Open is not enough: benefits from Debian as an integrated, community-driven computing platform

Yaroslav O. Halchenko & Michael Hanke

Debian Project
Dartmouth College, New Hampshire
University of Magdeburg, Germany

SEA 2013, Boulder CO

March 2 2013

Am I the right person?

To: debian-user@lists.debian.org
Subject: Duplicating Debian Installations?
From: tres@rap.ucar.EDU (Tres Hofmeister)
Date: Mon, 19 Aug 1996 19:10:41 -0600 (MDT)

Can someone point me towards info. on how one can duplicate the packages installed on one Debian system on another? Going through dselect by hand seems just a bit too tedious for multiple installations... Thanks.

--
Tres Hofmeister Research Applications Program
tres@ncar.ucar.edu National Center for Atmospheric Research

---

https://lists.debian.org/debian-user/1996/08/msg00890.html

Based on a true story...

www.frontiersin.org/Neuroinformatics/10.3389/fninf.2012.00022/full

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Front. Neuroinform., 29 June 2012 | doi: 10.3389/fninf.2012.00022

Open is not enough. Let's take the next step: an integrated, community-driven computing platform for neuroscience

Yaroslav O. Halchenko[1,2,3,†*] and Michael Hanke[4,5,3,†*]

1 Center for Cognitive Neuroscience, Dartmouth College, Hanover, NH, USA
2 Department of Psychological and Brain Sciences, Dartmouth College, Hanover, NH, USA
3 Debian Project, http://www.debian.org
4 Department of Experimental Psychology, Otto-von-Guericke University, Magdeburg, Germany
5 Center for Behavioral Brain Sciences, Magdeburg, Germany

The last 5 years have seen dramatic improvements in the collaborative research infrastructure. A need for open research tools has been identified (Ince et al., 2012), and one solution has been clearing houses, such as the INCF Software Center[1], and the NITRC[2] portal, which facilitate efforts of

Who is talking?

I and 

Who is talking?

http://www.pymvpa.org

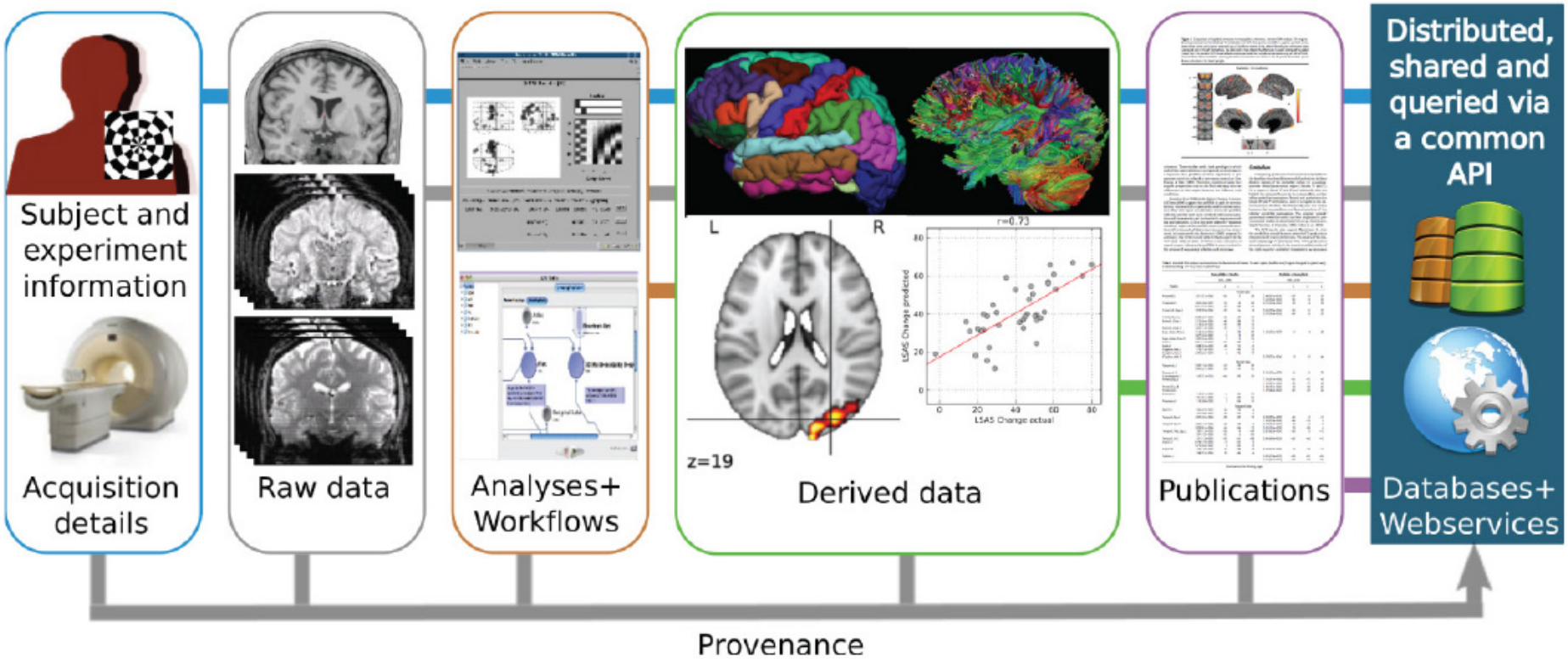
Who is talking?

http://www.debian.org

Who is talking?

`http://neuro.debian.net`

Our domain



Poline *et. al*, Data sharing in neuroimaging research, 10.3389/fninf.2012.00009

Our belief #1

There is **no** alternative to free and open-source software for scientific research.

Common problem: Availability != Accessibility

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"Standard" model of scientific software deployment

To download and install A on your system, you need to:

- Register/Request an account from the B
- Read these notes for C and D systems
- Download the source code and/or appropriate binaries for your system from E
- Remove old versions
- Install software
- Test software

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- Test software
- If you decide to go forth with building from source code, good luck!

Possible user experiences

Not so positive

- Software developers have no access to my system X and I need to build a few (dozens) of additional pre-requisites first:
  - I better ask our IT personnel to deploy it – usually takes less than a month
  - PhD students have all the time in the universe . . .

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Positive

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Positive

- Only an hour and "A" seems to be running – I can get back to do research again!
- Student's life is short:
  - Having A on one box should be enough
  - I better not have to upgrade it ever again
  - I will not even think about F and G alternatives
  - I value others' time: let me blog a "HOWTO install A v. x.y.z on C"

Hanke, M. (2012). Share your tools! But fear the wombat!

http://youtu.be/8t6znEOEDVo

Not so positive

- Software developers have no access to my system X an[...] need to build a few (dozens) of additional pre-requisit[...] first:
  - I better ask our IT personnel to deploy it – u[...] takes l[...] than a month
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WOMBAT

Positive

- Only an hour [...] se[...] to be ru[...] do research agai[...]
- S[...]de[...] ife is [...]rt.
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  - [...]tter not have to upgrade it ever ag[...]
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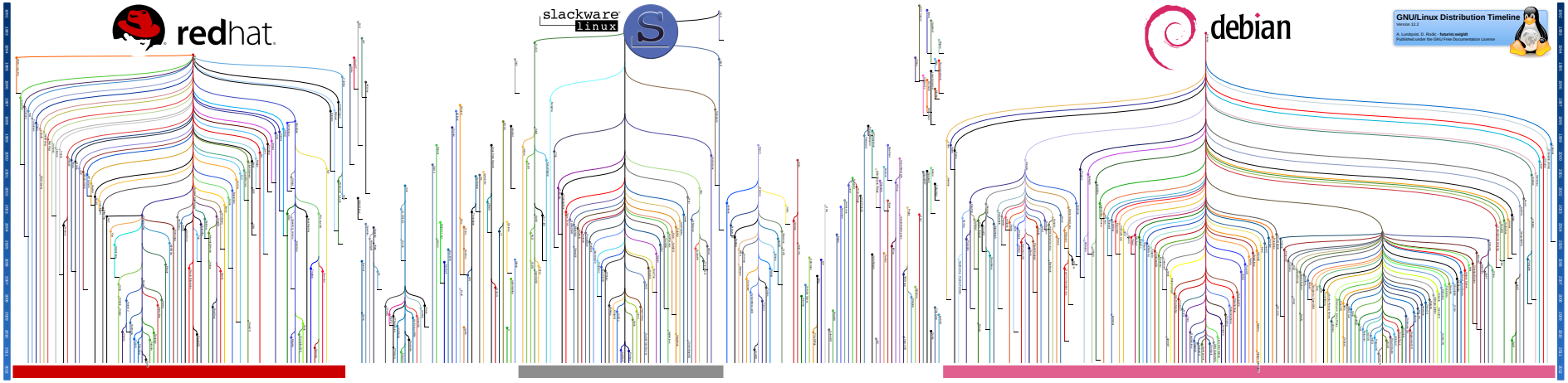
Scientists report:

[illegible] GNU/ Linux users report the lowest average time they need to invest in maintenance of their personal computing environment (5.77 h/ month). [illegible]

