Fermilab

MEMORANDUM OF UNDERSTANDING

Between

The Fermilab Computing Division

and

The NOvA Construction Project

for

Support for Computing Systems Needed During the Construction Phase of the NOvA Experiment

March 16, 2011
Version 1.0

SIGNATURES

_____Date_____
Vicky White
Head of the Fermilab Computing Sector

_____Date_____
Rob Roser
Head of the Fermilab Scientific Computing Division

_____Date_____
Jon Bakken
Head of the Fermilab Core Computing Division

_____Date_____
John Cooper
NOvA Construction Project Head

_____Date_____
Rick Tesarek
NOvA Construction Project

CONTRIBUTING ORGANIZATIONS

The following organizational units are involved in support activities under this MOU as of the time the time of writing.

The Computing Division

> Electronic System Engineering (ESE), Running Experiments (REX), Data Movement and Storage (DMS), Fermilab Experiments Facilities (FEF), Network and Virtual Services (NVS), Enterprise Services Operations (ESO), Central Information Systems (CIS), Database Services & Enterprise Apps Foundations (DSG).
>
> Contact:
> Lee Lueking, Computing Division Liaison to Neutrino Program

The NOvA Experiment

> NOvA Construction organization (Needs review)
>
> Contacts:
> Rick Tesarek, Fermilab PPD, NOvA Deputy Project Manager
> Jon Paley, Argonne National Laboratory, NOvA Database coordinator
> Andrew Norman, Fermilab CD, NOvA DAQ expert and Online representative
> Patrick Lukens, Fermilab PPD, NOvA L2 Construction Manager
> (?), University of Minnisota, UMinn Module Factory Manager
> Peter Shanahan, Fermilab PPD, NOvA Online representative
> Leon Mualem, California Institute of Technology, NOvA Online representative
> David Saranen, University of Minnisota, Network Liaison

PREAMBLE

This is a memorandum of understanding between the Fermilab Computing Sector (CS) and The NOvA Experiment Construction Project (NOvA). The memorandum is intended to clarify the roles and responsibilities of the two parties in supporting the computing resources needed in the construction of the NOvA experiment based upon requirements agreed to at the time of writing. The MOU will be reviewed and amended in May of each year as requirements change.

The MOU will be valid from the date of signing until the end of the construction period. During this period both the NOvA Near and Far Detectors will be built and commissioned. This period for NOvA is anticipated to begin in April of 2012 and extend through the completion of the project in spring 2014. Upon completion of the construction phase, relevant areas from this document will be added to the general NOvA MOU for the long term operation of the

experiment.

INTRODUCTION

This MOU describes the responsibilities of CS and NOvA personnel in operating the components needed during the construction phase of the experiment. These include the Data Acquisition (DAQ) systems, online computing systems in the NOvA control rooms, database systems, and all networking required to utilize these components. The details of the construction and the requirements for these various systems are documented in the NOvA TDR [1]. Here we summarize the major points to provide a context for the set of services that require operational support.

Blah, blah, blah… overview of construction. (Rick will fill in w/ a couple of Paragraphs)

SERVICES AND ACTIVITIES

In this section, we outline the services and activities required to support the deployment and operation of computing needed for the construction phase of the experiment. We describe the responsibilities assigned to the Computing Sector, the NOvA Experiment, or shared between the two parties. Unless otherwise specified, CS support is assumed to be provided on an 8x5 basis. Major support activities will be coordinated with the project so as not to adversely affect construction, commissioning and ultimate data taking. Similarly, the experiment will advise and consult with CS when activities by the experiment might result in special usage patterns or impose unusually large loads on computing systems.

1. Control Room Computers

The NOvA Far Detector control room (CR) is located at the experiment facility at Ash River MN, and the Near Detector CR is co-located with the MINOS and MINERvA control rooms at Fermilab in Wilson Hall. The control room hosts computing (servers, desktops, and gateways used for private network access) and networking equipment required for the construction testing of the detector and communicating with computing facilities at Fermilab. The computer security details are provided in the Minor Application Plan [2].

In the FD Control Room there are 5 Dell workstations with quad display heads, and monitors. All of this hardware is under maintenance contract with Dell, and any hardware requiring repair will be shipped to Fermilab for warranty maintenance. FEF server support will include installing the operating system, monitoring with Ganglia, and system administration.

1.1. CS responsibilities

1.1.1. Provide system administration services for control room computers

1.1.2. Install services for third party software at the operating system level needed for control room operations. (No support for third party software is implied. Moreover, third party software that requires root installation or privilege is highly discouraged and must be approved by system administrators on a case-by-case basis.)

