

Three Research Software Sustainability Activities (WSSSPE, BSSw, URSSI)

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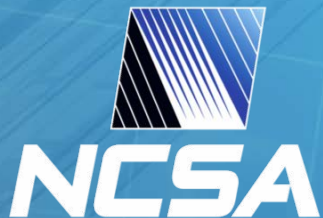
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National Center for Supercomputing Applications
University of Illinois at Urbana–Champaign

Defining research software sustainability

- Sustainable software has the capacity to endure, such that it will continue to be available in the future, on new platforms, meeting new needs.
- The research software lifecycle includes:
 - Acquiring and assembling resources (including funding and people) into teams and communities
 - Developing software
 - Using software
 - Recognizing contributions to and of software
 - Maintaining software

WSSSPE context

- Progress in scientific research is dependent on the quality and accessibility of software at all levels and it is now critical to address many new challenges related to the development, deployment, and maintenance of reusable software. In addition, it is essential that scientists, researchers, and students are able to learn and adopt a new set of software-related skills and methodologies.
- Established researchers are already acquiring some of these skills, and in particular a specialized class of software developers is emerging in academic environments who are an integral and embedded part of successful research teams.
- WSSSPE provides a forum for discussion of the challenges, including both positions and experiences, and a forum for the community to assemble and act.

WSSSPE mission and vision

Mission

- WSSSPE is an international community-driven organization that promotes sustainable research software by addressing challenges related to the full lifecycle of research software through shared learning and community action

