

# TRICKING OUT YOUR MAC FOR DATA ANALYSIS



SCREW HYDRA, I'M DOING IT  
MYSELF



# OUTLINE

- Should you?
- Basics tools you should have
- Installing more software
- Other technologies (python packages)
- VMs and related

# SHOULD YOU?

## Maybe

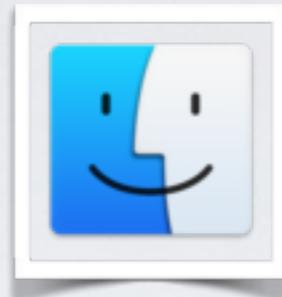
- **Pros:**

- It's common for development and testing
- You'll build your Unix skills (another way of saying it gets complicated)
- You have root access (easier to install- and screw things up)
- You'll do it anyway

- **Cons:**

- Steps done to install can't be directly scaled up (redo for hydra etc)
- The basic OS will likely remain stable, but the more you install, the less likely other things will work

# MAC OS X



- OS X (released 2000)
- Unix based (BSD), developed from NeXT (Jobs' company after Apple)
- Replaced "Classic Mac" OS 1984-2000 which basically sucked
- Unix terminal, compilation tools

# BASICS

# EASY THINGS EVERYONE SHOULD DO

*Best to have a 10.9 or 10.10 with a fresh install*

- Software already installed
- Xcode
- Text editors (TextMate and TextWrangler)
- Cyberduck (or FileZilla)
- Java

# ALREADY INSTALLED

- Terminal
- Python
- PHP
- Perl
- Apache webserver (not running)
- Unix tools: ssh, scp, split, sort, uniq, grep, awk, sed...



# XCODE

:)

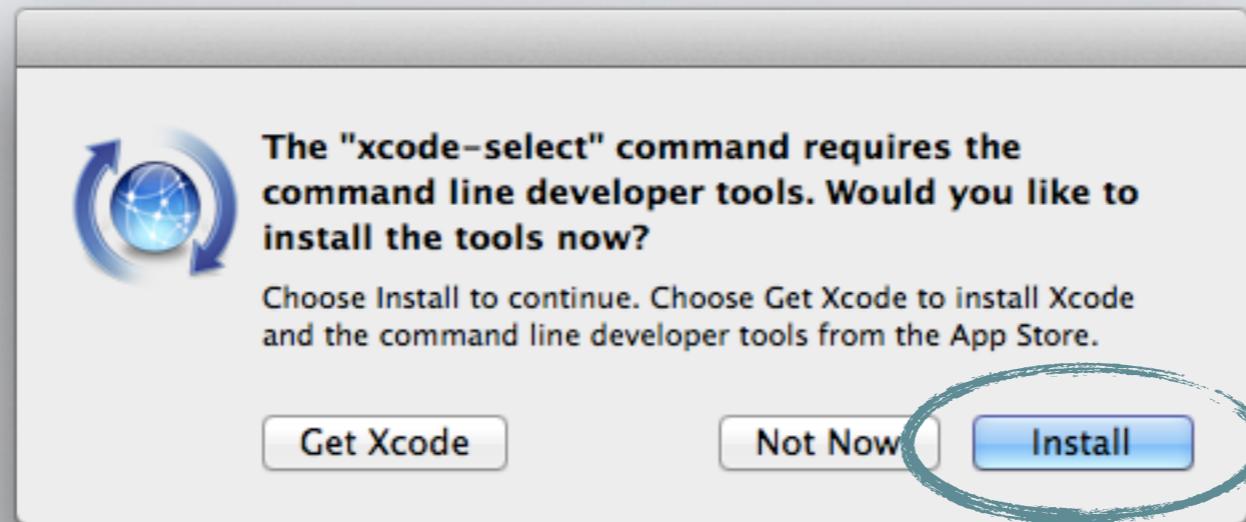


- Apple's developer tools
- Free
- Full dev system for MacOS/iOS
- BUT you only need the Command Line Tools (CLT)
- Installs: compilers, other basic tools for building software
- Updates will be installed with other OS updates via App store

# XCODE INSTALL



- Command line tools: `$ xcode-select --install`



- (10.9, 10.10), <10.9 you can find an installer on apple's support site
- Full version: App store NOT NEEDED

# TEXT EDITORS



:)

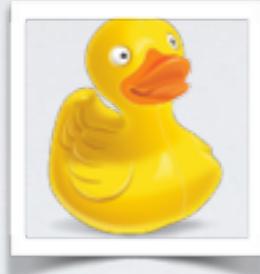


:)

Very useful for development and data files

- TextWrangler
  - Powerful text manipulation esp. data files (free)
- TextMate
  - Best for script/code development (free)

# GUI FOR FILE TRANSFER



:)

:)

Very useful for transfer to Hydra  
(both have Windows versions too)

- Cyberduck
  - Better GUI, takes some instruction to setup.
- FileZilla
  - SI approved. GUI less intuitive.

# JAVA



:)

Cross-platform system allows code to be used on different OS's

- GUI or command line programs: Geneious, FigTree, BEAST, Mesquite, jModelTest, trimmomatic
- **No longer provided by Apple** (Yosemite)
- **No:** Java web plugin (shouldn't be necessary, history of security issues)

# JAVA INSTALL...



- Install from java.com this way... **(make sure it's the JDK or JRE NOT the web plugin)**
- Google “Java jdk” or \$ java

# JAVA INSTALL

Java SE – Downloads | Oracle Technology Network | Oracle  
www.oracle.com/technetwork/java/javase/downloads/index.html

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Junho 23–25, 2015 São Paulo, Brasil #javaonebr [Inscreve-se](#) ORACLE

# JAVA INSTALL

Java SE Runtime Environment 8 – Downloads

www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html

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Java SE Runtime Environment 8 Downloads

Do you want to run Java™ programs, or do you want to develop Java programs? If you want to run Java programs, but not develop them, download the Java Runtime Environment, or JRE™.

If you want to develop applications for Java, download the Java Development Kit, or JDK™. The JDK includes the JRE, so you do not have to download both separately.

JRE MD5 Checksum

Java SE Runtime Environment 8u45

You must accept the [Oracle Binary Code License Agreement](#) for Java SE to download this software.

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Product / File Description	File Size	Download
Linux x86	11.0 MB	jre-8u45-linux-i586.rpm
Linux x86	62.63 MB	jre-8u45-linux-i586.tar.gz
Linux x64	39.51 MB	jre-8u45-linux-x64.rpm
Linux x64	60.87 MB	jre-8u45-linux-x64.tar.gz
Mac OS X x64	57.71 MB	jre-8u45-macosx-x64.dmg
Mac OS X x64	53.6 MB	jre-8u45-macosx-x64.tar.gz
Solaris SPARC 64-bit	46.06 MB	jre-8u45-solaris-sparcv9.tar.gz
Solaris x64	49.5 MB	jre-8u45-solaris-x64.tar.gz
Windows x86 Online	0.54 MB	jre-8u45-windows-i586-ifw.exe
Windows x86 Offline	35.6 MB	jre-8u45-windows-i586.exe
Windows x86	52.57 MB	jre-8u45-windows-i586.tar.gz
Windows x64	41.19 MB	jre-8u45-windows-x64.exe
Windows x64	55.6 MB	jre-8u45-windows-x64.tar.gz

Java SDKs and Tools

- [Java SE](#)
- [Java EE and Glassfish](#)
- [Java ME](#)
- [Java Card](#)
- [NetBeans IDE](#)
- [Java Mission Control](#)

Java Resources

- [Java APIs](#)
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- [Java Magazine](#)
- [Java.net](#)
- [Developer Training](#)
- [Tutorials](#)
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VIRTUAL TECHNOLOGY SUMMIT

February 11th  
February 25th  
March 4th

Elequa TRUSTe Notice

# RUNNING JAVA COMMANDS



- GUI: just double click (sometimes the .jar file)
- Command line:

```
$ java -jar filename.jar
```

- Specify RAM with -Xmx1024m (for 1024 MB of RAM)

```
$ java -Xmx1024m -jar filename.jar
```