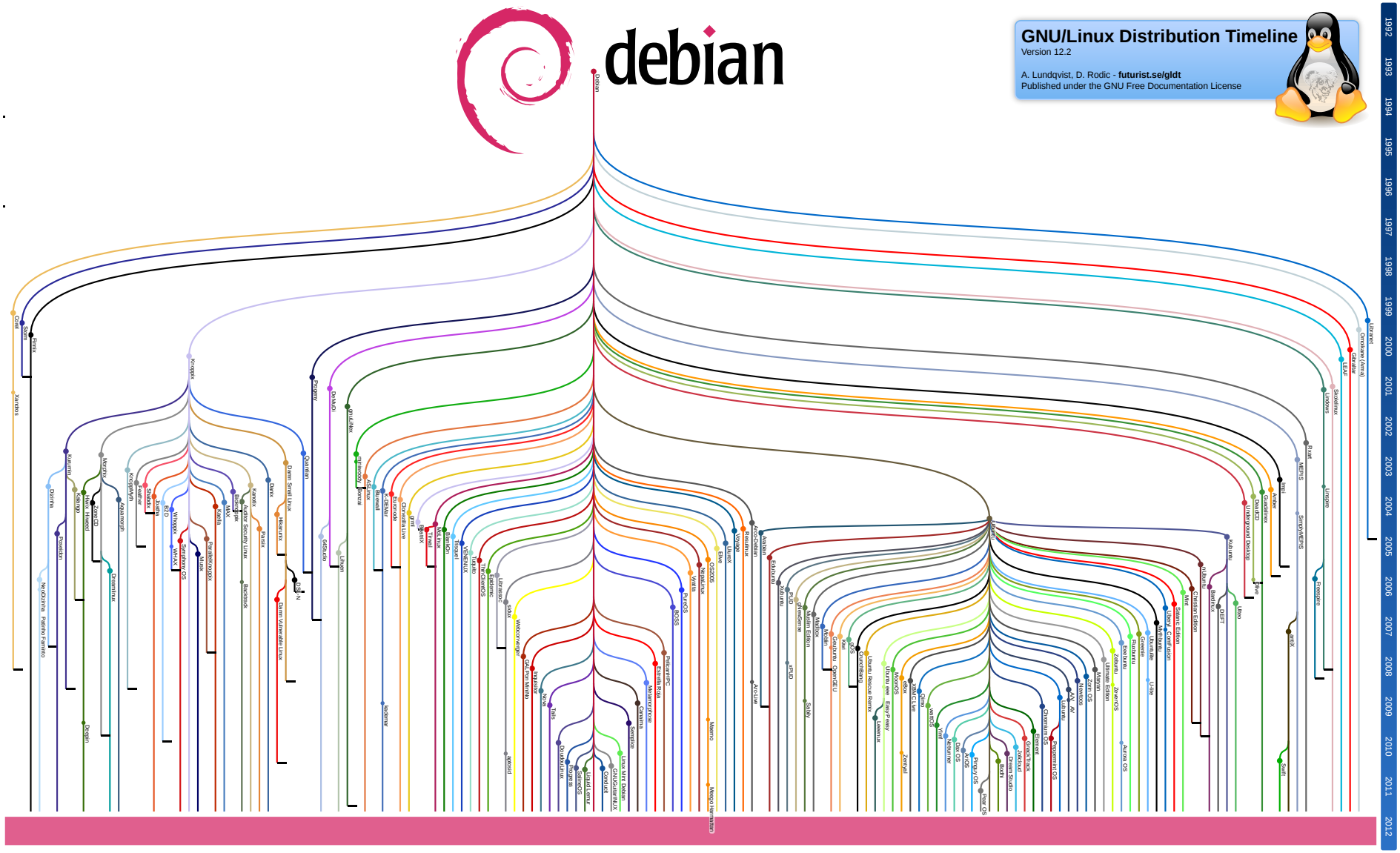
Hanke M and Halchenko YO (2011) *Neuroscience runs on GNU/Linux.* Front. Neuroinform. 5:8. doi: 10.3389/fninf.2011.00008

GNU/Linux'es



http://futurist.se/gldt

GNU/Linux'es



http://futurist.se/gldt

Our belief #2

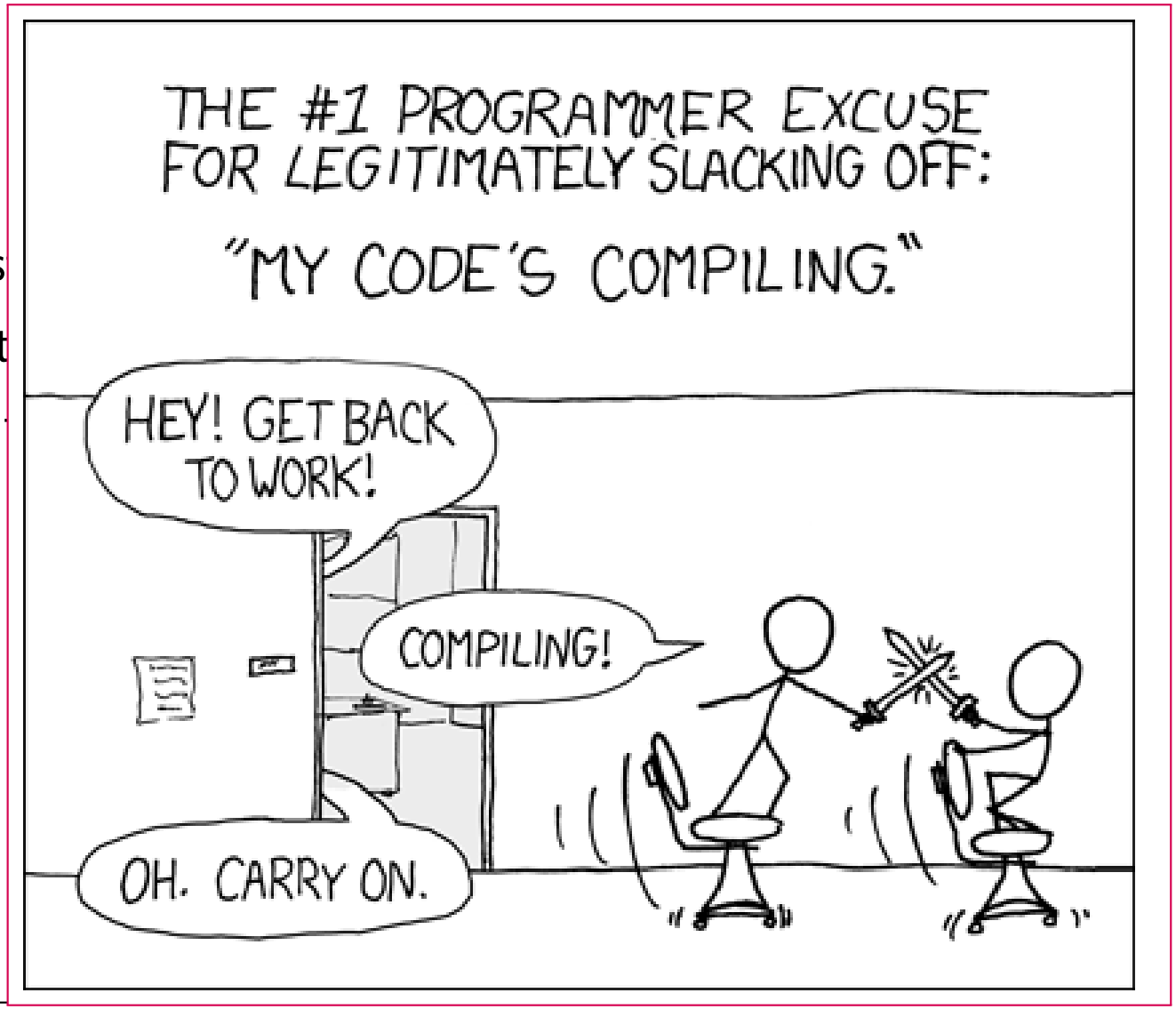
Debian provides the best proven, scalable, and sustainable approach toward free and open-source software platform for scientific research.

Debian's recipe

- Open standards
- Vibrant community: democracy and do-o-cracy
- Integration starting with the core OS
- Binary distribution based on source packages

Debian's recipe: Binary distribution

- Open s
- Vibrant
- Integra
- Binary



http://xkcd.com/303

Debian's recipe

- Open standards
- Vibrant community: democracy and do-o-cracy
- Integration starting with the core OS
- Binary distribution based on source packages
- Extensible distribution and archival infrastructure

Legal assurance Was: Register/Request an account from the B

3 Debian archive *areas*

- main – software under DFSG compliant licenses [1]
- contrib – DFSG-wannabees (depend on non-free) or helpers (*e.g.*, matlab-support)
- non-free – (re-)distributable but restricted

[1] See Debian Social Contract `http://www.debian.org/social_contract`

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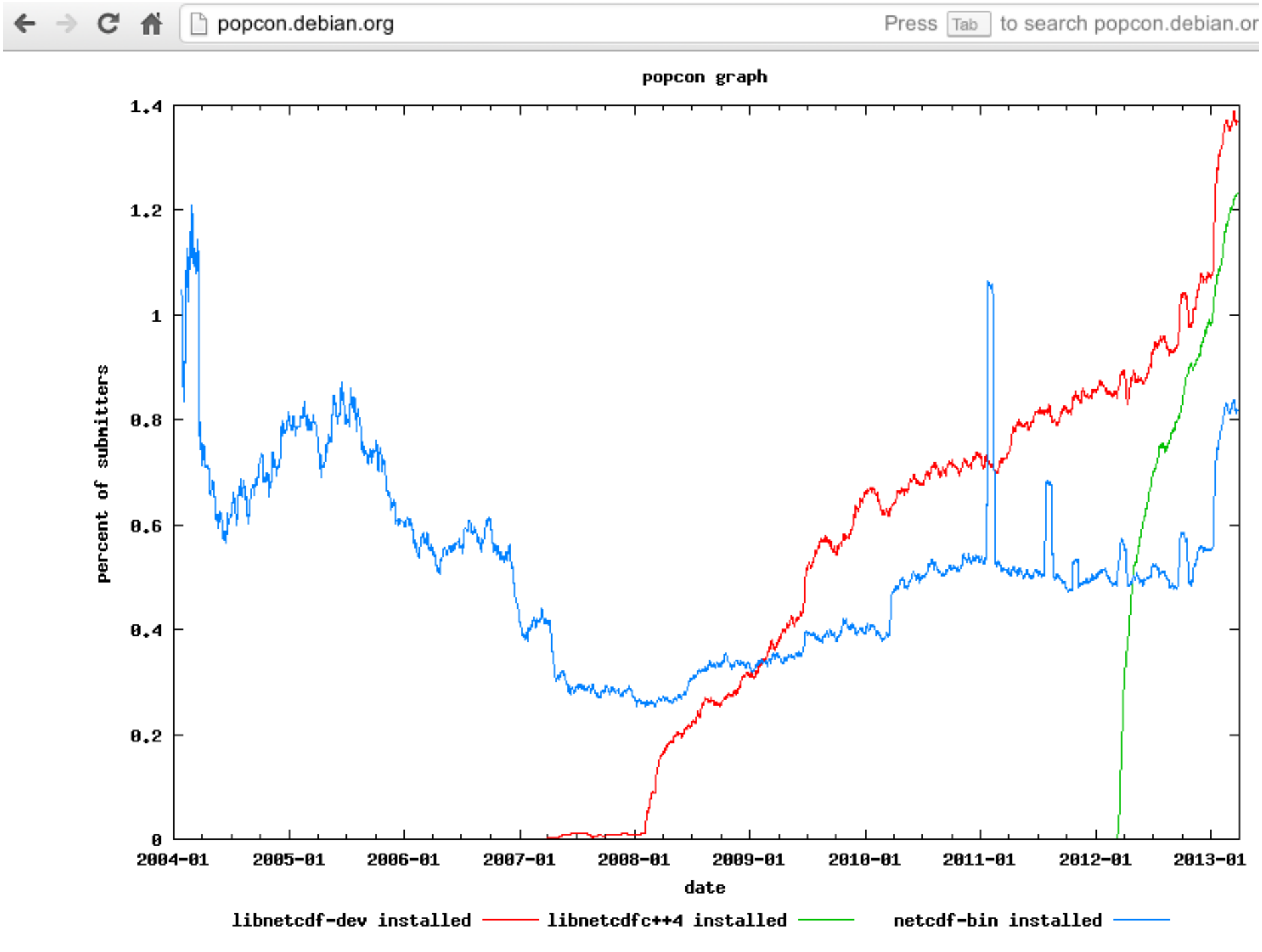
Pros

