NeuroFedora

Free Software for Free Neuroscience

NeuroFedora Contributors

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How: Research Pipeline

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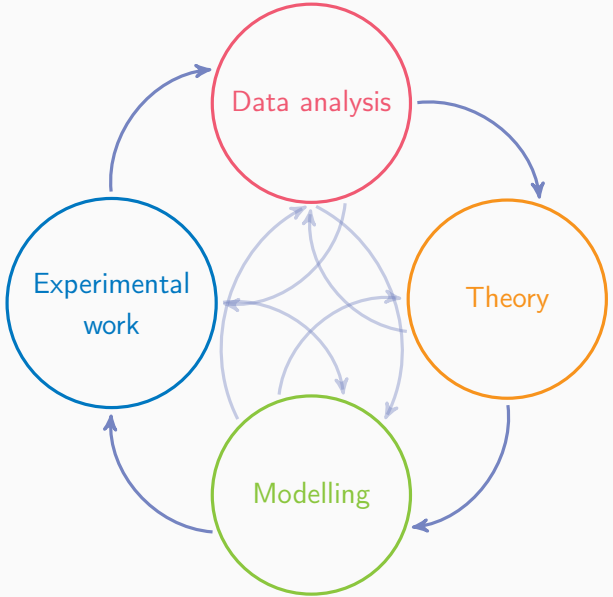
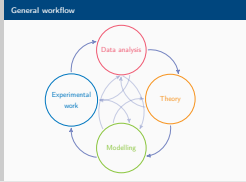
General workflow





1. A simplified diagram. Actually a lot more complex
2. General workflow of research-based work.
3. Most work now-a-days is being carried out with the use of computer software, such as ...

Tools of the trade

Experimental:

- EEG, ECoG, intracellular and extracellular single and multi neuron recording,
- CT, DOI, MRI, f-MRI, MEG, PET,

Data analysis:

- Statistics,
- Machine Learning, Big Data, Deep learning,

Theory and modelling:

- Simulators of all kinds,

1. Experimental: DICOM/Image viewers, fsl tools, software to drive the big machines
2. Data Analysis: Simple/complex libraries, from numpy, scipy to scikit-learn, tensorflow
3. Simulators: Neuron, NEST, plenty more...
4. Lots of hardware and software is required for basic neuroscience research.

Tools of the trade: II

Tools for the dissemination of knowledge[4]:

- visualisation,
- academic writing,
- non academic writing: blogging . . . ,
- pod-casting,
- video making,
- creating teaching materials,
- collaborative tools and utilities

[4] also to a non-specialist audience.

1. common tools used by people in science and research

Free/Open (neuro) Science

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The ideal, in short:

Free/Open Science:
Everyone should have the freedom to share, study, and modify scientific material.

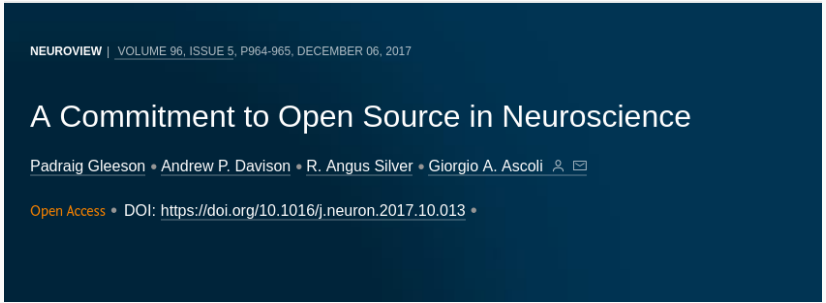
FOSS:
Everyone should have the freedom to share, study, and modify software[5].

Free/Open Science includes and relies heavily on Free/Open Source Software (FOSS).

[2] Free software foundation

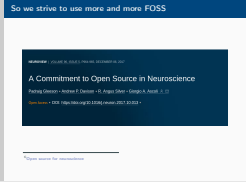
1. simple definitions

So we strive to use more and more FOSS



[6] Open source for neuroscience

So we strive to use more and more FOSS



1. reproducibility crisis. unable to reproduce data, results
2. benefits of open-sourcing code. helps community. reuse. build-on and improve. publication becomes an advert for the code.

NeuroFedora: why, how, what?

