



RESEARCH
COMPUTING CENTER

INFORMATION TECHNOLOGY SERVICES

Introduction to Linux

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Florida State University
Research Computing Center

September 23, 2025



Agenda

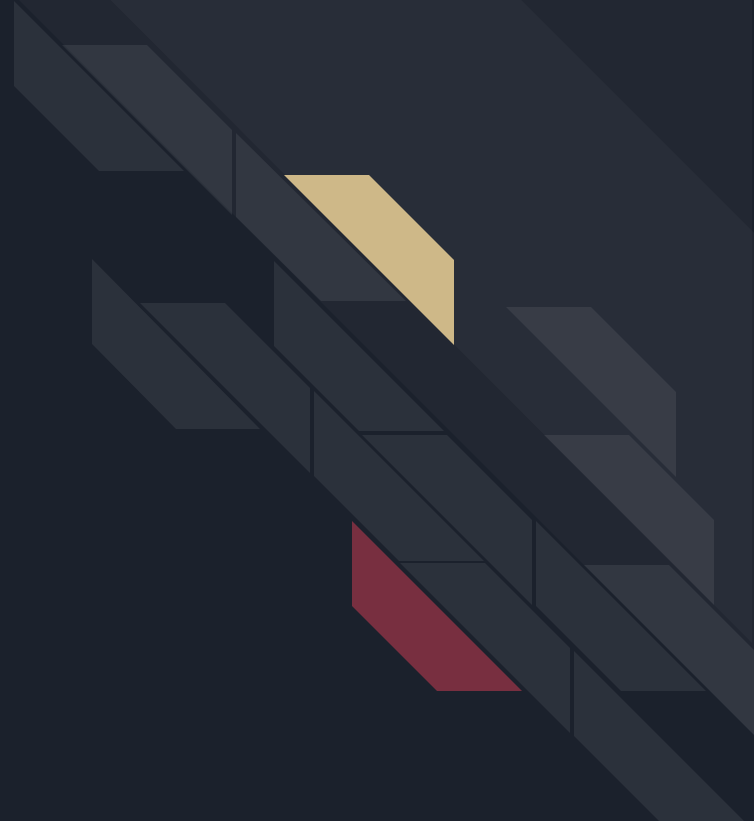
Concepts

- Operating Systems
- Linux
- File Systems

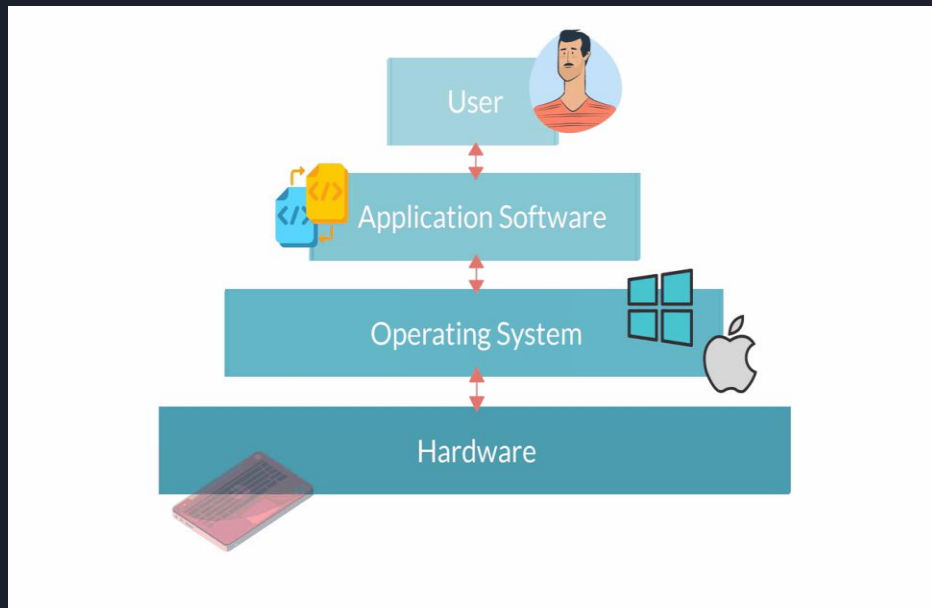
Application

- Linux Terminal
- **Commands in the
Terminal**

Operating Systems



What is an Operating System?



