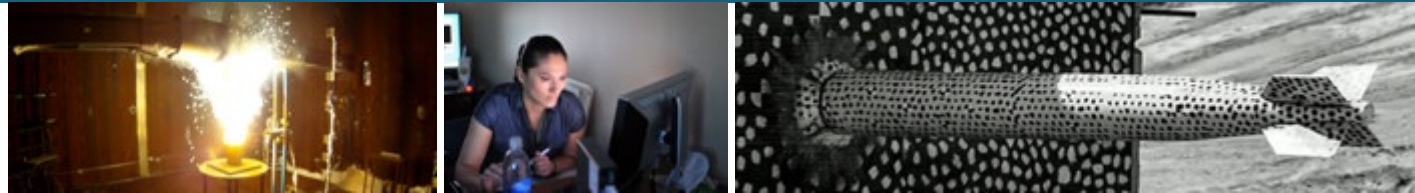


Research Software Science



PRESENTED BY

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Research Software Science: Key Idea



Apply the scientific method to study and improve how we develop and use research software.

Common (and noble) engineering approach:

- ID a problem, sample the space of possible solutions, pick one, move on.
- What's lost?
 - A record of the problem being solved, which options were considered, why one was picked.
 - Dissemination of techniques and finding, verification and validation of outcomes.

What's needed to make it science?

- New team skills: Social and cognitive sciences.
- Realistic expectations: Scientific progress takes time and money.
- Moving forward: Growing the approach and getting buy-in.

Why A Research Software Science Focus now: The “No CS” Scenario



Scenario:

Suppose our research centers had no formally trained computer scientists and CS work had to be done by people who learned it on their own, or just happened to study a bit of CS as part of their other formal training. This situation is undesirable in three ways:

1. We have non-experts doing CS work, making them less available in their expertise.
2. CS work takes a long time to complete compared to other work.
3. We get suboptimal results and pay high ongoing maintenance cost.

Replace ”CS” with “Software” and the situation describes research software today.

Why focus on research software science now:

- The role of software has become central to much of our work and the knowledge base is too sophisticated to rely only on non-experts.
- Scientific software success depends on producing high-quality, sustainable software products.
- Investing in software as a first class pursuit improves the whole scientific ecosystem.

Applying Social and Cognitive Science to Software Teams



Reed Milewicz – my postdoc, now staff.

Elaine Raybourn – Sandia applied cognitive scientist, joined my team several years ago.

New scientific tools to study and improve developer productivity, software sustainability.

Correlation: Happiness and connectedness.

Next: Design experiments to detect cause and effect.

Talk to Me: A Case Study on Coordinating Expertise in Large-Scale Scientific Software Projects

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Reed Milewicz and Elaine M. Raybourn

Abstract—Large-scale collaborative scientific software projects require more knowledge than any one person typically possesses. This makes coordination and communication of knowledge and expertise a key factor in creating and safeguarding software quality, without which we cannot have sustainable software. However, as researchers attempt to scale up the production of software, they are confronted by problems of awareness and understanding. This presents an opportunity to develop better practices and tools that directly address these challenges. To that end, we conducted a case study of developers of the Trinos project. We surveyed the software development challenges addressed and show how those problems are connected with what they know and how they communicate. Based on these data, we provide a series of practicable recommendations, and outline a path forward for future research.

Milewicz, Reed and Elaine M. Raybourn. “Talk to Me: A Case Study on Coordinating Expertise in Large-Scale Scientific Software Projects.” 2018 IEEE 14th International Conference on e-Science (e-Science) (2018): 9-18.

Arxiv: <https://arxiv.org/pdf/1809.06317.pdf>

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