- you know that everything is free and open-source
- eases integration
- helps to assure longevity
- `http://popcon.debian.org` is there to replace "registration" pages

[1] See Debian Social Contract `http://www.debian.org/social_contract`


popcon.debian.org
Press Tab to search popcon.debian.or
popcon graph
percent of submitters
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2004-01
2005-01
2006-01
2007-01
2008-01
2009-01
2010-01
2011-01
2012-01
2013-01
date
libnetcdf-dev installed
libnetcdfc++4 installed
netcdf-bin installed

Legal assurance Was: Register/Request an account from the B

Recommendations

- use standard OSI (`http://opensource.org`) and DFSG compliant licenses
- do not restrict the domain of application without need
- do not insert code/data with questionable license terms
- maintain a top-level list of licenses used in you project
- beware-of and/or state your trademark policies

Building

Building : developers

Image by Lewis Hine, 1930

Building : well-engineered software

Image by Lewis Hine, 1930
Image by Ad Meskens

Building : “state-of-art”

Image (C) 2006 by Nora Vass and Gergely Vass, GDFL

Building Was: If you decide to go with building from source code, good luck!

- Debian packaging strictly follows Debian Policy[1]
- 3rd-party modules become 1st-class citizens
- Figure out dependencies once – specify in debian/control
- Figure out building/installation once – specify in debian/rules

[1] `http://www.debian.org/doc/debian-policy/`

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- Figure out building/installation once – specify in debian/rules

Pros

- anyone can build any PACKAGE:
  `apt-get source -b PACKAGE`
- simplifies contributions
- allow for archive-wide QA rebuilds
  - library migrations
  - new compilers
  - new ports

[1] `http://www.debian.org/doc/debian-policy/`

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Recommendations

- keep source distribution modular:
  - code-vs-data
  - keep 3rd party as 3rd party – do not clone
- have a deterministic version
- provide exhaustive specification of (build-)dependencies
- assure API/ABI compatibility if you deliver libraries:
  - http://upstream-tracker.org/
  - http://github.com/lvc/abi-compliance-checker

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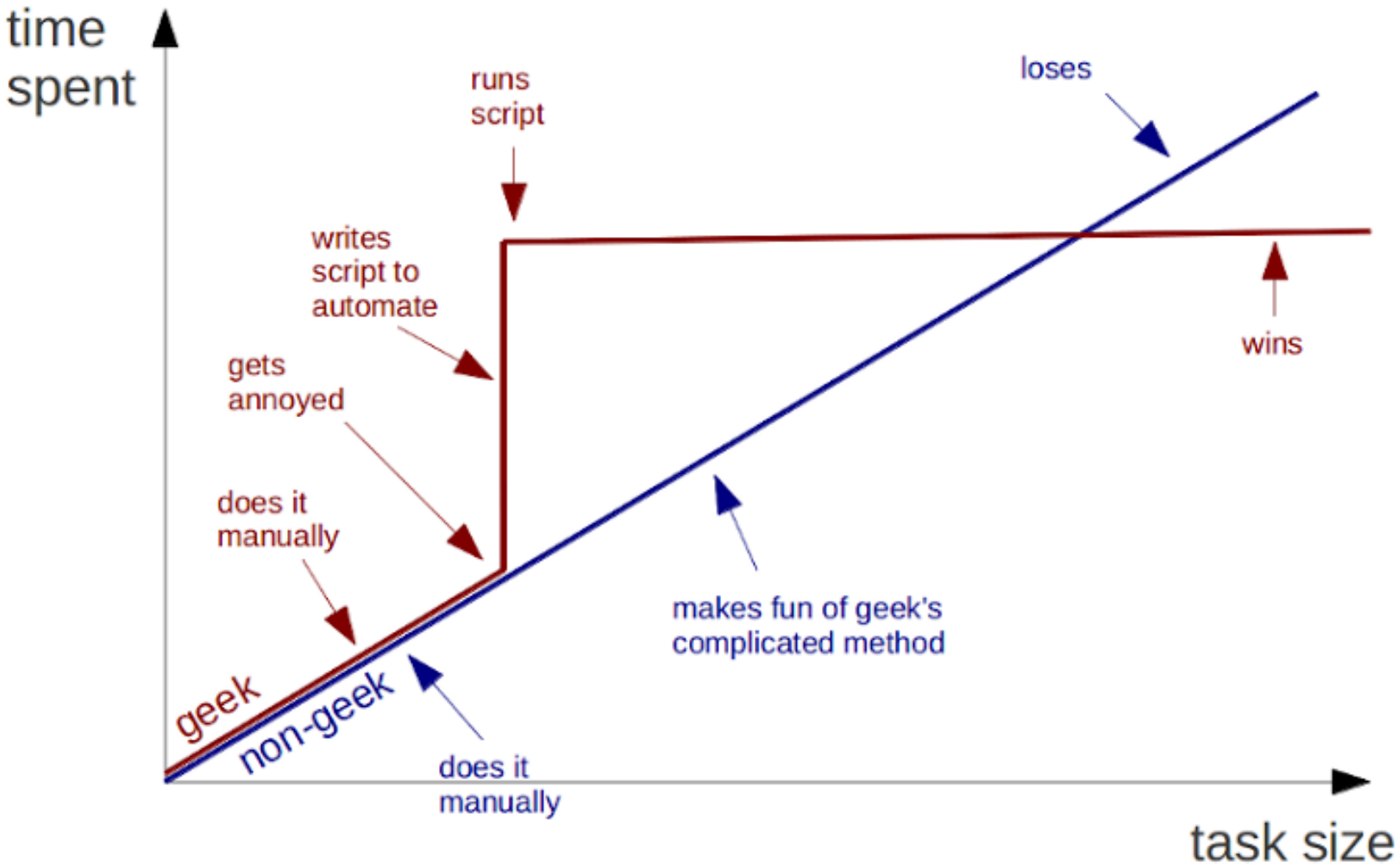
Above recommendations will help to deliver your software to any integration/distribution platform, not just Debian.

Testing

Geeks and repetitive tasks



Testing Was: Test software

- debian/rules: can exercise tests while building the binary packages

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Pros

- obtain a CI farm with $>$ 13 architectures/ports
- have I mentioned archive wide QA rebuilds?
  Go ahead of the OS not behind
- preclude problems on users' deployments

Testing Was: Test software

- debian/rules: can exercise tests while building the binary packages

Pros

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- have I mentioned archive wide QA rebuilds?
  Go ahead of the OS not behind
- preclude problems on users' deployments

- autopkgtest: automatic as-installed package testing

Pros

- exercise testing on installed machines
- could be "heavy" tests

Testing Was: Test software

Recommendations

- share your unit-, regression-, integration- tests
- work on your tests coverage

Testing Was: Test software

Recommendations

- share your unit-, regression-, integration- tests
- work on your tests coverage
- more problems we catch before delivering to users – less of WOMBAT

Installation, upgrades Was: Remove old versions; Install software

Install simple editor

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apt-get install gedit
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Install the entire suite of packages for meteorology

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apt-get install science-meteorology
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```