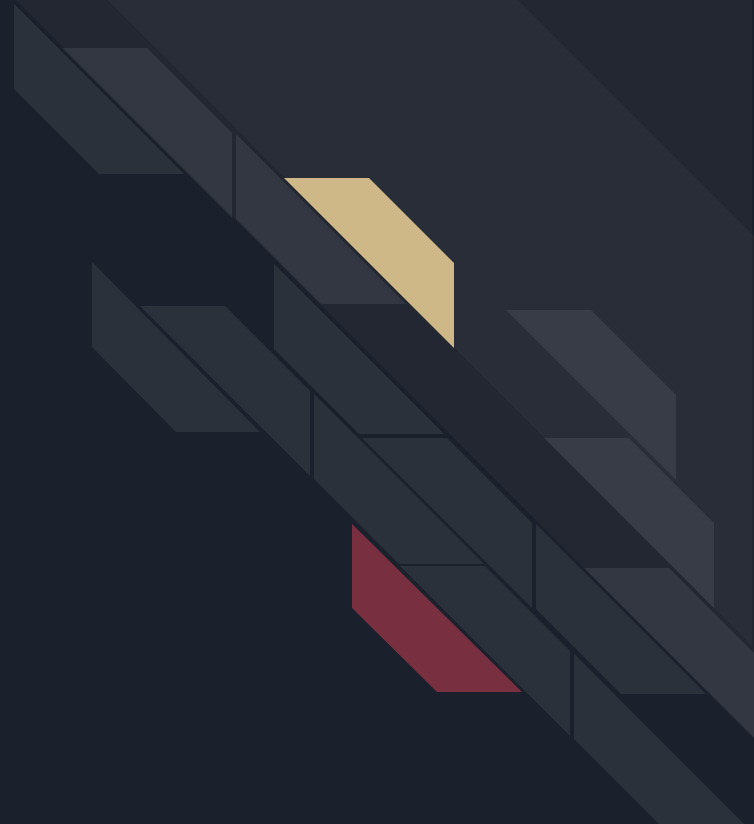
- The main logistics center:
 - manage the computer hardware
 - run at all times with all other application programs
 - act as a middleman between users and hardware

List of Common Operating Systems

- Windows OS
 - Microsoft
 - Good hardware compatibility and support
- Mac OS
 - Apple
 - Superior graphics and multimedia capabilities
- Linux



Linux





Linux Basics

- An Open Source Operating System
 - Linux Kernel + GNU Software + ...
 - Customization, security, stability, lightweight, and efficient
 - Powerful command-line interface
 - Suitable for developers, servers, High Performance Computing

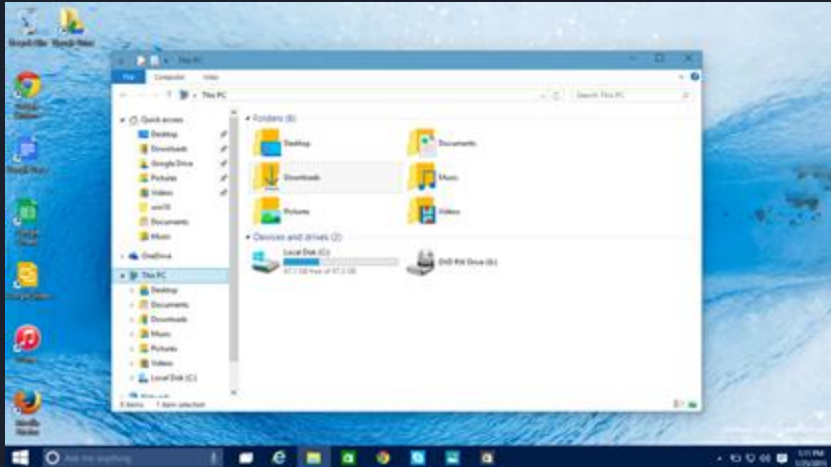


GUI vs CLI

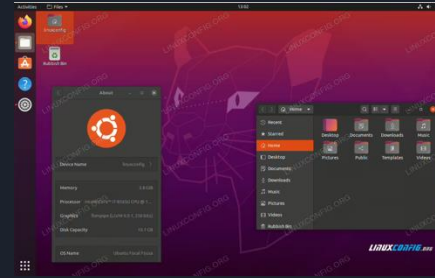
- Graphical User Interface (GUI)
 - Click, point, touch, drag and drop
 - Icons, menus, buttons, windows
- Command Line Interface (CLI)
 - Text-based program
 - commands + options
 - Keyboard
 - no mouse interaction

GUI vs CLI

- Windows (Primarily GUI)



- Linux (Primarily CLI)



