National Synchrotron Light Source II

Controls Program update for the SAC March 2019

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Controls program manager

U.S. DEPARTMENT OF ENERGY | Office of Science

BROOKHAVEN NATIONAL LABORATORY

Contents

- **Plans**, reviews, Structure changes, staffing movements
- **Groups:** ICT, DAMA, Core, Accelerator, Beamlines
- **Tickets** and dashboards
- **Technology** updates: EPICS, BLUESKY and EPS
- **Collaborations**
- **Cyber** security

IT action plan Self Assessment – Then

1. Establish bi-directional communication with stakeholders.
2. Configuration management, incident response, change management, release management
3. Self-help “how-to’s”, standards
4. IT steering group with ITD + stakeholders
5. Financial model proposed for use of CSI resources
6. IT group de-scope by offloading selected services
7. Deliver on critical unsolved issues
8. Take more advantage of COTS software packages
9. DAMA should be responsible for data management
10. Options to add additional staff to IT
11. Clear objectives for the IT
12. Investing in software and computing
13. Develop and resource a data management plan

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Beamline action plan self Assessment - Then

1 Talent-pool in core EPICS/software
2 Explore and implement talent-retention strategies.
3 Engage the tech staff in embracing & advancing facility goals
4 Is staffing model optimum to being world leading facility
5 Provide strong support to the POCs
6 More simple motor control solutions than Delta Tau
7 Robust development processes
8 Improve group interactions
9 Multi-disciplinary teams for appropriate projects
10 Priorities that are aligned with the strategic direction
11 Resolve the problems with the NFS server (IT)
12 Determine common pain points for beamlines
13 Level-1 support (simple tasks) performed by junior staff
14 Not duplicating functionality across the organization
15 Create a working environment, career opportunities
16 Set clearly defined objectives and priorities

Beamline action plan self Assessment - now

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Independent Review deferred

Deferred Until May

The IT and Beamlines reviews, promised last time have been deferred, not forgotten. Selected the May timeframe because:

- They were snowed in last time
- Availability of members
- Wanted to get “Core” group with runs on the board and ITD transition complete.
- Wanted to separate SAC comments from Review

Controls Structure and staffing

PoC and core separated, filling some vacancies

- Separated Beamlines PoC; and
- Core/Common group combining Motion, EPS and some Beamlines
- Promoted Group leader from within for the Core group (Anton Derbenev)
- One staff moved to DAMA from Beamlines (Garrett Bischof)
  Staff *Losses* since SAC last met:
  Mizuki Karasawa (ICT) to RACF (still in the lab)
  Li Li (DAMA) term expired, not extended.
  Staff *Pending*: A Walter (DAMA) will move to an Experimental program
  Staff *Open* Positions:
  Four + one in DAMA (three replacements, one new term (ISPYB, funded by Structural biology) and one moved from ICT to DAMA
  Two in Core (funded by Structural biology)
  One in Accelerator (Staff movement within Controls)
- Interviews and selections for the DAMA and Core positions are in progress and several offers have been made. Some have been rejected.

NSLS-II CONTROLS
R. Farnsworth
PROGRAM MANAGER

BEAMLINE CONTROLS
Z. Yin
GROUP LEADER
C. DeSilva
K. Gofron
H. Xu
J. Li
J. Ma
J. Sinsheimer
J. Skinner

ACCELERATOR CONTROLS
Y. Tian
GROUP LEADER

K. Ha
Y. Hu
I. Saleh
J. Tagger
Y-N. Tang

INFORMATION & COMMUNICATION TECHNOLOGY
R. Petkus
GROUP LEADER
M. Cowan
L. Flaks
M. Karasawa
T. Smith

CONTROLS COMMON SYSTEMS
A. Derbenev
GROUP LEADER
B. Clay
C. Guerrero
O. Ivashkevych
S. Myers
D. Poshka
K. Qian
S. Sauter
K. Shroff
R. Skelaney
S-L. So
B. Sobhani
Q. Tang

DATA ACQUISTION, MANAGEMENT and ANALYSIS
S. Campbell
GROUP LEADER
D. Allan
G. Bischof
T. Caswell
L. Li
N. Malitsky
M. Rakitin
A. Walter
K. Zhang

ICT (Information and Communication Technologies) Update

Ongoing issues, some progress, outsourcing options

The GPFS deployment remains an ongoing issue and is affecting data collection at times

A better level of GPFS Standardization still needed; exploring local onsite expertise, used external consultants

Some progress, but further GPFS issues to be resolved – e.g FXI data intermittent problem had to be solved with SSD, PDF has intermittent issues;

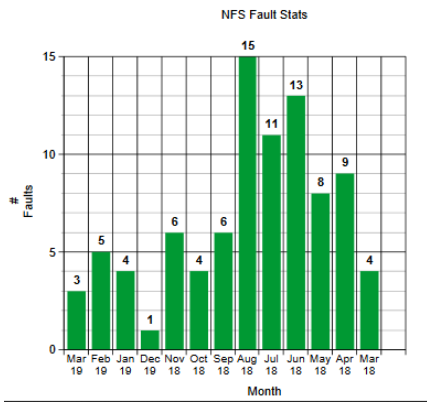
.

Significant progress has been made with NFS problems – further performance improvements planned, but some issues remain;

Added Lab standard "Redhat" to our supported list (Puppet);

Looking at options for outsourcing data storage and better separation of data from Beamlines

GPFS = General Parallel File System.
AKA IBM Spectrum Scale is a high-performance clustered file system



ITD network transition

Lab wide (campus) network staff are at work

- Been a slow and hard process. Technical and Human issues.
- ITD Network Engineering remain in transition
- ITD Network Engineering now have full write access and are making *all* changes. ICT (Controls) assist.
- Logs being converted
- Monitoring being setup – next shutdown
- Select NSLS-II staff can report faults directly to ITD network engineering via same web interface as all other campus support (Screen shot in Backup)
- We have a working SLA document covering roles responsibilities etc for both sides.
- We a detailed inventory, both spares and equipment.

ITD networks High Level Plan – Priority order

Significant items to make the network better

Management Functions have occurred

- Establish DTN communication between NSLS-II and ITD Network engineering
- Migrate management functions over to Network Engineering

Still to lots go

Technical functions

- Structure Spanning-Tree
- Establish Proof of concept for End-State Architecture
- Gather requirements for Beamline, Cell/Mezzanine, Injector areas
- Stabilize the Core
- Standardize existing configurations

Upgrades/Replacements

- Replace End-of-Life switches due in 2019. Replace Core
- Upgrade remaining Beamlines to L3 routing, as well as, 10G uplinks.
- Install new front end for Accelerator network aggregation
- Install new front end for Data Center services aggregation
- Replace End-of-Life switches due in 2021, 2022, 2023, beyond
- Remove L2/L3 links to Beamlines and make L3 only.

High Level Cost Projections

Average ~ 0.75 million $ per year

Redo Core and Replace end of life switches

2019	1,193,741	Core 350k + obsolete devices
2020	606,970	
2021	798,417	
2022	727,044	
2023	1,220,209	
Five year total	4,758,391	

We are working together to see if there are more cost effective solution to better fit our budget/reliability requirements.

