Cultural Barriers to Software Productivity at Los Alamos

Charles R. Ferenbaugh
Los Alamos National Laboratory

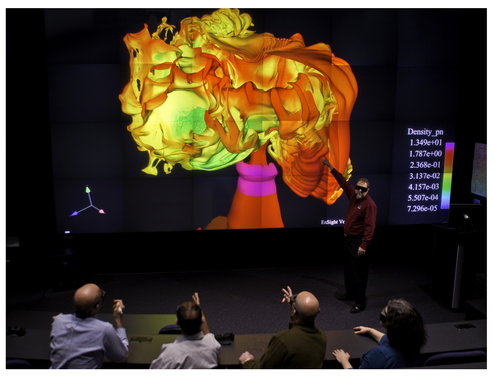
CSESSP Challenges Workshop
October 15, 2015

Introduction

The nuclear weapons program at LANL has a long history of developing software for physics applications. In recent years, the weapons code projects have given greater attention to modern software productivity practices, for a combination of reasons:

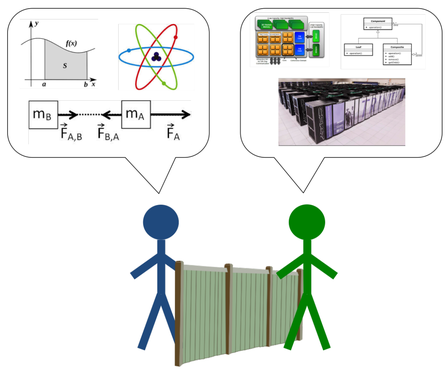
- Increased size, complexity, and longevity of codes
- Decreased funding and staffing levels
- The transition from nuclear testing to predictive science simulations
- The transition to new computer architectures such as Roadrunner

We've found that some of the biggest barriers to new practices were not technical but cultural. The institutional culture had evolved to fit traditional ways of doing things, and worked against adoption of new practices. Here are some specific issues we discovered.



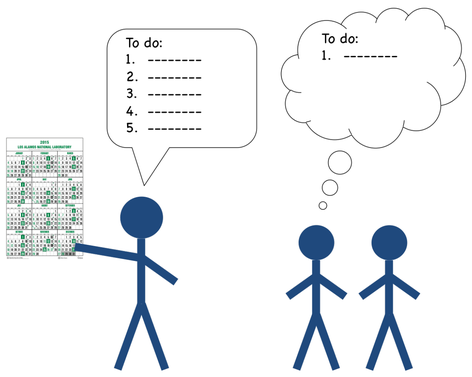
Separated Communities

Historically, physics code development and computer science at LANL have been done by separate organizations with different priorities. This has sometimes led to misunderstandings and mistrust between the two groups when they have needed to interact.



Management Priorities

In the past, the main measure for success of physics code projects has been "how much physics is in the code." Managers expected developers to implement physics features as quickly as possible. Software quality practices were shortchanged or ignored (or never even considered).

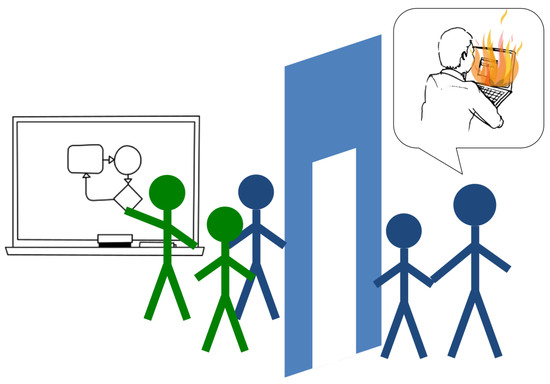


Multiple Commitments

Many agile methodologies call for team members to co-locate and work together, for:

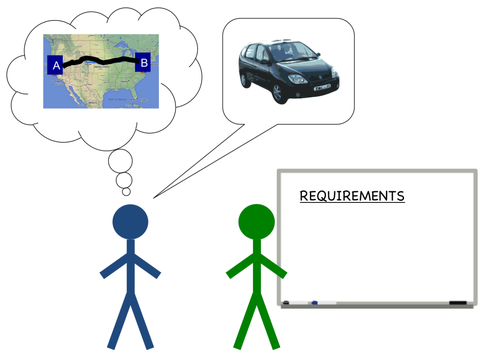
- pair programming
- group design reviews
- frequent exchange of information.

But most team members at LANL work on multiple projects, and legacy projects often pull people away to "put out fires." This makes it difficult for other teams to schedule large blocks of time together.



Requirements vs. Implementations

At LANL, software users have often written code themselves at some point in the past, So when they are asked, "What does our code need to do?" they often will instead answer the question "What would I implement in the code?" This can make it difficult for developers to gather requirements.

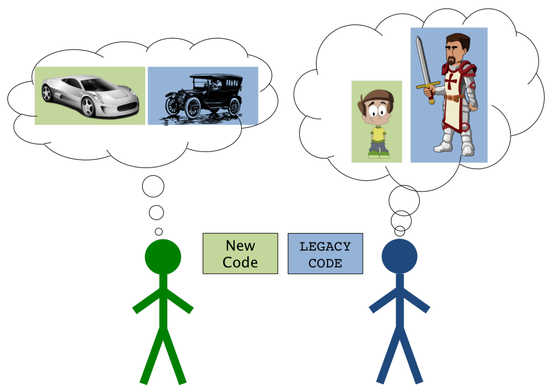


Experimental vs. Production Code

Often physicists write software tools or experimental codes for their own use. They use simple, ad-hoc processes which are sufficient for those tasks. This can lead to confusion when they work on production codes and keep on doing what they did before, even when more detailed processes are needed.

Verification and Validation

LANL legacy codes have undergone a great deal of formal and informal testing over the years, increasing users' confidence in the results. If developers propose to write a new code quickly, they may not appreciate the users' trust in the old code and their reluctance to use a new, untested one.



Conclusions

LANL is now making changes to address some of the above issues:

- More interaction between physics and CS communities
- Better balance between physics and CS experts on code teams
- New leadership structure, including a CS lead on each code team in addition to the physics lead
- Better management awareness of software issues

There's still more to do, and we are exchanging ideas with others on how to do it...

For more information

Charles Ferenbaugh
cferenba@lanl.gov