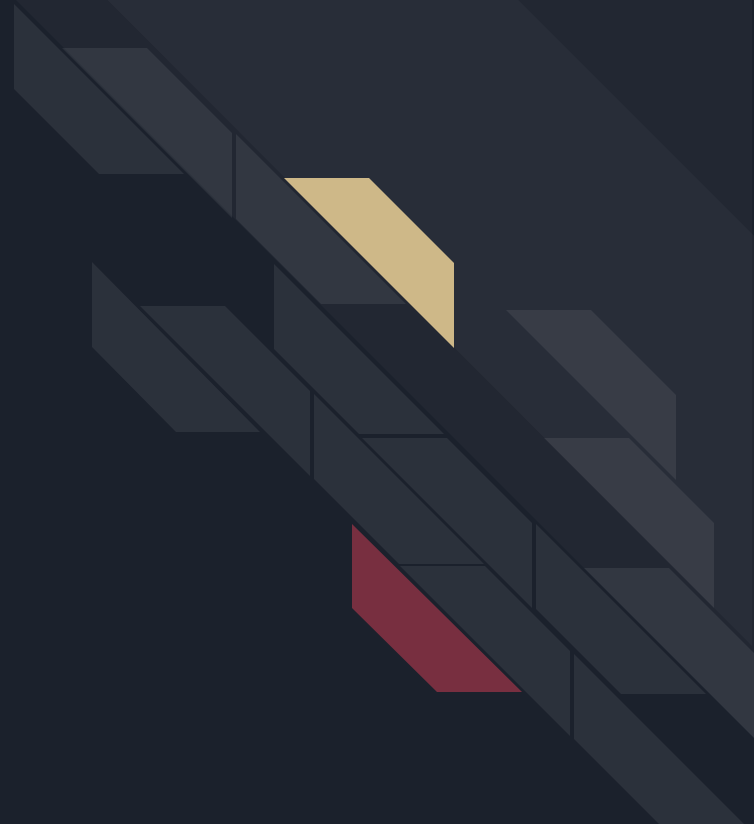
```

UDISKS IGNORE=1
UDISKS_LVMQ_PV_MUM_MDA=1
UDISKS_LVMQ_PV_UUID=k4qsyj-SMdx-6nSI-FchI-RYXb-vmvn-bH03aG
UDISKS_LVMQ_PV_VG_EXTENT_COUNT=476878
UDISKS_LVMQ_PV_VG_EXTENT_SIZE=4194384
UDISKS_LVMQ_PV_VG_FREE_SIZE=14266336
UDISKS_LVMQ_PV_VG_LV_LIST=name:root;uuid=OhthbP-Zr4Y-Eucy-kfPe-Zzqe-a88g-lZEaXT;size=1993565274112;;active=1
name=swap_1;uuid=UcyETs-rtcd-p9Cx-QrVy-nSed-SZNL-kt092Q;size=6429868832;;active=1
UDISKS_LVMQ_PV_VG_NAME=ubuntu-vg
UDISKS_LVMQ_PV_VG_PV_LIST=uuid=k4qsyj-SMdx-6nSI-FchI-RYXb-vmvn-bH03aG;size=2000137748480;allocated_size=1999
995142144
UDISKS_LVMQ_PV_VG_SEQUPM=3
UDISKS_LVMQ_PV_VG_SIZE=2000137748480
UDISKS_LVMQ_PV_VG_UUID=sqg7Xl-rTq3-zlYu-Bsq5-jenc-Q6XB-6kBXd3
UDISKS_PARTITION=1
UDISKS_PARTITION_ALIGNMENT_OFFSET=0
UDISKS_PARTITION_NUMBER=5
UDISKS_PARTITION_OFFSET=256981120
UDISKS_PARTITION_SCHEME=msr
UDISKS_PARTITION_SIZE=2000141942784
UDISKS_PARTITION_SLAVE=/sys/devices/pci0000:00/0000:00:1f.2/ata1/host0/target0:0:0/0:0:0/block/sda
UDISKS_PARTITION_TYPE=0x8e
UDISKS_PRESENTATION_HIDE=1
UDISKS_PRESENTATION_NOPOLICY=0
USEC_INITIALIZED=68

bluepenguin@rampage-iii:~$ cat /var/log/udev

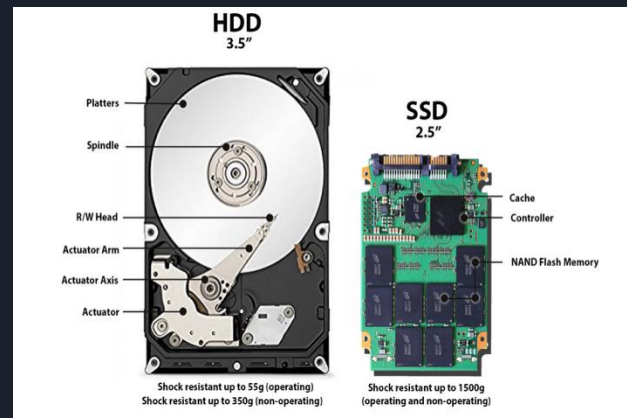
```

File Systems



What is a File System?

- A file system is a logical hierarchical structure that an OS uses to manage, organize, and access **data** on a **storage device**
- Data:
 - files, programs, pictures, videos, documents...
- Storage Device:
 - SSD: Solid-State Drive
 - HDD: Hard-Disk Drive
 - Other media...



File System Basics

- File Type

- Text: .txt, .doc
- Multimedia: .mov, .rm, .mpeg
- Source Code: .c, .cpp, .java, .py, .m
- Executable: .exe, .bin
- Batch: .bat, .sh
- Archive: .arc, .zip, .tar

- File Directories

- The collection of files and sub-directories
- Info: attributes, location, ownership, size, time-stamps...

