

NSLS-II IT Group Review

1. Introduction

NSLS-II management has instituted an external review of NSLS-II IT. This covers the technical areas all aspects of IT support and operation, and took place on the 30th January 2018. The review was made up of presentations by, and discussion sessions with NSLS-II staff. The committee presents their views as findings, comments and recommendations in response to each of the charge questions, together with overall comments and recommendations. This report was written and edited by all committee members and committee members agree unanimously on the contents of this report.

The committee was impressed by the willingness of NSLS-II staff to engage in the process. The openness of the discussions enabled the committee to gain insight into the functioning of the IT Group and the achievement in delivering NSLS-II. The committee highly commends the IT Group for their commitment and the solutions and services they have provided to the NSLS-II Beamlines.

A number of the committee considered many of their concerns were similar to the “growing pains” other facilities have encountered, either when undergoing a transition from construction to operations or (at the APS) when bringing previously independent beamlines under facility management. The NSLS-II is a complex facility; transition to operations is not a trivial task.

In considering the recommendations of this report, the reader should take them in the context of the review. Any recommendation is based on the limited insight one can achieve within a short, approximately one-day review. In order to avoid any misunderstandings or over-interpretation of the recommendations, the committee is willing to provide clarification should they be needed.

2. Is IT appropriately staffed and managed?

The group appears to be understaffed for its current scope. There is room for improvement in group management, particularly in the areas of stakeholder management and work prioritization.

Comments:

The group has a wide range of responsibilities that span the whole facility

For their present scope, the group probably do not have the optimum number of staff

Comparison with other light sources is difficult, since scope and facility size are different. However, our quick analysis does indicate the group is smaller than others on a FTE/beamline or FTE/end station basis.

The adoption of a ticketing and tracking system is a very positive step and is commended. To give the ticketing system credibility requires regular review of outstanding items and communications with the “customer” as to the status of tasks. This may be simply a message to say, “we haven’t forgotten about you, we hope to be able to get to your issue in 3 days” for example. Open tickets should be reviewed regularly (say weekly) by a designated individual, either a group member, or preferably, a manager.

The reviewers feel the technical solutions selected by the group are, in the main, viable but not optimal. The overall architecture is reasonable. There is a sense that solutions adopted when there were a small number of beamlines have not scaled well with the increased number of beamlines now at the facility.

There is a big gap in the groups own perception of how they are performing and the perception of the stakeholders we talked to on beamlines, the accelerator and other Controls groups. This is clearly a problem. It appears that some basic needs of stakeholders are not being addressed.

There appears to be a gap in communications between the IT group and their stakeholders. There does not appear to be a systematic way for beamlines to present their requirements and to have a dialog with the IT group to find out what could be reasonably achieved and what cannot.

Stakeholders did not have a clear idea of the services available from the group or standards that applied. We were told that much documentation existed within the group. It would be beneficial to make this available to stakeholders.

An important part of the IT group leaders role should be communicating with stakeholders. This includes listening to their concerns, collecting their requirements, resource planning with senior management to determine if those needs can be met and communicating the results back to the stakeholders.

We heard a lot of technical detail. It seems this is where the group prefers to spend it’s time. We heard very little about process, despite some prompting. As NSLSII matures into an operational facility, quality support from IT will depend upon well managed process to provide repeatable, dependable support. Adopting selected practices from ITIL or other standards will be beneficial. Areas would include configuration management, incident response, change management, release management.

Recommendations:

Establish bi-directional communication with stakeholders. This should include things such as; regular status update meetings open to all interested staff, meeting with individual beamlines to listen to their issues and needs, satisfaction surveys when tickets are closed etc.

Establish and adhere to process for areas such as configuration management, incident response, change management, release management.

Make all documentation available to stakeholders so that they can help themselves, e.g. a catalog of what services the group provide, self-help how-tos, standards to be followed. Put it in the NSLS project standard location where it is easy for people to find.

Senior NSLS II management should consider options to add additional staff to the IT Group along with greater management structure to create time for more effective management of the group. Management effort needs to be spent devising an IT strategy, improving management of group activities and improving the groups interaction with stakeholders.

Senior NSLS II management should set clear objectives for the IT Group in terms of: technical scope and requirements; use of central BNL IT services and customer engagement.

3. Is there overlap in scope with BNL ITD?

There is some overlap in scope between NSLS IT and ITD. There are opportunities for NSLS to work with ITD and others (RACF and CSI) to utilize resources and knowledge.

Comments:

ITD's resources are limited. Proper planning and time for requests will be necessary. ITD can assist NSLS in the following areas.