Install workload management system

```
apt-get install condor
```

Install the entire suite of packages for meteorology

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apt-get install science-meteorology
```

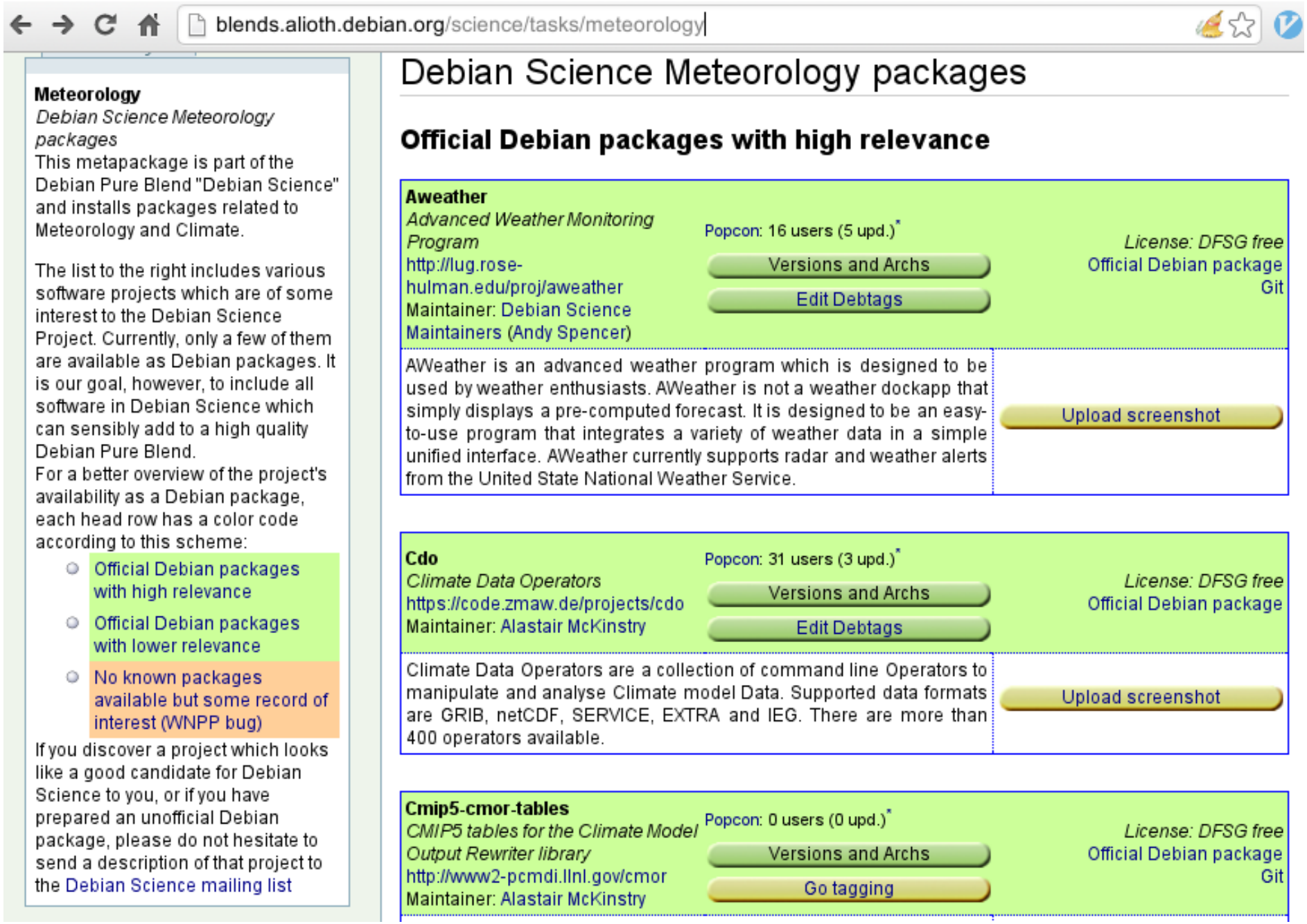
Keep the whole system up-to-date

```
apt-get update && apt-get upgrade
```

Climate/atmospheric research FOSS in Debian

Debian Science : `http://wiki.debian.org/DebianScience`
`http://blends.alioth.debian.org/science/tasks/meteorology`

Task pages: astronomy, astronomy-dev, bci, biology, chemistry, dataacquisition, dataacquisition-dev, distributedcomputing, electronics, electrophysiology, engineering, engineering-dev, geography, highenergy-physics, highenergy-physics-dev, imageanalysis, linguistics, machine-learning, mathematics, mathematics-dev, meteorology, meteorology-dev, nanoscale-physics, nanoscale-physics-dev, neuroscience-cognitive, neuroscience-datasets, neuroscience-modeling, numericalcomputation, physics, physics-dev, psychophysics, robotics, simulations, statistics, typesetting, viewing


blends.alioth.debian.org/science/tasks/meteorology
Meteorology
Debian Science Meteorology packages
This metapackage is part of the Debian Pure Blend "Debian Science" and installs packages related to Meteorology and Climate.
The list to the right includes various software projects which are of some interest to the Debian Science Project. Currently, only a few of them are available as Debian packages. It is our goal, however, to include all software in Debian Science which can sensibly add to a high quality Debian Pure Blend.
For a better overview of the project's availability as a Debian package, each head row has a color code according to this scheme:
Official Debian packages with high relevance
Official Debian packages with lower relevance
No known packages available but some record of interest (WNPP bug)
If you discover a project which looks like a good candidate for Debian Science to you, or if you have prepared an unofficial Debian package, please do not hesitate to send a description of that project to the Debian Science mailing list
Debian Science Meteorology packages
Official Debian packages with high relevance
Aweather
Advanced Weather Monitoring Program
http://lug.rose-hulman.edu/proj/aweather
Maintainer: Debian Science Maintainers (Andy Spencer)
Popcon: 16 users (5 upd.)
Versions and Archs
Edit Debtags
License: DFSG free
Official Debian package
Git
AWeather is an advanced weather program which is designed to be used by weather enthusiasts. AWeather is not a weather dockapp that simply displays a pre-computed forecast. It is designed to be an easy-to-use program that integrates a variety of weather data in a simple unified interface. AWeather currently supports radar and weather alerts from the United State National Weather Service.
Upload screenshot
Cdo
Climate Data Operators
https://code.zmaw.de/projects/cdo
Maintainer: Alastair McKinstry
Popcon: 31 users (3 upd.)
Versions and Archs
Edit Debtags
License: DFSG free
Official Debian package
Climate Data Operators are a collection of command line Operators to manipulate and analyse Climate model Data. Supported data formats are GRIB, netCDF, SERVICE, EXTRA and IEG. There are more than 400 operators available.
Upload screenshot
Cmip5-cmor-tables
CMIP5 tables for the Climate Model Output Rewriter library
http://www2-pcmdi.llnl.gov/cmor
Maintainer: Alastair McKinstry
Popcon: 0 users (0 upd.)
Versions and Archs
Go tagging
License: DFSG free
Official Debian package
Git

Climate/atmospheric research FOSS in Debian

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Alastair McKinstry <mckinstry@debian.org>
Ireland's High-Performance Computing Centre http://www.ichec.ie

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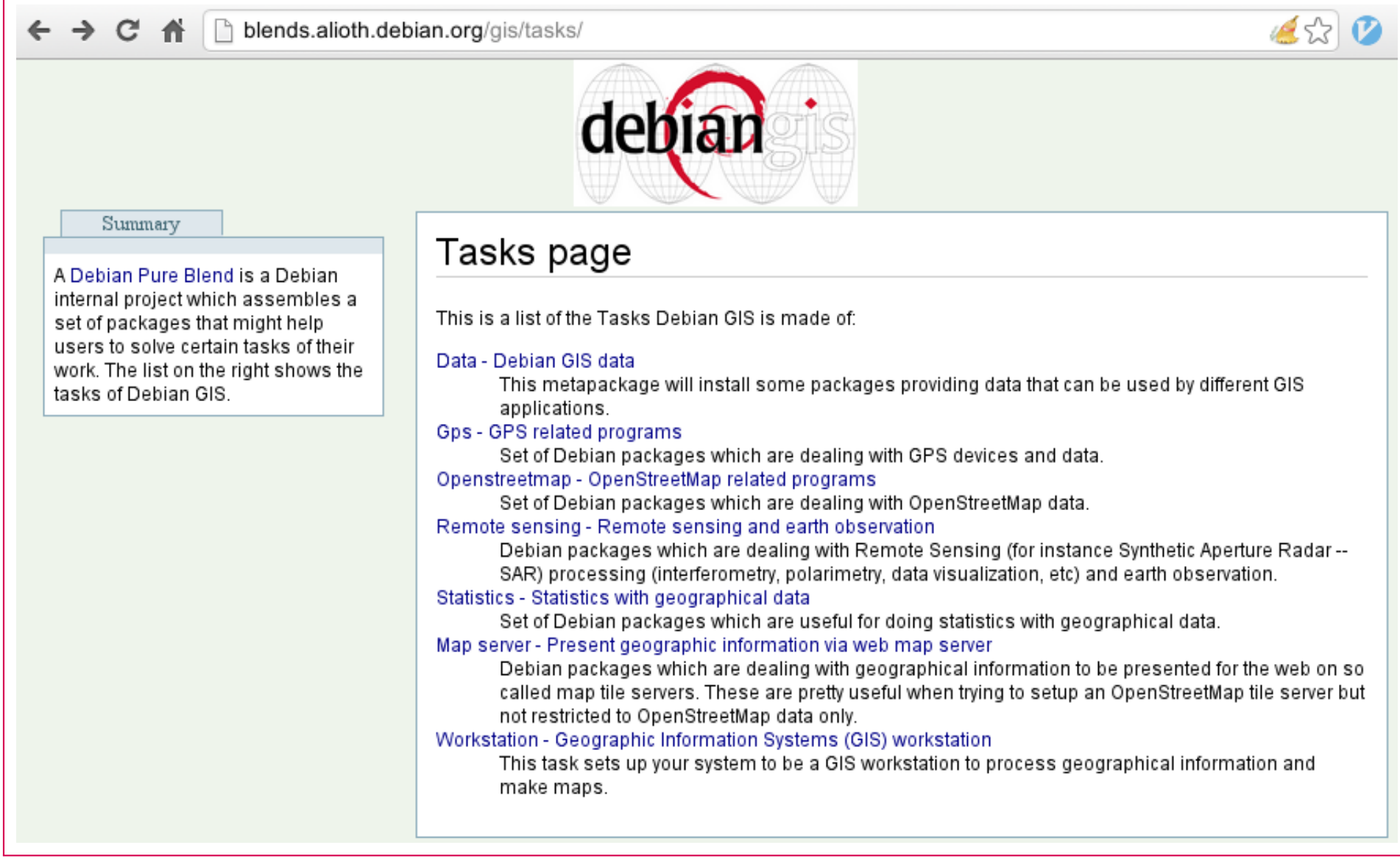
Alastair McKinstry <mckinstry@debian.org>
Ireland's High-Performance Computing Centre http://www.ichec.ie

Debian GIS : http://wiki.debian.org/DebianGis
http://blends.alioth.debian.org/gis/tasks/
Francesco P. Lovergine" <frankie@debian.org>

Climate/atmospheric research FOSS in Debian



Additional benefits (in examples)

- Longevity
- Reproducibility

Longevity

XGKS: Graphical Kernel System for the X Window System

`http://xgks.sourceforge.net`

- developed within `unidata.ucar.edu`
- now considered legacy:
  2.6 in 2000, 2.6.2 release in 2005-02-03
- still used by
  - Ferret: http://www.ferret.noaa.gov
  - UV-CDAT: http://uvcdat.llnl.gov from LLNL, DOE
- and is still maintained in Debian

Longevity

Recommendations

- **do not under-estimate the number of your users**
- prepare your software for the after-life:
  - clean legal terms
  - commented code
  - reliable build infrastructure

Reproducibility

- `http://archive.debian.org` – archive of ever existed releases

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  Example: state of a development box in 2003:

```
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- `schroot` – enter into the environment upon your convenience

```
> cat /etc/schroot/chroot.d/lenny-20080407
[potato]
description=Antique Debian from 2003
directory=/tmp/potato
users=YOURLOGIN
> schroot -c potato
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- `http://snapshots.debian.org` – snapshots of the archive

```
debootstrap --arch=i386 --include build-essential,libnetcdf-dev \
  testing /tmp/testing \
  http://snapshot.debian.org/archive/debian/20080407T000000Z/
```

Take home

If you care about open, accessible and reproducible science:

Get all software you care about into Debian!

Thanks

http://www.debian.org
http://neuro.debian.net

Yaroslav O. Halchenko
yoh@debian.org
Michael Hanke
mih@debian.org

about the slides:
available at http://neuro.debian.net/#publications

```
apt-get install -t audience [-a microphone] questions
```

Debian, 19 years old

- $\approx$ 18'704 (main), 222 (contrib), 506 (non-free) source packages
- $\approx$ 38'537 (main), 141 (contrib), 289 (non-free) binary packages
- largest n. of ports among mainstream distros (11 official, 11 unofficial)
  - 2 non-Linux ports: GNU/kFreeBSD + (unofficial Hurd)

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- 12 stable releases
  - The latest stable release: 6.0 Squeeze, February 6th 2011
  - Upcoming stable release: 7.0 Wheezy, TBA 2013
  - Released ≈ 2-3 years
  - Security support for 3 years
  - Upgradable

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- 12 stable releases
- 2 1/2 rolling releases: testing, unstable (sid), experimental

Debian, 19 years old: $>$ 100 derivatives