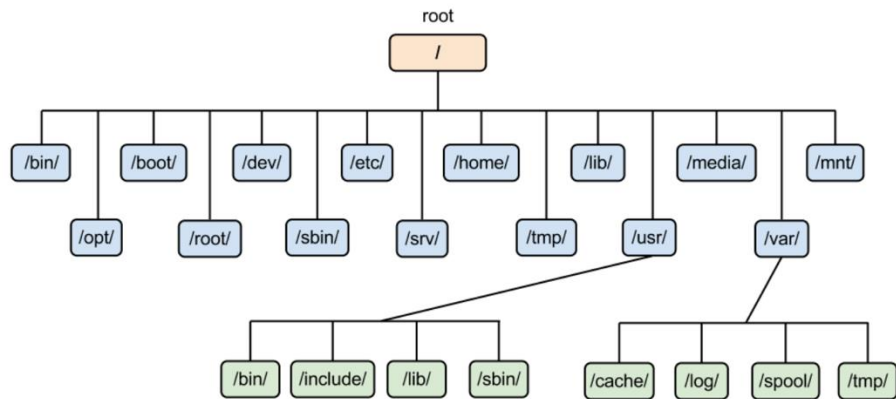
- Tree Structure

- **A single root**
- Easy organization
- Efficient search



Linux File System

- A Hierarchical Tree Structure



- Files start at ROOT: /
- The root is the highest level in the tree structure
- All other files and directories are contained within the root



File Paths and Directory Locations

- PATH

- A set of directions moves down from the root to locate the file or directory
- Directory names can be separated by:
 - “/” in Linux & Mac

```
/gpfs/home/zzzzz/Documents/workshops/presentation.pptx
```

- “\” in Windows

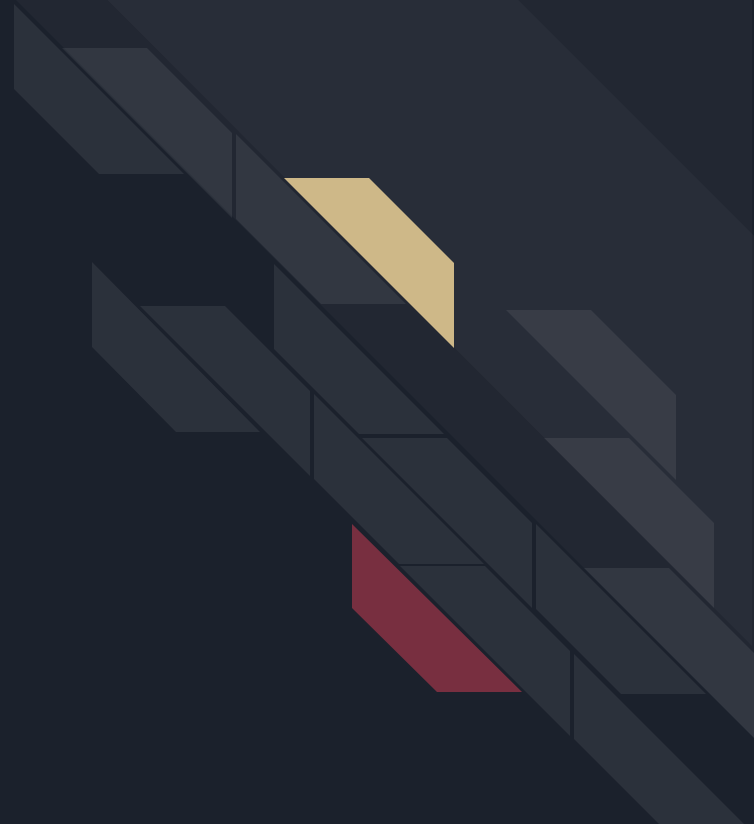
```
C:\Users\zzzzz\Desktop\workshops\presentation.pptx
```



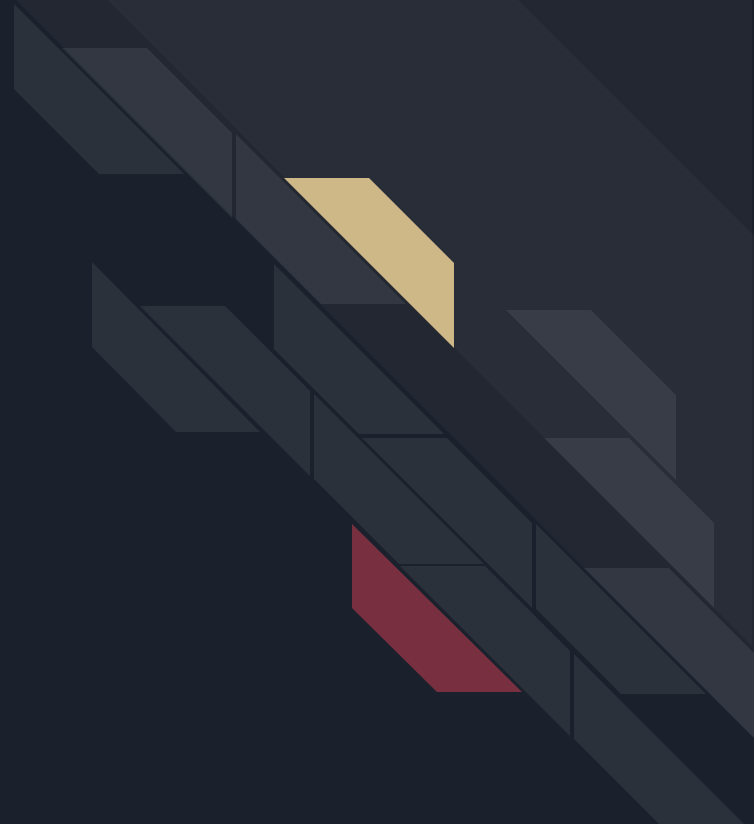
Recap:

- Operating System
 - A software that acts as a **middleman between users and hardware**
- Linux Operating System
 - Linux Kernel + GNU Software + ...
 - Command Line Interface
- Linux File System
 - OS uses it to manage and organize data on the storage device
 - A Logical hierarchical **tree structure starting at ROOT**

Questions?