- Account Management and Authentication
- Network architecture, implementation and management
- Network Wiring
- Linux server management
- Documentation management
- Incident management
- Change control

Account Management and Authentication

Users have expressed issues with needing multiple accounts to access NSLS II systems. ITD can provide solutions for account management and authentication using BNL Active Directory Domain as a single authentication source. ITD has completed a proof of concept for NSLS II authentication. We are arranging time with NSLS II IT staff to implement the POC on the NSLS II controls network. Network architecture, implementation and management

Users expressed issues with network performance and reliability. Network design decisions are made within the NSLS networking team. Input from users and ITD's Network Engineering staff could have provided options for a more stable network solution. Network equipment purchase and vendor selection was made within the NSLS networking team. The equipment purchased is not used anywhere else at BNL. After the purchase the vendor sold the network product line to another company. This has negatively impacted vendor support. Purchasing similar equipment from vendors already in use at BNL will provide NSLS IT with local resources and experience. NSLS staff

did not coordinate the private IP address space used for the controls network. This resulted in NSLS using address space already in use elsewhere on BNL's network making the controls network unrouteable on BNL's campus network. ITD did issue IP address space to NSLS that was never used. Recently, NSLS has been issued a new block of over 100,000 IP addresses to transition to.

ITD's Network Engineering staff support BNL's campus and perimeter networks. ITD manages 2 network engineers that are matrixed to support the RHIC and ATLAS Computing Facility and the Computational Science Initiative (CSI). Members of the ITD network staff possess many Cisco certifications including the prestigious networking certification in the industry, Cisco Certified Internetworking Expert (CCIE). ITD's Network Engineering staff has expert knowledge of Cisco, Arista, Palo Alto and Juniper network equipment. ITD's Network Engineering group is available to assist NSLS II with network architecture, implementation and hardware purchase decisions.

Network Wiring

Users commented on the time it takes for network wiring projects to be completed. NSLS IT management stated that they have one wiring technician and he is working 7 days a week. ITD has a staff of network wiring technicians. Requests can be submitted through the ITD Helpdesk to assist NSLS staff in cabling projects.

Linux server management

Stakeholders reported a lack of access and visibility with system monitoring. Staff is not being notified of simple system issues. ITD and NSLS use the same monitoring and system management tools (Splunk, Cacti, Nagios, Puppet, Ansible). ITD can provide assistance in implementing any of these tools.

Documentation management

Beamline and DAMA staff feel there is a lack of available documentation on IT policies and procedures. NSLS II IT staff manage internal documentation in a closed system (Evernote). ITD offers simple document management tools using SharePoint and Wiki's.

Incident management and Change control

NSLS has implemented their own ticketing system (Trac) for incident management. The system seems to fit their needs. Users did not have any issues using the system. Users did express issues with tickets taking long to be resolved or never receiving a status. NSLS should consider reviewing their incident management process and system. Incidents need to be categorized to better communicate user's expectations. ITD utilizes ServiceNow for incident, project and change management. NSLS should consider utilizing ServiceNow.

Recommendations:

NSLS IT staff should make use of the extensive IT knowledge at BNL. To leverage this institutional knowledge, BNL should established an IT working group consisting of technical staff from around the lab.

4. Is the group sufficiently collaborating and leveraging other Lab resources i.e.; CSI/SDCC?

No, it is clear the group is not working efficiently and exploiting other resources, both in the NSLS II organization and from BNL resources (ITD, CSI, SDCC).

Findings:

The use of CSI and SDCC is identified as a potential resource for staging experimental data storage. A network link exists but is not tested/used.

A single IT group supports the accelerator systems, the beamlines, and experiments for Network, servers, workstations, data storage, and backup. Group membership is 6 people, only two of which can configure the network, only one of which works with cables (fiber fitter).

The IT group interfaces with the DAMA group for experimental data processing.

IT group manages user accounts. (eliminate LDAP, use active directory)

IT group supports 3 generations of debian plus a few other systems.

IT group maintains storage and backup systems.

IT group monitors system performance and use.

IT group supports application deployment.

Comments:

A number of opportunities exist that need to be pursued and evaluated. It isn't clear the available resources have the time or expertise to evaluate these opportunities (use of CSI or SDCC for experimental data, as well as deployment system for analysis).

The financial model proposed for use of CSI resources needs to be negotiated at the level of upper management and made more favorable to NSLS II. If it is more cost effective to use cloud resources instead of CSI, BNL management needs to pursue how to bring the local cost down and made viable to NSLS II operations.

The IT administration burden is made inefficient by maintaining local user accounts. This burden can be reduced significantly by moving to a domain controller using BNL domain accounts (Single Sign on system).

The storage and backup systems could benefit from (NSLS II) external review. A more robust and efficient solution may be viable.