More details in Backup slides

DAMA Update

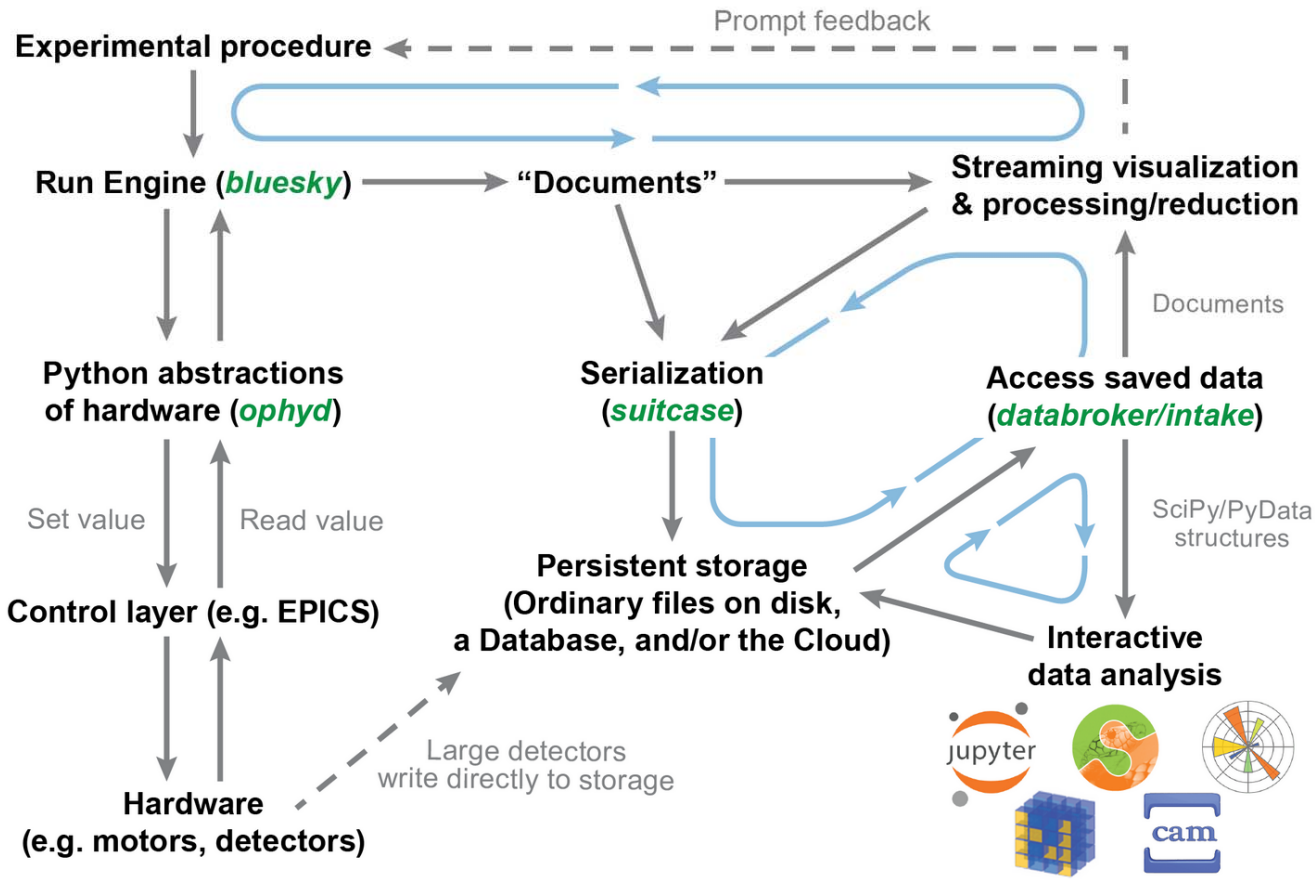
Bluesky maintenance and support

- Still emphasis on Data acquisition
- Writing some drivers (e.g. PDF/XPD)
- Detector additions / configuration updates
- Lots of general support tasks
- Storage Performance Issues causing extra debugging effort
- Implement standard directory naming scheme
- Rollout of updated Bluesky environments
- Not many major features Bugfixes / Maintenance

DAMA update – Enhanced scope

Added some features made by others,
export for data (serialization) + Intake

bluesky



Core group created

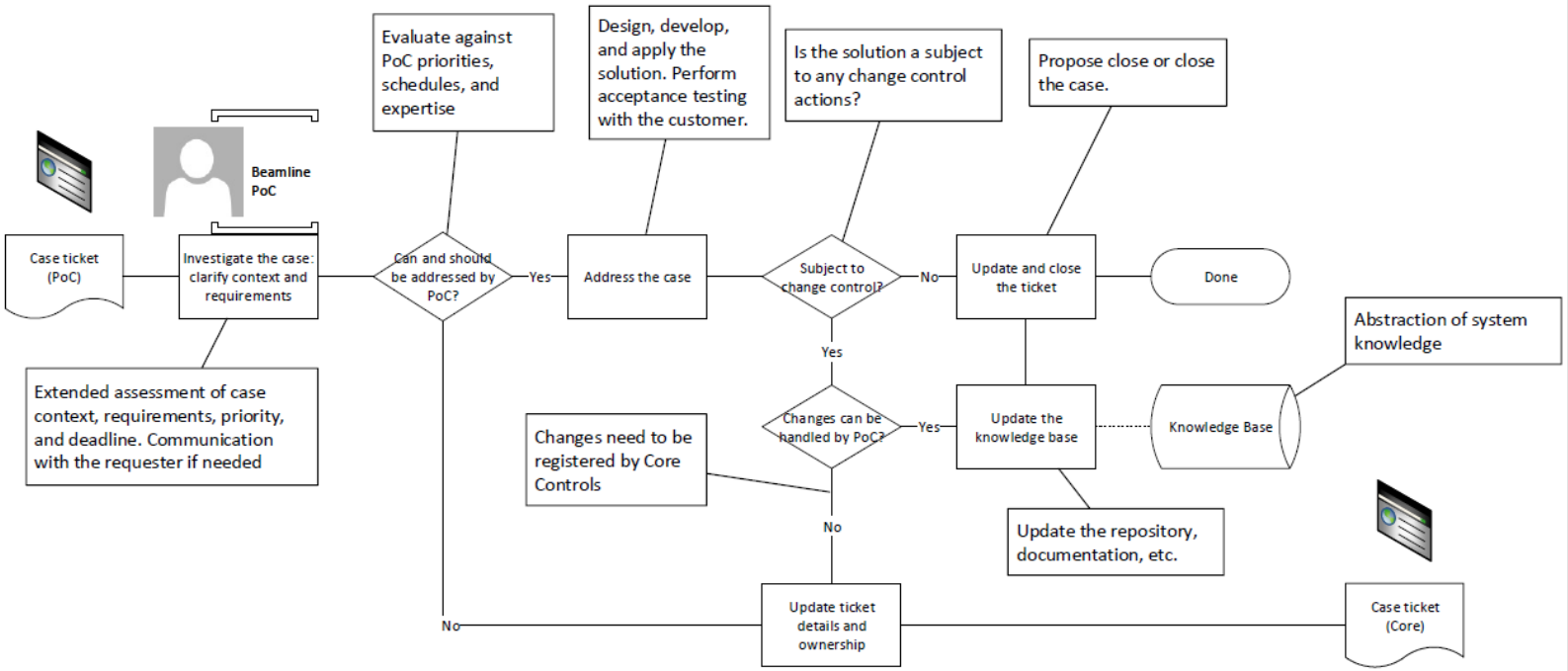
Combined smaller groups

As part of a transition for operations and away from separate projects and in order to promote common facility wide solutions, the specialty EPS and Motion groups and some Controls beamline specialist staff have been combined into a Core* system group has been formed.

* You may see this as “common” system in some org charts etc.
Prefer “core”. So much less common…

Workflows for Core group Communications – PoC to Core

Demonstrates the Engineering process (Full process in Backup slides)



Accelerator Controls update

Very stable group, working well

- Vacancy now Anton Derbenev promoted to core:
- Accelerator control responsibilities redistributed
  - Timing system, front-end slits control:
  - All ID motion control, Top off system:
  - Area Radiation Monitor (ARM)
  - Power distribution unit (PDU)
  - High precision temperature rack control
  - Rack Temperature control (RTC), Onewire temp

Accelerator controls

- Group Working extremely well
- BPM collaboration with ALS and APS
- No downtime/Beamloss due to Accelerator controls since last SAC meeting.
- Only concerns are with Specialist staff.

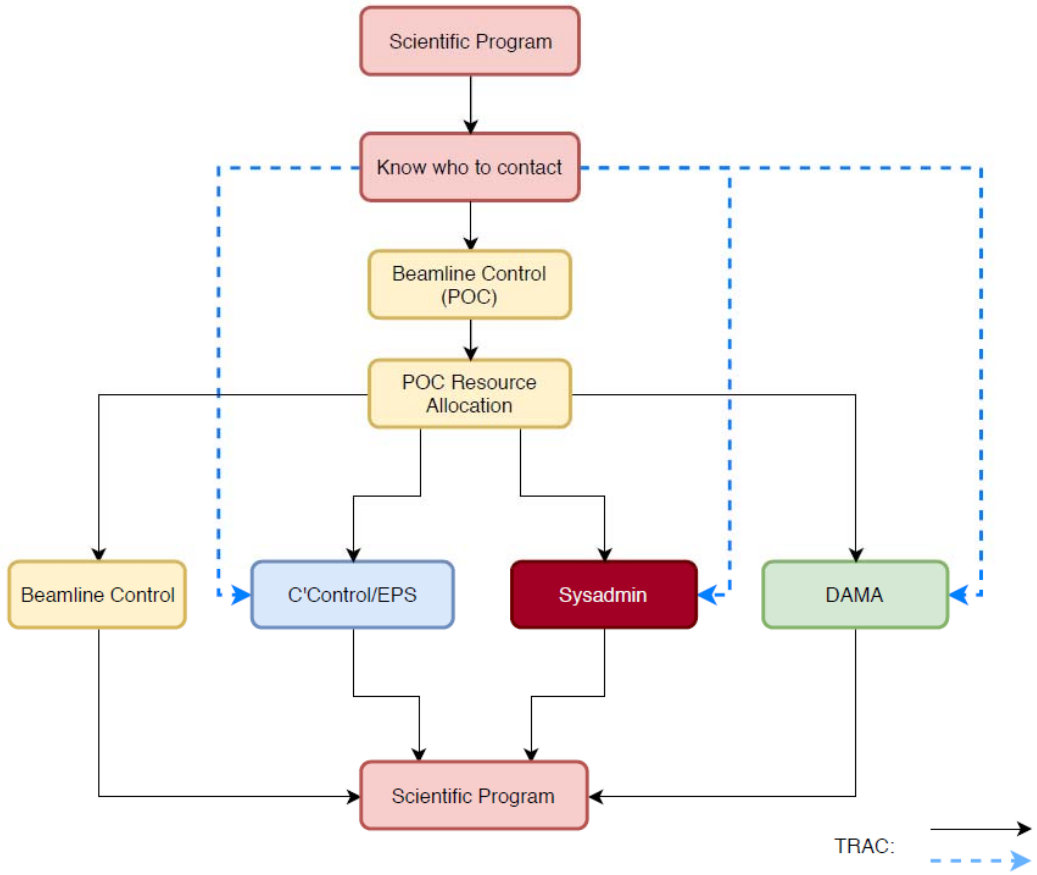
Beamlines group

Who are the PoC - Update

- Now is composed primarily of the PoC's
  (Slight deviation with J Skinner/Stu Myers)

Program	Program Manager	POC Controls Engineer	Beamlines
Soft X-ray	Stuart Wilkins	John Sinsheimer	CSX, IOS, ESM, SIX, FIS/MET
Imaging and Microscopy	Young Chu	Jun Ma	HXN, SRX, FXI, XFM, TES
Hard X-ray	Ron PIndak A/	Chanaka DeSilva	ISS, TES, QAS
Complex scattering	Ron Pindak	Kaz Gofron	CMS, IXS, SMI, CHX
Diffraction	Eric Doohyee	Ji Li	XPD, PDF, ISR, HEX
Structural Biology	Sean Mc Sweeney	Stu Myers	FMX, AMX, LIX, XFP, NYX
Experimental Develop	Wah-Keat Lee	Huijan Xu	Mech Eng, Res support, Tech, Optics and Metrology
NIST Beamlines	D. Fisher.	Zhijian Yin	BMM,SST-1, SST-2,

Beamline controls work flow (Rev 2.1)



- Scientific program and PoC assign tasks using TRAC system.
- When a ticket is assigned, the engineer shall take ownership of the issue to the completion of the task.
- PoC shall have power and judgement to assign jobs to other groups.
- PoC has power to direct resources in the controls program in emergency situations.

