Status of LArSoft work plan

K. Knoepfel & E. Snider on behalf of the SciSoft team

Project meeting

Nov. 7, 2019

The process

Develop a work plan annually to guide resource allocations, priorities

- Start each fall by meeting with each experiment offline leadership
  - Discuss
    - Last year's plan
    - Sim/reco priorities of the experiment for the coming year, implications for LArSoft
  - Gather any anticipated requests, comments, other input

- Use this input to develop a draft plan
  - Discuss with all experiments at the October Offline Leads Meeting
  - Iterate as needed

- Write final draft in Nov.
  - Distribute to experiment spokes
  - Get experiment approval at Dec. Steering Group Meeting
    (the spokes or their delegates)

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Brief status of 2019 work plan

Successes (completed projects or significant progress toward goals)

- Re-architecting LArSoft / experiment code for thread safety

- Optimizing for performance (mainly thinking vectorization, multi-threading)

- Migration to GitHub + pull-request approval workflow (a la CMS)

- Migrating experiments to re-factored Geant4 driver / interfaces

- Re-factoring to decouple from specific neutrino event generator versions

- Event overlay workshop (co-hosted with MicroBooNE)

- LArSoft tutorial / multi-threading / future vision workshop

- Builds of weekly integration releases + test releases + release candidates

- Customer support

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Less than successes (...so far)

- Event display re-architecting / re-writing

- New build system (despite significant progress…)

- Incorporating pixel detectors

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Overview of proposed 2020 work plan elements

Major projects in short-term priorities

- Event display work
- Thread safety / multi-threading / vectorization
- Integrating LArTPCs with pixel readouts
- Recommendations / support for running in containers
- New build system
- Complete nutools re-factoring

Potentially major item to watch:

- Possible adaptations required for long DUNE readouts (~100 sec)

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Overview of proposed 2020 work plan elements

Long-term and continuing priorities

- Software builds
- Customer support

Notable areas where assistance has been / will be requested

- Continued help with migration to re-factored Geant4 driver / interface
  - DUNE, ICARUS, SBND
- Magnetic field map for DUNE ND
- Coordination with non-LArTPC DUNE ND detector elements
- ICARUS geometry

...Will not talk about any of these last items

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The 2020 work plan items

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Event display

Goal

- Replace existing LArSoft ED with modern, maintainable, web-based ED

Comments

- Still **the most commonly requested work item**, so still a high priority
- Plan is to engage BNL for this
  - Leverage an existing display they are supporting
- Have had initial discussions
  - Generally positive, but needs additional follow-up work
- In the meantime
  - Experiments have requested improvements to the existing ED

Effort

- Plan / hope that bulk of coding to comes from outside
- Unsure until we negotiate terms. Will definitely require Fermilab effort.

Ensuring thread safety / multi-threading / vectorizing

Goal

- To ensure production workflows operate in multi-threaded art
- To introduce multi-threading in selected algorithm code to control memory scaling, CPU utilization on grid resources
- To enable running on HPC resources

Comments

- On-going thread safety / multi-threading work
  - ProtoDUNE / DUNE FD "data preparation" + signal processing workflows
  - ICARUS noise reduction + signal processing workflows
- Expect SBND to need this as well
  - Goal is common infrastructure, but unclear whether this will succeed

Effort

- Last year: about 1.5 FTE DC + some additional from HepReco SciDAC
- Have about 0.5 FTE available this year. Expect to last all year

Integrating pixel detectors

Goal:

- To integrate simulation and reconstruction for LArTPCs with pixel readouts into LArSoft

Comments

- Currently strong interest from DUNE ND (ArgonCube)
- Expect to play strong role in architecture and interfaces, but delegate most of implementation to DUNE ND
- 3D reconstruction should be shareable with other 3D imaging techniques

Effort

- Guessing: 0.1 FTE for 6 months to a year on LArSoft end

Support for containers

Goal:

- Provide an officially recognized, recommended solution for building / running LArSoft in containers
- Ensure suitable images are available

Comments

- High priority
- Dropped official Mac OS support due to effort of supporting builds
  - Situation may change with new build system
  - Still a vocal minority develop entirely on Mac OS
- This is the alternative solution
- Also desired to standardize environment for running on grid

Effort

- 1-2 FTE month to get started + on-going with regular releases

New build system

Goal:

- Replace existing arcane packaging and build tools used only by Fermilab with modern, community supported standard
  - Based around HEP Software Foundation endorsed Spack packaging + cmake

Comments

- High priority
  - Long-standing need, and long requested by DUNE
  - Dropped Mac OS support in part due to issues with current system
- Requires development of a layer between Spack and cmake: SpackDev
  - LArSoft is spectator to that project
  - Due to importance, we track status and progress on regular basis

Effort

- 2-4 FTE months once system is delivered

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NuTools re-factoring

Goal:

- To decouple LArSoft from specific generator versions
    - Requires re-factoring of NuTools and Genie products initially

Comments

- NuTools and Genie re-factoring nearly completed
- Desired extensions of work:
    - Include Gibuu and NuWro generators
        - Neither are currently directly interfaced with LArSoft
    - Geant4 (less important)

Effort

- ~ 1 FTE month remaining for NuTools / Genie
- ~ 3-5 FTE months for Gibuu + NuWro generators

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On-going work

Software builds

- Goals
  - Weekly integration releases (assuming no change post-GitHub migration)
  - Test/candidate releases as needed to for new versions of physics packages
- Historically ~0.3 FTE

Customer support

- Goals
  - Address issue tickets from uses, answer walk-in questions, provide expert software advice and guidance as needed
- Effort
  - Historically about 0.5 FTE. Believe we have this much work
  - Currently spending ~0.2-0.3 FTE on average integrated across people?

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Personnel issues

Lost 1 FTE recently

- Significant decline in effort toward customer support + MT work
- Will have impact on rate at which we deliver on goals

Losing an additional 0.3 FTE in February 2020

- Code and release management
- Working now to re-distribute those
  (+ the other 0.7 FTE of responsibilities going away, some of which impact LArSoft)

Sum of all project plan work

- Full best/worst case range about 1.7 to 5 FTE
- Have about 2 FTE of effort in FY2020 budget

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Summary

- Good progress made on 2019 workplan goals
  - An ambitious plan
  - Better than expected progress on several high priority items
  - Did not deliver on a couple of major work items

- Have draft 2020 work plan after consultation with experiments
  - No issues raised at Oct Offline Leads meeting
  - Drafting final version for approval by spokes

- The 2020 plan is also ambitious
  - Loss of effort will have an impact on MT work and customer support
  - Will work with experiments, other collaborators to pick up some of the load

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Backup

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Where would additional effort go? (i.e., what are we not doing?)

Boosting work within the current plan

- MT work
    - Ensuring that common framework emerges from data-prep + SP work
    - Then pulling some of the relevant code from experiments back into LArSoft
- Build system
- Event display
- Stronger customer support presence

Additional work the project should advance if possible

- Better ML integration
    - Build on work of uB and DUNE to make it a core component of LArSoft
- Better Wire-Cell integration
    - Want to bring core SP / signal induction simulation into LArSoft (many barriers to this)
    - More granular interfacing, more use of common data products
    - Build bridges between imaging and other 3D reco algorithms
- Summer 2020 workshop with intro tutorial, advanced programming, HPC topics