

Intro to Unix (Linux) shell

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Editing of the slides is still in progress :)



USC

Advanced Research Computing
Enabling scientific breakthroughs at scale

About

Asya Shklyar - Senior HPC Engineer

Joined USC CARC this April

Before that Pomona College Director of HPC, consultant for Bioteam, systems engineer and architect for life sciences companies like Myriad Health, ThermoFischer, Roche, and SpaceX

Generalist with the focus on data management

Today's session is meant to be fun!

The materials are courtesy of NCGAS - [National Center for Genome Analysis Support](https://ittraining.iu.edu/explore-topics/titles/bionboard/index.html) at Indiana University

<https://ittraining.iu.edu/explore-topics/titles/bionboard/index.html>

This session will be recorded and the slides will be provided on the web site

There will be a short break after each session

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Questions

Windows or Mac?

Familiarity with Linux, CLI?

Scripting or programming languages?

Area of study/research?

Coming to the special session on NLP?

Any specific areas of interest today?

Unix? Linux?

Linux refers to the kernel of the GNU/**Linux** operating system. More generally, it refers to the family of derived distributions. Developed by Linus Torvalds and the large community of open source developers.

Unix refers to the original operating system developed by AT&T.

<https://www.softwaretestinghelp.com/unix-vs-linux/#:~:text=Linux%20refers%20to%20the%20kernel,family%20of%20derived%20operating%20systems.>