Training – ongoing and conferences

Systems training

Training

- EPICS
- Motion
- Drivers
- Internal workshops
- Programmable logic controller, now have four capable engineers

Conferences

NOBUGS held was here last October

- EPICS Collaboration, Melbourne in November
- EPICS core and CSS will be here again this year

Tickets (Trac)

Main tool to control bugs, changes and minor project work

- Steady at about 400 active any given month.

  150 – ICT
  100 - PoC
  150 – Core
  3 - Accelerator
  10 - DAMA
  200 odd DAMA held tickets elsewhere (GITHUB) – but multiple facilities (See screenshots in Backup)

  These numbers, in themselves are more manageable, if broken out – see following slides

Note some new ticket status conditions:

- **propose_close** – task complete, waiting for requester acceptance
- **deferred** & owned by controls-core – task will not be addressed at this time
- **deferred** & owned an engineer – task is postponed by an engineer
- any other status – task is in progress

Note also color "heat" denotes priority, they alternate brightness for row clarity:

- Red = Highest
- Yellow = High
- Grey = Normal
- Turquoise = Low
- Purple = Lowest

Soft X-ray Scattering & Spectroscopy
PM: Stuart Wilkins, PoC: John Sinsheimer)

12 tickets

Ticket	Summary	Component	Status	Owner	Type	Priority
#3178	[EPS][IOS] - CSS not working properly	IOS	propose_close	nmaytan	problem report	highest
#2983	[EPS][ESM] Valve not remotely controllable anymore	ESM	accepted	nmaytan	defect	normal
#3076	[SIX][EPS] Rack temperatures in 740 and the electrical room are not in the EPS	SIX	assigned	bsobhani	configuration change	normal
#3077	[ESM][EPS] Add temperature monitoring of racks to EPS	ESM	assigned	bsobhani	task	normal
#3093	[SIX] [EPS] [legacy-EPS] Pt RTD integration for the main detector in the DAA chamber	SIX	accepted	nmaytan	task	normal
#3094	[SIX] [EPS] [legacy-EPS] detector (DAA) and spectrometer optics (3AA) tilt meters	SIX	accepted	nmaytan	task	normal
#3095	[SIX] [EPS] [legacy-EPS] piezo fast shutter state	SIX	deferred	nmaytan	task	normal
#3096	[SIX] [EPS] [legacy-EPS] LED lights and other lamp for sample chamber and sample transfer	SIX	deferred	nmaytan	task	normal
#3098	[SIX] [EPS] [legacy-EPS] sample switch on cryostat in chamber	SIX	accepted	nmaytan	task	normal
#3114	[SIX][EPS] High vacuum integration	SIX	propose_close	nmaytan	task	normal
#3134	[IOS][EPS] Develop integration of liquid isolation valve	IOS	accepted	nmaytan	task	normal
#1507	[EPS][CSX] Complete EPS wiring connections for 5th port on backing line 2	CSX	accepted	nmaytan	task	low

Imaging & Microscopy
HXN, XFM, SRX, FXI (PM: Yong Chu, PoC: Jun Ma)

17 tickets

Ticket	Summary	Component	Status	Owner	Type	Priority
#3001	[HXN] NSLS2-EM diagnostic	HXN	new	so	task	highest
#2057	[EPS][HXN] Add PVs to HXN Main EPS opi panel	HXN	propose_close	nmaytan	task	high
#2945	[EPS][HXN] 3-ID Processed Chilled Water Vlv Closed	HXN	deferred	nmaytan	problem report	high
#2964	[HXN] kohzu stages for HXN c-hutch experiement	HXN	propose_close	bsobhani	task	high
#3151	[SRX][EPS] Module Fault in A-hutch	SRX	propose_close	nmaytan	task	high
#751	[SRX] B hutch shutter intermittently does not move when commanded	SRX	assigned	nmaytan	defect	normal
#1182	css DataBrowser - Trace Type = Area - not working	HXN	propose_close	shroffk	task	normal
#2563	[SRX] Test new controller for SRX HDCM servo motor	SRX	accepted	cguerrero	task	normal
#2565	stopped piezo motors jump when the stop button is pushed	FXI	deferred	controls-core	task	normal
#2793	EPICS-IOC for Potentiostat	HXN	deferred	controls-core	task	normal
#2948	[HXN] rack temperature monitor	HXN	assigned	bsobhani	task	normal
#3025	[HXN] Cryo EPS trip	HXN	deferred	nmaytan	task	normal
#3029	[SRX] 1-wire temperature sensors	SRX	accepted	bsobhani	task	normal
#3079	[SRX] CSS Make Log Entry problems	SRX	assigned	shroffk	task	normal
#3084	[SRX] pco.edge IOC upgrade on Windows	SRX	assigned	controls-core	task	normal
#3108	One wire sensors installation	FXI	assigned	rskelaney	task	normal
#1490	[SRX] migrate area detector IOC for pco to linux - 12/1/17	SRX	deferred	controls-core	longer term project	low

Diffraction /In-situ Scattering
ISR, PDF, XPD, HEX (PM: Eric Doohyee, PoC: Ji Li)

14 Tickets

Ticket	Summary	Component	Status	Owner	Type	Priority
#2279	[XPD] Rack temperature motnitoring.	XPD	new	bsobhani	task	highest
#3133	Revisit tuning and implementation of PDF Bridge translations	PDF	assigned	oksana	task	highest
#2578	[XPD] Keithly multimeter set up.	XPD	propose_close	bsobhani	task	high
#2860	[ISR] 4-ID Turbo pump + angle valve configuration changes	ISR	accepted	cguerrero	task	high
#2931	[EPS] Change Allen-Bradley signal readings from millivots to volts	XPD	propose_close	bsobhani	task	high
#3027	Documentation of PDF Bridge Motors	PDF	new	oksana	task	high
#2169	Activate BDM Slit stray current measuring system	PDF	deferred	oksana	task	normal
#2170	Activate OCM Slit stray current measuring system	PDF	deferred	oksana	task	normal
#2171	Implement PDF WB filter thermocouple signal on PDF CSS	PDF	assigned	bsobhani	task	normal
#3064	[PDF] Add new PVs for filter 1A and filter 1B.	PDF	new	bsobhani	task	normal
#2166	Setup magnet +cryostat stage X/Y motion controls	PDF	deferred	oksana	task	low
#2168	Setup automatic sample alignment system controls	PDF	deferred	oksana	task	low
#2173	Increase D1 D2 X translation speed	PDF	deferred	oksana	enhancement	low
#2507	Setup controls for the automatic sample changer	PDF	deferred	oksana	task	low

NIST BMM, SST (PM: D. Fisher, PoC: ZY)

One ticket

Ticket	Summary	Component	Status	Owner	Type	Priority
#3180	Change 7-ID EPS logic for PSH1, PSH4, and FE shutter	SST	assigned	cguerrero	task	normal

Structural Biology
FMX, AMX, LIX, XFP, NYX (PM: Sean Mc Sweeney, PoC: Stuart

Ticket	Summary	Component	Status	Owner	Type	Priority
#2064	XFP: XIA 31 element detector electronics integration with EPICS	XFP	assigned	controls-core	task	normal
#2888	[XFP] Add virtual axes on XFP pink beam slits	XFP	propose_close	bsobhani	task	normal
#2934	[FMX+AMX] dewar rotation 360 rollover	FMX	accepted	cguerrero	task	normal

Hard X-Ray Spectroscopy
QAS, TES, ISS (PM:R Pindak A/, PoC: Chanaka De Silva)

2 tickets

Ticket	Summary	Component	Status	Owner	Type	Priority
#2906	[ISS] EPS Cryo power supply	ISS	propose_close	cguerrero	task	high
#3109	[ISS][EPS] Flowmeter and pressure gauge readbacks	ISS	propose_close	nmaytan	task	high

Complex Scattering: CMS, IXS, SMI, CHX (PM: Ron Pindak, PoC: Kaz Gofron)