Methods to offload IT tasks to beamline scientists, DAMA group members, and controls engineers could reduce the workload burden of the IT group without significantly impacting those other groups workload.

Capturing policies and procedures into the NSLS II conduct of operations will make the IT group's methods of work transparent to other groups, NSLS II management, and DOE oversight. This will also help the IT group better define how they conduct work and where improvements can be made.

Recommendations:

The financial model proposed for use of CSI resources needs to be negotiated at the level of upper management and made more favorable to NSLS II. If it is more cost effective to use cloud resources instead of CSI, BNL management needs to pursue how to bring the local cost down and made viable to NSLS II operations.

Work with lab to create a lab IT steering group to guide the lab to meet program needs. Increase transparency with the rest of lab to operations of NSLS-II.

5. Staff Burnout & Retention Issue

Both are significant issues identified by multiple members of the team and management.

Findings:

Speakers consistently report insufficient staffing.

Current turnover rate is 10%. Goal is to get to 4-5%.

When asked what skills are most needed the committee heard a core Linux expert and a storage system expert. It was also expressed that more people were needed to support beamline operations.

Compensation and benefits are commensurate with industry and not seen as an issue towards retaining talent.

Some talent wishes to work on construction and not work in an operations environment.

Comments:

A concern is whether IT staff are being asked to fill functions that fall well beyond their expertise. This can lead to inefficiency as members attempt to develop high enough level of competence to solve the given problem. One comment from a beamline scientist was the local support for GPFS was insufficient. Is this due to lack of expertise in this product or a lack of resources to handle GPFS issues?

The IT group is utilizing many products that are each systems requiring a high level of system administration expertise (Nagios, puppet, virtualization) as well as supporting application deployment and support of products such as MongoDB.

In general, a turnover rate of 10% is not unusual for the Information Technology industry. Within the national lab system, it does seem high, and certainly makes building domain knowledge harder.

Recommendations:

The group is currently spread thinly and is trying valiantly to provide many different services. Examine which of these services the group must provide and which could be provided by different means. See the recommendations below for more detail.

6. Are there opportunities for improved efficiencies that we should consider?

Findings:

IT services for NSLS II are currently wholly operated within the NSLS II network domain. Hence there is duplication of some IT services with those that already exist for site-wide BNL. There can be good operational reasons for this but such justifications should be explicitly stated as part of the making the case for establishing and new NSLS II IT service that duplicates an existing service. Similar there may opportunities for harmonize some of IT services for NSLS II with those of site-wide BNL (both are considered elsewhere in this report).

Comments:

NSLS II is one of the brightest light sources in the world, and so is in a unique position to be a leading facility in photon science. Like all leading light sources, NSLS II will be confronted with an exponential growth of data with volumes. Detector readout, data pre-processing, transfer, storage, reduction, analysis, archival, together with the associated IT infrastructure will present significant challenges to realize the scientific productivity of the facility. Data management will become increasingly important as new experimental techniques and methods requiring new and innovative approaches to data acquisition, data reduction, data analysis and long term storage come online. Senior management at NSLSII should recognize the importance of investing in software and computing in the planning and development of the resource model. The importance of such

investment, to sustain the quality, capability and capacity of scientific output may need to be communicated to funding authorities.

The choice of hardware solutions in some instances could be reviewed. For example, the selection of Brocade switches has meant that opportunities for synergies with ITD have been lost. The facility could consider refreshing this with the BNL CISCO standard at end-of-life or earlier.

Recommendations:

Consider what services the facility *must* provide from internal resources and which of these *have to* be provided by the IT group. Look for opportunities to offload other work from the IT group.

Examples include;

- Database administration to be transferred to the DAMA group and ITD
- Enable stakeholders to help themselves and not have to rely on the IT group. This would include making documentation available to them
- Utilize other resources at the lab for specialized expertise and for staff augmentation for specific tasks
- Standardize on one version of Operating System (the committee heard that there were 3 versions of Debian being supported).
- It was not clear that there was any vendor support for Debian. Consider moving to an OS where vendor support is available, for example RHEL.

NSLS II Senior Management should recognize the importance of investing in software and computing to sustain the quality, capability and capacity of scientific output of the facility. This should be reflected in the planning and development of the resource model and the importance of such investment may need to be communicated to funding authorities.

NSLS Senior Management should develop and resource a data management plan of facility.

7. Is the scope regarding Networking, Computing Workstations and servers, Storage infrastructure (Data, GPFS?) sufficient?

Findings:

The scope in the statement is not sufficient for operations of the facility.

The scope for the IT group must include in addition to those services, monitoring, event notification, configuration management (of networks, servers, storage), version control of configuration, database administration, deployment planning and execution, procedure and process documentation, and effective communication with clients and ITD.

