Managing Research Software Development
Better software, better research

Slides: https://doi.org/10.6084/m9.figshare.5649508

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Software is essential to research

S. Hettrick, “It’s impossible to conduct research without software, say 7 out of 10 UK researchers,” Software Sustainability Institute, 2014.

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And many researchers develop software

S. Hettrick, “It’s impossible to conduct research without software, say 7 out of 10 UK researchers,” Software Sustainability Institute, 2014.
This development is diverse

Which languages do you use at work?

Figure from UK RSE Survey 2017
This development is diverse

Which languages do you use at work?

- Python: 75%
- Unix Shell: 55%
- Markup Languages: 45%
- C++: 37%
- C: 36%
- JavaScript: 34%
- FORTRAN: 32%
- SQL: 31%
- Java: 26%
- Matlab: 24%

Figure from UK RSE Survey 2017
How can we improve research software development?
Software Management Plans

• Much research software development is not formally planned
  ▪ Developed to solve a research question
  ▪ Evolved rather than planned
  ▪ Even larger research software projects tend to be driven by a single person to start

• Software Management Plans are a way of thinking through the process of running a research software development project
Software Management Plans

• A Software Management Plan can help:
  ▪ Understand what and who the software is for
  ▪ Define success criteria for the software
  ▪ Understand what processes, resources and infrastructure are required
  ▪ Think about the future of our software once a project or funding period ends

• A Software Management Plan is principally for a project's own use, and should be developed and agreed by the whole project team
How do I create a plan?

- The Software Sustainability Institute has drawn up a checklist
  - [http://www.software.ac.uk/software-management-plans](http://www.software.ac.uk/software-management-plans)
- Series of questions to help you consider all aspects of the development of your software
- Complementary to Data Management Plans
  - [https://dmponline.dcc.ac.uk/](https://dmponline.dcc.ac.uk/)
SMP Checklist

- About your software (who, what, why, how)
- Software Development Infrastructure
- Developing good software
- Managing dependencies
- Managing software development
- Engaging users
- Intellectual property, copyright and licencing
- Preserving your software
A minimal software management plan

• What software will you write?
  ▪ What will your software do?
  ▪ Will your software have a name?
• Who are the intended users of your software?
  ▪ Is for one type of user or for many?
  ▪ What expertise is required?
• How will you make your software available?
• How will your software contribute to research and how will you measure its contribution?
Community standards are developing

- CLARIAH (Arts and Humanities): https://github.com/CLARIAH/software-quality-guidelines
- ELIXIR (Life Sciences): https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5490478/
Research Software Workflow

**describe**

- GitLab
- GitHub
- Bitbucket
- <sword/>
- zenodo
- DRYAD
- figshare

**develop → share → preserve**

- Developed and versioned using code repository
- Published via code repository or website
- Deposited in digital repository with paper / for preservation

Software Sustainability Institute
Learning from Open Source Software

- Scientific software development projects share characteristics with open source software projects
  - But more research has been done on OSS projects

- Karl Fogel’s "Producing Open Source Software: How to Run a Successful Free Software Project" distills this knowledge into a practical guide
Measuring the health of your software project

• As your project is running, how do you understand if it’s going well?

https://chaoss.community/
Other resources

- Software sustainability evaluation
  - [https://www.software.ac.uk/online-sustainability-evaluation](https://www.software.ac.uk/online-sustainability-evaluation)

- Software Sustainability Institute resources
  - Guides: [https://www.software.ac.uk/guides](https://www.software.ac.uk/guides)
  - Top Tips: [https://www.software.ac.uk/resources/top-tips](https://www.software.ac.uk/resources/top-tips)

- Scientific Software Practice
  - Good Enough Practices in Scientific Computing: [https://doi.org/10.1371/journal.pcbi.1005510](https://doi.org/10.1371/journal.pcbi.1005510)
  - Best Practices for Scientific Computing: [https://doi.org/10.1371/journal.pbio.1001745](https://doi.org/10.1371/journal.pbio.1001745)

- Software Citation
  - Principles: [https://peerj.com/articles/cs-86/](https://peerj.com/articles/cs-86/)
  - GitHub – Zenodo: [https://guides.github.com/activities/citable-code/](https://guides.github.com/activities/citable-code/)

- RDA Active Data Management Plans IG
  - [https://www.rd-alliance.org/groups/active-data-management-plans.html](https://www.rd-alliance.org/groups/active-data-management-plans.html)
Find out more about the SSI

- Community Engagement (Lead: Shoaib Sufi)
  - Fellowship Programme
  - Events and Workshops
- Consultancy (Lead: Steve Crouch)
  - Open Call for Projects / Collaborations
  - Software Evaluation
- Policy and Publicity (Lead: Simon Hettrick)
  - Case Studies / Policy Campaigns
  - Software and Research Blog
- Training (Lead: Aleksandra Nenadic)
  - Software Carpentry / Data Carpentry (300+ students/year)
  - Guides and Top Tips
- Journal of Open Research Software (Editor: Neil Chue Hong)

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Software Sustainability Institute
Additional slides
About your software

• What software will you write?
  ▪ What will your software do?
  ▪ Will your software have a name?
• Who are the intended users of your software?
• What software development skills, knowledge and expertise do your users need?
• How will you make your software available to users?
• How will your software contribute to research?
Your software development infrastructure

• What infrastructure will you need, now and in the future?
  ▪ Who needs access?

• Where will your infrastructure be hosted?
Developing good software

- How you will deliver code that can be understood and of good quality?
- How will you choose your test cases?
  - How will you make it easy to write and run tests?
  - How will you ensure that your software is tested regularly?
  - How will you let users know about the tests you do?
  - How will you help developers to understand, modify, extend and test your software?
- Will your software run under multiple environments?
- How will your software and documentation adhere to disability accessibility guidelines?
Managing your dependencies

• What third-party software, models, tools, libraries and services will you use?
• What third-party data sets and online databases will you use?
• What communications protocols and data formats will you use?
• How will you manage and document your dependencies?
• How will you track changes to dependencies?
Managing your software development (1)

• What effort will be available to develop your software?
• How will software development roles be assigned?
• How you will track who is doing what and when it needs to be done by?
• What software development model will you use?
Managing your software development (2)

- How you will manage releases of your software or updates to your services?
- How will you ensure that information is not lost when a developer leaves?
- How often will you review and revise your Software Management Plan?
- How does your Software Management Plan relate to any Data Management Plan?
Engaging with your users

• How will you promote what your software does and who has used it?
• How you will support your users when they ask for help?
• How will your users be able to contribute to your software?
Intellectual Property, Copyright and Licensing

- Who will own the copyright of your software?
- What licence will you choose?
- Where will you publish your copyright and license?
Preserving your software

• Do you have a preservation plan?
• Where can you deposit your software for long-term preservation?
• Do you plan to evolve your project into an open source project?