NeuroFedora

FOSS and Free and Open (Neuro)Science

NeuroFedora contributors
neuro.fedoraproject.org

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Open Science

Everyone should have the freedom to study, modify, and share scientific material[1].

[1] http://opensourceforneuroscience.org/

Open science is transparent and accessible knowledge that is shared and developed through collaborative networks.

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Scientists, academics, students, researchers, non-scientists, and non-academics should all have access to scientific material—irrespective of social status, location, age, nationality

. . . .

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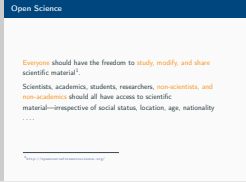

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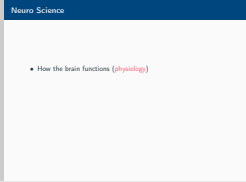
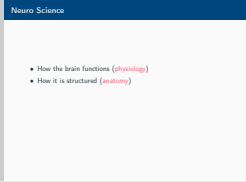
Neuro Science

- How the brain functions (physiology)



Neuro Science

- How the brain functions (physiology)
- How it is structured (anatomy)



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How: Research Pipeline

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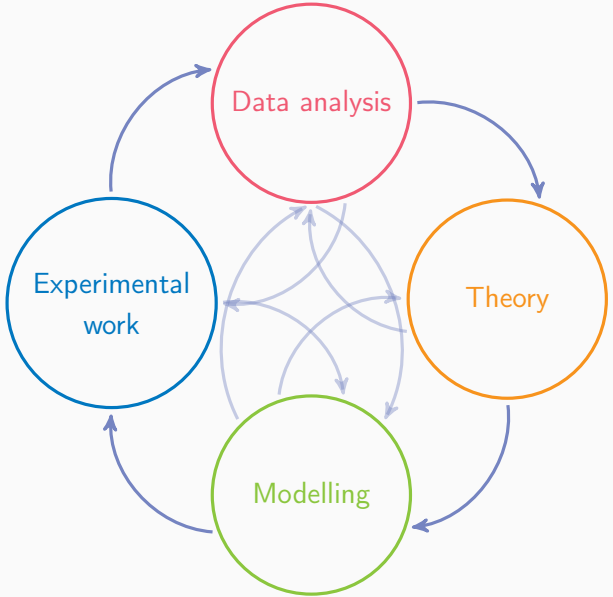
Basic Workflow



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,

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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.

Free/Open (neuro) Science

Free/Open (neuro) Science

The ideal, in short:

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

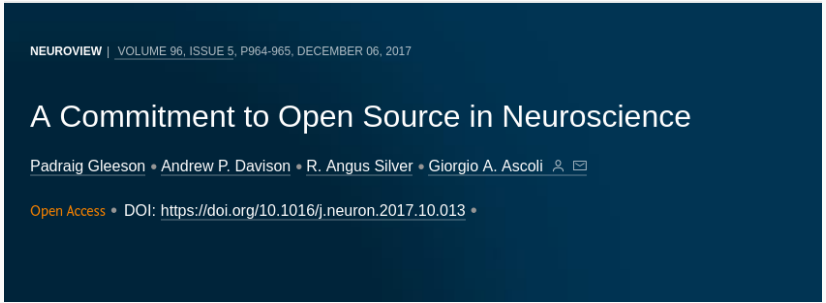
FOSS:
Everyone should have the freedom to share, study, and modify software[5].

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

[2] Free software foundation

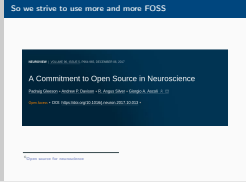
1. Summarizing everything
2. With the help of NeuroFedora we want to consolidate the two movements

So we strive to use more and more FOSS



[6] Open source for neuroscience

So we strive to use more and more FOSS



1. A fun paper to read on Open Science + Open Software
2. Discusses reproducibility crisis. Where people are unable to reproduce data, results
3. Also the 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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Let's talk about the neuroscience community first

Neuroscience community: highly multidisciplinary

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

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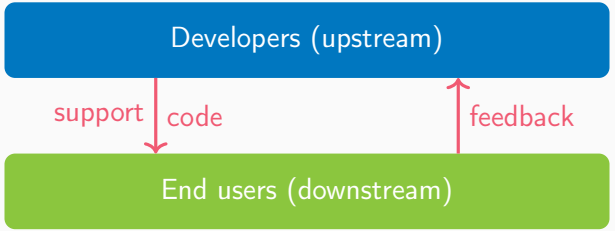
1. The community is multi-disciplinary
2. Full of people from various fields
3. Not all have the required XP