The IT group attempts to deliver on all the above mentioned scope. The IT group perceives that it delivers satisfactorily on this scope, although it feels stretched and would like an additional staff member, or to offload some of this scope to other groups e.g. database administration to DAMA.

The clients perceive that the group does not satisfy their expectations and have provided evidence e.g. poor NFS performance, poorly and unmanaged servers with old OS and library versions and poorly managed IP address space.

Comments:

There appear to be a significant, but yet to be quantified amount of effort to get the IT systems into full production. With some outstanding fundamental issues.

The decision of a supplier for network hardware that was not an ITD standard appears to have been a poor one, primarily because it limits the amount of support that ITD can provide. Future purchases should comply with ITD standards.

Staff are keen to use open source solutions where possible in order to reduce costs. This is laudable; however, it is important to consider the total cost of ownership of these solutions. Given the number of tasks facing a limited number of staff it may be useful to take more advantage of COTS software packages and the vendor support that is available to support them. It costs money, but can offer better service at lower overall price than hiring more staff. Open source is free to acquire, but can be expensive to support. Vendors of open source products often provide support contracts (e.g. Red Hat Enterprise Linux). Concentrate staff effort where they can make a unique contribution.

Recommendations:

It is recommended that the NSLS-II IT group *de-scope* by offloading selected services to other parts of Brookhaven National Laboratory. See previous recommendations for examples.

Consider that DAMA should be responsible for data management.

Work with ITD to deliver on critical unsolved issues e.g. IP address space management, NFS performance, GPFS tuning.

Take more advantage of COTS software packages and the vendor support that is available to support them.

8. Overall Assessment

A modern user facility depends upon having a solid IT infrastructure in place. The facility must be able to rely upon this as a foundation on which to build. It appears that some basic needs of stakeholders are not being addressed. We heard of problems in many areas including availability, performance, configuration management and communication. The committee has a sense that

solutions adopted when there were a small number of beamlines have not scaled well with the increased number of beamlines now at the facility.

There appears to be a gap in communications between the IT group and their stakeholders. Good communication between the group and their stakeholders is essential for success of the group and the facility. Improving communication can be hard and takes a lot of effort, particularly by management. It is important that the needs of key stakeholders, particularly beamlines, are heard and a two-way dialog created to ensure these are being addressed.

It is clear that the group is understaffed for the scope it is trying to achieve. Even if the group is expanded it is unlikely that it could realistically be expanded enough to cope with the current scope in the current funding climate. Therefore, consider what services the facility *must* provide from internal resources and which of these *have* to be provided by the IT group. Look for opportunities to offload non-core work from the IT group. These could range from transferring DBA responsibilities to DAMA to using more resources from the lab to making more use of external contractors. ITD should be utilized as a resource for staff augmentation and expertise. Alignment with ITD hardware standards will bring easier access to specialist expertise. Once it is decided what services the group must offer, staff the group appropriately.

It important that clear priorities are set for the group These should be communicated clearly to the group and to stakeholders. This will help stakeholders understand where their issues fall within the groups priorities and when (or if) they will be addressed. It may also help to improve morale among staff if they are able to focus on the top priorities and not be pulled in many directions.

Establish and adhere to process for areas such as configuration management, incident response, change management, release management. Use these processes as a basis for continual improvement. It may be useful to carry out a maturity assessment of the current state of IT at the facility. This could be used as a baseline to measure future maturity against (how far have we come) and would help in developing a strategic plan to improve IT service (where are we going). It would help to reveal areas that need to be addressed. There are many resources for such assessments available, from free material on-line to engaging external consultants.

Appendix A: IT Group Review Charge

Charge:

1. Is IT appropriately staffed and managed?
2. Does it service the technical needs of the accelerator?
3. Does it service the technical needs of the Beamlines?
4. Does it service the technical needs of the other controls groups?
5. Is there overlap in scope with BNL ITD.
6. Is the group sufficiently collaborating and leveraging other Lab resources i.e.; CSI/SDCC
7. Are there opportunities for improved efficiencies that we should consider?
8. Is the scope regarding Networking, Computing Workstations and servers, Storage infrastructure (Data, GPFS?) sufficient and well defined?

Appendix B: Review Committee

Kevin Brown – Relativistic Heavy Ion Collider, Brookhaven National Laboratory

Andrew Ferguson – ITD, Brookhaven National Laboratory

Daniel Flath – Linac Coherent Light Source, SLAC National Accelerator Laboratory

Nick Hauser – Australian Nuclear Science and Technology Organisation

Mark Heron – Diamond Light Source

John Maclean (Chair) – Advanced Photon source, Argonne National Laboratory