

The Long-Baseline Neutrino Experiment

LBNE Software and Computing Requirements – initial notes

Maxim Potekhin

LBNE S&C Co-coordinator

Brookhaven National Laboratory

LBNE/BNL weekly meeting

April 30th 2014

Overview

- The presentation of the Requirements in the DOE review is allotted 20+5 min
- There is also a separate presentation on the status of S&C, 15+5 min
- The Requirements are needed as a step towards the Computing Model, which will be the normative source to support our decision making regarding S&C technologies and policies
- In the course of the last year and a half we discovered that the need for such normative source is far from theoretical and it's necessary for us to move towards progressive and scalable infrastructure – otherwise the inertia is hard to overcome
- DAQ/Online Requirements are not included at this point
- This set of slides is the initial framework which will be improved upon, the deadline for the draft is this Friday May 2nd 2014 – right now it's mostly a copy of relevant lists and sections of the document itself.
- DocDB 8035 has been updated today. This is not the part of the official submission to the DOE, how to reference that new version will need to be decided.

Purpose, origin and scope of the S&C Requirements

These Requirements are developed based on “Physics Tools and Software and Computing Organization of the Long Baseline Neutrino Experiment: the goals, the structure and the plan”, FNAL DocDB 7818. They serve as a step towards the LBNE Computing Model. Upon acceptance by the Collaboration, the Computing Model will be considered a normative basis for policies to be implemented by the LBNE S&C Organization, in order to evolve the LBNE computing platform in the direction optimal for achieving the scientific goals of the experiment.

The Computing Model and documents pertaining to its implementation will also serve as instruments to inform the funding agencies about the scope of work and rate of progress of the LBNE Software and Computing Organization.

An effort was made to maintain a relatively high-level view of the S&C issues, and to not go into smaller details which are more likely to change as the project moves forward, while still providing adequate basis for making informed decisions. In cases where it was impossible to establish concrete metrics or parameters for a specific requirement, it is still listed as an item the S&C Organization will need to address in the future.

The Requirements for the Online/DAQ work area are not included in this document and will be created separately. At the same time, we define principles used in establishing interface with the DAQ group and procedures for handling data produced by systems under its management.

Categories covered in the S&C Requirements

- Software and Computing Organization of LBNE
- Data
- Databases
- Software
- Distributed Computing
- Geometry
- Visualization
- Networks
- Collaborative Tools
- Cybersecurity

Software and Computing Organization of LBNE

As LBNE S&C is evolving, there will be a recurring need to make technology and policy choices to fulfill the Requirements.

- A Software and Computing [Technical Advisory Committee](#) (TAC) shall be formed (appointed by the spokespeople). As its name suggests, its role is advisory and not normative.
- Interfaces with software and computing elements managed by the LBNE Project shall be considered in the Committee recommendations.
- The TAC shall advise the LBNE collaboration spokespeople on technical matters regarding collaboration software and computing, and proactively identify, examine and select technologies pertinent to LBNE software and computing.
- Recommendations and decisions by the TAC shall be reached through consensus formed by discussions within the S&C and in consultations with the TAC.
- In instances when consensus cannot be reached, the TAC shall provide its opinion to LBNE spokespeople, who will then make decisions based on the information provided to them.
- The [Operations group](#) shall have a mandate to support ongoing LBNE data processing, including but not limited to data management system, database performance and availability, status and performance of LBNE Grid sites etc.

Data Requirements

- Replication
- Retention
- Long-term preservation
- Rules of access
- Distribution
- File Catalog
- Metadata
- Data design and formats

Databases

- Master Database as the only definitive source of data (i.e. no information will be written to replicas externally), in order to insure data integrity
- Backup and restoration procedures to prevent data loss
- Performance and scalability
- Technology choices
- Access methods

Software

- Architecture and Architectural Compliance
- External Software
- Supported Platforms and Versions
- Documentation
- General Code Management
- Validation, Unit Testing and Continuous Integration
- Distribution and Configuration

Distributed Computing

- Grid and Cloud Computing Capabilities
- Workload Management System
- Technology trends in Distributed Computing