# INSTALLING ANALYSIS SOFTWARE

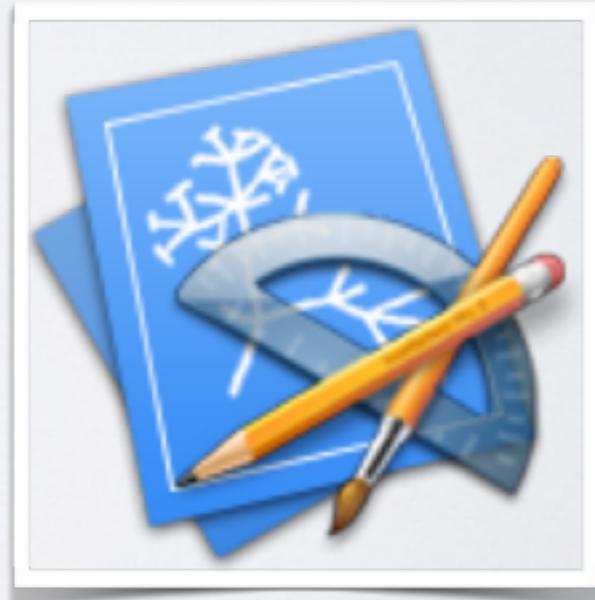
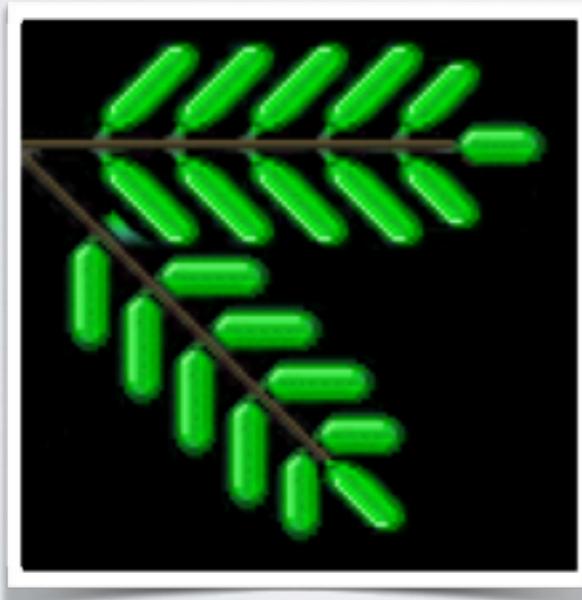
# INSTALLING ANALYSIS SOFTWARE

1. Standalone Applications
2. Installer packages
3. Pre-compiled binaries
4. Compile on your own
5. Package manager

# I. STANDALONE APPLICATIONS

:)

- Mac Applications with no separate installer
- Trivial, self contained
- Best to put in Applications (to organize)



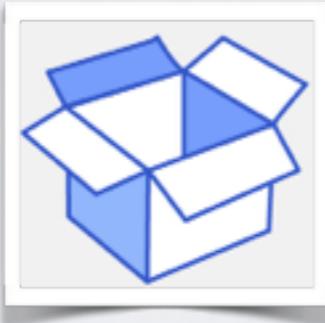
# 2. INSTALLER PACKAGES



**:/ use cautiously**

- Standard way to install mac software
- Install binaries (=precompiled code) and run scripts
- Usually run as root (full control of system!)
- Problem is where do they install???
- No uninstall (typically)
- Definitely use: R The R logo, which consists of a stylized blue 'R' inside a circular arrow.

# SUSPICIOUS PACKAGE



- [http://www.mothersruin.com/software/  
SuspiciousPackage](http://www.mothersruin.com/software/SuspiciousPackage)
- QuickLook plugin (Pressing space bar in the Finder)
- Shows files to be installed and code of scripts to be run

# BASESPACE EXAMPLE

BaseSpaceDownloader.Mac.pkg

Open with Installer



**BaseSpaceDownloader.Mac.pkg**

Developer ID Installer Package

 DEVELOPER ID Signed by "Developer ID Installer: Illumi..."