22 tickets

Ticket	Summary	Component	Status	Owner	Type	Priority
#2451	CHX alarm handler setup	CHX	assigned	shroffk	task	high
#2944	[CHX] 3D printer digital control	CHX	accepted	nmaytan	task	high
#2980	A random 'None' Bug after 7k-12k exposures	CMS	accepted	oksana	problem report	high
#1567	11-BM CMS: KB mirror motion tests without beam	CMS	deferred	oksana	task	normal
#1684	WAXS bounce down mirror -- ECC100 IOC installation	SMI	propose_close	so	task	normal
#1688	CSS screens migration	SMI	propose_close	so	task	normal
#1689	2 mono slits at HFM and VFM	SMI	propose_close	so	task	normal
#1707	Alarm config for 11bm, 12id, & 21id needs updating	SMI	propose_close	shroffk	task	normal
#1939	fast and slow shutter timing	CHX	assigned	nmaytan	task	normal
#2266	CSS periodic workspace save	IXS	propose_close	shroffk	task	normal
#2553	CSS frozen intermittently	IXS	new	shroffk	problem report	normal
#2727	[EPS] CHX FE shutter	CHX	deferred	controls-core	problem report	normal
#2956	CHX encoder head external UPS power	CHX	deferred	controls-core	task	normal
#2957	CHX rack expansion	CHX	deferred	controls-core	task	normal
#2973	10ID hutch temperature PLC network cabling	IXS	assigned	nmaytan	task	normal
#3003	Build microfluidic experimental capabilities for CHX	CHX	accepted	oksana	task	normal
#3065	XWin fonts disappearing issue	CHX	new	shroffk	task	normal
#3080	Xerox printer - install network cable	IXS	assigned	ssauter	task	normal
#3088	Label printers and switches in user area	IXS	assigned	ssauter	task	normal
#3100	SMI 10Gig network and 500Hz detector capability	SMI	new	so	task	normal
#3179	CHX smarAct request files for mc16	CHX	new	bsobhani	task	normal
#2450	MCS limit behavior	CHX	deferred	bsobhani	task	low

Ranking of Insertion devices by level of problems, worst on top

ID issues – and an integrated team to solve them

• 2.8 meter IVU's	(frequent problems)	ISR SMI LIX
• 1.5 meter IVU's	(frequent problems)	SRX AMX FMX
• 3 meter IVU	(infrequent until failure of HXN)	HXN CHX
• 2.7 meter EPU	(occasional problems)	ESM
• 3 meter IVU	(elevation issue)	IXS
• 1.4 meter EPU	(infrequent)	ESM
• 2 meter EPU	(infrequent)	SIX CSX1,2
• Damping wigglers	(no issues reported	ISS FXI XPD
• Three pole wigglers	(initial speed issues fully resolved)	

Order of attack

Value of a multidisciplinary group; we works as a team

- Working group formed/lead by Electro/Mechanical Engineer (John Escallier)
- Controls (3), Mechanical (3), Physics(3) Team
- It was decided to attack the 2.8 meter IVU LIX first
  - It was the most frequent problem (by number of complaints)
  - It had >13 thousand lines of code (the deep end of the pool)
  - The software framework was common to a total of 8 devices, so what is learned can be used to fix all 8
- Abandoned the existing code
  - It is far too convoluted
    - Patches within patches
  - It would take far too long to find all the problems (If even possible)
    - Found many of the problems
  - Much of it was written to address problems caused by conceptual misunderstandings of the vendor's motion control programmers
    - Some was due to their inexperience with the Delta Tau
    - Some due to inexperience with mechanics
  - The IVU now works well and exceeds original requirements
  - Added diagnostics applicable to all

More details in Backup slides

Storage I/O – Beamline→Central Data Rates

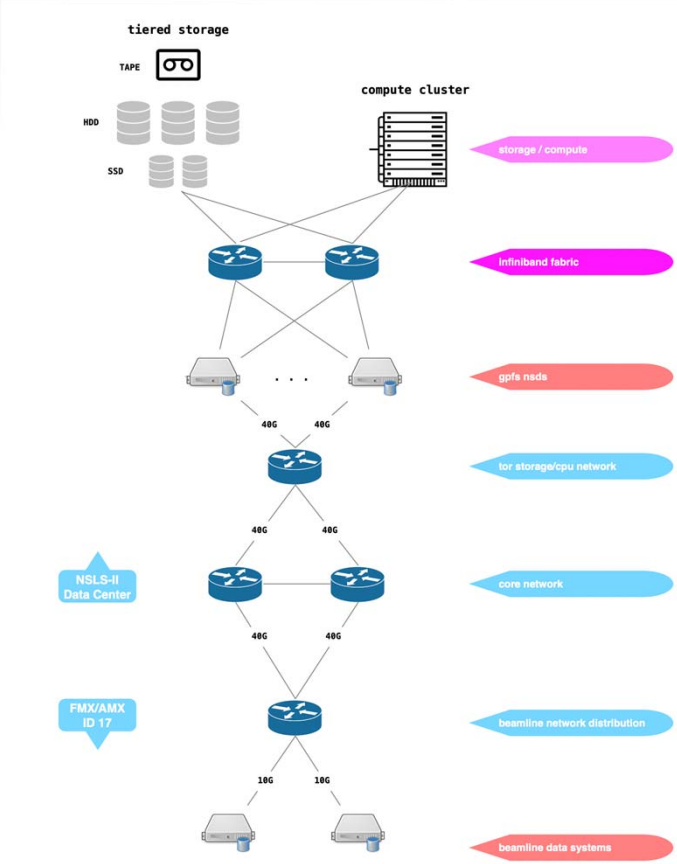
Current model for Beamlines Data
Best example is FMX/AMX

Is performing roughly as expected

Full performance data in backup slides

Needs to be performing on
all beamlines – reliably

Measured Data rates in back slides.



Equipment Protection system (EPS) issues

Help diagnose why EPS is triggered and to control changes

First issue

Noticed lots of calls for EPS assistance, but very little EPS changes actually happening
The purpose of the EPS system is to stop damage => stop equipment

Ongoing emphasis on better diagnostics. Need the user to more easily find "Why is my EPS system not allowing me to do something?"

Second issue:

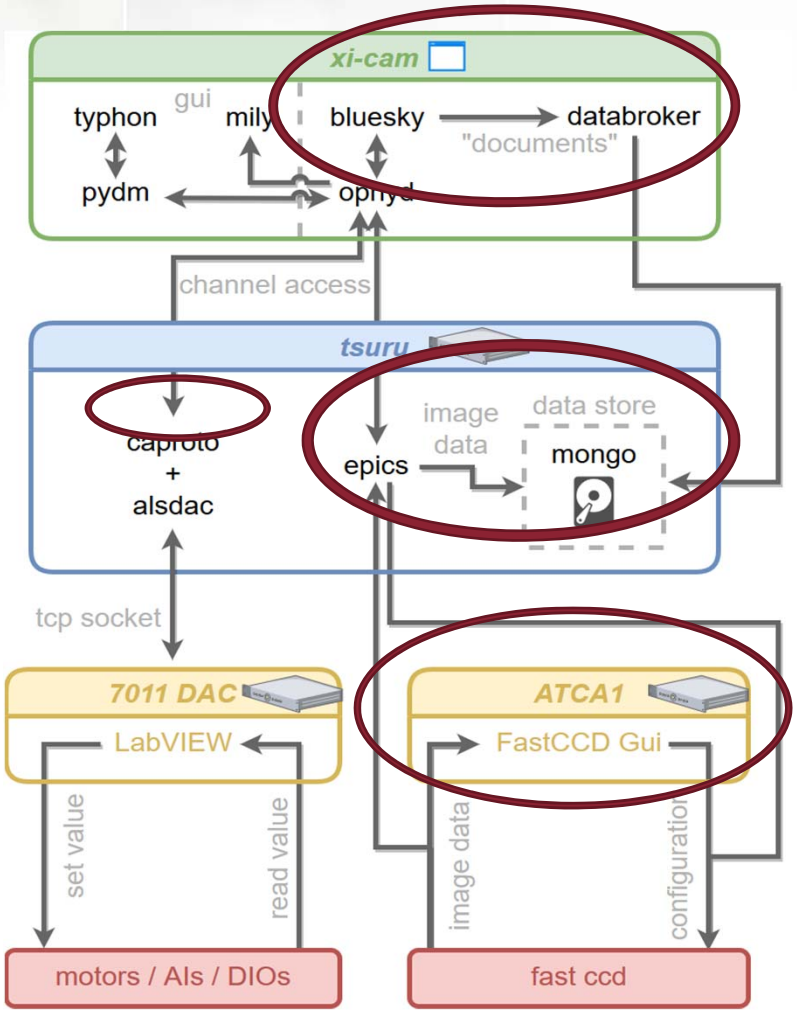
EPS system being used for non EPS purposes.

- Change control board instituted.
- No use of EPS systems for non EPS purposes (hard line)

BLUESKY / OPHYD at COSMIC (ALS)

