# Beginner's
# Introduction to Computing at CARC
# with JupyterHub

Matthew Fricke

Version 0.1

# Goals

- 1) Basic Linux Literacy
- 2) Using Compute Nodes with Slurm
- 3) Jupyterhub

I hope to spend about an hour on each with a 15 minute break.

# Outline

- High Performance Computing Overview
- Logging in
- The BASH Shell
- The Slurm Job Scheduler
- Transferring data to and from CARC
- Accessing software and the module system
- Conda environments
- Jupyterhub

# High Performance Computing

- What is high performance computing?
  - Really just means something that is a lot more powerful than your desktop or laptop.
  - Hardware:
    - That might mean more and faster processors to do the calculations more quickly (eg 400 CPUs instead of 4)
    - More RAM so you can work on bigger problems (3,000 GB instead of 8)
    - Bigger file systems so you can process larger datasets
    - More and bigger GPUs to accelerate your computations (12 GPUs at a time instead of 1)
  - People:
    - Someone else to manage the systems and keep them running and secure
    - Someone to answer your questions and help with problems

# Logging into Wheeler


First login to the Linux **workstation** in front of you.

Use your CARC username and password.

Keven, Tannor, Viacheslav (Slava), and Jose can help you login if you have trouble.

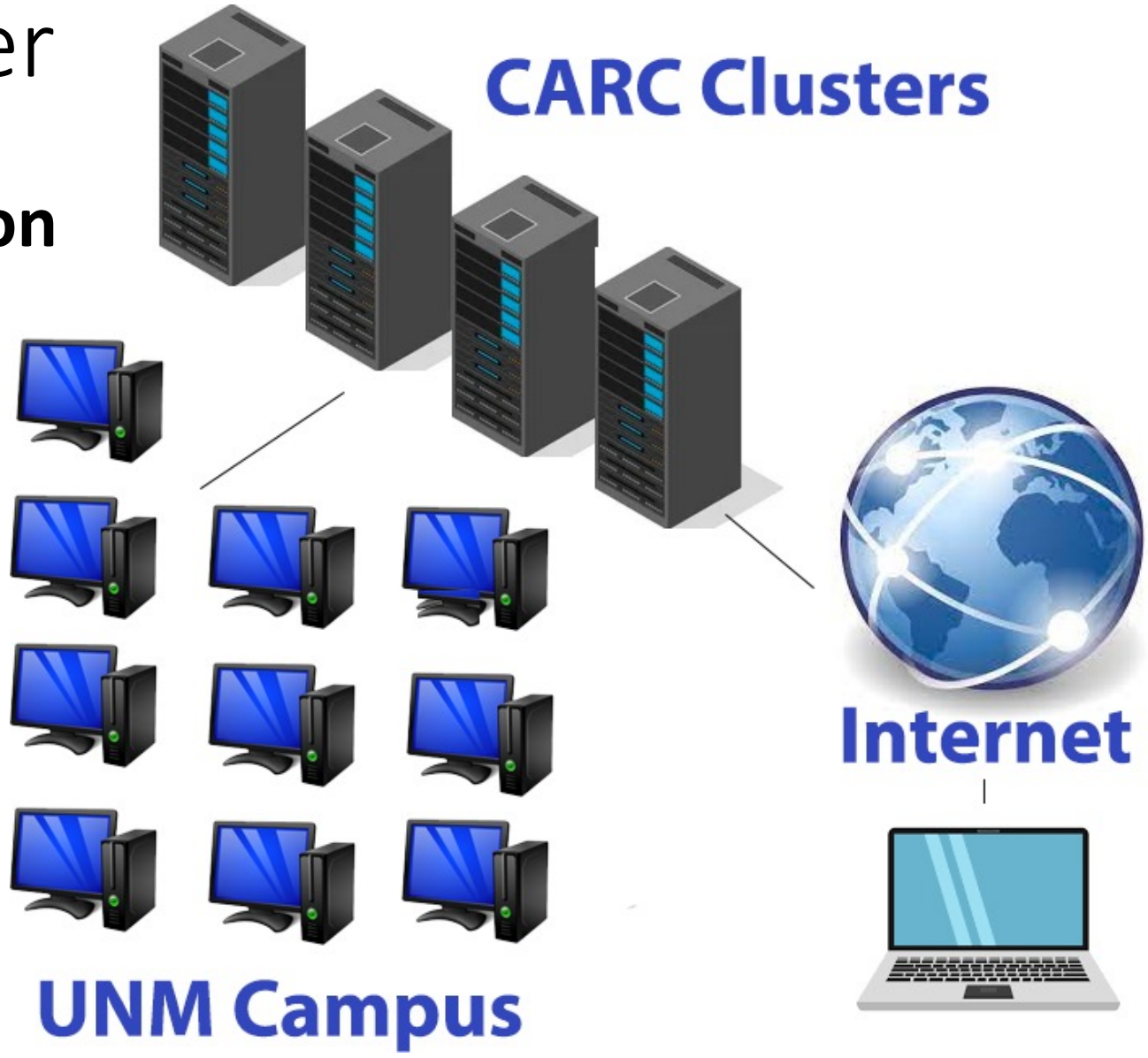
This is an “important step” so don’t let me move on until you have logged in

# Logging into Wheeler

First login to the **workstation** in front of you.

You will always login to CARC cluster remotely.

These clusters don’t even have monitors.



# Logging into Wheeler

We are going to use a program called secure shell.

Secure shell (ssh) is now built into every major operating system (Windows, OSX, and Linux).

You don’t need third party programs like putty anymore.

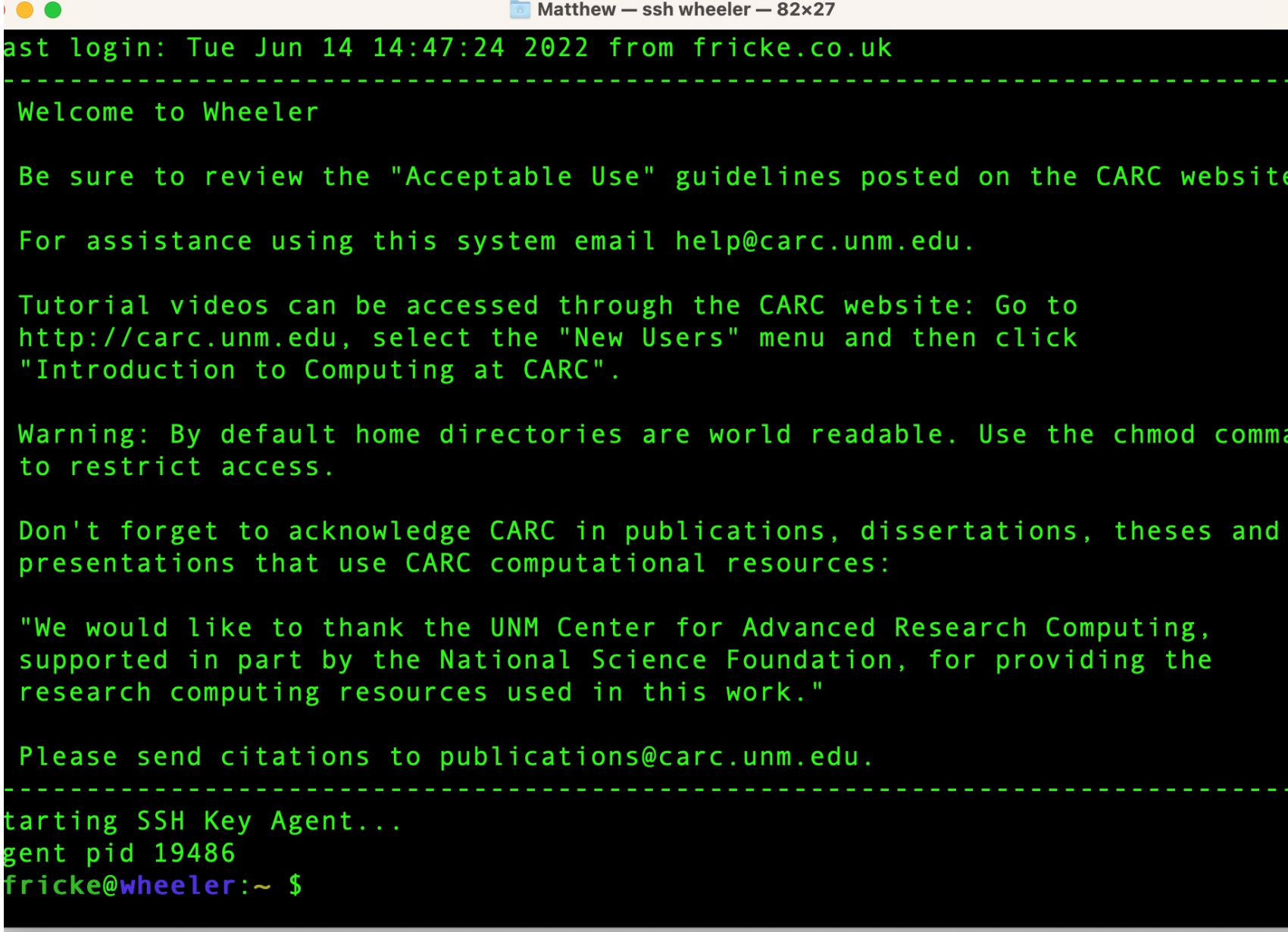
# Logging into Wheeler


```
ssh vanilla@wheeler.alliance.unm.edu
```

Should prompt you for a password…

Don’t let me move on until you are able to login.

# Logging into Wheeler



# Please enter the following command

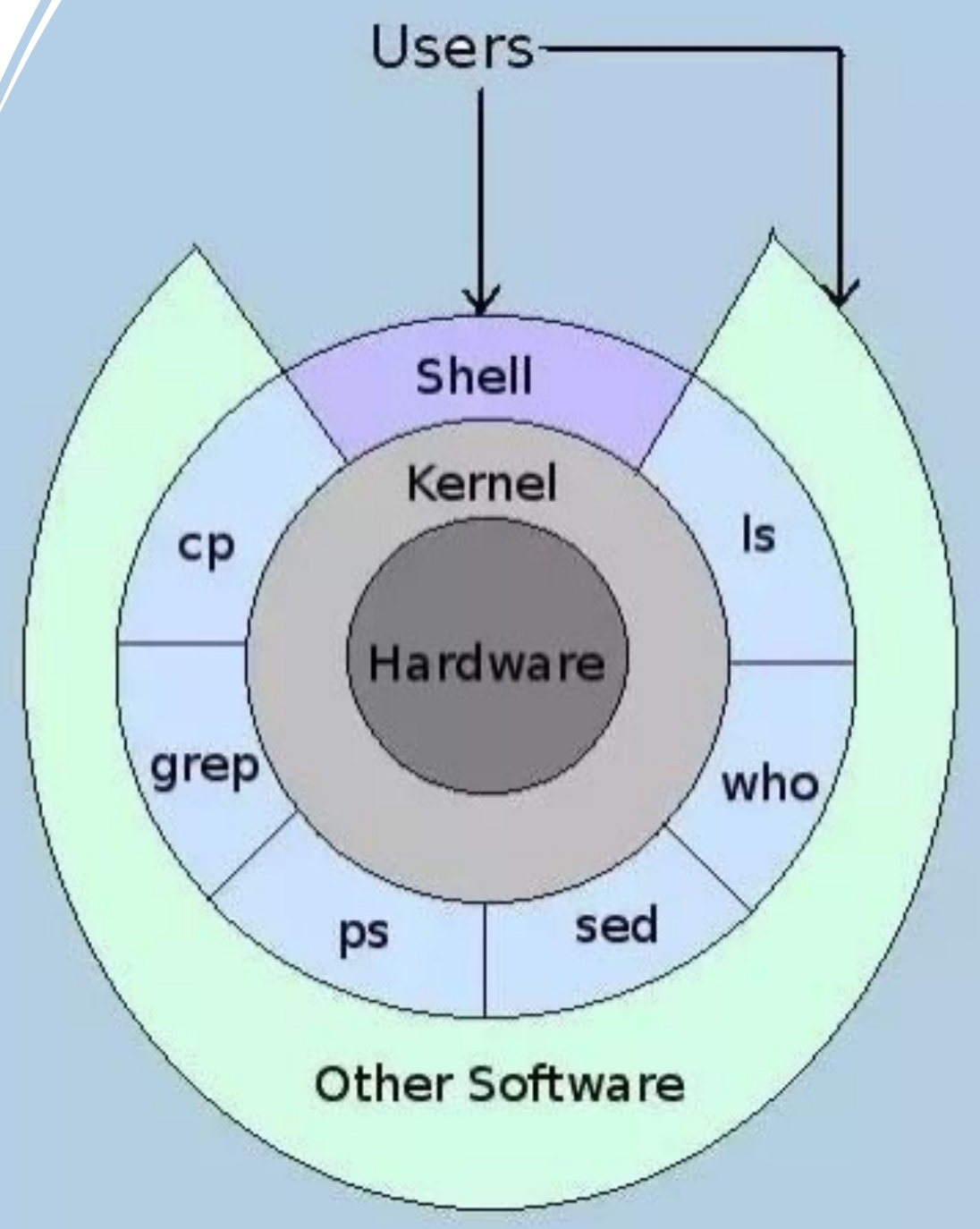

cp –r /projects/shared/workshops/beginner/mystuff ~/

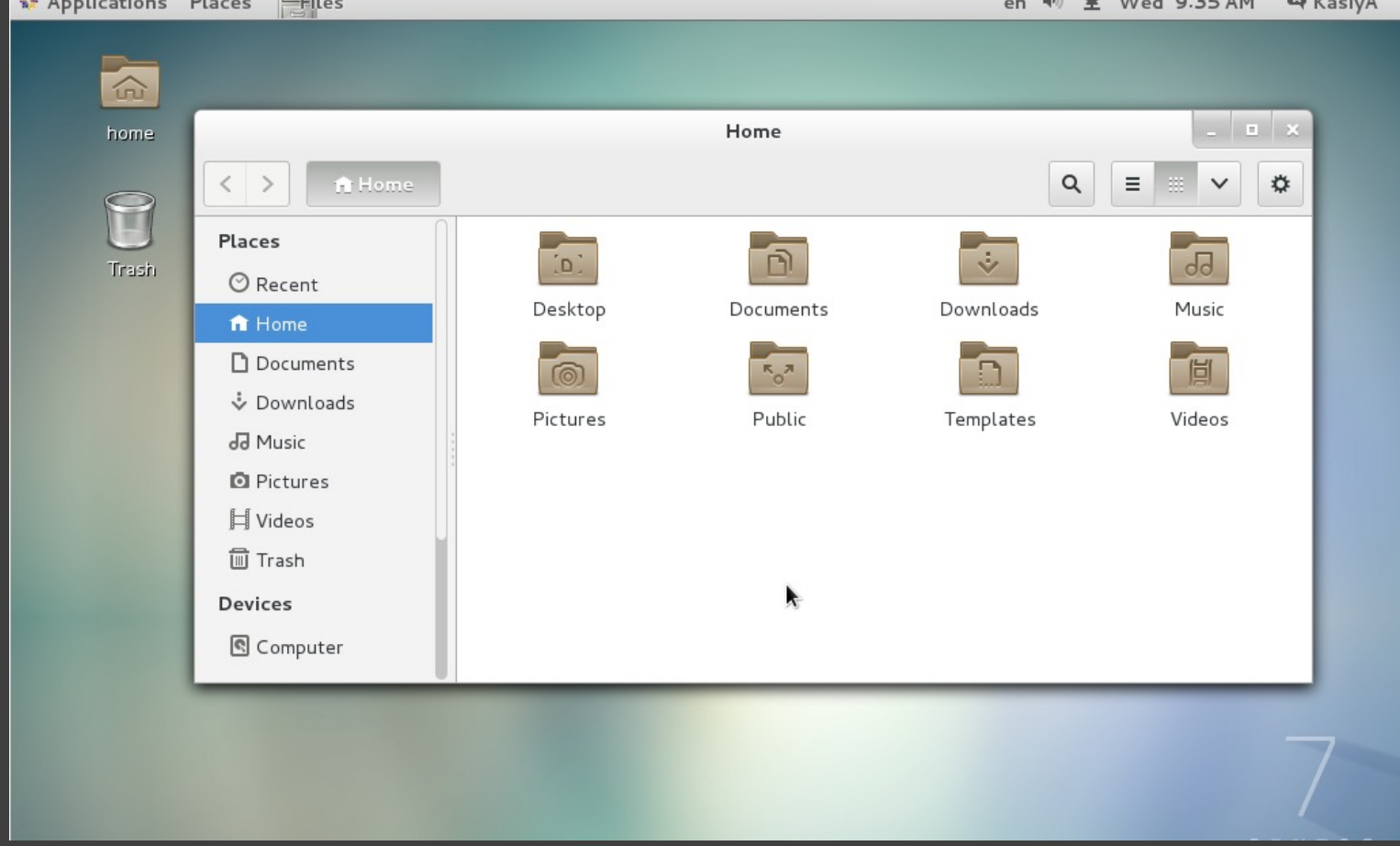
We will come help you if you have any trouble.