16.1 MB for package — 50 MB installed on disk

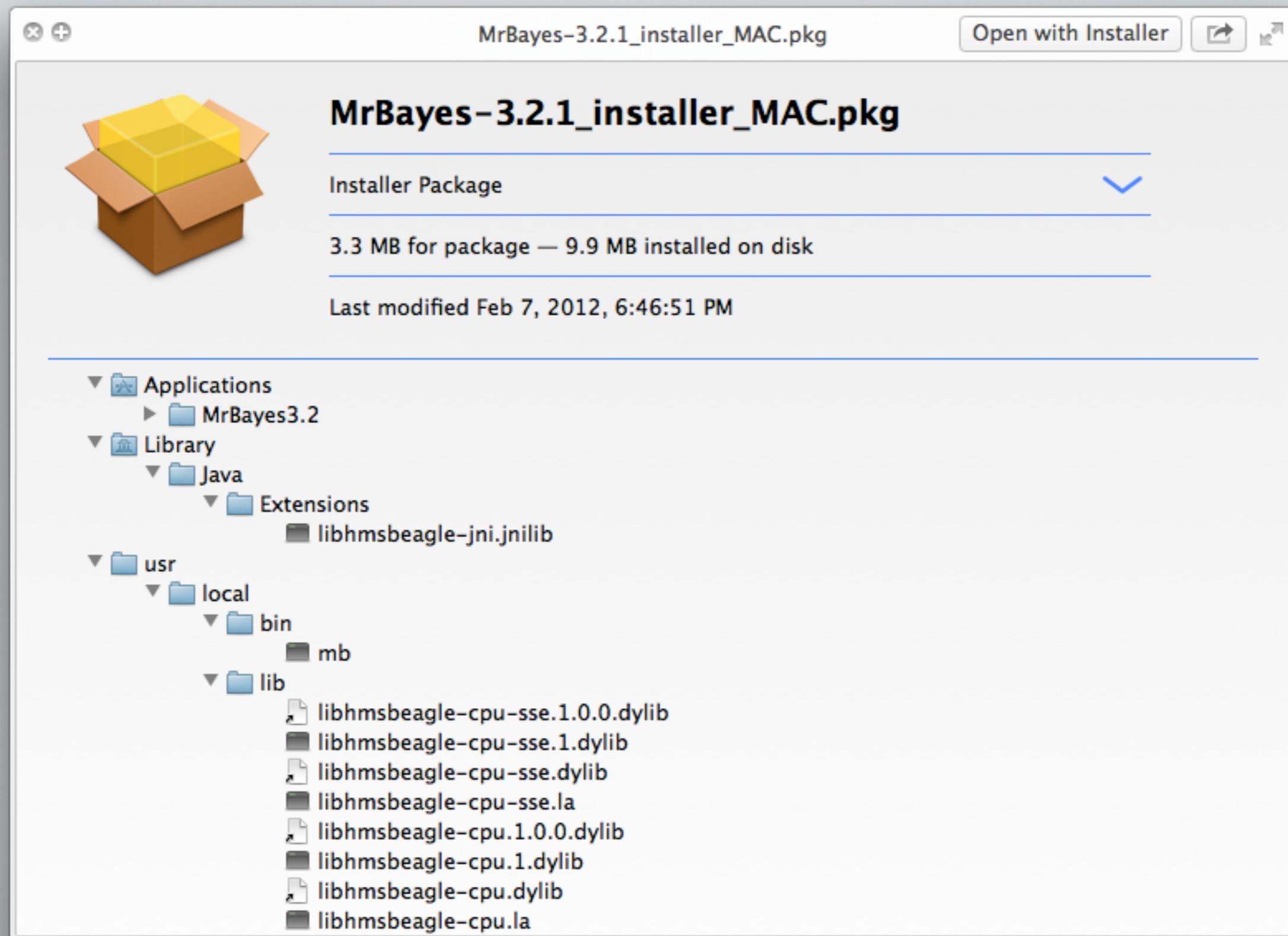
Last modified Apr 20, 2015, 10:17:33 AM

▼ Applications

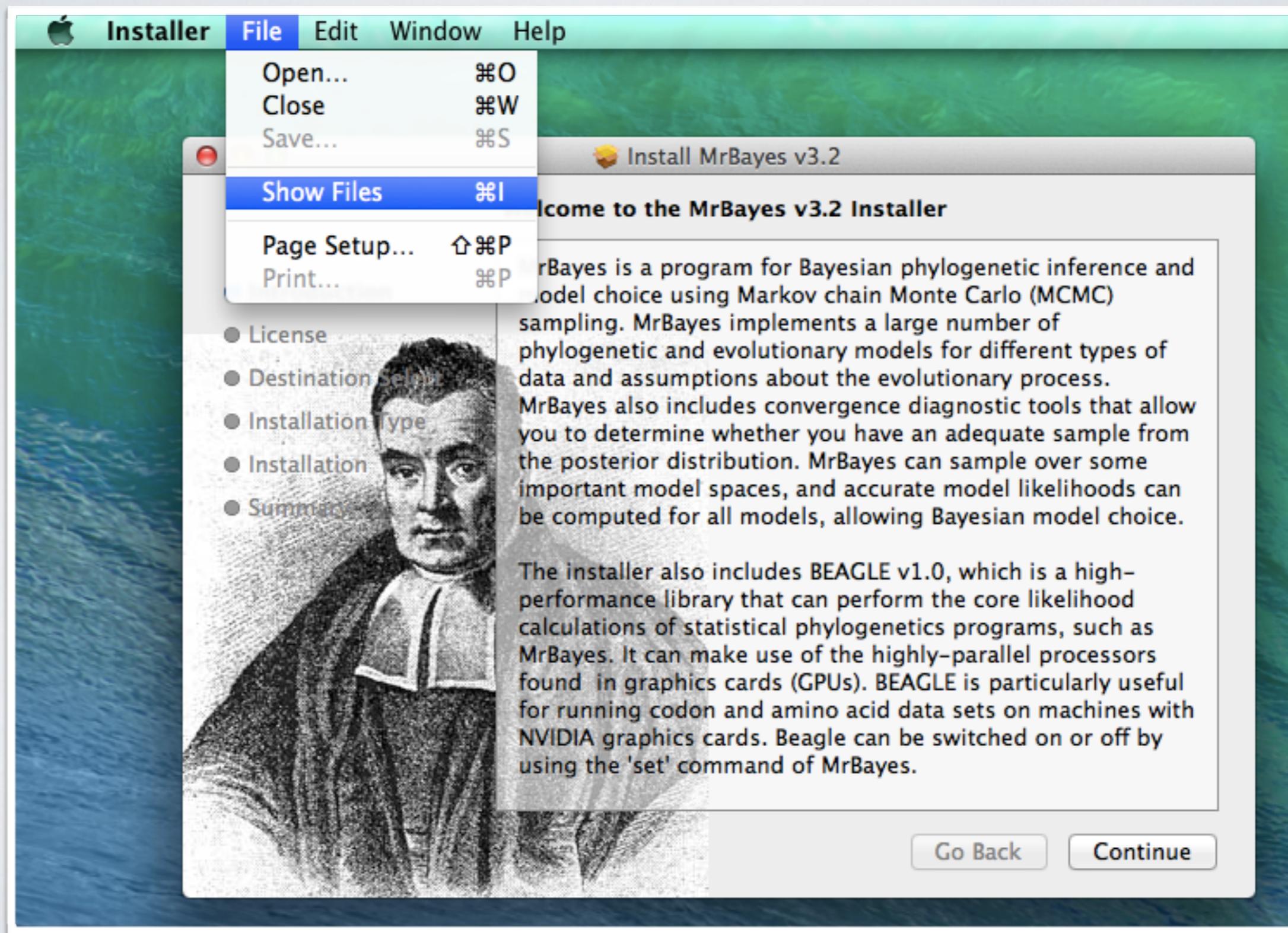
► BaseSpace Downloader.app Version 1.0.500.102 (102)

Quick Look generated by  [Suspicious Package](#) version 2.0.1

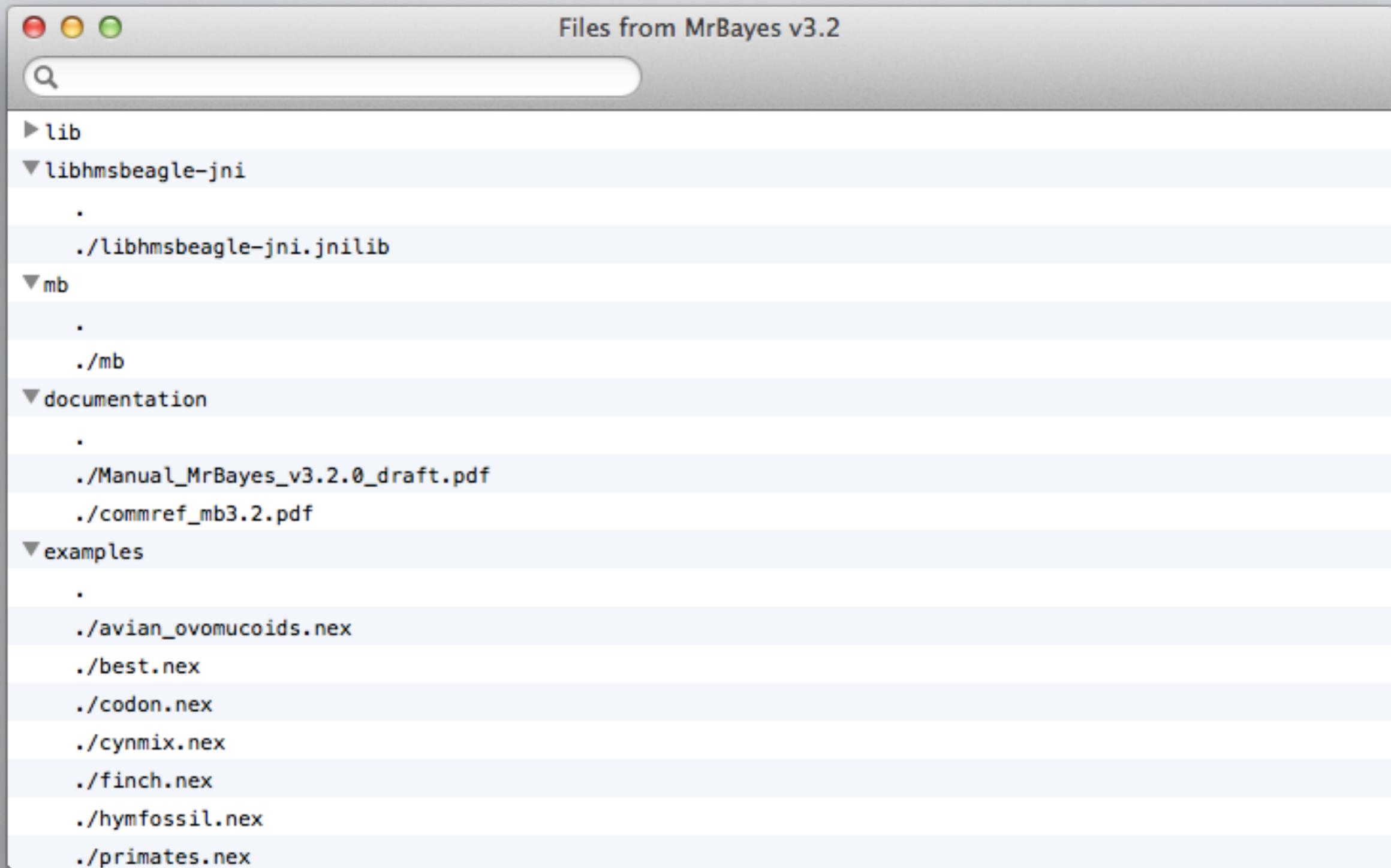
# MRBAYES EXAMPLE



# INSTALLER APP INFO



# INSTALLER APP INFO



# 3. PRECOMPILED BINARIES



:)

- Command line tool developer has already compiled for mac
- You get the program file, no installer
- Garli, BLAST, clustalw2, mafft, paup, mira
- (sometimes latest version isn't pre-compiled)

# GARLI EXAMPLE



bin

bin

Shared Folder

All My Files

AirDrop

Applications

Desktop

Documents

Downloads

Movies

Music

Pictures

Google Drive

Remote Disc

FigTree... ▲

Red

Orange

Yellow

adminer-4....ysql-en.php

DL700D(B)\_...user\_manual

editor-4.2.1-mysql-en.php

foo.jpg

Garli-2.0-In...multithread

Garli-2.0-In...hread.tar.gz

genomics-1...-v1-sgk.pdf

hamlet.txt

LightPaper\_v0.0.9.dmg

MacDown.app.zip

Try one (built-in mac)

bin

doc

example

QuickStart.txt

README.txt

Garli-2.0

exec

Name Garli-2.0  
Kind Unix Executable File  
Size 3.6 MB  
Created Apr 4, 2011, 4:43 PM  
Modified Apr 4, 2011, 4:43 PM  
Last opened Apr 4, 2011, 4:43 PM

1 of 1 selected, 136.34 GB available

# RUN FROM CURRENT DIR



- In terminal open directory with file

```
$ cd ~/Downloads/Garli-2.0-IntelOSX-  
multithread/bin
```

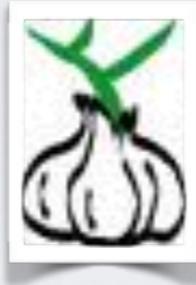
- Make executable

```
$ chmod a+x Garli-2.0
```

- Execute in directory (put files in that directory)

```
$ ./Garli-2.0
```

# RUN FROM ANY DIR



- In terminal open directory with file

```
$ cd ~/Downloads/Garli-2.0-IntelOSX-  
multithread/bin
```

