DUNE Component/QC/Installation (Hardware) Database Requirements

Overview

The DUNE will utilize a near and far detector. The far detector (FD) will comprise four 10 kt (fiducial) LAr TPC modules, while a multi-component system will make up the near detector. Both detectors will contain many thousands of individual components that will need to be carefully tracked throughout their lifetime, from procurement, through quality assurance testing, and to their eventual installation. Given the large, international nature of the DUNE project it will be a monumental task to ensure that the tracking of all data pertaining to the components, and subsystems, making up the DUNE detectors are carefully, and reliably collected into the hardware database.

Components and subsystems* will be procured and fabricated at a number of sites, and two or three tiers prior to arriving at the ND or FD site for installation into the corresponding detector. The basic structure of production/procurement sites, integration and testing sites, through to ND/FD sites is shown in Figure 1.

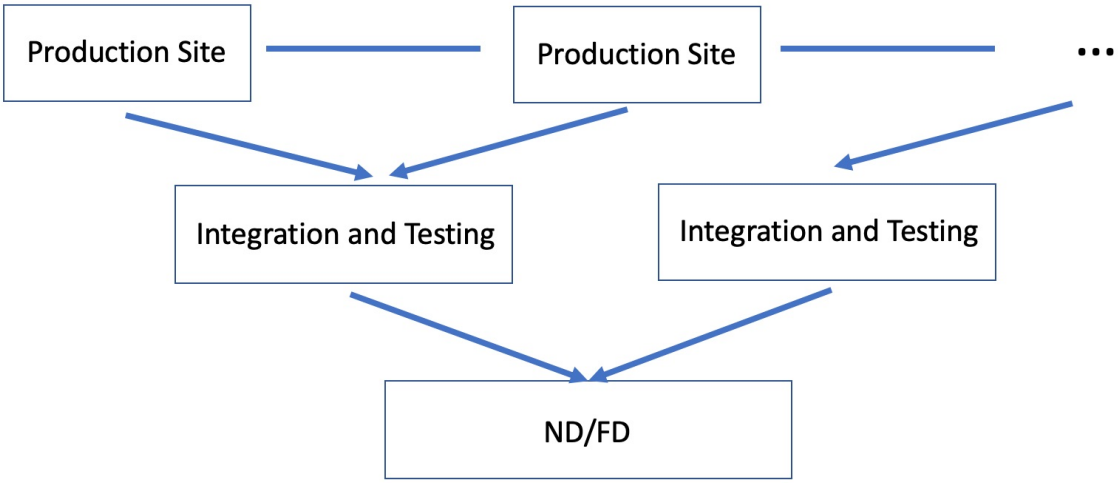

Figure 1: Basic structure of hardware component/subdetector path from procurement and production through to installation. Each box represents a site and sites will exist in several countries.

The various production and integration/testing sites will exist both in the US and internationally, which will further require careful implementation of the infrastructure for collecting data to be archived in the hardware database. While the development of the sites in Figure 1 is beyond the scope of the database group, the DB group will define requirements for the interfaces between each of these sites and the DB group, as well as provide tools to ensure reliable and efficient gathering of hardware data to be archived in the hardware database. It is not 100% clear to me where the database group responsibilities and those of the integration group separate. It will make good sense to have a strong interface between the two groups.

* Subsystem in this context refers to a "modular" part of a detector system containing some number of components – eg. a photon detector Arapuca module.

This document defines the requirements for the database, specifically regarding database hardware (storage and bandwidth, etc..), software, organization, and responsibilities.

General

1. There will be a "master" hardware database that any mirror copies, should there be any, would copy from. Any mirror databases must be read-only.
2. Write access to master hardware database must be highly restricted.
3. A single data† format will be utilized across the hardware database.
4. All data archived by the DUNE hardware database will be preserved through the lifetime of any data collected by the DUNE detectors, or as otherwise determined by DUNE leadership/management.

Questions – will we have separate ND and FD hardware databases?

Hardware

The DUNE database hardware requirements are the following:

1. Hardware DB servers will be positioned at the far site and Fermilab‡.
2. Technical support for database servers must be provided 24/7. Additionally, support of hardware/software maintenance must be provided.
3. Hardware at sites (production and integration) below the will utilize uniform structure and tools. – this seems VERY hard to require and maybe should be left out?
4. Back-up systems must be implemented for all hardware database servers.
5. Server hardware must be chosen such to ensure that

Software

The DUNE hardware database server(s) must reliably operate with:

1. Uptime of (95%?) – assumes a day per month of maintenance and allows for contingency beyond
2. Must be able to manage write rate of (?) – will be low
3. Storage of O(100 TB?) must be available.
    a. Archiving of hardware database may occur after (?) years – Maybe not needed.
4. Zero data loss is acceptable from any of the following:
    a. Disk failure of master DB or temporary storage prior to transfer to master

† Data in this document refers to any parameter or metadata potentially stored in the hardware database rather than the data collected by the DUNE detectors.
‡ Should another site host the master hardware DB this would be located at that site.

   b. No data loss from system interruption hangs
   c. No data loss during transfers to master DB – pre/post transfer checks are required
5. Any/all data management requirements of funding agencies will be assumed
6. Any/all security requirements of funding agencies will be assumed

Organization and Responsibilities

1. Each site in Figure 1 must have a liaison to the DB group
2. Each detector subsystem must provide a Schema for their system to the database group
3. Each detector subsystem must supply both rate and storage estimates to the database group.

There are other requirements I have certainly missed.