CentOS vs others: Ubuntu, FreeBSD, Red Hat, Scientific Linux, Fedora, Debian

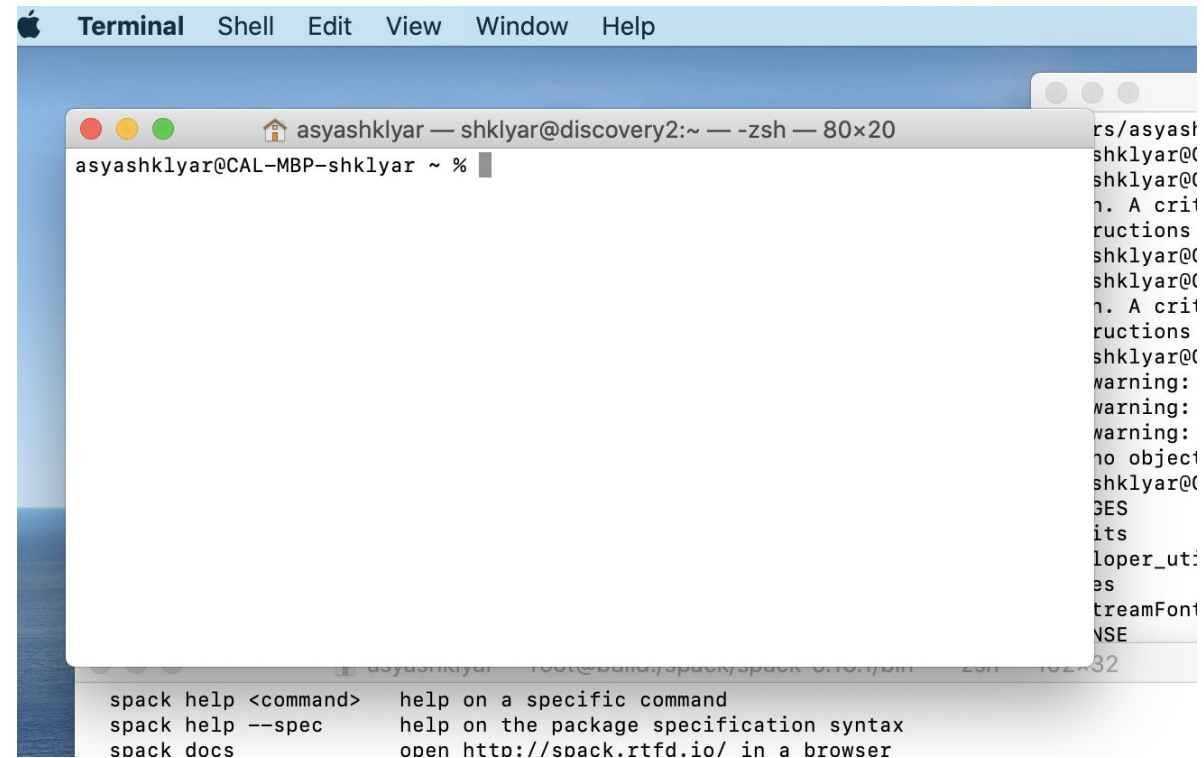
CentOS 7 and 8 debacle-> Rocky Linux



bash - CLI - Command Line Terminal

Yes, all of the above

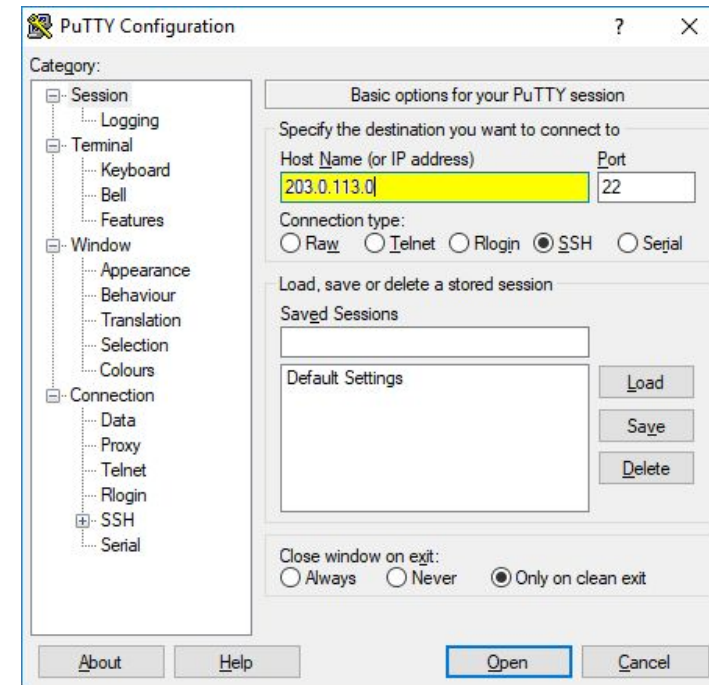
Example: Mac Terminal



The image shows a screenshot of a Mac Terminal window. The title bar at the top reads "Terminal" with menu items "Shell", "Edit", "View", "Window", and "Help". Below the title bar, the window title is "asyashklyar — shklyar@discovery2:~ — zsh — 80x20". The main content area shows the prompt "asyashklyar@CAL-MBP-shklyar ~ %" followed by a cursor. To the right, a scrollable list of text is visible, including "rs/asyas", "shklyar@", "shklyar@", "n. A cri", "ructions", "shklyar@", "shklyar@", "n. A cri", "ructions", "shklyar@", "warning:", "warning:", "warning:", "no object", "shklyar@", "GES", "its", "loper_ut:", "es", "treamFont", "NSE", and "32". At the bottom, a list of spack commands and their descriptions is shown: "spack help <command> help on a specific command", "spack help --spec help on the package specification syntax", and "spack docs open http://spack.rtd.io/ in a browser".

How do I login to the HPC environment?

Terminal on Mac (built-in, in Applications, Utilities) or putty/ssh on Windows



<https://www.putty.org/> or <https://docs.microsoft.com/en-us/windows/wsl/install-win10>

How do I login to the HPC environment?

Install Duo app on your phone

ssh yourusername@discovery.usc.edu

confirm push notification and you are in!

```
asyashklyar@CAL-MBP-shklyar ~ % ssh shklyar@discovery.usc.edu
Duo two-factor login for shklyar
```

Enter a passcode or select one of the following options:

1. Duo Push to XXX-XXX-5230
2. Phone call to XXX-XXX-5230
3. SMS passcodes to XXX-XXX-5230

Passcode or option (1-3): █

```
Success. Logging you in...
Last login: Tue Jun  1 13:45:14 2021 from 10.21.37.1
```

```
-----
Welcome to the Center for Advanced Research Computing (CARC)
at the University of Southern California (USC)
-----
```

```
CARC website : https://carc.usc.edu
User portal   : https://hpcaccount.usc.edu/
User support  : https://carc.usc.edu/user-support
User guides   : https://carc.usc.edu/user-information/user-guides
```

```
** Unauthorized use/access is prohibited **
```

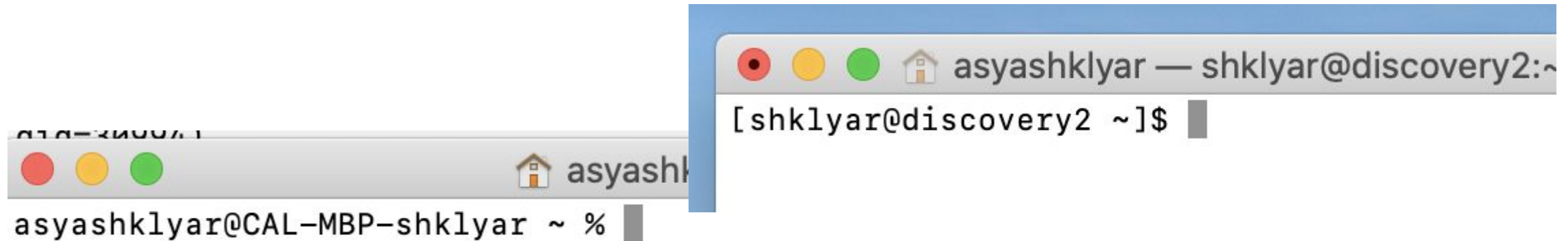
```
If you log on to this computer system, you acknowledge your awareness of and
concurrency with the USC CARC Acceptable Use Policy. USC will prosecute
violators to the full extent of the law.
```

```
-----
[shklyar@discovery2 ~]$ █
```



How do I know if I am still on my computer or on a remote node?