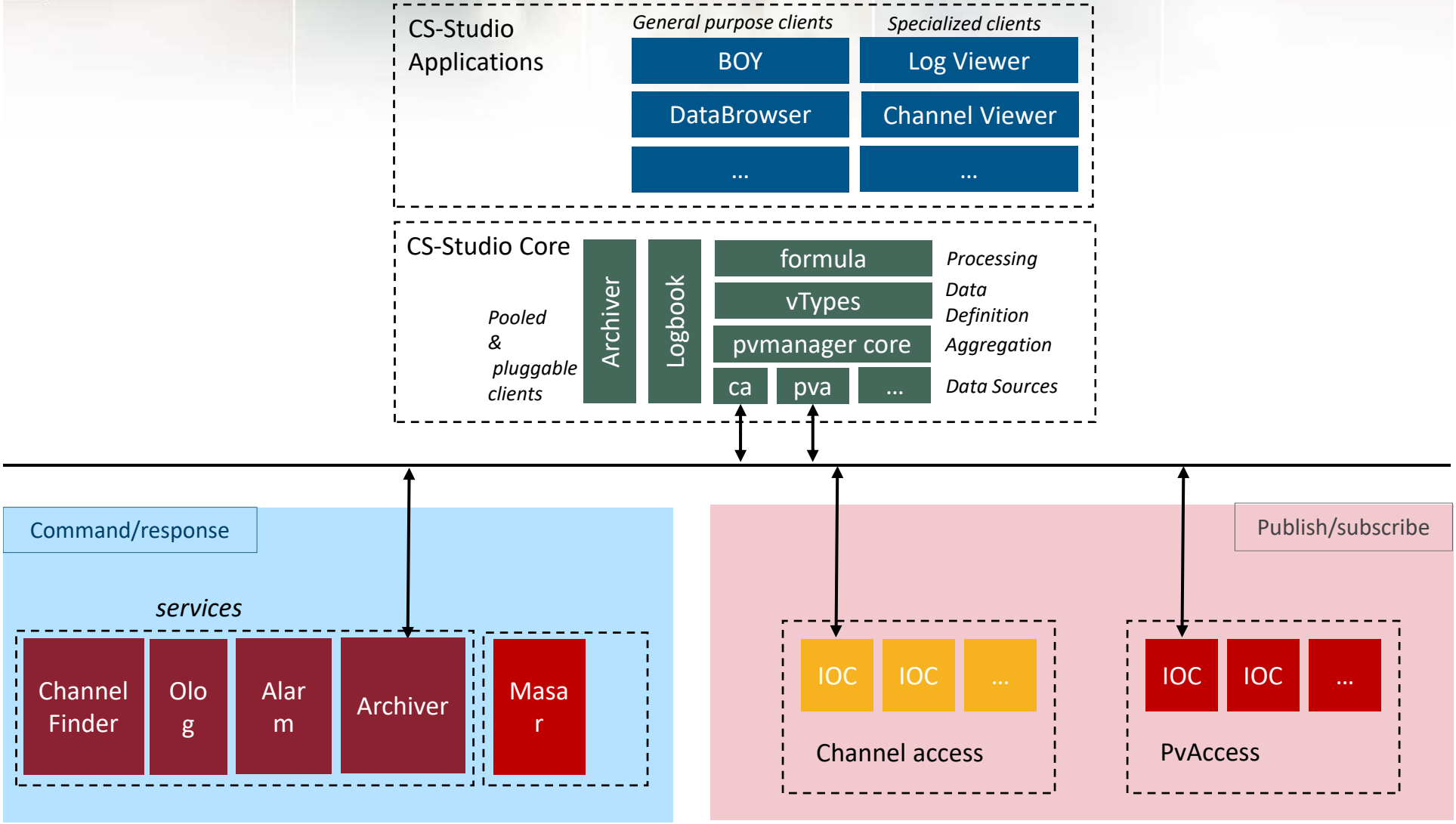
External collaboration

- The COSMIC beamline at the ALS for Soft X-ray XPCS has adopted the NSLS-II DAMA software for next generation experimental control and data management.
- The close collaboration between the COSMIC beamline team, the DAMA group at NSLS-II, the computing group at ALS, Mark Rivers at the APS and the Soft X-ray program at NSLS-II lead to a very quick deployment of the DAQ at the COSMIC Beamline.
- NSLS-II Developed and contributed the following components:
  - *areaDetector* driver for the LBL FastCCD
  - *ophyd* drivers for the control of the Detectors
  - *bluesky* DAQ.
  - *databroker* Data Management Database
  - *caproto* which enabled an EPICS interface to the LBNL legacy LabVIEW controls
- This collaboration was also possible because of a long standing collaboration with the LBNL detector group.



CS-Studio& EPICS service Infrastructure

We are a big part of this collaboration



Further details in backup slides

Cyber security

An increasing challenge

- Open Beamlines up to external traffic
- Cyber security concerns are increasing
- Working with Lab to ensure all policies are up to date
- Firewalls appropriate
- No intrusions
- We have lengthy document, upon request
- Takes real manpower to negotiate this realm

Summary

- Making progress on the Action plan
- Made appropriate Org changes for the plan
- IT performance issues known, not all solved, data performance more critical. Outsourced network responsibility to others. Network Improvements should follow as we invest.
- Task Priorities, Issues and work “tracked” more closely
- Multi-disciplinary groups to solve big problems
- Bluesky and EPICS collaborations
- Cyber security issues important

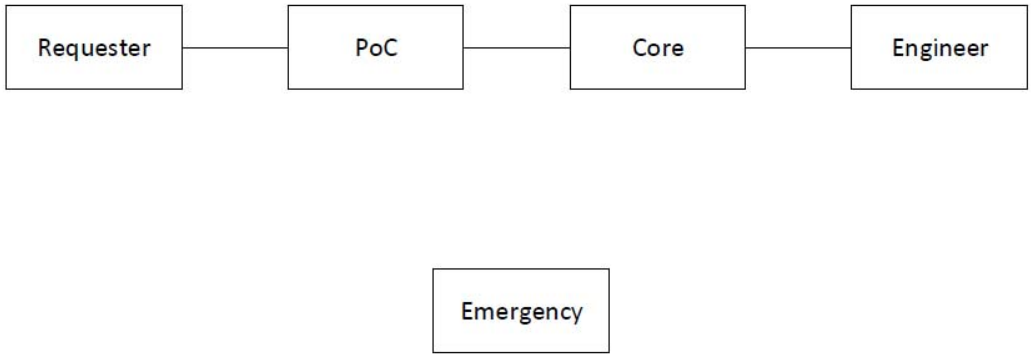
End of Presentation

Backup slides – contents

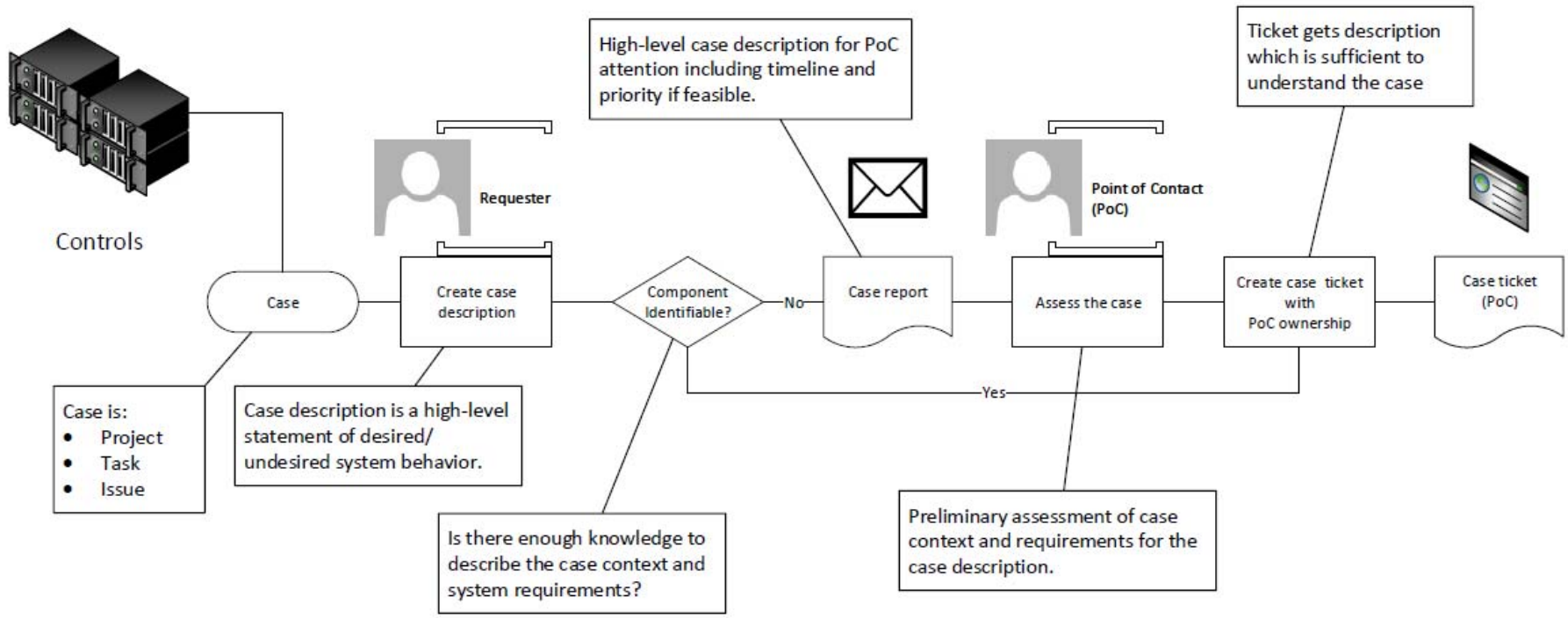
- Full Core process for problem resolution
- Cost estimate Details for IT
- ITD reporting “portal”
- Bluesky issue tracking
- Future Work – Insertion devices
- Data transfer rates for one beamline
- EPICS services