(Later I will go over what this command does)

# Linux and the BASH Shell

- The Kernel manages access to the hardware in a computer.
- An Operating System (OS) is the Kernel plus useful programs provided by the OS.
- The “shell” is the outermost layer of the OS.
- It is where the user interacts with the OS.

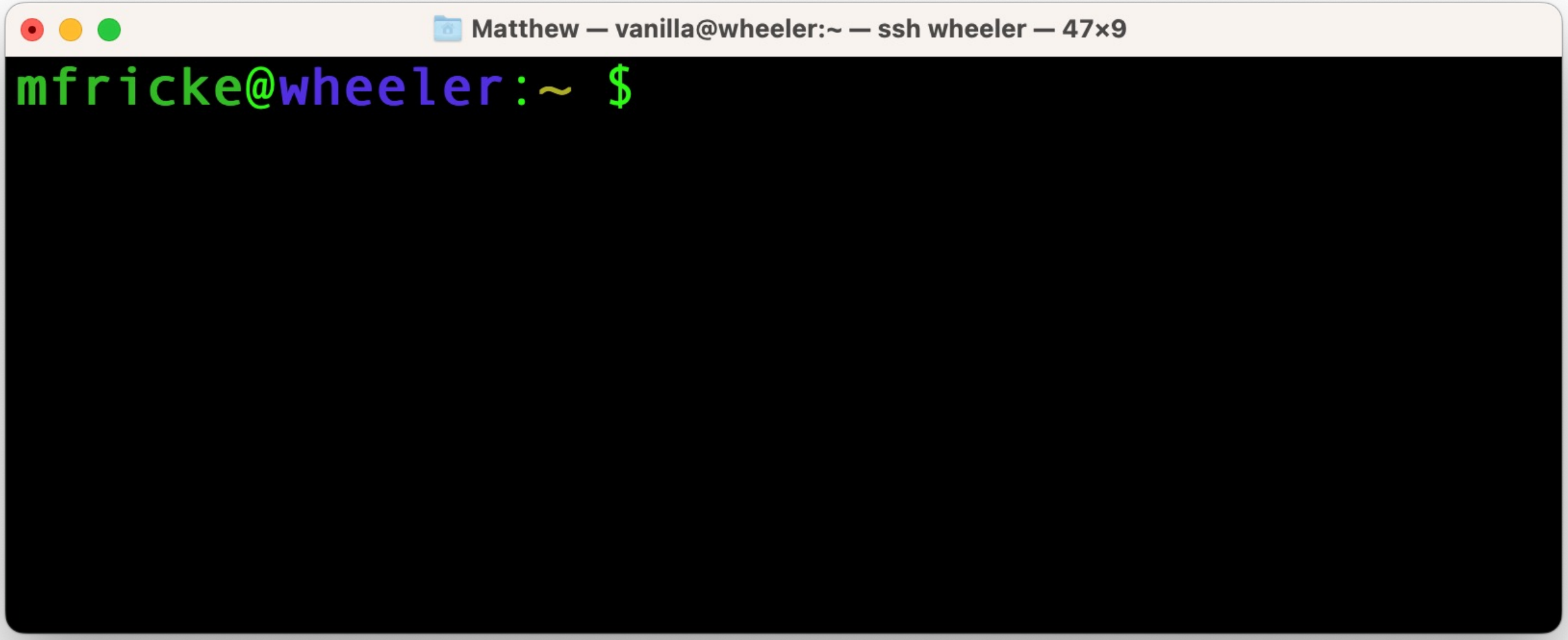




# Graphical Shells (GUIs)

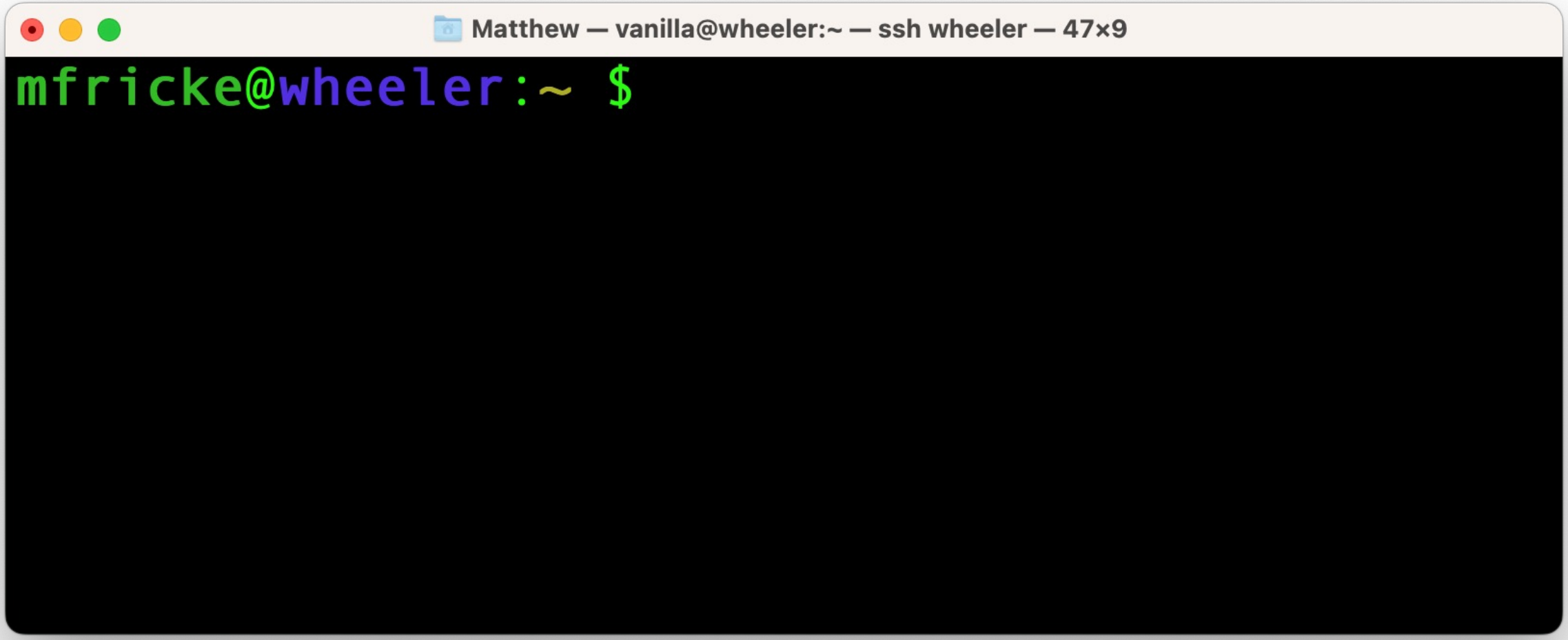
# Logging into Wheeler

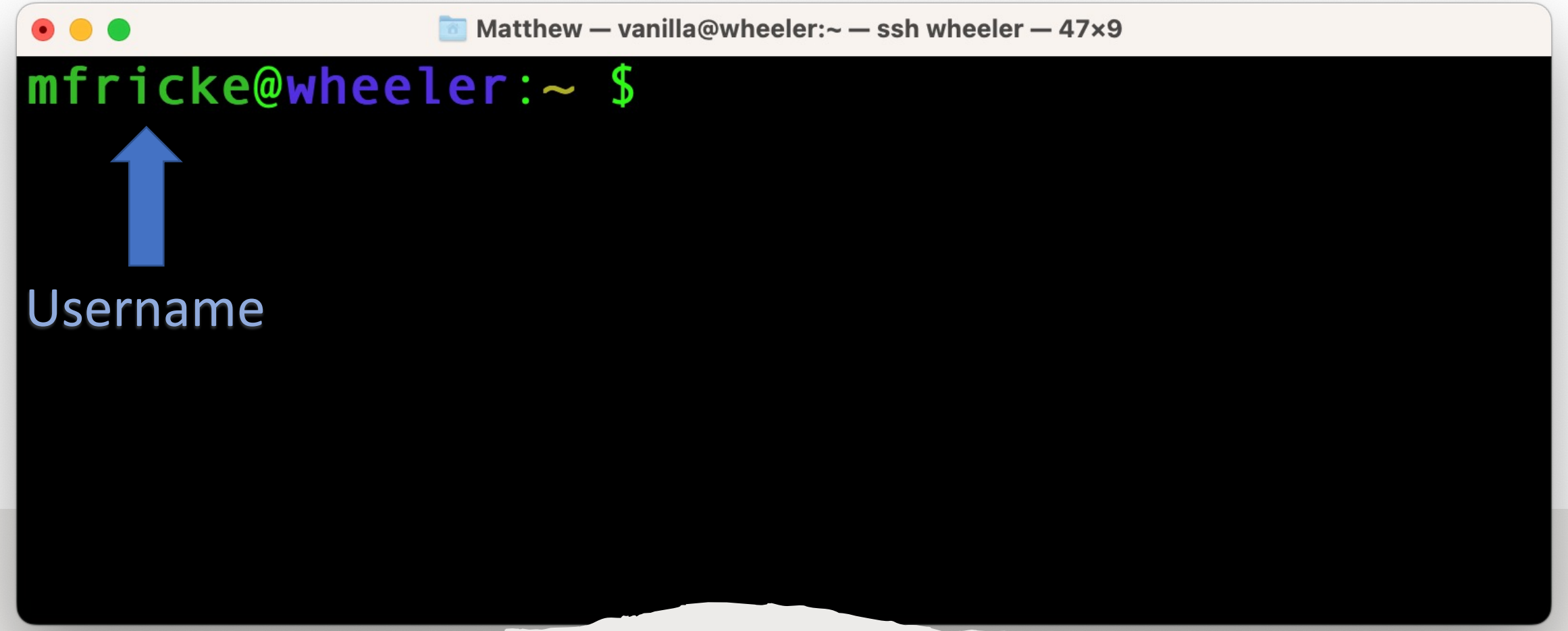


# Linux and the BASH Shell

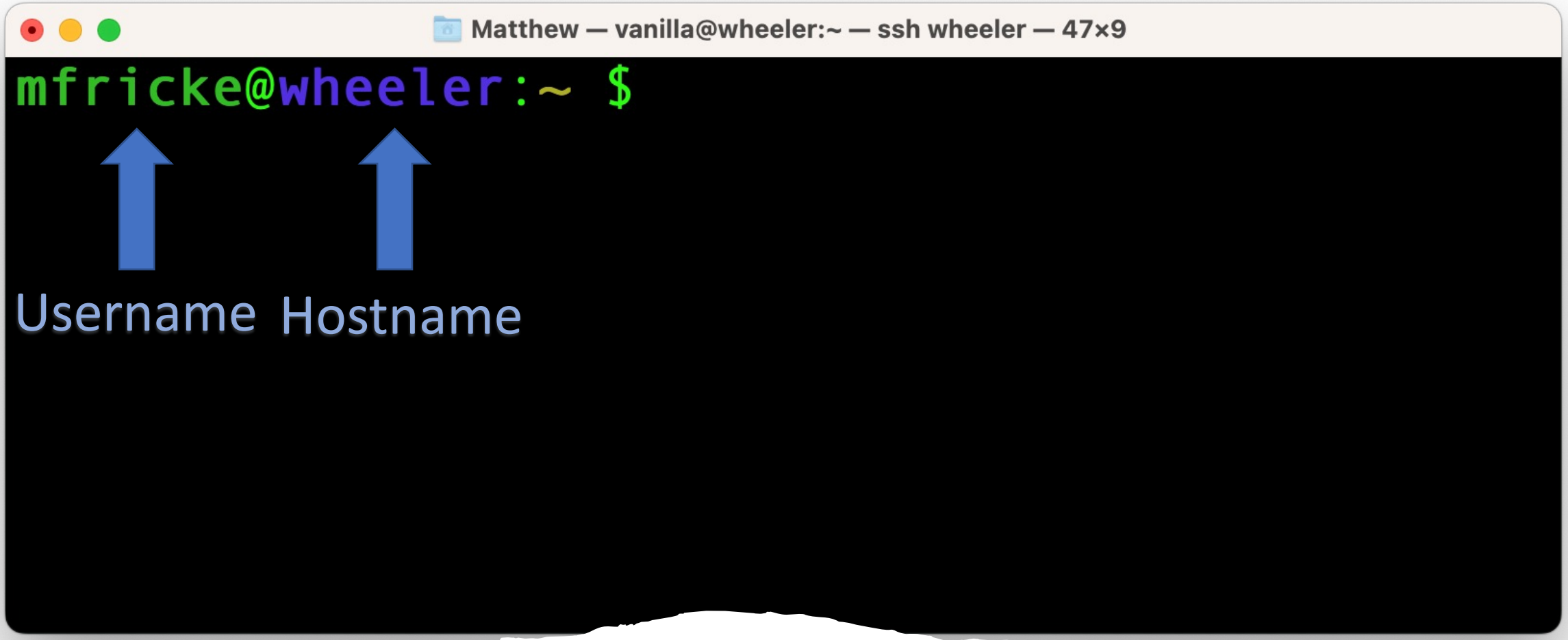
# The Borne-Again Shell (BASH)

Written in 1976 by Stephen Bourne for UNIX version 7.






# Understanding the BASH prompt…

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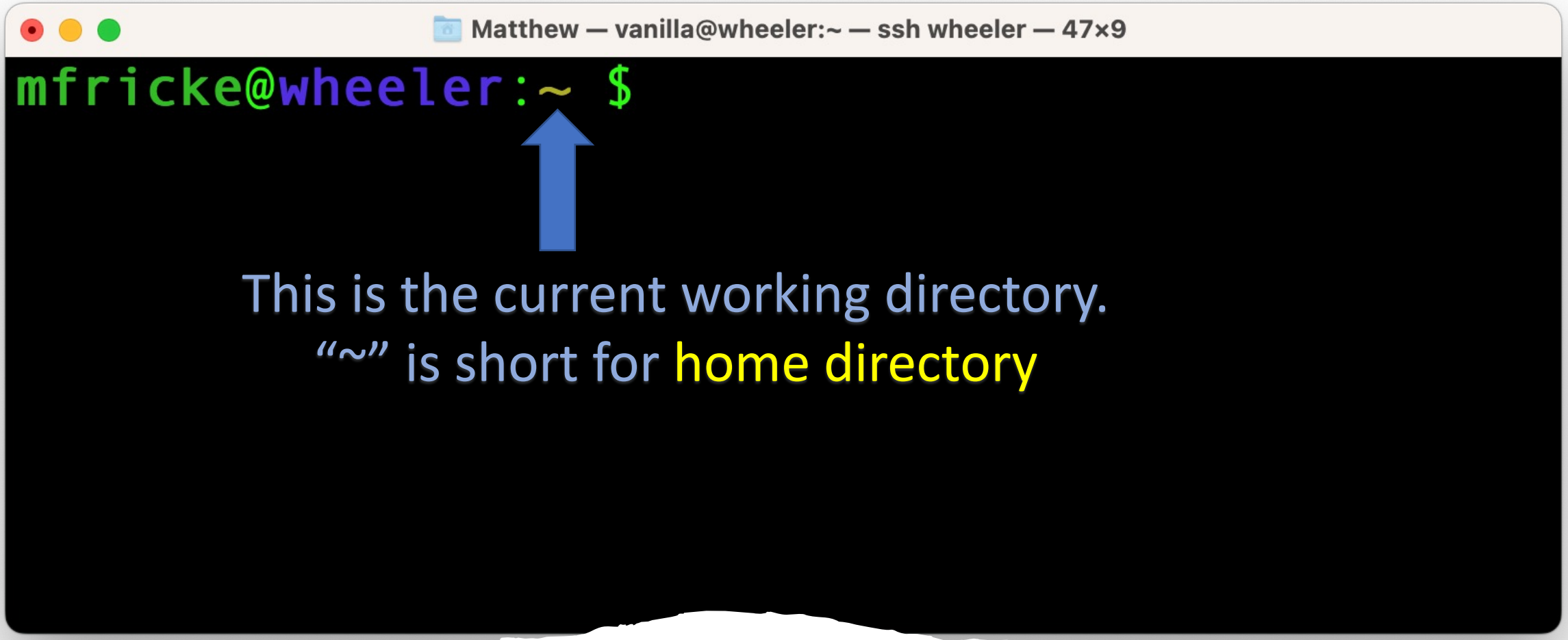