Pay attention to your username and the computer name in the prompt



More information about Discovery and other CARC resources

<https://carc.usc.edu/>

<https://carc.usc.edu/services/hpc>

User Support



Ticket Submission

Send a message to the CARC team with your specific issue.



CARC User Portal

Request and manage resources and allocations for your projects.



User Forum

A question and answer community for CARC-specific topics.



Frequently Asked Questions

Your common questions about CARC services and systems.



User Guides

Comprehensive how-to guides for CARC resources and services.



IT Services Help

USC NetID management, password reset, Duo two-factor authentication, and more ITS help topics.



How do I know where my files are?

ls (list) or ls -lah (for more details)

```
[[shklyar@discovery2 ~]$ ls
```

```
~
```

```
module_avail_before_sarus_install
```

```
ondemand
```

```
[[shklyar@discovery2 ~]$
```

PonyLinux

ponysay

r-base_latest.sif

sarus

script.sh

spack_List.txt

test_python.py

ubuntu_latest.sif

```
[[shklyar@discovery2 ~]$ ls -lah
```

```
total 91K
```

```
-rw-rw----  1 shklyar shklyar   56 May 28 19:10 ~
drwxr-x--- 14 shklyar shklyar   24 Jun  3 09:25 .
drwxr-xr-x 2967 root    root    2.9K Jun  7 07:00 ..
-rw-----  1 shklyar shklyar  5.8K Jun  7 13:04 .bash_history
-rw-r----- 1 shklyar shklyar  193 Apr 16 01:03 .bash_profile
-rw-r----- 1 shklyar shklyar  485 May 28 16:51 .bashrc
drwxrwx---  3 shklyar shklyar    1 Apr 21 12:51 .cache
drwx----- 4 shklyar shklyar    2 Apr 21 12:51 .config
-rw-----  1 shklyar shklyar    0 May 27 17:33 .lessht
drwx----- 3 shklyar shklyar    1 May  5 14:49 .local
-rw-rw----  1 shklyar shklyar  18K May 26 14:23 module_avail_before_sarus_install
drwxr-xr-x  3 shklyar shklyar    1 Apr 27 13:59 ondemand
drwxr----- 3 shklyar shklyar    1 Apr 15 13:26 .pki
drwxr-xr-x 10 shklyar shklyar   24 Jun  2 14:26 PonyLinux
drwxr-xr-x 15 shklyar shklyar   23 Jun  2 14:30 ponysay
-rwxrwx---  1 shklyar shklyar 294M May  5 14:52 r-base_latest.sif
drwxrwxr-x  3 shklyar shklyar    2 May 25 09:59 sarus
-rwxrwx---  1 shklyar shklyar  179 May 28 19:20 script.sh
drwx----- 3 shklyar shklyar    1 May  5 14:48 .singularity
drwxrwxr-x  3 shklyar shklyar    2 May 24 18:44 .spack
-rw-rw-r--  1 shklyar shklyar  53K May 24 15:57 spack_List.txt
drwx----- 2 shklyar shklyar    6 May 27 16:06 .ssh
-rw-rw----  1 shklyar shklyar   23 May 28 19:21 test_python.py
-rwxrwx---  1 shklyar shklyar  27M May  5 14:48 ubuntu_latest.sif
drwxr-xr-x  2 shklyar shklyar    1 Jun  3 09:25 .vim
-rw-----  1 shklyar shklyar  4.7K Jun  3 09:25 .viminfo
```



manual pages aka man pages

“man ls”

use “/” to search

```
LS(1)                                BSD General Commands Manual                                LS(1)

NAME
    ls -- list directory contents

SYNOPSIS
    ls [-ABCFGHLOPRSTUW@abcdefghiklmnopqrstuwx1] [file ...]

DESCRIPTION
    For each operand that names a file of a type other than directory, ls displays its
    name as well as any requested, associated information. For each operand that names a
    file of type directory, ls displays the names of files contained within that direc-
    tory, as well as any requested, associated information.

    If no operands are given, the contents of the current directory are displayed. If
    more than one operand is given, non-directory operands are displayed first; directory
    and non-directory operands are sorted separately and in lexicographical order.

    The following options are available:

    -@      Display extended attribute keys and sizes in long (-l) output.

    -1      (The numeric digit `one'.) Force output to be one entry per line. This is
            the default when output is not to a terminal.

    -A      List all entries except for . and ... Always set for the super-user.

    -a      Include directory entries whose names begin with a dot (.).

    -B      Force printing of non-printable characters (as defined by ctype(3) and current
```

A great text-based tutorial (for later):