Full Core process
Backup Slides

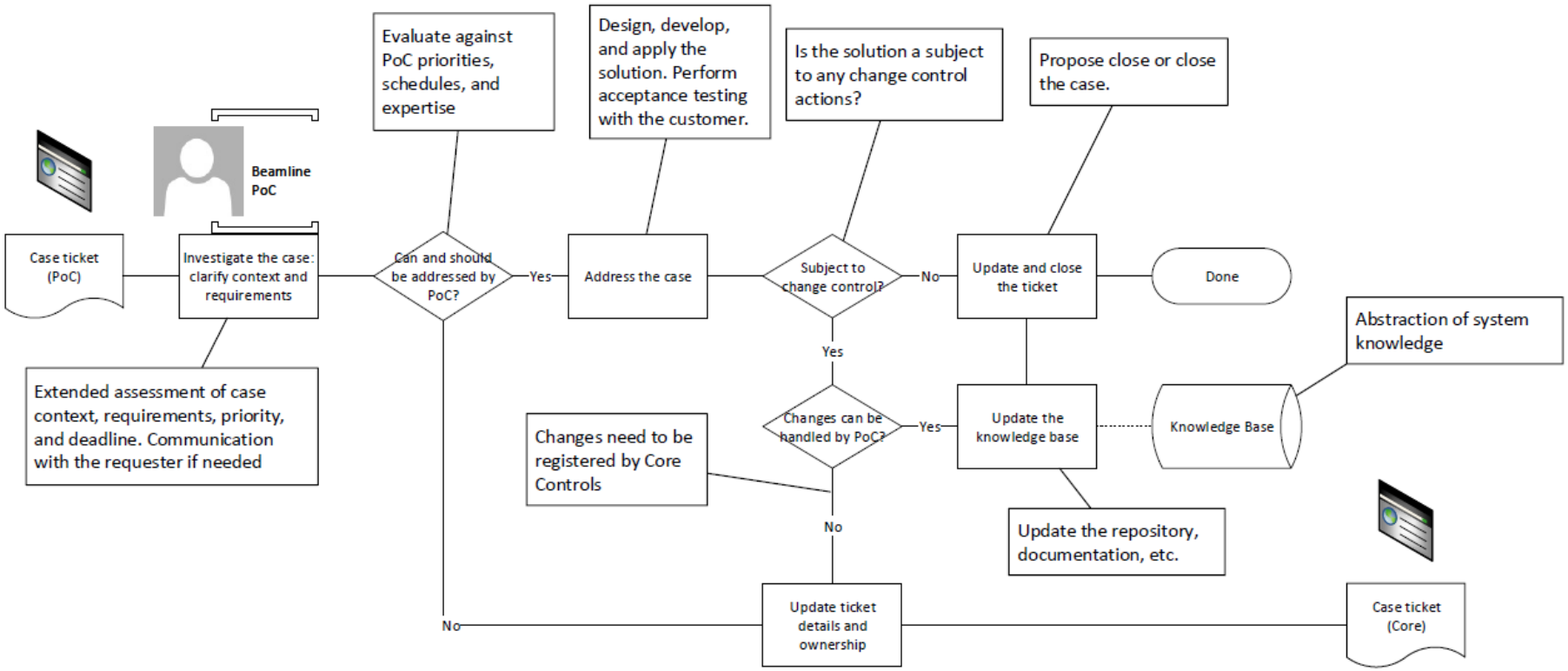
Core Controls Communications



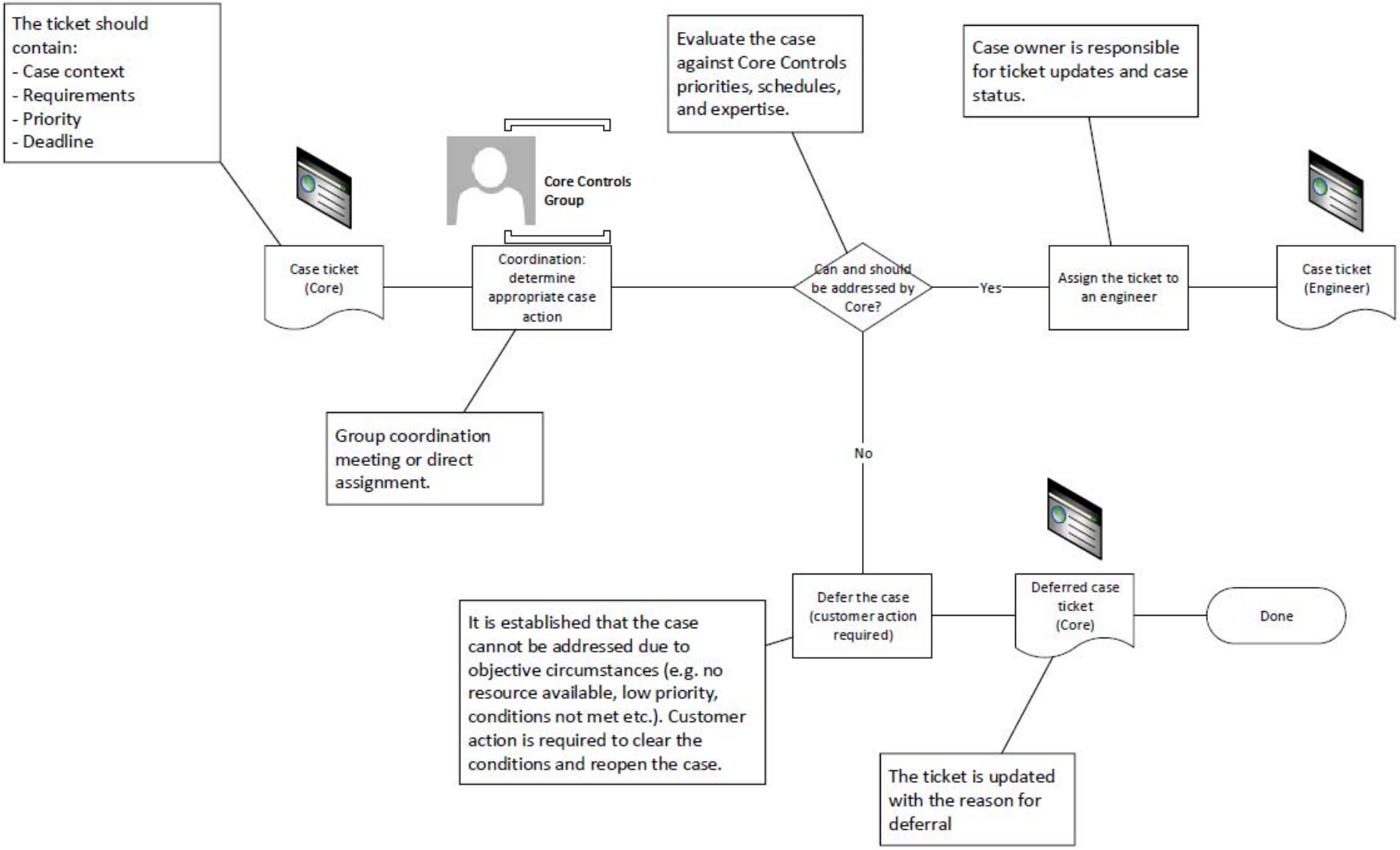
Requester to PoC



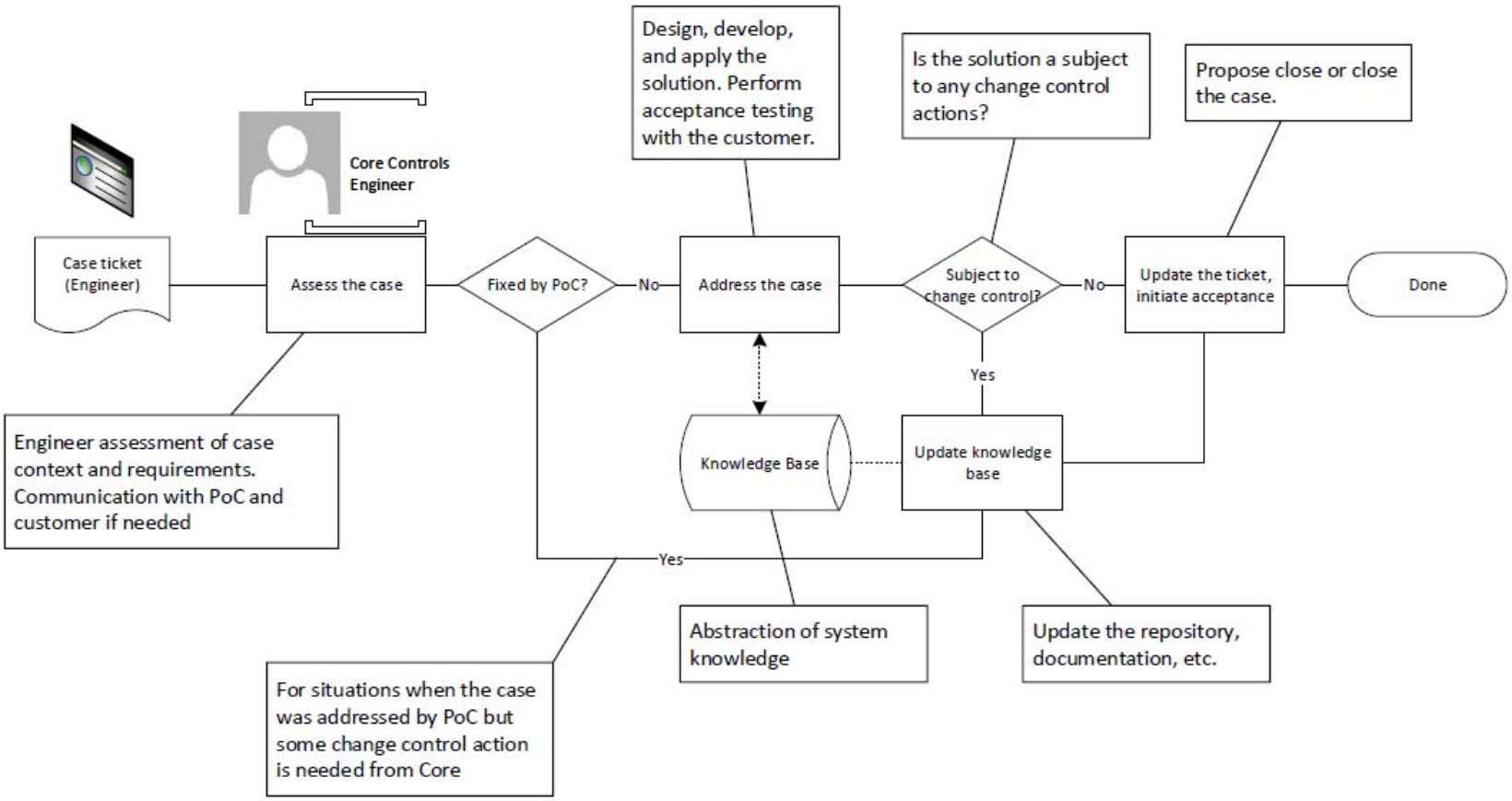
PoC to Core


Evaluate against PoC priorities, schedules, and expertise
Design, develop, and apply the solution. Perform acceptance testing with the customer.
Is the solution a subject to any change control actions?
Propose close or close the case.
Beamline PoC
Case ticket (PoC)
Investigate the case: clarify context and requirements
Can and should be addressed by PoC?
Yes
Address the case
Subject to change control?
No
Update and close the ticket
Done
Abstraction of system knowledge
Yes
Extended assessment of case context, requirements, priority, and deadline. Communication with the requester if needed
Changes need to be registered by Core Controls
Changes can be handled by PoC?
Yes
Update the knowledge base
Knowledge Base
No
Update the repository, documentation, etc.
No
Update ticket details and ownership
Case ticket (Core)