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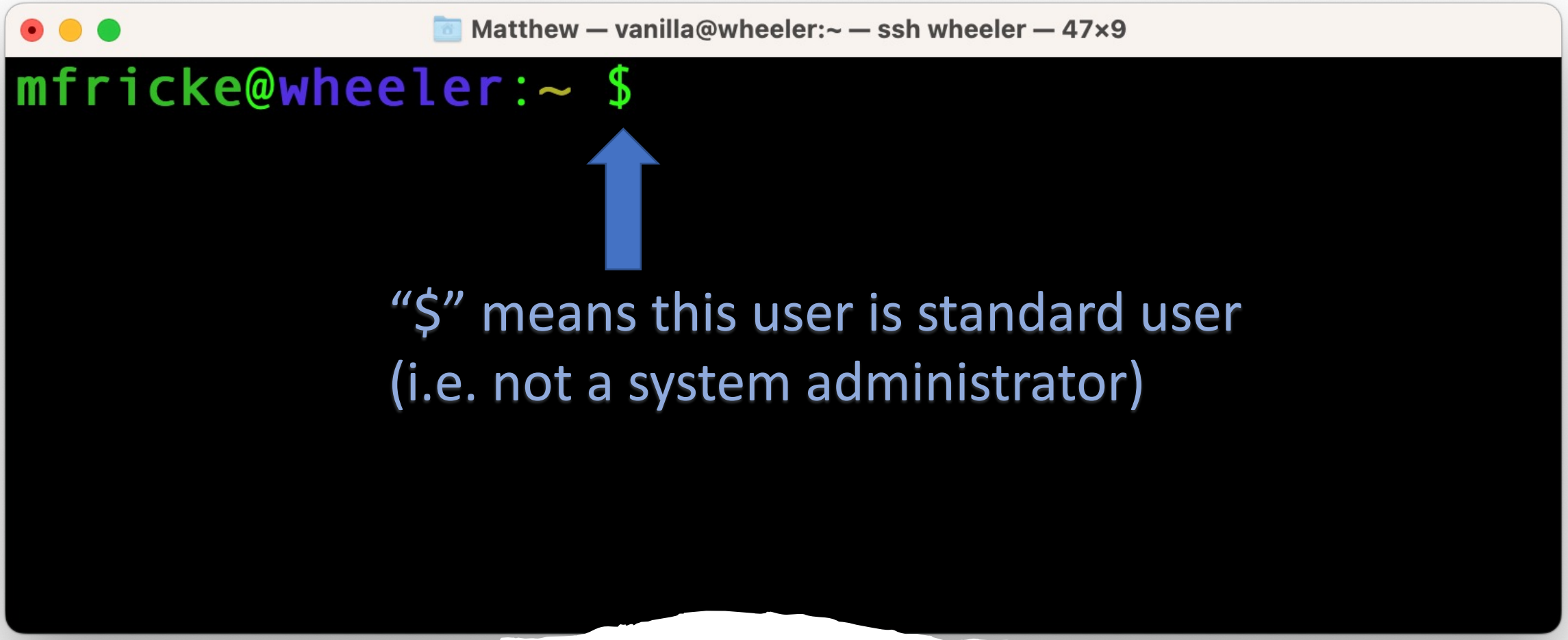


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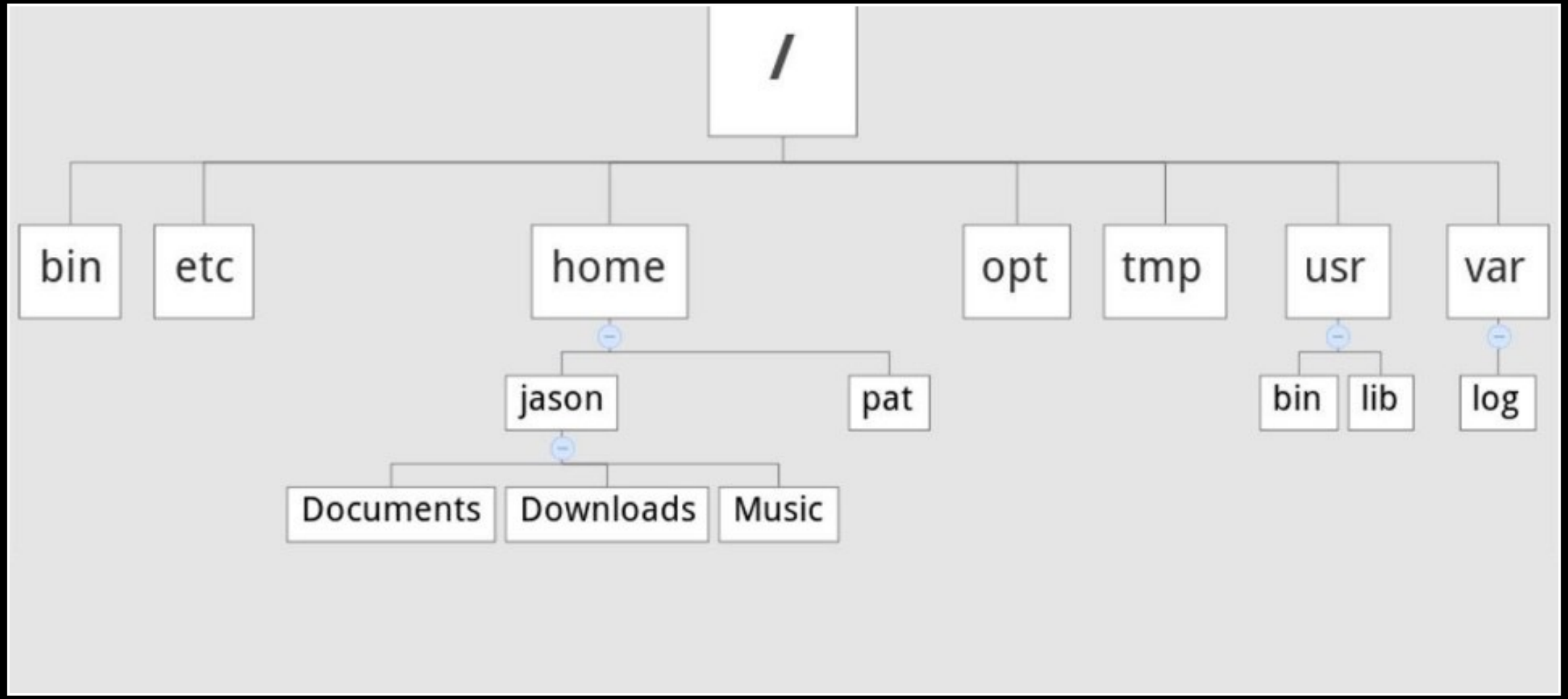
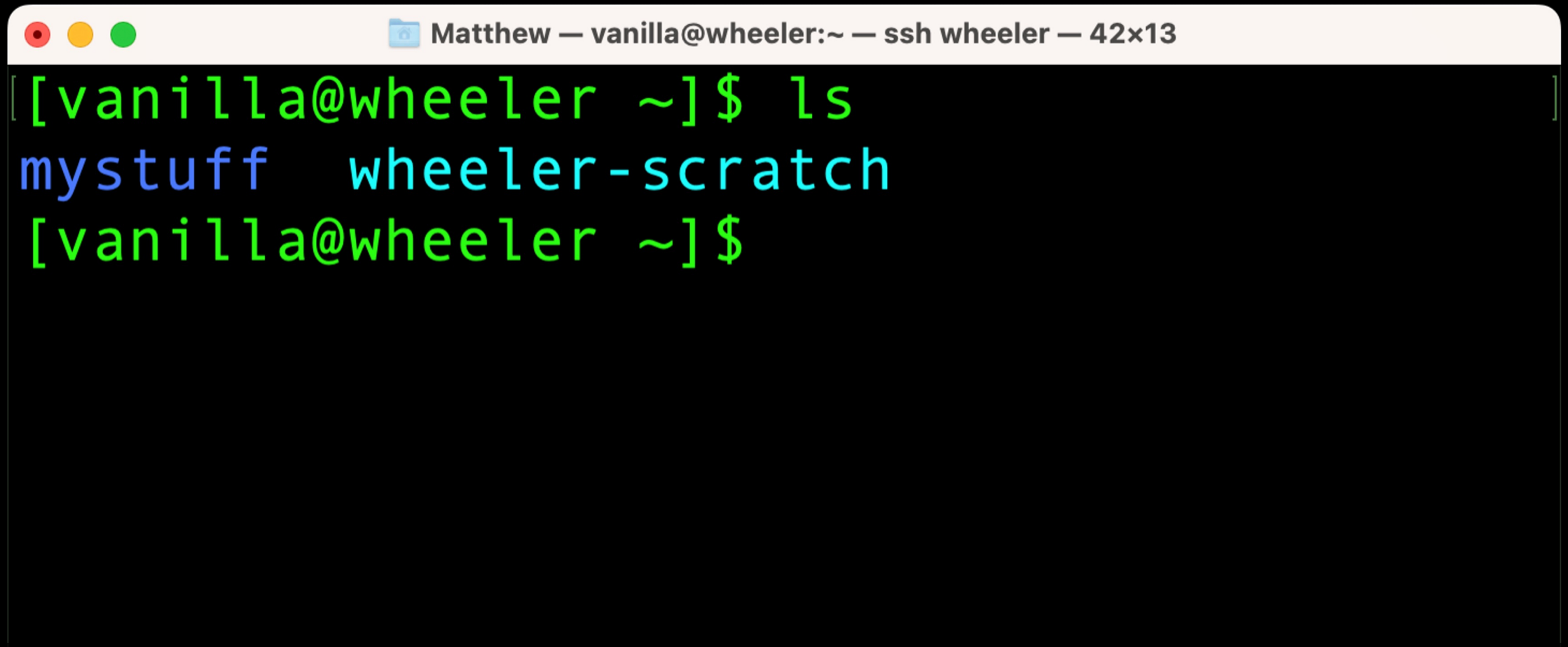
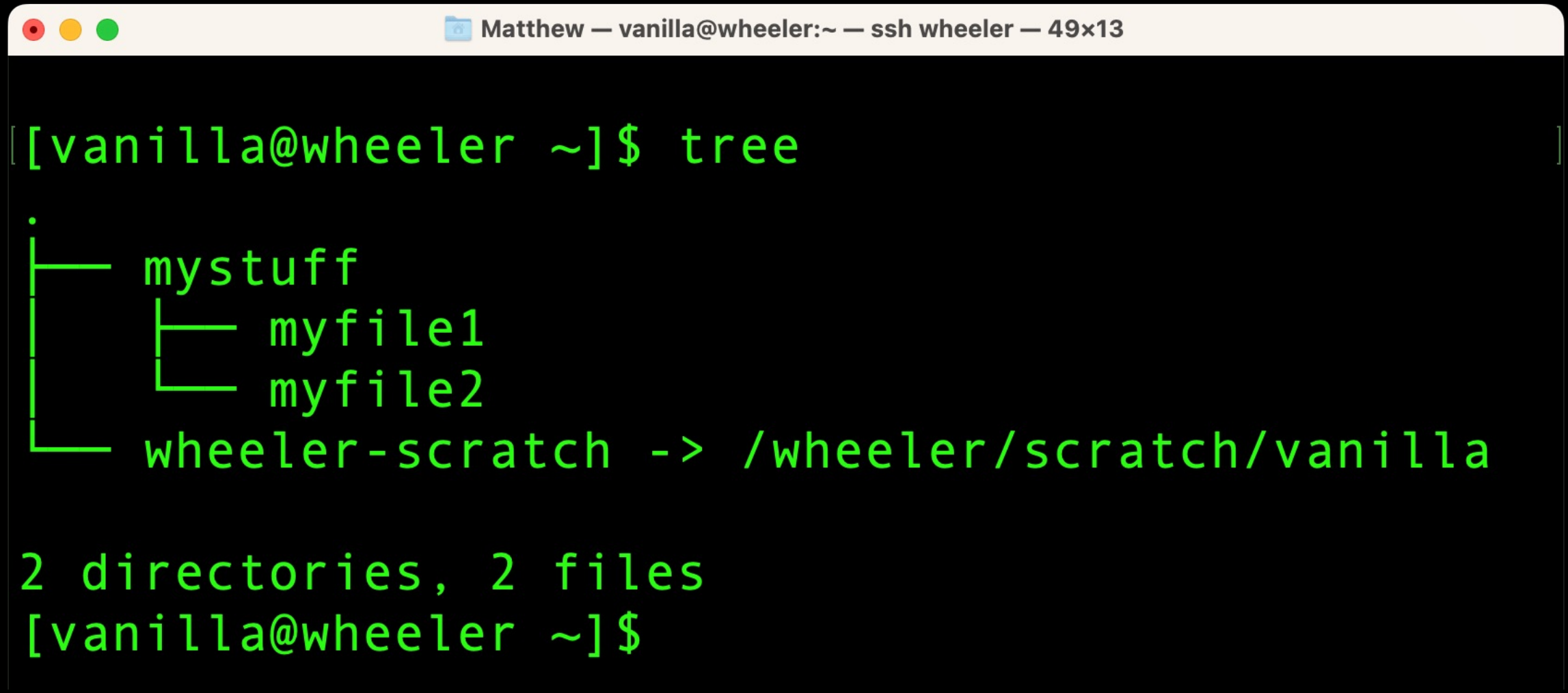