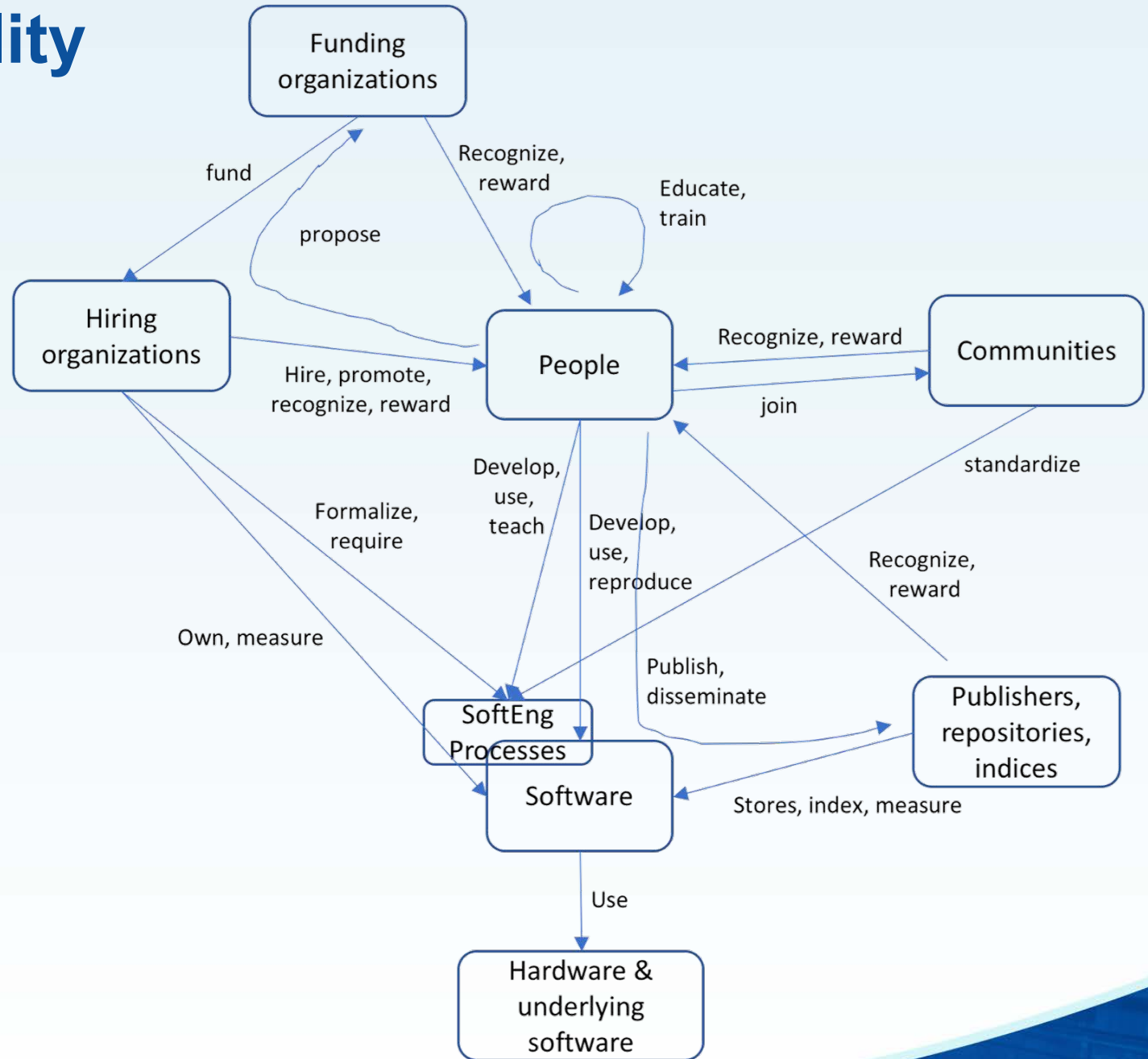
Vision

- We envision a world where research software is accessible, robust, sustained, and recognized as a scholarly research product critical to the advancement of knowledge, learning, and discovery

WSSSPE focus areas

- WSSSPE promotes sustainable research software by positively impacting:
 - **Principles and Best Practices.** Promoting best practices in sustainable software
 - **Careers.** Developing and supporting career paths in research software development and engineering
 - **Learning.** Engaging in activities to promote peer learning and interaction
 - **Credit.** Ensuring recognition of research software as an intellectual contribution equal to other research products

Sustainability Schematic



What is WSSSPE?

- Originally, Workshop on Sustainable Software for Science: Practice and Experience
- Now also Working towards Sustainable Software for Science: Practice and Experience
- “Science” really is more general “Research”
- Web site <http://wssspe.researchcomputing.org.uk> & mailing list & slack channel & twitter & facebook
- Community
- Set of meetings
- Set of activities

WSSSPE meetings

- WSSSPE1 and WSSSPE2 (2013 & 2014)
 - One-day workshops at SC13 & SC14
 - Good for community forming and presentations, not good for discussion or activities
- WSSSPE1.1 and WSSSPE2.1 (2014 & 2015)
 - Half-day workshops at SciPy2014 & SciPy2015
 - Focus on presentations and lesson from SciPy projects
- WSSSPE3 (2015)
 - 1 ½ day workshop in Boulder (plus ½ day for report writing)
 - Some presentations, mostly groups (10) formed around activities
 - Most groups (9) created plans to continue
 - After a year, about ⅓ of groups were active and working with others, ⅓ had made some progress, ⅓ were waiting for a leader

WSSSPE meetings (2)

- WSSSPE4 (2016)
 - 2 ½ day workshop in Manchester, UK, with 1st RSE conference
 - Developed mission and vision
 - Two tracks:
 - Track 1 – Building a sustainable future for open-use research software: defining a vision of the future of open-use research software, and in the workshop, initiating the activities that are needed to get there
 - Track 2 – Practices & experiences in sustainable scientific software: improving the quality of today's research software and the experiences of its developers by sharing best practices and experiences
 - Goal: continue working groups from WSSSPE3, with some new participants, start some new groups
 - Working groups meet, define specific plans to make progress, get feedback from larger community, start work
 - After WSSSPE4, working groups continue to make progress

WSSSPE4 working groups

- Verifying best practices & metrics for sustainable research software
- Software Sustainability Alliance
- Scientific Software Prototyping Infrastructure (S2PI)
- Standard metadata for software (CodeMeta)
- White paper on developing sustainable software
- Social science for scientific software
- Software best practices for undergraduates
- Meaningful metrics for sustainable software
- Coordinating access to CI for research software
- Software engineering processes tailored for research software
- Open research index
- Letters of evaluation for computational scientists

