"Everything" about scientific software documentation that wasn’t in the manual

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Talk overview

1. Empirical studies of (scientific) software development
2. Documentation in scientific end-user development
3. Documentation beyond scientific end-user development
4. Community's role in producing documentation
5. Crowd-sourcing documentation - implementation
6. Benefits of crowd-sourcing documentation
7. Challenges in crowd-sourcing documentation

Empirical studies of (scientific) software development

- Real-life situations and activities

- The importance of the context

- Actual software development practices

- The human factor

Image source: http://www.drimmit.com/theman/become-a-great-programmer/

Study data

33 Interviews:

Scientists who commercialized their research software
Scientists developing scientific software
Scientists using scientific software

Case study: SciPy/Numpy Documentation Project:

8 interviews with key stakeholders
10 years of 3 mailing lists archives
2 Progress Reports (SciPy Conference proceedings)
Documentation system data and logs

Documentation production in scientific software development contexts

Context 1:

Scientific end-user development

Documentation production in scientific software development contexts

Context 1:

Scientific end-user development

Context 2:

Scientific software developed for and used by a wider user community

Scientific end-user development (Context 1)

- Advancing research - the main aim
- The developer is the (sole) user
- Typically no other developers
- One-off use software

Therefore...

...documentation production too big an investment

- If anything is well documented, it’s typically the scientific model
- Scarce or non-existent technical documentation
- Comments in the source code often understandable only to the original developer
- No user manuals

Seems reasonable but...

Documentation production supports reasoning process

" I never felt the need to document it [when developing for own use]. In hindsight I think it would have been a good idea because it makes you think about what the code is actually doing..." [Scientist-developer A]

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No documentation - reproducibility issues

"I reckon I repeated 3.5 years of work in 6 months at the end of my PhD. If stuff had been better documented, then it would have probably been more like 2 months. I probably wasted 4 months retrying the wrong thing because I had not made sufficiently good notes." [Scientist-developer B]

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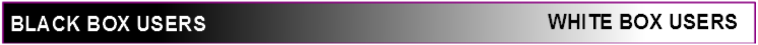
And what if....

...software is developed for a wider community? (Context 2)

- Users: manuals, tutorials, examples
- Users represent a continuum:

End-users User-developers



BLACK BOX USERS WHITE BOX USERS

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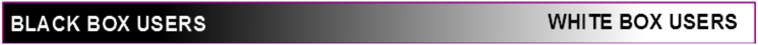


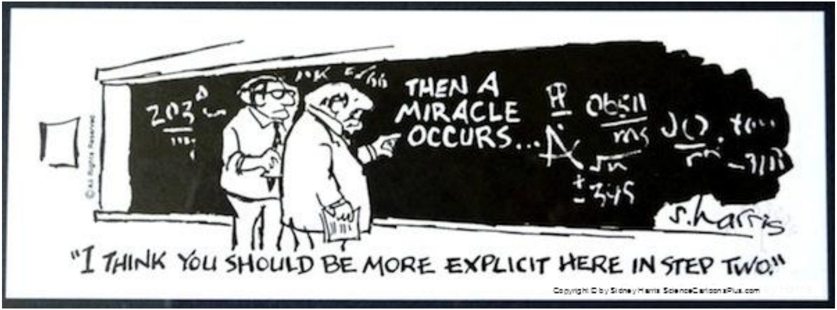
BLACK BOX USERS

WHITE BOX USERS

- Software maintenance: technical documentation
- Developers often belong to the same community as users

Does that influence documentation production?

- Tacit knowledge - informal documentation
- Assumptions about users’ knowledge related to: scientific domain as well as IT & general computing



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Problems with documentation are still there

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"We weren’t really spending time on the documentation. In the end it wasted a lot of time because we couldn’t remember quite what we did. (...) we couldn’t remember how we did things so when the program didn’t work we had quite a long time rectifying it." [Scientist-developer D]

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It's evident in all the data sources that lack of documentation is a major cause of problems!

Main challenges in documentation production

- Lack of time and resources.
- Nature of research - impossible to predict its direction
- Dynamic users' needs
- Users finding new applications for the software...
  ...especially user-developers

Where do users get information about the software?

- Consult the community and share experiences
- Use research publications, conferences, mailing lists, internet forums....
- Deploy the potential of communities and networks of practice

Advantages of consulting the user community

- Cumulative knowledge about software
- Collection of different experiences coming from different viewpoints
- Peer-to-peer understanding
- Inspirational ideas

Challenges in consulting the user community

- Finding those who know
- Taking up people's time
- Competitive research environment

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"If they working on the same problem, you don’t know that, then that may spur them to write the paper quicker. You may end up in a worse position. (...) Sometimes people are working on things and they discover that other people are working on the same thing and then it’s a bit of a race to finish. It’s not fun.” [Scientist-user A]

But still, the user community generates a lot of useful documentation

"If it still doesn't work, I will then look up examples. People often have forums where they ask questions and they do things which are similar. I see how other people have done it and try to understand what is going on." [Scientist-user B]

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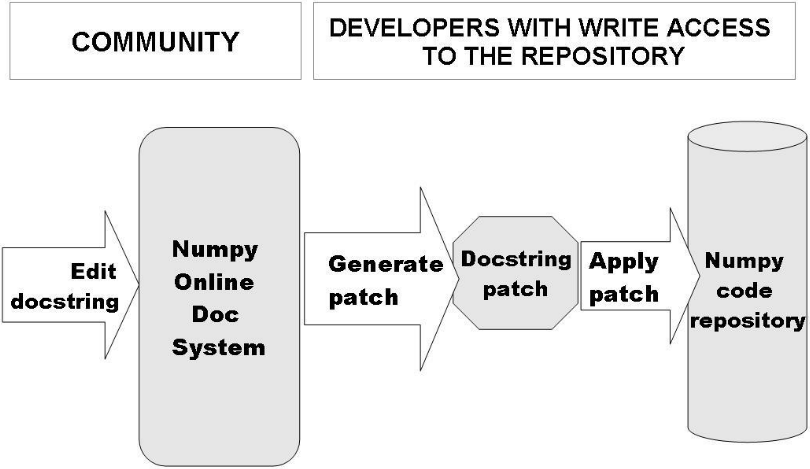
Crowd-sourcing documentation?