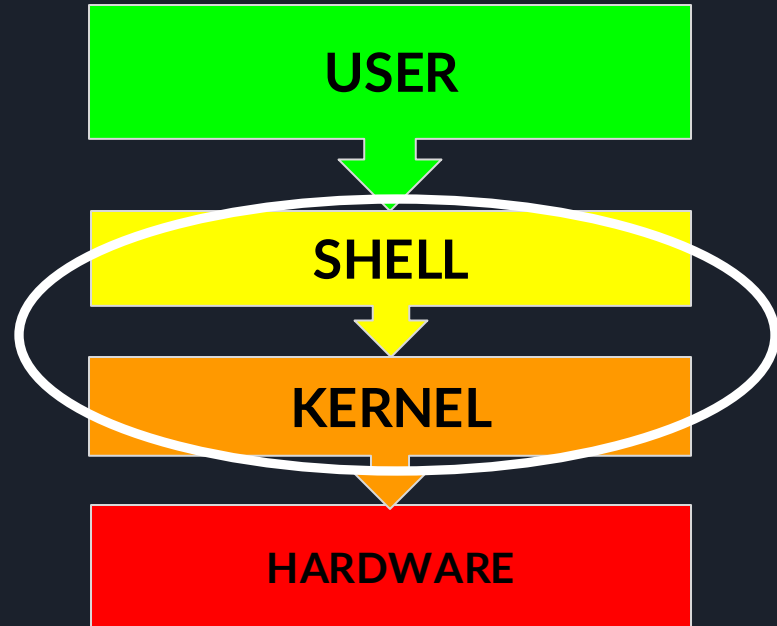


Linux Terminal



The Linux Terminal

- Shell
- Terminal
- Command Line Interface





Terminology:

- Shell
 - A program that takes commands from the keyboard and sends them to the OS to perform
 - bash (default), zsh, fish...
- Terminal/Command Line Interface
 - Applications that launch a shell and provide a command line interface to the user
 - A text-based interface basically
 - iTerm-2, Windows PowerShell, PuTTY, MobaXTerm...
 - [Open OnDemand](#) : RCC HPC Cluster Shell Access

Make sure you have a Linux terminal!

Functionalities of the Linux Terminal

- Issue commands to perform tasks
- Monitor the operations and status
- Log into other computers/remote systems via:
 - `sftp`: Secure File Transfer Protocol
 - `ssh`: Secure Shell

```
ssh USERNAME@hpc-login.rcc.fsu.edu
```

```
zheli@Zhes-MacBook-Pro ~$ ssh zl17b@hpc-login.rcc.fsu.edu
zl17b@hpc-login.rcc.fsu.edu's password:

Welcome to the RCC

~~~~~
RCC/HPC Documentation can be found here:
https://rcc.fsu.edu/docs
~~~~~

Last login: Fri Aug 23 11:44:14 2024 from 10.146.38.190

** Disk usage (GPFS) quota report: 118.2G used of 150G available
For a disk quota report, run: gpfs_quota

(base) [zl17b@h22-login-24 ~]$
```

The Linux Terminal Window

- Format:

```
username@hostname:current_directory $
```

Prompt Symbol

Text Area

- Example:

```
[workshop-001@h22-login-26 ~]$
```

Home Directory

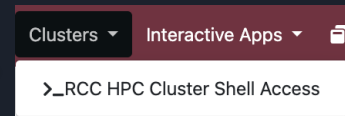
Hands-On Practice (A)

- Connect using an SSH-supporting terminal:

1) Windows PowerShell (in-class) or iTerm-2

```
$ ssh workshop-ID@hpc-login.rcc.fsu.edu
```

2) Open OnDemand



- Type the commands and see what they output:

1) \$ date

2) \$ whoami

3) \$ hostname

4) \$ echo helloworld

Commands in the Terminal

The background of the slide features a series of overlapping, three-dimensional rectangular blocks in various shades of dark blue and grey. These blocks are arranged in a way that creates a sense of depth and perspective, extending from the top right towards the bottom left. Two specific blocks stand out: a bright yellow one and a dark red one, both positioned towards the right side of the frame. The overall aesthetic is modern and technical, fitting the theme of terminal commands.