1.1.3. Ensure that there exists a robust recovery plan for machines critical to detector construction, or that there is sufficient redundancy to survive the loss of such machines.

1.1.4. CS will provide a level of service sufficient to allow 24x7 operation of the control room. [Terms of support for critical machines should be spelled out in detail here (i.e., the options for enhanced support). Note that no one in CD provides 24x7 for other experiments]

1.1.5. Provide appropriate packaging of CS-supported physics toolkits and utilities needed for construction operations.

1.2. NOvA responsibilities

1.2.1. Document the requirements for control room computers, including the need for any third party software at the operating system level, and the identity of any machines that are critical to data taking that might require enhanced levels of support.

1.2.2. Support of all online application software.

1.2.3. Install all Fermilab supported physics toolkits and utilities needed for online operations. This software should be managed alongside other experiment-specific software that will be the responsibility of the experiment.

1.2.4. Provide schedules for deploying security patches to all systems that are consistent with Lab security policies and the NOvA Minor Application Plan.

1.2.5. Provide an expert from the experiment who can assist system administrators if needed.

1.3. Joint responsibilities

1.3.1. NOvA computing and CS system administrators will work together to determine the operating system configuration required to meet the needs of control room computers, and review any third party software installed by system administrators.

1.3.2. Document suitable support models for machines critical to data taking for which an enhanced level of support is needed.

2. DAQ Systems: Hardware

The Far Detector DAQ computing hardware is composed of Dual 8-core servers from KOI Computing that will grow in number from the current 75 to 200 by early 2013. Some of these are disk servers with 16 disk RAID arrays. The systems and software included in the DAQ are described in the documents listed in [3].

2.1.CD responsibilities

2.1.1. Installation of the Scientific Linux Operating Systems.
2.1.2. Establish and maintain the monitoring for these systems using Ganglia.
2.1.3. Ongoing system administration, patches and kernel upgrades.
2.1.4. All such services will be provided on an 8x5 basis unless otherwise coordinated.

2.2.NOvA responsibilities
2.2.1. Follow best practices for application installation and maintenance on the systems.
2.2.2. Assume responsibility for problems that may occur outside of Fermilab business hours.

2.3.Joint responsibilities
2.3.1. Coordinate how various problems or emergencies that occur outside Fermilab working hours will be diagnosed and resolved.

3. DAQ systems: Software

The software included in the DAQ are described in the documents listed in [3].

3.1.CD responsibilities
3.1.1. CD support for DAQ software is limited to that required for standard operations. Consulting services for major changes or upgrades can be provided upon request by NOvA and agreement with the relevant CS/CD Departments.
3.1.2. Support for the following CS-developed DAQ/online software:
3.1.2.1. Message Logging System (MLS) API;
3.1.2.2. Responsive Messaging System (RMS) API;
3.1.2.3. Data handling and buffering libraries for the Event Builder and Data Buffers software;
3.1.3. Support for the CD-developed API to the Message Logging System (MLS);
3.1.4. Support for the CD-developed API to the Responsive Messaging System (RMS).

3.2.NOvA responsibilities
3.2.1. Provide on-call DAQ experts to provide 24/7 response to problems.
3.2.2. Contact CS personnel during business hours to request fixes or feature enhancements.
3.2.3. Comply with security requirements outlined in the NOvA Minor Application Plan
3.2.4. DAQ code and the data taking control code used by detector operators are NOvA's responsibility.

3.3.Joint responsibilities
3.3.1. (None identified)

4. Networking

The networking for the Far Detector facility located near Ash River MN is critical to the construction project. These components include:

1. The networking infrastructure needed to operate the DAQ.
2. The infrastructure and configurations that enable the Fermilab fgz network connections to be available at the detector hall.
3. The Wireless Access Points located throughout the detector hall.
4. The Wde Area Network between Ash River and Fermilab, through the University of Minnesota.
5. Networking components at Fermilab.

The configuration and support service level for this network is expected to be similar to that of the MINOS far detector facility in Soudan. Interruptions in connectivity between the Far Detector and Fermilab must be restored in a reasonable time frame subsequent to problem detection. It is understood that the network between Farmilab and the FD is provided by a third party supplier contracted through the University of Minnesota. Interruptions in this service are not the responsibility of the Fermilab Networking Department.

4.1. CS responsibilities

1.1.1. Install, configure and maintain all networking equipment located at the Ash River facility, and at Fermilab required to meet the operational needs of the NOvA construction.

