Effective Metrics for Measuring and Enhancing Sustainability in Scientific Software

NLIT'24 Summit
April 10, 2024

Gregory R. Watson[1], Addi Malviya Thakur[1],
Elaine M. Raybourn[2], Daniel S. Katz[3],
Bill Hoffman[4], Dana Robinson[5]
[1]*ORNL,* [2]*SNL,* [3]*UIUC,* [4]*Kitware Inc.,* [5]*The HDF Group*

This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Advanced Scientific Computing under contract number DE-AC05-00OR22725

Workshop Goals

- Work towards a comprehensive understanding of sustainability metrics and software stewardship.
- A white paper, summarizing the workshop's findings and recommendations, will be published. Attendees will have the opportunity to contribute to this paper.
- The establishment of a community dedicated to the ongoing development and research in this area, paving the way for future workshops.

Outline

Total time (100 minutes)

- Introduction and context (20 min): Brief introduction and attendee engagement into definition of sustainability and sustainability factors.

- Breakout Sessions (50 minutes): Attendees will split into smaller groups to discuss specific topics related to sustainability metrics.

- Break (10 minutes)

- Readouts (20 minutes): Each breakout group will summarize their discussions.

CORSA Vision & Goals

To become a community of practice that creates pathways for open-source scientific software projects to avail themselves of resources for long-term growth, stewardship, advancement, and innovation.

1. Create pathways to foundations for projects and stakeholders.
2. **Empower software communities through software sustainability metrics.**
3. Facilitate cross-cutting activities to address the needs of unique and diverse communities.
4. Provide objective guidance to software communities.

Software Sustainability and Metrics

Software sustainability: Ensuring software can endure and remain operational, useful, and relevant over time.

Purpose of software sustainability metrics: measuring the sustainability of scientific and research software.

> Question: which metrics would be most effective?

Potential metrics: Measures that could help to evaluate how effectively a software system can be maintained and developed over time, ensuring it remains functional, relevant, and valuable over time.

> Question: which metrics are feasible to collect?

Workshop Objective: Engage the community in this discussion

Potential software sustainability considerations

Lots of people have thought about this, and come up with:

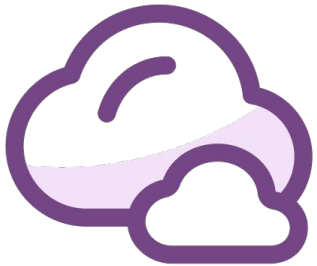
- **Maintainability**: Code quality, documentation, modularity, code and process metrics (complexity measures, defect density, productivity, cycle time, number of commits).
- **Reusability**: Standards compliance, modular design, open licensing.
- **Portability**: Cross-platform compatibility, dependency management.
- **Scalability**: Performance under load, resource efficiency, performance metrics (execution time, storage requirements).
- **Community Engagement and Support:** Active user community, developer support, open source involvement, community contributions.
- **Reproducibility**: Version control, automated testing.
- **Interoperability**: Data formats, APIs and integration points, general quality metrics (interoperability, sustainability assessments).
- **Funding and Institutional Support:** Sustainable funding models, institutional backing, collaboration and funding aspects.
- **Testing and Quality Metrics:** Testing metrics (code coverage, number of tests), general quality metrics.
- I**mpact and Recognition:** Recognition metrics (citations, downloads), recognition and reward for software contributions.

There are likely more, too - what do you think?

References:
https://chaoss.community/kb-metrics-and-metrics-models/
https://www.software.ac.uk/publication/better-software-better-research
https://bssw.io/blog_posts/use-of-software-metrics-in-research-software

What does Sustainability mean for your scientific/research software?

slido

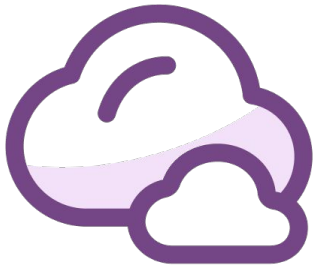


What does Sustainability mean for your scientific/research software?

ⓘ Click **Present with Slido** or install our Chrome extension to activate this poll while presenting.

Which sustainability metrics are you using for your projects?

slido



Which sustainability metrics are you using for your projects?

ⓘ Click **Present with Slido** or install our Chrome extension to activate this poll while presenting.

Breakout Session questions

Attendees will split into smaller groups to independently discuss these questions related to sustainability & metrics.

1. Why does sustainability matter to your work or projects?
2. What aspects of sustainability are most important to you?
3. How do you measure those aspects (which sustainability metrics do you collect)?
4. What do you want to know that you can't measure today?

Breakout notes: https://shorturl.at/rt058

Break (10 min)

Readouts

Thank you!

Backup slides

Breakout Session questions

Attendees will split into smaller groups to independently discuss these three topics related to sustainability metrics.

- Question 1: Which sustainability metrics are important to your projects and why?
- Question 2: What are the key aspects of sustainability that are important to you?
- Question 3: How does sustainability impact your work or projects?

Breakout Session questions

Attendees will split into smaller groups to independently discuss these questions related to sustainability & metrics.

1. Why does sustainability matter to your work or projects?
2. What aspects of sustainability are most important to you?
3. How do you measure those aspects (which sustainability metrics do you collect)?
4. What do you want to know that you can't measure today?

https://drive.google.com/drive/u/0/folders/1RtdVvFvVQl5ApfDXd59

Software Sustainability and Metrics

Software sustainability: Ensuring software can endure and remain operational, useful, and relevant over time.

Software sustainability metrics: Measures that help to evaluate how effectively a software system can be maintained and developed over time, ensuring it remains functional, relevant, and valuable over time.

Workshop Objective: Engage the community in identifying which software sustainability metrics are most effective for measuring the sustainability of scientific and research software.