


# Introduction to Linux

Zhe Li

Florida State University
Research Computing Center

September 22, 2026

# Agenda

## Concepts

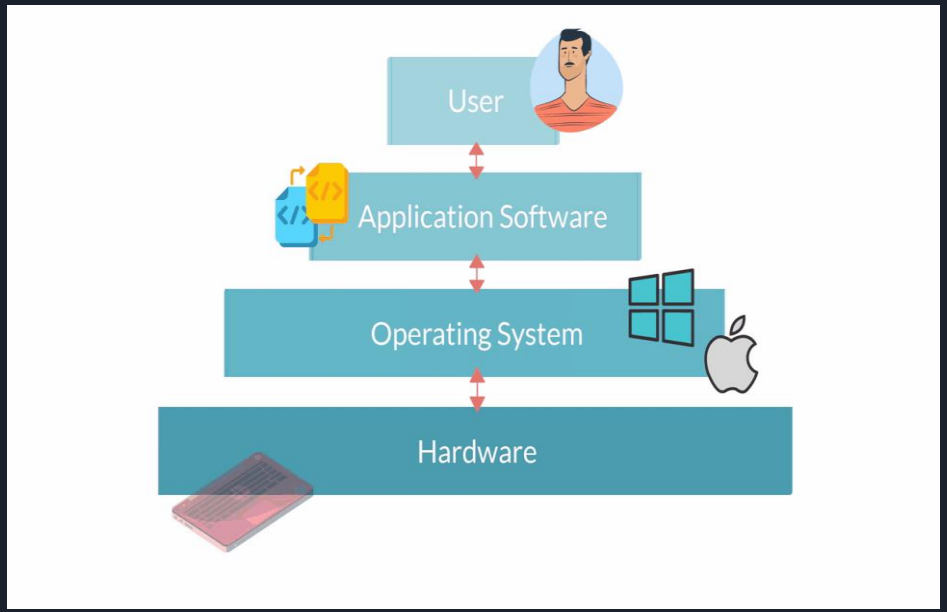
- Operating Systems
- Linux
- File Systems

## 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

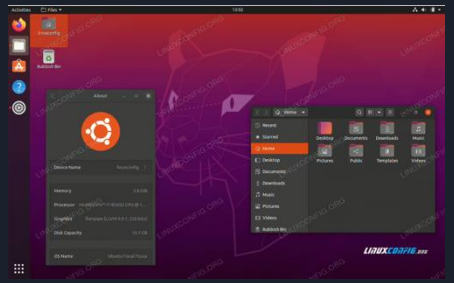
- An Open Source Operating System
  - Linux Kernel + GNU Software and tools + ...
  - Customization, security, stability, lightweight, and efficient
  - Powerful command-line interface
  - Suitable for developers, servers, High Performance Computing

# GUI vs CLI

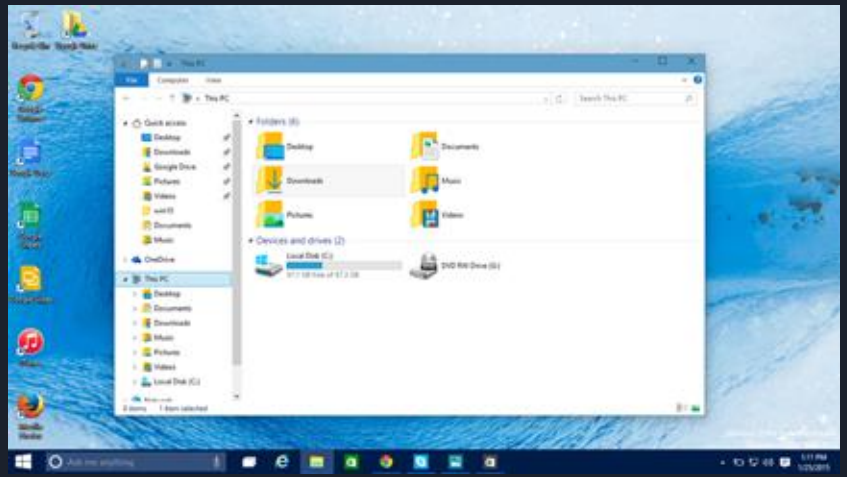
- Graphical User Interface (GUI)
  - Click, point, touch, drag and drop
  - Icons, menus, buttons, windows