1.1.2. Work with the WAN network provider to ensure a reliable network, and recover from any unforeseen outages.

4.2.NOvA responsibilities

4.2.1. Determine the network throughput requirements between the various networking endpoints.

4.3.Joint responsibilities

4.3.1. (None identified)

5. PREP electronics

(this section needs to be redone) (Rick suggests that we can simply add together the spare and other module counts.)

The experiment will utilize a broad array of electronics in the development, commissioning, and operation of the DAQ system. The equipment required includes standard test and laboratory equipment (e.g., oscilloscopes, voltage meters, current load boxes, NIM crates and associated modules), basic data acquisition systems needed to interface with other laboratory systems (e.g., CAMAC crates and modules needed to receive and process signals from the accelerator facilities), and NOvA-specific hardware procured from outside vendors or built in-house. Some details of these special cases are described below.

5.1.CS responsibilities

5.1.1. Low Voltage Power supplies: The supplies to be procured will be Wiener Plein and Baus Ltd. Model number PL506 in a configuration specifically tailored to the NovA experiment. Each contains three supply pods with a variable range of 2-7 V, and three supply pods with a variable range of 12-30 V, or in an alternate configuration with two 2-7 V pods and four 12-30 V pods in a master/slave configuration.

5.1.1.1. The Near Detector requires 4 operational supplies plus 3 spares. The spares may be used by Prep for testing. The Far Detector will employ 66 operational supplies and have 4 spares.

5.1.1.2. CD personnel will receive training and diagnostic, repair and maintenance documentation from the manufacturer.

5.1.2. High Voltage Power supplies: For the near detector the number of supplies that will be procured is 3, where 2 of them are denoted as spares. The NOvA experiment will use floating high voltage power supplies from WIENER Plein and Baus Ltd. The supplies that will be procured and used will be model designation MPOD HV-EX with high voltage card designations ISEG EHS/EDS. The Near and Far Detectors will each use 1 supply and have 2 spares.

5.1.3. The manufacture has agreed to provide training and information regarding the diagnosis, repair and maintenance of these devices to the FNAL computing division's technical staff and the personnel involved with the PREP equipment pool. The contract with Plein stipulates the support and training for PREP personnel.

5.1.4. Data Concentrator Modules: The DCM was designed by the CD for use in the primary DAQ/readout chain for NOvA. CD will provide maintenance for these modules during the construction phase. For the Near Detector there will be 12 modules and 4 spares. For the Far Detector there will be 180 modules and 20 spares.

5.1.5. Timing systems: NOvA uses two timing devices, the Master Timing Unit (MTU) and the Timing Distribution Unit (TDU), to provide synchronization of the front end boards. Both the MTU and TDU were designed by CD for use in the NOvA DAQ/readout chain. CD will provide maintenance for the boards during the data taking phase of the NDoS. For the Near Detector there will be 2 masters and 4 slaves. For the Far Detector there will be 2 masters and 15 slave units.

5.1.6. Provide and maintain standard test and laboratory equipment as agreed upon with the experiment.

5.1.7. Faulty equipment shipped to Fermilab will be repaired and returned in a timely manner.

5.2. NOvA responsibilities

5.2.1. Provide timely specification of standard test and laboratory equipment needed.

5.2.2. Perform any testing needed to ensure that equipment meets the needs of the experiment.

5.2.3. If any Ash River component is determined faulty it will be shipped in a timely fashion to Fermilab for repair.

5.3. Joint responsibilities

5.3.1. (None identified)

6. Database: Construction

The major databases application required for the construction phase is the construction and hardware database. Use cases and requirements for this part of the operation can be found in [4].

Currently there is a single server in place which is critical for construction of the detector. This machine is used to store the parameters needed for the construction, and to input information at the time of the assembly at Ash River. There is information in the database regarding the modules and their serial numbers. A laser scan is performed at the time of construction that records a surface map also stored in the database.

Access to this information must be available 5 days a week, 20 hours a day during the construction crew shifts. Specifically, starting April 1, 2012 there will be one shift M-F. In the Summer of 2012 this will increase to two shifts on M,T,W,Th, and one shift on Friday.

(NB: The specific details to ensure this level of availability STILL NEED TO BE WORKED OUT. We have discussed a database server be installed at the Far Detectors site, in addition to the database resources located at Fermilab. However, this has many complexities that may be untenable.)

Maintaining database services entails support across several layers: database server hardware, database software service, and web application interface. Ensuring robust services requires coordinated planning by all stakeholders across all layers. In the following summary of responsibilities, support for a database application by an organization implies support at all three levels unless specified otherwise.