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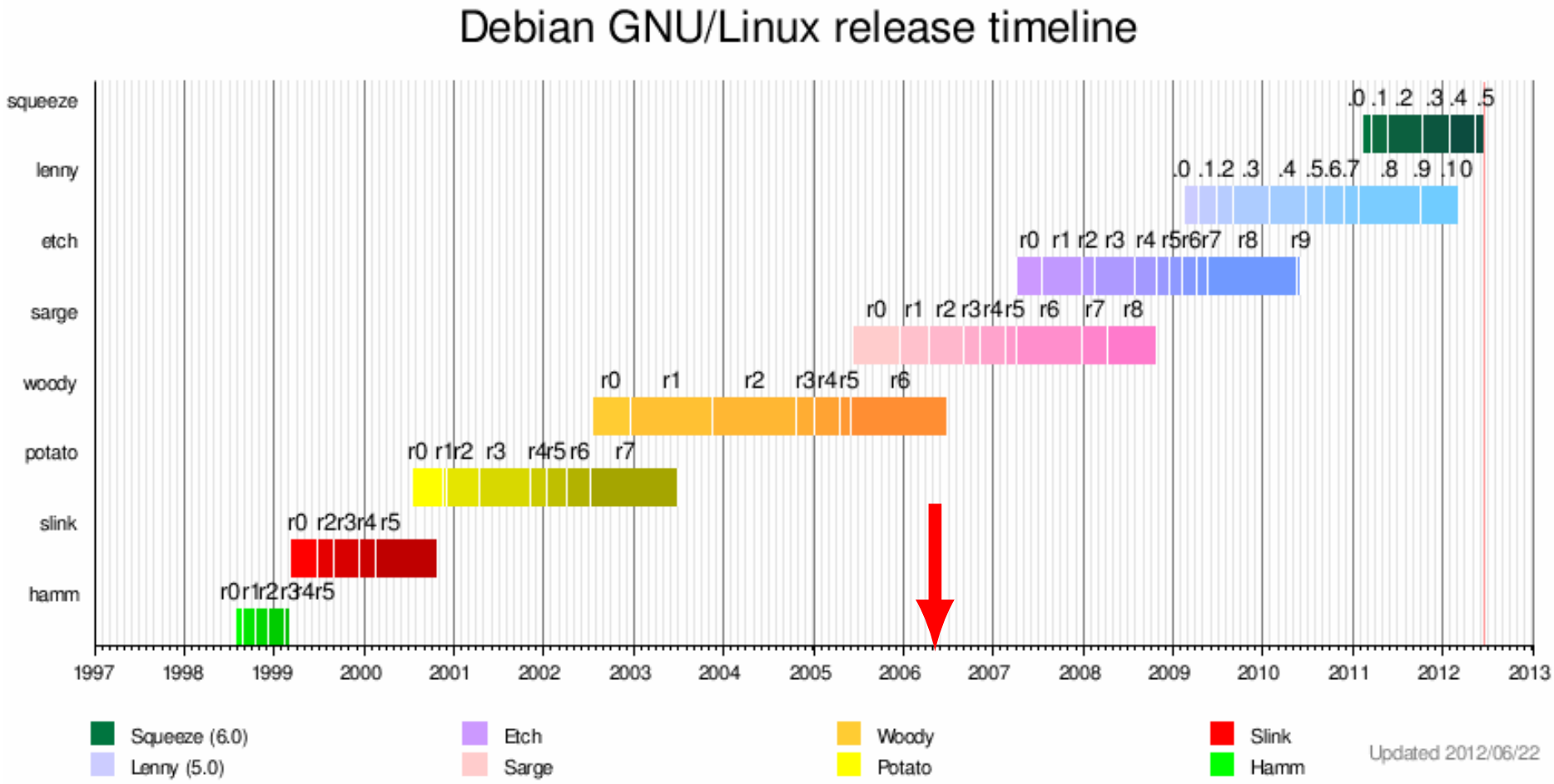
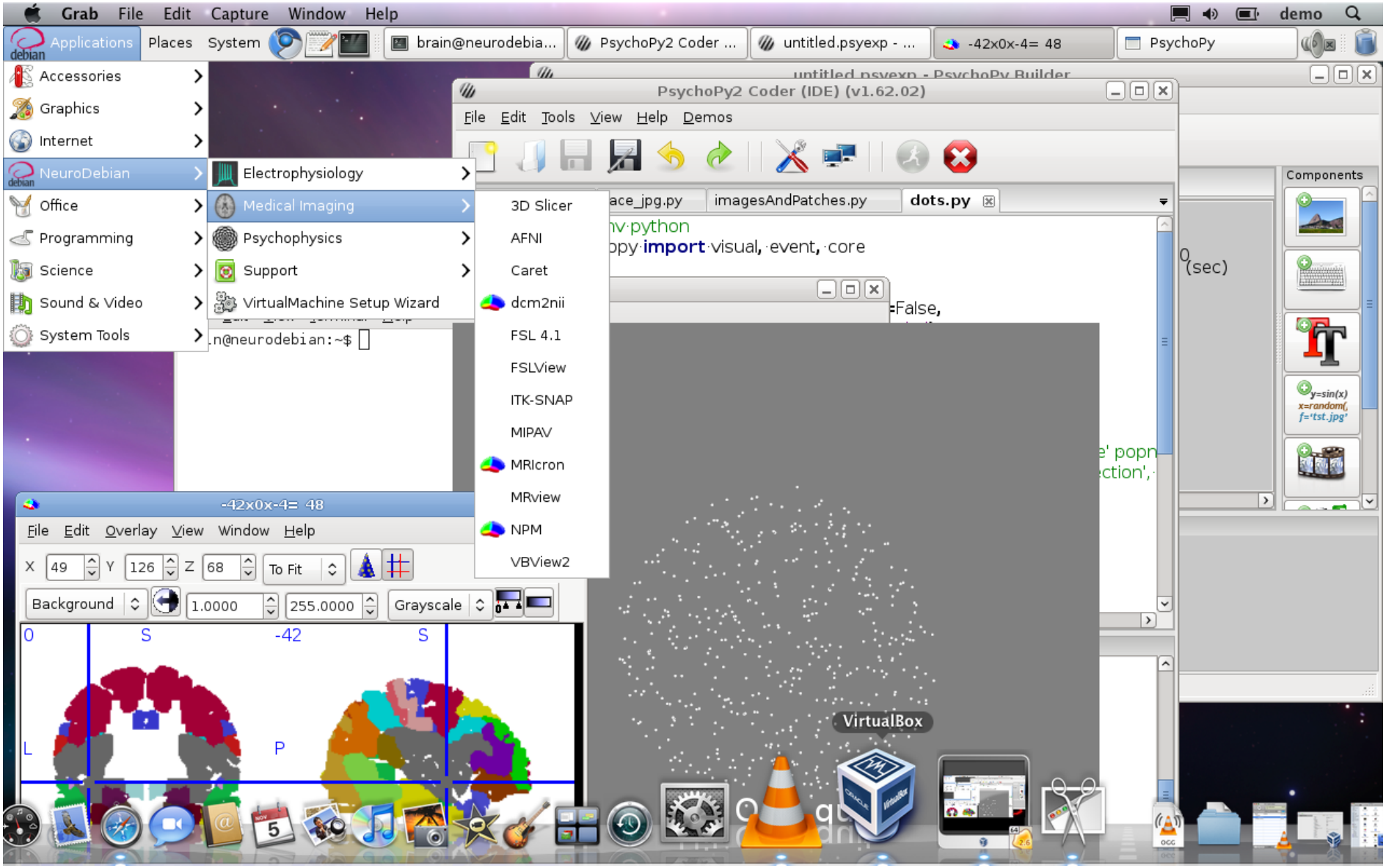

Debian GNU/Linux release timeline
squeeze
lenny
etch
sarge
woody
potato
slink
hamm
.0 .1 .2 .3 .4 .5
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 .10
r0 r1 r2 r3 r4 r5 r6 r7 r8 r9
r0 r1 r2 r3 r4 r5 r6 r7 r8
r0 r1 r2 r3 r4 r5 r6
r0 r1 r2 r3 r4 r5 r6 r7
r0 r2 r3 r4 r5
r0 r1 r2 r3 r4 r5
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Squeeze (6.0)
Lenny (5.0)
Etch
Sarge
Woody
Potato
Slink
Hamm
Updated 2012/06/22

NeuroDebian VM in VirtualBox



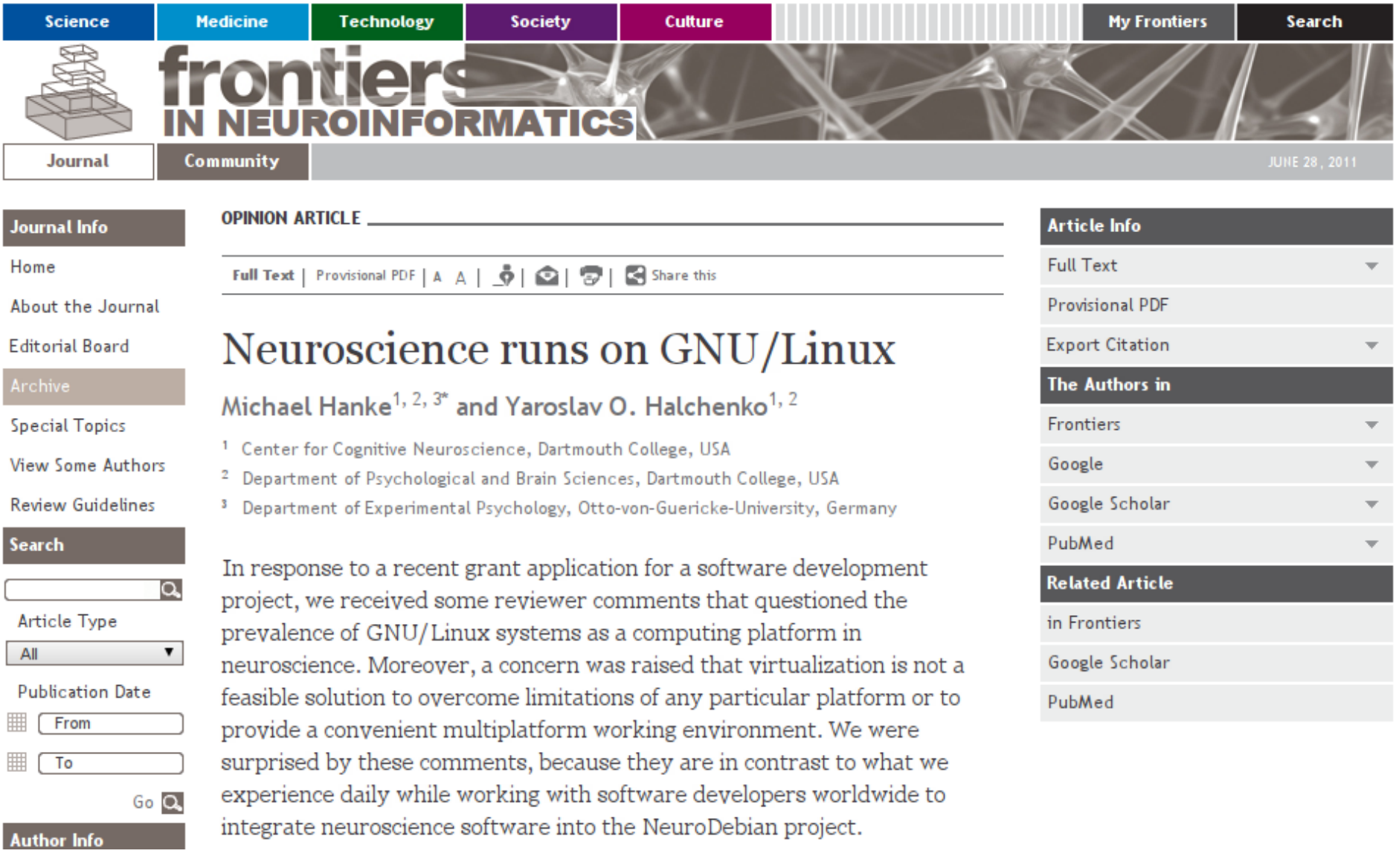
http://neuro.debian.net/vm.html

Ways to contribute

`http://wiki.debian.org/ProjectNews/HowToContribute`
`http://raphaelhertzog.com/2011/06/30`

- reportbug (+ patches)
- Internationalization (i18n):
  `http://www.debian.org/doc/manuals/intro-i18n`
- packaging
  - Luca's tutorial
    apt-get install packaging-tutorial
    `http://www.lucas-nussbaum.net/blog/?p=640`
  - Bootstrap packaging of Python modules:
    py2dsc (python-stdeb package)
  - Good night reading: Debian Policy
  - Seek mentor/sponsor-ship: `http://mentor.debian.org`
  - Become "Debian Maintainer":
    `http://wiki.debian.org/DebianMaintainer`
  - Become "Debian Developer":
    `http://wiki.debian.org/DebianDeveloper`

And it seems to work. . .



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Neuroscience runs on GNU/Linux

Michael Hanke[1, 2, 3*] and Yaroslav O. Halchenko[1, 2]

[1] Center for Cognitive Neuroscience, Dartmouth College, USA

[2] Department of Psychological and Brain Sciences, Dartmouth College, USA

[3] Department of Experimental Psychology, Otto-von-Guericke-University, Germany