- Command Line Interface (CLI)
  - Text-based program
    - commands + options
  - Keyboard
    - no mouse interaction

# GUI vs CLI



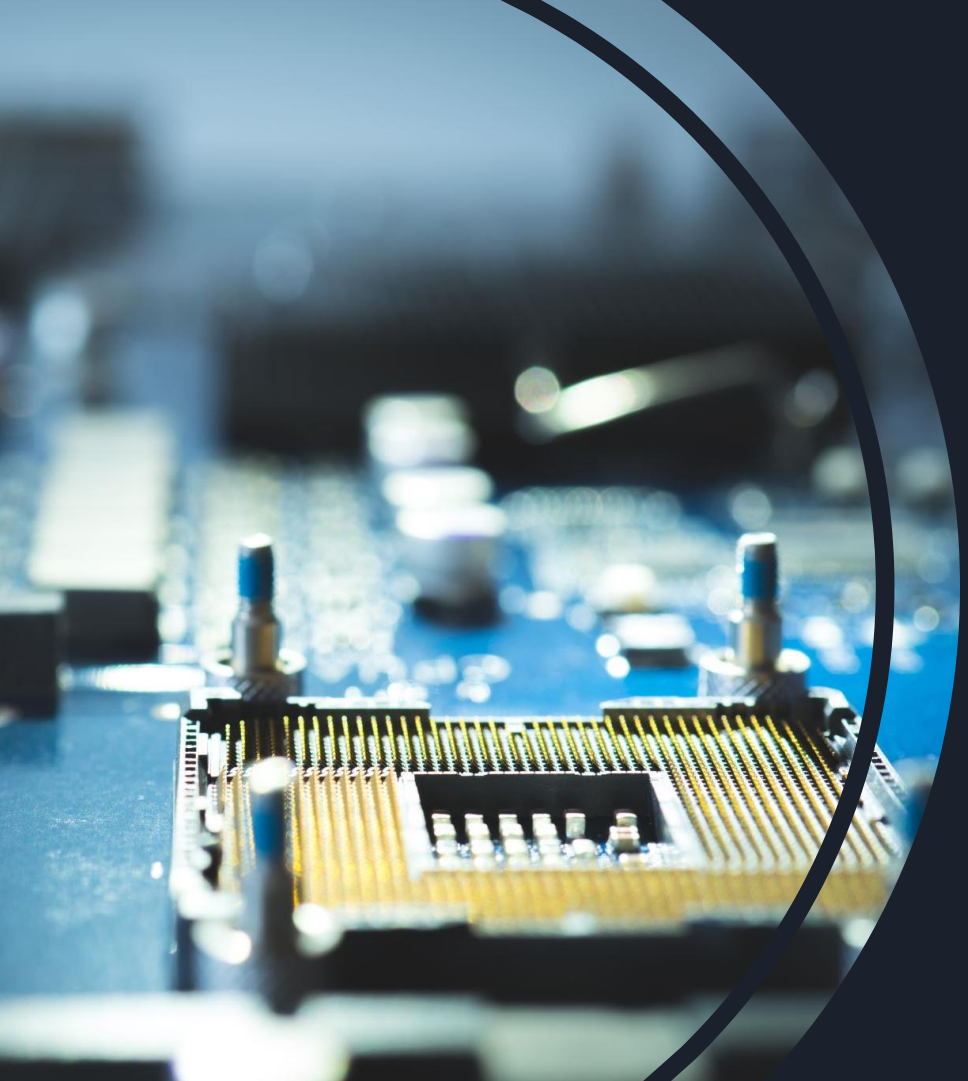
- Windows (Primarily GUI)