Example Filesystem Tree

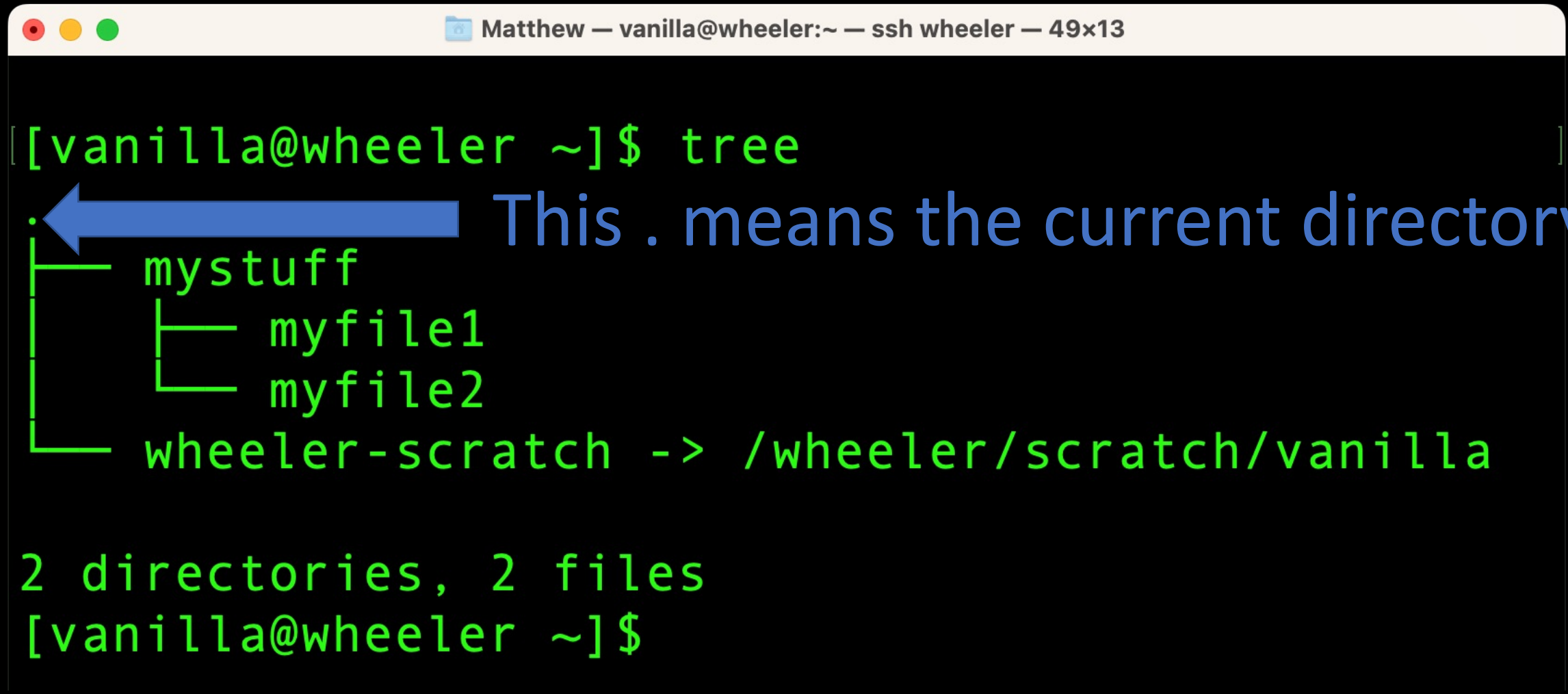

Figuring out where you are in the filesystem…




Figuring out where you are in the filesystem…




Figuring out where you are in the filesystem…



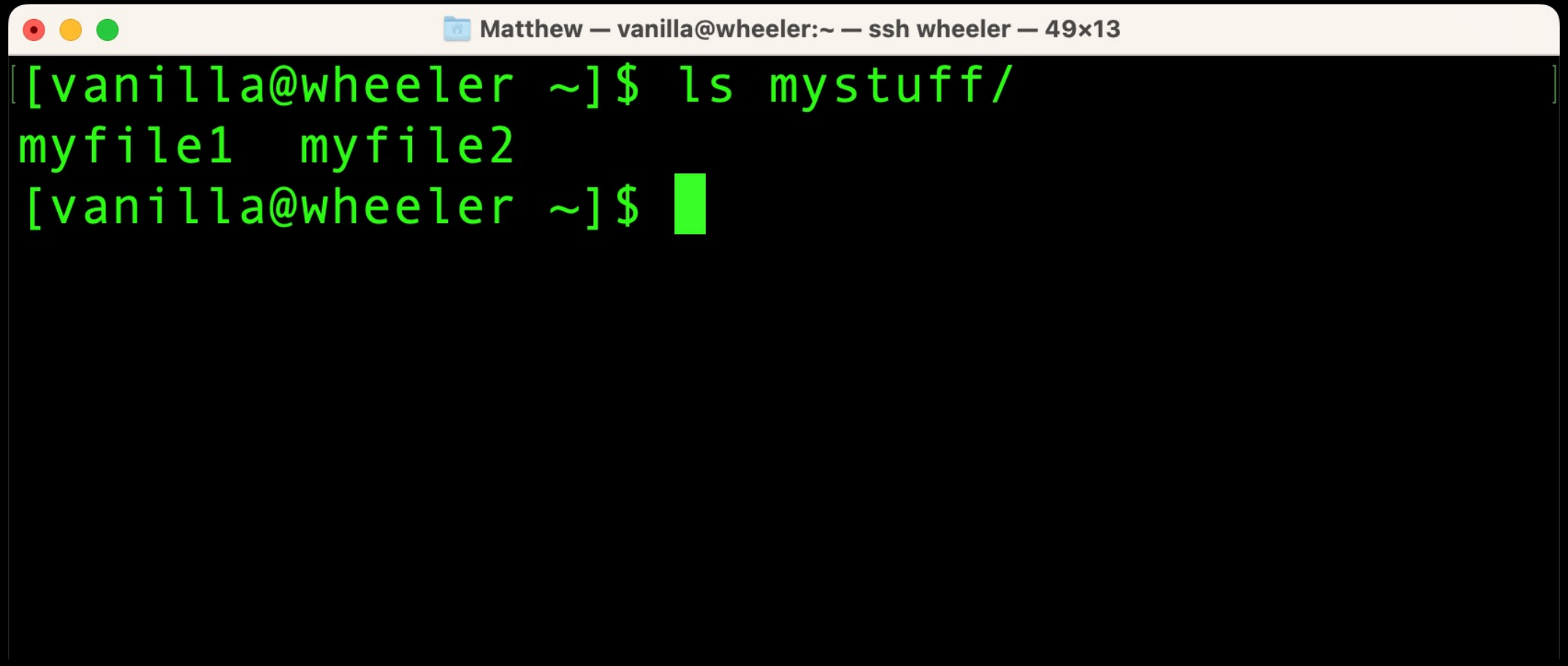

Figuring out where you are in the filesystem…

# “Absolute” paths vs “relative” paths

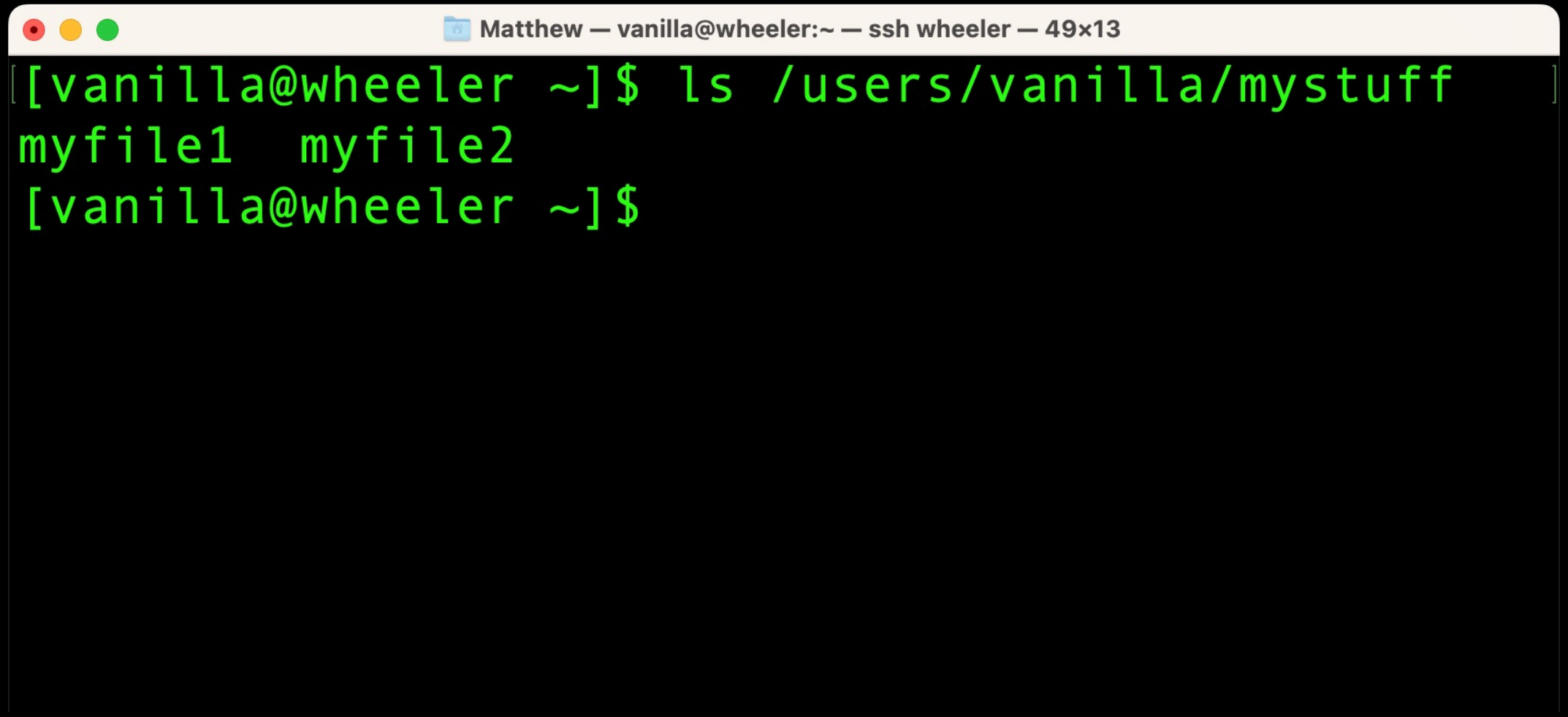
- A path is a list of directories and/or files. It is a path through the directory tree that tells one how to get somewhere in the filesystem.

- An absolute path tells one how to get to the destination from starting from the root of the filesystem. E.g “/users/vanilla/mystuff/”

- A relative path specifies how to get there *starting from the current working directory*. E.g vanilla/mystuff/




Figuring out where you going...




Figuring out where you going…

```
[vanilla@wheeler ~]$ ls ./mystuff/
myfile1  myfile2
[vanilla@wheeler ~]$ ls ~/mystuff/
myfile1  myfile2
[vanilla@wheeler ~]$
```

Figuring out where you going…

```
[vanilla@wheeler ~]$ ls -a
.                       .modulesbeginenv
..                      mystuff
.addressbook            .oracle_jre_usage
.addressbook.lu         .pinerc
.bashrc                 .pki
.cache                  .rhosts
.comsol                 .shosts
.config                 .spack
.flexlmrc               .ssh
```

Figuring out where you going...

```
[vanilla@wheeler ~]$ ls -l
total 4
drwxr-xr-x 2 vanilla users 4096 Jun 14 22:05 mystuff
lrwxrwxrwx 1 vanilla users   24 Jun 14 21:20 wheeler-scratch ->
/wheeler/scratch/vanilla
[vanilla@wheeler ~]$
```

Figuring out where you going…

```
[vanilla@wheeler ~]$ ls -l mystuff/
total 473704
-rw-r--r-- 1 vanilla users 483165473 Jun 14 23:20 myfile1
-rw-r--r-- 1 vanilla users         0 Jun 14 22:05 myfile2
[vanilla@wheeler ~]$
```

Figuring out where you going...

```
[vanilla@wheeler ~]$ ls -lh mystuff/
total 463M
-rw-r--r-- 1 vanilla users 461M Jun 14 23:20 myfile1
-rw-r--r-- 1 vanilla users    0 Jun 14 22:05 myfile2
[vanilla@wheeler ~]$
```

Figuring out where you going...

```
[vanilla@wheeler ~]$ du -s
499704 .
[vanilla@wheeler ~]$ du -sh
488M .
[vanilla@wheeler ~]$
```

Figuring out where you going...

```
[vanilla@wheeler ~]$ df -h
Filesystem                          Size  Used Avail Use% Mounted on
devtmpfs                             24G     0   24G   0% /dev
tmpfs                                24G   64K   24G   1% /dev/shm
tmpfs                                24G  968M   23G   5% /run
tmpfs                                24G     0   24G   0% /sys/fs/cgroup
/dev/mapper/centos-root             930G  567G  363G  61% /
/dev/sdc2                           836G   72G  764G   9% /tmp
/dev/md126p1                        2.0G  333M  1.7G  17% /boot
172.17.2.254:/mnt/wheeler-scratch    37T   28T  8.7T  77% /wheeler/scratch
172.17.2.255:/mnt/wheeler-scratch2   37T   28T  9.0T  76% /wheeler/scratch2
beegfs_nodev                        110T   51T   60T  46% /carc/scratch
chama:/home/homes                    65T   36T   30T  55% /users
chama:/home/carc_projects            65T   36T   30T  55% /projects
```

Figuring out where you going…

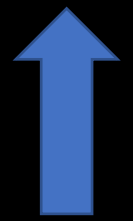
```
[vanilla@wheeler ~]$ quota -s
Disk quotas for user vanilla (uid 659):
     Filesystem   space   quota   limit   grace   files   quota   limit   grace
chama:/home/homes
                  488M    100G    200G             315   4295m   4295m
[vanilla@wheeler ~]$
```

Figuring out where you going...

```
[vanilla@wheeler ~]$ stat mystuff/myfile1
  File: ‘mystuff/myfile1’
  Size: 483165473 Blocks: 947408     IO Block: 65536  regular file
Device: 28h/40d Inode: 9232782834205560540  Links: 1
Access: (0644/-rw-r--r--)  Uid: (  659/ vanilla)   Gid: (  100/   users)
Access: 2022-06-14 22:05:27.503289000 -0600
Modify: 2022-06-14 23:20:26.945918000 -0600
Change: 2022-06-14 23:20:48.754917000 -0600
 Birth: -
```

# Figuring out what you’ve got…

```
[vanilla@wheeler ~]$ find -name myfile2
./mystuff/myfile2

[vanilla@wheeler ~]$ find -name "myfile*"
./mystuff/myfile1
./mystuff/myfile2
./mystuff/myfile3
./mystuff/myfile0
```



Wildcard

Figuring out what you've got…

```
[vanilla@wheeler ~]$ cd mystuff/
[vanilla@wheeler ~/mystuff]$
```

Use the tab key to autocomplete

Going somewhere new…

# Now it is your turn…


- For this path:
  /projects/shared/workshops/beginner/vecadd

- What are the names of the files in that directory?
- When were they last modified?
- How large are the files?

You can find this information with the ls command.

# Now it is your turn…


- For this path:
  /projects/shared/workshops/beginner/vecadd

  Now “cd” into that directory using <tab> autocomplete.

- Now you know how to find your way around filesystems using bash
- Let’s see how to modify the filesystem.

- In bash to move a file we use the mv command.
- To copy a file it is cp.
- To copy files from CARC to a personal computer use scp or rsync.

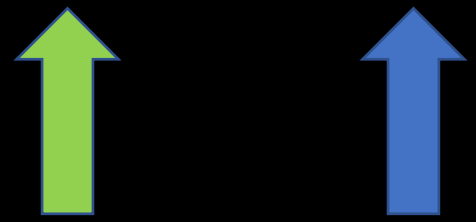
```
[vanilla@wheeler beginner]$ pwd
/projects/shared/workshops/beginner
[vanilla@wheeler beginner]$ cd ~
[vanilla@wheeler ~]$ pwd
/users/vanilla
[vanilla@wheeler ~]$
```

First return to your home directory…

```
[vanilla@wheeler ~]$ cd mystuff
[vanilla@wheeler ~/mystuff]$ mv myfile1 myfile0
[vanilla@wheeler ~/mystuff]$ ls
myfile0  myfile2  myfile3
[vanilla@wheeler ~/mystuff]
```

Modifying the filesystem…
moving a file.

```
[vanilla@wheeler ~/mystuff]$ cp myfile0 myfile1
[vanilla@wheeler ~/mystuff]$
```



Source Destination

```
[vanilla@wheeler ~/mystuff]$ ls
myfile0  myfile1  myfile2  myfile3
[vanilla@wheeler ~/mystuff]$
```

Modifying the filesystem…
copying a file.

```
[vanilla@wheeler ~]$ cp -r mystuff mystuff2
[vanilla@wheeler ~]$
```

Source

Destination

```
[vanilla@wheeler ~]$ ls
mystuff  mystuff2  wheeler-scratch
```

Copying a whole directory tree…

```
Lycaon:~ matthew$ scp vanilla@wheeler.alliance.unm.edu:~/mystuff/myfile3 Desktop/
```

Source

Destination

```
(vanilla@wheeler.alliance.unm.edu) Password:
myfile3                       100%   40     2.0KB/s   00:00
```

# Copying data to a personal computer from CARC…

```
Lycaon:~ matthew$ scp -r vanilla@wheeler.alliance.unm.edu:~/mystuff Desktop/
```

Source

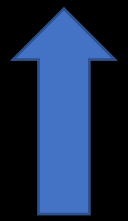
Destination

```
(vanilla@wheeler.alliance.unm.edu) Password:
myfile1                       100% 1024KB   6.5MB/s   00:00
myfile2                       100% 2048KB 382.5KB/s   00:05
myfile3                       100%   40     3.2KB/s   00:00
myfile0                       100% 1024KB   8.8MB/s   00:00
```

# Copying data to a personal computer from CARC…

```
Lycaon:~ matthew$ scp -r Desktop/mystuff vanilla@wheeler.alliance.unm.edu:~/
```

Source



Destination

```
(vanilla@wheeler.alliance.unm.edu) Password:
myfile1                       100% 1024KB 591.5KB/s   00:01
myfile0                       100% 1024KB   2.0MB/s   00:00
myfile2                       100% 2048KB   2.1MB/s   00:00
myfile3                       100%   40     2.1KB/s   00:00
```

# To copy from a personal computer to CARC…

```
ssh vanilla@wheeler.alliance.unm.edu
```

Log back into wheeler…

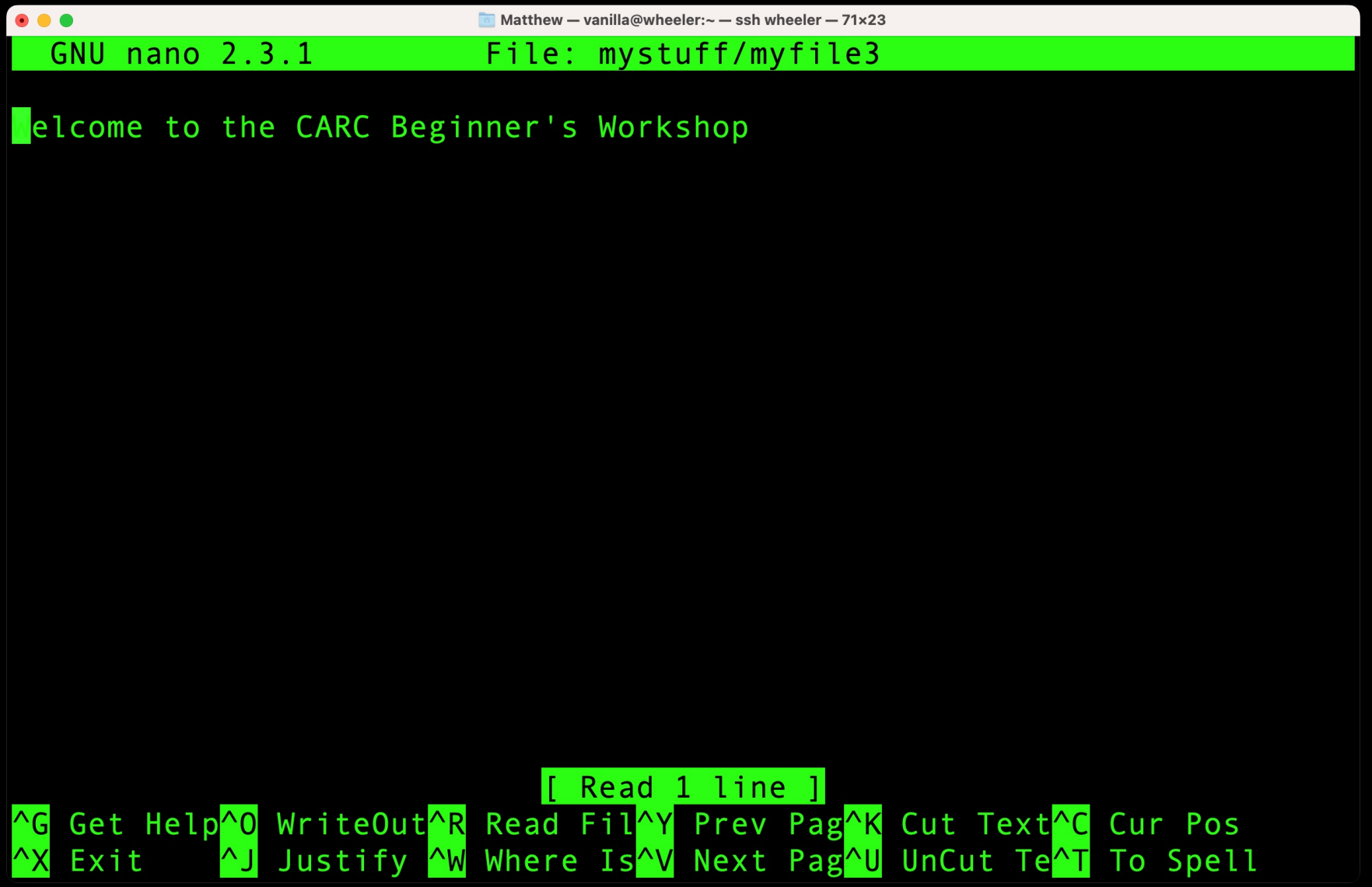
```
[vanilla@wheeler ~]$ file mystuff/myfile0
mystuff/myfile0: data

[vanilla@wheeler ~]$ file mystuff/myfile3
mystuff/myfile3: ASCII text
```