Basic File and Directory Commands

- Creating
- Editing
- Viewing
- Moving/Copying
- Deleting
- Navigating
- Listing
- Finding
- Basic Info
- Getting Help



Creating Files

`mkdir <dirName>`

Make a new directory/folder

`touch <fileName>`

1) Create new file(s)

`touch <file>`

2) Update the **TIMESTAMP** of the existing file or **directory**

`touch <dir>`

```
$ touch hello
```

```
$ mkdir DEMO
```

```
$ touch hello
```

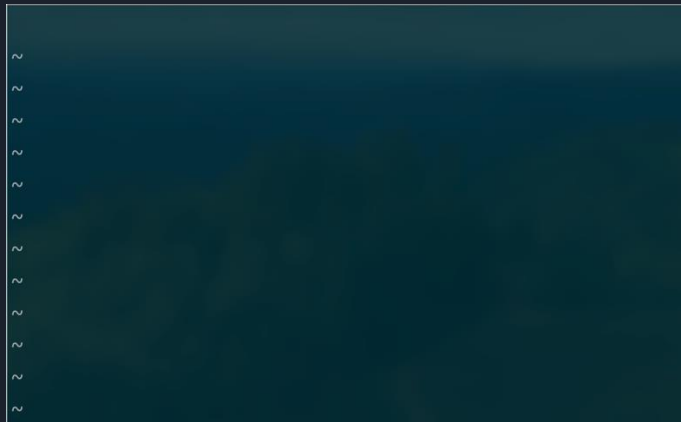
NOTE: Case-Sensitive!

Editing Files

- Text Editors

- Editing/viewing code, text and data files
 - .txt, .cpp, .py, .csv...
- `vim <fileName>`
- `vi <fileName>`
- `nano <fileName>`
- `emacs <fileName>`

```
$ vim hello
```





Viewing Files

`cat <file>` Concatenate the contents of the file(s) to the screen



`less <file>` Print only some of the file to the screen
Print more as you scroll down, q to quit

`head <file>` Print the first ten (default) lines of a file

`tail <file>` Print the last ten (default) lines of a file

```
$ cat news.txt books.txt
```

```
$ less DEMO/news.txt
```



Copying/Moving Files

`mv <source> <destination>`

1) Move file(s) or directory
to a location

`mv <source1> <source2>`

2) Rename the file or the
directory

`cp <source> <destination>`

Copy file(s) or directory to a
location

```
$ mv hello hello.txt
```

```
$ cp hello.txt DEMO/
```

```
$ mv hello.txt DEMO/
```

CAUTION: Overwritten!



Deleting Files

`rm <file>` Delete file(s) from the current working directory

`rm *` Delete all files from the current working directory

`rm -rf <dir>` Delete a directory in the current working directory



CAUTION: No Undo and No Trash Can/Recycle Bin

```
$ rm books.txt
```

```
$ rm -rf DEMO/
```

```
$ rm *.txt
```



Hands-On Practice (B)

- Creating, Moving, Removing the Files
 - 1) Create two new files, named “command” and “testing”
 - 2) Create a directory named “Workshop”
 - 3) Remove the file “command”
 - 4) Rename the file “testing” to “testing.txt”
 - 5) Move the file “testing.txt” into the “Workshop” directory



Solutions to the Hands-On Practice (B)

- 1) `$ touch command testing`
- 2) `$ mkdir Workshop`
- 3) `$ rm command`
- 4) `$ mv testing testing.txt`
- 5) `$ mv testing.txt Workshop`

Navigating the Linux File System

`cd <dir>` Change the current working directory to a different one

`cd ~` Change the current directory to the home directory

`cd ..` Change the directory above your current

`cd -` Change to the previous working directory

`pwd` Show current working directory



Listing the Contents of the Directory

`ls` List the contents of current working directory

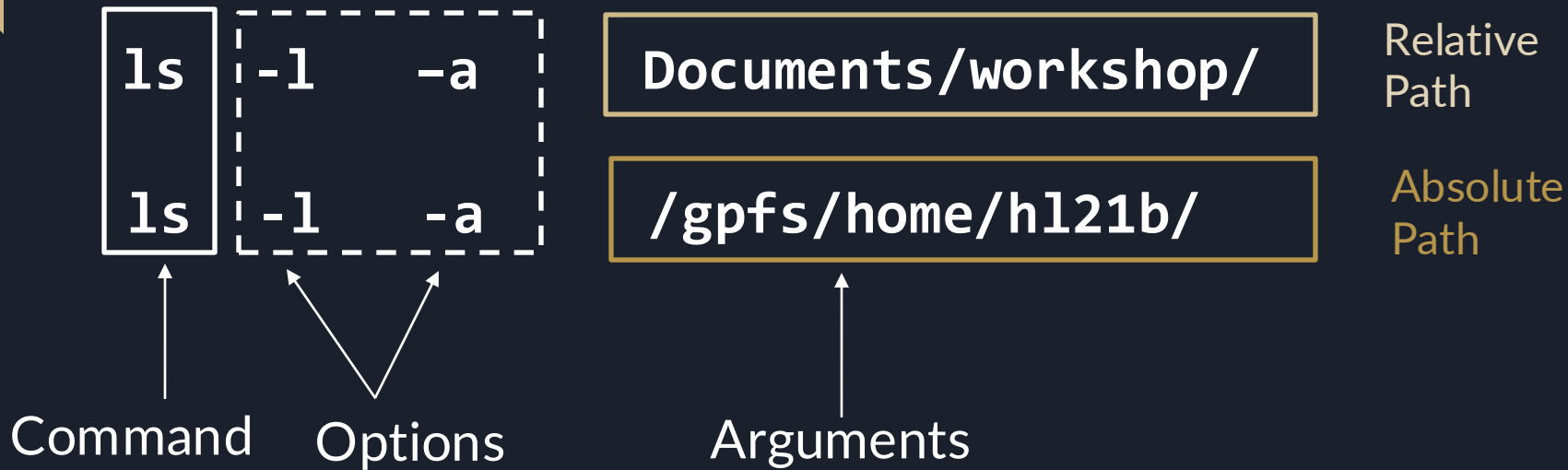
`ls <dir>` List the contents of that specific directory

↑
Command

↖
Arguments



The Anatomy of a Command



NOTE: Options can be combined!