In response to a recent grant application for a software development project, we received some reviewer comments that questioned the prevalence of GNU/Linux systems as a computing platform in neuroscience. Moreover, a concern was raised that virtualization is not a feasible solution to overcome limitations of any particular platform or to provide a convenient multiplatform working environment. We were surprised by these comments, because they are in contrast to what we experience daily while working with software developers worldwide to integrate neuroscience software into the NeuroDebian project.

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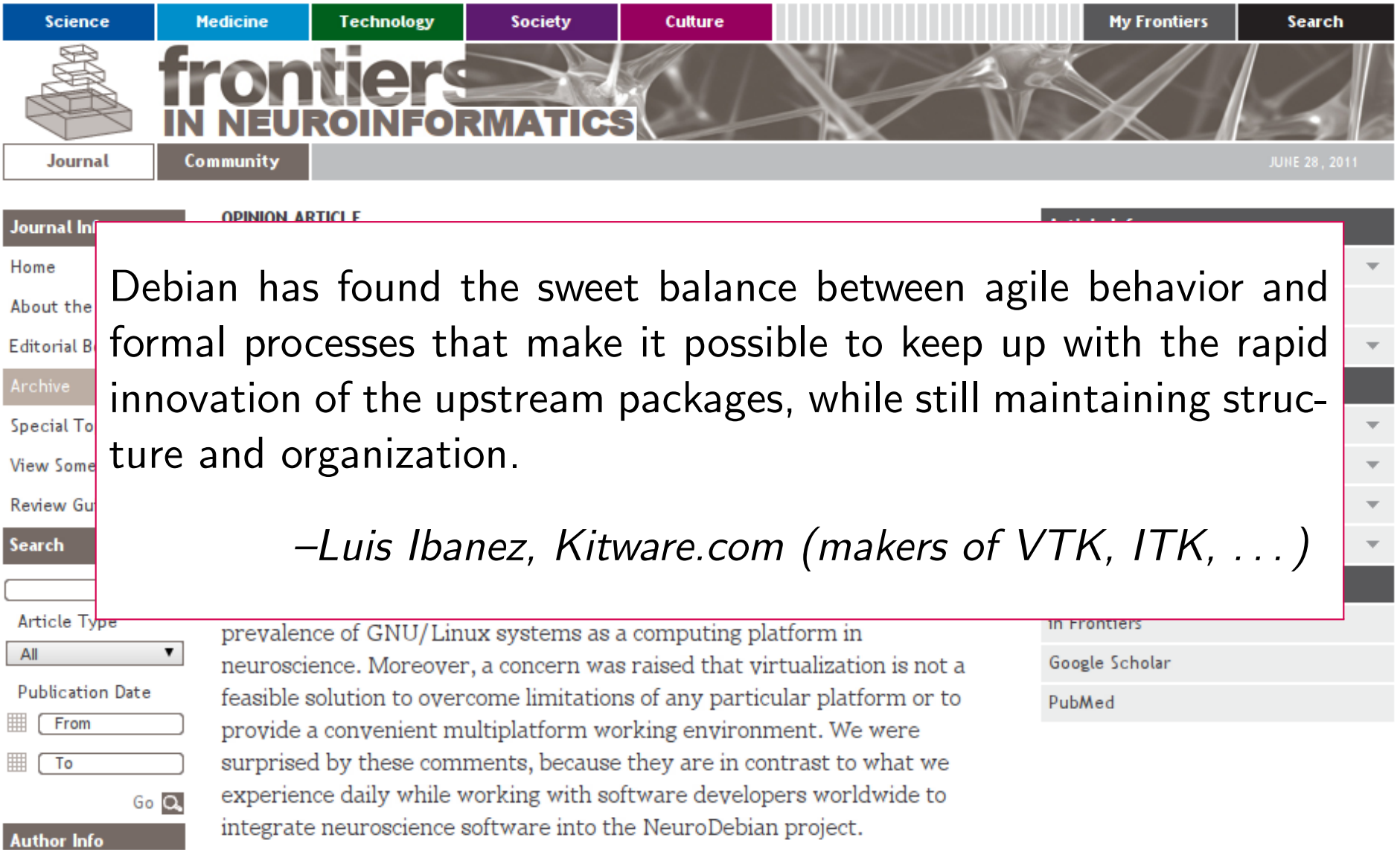
And it seems to work. . .

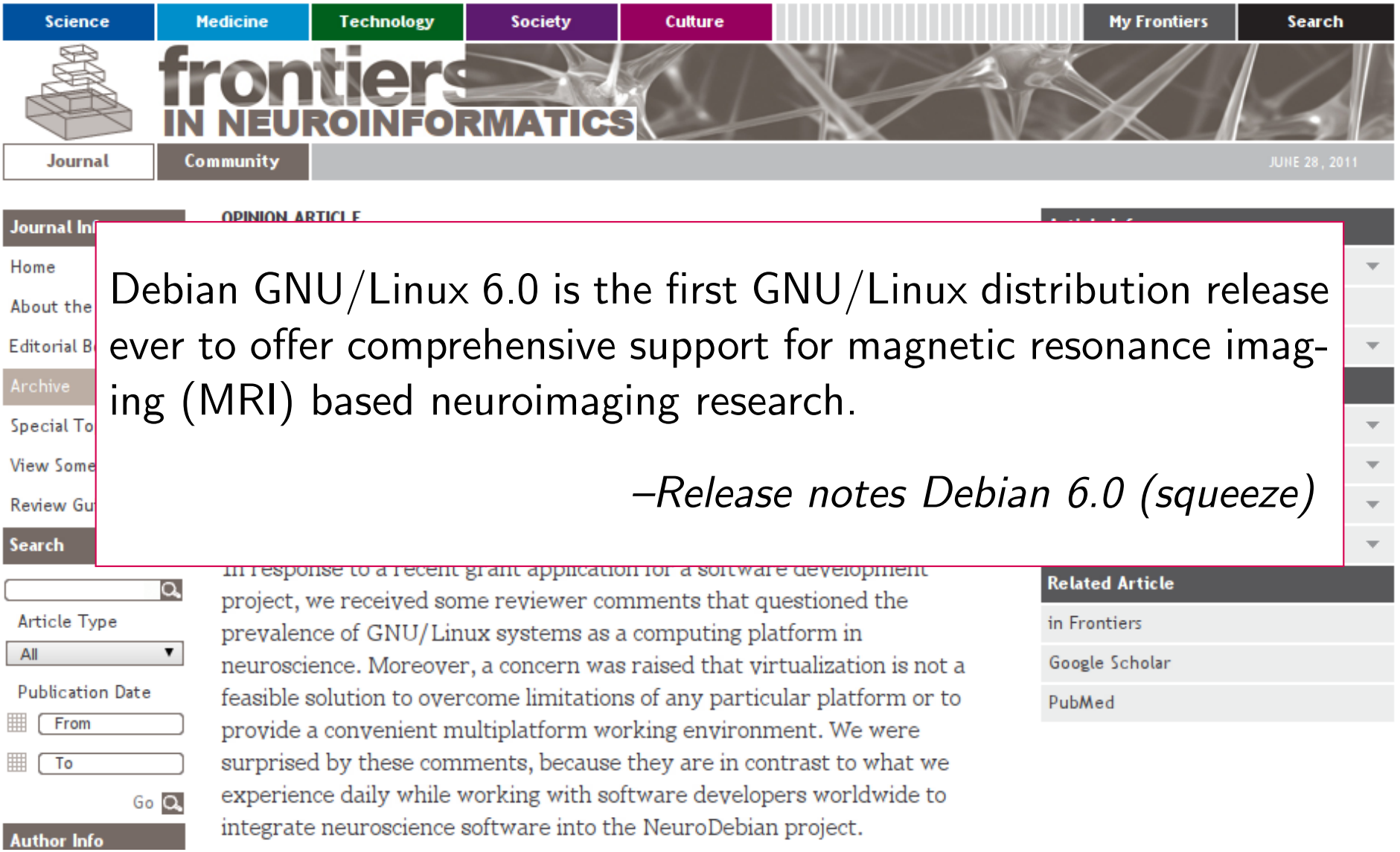


Debian has found the sweet balance between agile behavior and formal processes that make it possible to keep up with the rapid innovation of the upstream packages, while still maintaining structure and organization.

–Luis Ibanez, Kitware.com (makers of VTK, ITK, . . .)

http://www.frontiersin.org/Neuroinformatics/10.3389/fninf.2011.00008/full

And it seems to work...

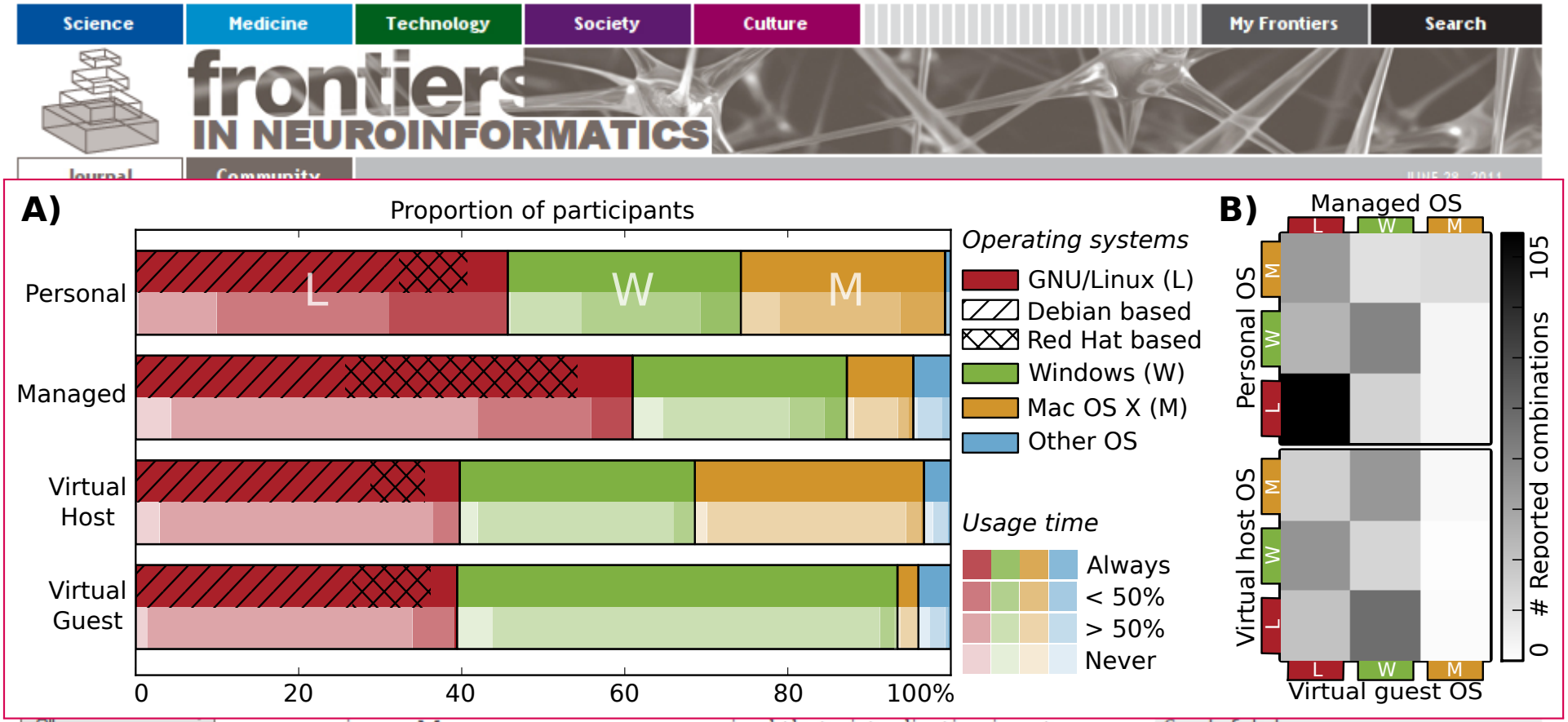


Debian GNU/Linux 6.0 is the first GNU/Linux distribution release ever to offer comprehensive support for magnetic resonance imaging (MRI) based neuroimaging research.

–Release notes Debian 6.0 (squeeze)

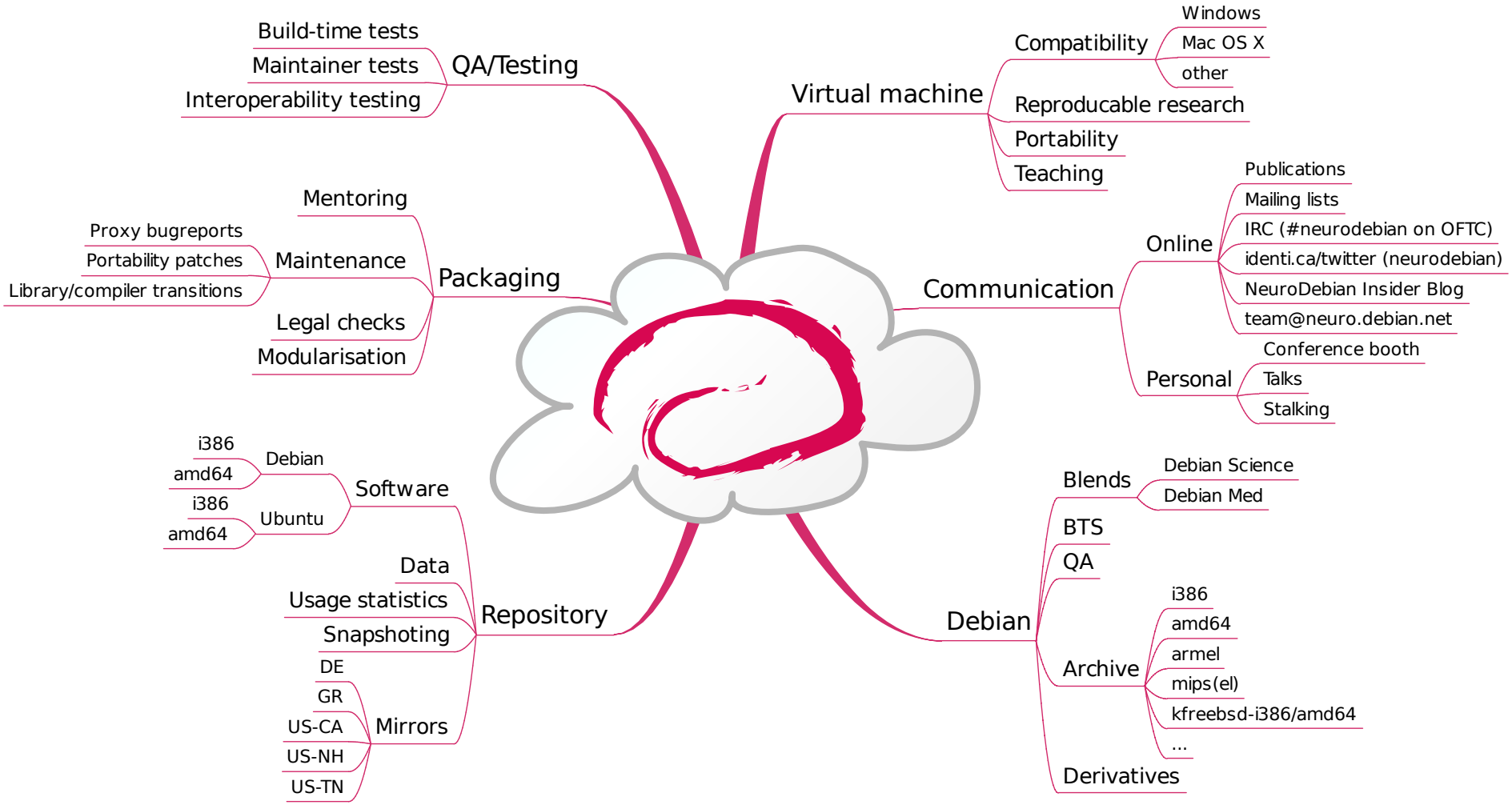
http://www.frontiersin.org/Neuroinformatics/10.3389/fninf.2011.00008/full

And it seems to work. . .



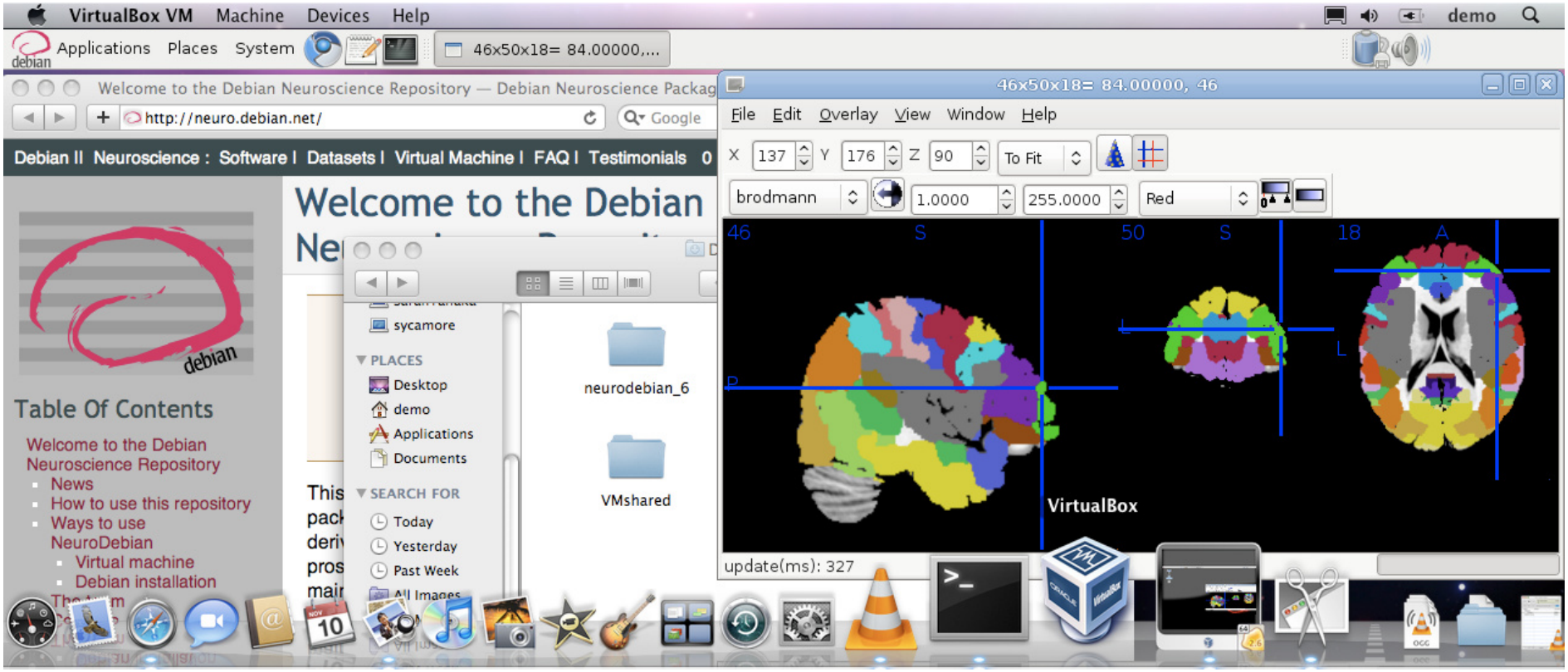
http://www.frontiersin.org/Neuroinformatics/10.3389/fninf.2011.00008/full

What is NeuroDebian?