- Linux (Primarily CLI)

```
UDISKS_IGNORE=1
UDISKS_LVM2_PV_NUM_MDA=1
UDISKS_LVM2_PV_UUID=kUqsYj-SMdx-6m5I-FcHI-RYXb-vmvn-bHO3aG
UDISKS_LVM2_PV_VG_EXTENT_COUNT=476870
UDISKS_LVM2_PV_VG_EXTENT_SIZE=4194304
UDISKS_LVM2_PV_VG_FREE_SIZE=142606336
UDISKS_LVM2_PV_VG_LV_LIST=name=root;uuid=0hthbP-Zr4Y-Euey-kfPe-Zzqe-a88g-lZEsXT;size=1993565274112;;active=1
 name=swap_1;uuid=UcyETs-rUcd-p9Cx-QrVy-n5ed-5ZNl-kt092Q;size=6429868032;;active=1
UDISKS_LVM2_PV_VG_NAME=ubuntu-vg
UDISKS_LVM2_PV_VG_PV_LIST=uuid=kUqsYj-SMdx-6m5I-FcHI-RYXb-vmvn-bHO3aG;size=2000137748480;allocated_size=1999
995142144
UDISKS_LVM2_PV_VG_SEQNUM=3
UDISKS_LVM2_PV_VG_SIZE=2000137748480
UDISKS_LVM2_PV_VG_UUID=sQg7X1-rTqJ-zIYu-B5q5-jenc-Q0X8-6k8xH3
UDISKS_PARTITION=1
UDISKS_PARTITION_ALIGNMENT_OFFSET=0
UDISKS_PARTITION_NUMBER=5
UDISKS_PARTITION_OFFSET=256901120
UDISKS_PARTITION_SCHEME=mbr
UDISKS_PARTITION_SIZE=2000141942784
UDISKS_PARTITION_SLAVE=/sys/devices/pci0000:00/0000:00:1f.2/ata1/host0/target0:0:0/0:0:0:0/block/sda
UDISKS_PARTITION_TYPE=0x8e
UDISKS_PRESENTATION_HIDE=1
UDISKS_PRESENTATION_NOPOLICY=0
USEC_INITIALIZED=68

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



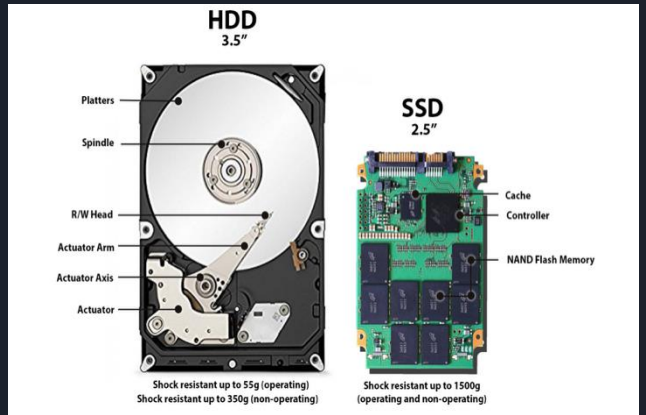
# Food for Thought

- What company invented the first computer with a graphical user interface (GUI) and a mouse used to control operations?
- What company first widely marketed a VERY popular computer that used GUI?

# 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…

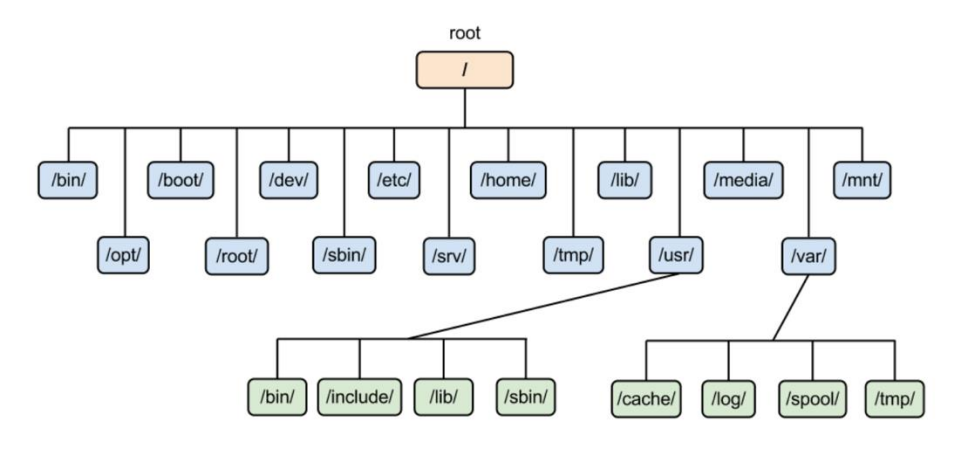


# File System Basics

- 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/zlabc/Documents/workshop/presentation.pptx
```