Figuring out file types …

```
[vanilla@wheeler ~]$ cat mystuff/myfile3
Welcome to the CARC Beginner's Workshop
```

Text files ...

```
[vanilla@wheeler ~]$ nano mystuff/myfile3
```



# 15 Minute Break

# Software Access

Lmod Modules

Conda

```
[vanilla@wheeler ~]$ module spider matlab


----------------------------------------------------------------------------
-
  matlab:
----------------------------------------------------------------------------
-
     Versions:
        matlab/R2017a
        matlab/R2018b
        matlab/R2019a
        matlab/R2020a
        matlab/R2021a
```

# Getting access to software…

```
[vanilla@wheeler ~]$ module load matlab/R2021a
Lmod has detected the following error: Matlab may only be run on compute
nodes. wheeler is not a compute node. Exiting...
While processing the following module(s):
    Module fullname  Module Filename
    ---------------  ---------------
    matlab/R2021a    /opt/local/modules/matlab/R2021a.lua
```

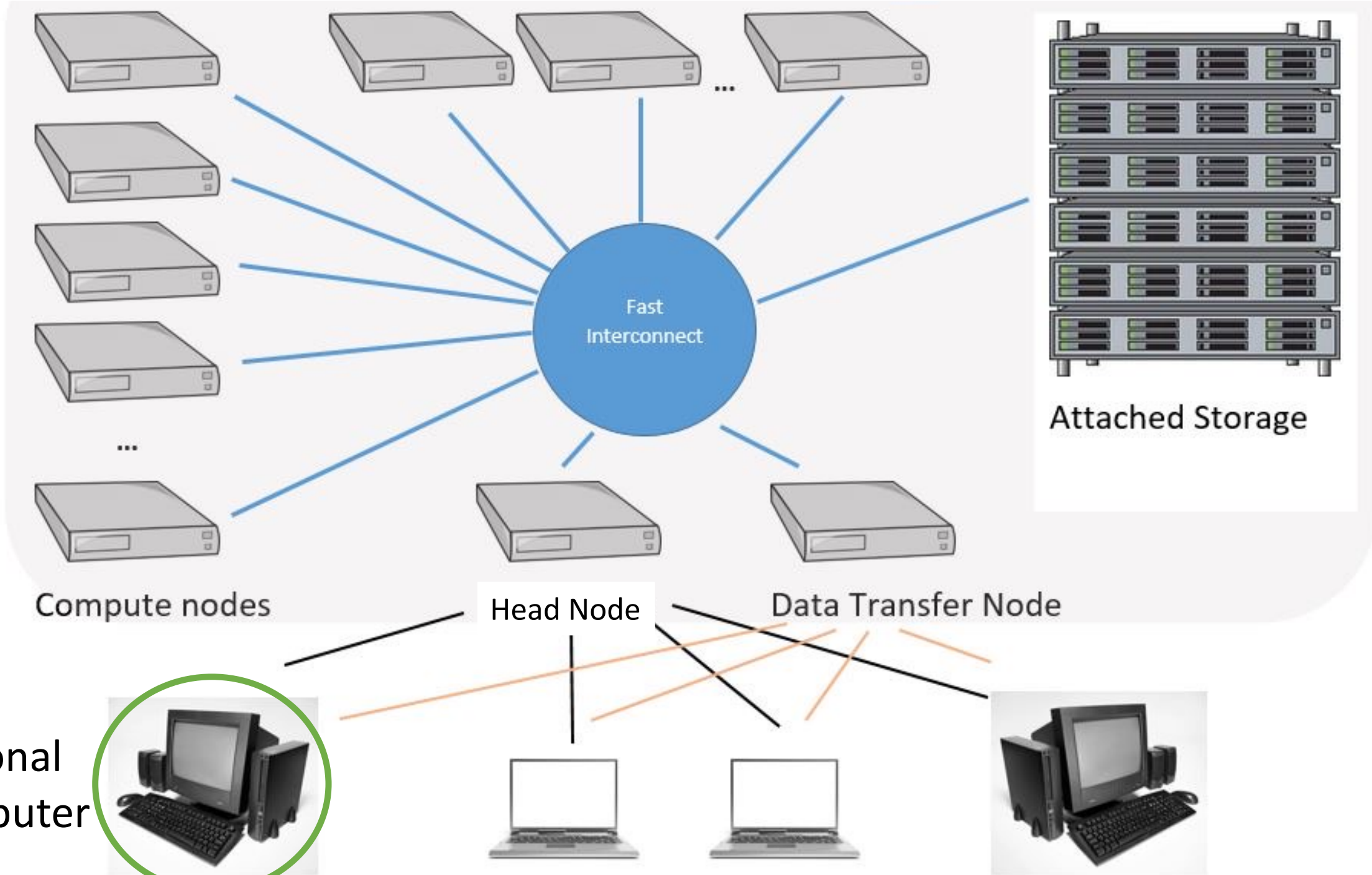
# Getting access to software…

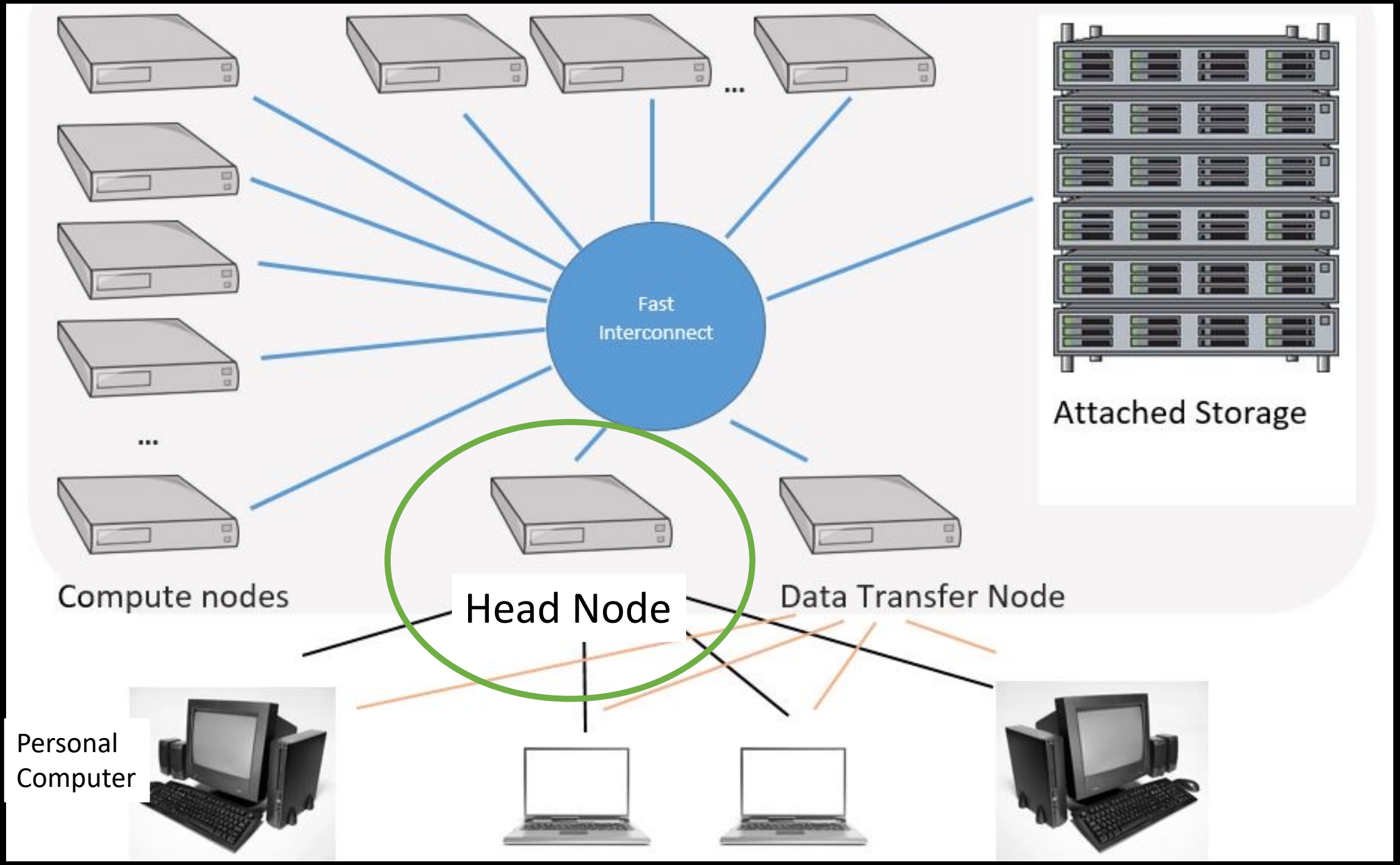
```
[vanilla@wheeler ~]$ module load matlab/R2021a
Lmod has detected the following error: Matlab may only be run on compute
nodes. wheeler is not a compute node. Exiting...
While processing the following module(s):
    Module fullname  Module Filename
    ---------------  ---------------
    matlab/R2021a    /opt/local/modules/matlab/R2021a.lua
```

# What is a compute node?

Getting access to software…

# HPC Cluster


Fast
Interconnect
Attached Storage
Compute nodes
Head Node
Data Transfer Node
Personal
Computer


Fast
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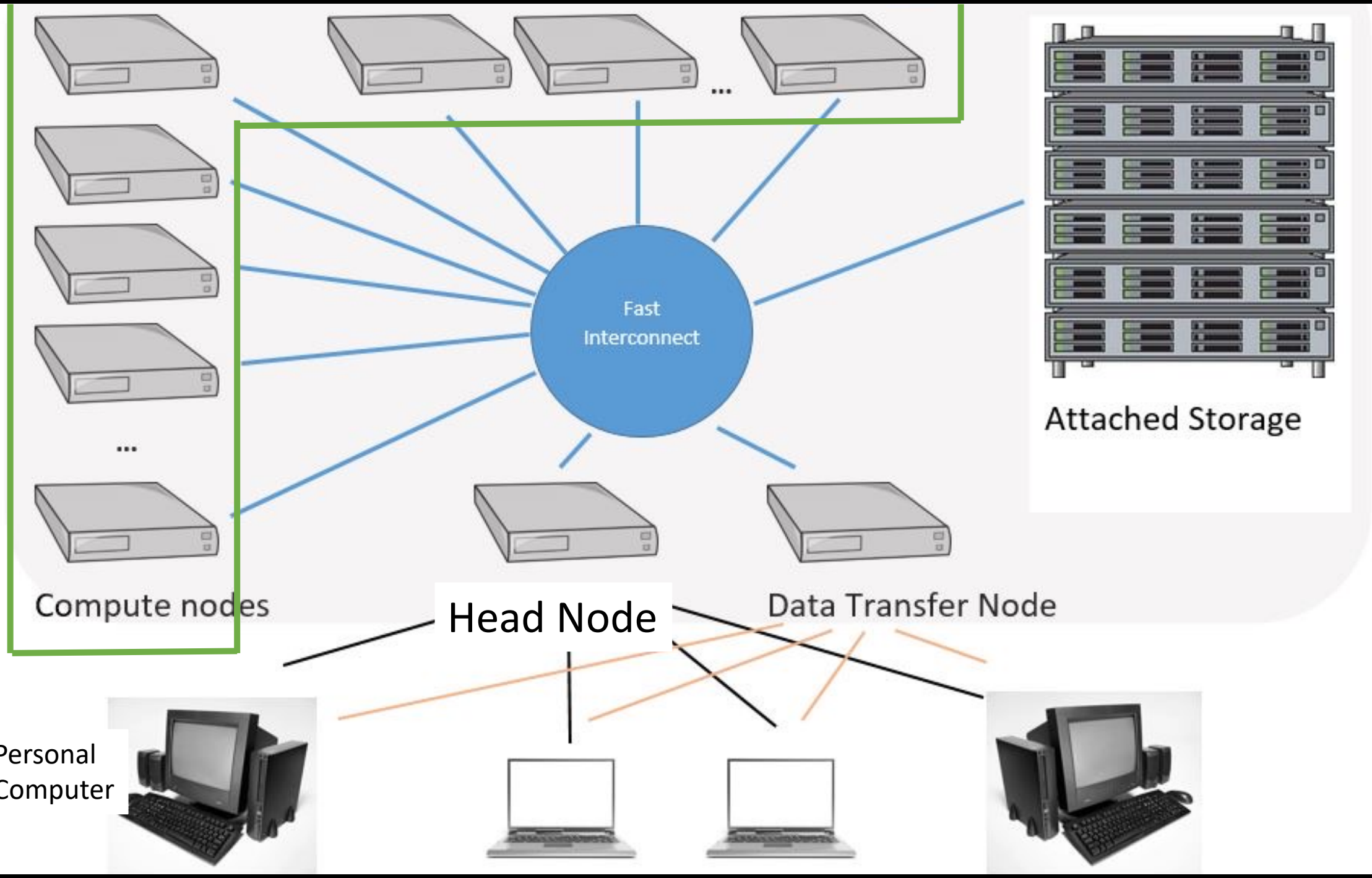

Fast
Interconnect
Attached Storage
Compute nodes
Head Node
Data Transfer Node
Personal
Computer


Never run computations on the head node

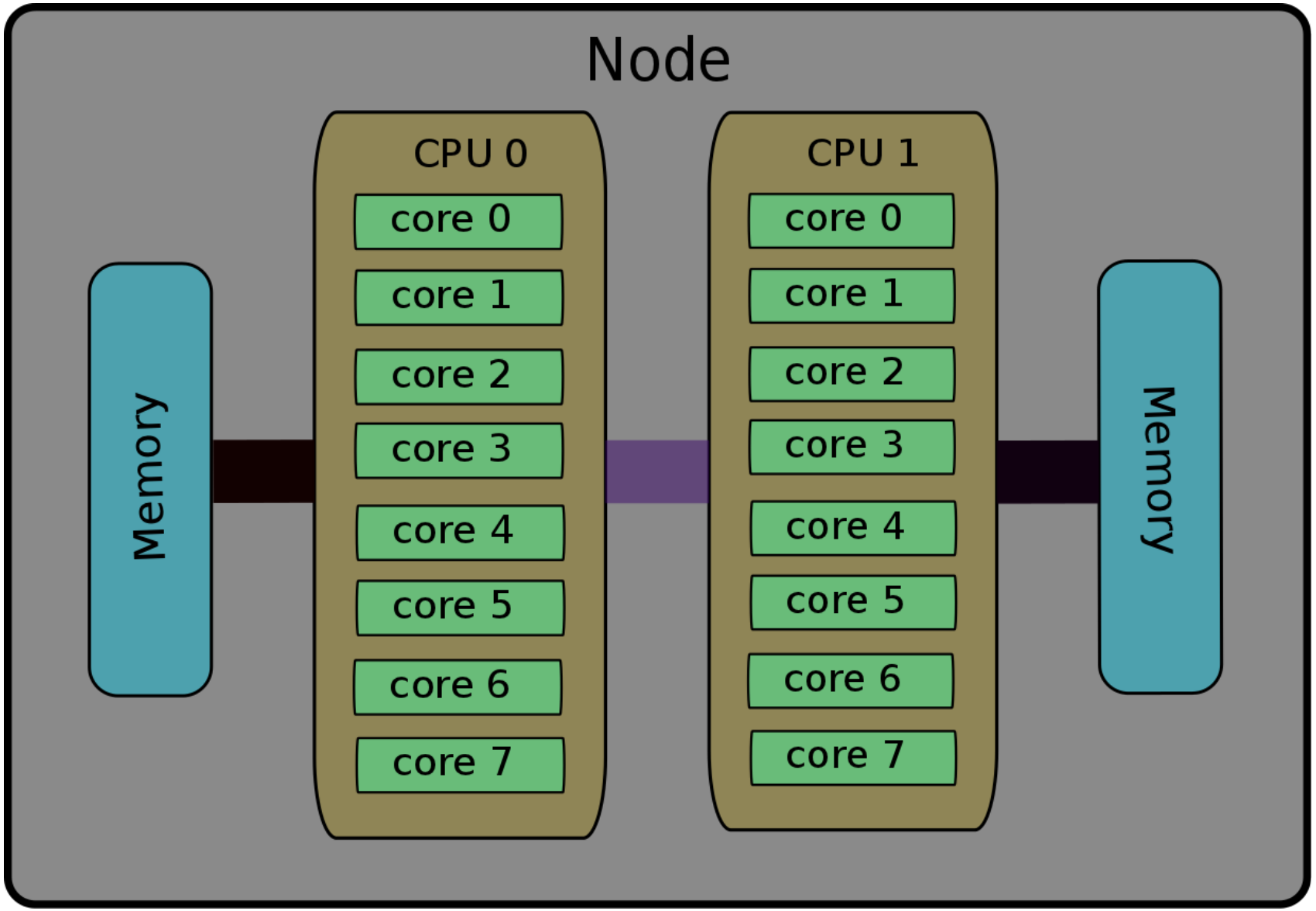
Always use compute nodes

```
[vanilla@wheeler ~]$ qgrok
queues    free    busy    offline   jobs    nodes   CPUs
------    -----   -----   -----     -----   -----   -----
normal    0       299     1         97      300     2400
debug     4       0       0         0       4       32
totals:   4       299     1         97      304     2432
```

