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.

S.J. Hettrick,, et al, "UK Research Software Survey 2014", Zenodo, 2014. doi: 10.5281/zenodo.14809

U. Nangia and D. S. Katz, "Track 1 Paper: Surveying the U.S. National Postdoctoral Association Regarding Software Use and Training in Research," Zenodo, 2017. doi: 10.5281/zenodo.814102

www.software.ac.uk

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.*
S.J. Hettrick,, et al, "UK Research Software Survey 2014", Zenodo, 2014. doi: 10.5281/zenodo.14809

This development is diverse

Which languages do you use at work?
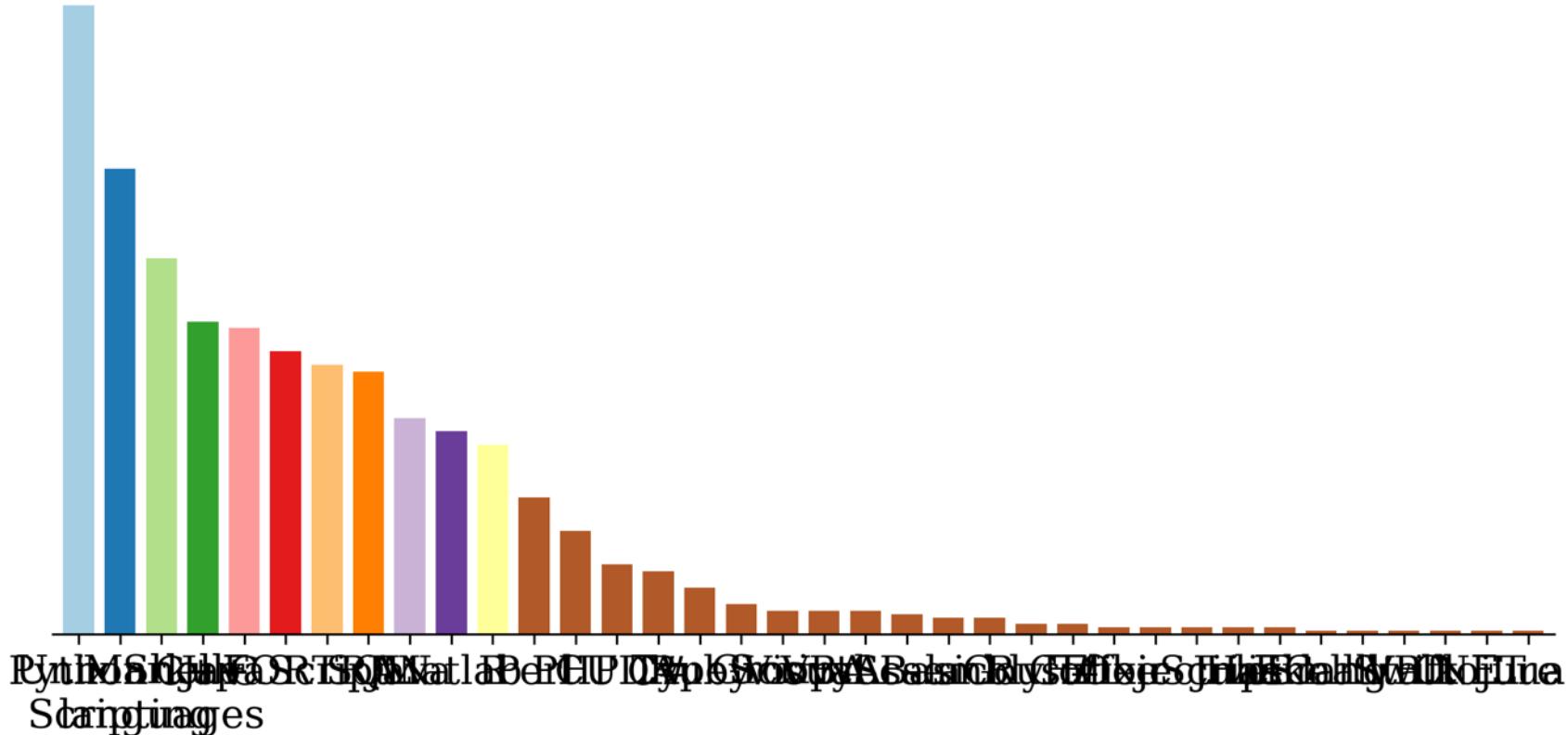
Figure from UK RSE Survey 2017 Software Sustainability Institute