What didn't work at WSSSPE4

- Used ideas to create and form working groups
 - Intended to start at workshop, continue afterwards
- Reinforced WSSSPE3 lesson
 - Relatively easy to get motivated people to attend a meeting and productively spend their time there doing and planning work
 - Very hard to get that additional post-meeting work to take place
 - Main problem seems to be time
- If attendees commit to spend their time at workshop
 - They put their energy into doing so productively
 - But they haven't really committed to anything more than this
 - Energy & effort trails off as other commitments come back to the fore
- Without resolving this, further multi-day WSSSPE workshops focused on new activities unclear

What did work at WSSSPE4

- A gathering place to discuss scientific software sustainability
- Meeting place for for groups already in place or composed of related funded activities
- Future WSSSPE meetings to likely combine these functions:
 - A meeting place for like-minded individuals
 - A place to share experiences and lessons learned
 - A place for both existing groups and sets of related projects to meet in person
- Other parts of the WSSSPE infrastructure (email list & Slack) to be used for general discussions & for new groups to focus on specific problems

WSSSPE meetings (3)

- WSSSPE5.1 (2017)
 - One-day workshop with 2nd RSE Conference (Manchester, UK)
 - Short talks and speed-blogging
 - The Research Software Project Manager
 - Looking for software use in research
 - Towards Reproducibility in Research Software
 - Overcoming barriers to adopting software best practices in research
 - Why research software engineers should have permanent contracts
 - A standard format for CITATION files
 - Encouraging good software development practice in research teams
 - Overcoming Entry Barriers to Motivate Better Practice in Research Software Engineering
- WSSSPE5.2 (2017)
 - One-day workshops at eScience 2017 (Auckland, NZ)
 - Focus on presentations and community building in NZ & Australia

WSSSPE5.1 speed blogs mapped

Overcoming Entry Barriers to Motivate Better Practice in Research Software Engineering

Why research software engineers should have permanent contracts

Research Software Project Manager

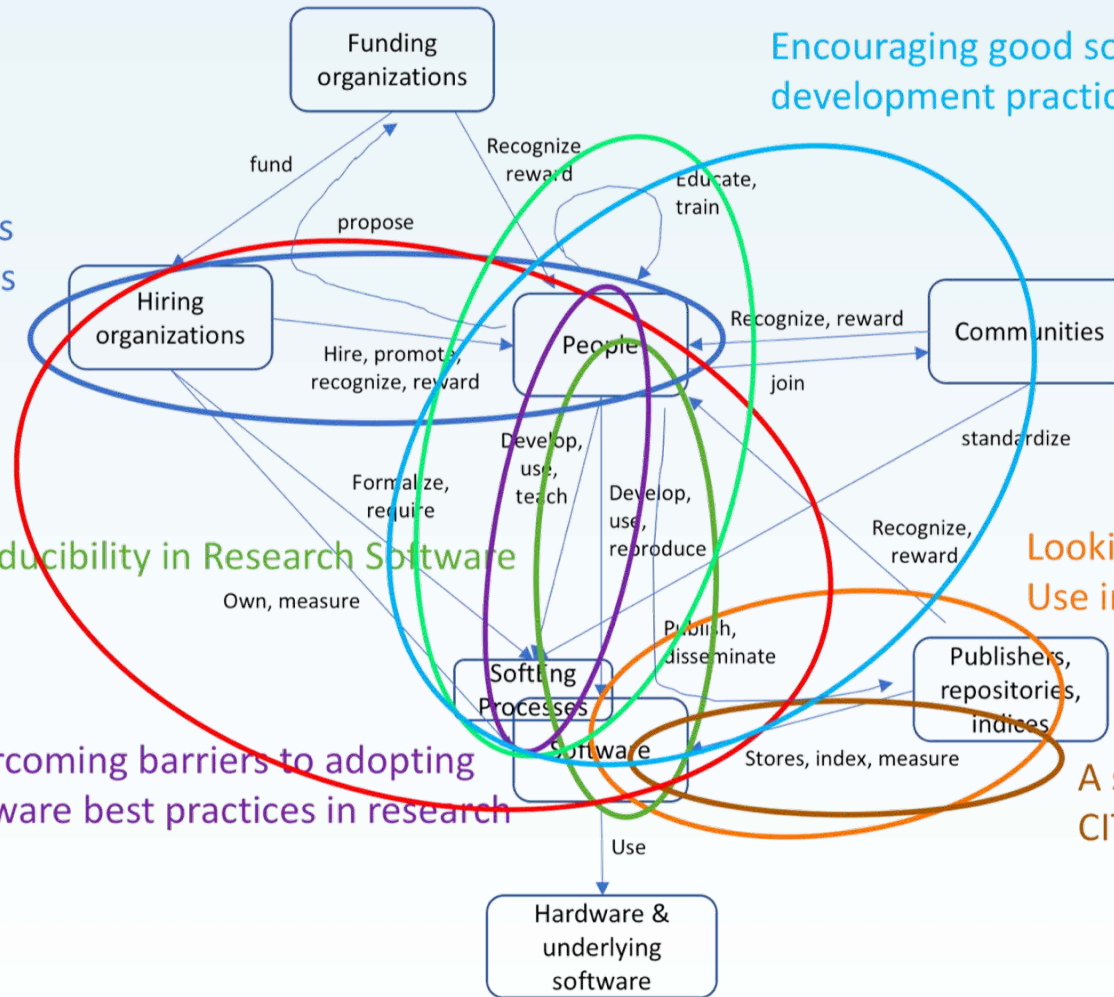
Towards Reproducibility in Research Software