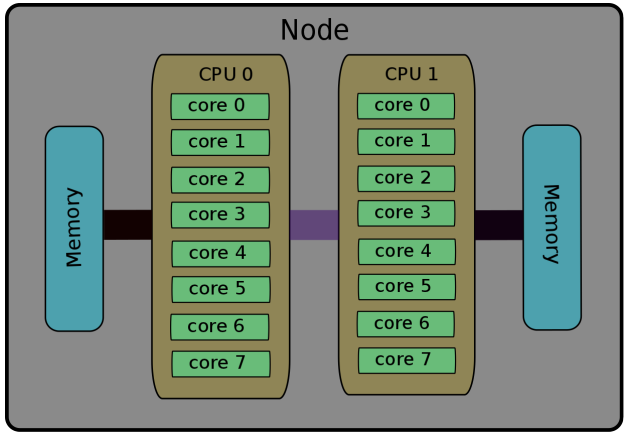
Compute nodes and partitions…

```
qmfricke@hopper:~ $ qgrok
queues      free   busy   offline  jobs   nodes  CPUs
-----       -----  -----  -----    -----  -----  -----
general     12     0      0        0      12     384
condo       29     1      7        0      37     1184
bugs        2      0      0        0      2      64
pcnc        2      0      0        0      2      64
pathogen    0      1      0        1      1      32
tc          7      0      3        0      10     320
gold        2      0      0        0      2      64
fishgen     1      0      0        0      1      32
neuro-hsc   13     0      1        0      14     448
cup-ecs     2      0      0        0      2      64
tid         0      0      1        0      1      32
biocomp     0      0      1        0      1      32
chakra      0      0      1        0      1      32
totals:     70     2      14       1      86     2752
```

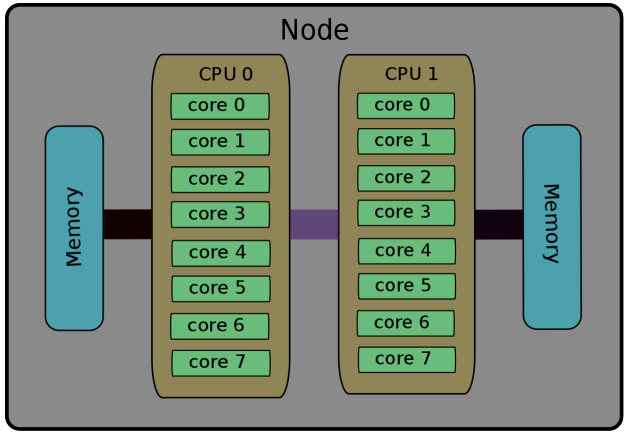
# Compute nodes and partitions…


Node
CPU 0
core 0
core 1
core 2
core 3
core 4
core 5
core 6
core 7
CPU 1
core 0
core 1
core 2
core 3
core 4
core 5
core 6
core 7
Memory
Memory

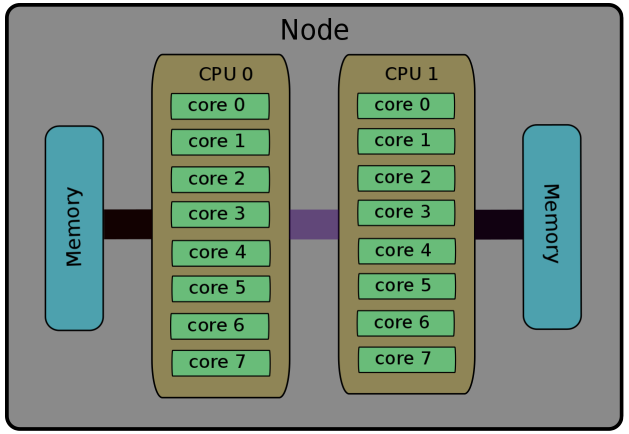
# Head Node (wheeler)




# Compute Nodes

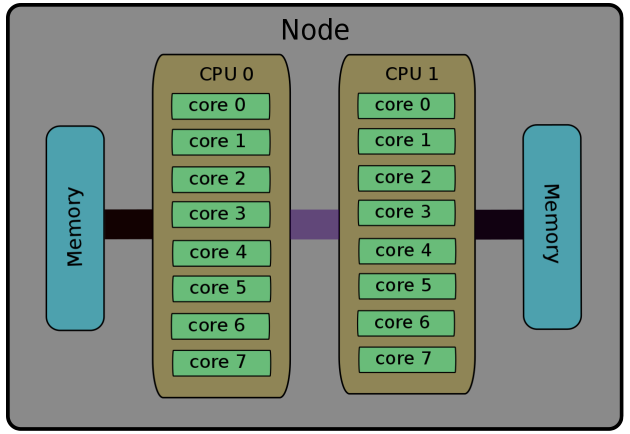



wheeler001




wheeler002

...




wheeler304

```
[vanilla@wheeler ~]$ lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                8
On-line CPU(s) list:   0-7
Thread(s) per core:    1
Core(s) per socket:    4
Socket(s):             2
NUMA node(s):          2
Vendor ID:             GenuineIntel
CPU family:            6
Model:                 26
Model name:            Intel(R) Xeon(R) CPU X5550  @ 2.67GHz
```

Wheeler has 8 cores per node….

```
mfricke@hopper:~ $ lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                64
On-line CPU(s) list:   0-63
Thread(s) per core:    2
Core(s) per socket:    16
Socket(s):             2
NUMA node(s):          2
Vendor ID:             GenuineIntel
CPU family:            6
Model:                 85
Model name:            Intel(R) Xeon(R) Gold 6226R CPU @ 2.90GHz
```

Hopper has 32 real cores (64 virtual cores) per node....

# Architecture

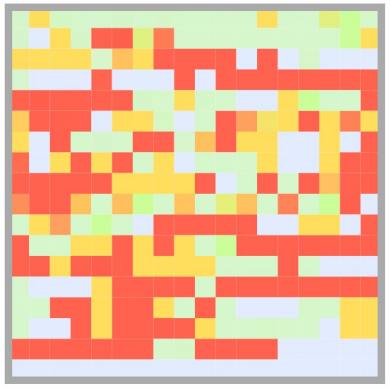
**Wheeler Cluster Grid** > **Wheeler Cluster** > --Choose a Node

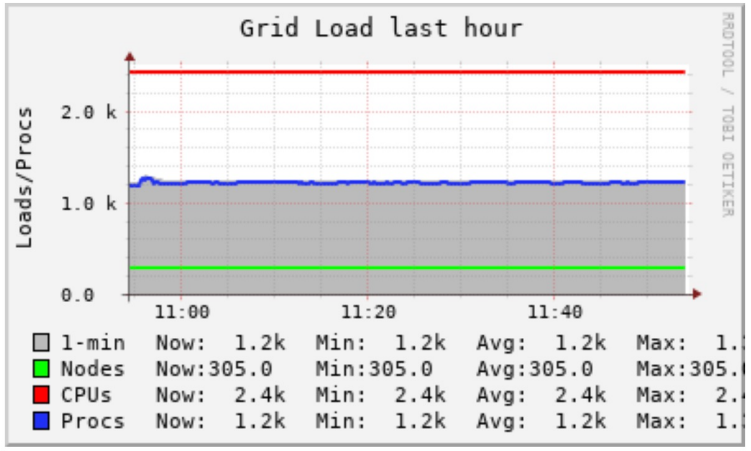
Overview of @ 2022-03-03 18:54

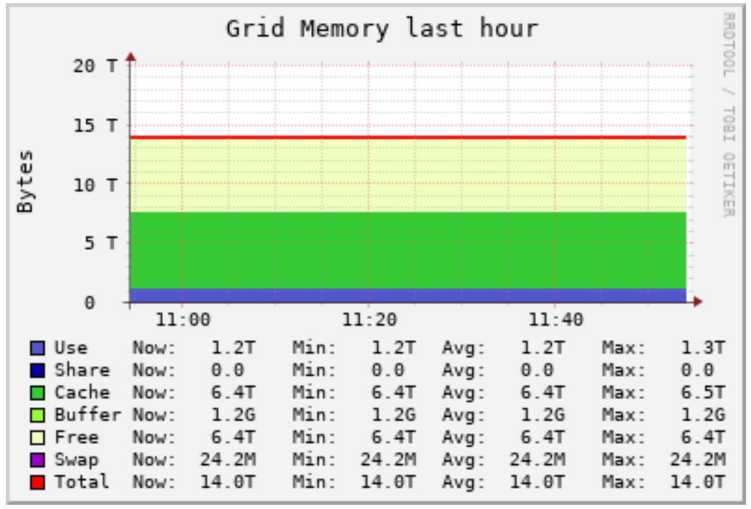
CPUs Total: **2440**
Hosts up: **305**
Hosts down: **0**

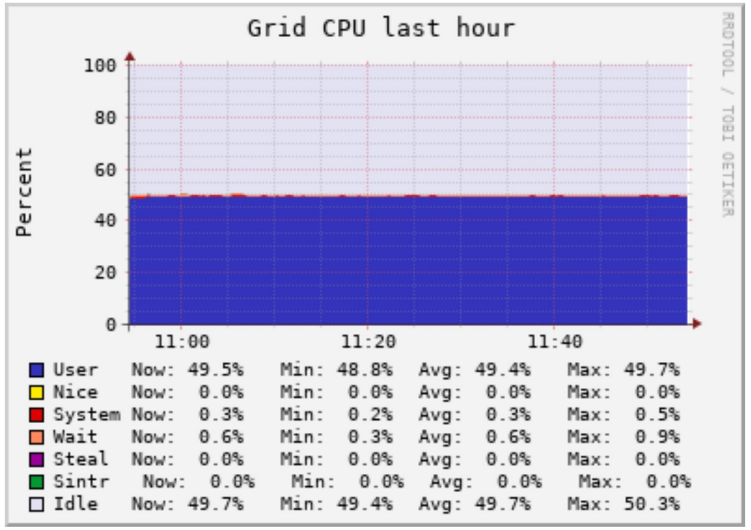
Current Load Avg (15, 5, 1m):
**51%, 51%, 51%**
Avg Utilization (last hour):
**51%**

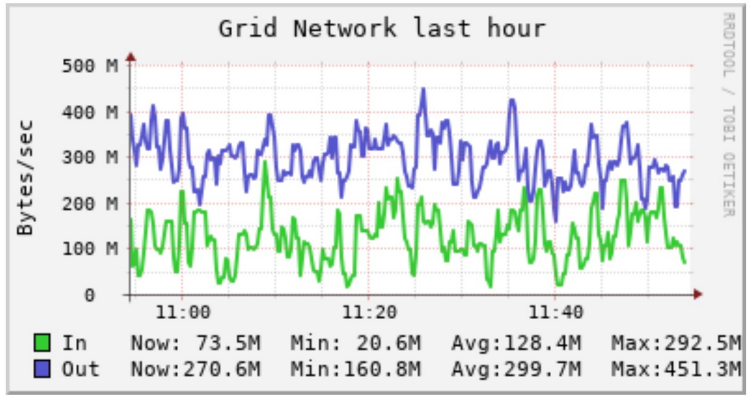
Server Load Distribution





Technology, IT etc.

# SLURM

means

## Simple Linux Utility for Resource Management


ENJOY
Slurm
SODA
IT'S HIGHLY ADDICTIVE!
VOTED #1 SOFT DRINK OF THE 31ST CENTURY!

```
[vanilla@wheeler ~]$ squeue
             JOBID PARTITION     NAME     USER ST       TIME  NODES NODELIST(REASON)
            159914    normal co-mcpdf nsharma2 CG 2-00:00:26      1 wheeler257
            159915    normal co-mcpdf nsharma2 CG 2-00:00:26      1 wheeler257
            159916    normal co-mcpdf nsharma2 CG 2-00:00:26      1 wheeler257
            159917    normal co-mcpdf nsharma2 CG 2-00:00:26      1 wheeler257
            159918    normal co-mcpdf nsharma2 CG 2-00:00:26      1 wheeler257
            159919    normal co-mcpdf nsharma2 CG 2-00:00:26      1 wheeler257
            159912    normal co-mcpdf nsharma2 CG 2-00:00:28      1 wheeler257
            159913    normal co-mcpdf nsharma2 CG 2-00:00:28      1 wheeler257
166800_[21-100%10]    normal   Jannat   jannat PD       0:00      1 (JobArrayTaskLimit)
            167067    normal WINDENER rubeldas PD       0:00     36
(QOSMaxCpuPerUserLimit)
            167068    normal WINDENER rubeldas PD       0:00     24
```

Slurm….

```
[vanilla@wheeler ~]$ srun --partition debug --nodes 2 hostname
srun: Account not specified in script or
~/.default_slurm_account, using latest project
wheeler302.alliance.unm.edu
You have not been allocated GPUs. To request GPUs, use the -G
option in your submission script.
wheeler301.alliance.unm.edu
[vanilla@wheeler ~]$ srun --partition debug --nodes 2 hostname
```

# The srun command…

```
[vanilla@wheeler ~]$ srun --partition debug --ntasks 8 hostname
srun: Account not specified in script or ~/.default_slurm_account, using
latest project
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
You have not been allocated GPUs. To request GPUs, use the -G option in your
submission script.
wheeler302.alliance.unm.edu
wheeler302.alliance.unm.edu
```

# The srun command...

# JupyterHub


python™

julia

jupyter Welcome to P

File Edit View Insert Cell

jupyter

## Welcome to the

This Notebook Server wa

WARNING

Don't rely on this ser

Your server is hosted tha

## Run some Python

To run the code below:

1. Click on the cell to se
2. Press SHIFT+ENTER

A full tutorial for using the

```
In [ ]: %matplotlib inline

        import pandas as pd
        import numpy as np
        import matplotlib
```

# Exploring the Lorenz System

In this Notebook we explore the Lorenz system of differential equations:

$$\dot{x} = \sigma(y - x)$$
$$\dot{y} = \rho x - y - xz$$
$$\dot{z} = -\beta z + xy$$

This is one of the classic systems in non-linear differential equations. It exhibits a range of complex behaviors as the parameters ($\sigma$, $\beta$, $\rho$) are varied, including what are known as chaotic solutions. The system was originally developed as a simplified mathematical model for atmospheric convection in 1963.

```
In [7]: interact(Lorenz, N=fixed(10), angle=(0.,360.),
                σ=(0.0,50.0),β=(0.,5), ρ=(0.0,50.0))
```

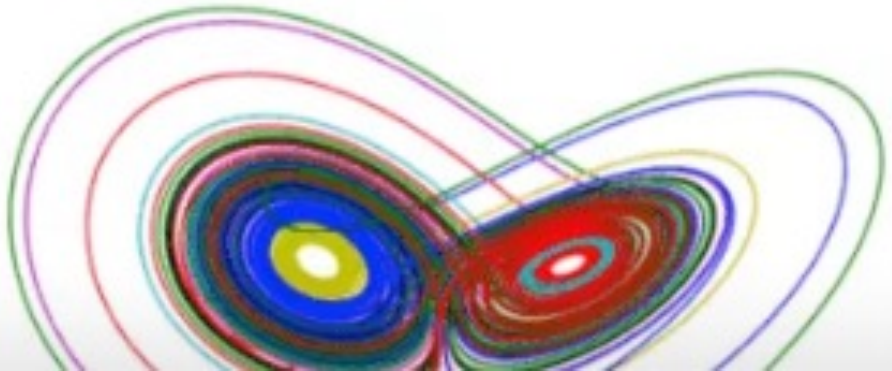
angle 308.2

max_time 12

σ 10

β 2.6

ρ 28



# The Hopper Cluster

- Login to hopper.