<https://swcarpentry.github.io/shell-novice/>

Schedule

	Setup	Download files required for the lesson
00:00	1. Introducing the Shell	What is a command shell and why would I use one?
00:05	2. Navigating Files and Directories	How can I move around on my computer? How can I see what files and directories I have? How can I specify the location of a file or directory on my computer?
00:45	3. Working With Files and Directories	How can I create, copy, and delete files and directories? How can I edit files?
01:35	4. Pipes and Filters	How can I combine existing commands to do new things?
02:10	5. Loops	How can I perform the same actions on many different files?
03:00	6. Shell Scripts	How can I save and re-use commands?
03:45	7. Finding Things	How can I find files? How can I find things in files?
04:30	Finish	

The actual schedule may vary slightly depending on the topics and exercises chosen by the instructor.

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[Foundation](#)

[Edit on GitHub](#) / [Contributing](#) / [Source](#) / [Cite](#) / [Contact](#)

Using [The Carpentries style](#) version 9.5.3.



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Cheat Sheets

<https://devhints.io/bash>

<https://github.com/LeCoupa/awesome-cheatsheets/blob/master/languages/bash.sh>

```
#####  
# FILE COMMANDS  
#####
```

ls	# lists your files in current directory, ls <dir> to print files in a specific directory
ls -l	# lists your files in 'long format', which contains the exact size of the file, who owns the file and who has
ls -a	# lists all files in 'long format', including hidden files (name beginning with '.')
ln -s <filename> <link>	# creates symbolic link to file
readlink <filename>	# shows where a symbolic links points to
tree	# show directories and subdirectories in easilly readable file tree
mc	# terminal file explorer (alternative to ncdu)
touch <filename>	# creates or updates (edit) your file
mktemp -t <filename>	# make a temp file in /tmp/ which is deleted at next boot (-d to make directory)
cat <filename>	# prints file raw content (will not be interpreted)
any_command > <filename>	# '>' is used to perform redirections, it will set any_command's stdout to file instead of "real stdout" (generally useful for saving the output of a command)
more <filename>	# shows the first part of a file (move with space and type q to quit)
head <filename>	# outputs the first lines of file (default: 10 lines)
tail <filename>	# outputs the last lines of file (useful with -f option) (default: 10 lines)
vim <filename>	# opens a file in VIM (VI iMproved) text editor, will create it if it doesn't exist
mv <filename1> <dest>	# moves a file to destination, behavior will change based on 'dest' type (dir: file is placed into dir; file: file is replaced)
cp <filename1> <dest>	# copies a file

Books

<https://www.linuxlinks.com/excellent-free-books-learn-bash/>

2. Advanced Bash Scripting Guide by Mendel Cooper

Advanced Bash-Scripting Guide is an in-depth exploration of the art of scripting. Almost the complete set of commands, utilities, and tools is available for invocation by a shell script.

The book explains:

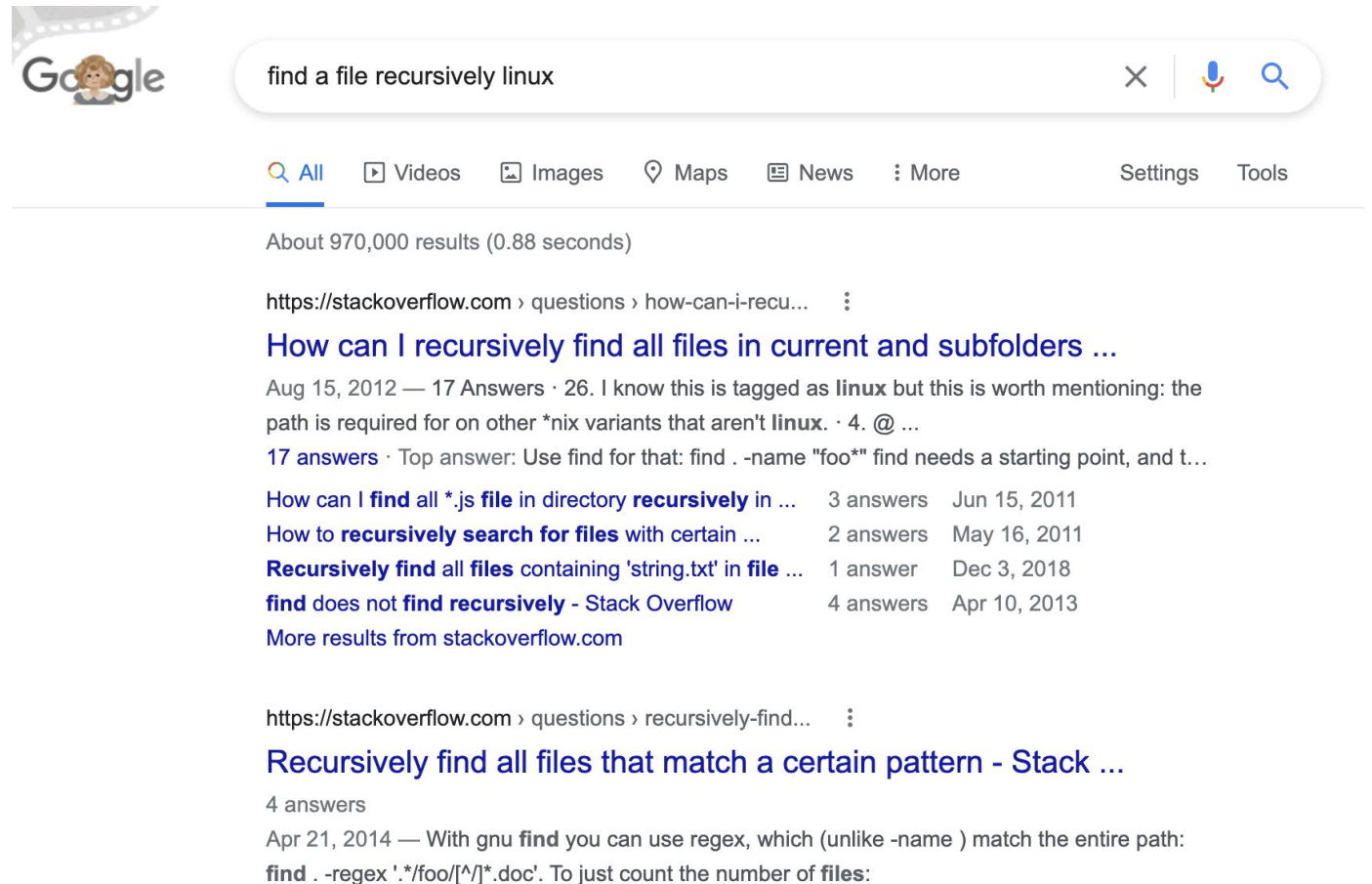
- Basics such as special characters, quoting, exit and exit status.
- Beyond the Basics including loops and branches, command substitution, arithmetic expansion, recess time.
- Commands – Internal commands and builtins; External filters, programs and commands; System and Administrative Commands.
- Advanced topics: Regular Expressions, Here Documents, I/O Redirection, Subshells, Restricted Shells, Process Substitution, Functions, Aliases, List Constructs, Arrays, Indirect References, /dev and /proc, Of Zeros and Nulls, Debugging, Options, Gotchas, Scripting with Style.



This book is in the public domain.

Don't be shy to google

“find file recursively linux”



Google

find a file recursively linux

× | 🔊 🔍

[All](#) [Videos](#) [Images](#) [Maps](#) [News](#) [More](#) [Settings](#) [Tools](#)

About 970,000 results (0.88 seconds)

[https://stackoverflow.com > questions > how-can-i-recu...](https://stackoverflow.com/questions/how-can-i-recu...)

How can I recursively find all files in current and subfolders ...

Aug 15, 2012 — 17 Answers · 26. I know this is tagged as **linux** but this is worth mentioning: the path is required for on other *nix variants that aren't **linux**. · 4. @ ...

17 answers · Top answer: Use find for that: find . -name "foo*" find needs a starting point, and t...

How can I **find** all *.js file in directory **recursively** in ... 3 answers Jun 15, 2011

How to **recursively search** for files with certain ... 2 answers May 16, 2011

Recursively find all files containing 'string.txt' in file ... 1 answer Dec 3, 2018

find does not **find recursively** - Stack Overflow 4 answers Apr 10, 2013

[More results from stackoverflow.com](#)

[https://stackoverflow.com > questions > recursively-find...](https://stackoverflow.com/questions/recursively-find...)

Recursively find all files that match a certain pattern - Stack ...

4 answers

Apr 21, 2014 — With gnu **find** you can use regex, which (unlike -name) match the entire path:

find . -regex '.*foo/[^\/*]*.doc'. To just count the number of **files**:

Where am I?

pwd

```
[[shklyar@discovery2 ~]$ pwd  
/home1/shklyar  
[[shklyar@discovery2 ~]$ █
```


Other disks and file systems

“df -h” and “mount”... and “du -ksh”... and “less” and “grep” and “/”