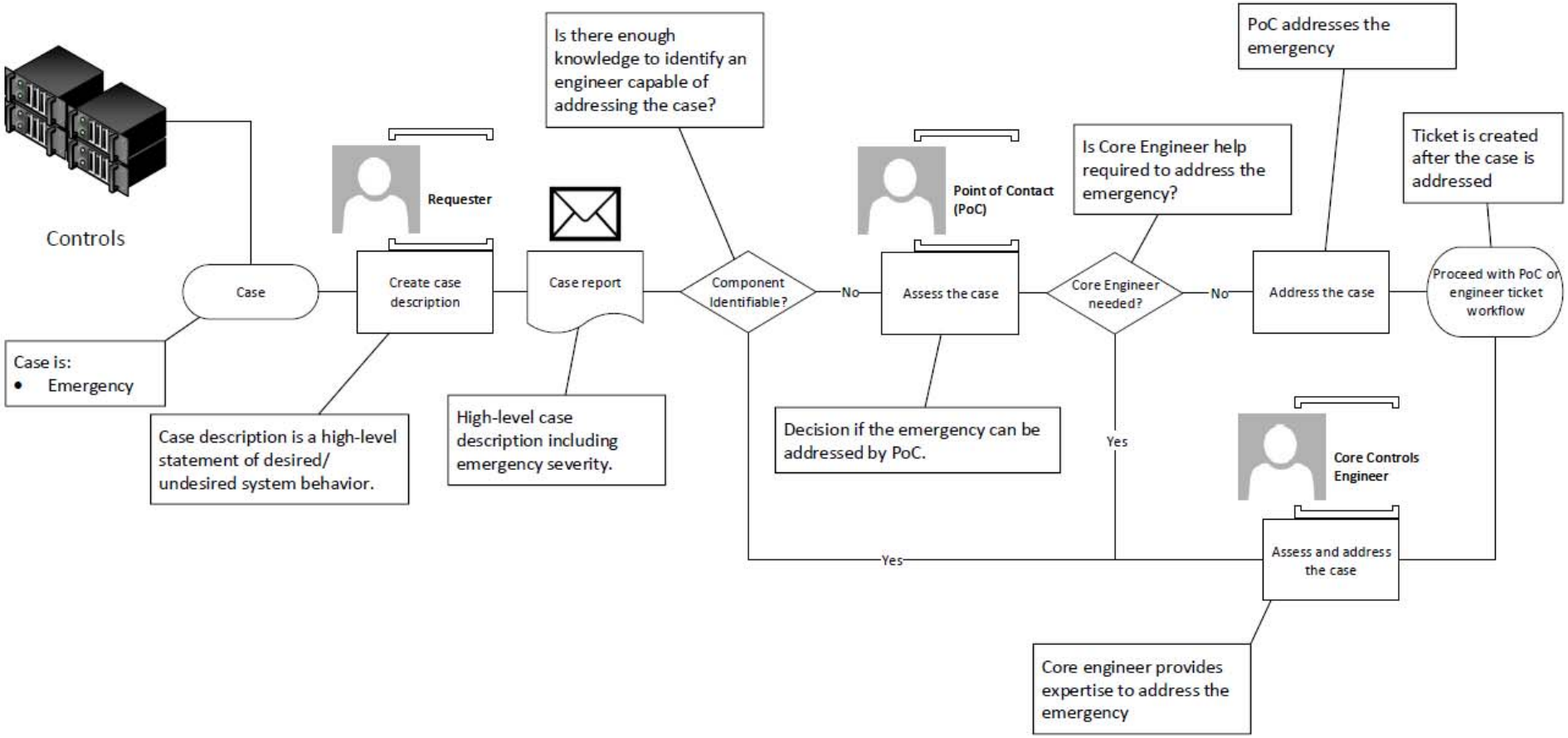
Core to Engineer



Engineer to Requester



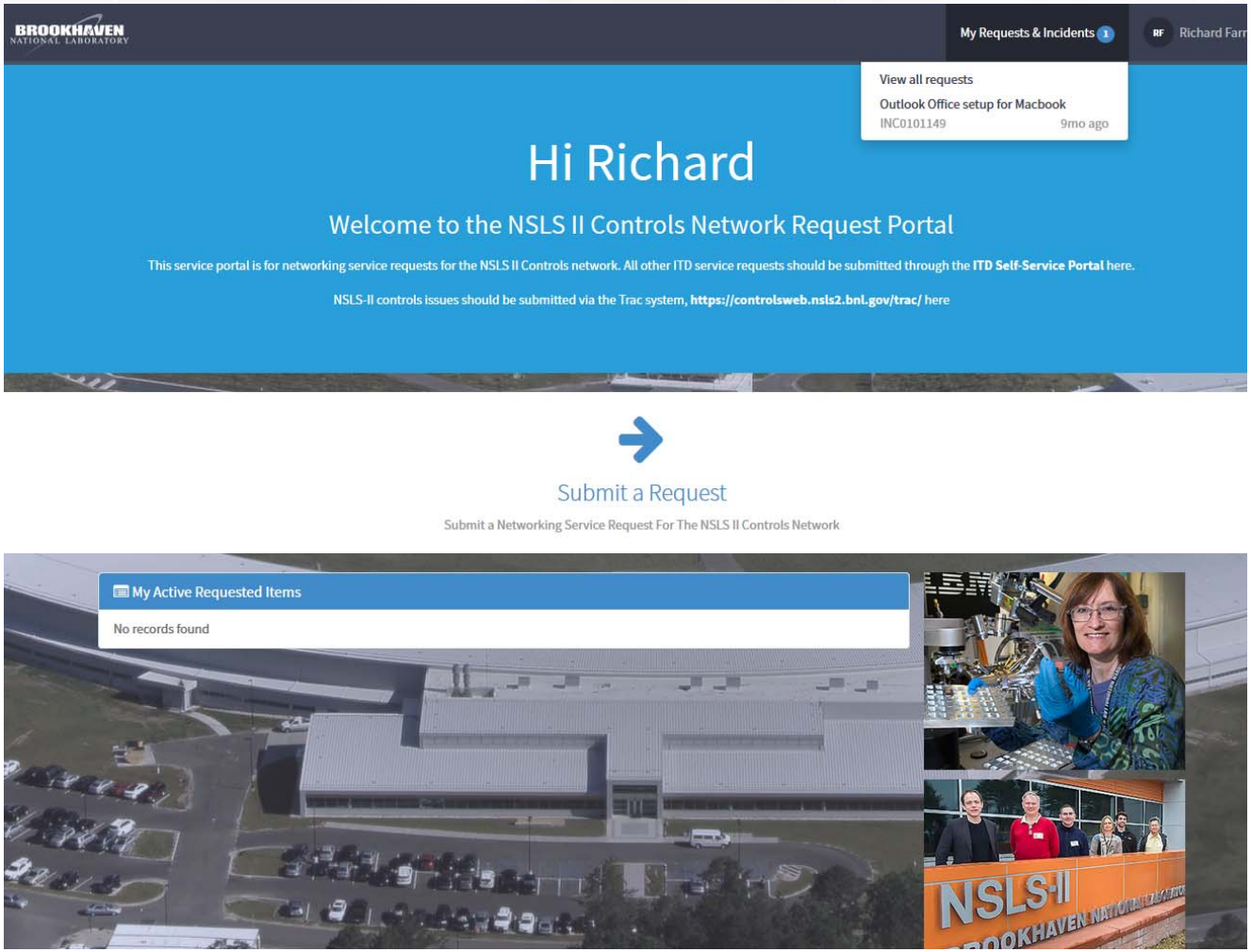
Emergency Handling



High Level Cost Projections
~ 0.75 million per year

High Level Plan	Effort	Hard Costs
Migrate management functions	Review and reconfigure 300+ switches	0
Structure Spanning-Tree	Identify appropriate intermediate roots and implement changes 300+ switches	0
POC End-State Architecture	Build and test POC	0
Gather requirements for Beamline areas	Determine current and future requirements	0
Gather requirements for Cell/Mezzanine areas	Determine current and future requirements	0
Gather requirements for Injector Service Buildings	Determine current and future requirements	0
Stabilize the Core	Order, configure and implement Arista Core	385,716
Standardize existing configurations	Review and reconfigure 300+ switches	0
Replace End-of-Life switches due in 2019	Order, configure and implement 110 switches	803,025
Upgrade remaining Beamlines to L3 routing, as well as, 10G uplinks.	Reconfigure Beamlime Aggregate switches	5,000
Install new front end for Accelerator network aggregation	Order, configure and implement 2 switches	51,170
Install new front end for Data Center services aggregation	Order, configure and implement 2 switches	160,840
Replace End-of-Life switches due in 2021	Order, configure and implement 24 switches	606,970
Replace End-of-Life switches due in 2022	Order, configure and implement 73 switches	798,417
Replace End-of-Life switches due in 2023	Order, configure and implement 56 switches	727,044
Replace End-of-Life switches due beyond 2023	Order, configure and implement 57 switches	1,220,209
Remove L2/L3 links to Beamlines and make L3 only	Reconfigure Beamline Aggregates for VxLAN	0
Total		4,758,391
2019 Budget		1,193,741
2020 Budget		212,010
2021 Budget		606,970
2022 Budget		798,417
2023 Budget		727,044
2024 Budget		1,220,209
Total		4,758,391