Overcoming barriers to adopting software best practices in research

Encouraging good software development practice in research teams

Looking for Software Use in Research

A standard format for CITATION files



WSSSPE6 (2018)

- Discussing ~1-day workshop with URSSI meeting (US)
- Discussing 1-day workshop with eScience 2018 (Amsterdam)
- Stay tuned



Better Scientific Software

<https://bssw.io>

So your code will see the future.

Mike Heroux (SNL) and Lois Curfman McInnes (ANL)

▶ BSSw Site Launch At SC17 ... Contribute To Better Scientific Software!



<https://bssw.io>

Collaborative content development on general topics topics related to developer productivity and software sustainability for CSE

We want and *need* contributions from the community ... Join us!

Better Scientific Software (BSSw)

Scientific software has emerged as an essential discipline in its own right. Because computational models, computer architectures, and scientific software projects have become extremely complex, the Computational Science & Engineering (CSE) community now has a unique opportunity—and an implicit mandate—to address pressing challenges in scientific software productivity, quality, and sustainability.

GET ORIENTED

Communities Overview

Site Overview

Intro To CSE

Intro To HPC



Dedicated to improving developer productivity and software sustainability for CSE

<https://bssw.io>

- **New [community-based resource](#) for scientific software improvement exchange**
- A central hub for sharing information on practices, techniques, experiences, and tools to improve developer productivity and software sustainability for computational science & engineering (CSE)

Goals:

- Raise awareness of the importance of good software practices to scientific productivity and to the quality and reliability of computationally-based scientific results
- Raise awareness of the increasing challenges facing CSE software developers as high-end computing heads to extreme scales

Site users can:

- **Find information** on scientific software topics
- **Propose to curate or create new content** based on their own experiences. The backend enables collaborative content development using standard GitHub tools and processes.

Resource topics



Better Performance:

- High-performance computing
- Performance at LCFs
- Performance portability

Better Planning:

- Requirements
- Design
- Software interoperability

Better Skills:

- Personal productivity and sustainability
- Online learning



Better Development:

- Documentation
- Version control
- Configuration and builds
- Deployment
- Issue tracking
- Refactoring
- Software engineering
- Development tools

Better Reliability:

- Testing
- Continuous integration testing
- Reproducibility
- Debugging

Better Collaboration:

- Licensing
- Strategies for more effective teams
- Funding sources and programs
- Projects and organizations
- Software publishing and citation
- Discussion forums, Q&A sites

Site content spans a broad range of topics

We *need* your input! Contribute to BSSw!