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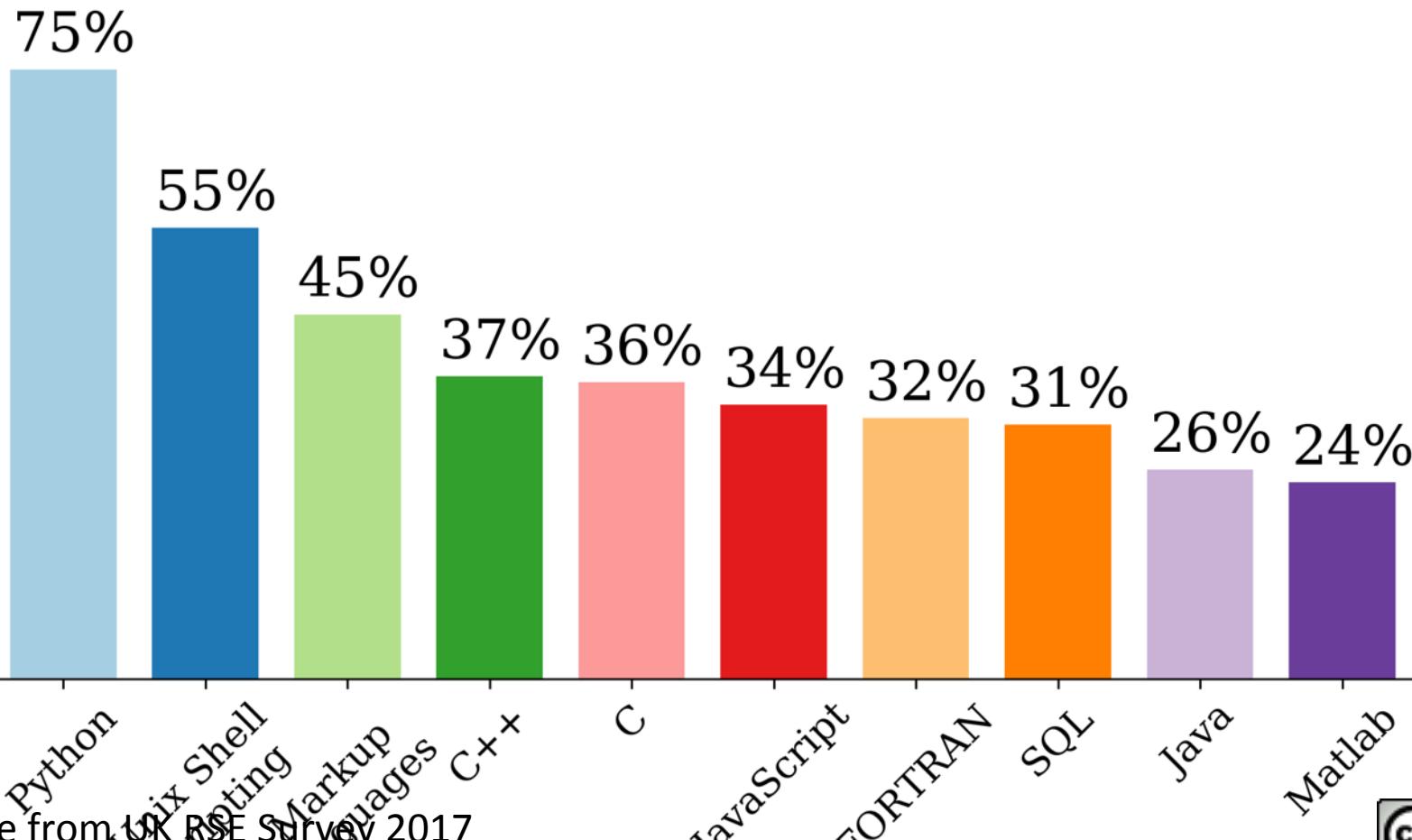
Figure from UK RSE Survey 2017

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
- 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/

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

- ESIP (Earth Sciences): https://esipfed.github.io/Software-Assessment-Guidelines/

- CLARIAH (Arts and Humanities): https://github.com/CLARIAH/software-quality-guidelines

- IPOL (Image Processing): https://tools.ipol.im/wiki/ref/software_guidelines/

- ELIXIR (Life Sciences): https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5490478/