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	126G	0	126G	0%	/dev
tmpfs	126G	1.2M	126G	1%	/dev/shm
tmpfs	126G	3.3G	123G	3%	/run
tmpfs	126G	0	126G	0%	/sys/fs/cgroup
/dev/sda4	3.9G	652M	3.0G	18%	/
/dev/sda5	7.8G	2.9G	4.5G	40%	/usr
/dev/sda2	486M	27M	431M	6%	/boot
/dev/sda7	176G	1.1G	166G	1%	/var
/dev/sda6	32G	101M	30G	1%	/tmp
apps:/spack	1.7T	382G	1.4T	23%	/spack
beegfs_nodev	483T	49T	434T	11%	/home1
beegfs_nodev	7.6P	2.7P	4.9P	36%	/project
beegfs_nodev	709T	557T	152T	79%	/scratch2
beegfs_nodev	806T	647T	159T	81%	/scratch
tmpfs	26G	0	26G	0%	/run/user/352098
tmpfs	26G	0	26G	0%	/run/user/327602
tmpfs	26G	0	26G	0%	/run/user/268648
tmpfs	26G	0	26G	0%	/run/user/172734
tmpfs	26G	0	26G	0%	/run/user/351147
tmpfs	26G	0	26G	0%	/run/user/356650
tmpfs	26G	0	26G	0%	/run/user/600305
tmpfs	26G	0	26G	0%	/run/user/329077

```
/dev/sda2 on /boot type ext4 (rw,relatime,data=ordered)
/dev/sda7 on /var type ext4 (rw,relatime,data=ordered)
/dev/sda6 on /tmp type ext4 (rw,relatime,data=ordered)
sunrpc on /var/lib/nfs/rpc_pipefs type rpc_pipefs (rw,relatime)
apps:/spack on /spack type nfs4 (ro,relatime,vers=4.1,rsz=1048576,wsz=1048576,namlen=
255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,clientaddr=10.125.0.197,local_lock=none,ad
dr=10.125.0.88)
beegfs_nodev on /home1 type beegfs (rw,relatime,cfgFile=/etc/beegfs/beegfs-client-home1.c
onf,_netdev)
beegfs_nodev on /project type beegfs (rw,relatime,cfgFile=/etc/beegfs/beegfs-client-proje
ct.conf,_netdev)
beegfs_nodev on /scratch2 type beegfs (rw,relatime,cfgFile=/etc/beegfs/beegfs-client-scrat
ch2.conf,_netdev)
beegfs_nodev on /scratch type beegfs (rw,relatime,cfgFile=/etc/beegfs/beegfs-client-scrat
ch.conf,_netdev)
```

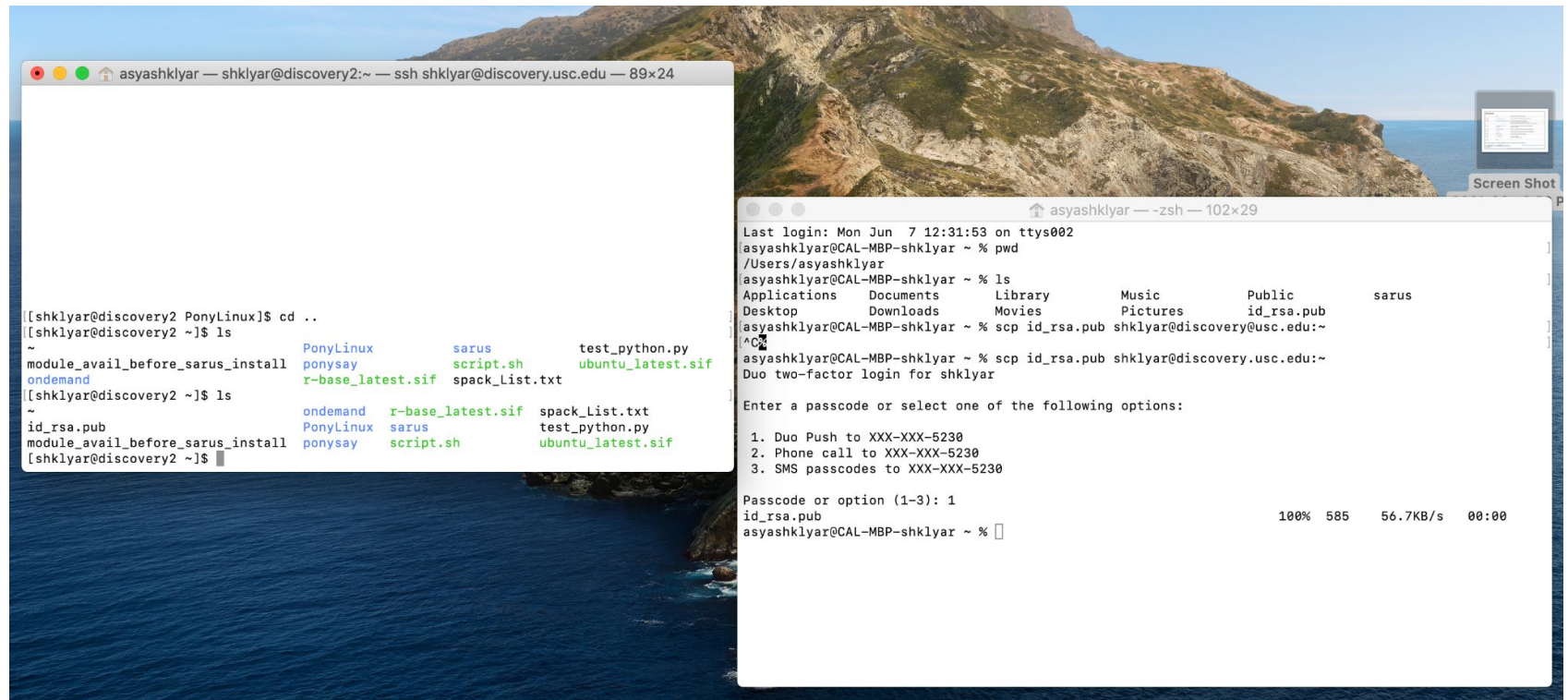
How do I go to another directory?