The Physiology of a Command

VERB

Do X

`ls`

ADJECTIVES

Using method Y

`-l -a`

NOUN

At location Z

`/gpfs/home/h121b/`

`ls` = list ← VERB

`-l -a` = verbosely all files ← Adjectives

`/gpfs/home/h121b/` = in my home directory ← NOUN

```
$ ls -a DEMO/
```

```
$ ls -al
```

```
$ ls -t
```

```
$ ls -r
```

Users, Groups and Permissions

```
$ ls -l
```

```
$ ll
```

- -l: long
- A detailed list of files in a long format

Long Format Example:

```
drwxr-xr-x 7 h121b h121b 4096 Mar 6 16:33 bioinformatics2022Fall
```

File
Permissions

of links

Owner
Name

Owner
Group

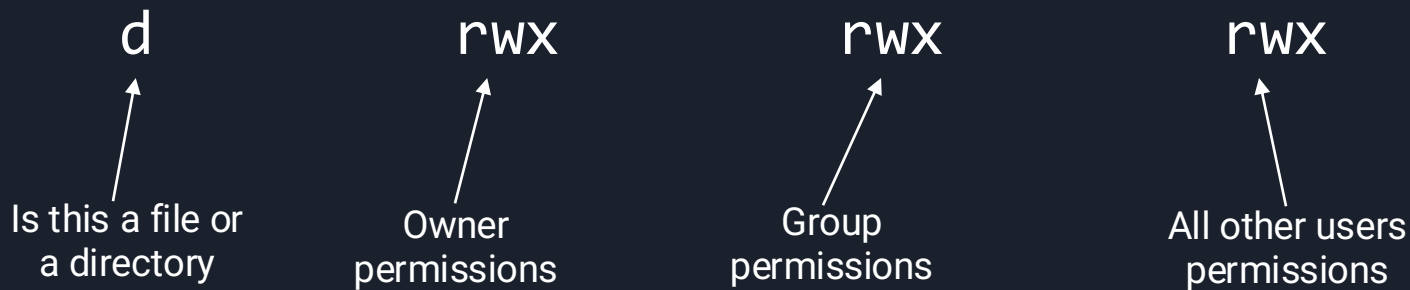
Size

Timestamp of last
modification

Name

Meaning of the File Permissions

- d: directory
- rwx: read, write, execute
- -: not/no access



```
[hl21b@h22-login-25 ~]$ ls -l /gpfs/home/hl21b/
-rwxr-xr-x  1 hl21b hl21b 14019 Apr 13 20:45 backup-40
drwxr-x---  6 hl21b hl21b  4096 Aug 22 13:48 hysplit
drwxrwx---  4 hl21b hl21b  4096 Apr 19 10:23 Environment
```



Finding Things in the Linux File System

`find <path> <expression>` Search for files and directories

`<expression>:name, type, size`

Criteria to filter the search result

```
[zzzzz@h22-login-25 ~]$ find . -name backup-409
./others/backup-409
./backup-409
```



Basic Info Commands

`whoami` Lists your username

`hostname` List the name of the computer you're on

`date` List the Date, Time and Time Zone

`echo` Write the arguments (the string specified) to
standard output

```
$ echo $PATH
```

Getting Help with Linux Commands

<code>man <commandName></code>	Prints the manual entry for the command
<code>info <command></code>	Verbose, prose-like information
<code>type <command></code>	What is the command type
<code>which <command></code>	Where is the command or file located
<code>help <command></code> <code><command> --help</code>	Built-in tools to help you use commands (bash commands: echo, logout, pwd, ect)





More Helpful Commands

`clear` Clear the terminal screen

`history` Show the history of issued commands

`q` Exit from less/man/etc

`exit` Exit the terminal



Advanced Helpful Key Strokes

Up Arrow Go back to the last command issued

TAB Complete typing out this command for me

<ctrl>+c Exit from the current task

<ctrl>+l Clear the terminal screen



Hands-On Practice (C)

- Navigating and Finding Files
 - 1) Check the timestamp of “testing.txt”, update the timestamp, and verify the change
 - 2) Create a new directory named “LinuxDemo” inside your “Workshop” directory
 - 3) Rename the “LinuxDemo” directory to “yourFSUID”
 - 4) Copy the file “testing.txt” into the newly renamed “yourFSUID” folder



Hands-On Practice (C)