NSLSII Controls Network request portal



Bluesky Issue tracking

NSLS-II / bluesky

Watch 25 | Star 39 | Fork 36

Code | Issues 119 | Pull requests 20 | Projects 0 | Insights

is:issue is:open | Labels 16 | Milestones 3 | New issue

119 Open | 312 Closed | Author | Projects | Labels | Milestones | Assignee | Sort

- [CSX] Detector data appears saved but is not accessible — 1
  #1162 opened 7 days ago by cmazzoli
- [CSX] Error during BS script execution (fCCD related?) — 3
  #1159 opened 9 days ago by cmazzoli
- Exception trace from flyer example [bug] [documentation] [shiny] — 16
  #1157 opened 12 days ago by prjemian
- A general pattern for handling dark frames
  #1150 opened 16 days ago by danielballan
- Generalize list_scan and log_scan same as scan. — 1
  #1144 opened on Jan 28 by danielballan
- Unhelpfully verbose traceback when calling RE.abort()
  #1138 opened on Jan 9 by awalter-bnl
- Feature idea: subscribe_deferred
  #1137 opened on Jan 8 by danielballan
- Watch memory usage during a 500,000-point scan. — 5
  #1136 opened on Jan 7 by danielballan
- A slimmer interactive syntax — 1
  #1129 opened on Dec 17, 2018 by danielballan 1.6
- Is there a place we could call pyplot.ion() safely?
  #1126 opened on Dec 10, 2018 by danielballan 1.6
- check_limits does not work well with detector setting — 2
  #1119 opened on Nov 18, 2018 by ambarb 1.6
- check_limits does not work well with pyHKL object — 2
  #1118 opened on Nov 18, 2018 by ambarb 1.6
- Run interactive tests during test suite
  #1110 opened on Nov 5, 2018 by danielballan 1.6
- Simplify zmq--asyncio event loop integration — 1
  #1108 opened on Nov 1, 2018 by danielballan 1.6
- Requested updates to LiveGrid — 11
  #1095 opened on Sep 18, 2018 by awalter-bnl 1.6
- Log vs Linear Norms for LiveImage — 5
  #1093 opened on Sep 4, 2018 by CJ-Wright 1.6

Future Work – Insertion devices Diagnostics, limits, vibration

- Further develop the diagnostic code for Preventative Maintenance
  - Extend this to all ID's
- Establish reference scans for all devices
  - Torque performance
  - Rotary to linear hysteresis loop data
  - Following error characteristics
- Establish action limits for reference scans
- Develop advanced code using the U68 in building 832
- Begin initial code review of Kyma EPU's
  - First look-see shows gap and phase motors tuned almost exactly the same (not optimum)
  - The difference *does not address the phase girder magnetic forces (or flip) at all*
- Starting mono to ID link work
  - Expectation is to coordinate ID and Mono
    - Master/slave, simultaneous coordinated move, and two axis interpolated spline are possibilities
  - Actual software design still a work in progress
    - Two DT's have been linked together using fiber in tests in 832
  - Need to examine Mono motion control and accuracy
- Mono vibration cancellation motion algorithm
  - Three designs so far, proposal was not funded

What we have learned with IVU teamwork

How to work as a team and …

- How to control the gap to better than original requirements (as best as we can)
- We have software diagnostics for monitoring motion mechanics
  - We have identified excessive torque ripple
    - The first 2.8 meter motor examined revealed a 200 micron wobble at the motor
    - Use of a proper coupler is considered the best option here
  - We have identified excessive torque between identical motors on same girder
    - The first 1.5 meter motor examined revealed misalignment between worm and motor shafts
      - 200 microns vertical misalignment
      - Use of a proper coupler is one option
      - Shimming to correct alignment is another
  - We can correlate torque to following error
  - We can measure the compensation spring accuracy
  - We can monitor the spring engagement and it's impact on following errors

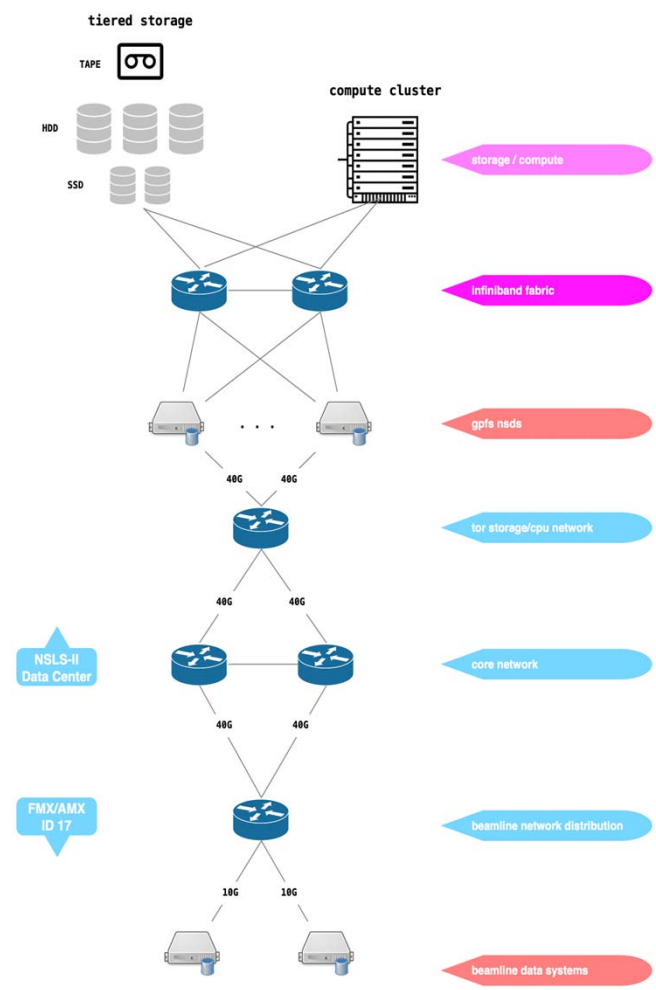
Future work in Backup slides

Beamline → Central Data Flow

Model for Beamlines, Data movement

- 2x 10Gb/s line-rate network bandwidth between beamlines → core infrastructure. Exceptions:

  2x 1Gb/s for a small number of beamlines with min bandwidth needs
  2x 40Gb/s for direct streaming from high-perf detectors (AMX/FMX)
- Beamlines have a local storage buffer for data ingestion and real-time processing/analysis
  - Local GPFS cluster and filesystem with redundant storage access
  - Fast client protocol access
- Beamline storage and compute systems share commonality but are not homogeneous (e.g., high, *bursty* data rates may require local SSDs)
- Data creation and longevity is based on filesystem policy. For example:
  - Files with extensions .cbf and .h5 get written to SSDs first and flushed to HDDs in 24 hours
  - Files >1 month are migrated off local to central storage
  - File paths always remain the same regardless of location
- Asynchronous data mirroring to central storage
  - Data can be transferred offsite from central via 40G data transfer nodes
  - Data transfer and backup without impacting local beamline I/O



Storage I/O – Beamline→Central Data Rates

Performance data follows

- General benchmarks performed during storage installation
- Difficult to run additional tests during operations as the systems are exercised 24x7
- Full suite of long-term benchmarks to be run during 4/2019 shutdown
  - Beamline→Central
  - Central→CSI
  - Central→Offsite
- From candidate beamline AMX (ID 17) to central storage we consistently measured:
  - ~15Gb/s @ 470 Op/s *write* – 10G files - SSD
  - ~9Gb/s @ 281 Ops/s *write* – 10G files - HDD
  - ~7Gb/s @ 226 Op/s *read sequential* – 10G files – SSD
  - ~2.5Gb/s @ 80 Op/s *read sequential*– 10G files – HDD
  - ~3.8Gb/s @ 240 Op/s read 8x random blks in 10G files – SSD
  - ~1Gb/s @ 28 Op/s read 8x random blks in 10G files – HDD
- Testing notes:
  - Multiple 1-10-50G files
  - 4M block sizes → smaller/larger block sizes = similar performance w/varying Op/s (GPFS utilizes sub-blocks)
  - Fsync on all tests

  (Stuart has a little more data)

EPICS services

Details

- Directory service

  A searchable store of the 100k's of epics pvs and their current state

  - Upgraded performance by 2 orders of magnitude by the use of elastic as the backend
- Alarm System
  - Kafka based alarm system capable of effectively processing thousand of epics alarm states to produce useful alarm events for user action
  - The alarm events are produced with guidance, recommended diagnostic steps, and automated actions
  - Alarm micro services ensure
- Elastic based Online Logbook

  Refactoring Olog to use elastic search

  - Natural language search
  - Fuzzy search
  - Horizontal scaling