- copy to **/usr/local/bin**

```
$ sudo cp Garli-2.0 /usr/local/bin
```

- Execute in any directory

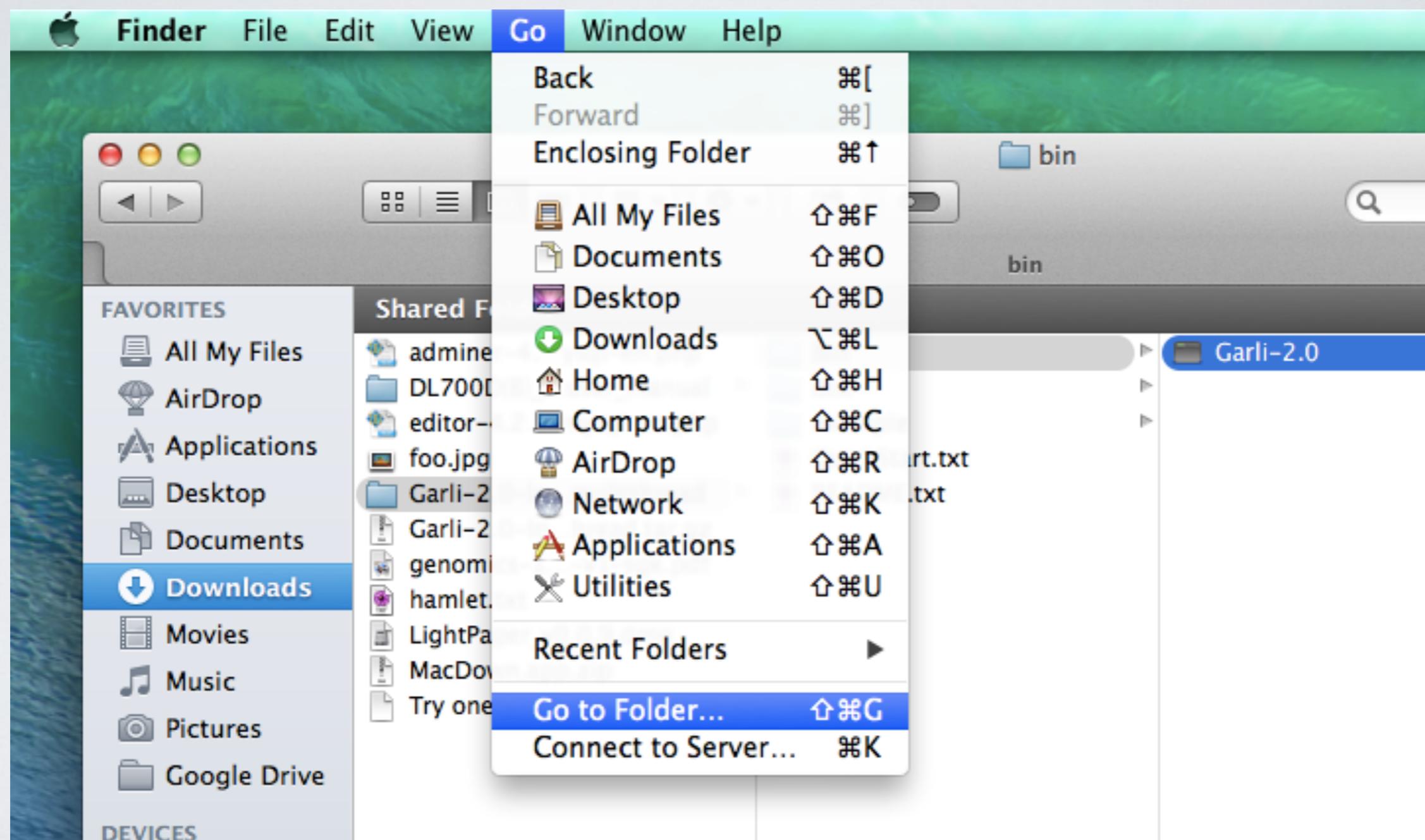
```
$ Garli-2.0
```

# /USR/LOCAL

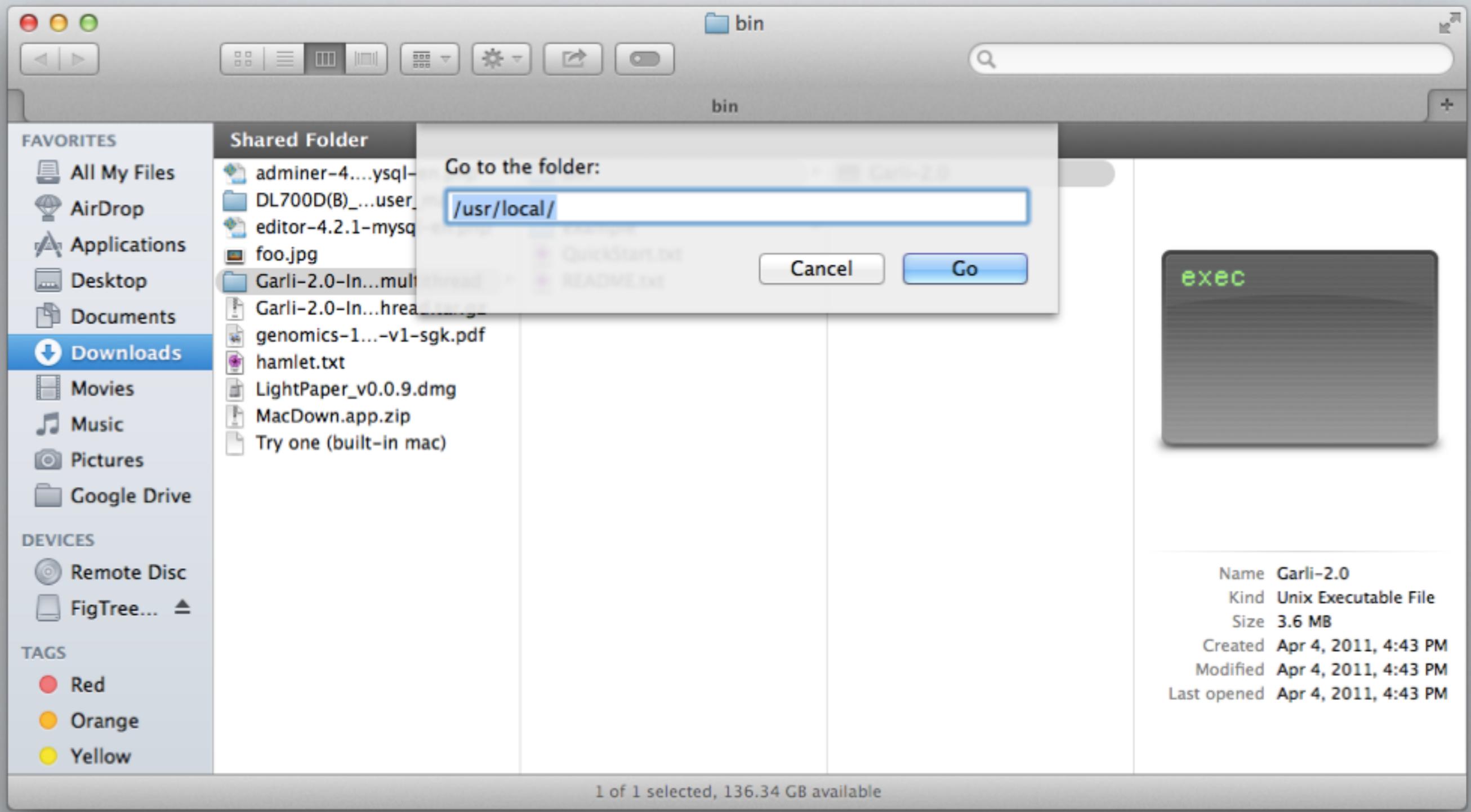
:)

- In Unix system a typical place to put user installed command line tools
- A new Mac system has nothing in this folder
- You can delete everything in here and not affect basic system functionality (well except McAfee)
- System already setup to check this folder for programs
- Need to be a system administrator to edit these files (sudo cp...)
- **/usr/local/bin/** applications (commands run on the command line)
- **/usr/local/lib/** "libraries" of code that are used by other programs