cd yourdirectory

```
[shklyar@discovery2 ~]$ cd PonyLinux/
[shklyar@discovery2 PonyLinux]$ ls
CHANGES          installation_instructions.md  ponyicon.png  runQuiz.sh      Section_Three_dev  Utilities.sh
Credits           JetstreamFont.png           Ponylinux.sh  runTutorial.sh  Section_Two
Developer_utilities LICENSE                      ponysay       Section_One     splash.txt
Images           minibash.sh                 README.md     Section_Three   starbucks.txt
```

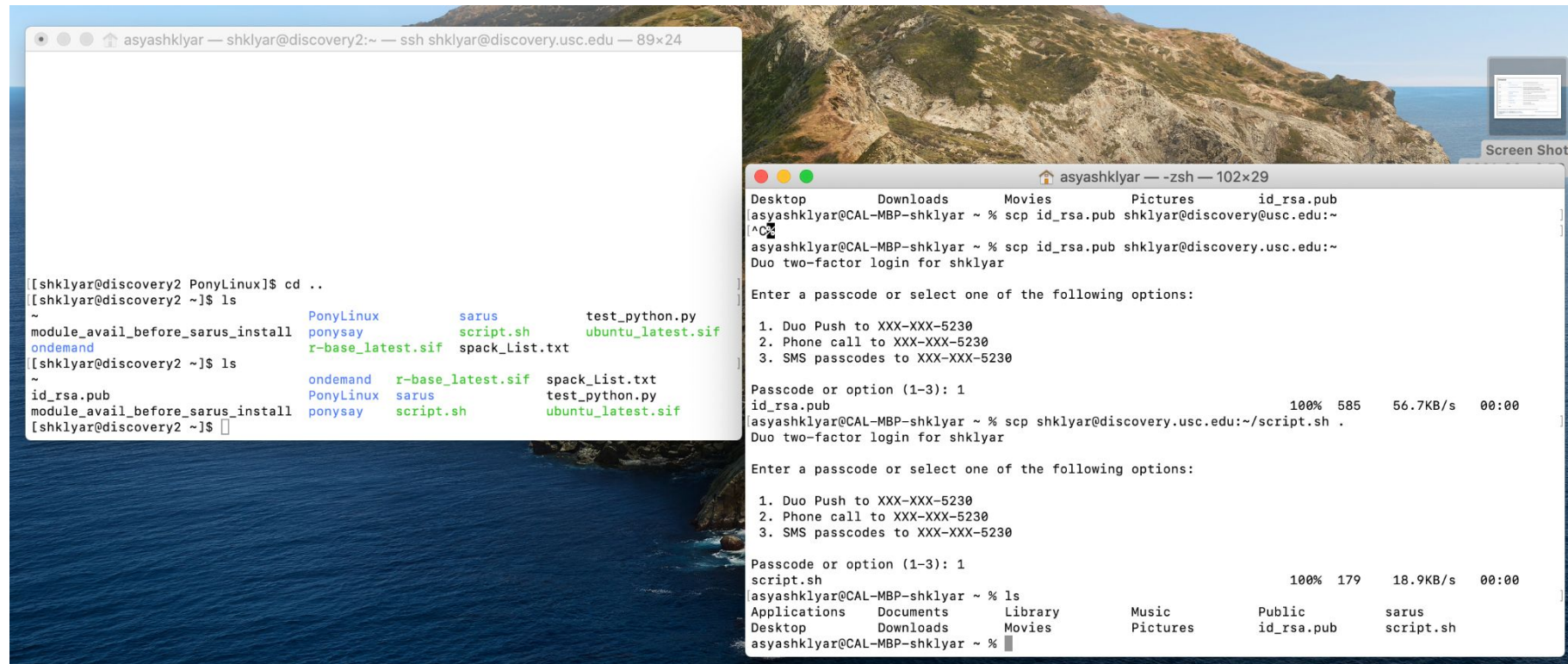
How do I copy a file to the node?

`scp yourfile yourusername@discovery.usc.edu:~`



How do I get my data out?

scp yourusername@discovery.usc.edu:~/yourfile .