Is crowd-sourcing documentation feasible?

SciPy/Numpy Documentation Project

- “Scratching one’s personal itch”
- Securing resources
- Finding a leader / project coordinator
- It’s been out there since 2008: *docs.scipy.org*

Setting up the infrastructure



COMMUNITY

DEVELOPERS WITH WRITE ACCESS TO THE REPOSITORY

Edit docstring

Numpy Online Doc System

Generate patch

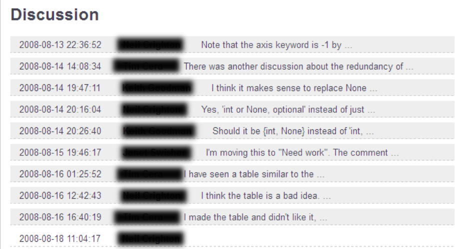
Docstring patch

Apply patch

Numpy code repository

Standards and quality control

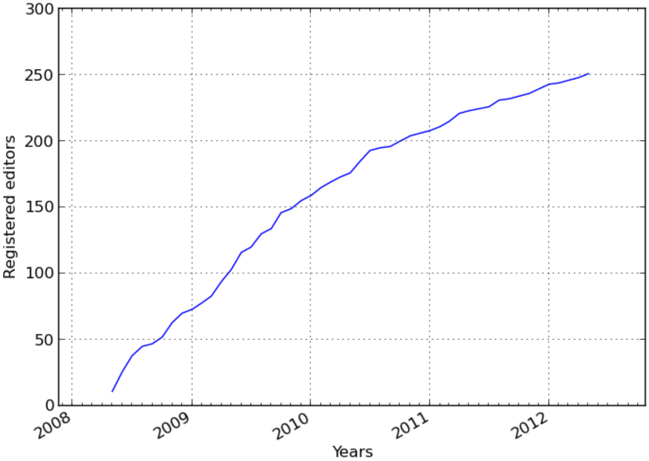
- Numpy/SciPy Docstring Standard: the community discussion
- The workflow: Editing + Proofing + Reviewing
- Editors negotiating changes of docstrings



Discussion

2008-08-13 22:36:52	[redacted]	Note that the axis keyword is -1 by ...
2008-08-14 14:08:34	[redacted]	There was another discussion about the redundancy of ...
2008-08-14 19:47:11	[redacted]	I think it makes sense to replace None ...
2008-08-14 20:16:04	[redacted]	Yes, 'int or None, optional' instead of just ...
2008-08-14 20:26:40	[redacted]	Should it be {int, None} instead of 'int, ...
2008-08-15 19:46:17	[redacted]	I'm moving this to "Need work". The comment ...
2008-08-16 01:25:52	[redacted]	I have seen a table similar to the ...
2008-08-16 12:42:43	[redacted]	I think the table is a bad idea. ...
2008-08-16 16:40:19	[redacted]	I made the table and didn't like it, ...
2008-08-18 11:04:17	[redacted]	

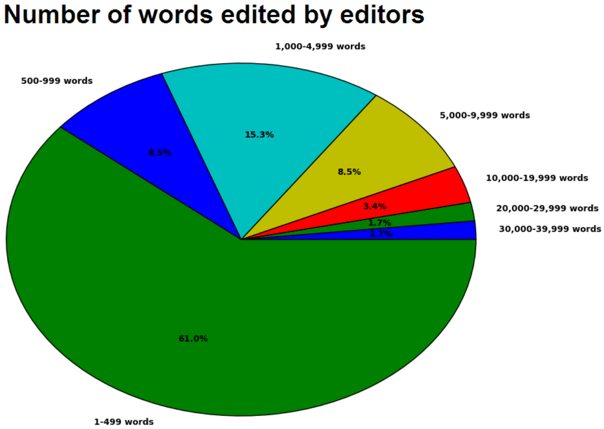
Engaging the community



Keeping up the momentum

- Documentation Marathon 2008
- Progress monitoring - automatic statistics
- Setting up milestones
- Reporting back to the community (annual SciPy Conference)
- The 1000 words T-shirt reward

The Pareto principle



Crowd sourcing documentation: benefits

- Boost in documentation production: >76% coverage; from 8,521 words to over 140,000 words
- Lowering entry barriers - expanding the community
- Documentation written by users for users
- New stakeholders = new opinions, views and concepts

Crowd sourcing documentation: challenges

- New stakeholders = new opinions, views and concepts
- Time & resources investment
- Making it work long-term

Image courtesy of jfravel: http://www.flickr.com/photos/jfravel/283128313/

Conclusions

- Documentation in scientific software - extended definition
- Tacit knowledge and informal information exchange
- Documenting scientific model essential but not sufficient
- Addressing different needs of different users
- Crowd sourcing documentation - balancing challenges and benefits

Thank you for your attention.

Questions?