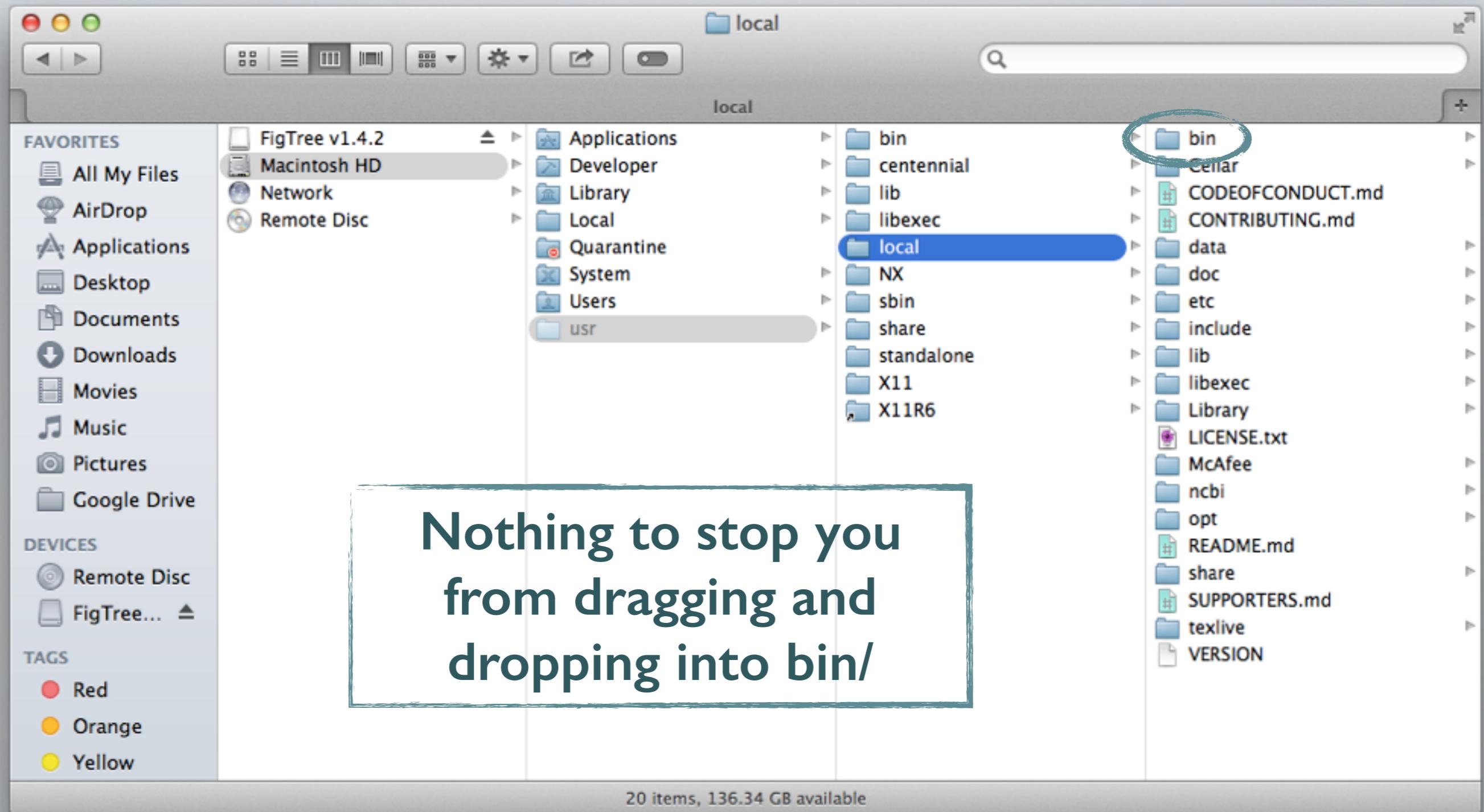
# GETTING TO HIDDEN DIRS



# GETTING TO HIDDEN DIRS



# GETTING TO HIDDEN DIRS



# 4. COMPILE YOURSELF



- Download source code and compile
- Check instructions for Mac specific notes (INSTALL file or README)

Either:

- **\$ ./configure** checks systems for required components. Other configuration options (install directory, turn on/off program features)
- **\$ make** compiles the program (typically "warnings" are ok, "Errors" are NOT)
- **\$ sudo make install** moves the compiled code to /usr/local/bin or other parts of /usr/local

Or just:

- **\$ make** (uses instructions in Makefile)

# 4. COMPILE YOURSELF



:

- Installing dependencies (libraries, other programs) can be difficult
- Those dependencies can interfere with a package manager system (covered next)
- Recommendation: OK if it works (dependencies are met, code compiles). Not recommended for complex programs: gcc, mpi

# 5. PACKAGE MANAGERS



## :) **homebrew**

- System that allows automatic install of a (command line) program
  - Will either compile from source or download pre-compiled binaries
- **Homebrew**: newest, most popular, recommended, will cover
- **Fink**
- **MacPorts**: doesn't work behind SI firewall (needs to rsync to an outside server)
- Don't use more than one on your system

# HOMEBREW



- ONLY puts file into /usr/local
- Easy to install, very explicit about what it does
- <http://brew.sh>
- `brew doctor` check configuration (you should follow through on warnings)
- `brew update` updates package list
- `brew install <package>` install a package
- Makes /usr/local group writable- **sudo not need for program install.** It won't go outside of /usr/local!

# HOMEBREW

The screenshot shows a web browser window displaying the Homebrew website. The title bar reads "Homebrew — The missing package manager for OS X". The main content features a large "Homebrew" logo, the tagline "The missing package manager for OS X", and a "Install Homebrew" section with a terminal command. A "Fork me on GitHub" button is visible in the top right corner.

**Homebrew**  
The missing package manager for OS X

English

**Install Homebrew**

`ruby -e "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/master/install)"`

Paste that at a Terminal prompt.

The script explains what it will do and then pauses before it does it. There are more installation options [here](#) (needed on 10.5).

**What Does Homebrew Do?**

# HOMEBREW INSTALL

```
Default (ssh)
ruby-test-172017241099:~ adminlab$ clear
ruby-test-172017241099:~ adminlab$ ruby -e "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/master/install)"
=> This script will install:
/usr/local/bin/brew
/usr/local/Library/...
/usr/local/share/man/man1/brew.1
=> The following directories will be made group writable:
/usr/local/.
/usr/local/bin

Press RETURN to continue or any other key to abort
=> /usr/bin/sudo /bin/chmod g+rwx /usr/local/. /usr/local/bin

WARNING: Improper use of the sudo command could lead to data loss
or the deletion of important system files. Please double-check your
typing when using sudo. Type "man sudo" for more information.

To proceed, enter your password, or type Ctrl-C to abort.
Password:  
=> /usr/bin/sudo /bin/mkdir /Library/Caches/Homebrew
=> /usr/bin/sudo /bin/chmod g+rwx /Library/Caches/Homebrew
=> Downloading and installing Homebrew...
remote: Counting objects: 3599, done.
remote: Compressing objects: 100% (3443/3443), done.
remote: Total 3599 (delta 28), reused 660 (delta 17), pack-reused 0
Receiving objects: 100% (3599/3599), 2.88 MiB | 0 bytes/s, done.
Resolving deltas: 100% (28/28), done.
From https://github.com/Homebrew/homebrew
 * [new branch]      master    -> origin/master
HEAD is now at b3c83a6 Formula: always print keg_only_text
=> Installation successful!
=> Next steps
Run `brew help` to get started
ruby-test-172017241099:~ adminlab$
```

Enter Mac password  
when prompted

# HOMEBREW PACKAGE INSTALL

- Goes to github for the instructions
- installs in /usr/local/Cellar and links ("alias") to /usr/local/bin
- Downloads source and compiles or downloads pre-compiled programs
- Finding packages:
  - [brewmeister.org](http://brewmeister.org)
  - [github.com](https://github.com) “homebrew package”

# HOMEBREW-SCIENCE

<https://github.com/Homebrew/homebrew-science>

Homebrew/homebrew-science

GitHub, Inc. [github.com/Homebrew/homebrew-science](https://github.com/Homebrew/homebrew-science) Reader Done

513 matches Q .rb

Watch 51 Star 504 Fork 549

Homebrew / **homebrew-science**

Scientific formulae for the Homebrew package manager <http://brew.sh/homebrew-science/>