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Neuroscience community: highly multidisciplinary

- various specialities: biologists, mathematicians, physicists, chemists, psychologists, . . . ,
- small proportion of trained software developers

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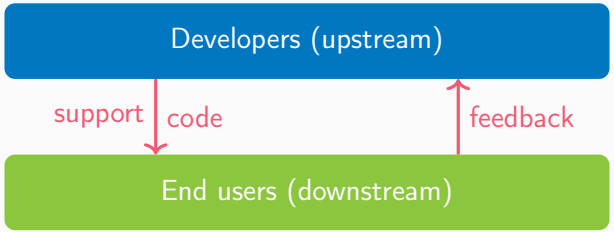
1. Full of people from various fields
2. Not all have the required XP

FOSS: Developers and users



FOSS: Developers and users
Developers (upstream)
support
code
feedback
End users (downstream)

1. The dev may not provide instructions on how to use the software
2. Difficult for people who lack programming knowledge to build/use the tool directly from the dev.
3. End users not always provide feedback

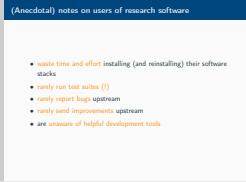
(Anecdotal) notes on development of research software

- often single developer, or small development teams
- limited maintenance, short-lived projects
- limited access to hardware/resources
- limited code quality
- limited use of established best practices
- limited testing for correctness (!)
- complex dependency chains
- lack of documentation and support
- lack of community development know-how

1. Given how interdisciplinary neuroscience is, most researchers are NOT trained in development
2. based on anecdotal evidence, software used in research is not of the best quality
3. may or may neet development standards
4. may have an instruction set on how to install/use the software
5. resolving dependencies can be difficult

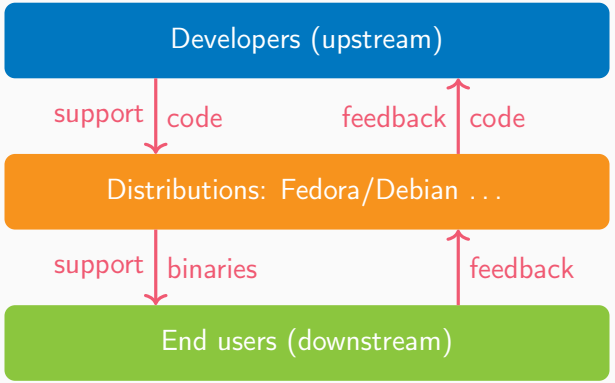
(Anecdotal) notes on users of research software

- waste time and effort installing (and reinstalling) their software stacks
- rarely run test suites (!)
- rarely report bugs upstream
- rarely send improvements upstream
- are unaware of helpful development tools

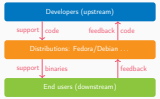


1. The other side of the bridge is the users
2. also suffer from resolving dependencies
3. lack the required skill/knowledge of programming, they have a hard time setting up and using the software
4. If correctness of a tool cannot be verified, how can the correctness of the scientific result be claimed?

Distributions liaison between developers and users



Distributions liaison between developers and users



1. role of distros:
2. liaison between the users and developers
3. provide feedback, report bugs to the dev
4. simplify installation/usage XP

Distributions, like Fedora, are in a unique position:

- liaison between upstream and users
- have the infrastructure
- follow best practices in software development
- constantly work on community development
- learn from one another—train while working
- disseminate information to end-users

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1. high end servers. multiple mirrors across the globe
2. firm packaging guidelines; go through a heavy-duty review process; proper testing of the software before releasing to the general user
3. many contributors hail from different backgrounds, and have a lot to learn
4. provide help to the users

NeuroFedora:

Primary goal:

- Provide a ready to use, integrated FOSS platform for neuroscientists[7].

Secondary/collateral goals:

- help improve the standard and maintenance of tools
- help users develop software development skills
- make neuroscience accessible to non-specialists

[7] Researchers, academics, hobbyists, anyone!

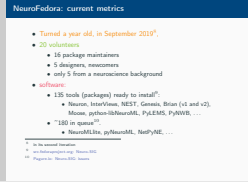
NeuroFedora: current metrics

- Turned a year old, in September 2019[8],
- 20 volunteers
  - 16 package maintainers
  - 5 designers, newcomers
  - only 5 from a neuroscience background
- software:
  - 135 tools (packages) ready to install[9]:
    - Neuron, InterViews, NEST, Genesis, Brian (v1 and v2), Moose, python-libNeuroML, PyLEMS, PyNWB, ...
  - ~180 in queue[10].
    - NeuroMLlite, pyNeuroML, NetPyNE, ...

8 in its second iteration

9 src.fedoraproject.org: Neuro-SIG

10 Pagure.io: Neuro-SIG: issues



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