Learning from Open Source Software
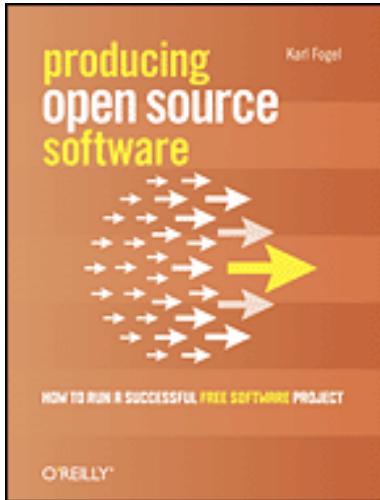
producingoss.com

- 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?

CHAOSS

https://chaoss.community/
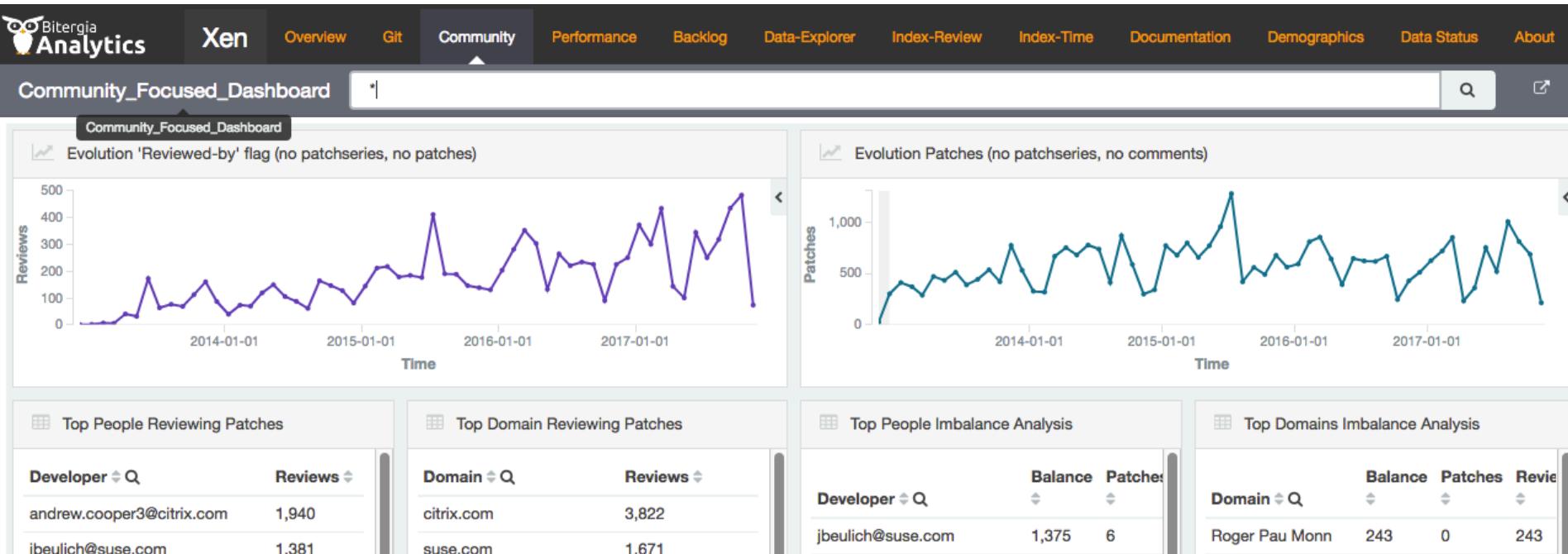
Other resources

- Software sustainability evaluation
  - https://www.software.ac.uk/online-sustainability-evaluation
- Software Sustainability Institute resources
  - Guides: https://www.software.ac.uk/guides
  - 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
  - Best Practices for Scientific Computing: https://doi.org/10.1371/journal.pbio.1001745
- Software Citation
  - Principles: https://peerj.com/articles/cs-86/
  - GitHub – Zenodo: https://guides.github.com/activities/citable-code/
- RDA Active Data Management Plans IG
  - 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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- *Malcolm Illingworth*

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- Kaitlin Thaney
- Martin Fenner
- Victoria Stodden
- WSSSPE community

Software/Data Carpentry
- Greg Wilson
- Jonah Duckles
- Tracy Teal
- Instructor Community

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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?