Overview of LBNE Software Landscape

Brett Viren

Physics Department

BROOKHAVEN NATIONAL LABORATORY

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Outline

Existing Applications

Software Infrastructure

Build Issues

G4LBNE - Neutrino Flux

- Geant4-based simulation with hooks for FLUKA
  - Geometry: mix of hard-coded C++ and GDML
- ROOT ntuple output in "standard" Dk2Nu format
- Fork of MINOS g4numi
- CMake-based build (also older generic Make-based)
- Not yet integrated in LBNE or Fermilab builds

`https://cdcvs.fnal.gov/redmine/projects/lbne-beamsim`

FastMC

- Parameterized MC
- Genie + Globes + bag of scripts and ROOT analysis
- Make-based build leveraging Genie
- Not yet integrated in LBNE or Fermilab builds

`https://cdcvs.fnal.gov/redmine/projects/fast_mc`

Art Based

HiSoft - Near Detector

- Derived from LArSoft, but now independent (still uses Art)
- https://cdcvs.fnal.gov/redmine/projects/lbnend

LBNECODE - Far Detector

- Based on LArSoft/art, extracted from LArSoft
- https://cdcvs.fnal.gov/redmine/projects/lbnecode

Both:

- G4-based detector simulation, GDML geometry,
- some reconstruction modules
- Currently using UPS-encumbered CMake-based build

Repositories

Redmine:

- git/svn/cvs repositories, issue tracker, wiki
- official "home" to most projects
- supported/provided by Fermilab.
- List of projects: `https://cdcvs.fnal.gov/redmine/projects`

GitHub:

- git/svn repositories, issue tracker, wiki
- "home" to some projects, mirror+dev of Redmine projects
- neutral-party, community supported
- LBNE organization: `https://github.com/LBNE`

Fermilab Software Infrastructure

- Fermilab builds weekly releases of Art-based projects
  - LBNECODE releases driven by LBNE (David Adams @ BNL)
- Build results only available on Sci. Linux
  - Build results ready to use on Fermilab machines
  - Others may install SL (or Mac OS X M.L.) binaries from `http://scisoft.fnal.gov/`[1]
- Build and end-user environment requires UPS
  - Effectively impossible to port to new platforms
  - Can not build from source from "first principles", must accept entire Fermilab software infrastructure.
  - LBNE is working on breaking free of these restraints

[1] see also: `https://github.com/brettviren/python-ups-utils/`

Problems with Fermilab Software Build

Fermilab's "UPS/CET-entangle" CMake build system for Art-based packages

- Inverted build-time dependency on end-user environment management.
- Run-time dependency on build-time tools.
- CMake-based but heavily entangled with large base of hand-written and generated scripts in a variety of languages.
- Build system is locked in for Art-based packages
- Dictates experiment and external package versions, releases disrupt developer environment.
- Art/LArSoft packages relatively small (all together 1/5'th the size of ROOT) to inflict such a high cost of usage.
- Art developers not receptive to change

To meet its software requirements, LBNE has decided to rewrite ("purify") the CMake build system to remove dependency on UPS and other Fermilab software infrastructure.

Build orchestration via Worch

- Provides framework for automated building and installing
- Isolates build configuration information from build processes
- Highly parallel and portable (based on waf)
- Includes support for many common package-level build systems, extensible via Python
- Policy is in configuration, many patterns possible (eg, UPS, rpm/deb, Conda, Environment Modules)

`https://github.com/brettviren/worch`

Status and Plans for Pure-CMake Build

Status

- Tracking forks of all art and larsoft packages in GitHub
- Art "purified", worch config developed, tested on several Linux and Mac platforms
- Larsoft "purification" mostly complete, worch config developed, tests ongoing

A plan exists for pushing the purification upstream

- "Purify" lbnecode in GitHub
- Port changes to Redmine/git in order: lbnecode, larsoft, art
- Initial port puts CMake changes behind `if/then` blocks, default to UPS-entangled method
- Give Fermilab time to learn to use Worch + Purified build
- Flip switch to make pure build the default and remove UPS-entanglements.