But, but my true love is a fruit and I'm married to monster!

- NeuroDebian virtual machine (32/64bit, multi-core)
- Most convenient solution for Mac OS X, Windows
- Base image with setup wizzard, fully functional within minutes
- Great for teaching, workshops, development, analysis

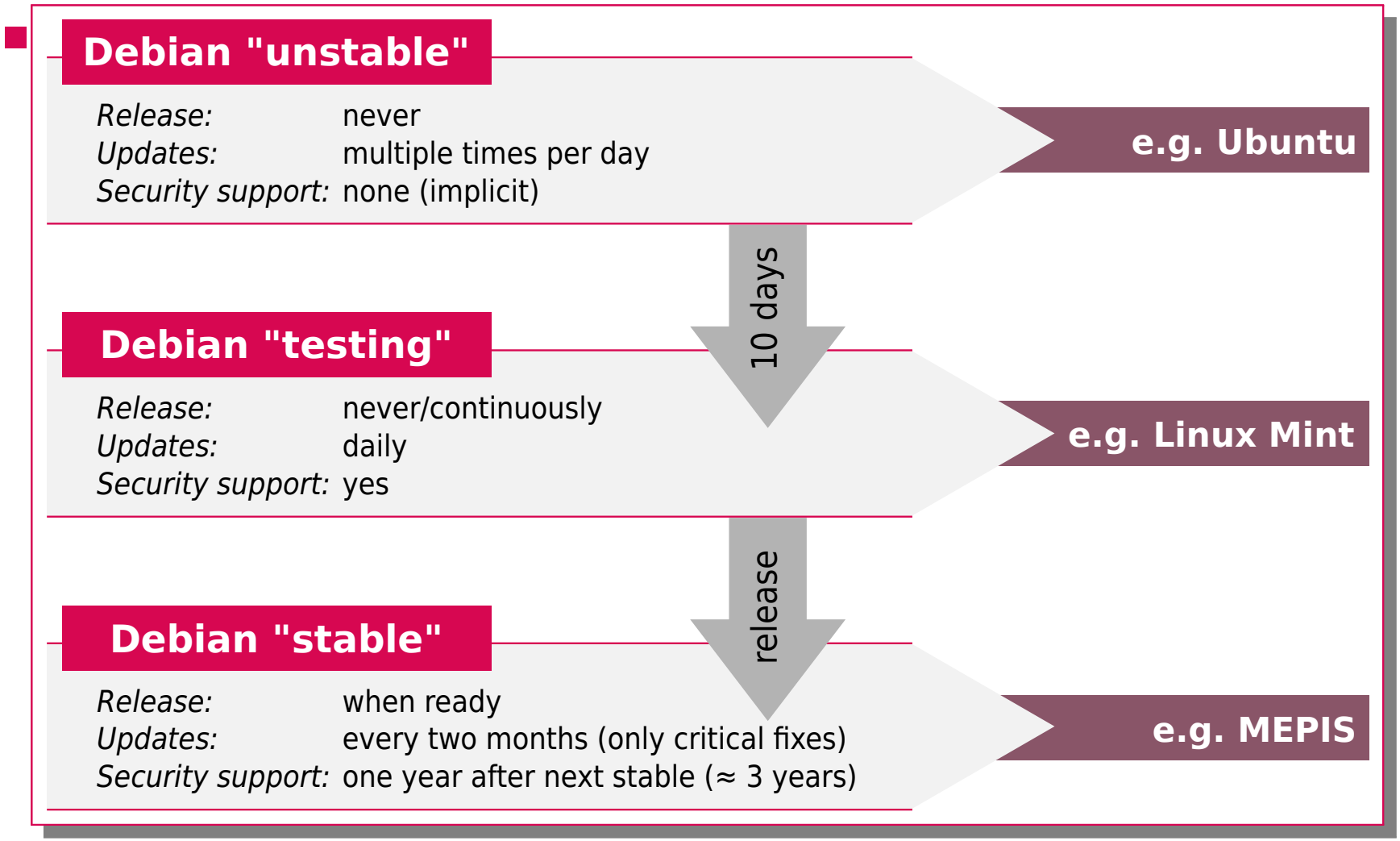


`http://neuro.debian.net/vm.html`

How does software benefit from Debian?

- Extended reach
  - one stable release, two rolling "release" flavors
  - ≈130 derivative distributions (distrowatch.org)

How does software benefit from Debian?



How does software benefit from Debian?

- Extended reach
  - one stable release, two rolling "release" flavors
  - ≈130 derivative distributions (distrowatch.org)
- Mutual awareness
  - Explicitly documented dependencies
  - Synchronized transitions
- Less maintenance work through modularity
  - 3rd-party software in dedicated packages maintained by someone else
- Continuous integration testing
  - 13 hardware architectures
  - Three kernels
  - Continuous automated testing for
    - Build success
    - Clean installation/de-installation, Availability of dependencies
    - Policy compliance
    - Package conflicts

But I only care about Ubuntu!

No, you don't!

- Most software we care about comes (almost) 1:1 from Debian (SciPy, VTK, ITK, ...)
- No LTS for neuroscience (NumPy only since 10.04)

Go Debian!

- Developers: Get it right in Debian, have it work in Debian/Ubuntu/Mint/aptosid/Mepis/... (at no additional cost)
- Users: Stable release with 3-4 years support for all software
- Scientists: Want your research tool to be found and used? Include it in the largest software archive in the world.

NeuroDebian world-map