3,641 commits 2 branches 18 releases 359 contributors

branch: master homebrew-science / +

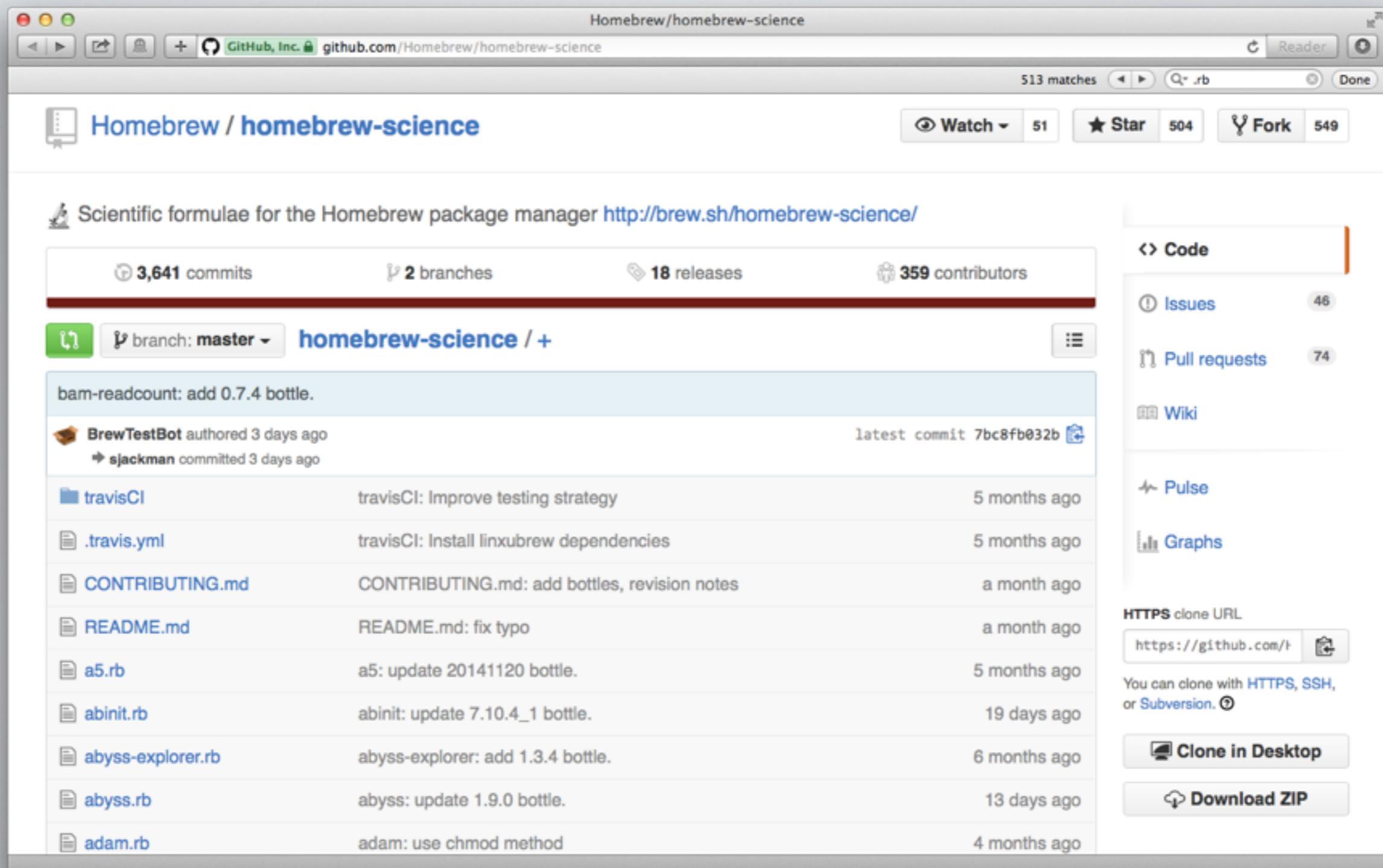
File	Description	Time
bam-readcount	: add 0.7.4 bottle.	3 days ago
BrewTestBot	authored 3 days ago ↳ sjackman committed 3 days ago	latest commit 7bc8fb032b
travisCI	travisCI: Improve testing strategy	5 months ago
.travis.yml	travisCI: Install linuxbrew dependencies	5 months ago
CONTRIBUTING.md	CONTRIBUTING.md: add bottles, revision notes	a month ago
README.md	README.md: fix typo	a month ago
a5.rb	a5: update 20141120 bottle.	5 months ago
abinit.rb	abinit: update 7.10.4_1 bottle.	19 days ago
abyss-explorer.rb	abyss-explorer: add 1.3.4 bottle.	6 months ago
abyss.rb	abyss: update 1.9.0 bottle.	13 days ago
adam.rb	adam: use chmod method	4 months ago

Code Issues 46  
Pull requests 74  
Wiki  
Pulse  
Graphs

HTTPS clone URL <https://github.com/>

You can clone with [HTTPS](#), [SSH](#), or [Subversion](#).

Clone in Desktop Download ZIP



# HOMEBREW-SCIENCE

<https://github.com/Homebrew/homebrew-science>

- `$ brew install homebrew/science/<formula>`
- or
  - `$ brew tap homebrew/science`
  - `$ brew install <formula>`

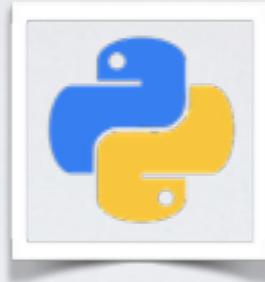
# FASTX-TOOLKIT EXAMPLE

```
Default (bash)
MattAir:~ mkweskin$ brew install fastx_toolkit
⇒ Installing fastx_toolkit from homebrew/homebrew-science
⇒ Installing homebrew/science/fastx_toolkit dependency: pkg-config
⇒ Downloading https://homebrew.bintray.com/bottles/pkg-config-0.28.mavericks.bottle.2.tar.gz
Already downloaded: /Library/Caches/Homebrew/pkg-config-0.28.mavericks.bottle.2.tar.gz
⇒ Pouring pkg-config-0.28.mavericks.bottle.2.tar.gz
🍺 /usr/local/Cellar/pkg-config/0.28: 10 files, 604K
⇒ Installing homebrew/science/fastx_toolkit
⇒ Downloading https://github.com/agordon/fastx_toolkit/releases/download/0.0.14/fastx_toolkit-0.0
⇒ Downloading from: https://s3.amazonaws.com/github-cloud/releases/14233196/f0821c9e-764e-11e3-99
Already downloaded: /Library/Caches/Homebrew/fastx_toolkit-0.0.14.tar.bz2
⇒ Downloading https://github.com/agordon/libtextutils/releases/download/0.7/libtextutils-0.7.ta
⇒ Downloading from: https://s3.amazonaws.com/github-cloud/releases/14094273/4a8d6664-764d-11e3-8b
Already downloaded: /Library/Caches/Homebrew/fastx_toolkit--libtextutils-0.7.tar.gz
⇒ ./configure --prefix=/usr/local/Cellar/fastx_toolkit/0.0.14
⇒ make
⇒ make install
⇒ ./configure --prefix=/usr/local/Cellar/fastx_toolkit/0.0.14 PKG_CONFIG_PATH=/usr/local/Cellar/f
⇒ make install
🍺 /usr/local/Cellar/fastx_toolkit/0.0.14: 43 files, 884K, built in 50 seconds
MattAir:~ mkweskin$
```

# SUMMARY OF INSTALLS

1. Standalone Applications :)
2. Installer packages :\
3. Pre-compiled binaries :)
4. Compile on your own :\
5. Package manager (homebrew) :)

# PYTHON



- I recommend built-in Python OR Anaconda, but not installing from [python.org](http://python.org)
- What's preinstalled with the Mac? SciPy, NumPy
- This usually works
  - `$ sudo easy_install -U biopython`

# ANACONDA



:)

- Package manager for Python
- <https://store.continuum.io/cshop/anaconda/>
- Doesn't interfere with system's pre-installed python
- Administrator privileges NOT required
- conda command line tool ...phyluce

# ANACONDA + BINARIES

The screenshot shows a web browser window with the following details:

- Title Bar:** faircloth-lab (faircloth-lab)
- Address Bar:** https://binstar.org/faircloth-lab/
- Header:** Binstar, Search Packages ..., About, Plans & Pricing, Help, Login
- Left Sidebar (for faircloth-lab):**
  - faircloth-lab
  - faircloth-lab
  - LSU
  - <http://faircloth-lab.org>
  - Baton Rouge, LA, USA
  - Joined on Sep 08, 2013
  - 40 Packages
- Main Content Area:**
  - Packages** (Quick Nav: all, personal, private, original, copy)
  - dendropy 4.0.0** (<http://packages.python.org/DendroPy/>) conda
  - ete 2.3** (No Summary) conda
  - phyluce 1.5.0** (No Summary) conda
  - bowtie 1.1.1** (No Summary) conda
  - trinity 2.0.6** (No Summary) conda
  - gblocks 0.91b** (No Summary) conda
  - pycogent 0.7.7** (No Summary) conda
  - abyss 1.3.7** (<http://www.bcast.ca/platform/bioinfo/software/abyss>) conda

# PERL



Oy!