Tech tattoo

... for your laptop
actual size 2"x4"

URSSI: Conceptualizing a US Research Software Sustainability Institute

<http://urssi.us>

Karthik Ram (PI), Jeffrey Carver, Sandra Gesing,
Daniel S. Katz, Nicholas Weber

Berkeley
UNIVERSITY OF CALIFORNIA



UNIVERSITY OF
NOTRE DAME



URSSI team

- PIs: Karthik Ram (PI, UC Berkeley), Jeffrey Carver (Alabama), Sandra Gesing (Notre Dame), Daniel S. Katz (Illinois), Nicholas Weber (Washington)
- Senior Personnel: Wolfgang Bangerth (Colorado State), Anshu Dubey (Argonne), Melissa Haendel (Oregon State), Mike Heroux (Sandia), Katy Huff (Illinois), Suresh Marru (Indiana), Kate Mueller (Notre Dame), Jarek Nabrzyski (Notre Dame), Kyle Niemeyer (Oregon State), Marlon Pierce (Indiana), Ariel Rokem (Washington), Arfon Smith (STScI), Tracy Teal (Carpentries), Matt Turk (Illinois), Rick Wagner (Argonne), Mike Zentner (Purdue)
- Advisory Committee: Richard Arthur (GE Global), Michelle Barker (Nectar), Phil Bourne (Virginia), Daniel Crawford (MoSSI & Va Tech), Neil Chue Hong (SSI & Edinburgh), James Howison (Texas), Kurt Schwehr (Google), Jeff Spies (COS), Nancy Wilkins-Diehr (SGCI & UCSD)

URSSI context

- Modern research is digital
 - Data & publications created, analyzed, and stored electronically
 - Using tools and methods expressed in software
- Much software developed specifically for research, by researchers
- Research software essential to progress in almost all research fields
- But often not developed in an efficient or sustainable way
- Knowledge often locked away in individual laboratories or only shared via method papers that cannot directly be used by others
- Researchers know their disciplines
 - Often don't have training and understanding of best practices to ...
 - ease development & maintainability and to encourage sustainability & reproducibility
- Developers don't match the diversity of overall society or of user communities

URSSI conceptualization goals

- Conceptualize (plan) a US Research Software Sustainability Institute
- Go beyond resources like GitHub
- Cut across existing activities funded by NSF and beyond
- Directly and indirectly positively impact all software development and maintenance projects across all of NSF
- Focus on the entire research software ecosystem, including the people who create, maintain, and use research software
- Outputs:
 - Eager supportive & inclusive community
 - Concrete institute plan configured to offer valued services
 - Published survey and data that demonstrates community need

URSSI activities

- Workshops (currently planning five)
 - General discussion; community & idea gathering (Berkeley, April 10-12)
 - 3 topical workshops on specific ideas
 - Wrap up; finalize plan
- Survey
 - Widely-distributed to engage stakeholder communities
 - Learn about software they produce and use, ways they contemplate sustaining it
- Ethnographic studies
 - 3 – 5 software projects will be recruited for participant observation and interviews
 - Learn about specific sustainability practices and project governance-in-action
- Communication
 - Newsletters
 - Web site (<http://urssi.us/>)
 - Social media
- Iteratively build on existing, extensive understanding of the challenges for sustainable software and its developers

Areas of Concern

- Functioning of the individual and team
- Functioning of the research software
- Functioning of the research field itself

Functioning of the individual and team

- Training & education
- Ensuring appropriate credit for software development
- Enabling publication pathways for research software
- Fostering satisfactory and rewarding career paths for people who develop and maintain software
- Increasing the participation of underrepresented groups in software engineering

Functioning of the research software

- Supporting sustainability of the software
- Growing community, evolving governance, and developing relationships between organizations, both academic and industrial
- Fostering both testing and reproducibility
- Supporting new models and developments (e.g., agile web frameworks, Software-as-a-Service)
- Supporting contributions of transient contributors (e.g., students)

Functioning of the research field itself

- Growing communities around research software and disparate user requirements
- Cataloging extant and necessary software
- Disseminating new developments
- Training researchers in the usage of software
- Understanding and improving pipelines of diverse developers and maintainers

How to get involved in URSSI

- Watch the web page
 - <http://urssi.us>
- Join the mailing list
 - Form on the URSSI web page
- Follow on twitter
 - <https://twitter.com/si2urssi>
- Take the survey when it is released
- If you have questions, want to suggest something, want to volunteer, email us
 - contact@urssi.us