6.1. CD responsibilities

6.1.1. Install and maintain databases and database servers needed to store and utilize the following mission critical data:
6.1.1.1. Data relating to the construction of the NOvA detector
6.1.2. Support the schema for the NOvA Hardware Database, a web-based GUI to access the Hardware Database, and a set of import/export tools for data in the Hardware Database.
6.1.3. Install and maintain an instance of the Control Room Logbook as needed by the experiment.

6.2. NOvA responsibilities
6.2.1. Enter the content of all databases;
6.2.2. Interfacing NOvA software with the database applications;
6.2.3. Monitoring that all database applications meet the operational needs of the experiment
6.2.4. Ensuring that users are informed as to appropriate usage patterns, and otherwise assisting CD personnel in investigating and addressing operational issues.
6.2.5. For cases in which there is no existing schema or database application, specify and document the requirements, the use cases and queries needed, etc., as requested by the CD.
6.2.6. Provide time windows during which regular database maintenance may be performed and security patches applied in a manner consistent with Fermilab security policies and the NOvA Minor Application Plan.

6.3. Joint responsibilities
6.3.1. Developing and approving the specifications for the database applications and schemas.
6.3.2. Participate in annual "Taking Stock" meetings to long-term operational issues and resource planning. CD will coordinate these meetings.

7. Database: DAQ

CS provides tiered levels of support for database services ranging from 24x7 to 8x5 best effort, the choice depending upon the application and the type of underlying database. It is assumed that each production database instance supported by CS will be accompanied by integration and development instances, both of which receive the lowest available tier of support.

7.1. CS responsibilities
7.1.1. Install and maintain databases and database servers needed to store and utilize the following mission critical data:
7.1.1.1. Data relating to the construction of the NOvA detector;
7.1.1.2. Electronics configuration data;
7.1.1.3. "Conditions" data, such as beam parameters, detector calibrations, detector alignment, etc. According to current estimates, the size of this

database is expected to be 10's of GByte per year, possibly reaching 100 GB by the end of the experiment.

7.1.2. Support the schema for the NOvA Hardware Database, a web-based GUI to access the Hardware Database, and a set of import/export tools for data in the Hardware Database.

7.1.3. Install and maintain an instance of the Control Room Logbook as needed by the experiment.

7.2.NOvA responsibilities

7.2.1. Enter the content of all databases;

7.2.2. Interfacing NOvA software with the database applications;

7.2.3. Monitoring that all database applications meet the operational needs of the experiment

7.2.4. Ensuring that users are informed as to appropriate usage patterns, and otherwise assisting CD personnel in investigating and addressing operational issues.

7.2.5. For cases in which there is no existing schema or database application, specify and document the requirements, the use cases and queries needed, etc., as requested by the CD.

7.2.6. Provide time windows during which regular database maintenance may be performed and security patches applied in a manner consistent with Fermilab security policies and the NOvA Minor Application Plan.

7.3.Joint responsibilities

7.3.1. Developing and approving the specifications for the database applications and schemas.

7.3.2. Participate in annual “Taking Stock” meetings to long-term operational issues and resource planning. CD will coordinate these meetings.

8. Miscellaneous

8.1.CD responsibilities

8.1.1. Support an instance of DocDB for use by NOvA;

8.1.2. Provide off-hours and emergency paging support from the Service Desk for selected critical systems.

8.1.3. Provide an issue tracking system for NOvA construction computing issues.

8.2.NOvA responsibilities

8.2.1. Work with CD service providers and the Service Desk to arrive at a specification for the off-hour and emergency response needed from the Service Desk for critical systems.

8.2.2. Maintain contact information to CS personnel so critical maintenance and down times can be reviewed and announced.

8.3.Joint responsibilities

8.3.1. Configure and administer the NOvA issue tracking system.

Glossary

References

[1] “Technical Design Report for CD-2/3a,” NOVA Document 2678-v8, October 8, 2007.

[2] NOvA Minor Application Plan (in progress), NOvA DocDB #4250.

[3] The following NovA documents describe the DAQ system requirements: DAQ Monitor (#3769), Data Concentrator Module (Software) (#3664), Data Logger (#3683), Data Quality Monitoring (#3799), Dispatcher (#3944), Event Builder (#1168), File Transfer System (#3786), Global Trigger (#2631), Spill Server (#4529), Message Logging System (#2332), Message Passing System (#1210), Resource Manager (#3678), Run Control (#1877). These documents are in the NOVA-DocDB.

[4] NOvA Construction Database Use Cases and Requirements.