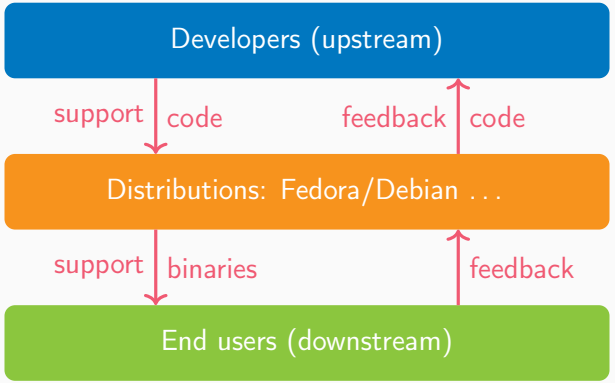
FOSS: Developers and users



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

1. Issues with the flowchart: 1. Dev assumes the end users are knowledgeable, who know how to build/install their tool? 2. The devs expect the end users to provide regular feedback, run tests etc.
2. based on anecdotal evidence, software used in research is not of the best quality
3. may or may not meet development standards
4. may not have an instruction set on how to install/use the software
5. users also suffer from resolving dependencies
6. lack the required skill/knowledge of programming, they have a hard time setting up and using the software
7. If correctness of a tool cannot be verified, how can the correctness of the scientific result be claimed?

Distributions liaison between developers and users



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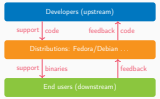

1. role of distros:
2. liaison between the users and developers
3. provide feedback, report bugs to the dev
4. simplify installation/usage XP

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:

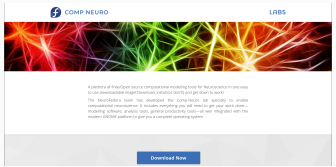
- help improve the standard and maintenance of tools
- help users develop software development skills
- make neuroscience accessible to non-specialists

[7] Researchers, academics, hobbyists, anyone!

NeuroFedora: What we offer?

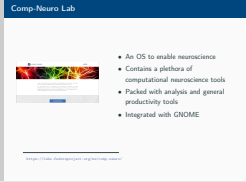
So, what we, as a SIG, are offering to the community?

Comp-Neuro Lab



- An OS to enable neuroscience
- Contains a plethora of computational neuroscience tools
- Packed with analysis and general productivity tools
- Integrated with GNOME

https://labs.fedoraproject.org/en/comp-neuro/



1. The comp-neuro OS is a "spin" of Fedora with all the neuro tools pre-installed
2. Easy to use, just install and play

Comp-Neuro Container

- A ready-to-use comp-neuro container
- Can be used with Podman/Docker
- Can be obtained from standard public container image registries like Docker Hub

https://docs.fedoraproject.org/en-US/neurofedora/containers/
https://podman.io/
https://www.docker.com/

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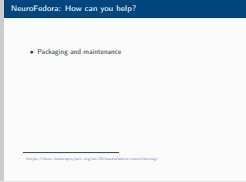
NeuroFedora: How can you help?

- Packaging and maintenance

https://docs.fedoraproject.org/en-US/neurofedora/contributing/



1. Packages that we provide must go through the Fedora Quality Assurance (QA) process. You can simply enable the updates-testing repository and help by testing updates.
2. Bugs must be reported to the bugzilla. Any bugs related to packages can be helped with at upstream
3. User documentation is a most important resource. You can help by improving or contributing to our documentation.
4. We've set up communication channels to help users troubleshoot issues and get help. You can help by remaining present in the communication channels and answering users' questions.
5. Help us spread the word! Write about NeuroFedora, share your opinions on social media, help more people learn about the project and get involved!

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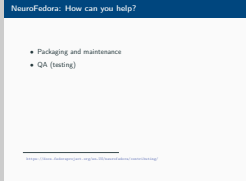

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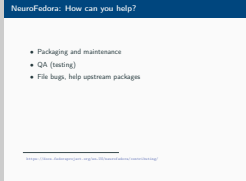

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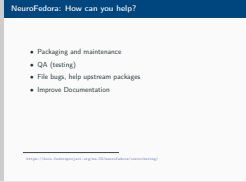

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- QA (testing)
- File bugs, help upstream packages
- Improve Documentation
- Help other users

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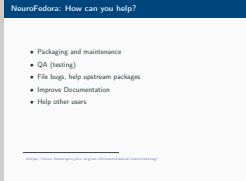

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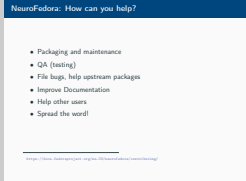

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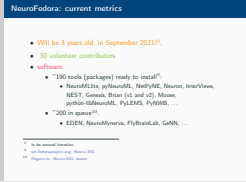
NeuroFedora: current metrics

- Will be 3 years old, in September 2021![8],
- 30 volunteer contributors
- software:
  - ~190 tools (packages) ready to install[9]:
    - NeuroMLlite, pyNeuroML, NetPyNE, Neuron, InterViews, NEST, Genesis, Brian (v1 and v2), Moose, python-libNeuroML, PyLEMS, PyNWB, ...
  - ~200 in queue[10].
    - EDEN, NeuroMynerva, FlyBrainLab, GeNN, ...

8 in its second iteration

9 src.fedoraproject.org: Neuro-SIG

10 Pagure.io: Neuro-SIG: issues



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