The image shows two terminal windows. The left window is a terminal session on a remote host, showing the user navigating to the parent directory and listing files. The right window is a local terminal on a Mac, showing the user running SCP commands to transfer files from the remote host to the local machine. The first SCP command transfers 'id_rsa.pub' and shows a progress bar at 100% with a transfer rate of 56.7KB/s. The second SCP command transfers 'script.sh' and also shows a progress bar at 100% with a transfer rate of 18.9KB/s. Both transfers are successful.

```
asyashklyar — shklyar@discovery2:~ — ssh shklyar@discovery.usc.edu — 89x24
[shklyar@discovery2 PonyLinux]$ cd ..
[shklyar@discovery2 ~]$ ls
~
module_avail_before_sarus_install  PonyLinux      sarus          test_python.py
ondemand                          ponysay        script.sh      ubuntu_latest.sif
[shklyar@discovery2 ~]$ ls
~
id_rsa.pub                         ondemand       r-base_latest.sif  spack_List.txt
module_avail_before_sarus_install  PonyLinux      sarus          test_python.py
[shklyar@discovery2 ~]$

asyashklyar — -zsh — 102x29
Desktop  Downloads  Movies  Pictures  id_rsa.pub
asyashklyar@CAL-MBP-shklyar ~ % scp id_rsa.pub shklyar@discovery.usc.edu:~
^C
asyashklyar@CAL-MBP-shklyar ~ % scp id_rsa.pub shklyar@discovery.usc.edu:~
Duo two-factor login for shklyar

Enter a passcode or select one of the following options:

1. Duo Push to XXX-XXX-5230
2. Phone call to XXX-XXX-5230
3. SMS passcodes to XXX-XXX-5230

Passcode or option (1-3): 1
id_rsa.pub                                100% 585   56.7KB/s   00:00
asyashklyar@CAL-MBP-shklyar ~ % scp shklyar@discovery.usc.edu:~/script.sh .
Duo two-factor login for shklyar

Enter a passcode or select one of the following options:

1. Duo Push to XXX-XXX-5230
2. Phone call to XXX-XXX-5230
3. SMS passcodes to XXX-XXX-5230

Passcode or option (1-3): 1
script.sh                                100% 179   18.9KB/s   00:00
asyashklyar@CAL-MBP-shklyar ~ % ls
Applications  Documents  Library  Music  Public  id_rsa.pub  sarus
Desktop       Downloads  Movies   Pictures
asyashklyar@CAL-MBP-shklyar ~ %
```


Practicum: Pony Linux - Introduction

Welcome to PonyLinux!

PonyLinux is a very basic tutorial on using the **command line** in Unix operating systems, such as Ubuntu Linux.

Walk through a series of tutorial sections that will teach you different **commands**, what they do, and how to use them. The tutorials are interactive, with mini sessions to ensure you get more practice and engagement. Your task will be to take the knowledge you gained during the tutorials to find the Princess in the dungeon! So go on brave one, and be a hero while learning about Linux!



Practicum: Pony Linux - Content

SECTION ONE

Section one introduces the structure of things that are typed into the **command line**, and the concept that programs can be run using text. We delve into basic movement between folders and showing what is inside a folder. Understanding and setting permission to view, open, and change files and folders is covered, as well as how to read the contents of a file.

We go over the following **commands**:

```
cd  
ls  
pwd  
find  
chmod  
less
```



Section One wraps up with a challenge. Use the commands you learned during the tutorials to defeat a dungeon set up using files and folders right in the Linux environment. Your goal is to find the Princess in the dungeon with the knowledge you earned in the tutorial.

Practicum: Pony Linux - Content

SECTION TWO

We go over the following **commands**:

```
head  
tail  
wc  
cat  
less  
nano  
cp  
alias  
mv  
rm  
touch  
mkdir
```

The goals of section two will be to start getting into more bash commands that will introduce you to file handling in Linux - how to read, edit, generate, and remove files. Your goal is to use your new skills to navigate the dungeon, which is now a ruin and overrun with animals, to find the Princess's key.

More learning!

<https://datacarpentry.org/lessons/>

About The Carpentries Curricula

- [Data Carpentry: Ecology](#)
- [Data Carpentry: Genomics](#)
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- [Software Carpentry \(Programming with R\)](#)
- [Software Carpentry \(R for Reproducible Scientific Analysis\)](#)
- [Community Developed Lessons](#)

Learning Subscriptions available at USC

LinkedIn Learning (Lynda)

<https://www.linkedin.com/learning/learning-bash-scripting-2/learning-bash-scripting>

Pluralsight

<https://www.pluralsight.com/courses/bash-shell-scripting>

Upcoming workshops

NVIDIA

July 25th and August 28th - Wednesday - all day

Watch the web site for the registration information

Practicum: Pony Linux - Let's do this!

Normally we would do this:

Log in to Discovery

Load the module

But, between the lack of time and my Internet issues yesterday I am going to use a local install and you are welcome to follow it.

<https://github.com/NCGAS/PonyLinux>

This will be available to use after the bootcamp on Discovery.

Happy Learning!