- If you are already logged into wheeler this is just:

```
ssh hopper
```

If you are not then

```
ssh username@hopper.alliance.unm.edu
```

https://github.com/unm-escape/okada_jupyter

Product Team Enterprise Explore Marketplace Pricing Search / Sign in Sign up

unm-escape / okada_jupyter Public

Notifications

Code Issues Pull requests Actions Projects Wiki Security Insights

main 1 branch 0 tags

Go to file Code

ericlindsey Update README.md

| | | |
|---|---|---|
| AlaskaFaultsShapefiles | Initial commit of files | |
| Surface_Rupture_Ridgecrest_Prov... | Initial commit of files | |
| GPS_Alaska2021.csv | Initial commit of files | |
| GPS_Ridgecrest.csv | Initial commit of files | |
| README.md | Update README.md | |
| fault_model.py | Initial commit of files | |
| fault_plots.py | Initial commit of files | 4 days ago |
| fit_fault_model.ipynb | Initial commit of files | 4 days ago |
| geod_transform.py | Initial commit of files | 4 days ago |
| moment_tensor.py | Initial commit of files | 4 days ago |
| okada85.py | Initial commit of files | 4 days ago |
| okada_greens.py | Initial commit of files | 4 days ago |

Clone

HTTPS GitHub CLI

https://github.com/unm-escape/okada_ju

Use Git or checkout with SVN using the web URL.

Open with GitHub Desktop

Download ZIP

About

Okada fault modeling to fit GPS data in Jupyter

Readme

1 star

1 watching

1 fork

Releases

No releases published

Packages

No packages published

Languages

Python 81.5%

Jupyter Notebook 18.5%

README.md

# Jupyterlab example for Okada fault modeling

# unm-escape / okada_jupyter

Public

Notifications

Code | Issues | Pull requests | Actions | Projects | Wiki | Security | Insights

main | 1 branch | 0 tags | Go to file | Code

**ericlindsey** Update README.md

| | | |
|---|---|---|
| AlaskaFaultsShapefiles | Initial commit of files | |
| Surface_Rupture_Ridgecrest_Prov... | Initial commit of files | |
| GPS_Alaska2021.csv | Initial commit of files | |
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## About

Okada fault modeling to fit GPS data in Jupyter

Readme
1 star
1 watching
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## Releases

No releases published

## Packages

No packages published

## Languages

Python 81.5%
Jupyter Notebook 18.5%

README.md

# Jupyterlab example for Okada fault modeling

```
vanilla@wheeler:~ $ git clone https://github.com/unm-escape/okada_jupyter.git
Cloning into 'okada_jupyter'...
remote: Enumerating objects: 30, done.
remote: Counting objects: 100% (30/30), done.
remote: Compressing objects: 100% (28/28), done.
remote: Total 30 (delta 3), reused 25 (delta 1), pack-reused 0
Unpacking objects: 100% (30/30), done.
mfricke@wheeler:~ $
```

Download example code from GitHub

# Dependencies

- The example code depends on these libraries:
- numpy
- matplotlib
- Pandas
- Scipy
- ipywidgets

- Using it with jupyterhub requires ipykernel

```
vanilla@wheeler:~ $ conda create --name fit_fault_model numpy matplotlib
pandas scipy cartopy ipywidgets ipykernel
Collecting package metadata (current_repodata.json): done
Solving environment: done
## Package Plan ##
  environment location: /users/mfricke/.conda/envs/fit_fault_model
  added / updated specs:
    - ipykernel
    - matplotlib
    - numpy
    - pandas
    - scipy
The following packages will be downloaded:
    package                    |            build
    ---------------------------|-----------------
    asttokens-2.0.5            |     pyhd3eb1b0_0          20 KB
[SNIP]
    traitlets-5.1.1            |     pyhd3eb1b0_0          84 KB
    ------------------------------------------------------------
                                           Total:        74.4 MB
The following NEW packages will be INSTALLED:
  _libgcc_mutex      pkgs/main/linux-64::_libgcc_mutex-0.1-main
[SNIP]
  gstreamer          pkgs/main/::64::zlib-1.2.12-h7f8727e_2
  zstd               pkgs/main/linux-64::zstd-1.5.2-ha4553b6_0

Proceed ([y]/n)?
```

```
Downloading and Extracting Packages
entrypoints-0.4       | 16 KB     |
################################################################################ | 100%
bottleneck-1.3.5      | 274 KB    |
################################################################################ | 100%
[SNIP]
brotli-bin-1.0.9      | 19 KB     |
################################################################################ | 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
#
# To activate this environment, use
#
#     $ conda activate fit_fault_model
#
# To deactivate an active environment, use
#
#     $ conda deactivate

mfricke@xena:~ $
```

# Welcome to the Center for Advanced Research Computing

The UNM Center for Advanced Research Computing is the hub of computational research at UNM and one of the largest computing centers in the State of New Mexico. It is an interdisciplinary community that uses computational resources to create new research insights. The goal is to lead and grow the computational research community at UNM.

CARC provides not just the computing resources but also the expertise and support to help the university's researchers. This service is available to faculty, staff, and student researchers free of charge through support from the UNM Office of the Vice President for Research.

Systems menu:

- CARC systems information
- CARC infrastructure
- Resource limits
- Storage and backup
- Export control
- JupyterHub cluster links
- System status and downtime
- System Usage by Principal Investigator

JupyterHub cluster links:

- Hopper
- Gibbs
- Taos
- Wheeler
- Xena

JupyterHub cluster links

Get sta

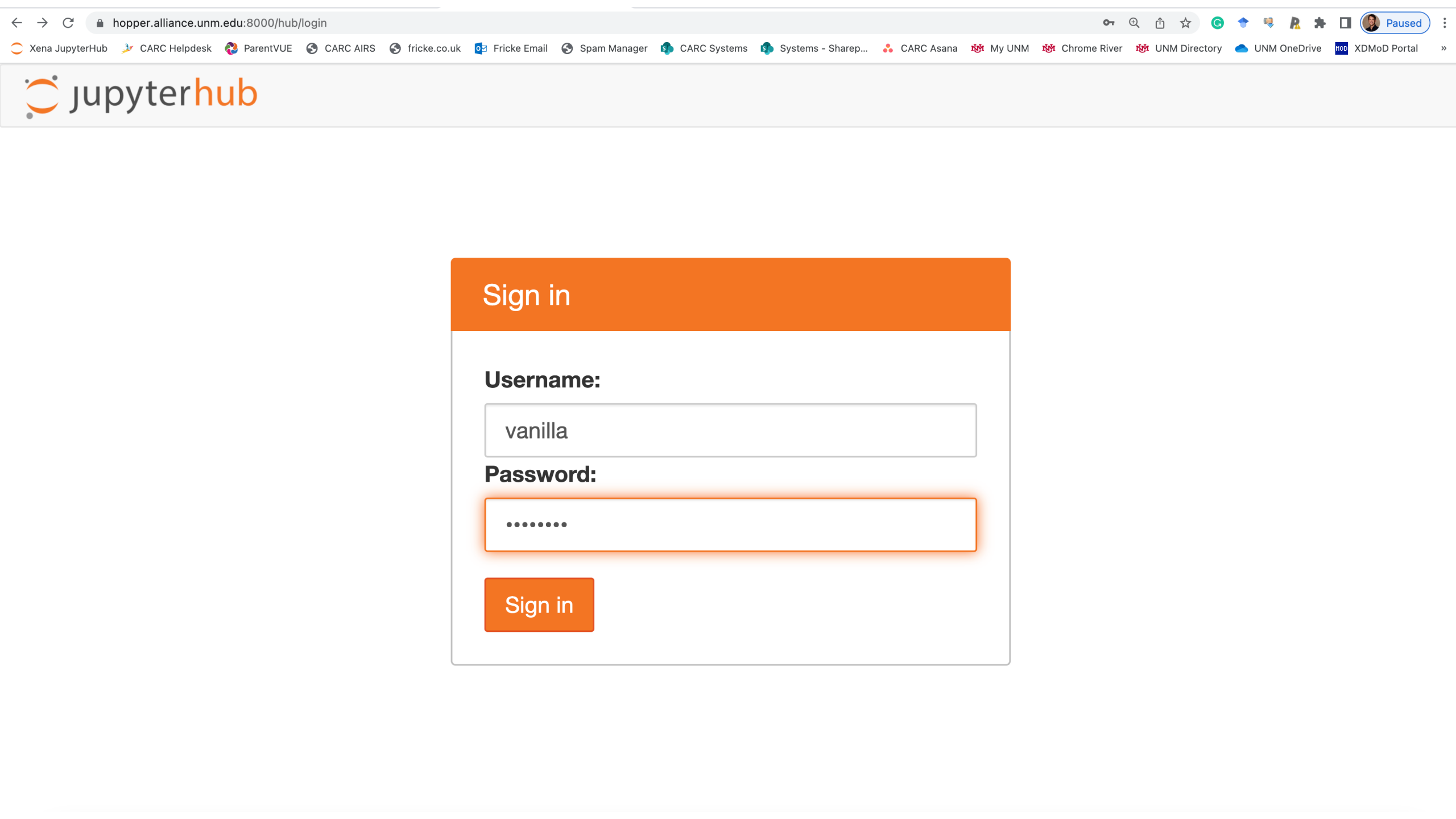
Create a help ticket

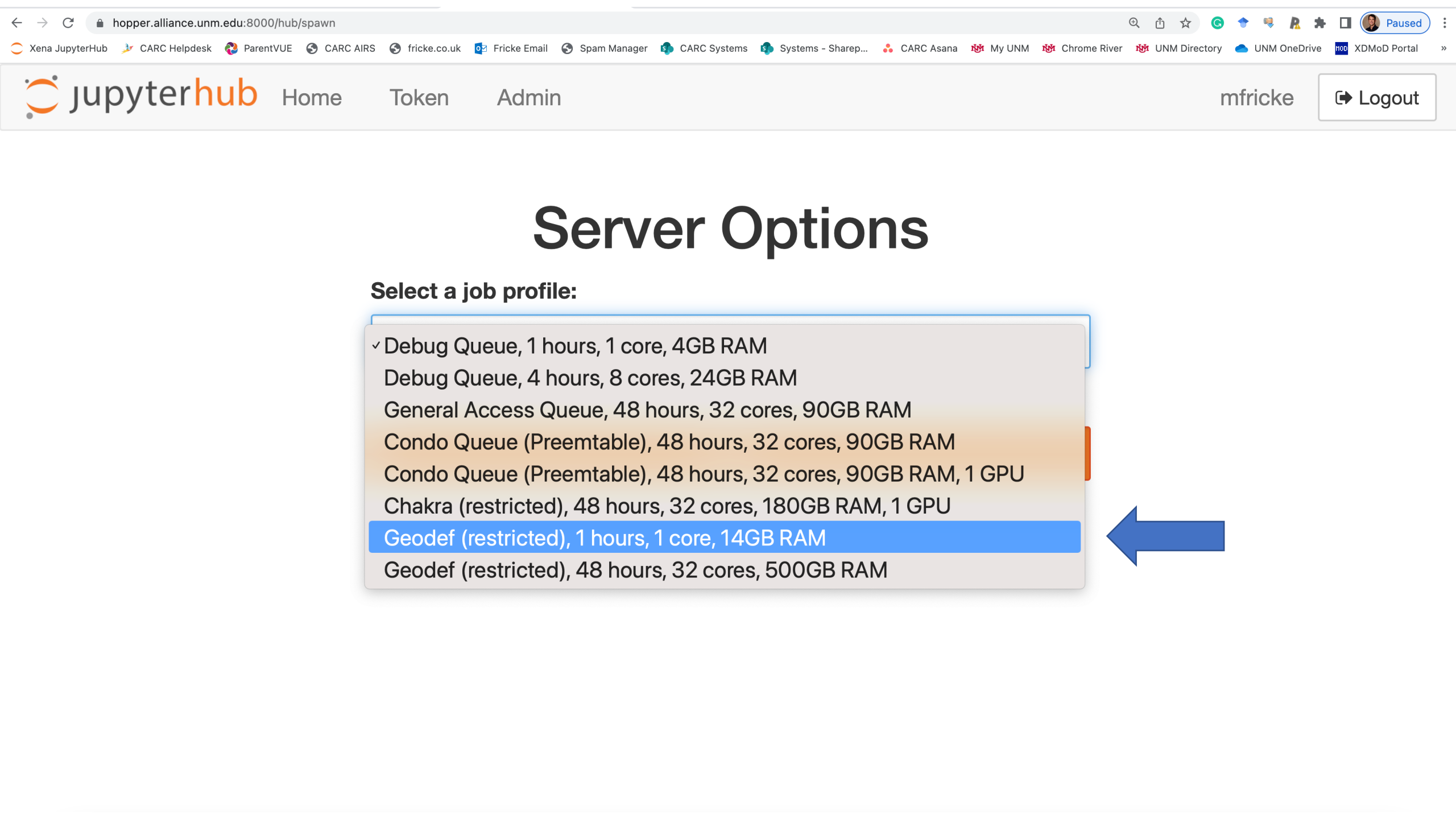
Downtime notices

**Students go on-si... greenhouse gas e...**

**UNM Earth Science Professor to study the health of groundwater aquifers across the state**

**Explore or exploit: How our brains make choices**


hopper.alliance.unm.edu:8000/hub/login
Paused
Xena JupyterHub
CARC Helpdesk
ParentVUE
CARC AIRS
fricke.co.uk
Fricke Email
Spam Manager
CARC Systems
Systems - Sharep...
CARC Asana
My UNM
Chrome River
UNM Directory
UNM OneDrive
XDMoD Portal
jupyterhub
Sign in
Username:
vanilla
Password:
Sign in


hopper.alliance.unm.edu:8000/hub/spawn
Paused
Xena JupyterHub
CARC Helpdesk
ParentVUE
CARC AIRS
fricke.co.uk
Fricke Email
Spam Manager
CARC Systems
Systems - Sharep...
CARC Asana
My UNM
Chrome River
UNM Directory
UNM OneDrive
XDMoD Portal
jupyterhub
Home
Token
Admin
mfricke
Logout
Server Options
Select a job profile:
Debug Queue, 1 hours, 1 core, 4GB RAM
Debug Queue, 4 hours, 8 cores, 24GB RAM
General Access Queue, 48 hours, 32 cores, 90GB RAM
Condo Queue (Preemtable), 48 hours, 32 cores, 90GB RAM
Condo Queue (Preemtable), 48 hours, 32 cores, 90GB RAM, 1 GPU
Chakra (restricted), 48 hours, 32 cores, 180GB RAM, 1 GPU
Geodef (restricted), 1 hours, 1 core, 14GB RAM
Geodef (restricted), 48 hours, 32 cores, 500GB RAM

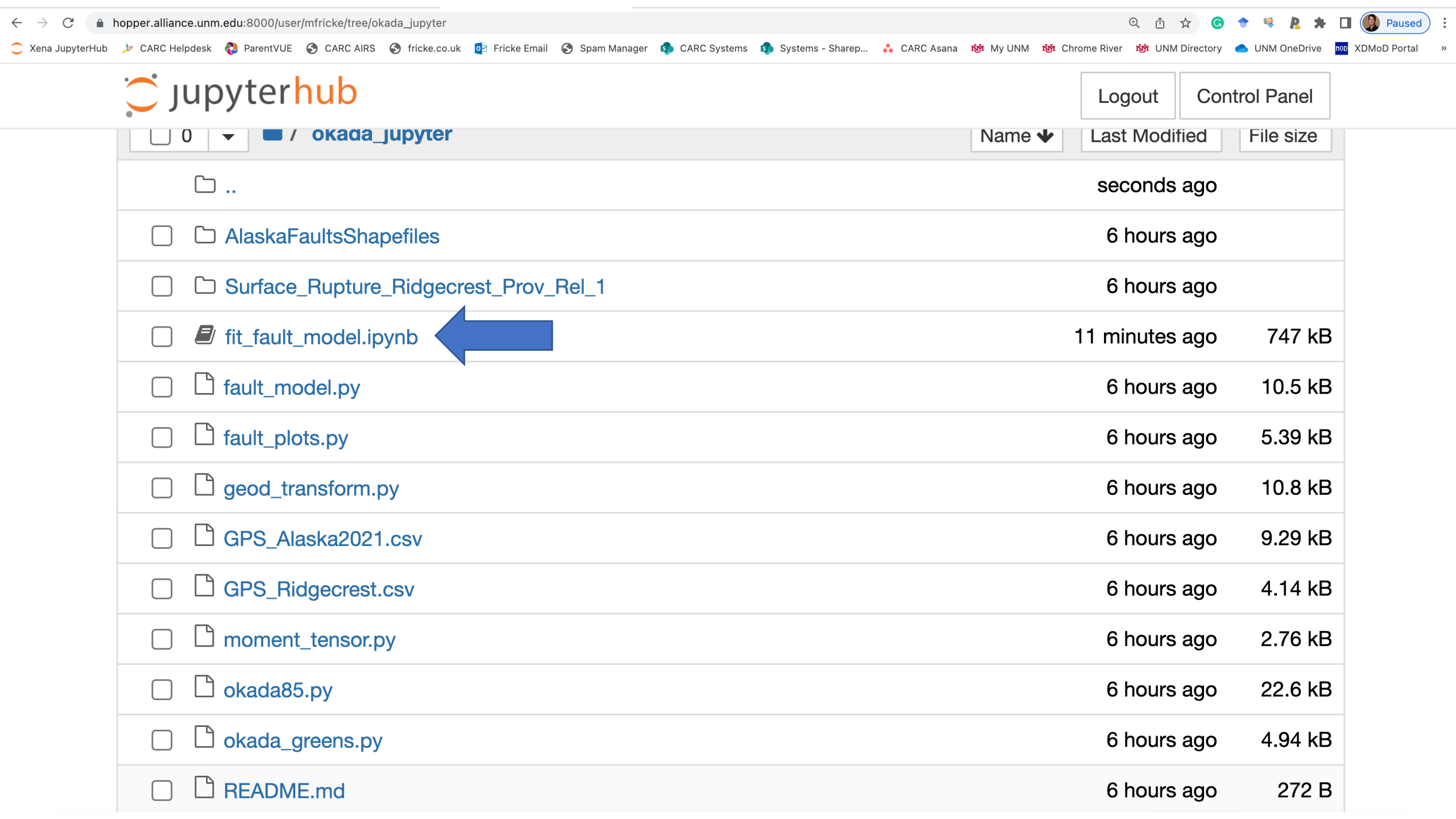
Your server is starting up.

