Roadmap for SLAC EPICS-based Software for the LCLS-I/II Complex


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Abstract

With the advent of LCLS-II construction, a SLAC-wide Software Roadmap was established. Complex bunch patterns and multiple beam paths require structured data and middle layer services motivating EPICS 7. Structured data flow will be leveraged for necessary improvements to middle-layer services required for the operation and modeling of multiple accelerators/beamlines.

Principles

- SLAC has multiple facilities & multiple EPICS Controls Groups
- SLAC desires to reduce multiplicity, duplication, Non Recurring Engineering (NRE) development, support & maintenance efforts
- SLAC-wide working groups focus on standardization of implementations:

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<th>Long-term Goals</th>
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<td>Automatic Tuning</td>
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<tr>
<td>Model Dependent + Model Independent Analysis</td>
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<tr>
<td>Machine Learning</td>
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Plan

1. Achieves effective software for a premier, production scientific facility...
   - Complex Bunch Patterns & Multiple Beam Destinations
   - Require Structured Data & Middleware Service Layer
   - Strong Motivation for EPICS 7

2. Leverage SLAC EPICS repo & versioning lab-wide
   - Unify on V3.15; upgrade to git from cvs/svn
   - THSPA007 - Git Workflow for EPICS Collaboration

3. Develop UI/UX environment aligned with the modern scientific & programming community
   - Why was PyDM chosen as a Display Manager over CSS BOY?
   - Minimize # of languages & skill sets to maintain
   - Dynamic displays can easily be built for LCLS-II, with complex, multi-e-beam destinations & multiple electron sources
   - Fulfills SLAC-wide accelerator and beamline use cases
   - Beamline is developing PyDM
   - Operators, physicists, users, engineers widely script in python; low barrier to entry
   - pvPy (for EPICS 7 enabled PyDM) evaluation; potential performance improvement
   - Aggregation/throttling of PV monitor client callbacks
   - EPICS 7 IOCcs (requires a robust qSrv)
   - EDM -> PyDM conversion utility (desired)

4. Add to existing suite with pulse Beam Synchronous Acquisition (BSA) Service to synchronize data across devices (z) & deep time (phase) from LCLS-I & II timing data (diff. timing systems)
   - Embed timing metadata (pulseID, charge, destination…) in NTScalar usertag
   - qSrv is made robust & incorporated into V3 IOCs, producing NTScalar usertag (equivalent of V3 rSrv)
   - Archiver requires pvAccess Gateway

5. Middleware to improve common physics tasks & control maintenance

SLAC EPICS-based Software Roadmap

LCLS-II early injector commissioning (EIC) (FY18 Q1 – FY18 Q4) uses EPICS V3.15 IOCs, EDM, Channel Access (CA)

From now to FY20 (LCLS-II First Light) the following will be developed, as guided by the SLAC Software Working Group:

- PyDM Display Manager adds features; will be productized
- Timing metadata will be embedded in NTScalar
- qSrv is made robust & incorporated into V3 IOCs, producing EPICS 7 IOCs; pvAccess & CA co-exist
- Structured data (w timing metadata) served via EPICS 7 IOCs & pvAccess is served to EPICS T-aware clients
- pvAccess Gateway further tested, developed, integrated
- Structured data archived to EPICS 7-enabled Archive Application and viewable by enhanced Archive Viewer
- LCLS BSA Service incorporates LCLS-II BSA data

Note: MAD model will replace XAL model in parallel

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Components

- PVAS: Python-based Framework for Control System Graphical User Interface
- OV2: Optimized Variable 2
- LabView: National Instruments LabView
- D. Rogind: D. Rogind - SLAC EPICS Software
- J. Delong: J. Delong - SLAC EPICS Software
- D. Flath: D. Flath - SLAC EPICS Software
- M. Gibbs: M. Gibbs - SLAC EPICS Software
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- A. Perazzo: A. Perazzo - SLAC EPICS Software
- M. Shankar: M. Shankar - SLAC EPICS Software
- G. White: G. White - SLAC EPICS Software
- E. Williams Jr.: E. Williams Jr. - SLAC EPICS Software
- M. Zelazny: M. Zelazny - SLAC EPICS Software

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THP012: PyDM - A Python-Based Framework for Control System Graphical User Interface

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