- 5) Check the file “testing.txt” located within "yourFSUID" folder
 - 6) Show the full path of your current working directory
 - 7) Change to the parent directory of your current location
 - 8) Change to your home directory
 - 9) Find the file “testing.txt” from your current location
- Clearing and Ending a Session
 - 10) Clear the content on your screen
 - 11) Disconnect from the terminal session



Solutions to Hands-On Practice (C)

- 1) `$ cd /path/to/testing.txt $ ll $ touch testing.txt $ ll`
- 2) `$ cd Workshop/ $ mkdir LinuxDemo`
- 3) `$ mv LinuxDemo/ fsuID/`
- 4) `$ cp testing.txt fsuID/`
- 5) `$ cd fsuID/ $ ll`
- 6) `$ pwd`
- 7) `$ cd ..`
- 8) `$ cd ~`
- 9) `$ find . -name testing.txt`
- 10) `$ clear`
- 11) `$ exit`



Register For an FSU RCC Account

Register For an Account

Faculty Requirements

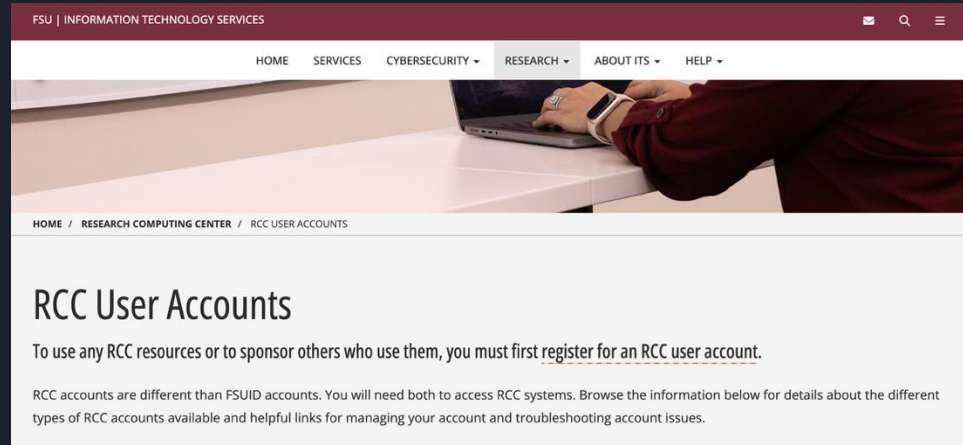
- FSU ID and password

Student Requirements

- FSU ID and password
- Faculty Sponsor

Guest (non-FSU)

- Guest FSU ID
- Faculty Sponsor



<https://its.fsu.edu/research/rcc-user-accounts>

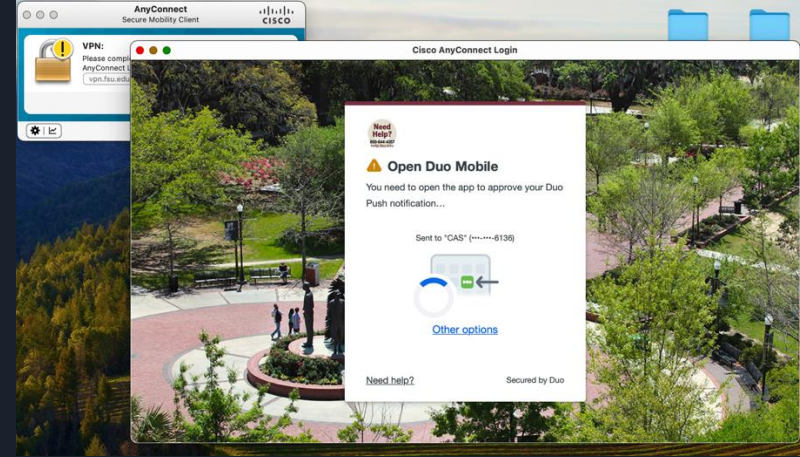
Connect to the HPC from Off-Campus

Initial Setup

- Log in to vpn.fsu.edu/hpc
- FSU ID and password
- [FSU Cisco AnyConnect VPN client](#)

Important Note

- An active RCC account to use the “hpc” VPN profile
- Faculty/staff: options of main FSU VPN profile (vpn.fsu.edu)
- Student: HPC VPN profile (vpn.fsu.edu/hpc)



<https://servicecenter.fsu.edu/How-do-I-connect-to-the-HPC-or-other-RCC-resources-from-off-campus>



Email us at support@rcc.fsu.edu
for any questions or concerns

Resources

- FSU Research Computing Center
 - Location: Dirac Science Library 151
 - [RCC Website](#)
 - HPC Drivers Ed: [Intro to HPC Materials](#)
 - Additional [RCC Documentation](#)
- Free Linux Resources:
 - [Linux Cheat Sheet](#)
 - [Free Linux Book](#)
 - [Open Vim](#)
 - [Vim Genius](#)



RCC Workshops

- Parallel R
 - Oct 14 at 3:00 pm to 4:30 pm
- Intro to SQL
 - Oct 21 at 3:00 pm to 4:30 pm
- REDCap Consortium Lunch, Learn & Collaborate Meeting
 - Oct 29 at 12:30 pm to 1:30 pm EDT

Survey



Questions?