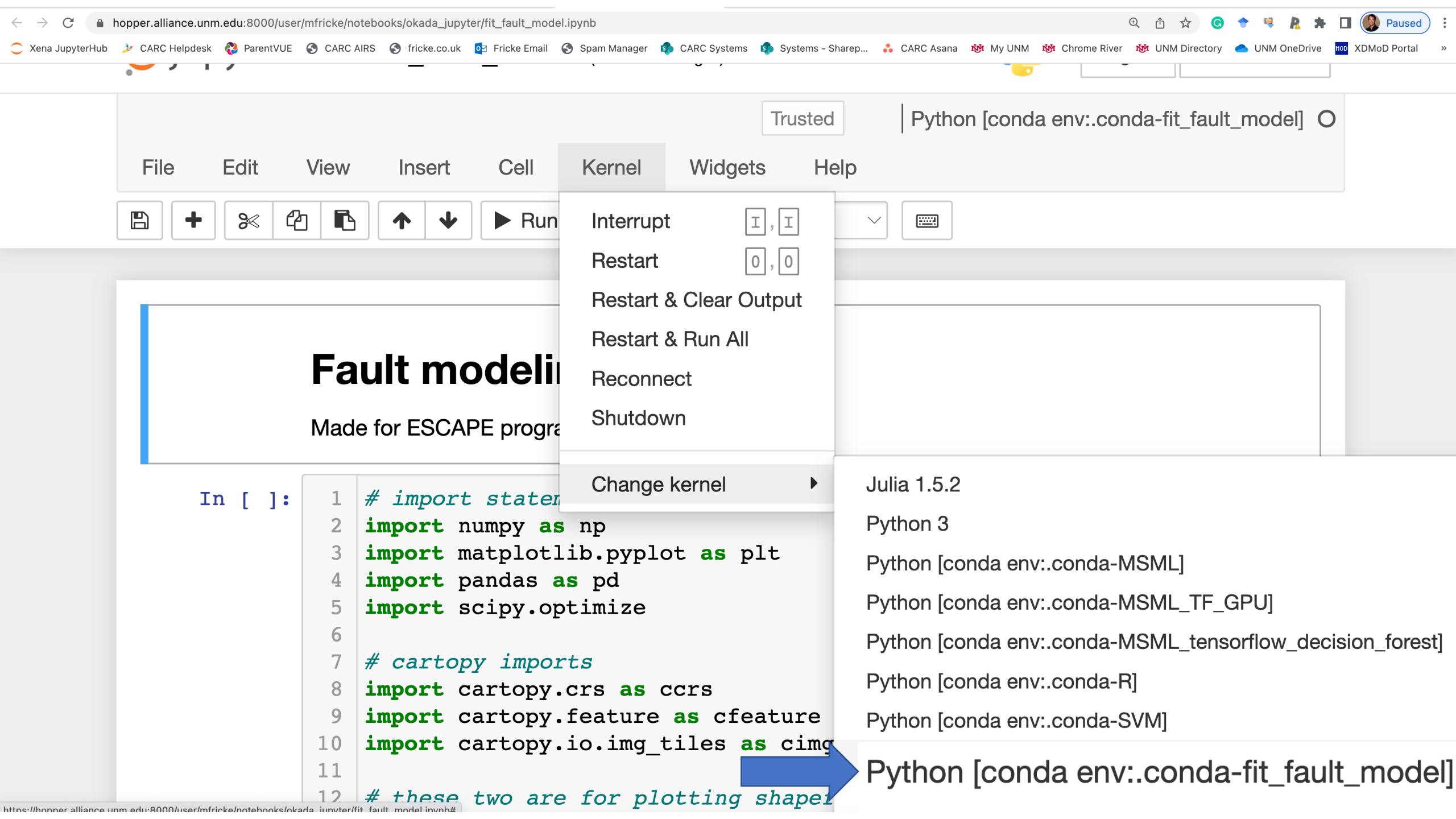
You will be redirected automatically when it's ready for you.

Cluster job running... waiting to connect

Event log

| | | |
|---|---|---|
| ☐ | ncbi | 3 years ago |
| ☐ | new_xena_ganglia | 2 years ago |
| ☐ | not working | 3 years ago |
| ☐ | okada_jupyter | 10 minutes ago |
| ☐ | okada_jupyter2 | 6 hours ago |
| ☐ | old_xena_ganglia | 2 years ago |
| ☐ | orca | 2 months ago |
| ☐ | OUTPUT | 5 days ago |
| ☐ | parallel_matlab | a year ago |
| ☐ | PBS-tools | a year ago |
| ☐ | pbs_examples | a year ago |
| ☐ | pbs_scripts | 3 years ago |
| ☐ | perl5 | a year ago |
| ☐ | Pictures | 3 years ago |


hopper.alliance.unm.edu:8000/user/mfricke/tree/okada_jupyter
Paused
Xena JupyterHub
CARC Helpdesk
ParentVUE
CARC AIRS
fricke.co.uk
Fricke Email
Spam Manager
CARC Systems
Systems - Sharep...
CARC Asana
My UNM
Chrome River
UNM Directory
UNM OneDrive
XDMoD Portal
jupyterhub
Logout
Control Panel
0
/ okada_jupyter
Name
Last Modified
File size
..
seconds ago
AlaskaFaultsShapefiles
6 hours ago
Surface_Rupture_Ridgecrest_Prov_Rel_1
6 hours ago
fit_fault_model.ipynb
11 minutes ago
747 kB
fault_model.py
6 hours ago
10.5 kB
fault_plots.py
6 hours ago
5.39 kB
geod_transform.py
6 hours ago
10.8 kB
GPS_Alaska2021.csv
6 hours ago
9.29 kB
GPS_Ridgecrest.csv
6 hours ago
4.14 kB
moment_tensor.py
6 hours ago
2.76 kB
okada85.py
6 hours ago
22.6 kB
okada_greens.py
6 hours ago
4.94 kB
README.md
6 hours ago
272 B


hopper.alliance.unm.edu:8000/user/mfricke/notebooks/okada_jupyter/fit_fault_model.ipynb
Paused
Xena JupyterHub
CARC Helpdesk
ParentVUE
CARC AIRS
fricke.co.uk
Fricke Email
Spam Manager
CARC Systems
Systems - Sharep...
CARC Asana
My UNM
Chrome River
UNM Directory
UNM OneDrive
XDMoD Portal
Trusted
Python [conda env:.conda-fit_fault_model]
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Run
Interrupt
I, I
Restart
0, 0
Restart & Clear Output
Restart & Run All
Reconnect
Shutdown
Change kernel
Julia 1.5.2
Python 3
Python [conda env:.conda-MSML]
Python [conda env:.conda-MSML_TF_GPU]
Python [conda env:.conda-MSML_tensorflow_decision_forest]
Python [conda env:.conda-R]
Python [conda env:.conda-SVM]
Python [conda env:.conda-fit_fault_model]
Fault modeli
Made for ESCAPE progra
In [ ]:
# import stater
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import scipy.optimize
# cartopy imports
import cartopy.crs as ccrs
import cartopy.feature as cfeature
import cartopy.io.img_tiles as cimg
# these two are for plotting shapel

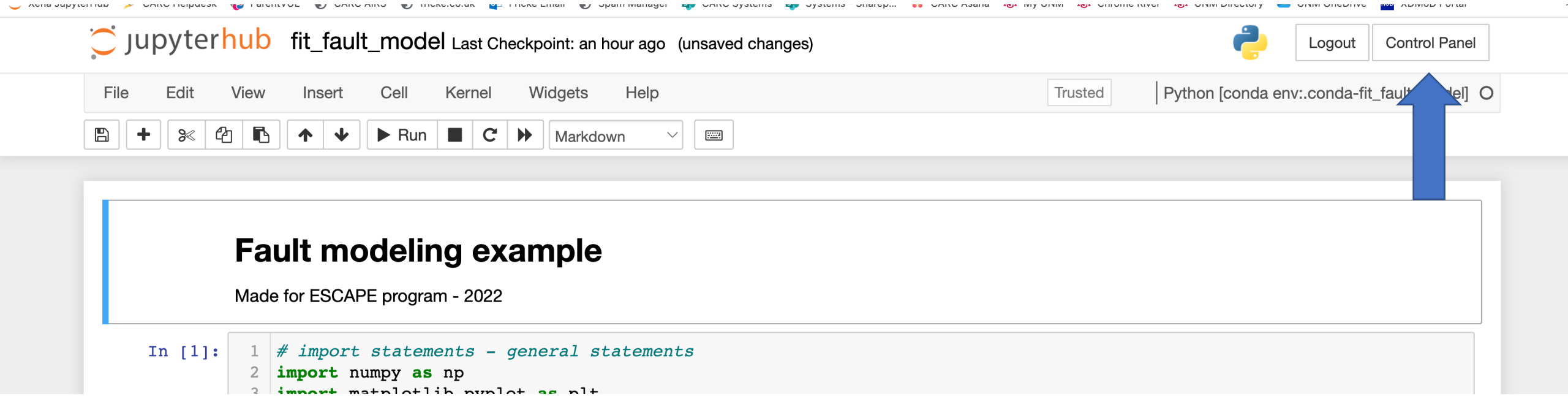
In [ ]:

```python
# import statements - general statements
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import scipy.optimize

# cartopy imports
import cartopy.crs as ccrs
import cartopy.feature as cfeature
import cartopy.io.img_tiles as cimgt

# these two are for plotting shapefiles
from cartopy.io.shapereader import Reader
from cartopy.feature import ShapelyFeature

# import statements - specific to our problem.
import fault_model
import fault_plots

# this special Jupyter command makes zooming, panning and downloading the figures easy
#%matplotlib widget

# import statement for an interactive plot
from ipywidgets import interactive

```

In [ ]:

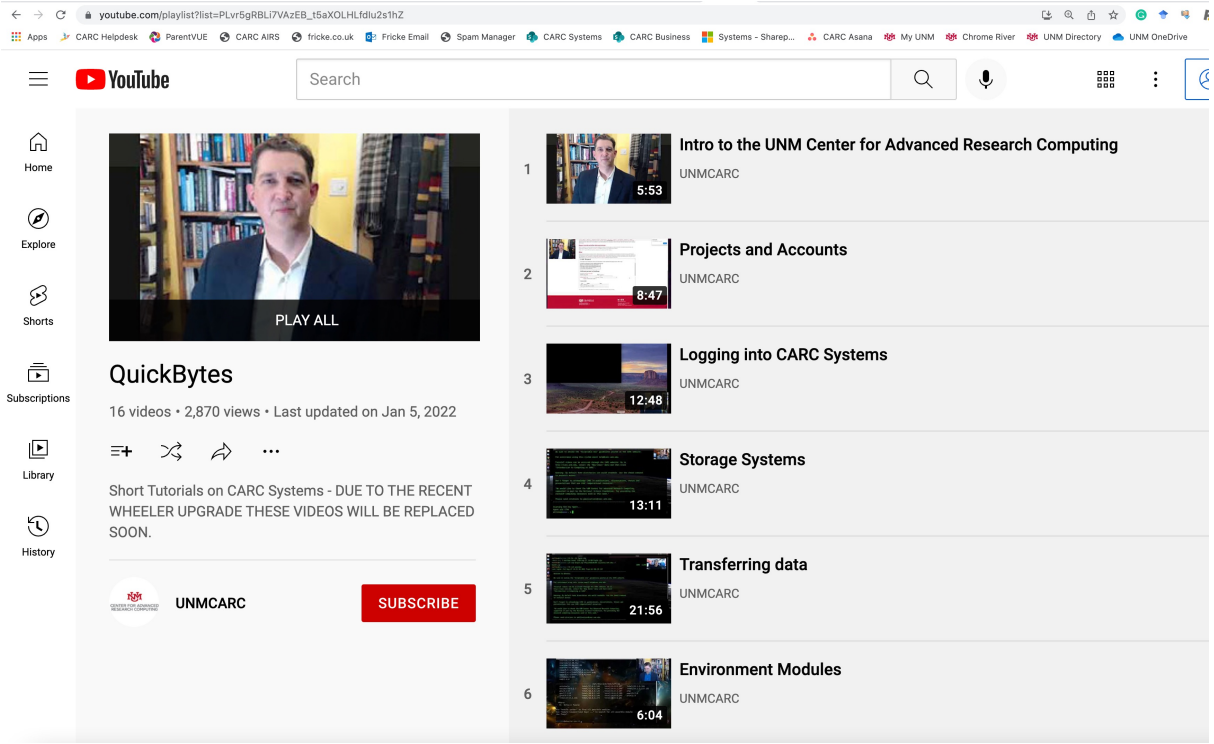
```python
# load GPS data
gpsdata = pd.read_csv('GPS_Ridgecrest.csv')

# I will convert them all to arrays at the start.
gpslon = np.asarray(gpsdata["X"])
gpslat = np.asarray(gpsdata["Y"])
gps_dE = np.asarray(gpsdata["E"])
gps_dN = np.asarray(gpsdata["N"])
```

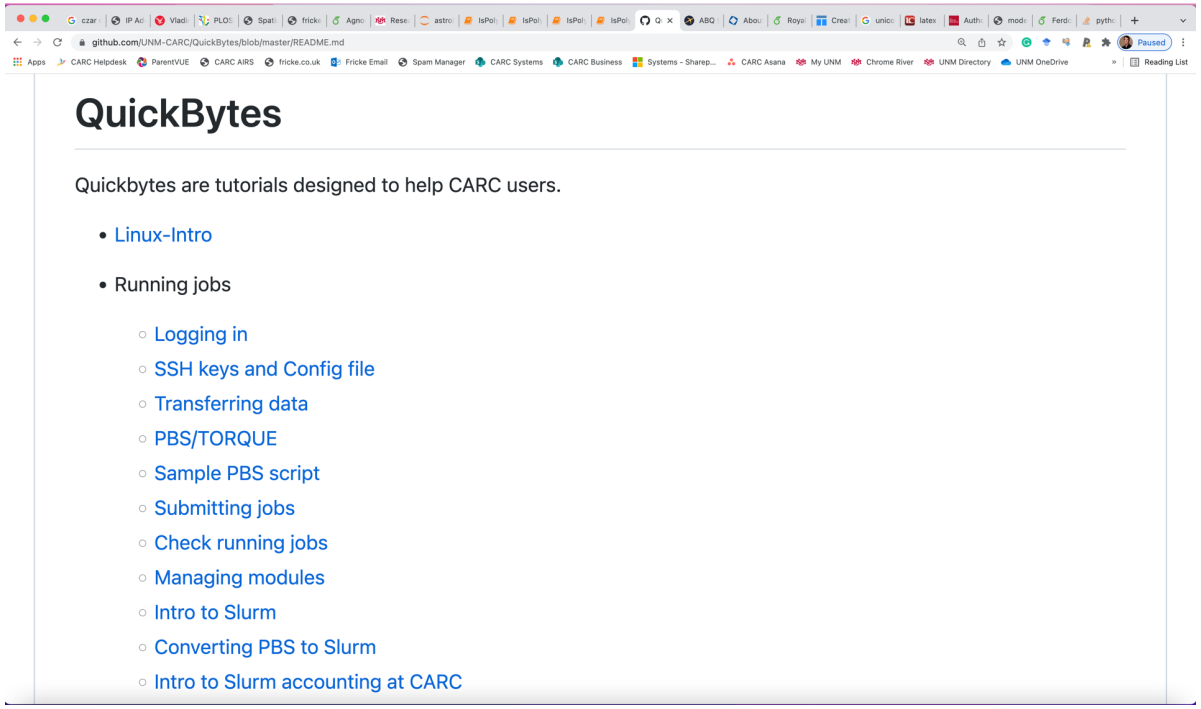
# Shut down your jupyterhub server




# CARC Resources

- Tutorial Videos
- Written Tutorials



# Getting Help

help@carc.unm.edu

Office hours