- Ack, no one seems to have good automated installs of packages (not homebrew)
- `$ cpan` is the package install system
- Easiest is to have root privs
- Recommendation:

# VIRTUAL MACHINES

# VIRTUAL MACHINES

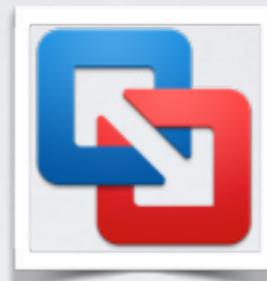
:)

- Run another, isolated OS within your main OS
- Use to run: linux, Windows (requires license), another MacOS
- Why?
  - Easier to install a program on another OS (linux)
  - Isolated from your system
  - "Snapshots" of a system at a state (easy to rollback)
- Disadvantages
  - Always somewhat slower than running natively on your hardware
  - Splits pool of RAM with Host (=less RAM available)

# VIRTUAL MACHINES



:)

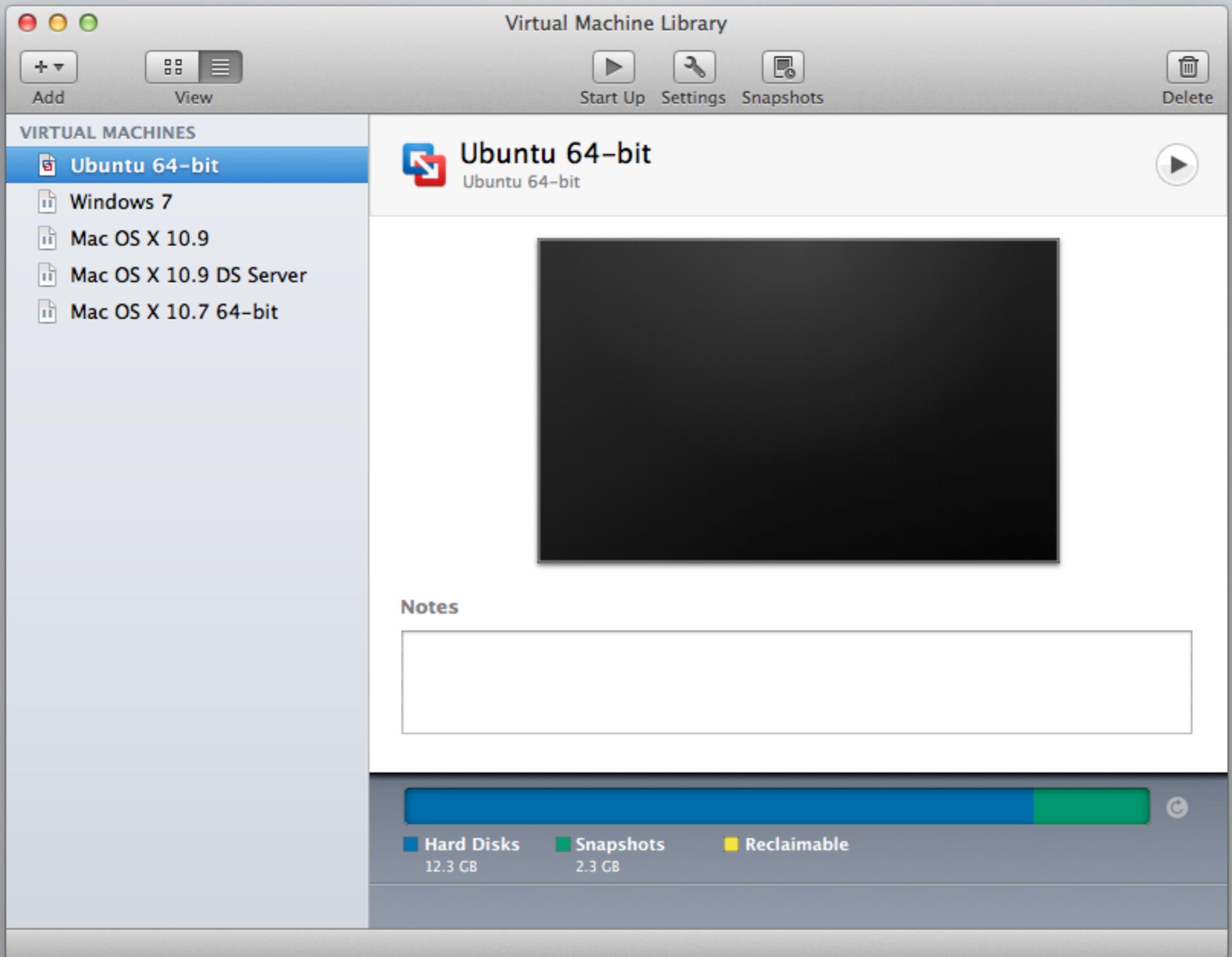


:)



:)

- VirtualBox: FREE, used by other technologies, more difficult than paid products below
- VMWare Fusion: market leader
- Parallels: best mac integration

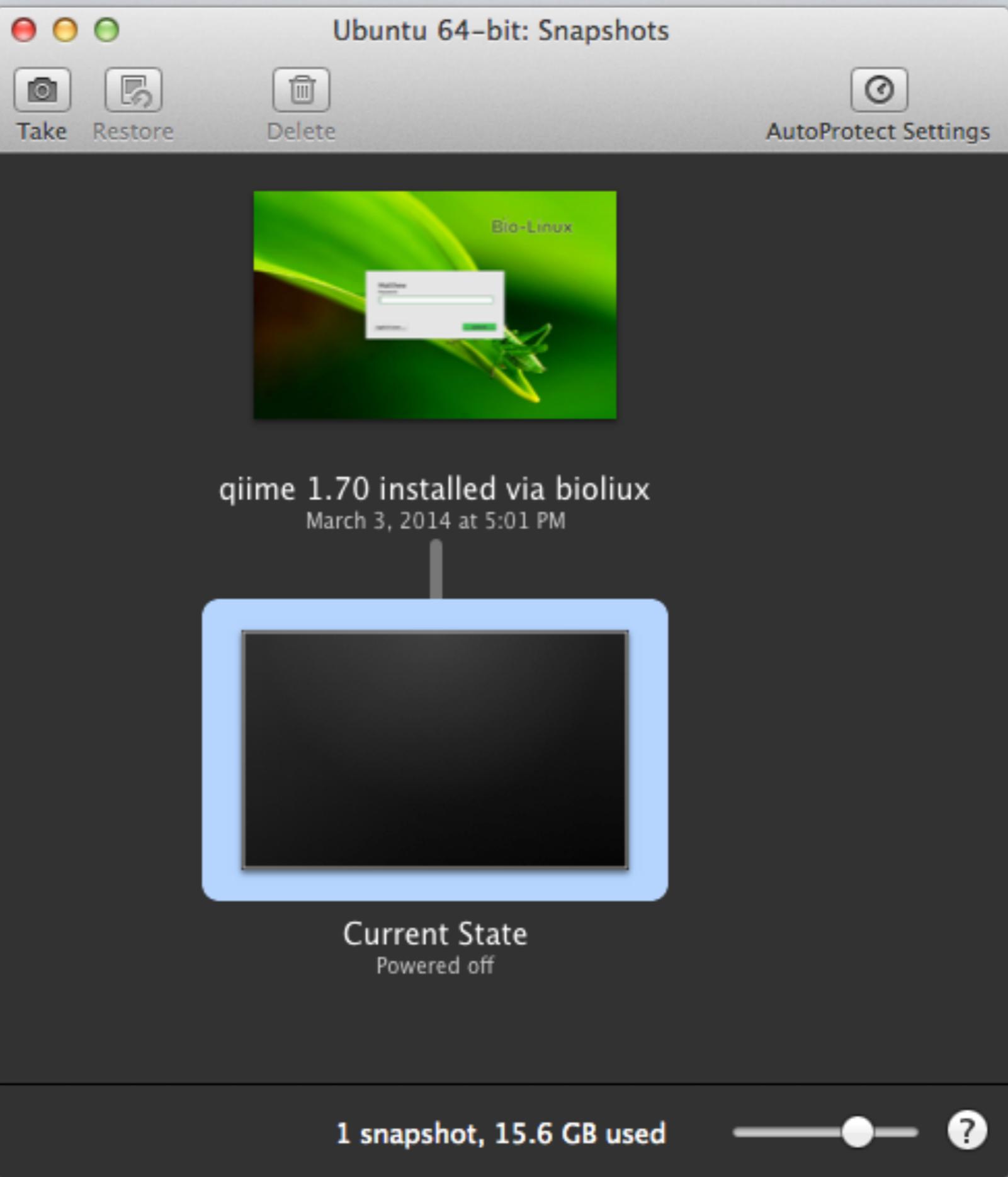
A screenshot of a Mac OS X application window titled "Virtual Machine Library". The window has a standard OS X title bar with red, yellow, and green buttons. Below the title bar is a toolbar with icons for "Add" (a plus sign), "View" (grid and list icons), "Start Up" (play button), "Settings" (gear icon), "Snapshots" (camera icon), and "Delete" (trash can icon).  
**VIRTUAL MACHINES**  
The left sidebar lists several virtual machines:

- Ubuntu 64-bit** (selected, highlighted in blue)
- Windows 7
- Mac OS X 10.9
- Mac OS X 10.9 DS Server
- Mac OS X 10.7 64-bit

  
**Ubuntu 64-bit**  
Ubuntu 64-bit  
The main pane displays the selected virtual machine, "Ubuntu 64-bit". It shows a thumbnail image of the Ubuntu desktop environment. To the right of the thumbnail is a play button icon.  
**Notes**  
A large, empty text input field for notes.  
  