Geometry

- **Definition** – Geometry description: a collection of information sufficient for creation of the geometry model of the detector, for the purposes of either simulation, reconstruction or both.
- **Definition** – Geometry model: a collection of data structures plus the code to manipulate these structures, which together provide the functionality required by the application (simulation etc, cf. the geometry model in Geant4).
- LBNE S&C Organization shall develop a geometry data management system from which specific applications may derive their geometry information.
- The Geometry Description formats and interfaces shall be chosen in a way that is not restricted to a single software package or toolkit when building the Geometry Model.
- Provision shall be made to accommodate non-ideal, “distorted” or “perturbed” versions of geometry description, containing the realistic alignment parameters (e.g. as determined by a survey in situ).
- The geometry data management system shall support reliable storage and revision control of any set of geometry information.

Visualization

- Applications and supporting tools to visualize the LBNE geometry and event data shall be provided by the S&C Organization.
- A visualization toolkit available to LBNE shall be created.
- The visualization toolkit shall cover a range of functionalities, including interactive event displays, and capability to produce publication-grade graphics.
- Specific needs of simulation work shall be accommodated, such as displaying “Monte Carlo truth” information.
- The visualization toolkit shall cover the needs of expert users (such as during event scanning studies) as well as general needs of the collaborators who do not necessarily possess significant programming expertise.

Networks

- A R&D effort shall be undertaken to design and create the necessary infrastructure, including software and requisite systems integration, for the “Beam on Target” signal.
- Research to establish performance parameters for the primary data network connection between the Far Detector and LBNE data storage centers (e.g. FNAL) shall be conducted by the S&C Organization.
- A network monitoring system shall be put in place to continuously gauge the bandwidth, availability and other vital parameters of network connections established among participating LBNE sites.
- Network metrics shall be collected and stored in a database for analysis, and used for debugging and optimizing data distribution algorithms and policies.
- The network monitoring system and its associated databases shall be equipped with appropriate interfaces to make the monitoring and performance data available to LBNE data distribution and Workload Management systems.

Collaborative Tools

- A single issue tracking system will be put in place to cover all aspects of work in the S&C Organization.
- The specific type of issue tracking system shall be determined by S&C and its TAC on a time scale of a few months.
- The system used for issue tracking shall have a network interface such that it can be used in non-interactive and automated applications and integration projects (e.g. RESTful interface).
- A CMS shall be evaluated by the S&C Organization.
- Legacy systems will continue to be used for immediate needs of the Collaboration.
- The CMS shall have to include authentication/authorization and granular access control functionality, revision control and formatting tools. No new CMS shall be developed in-house.
- Teleconferencing tools shall be chosen to provide reliable connectivity for at least 100 concurrent callers, and a functional set of common conference management tools (e.g. ability to mute users, manage the duration of the conference etc).
- A document management system shall be used for LBNE S&C documentation.
- The document management system shall include authorship management, revision control capability and review/approval functionality.
- A meeting/conference scheduling and organization tool shall be identified based on preferences of the Collaboration, functionality and ease of use.
- Information systems and their Web interfaces shall be based on existing and proven technologies e.g. web frameworks, as opposed to creating in-house solutions for DB access and Web UI.

Cybersecurity

- LBNE S&C shall establish close cooperation with Cybersecurity personnel at participating sites.
- Participating sites shall be required to report all LBNE security related incidents to S&C on a monthly basis or more frequently in a crisis situation.
- All rules and policies set forth by DOE and other authoritative sources shall be implemented.
- Protocols shall be established to stop and mitigate attacks.
- The LBNE S&C Organization shall periodically review the configuration and security features of its member sites.
- Creation and use of “production accounts”, i.e. user identities associated with automated services, agents and other such type of computer processes, shall be kept to absolute minimum, reviewed on case-by-case basis and subject to strict information protection.
- A blacklisting capability in the LBNE Workload Management System shall be created which will make it possible to block compromised or abused accounts on short notice.
- Blacklisting capability in additional LBNE Oine Software systems shall be determined necessary by the LBNE S&C Organization.