cycles are non-deterministic in time domain and spend longer time than the 360Hz timestamp update period. These bring difficulty of timestamp tagging for image data.
We have discussed with Mark Rivers, author for the areaDetector module, about time source callback to implement the driver level timestamp tagging with user defined function. The driver level timestamp tagging gives more deterministic and real-time behavior. The timestamp is stored as a part of meta-data of the image and can be utilized by downstream plugins such as file plugin which saves the timestamp into image file format. We also discussed to extend attribute plugin to post out the timestamp related data to epics PVs. He reflected our requirements for the time source callback in the latest areaDetector module and the attribute plugin also.
We are going to describe the details about the time source callback and attribute plugin.

Services / **10**

Traveler and cable web applications at FRIB

Author: Dong Liu[1]

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The traveler and cable web applications have been actively developed at FRIB since the beginning of 2013. The traveler application V2 entered production usage in March 2014. FRIB cable data has been imported into the cable application in production since Dec. 2014.

The traveler and cable applications shares a similar technology stack: node.js, Express, and MongoDB. In this talk, I will give a demo of the two applications. I will report the requirements, design, and implementation of the two applications. I will also present how they have been evolved over the last two years, and the lessons that we have learnt.

Services / **37**

Updates from Data Integration In Real-Time (DIIRT)

Author: Gabriele Carcassi[1]

[1] *Carcassi LLC*

We present the status and future plans for DIIRT (Data Integration In Real-Time), the Java Connection layer used in CS-Studio, WebPODS and available to any Java program. The features in the new 3.0 release will be presented, including the improved support for services, the improved support for real-time formulas, improved color maps for intensity graphs and the integration with JavaFX.

Services / **38**

WebPODS: web gateway and HTML/CSS widgets

Author: Gabriele Carcassi[1]

[1] *Carcassi LLC*

There is an increasing interest to access data coming out of the control system through web technology. Use cases includes the integration with other web tools, applications on tablets/devices, office network live reports/status and off campus access for monitoring beamlines. WebPODS aims to provide a specification based on HTTP/WebSockets/JSON to access the data, a server implementation to act as a gateway, a javascript client library, a set of pure HTML/CSS widgets to display such data and a Java client library. The server utilizes DIIRT as the connection layer, the same engine used in CS-Studio, and therefore makes already available a broad set of functionality (e.g. support for different protocols, formulas, …). As the project has completed its first official release, we go through its status, its functionality and its future.

Experimental Controls / 81

areaDetector EPICSv4 modules

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[2] *Brookhaven National Lab*

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A plugin and a driver for areaDetector were developed to allow data to be transported between areaDetector instances using EPICSv4's pvAccess protocol. This presentation discusses implementation details and test results for them, demonstrating the feasibility of real time data processing at rates above 10Gbps with very few frame losses.

Experimental Controls / 52

areaDetector: What's New?

Author: Mark Rivers[1]

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areaDetector: What's New?

M. L. Rivers, Center for Advanced Radiation Sources (CARS), The University of Chicago, Chicago, IL 60637

This talk will focus on enhancements to the areaDetector package since it was last presented at the 2014 collaboration meeting at Saclay. These include:
- New driver for cameras from QImaging.
- New driver for Dexela flat-panel CMOS detectors from Perkin Elmer.
- New driver for detectors from Princeton Instruments using their PICam library.
- New driver for the Merlin detector from Quantum detectors.
- Added the modules ffmegViewer, ffmegServer, aravisGogE, and firewireDCAM to the github repository. These modules were written at Diamond Light Source and were previously hosted there.
- NDPluginROIStat: New plugin that supports multiple regions-of-interest with simple statistics on each. It is more efficient and convenient than the existing NDPluginROI and NDPluginStats when many regions of interest with simple statistics are needed.
- NDPluginCircularBuff: New plugin that implements a circular buffer. NDArrays are stored in the buffer until a trigger is received. When a trigger is received it outputs a configurable number of pre-trigger and post-trigger NDArrays. The trigger is based on NDArray attributes using a user-defined

calculation.
- NDPluginAttribute: New plugin that exports attributes of NDArrays as EPICS PVs. Both scalar (ai records) and time-series arrays (waveform records) are exported.
- iocs/simDetectorNoIOC: New application that demonstrates how to instantiate a simDetector driver and a number of plugins in a standalone C++ application, without running an EPICS IOC. Applications only need the libCom library from EPICS base and the asyn library.

The talk will also discuss future plans for the areaDetector package.

Services / 7

caputRecorder: a "macro" recorder for EPICS

Author: Tim Mooney[1]

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caputRecorder supports the recording and playback of sequences of caputs. It records each caput as a python command, and a sequence of caputs as a python function (users call this a "macro"). caputRecorder can also serve as a simple user interface for delivering canned python functions to end users. caputRecorder communicates with users via an EPICS database, so it allows any EPICS record or channel-access client to record and run python functions, and to wait for them to complete.

See http://www.aps.anl.gov/bcda/synApps/caputRecorder/caputRecorder.html

Services / 53

infoServ

Author: John Priller[1]

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An IOC task to provide PV and configuration information to scripting languages over HTTP

Experimental Controls / 58

nED - EPICS-based neutron data acquisition and detector control software

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[1] *ORNL / SNS*

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This talk will present an overview of nED software, with a focus on the software architecture and design.

Summary:

At ORNL's Spallation Neutron Source, a next generation neutron data acquisition and detector control software system is being developed to replace the legacy software. This high performance software is known as nED (neutron Event Distributor), and is actively being deployed at production beam lines. nED is developed as an EPICS soft IOC, utilizing asynPortDriver to communicate with detector hardware, and EPICS v4 is leveraged to serve neutron data to higher layer clients. With nED, strides are being made to improve both the stability and the data throughput possible in current data acquisition software.

Five Minute Talks / 60

pvWebMonitor: post EPICS PVs to read-only (static) web page(s)

Author: Pete Jemian[1]

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The pvWebMonitor package provides a background service that monitors EPICS PVs and writes them into customized HTML files in a WWW server directory. The service can be started and stopped by a manage.csh script for automated startup in a cron task or at system startup.

Summary:

docs: http://pvWebMonitor.readthedocs.org
git: https://github.com/prjemian/pvWebMonitor.git
PyPI: https://pypi.python.org/pypi/pvWebMonitor

Low-level Controls / 55

softGlue: user programmable digital electronics

Author: Tim Mooney[1]

Co-authors: Eric Norum [2] ; Kurt Goetze [3] ; Marty Smith [3]

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softGlue is an EPICS module that supports the Acromag IP-EP20x IndustryPack module (FPGA-based digital I/O). It enables users and application developers to construct small, simple, digital electronic circuits, and to connect those circuits to field wiring, all by writing to EPICS PV's. Because the circuits and field connections are defined entirely by EPICS PV's, they can be autosaved and restored, saved as text files (for example, as BURT snapshot files), emailed from one user to another, etc. softGlue also provides simple and safe (throttled) user control over how hardware interrupts are generated by field I/O signals, and how they are dispatched to cause EPICS record processing.