**Storage Summary**  

 Hard Disks	 Snapshots	 Reclaimable
12.3 GB	2.3 GB	

A circular refresh/circular arrow icon is located at the bottom right of the storage summary.



# AMAZON WEB SERVICE

:\$

- Run linux or Windows instances in the cloud
- Great to experiment with
- Promise with paying for only computing power you need
- Of course can get expensive (including storage)
- Smallest instances are cheap (pennies an hour)
- Check out spot instances (low price for unused computers)

# VAGRANT



:)

- VirtualBox + Linux + configuration scripts
- Downloads a basic linux VM and scripts install all the needed components

# VAGRANT STACKS

Smithsonian/vagrant-stacks

GitHub, Inc. [github.com/Smithsonian/vagrant-stacks](https://github.com/Smithsonian/vagrant-stacks) Reader

Smithsonian / **vagrant-stacks** Unwatch 8 Star 0 Fork 1

Vagrant launcher for STACKS

10 commits 1 branch 0 releases 2 contributors

branch: master vagrant-stacks / +

Switched to using Ubuntu 14.04 (Trusty) and changed web settings to s...  
mkweskin authored on Feb 27 latest commit 06f947462a

conf Switched to using Ubuntu 14.04 (Trusty) and changed web settings to s... 4 months ago  
README.md Switched to using Ubuntu 14.04 (Trusty) and changed web settings to s... 4 months ago  
Vagrantfile Switched to using Ubuntu 14.04 (Trusty) and changed web settings to s... 4 months ago  
provision\_stacks.sh Switched to using Ubuntu 14.04 (Trusty) and changed web settings to s... 4 months ago

README.md

## vagrant-stacks

Vagrant launcher for STACKS 1.27 (<http://creskolab.uoregon.edu/stacks>)

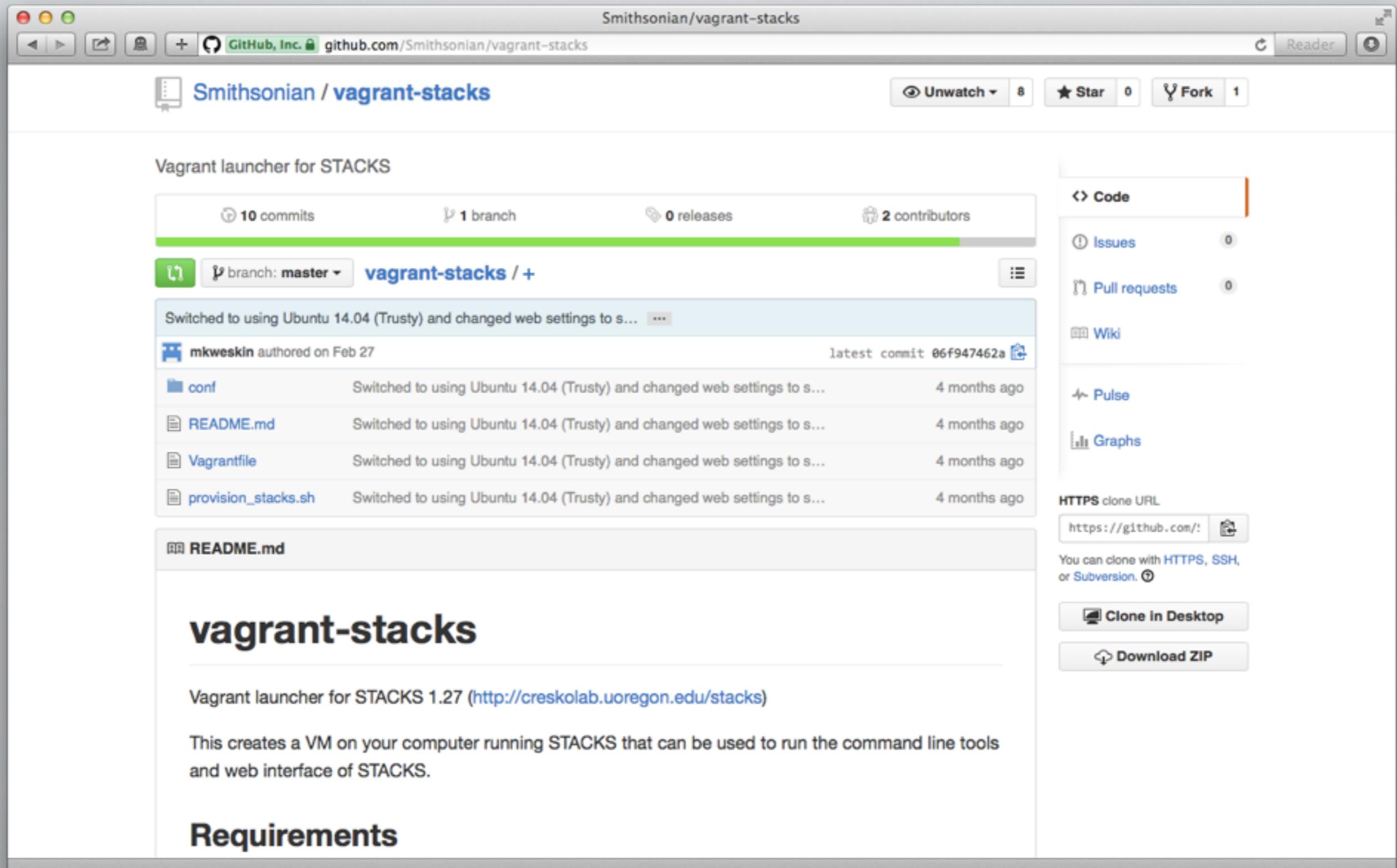
This creates a VM on your computer running STACKS that can be used to run the command line tools and web interface of STACKS.

## Requirements

Code Issues 0 Pull requests 0 Wiki Pulse Graphs

HTTPS clone URL <https://github.com/> You can clone with HTTPS, SSH, or Subversion.

Clone In Desktop Download ZIP



# VAGRANT STACKS

vagrant-stacks/provision\_stacks.sh at master · Smithsonian/vagrant-stacks

vagrant-stacks/provision\_stacks.sh at master · Smithsonian/vagrant-stacks

Bioinformatics Brew

branch: master vagrant-stacks / provision\_stacks.sh

mkweskin on Feb 27 Switched to using Ubuntu 14.04 (Trusty) and changed web settings to s...

2 contributors

52 lines (39 sloc) 1.666 kB

Raw Blame History

```
1 # reference: http://creskolab.uoregon.edu/stacks/manual
2
3 CURRENTVERSION=1.27
4
5 # install prereqs
6 sudo apt-get update
7 sudo apt-get -y install make g++
8
9 # prep non-interactive mysql-server
10 echo mysql-server mysql-server/root_password password vagrant | sudo debconf-set-selections
11 echo mysql-server mysql-server/root_password_again password vagrant | sudo debconf-set-selections
12
13 sudo apt-get -q -y install mysql-server php5 apache2
14 sudo apt-get -y install php-mdb2 php-mdb2-driver-mysql
15 sudo apt-get -y install libdbd-mysql-perl
16 sudo apt-get -y install samtools
17 sudo apt-get -y install libbam-dev
18 sudo apt-get -y install sparsehash
19 sudo apt-get -y install zlib1g-dev
20
21 # install STACKS
22 wget http://creskolab.uoregon.edu/stacks/source/stacks-$CURRENTVERSION.tar.gz
23 tar xfvz stacks-$CURRENTVERSION.tar.gz
24 cd stacks-$CURRENTVERSION
25 ./configure --enable-sparsehash --enable-bam --prefix=/home/vagrant/stacks
26 ./configure
27 make
28 make install
29 sudo mv /usr/local/share/stacks /usr/share
30
```

# DOCKER



:)

- The hottest right now
- Idea of a shipping container that is interchangeable
- Preconfigured system you run- includes all req'd software
- If you're running on an Linux machine, the container software runs natively parallel to the OS (fancy!)
- On a mac: you have a linux VM running in VirtualBox that runs all the "containers"
- MitoBIM, Phyluce

# SUMMARY

- Basics (xcode CLT, java...) :)
- Package management
- 1. Standalone Applications :)
- 2. Installer packages :\
  - 3. Pre-compiled binaries :)
  - 4. Compile on your own :\
    - 5. Package manager  
(homebrew) :)
  - Python
    - Pre-installed Python :\
      - Anaconda :)
    - VMs :)
    - EC2 :\$
      - Vagrant :)
      - Docker :)