    - “\” in Windows

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

# Test Your Knowledge: Hierarchical File System

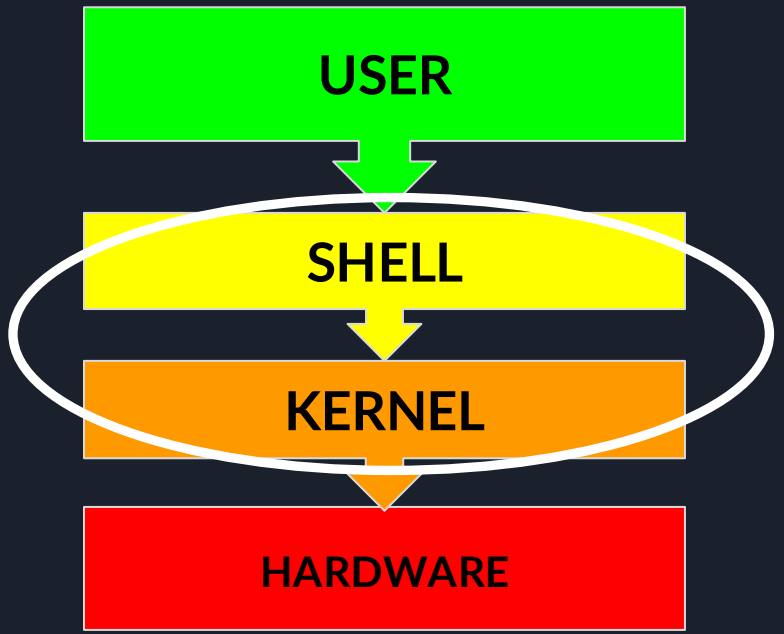
- True or False
  1) The root directory / has a parent directory. **False** ❌
  2) A directory can have several child files and directories. **True** ✅
  3) A file/directory can have several parent directories at the same time. **False** ❌
  4) Two files in the same directory can have the same filename. **False** ❌
  5) Two files/directories can have the same name if they are located in different parent directories. **True** ✅
  6) Every file and directory can be traced back to the root directory. **True** ✅

# Questions?

# Linux Terminal

# The Linux Terminal

- Shell
- Terminal
- Command Line Interface



# Terminology:

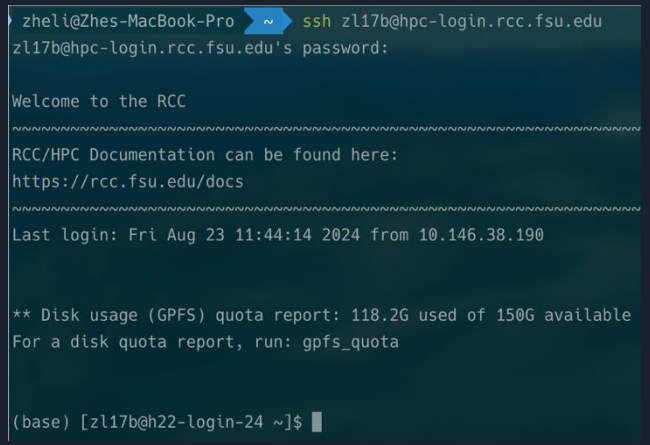
- Shell
  - A program that takes commands from the keyboard and sends them to the OS to perform
  - bash (default), zsh, fish...
- Terminal/Command Line Interface
  - Applications that launch a shell and provide a command line interface to the user
  - A text-based interface basically
  - iTerm-2, Windows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

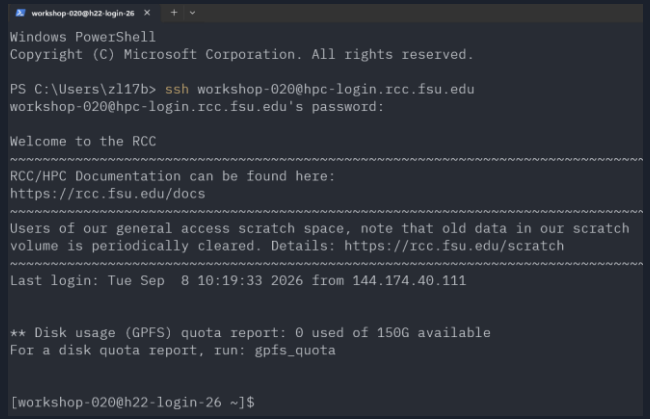
**Make sure you have a Linux terminal!**

# 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
```



# The Linux Terminal Window

- Format:

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

Prompt Symbol

Text Area

- Example:

```
[workshop-020@h22-login-26 ~] $
```

Home Directory

# Commands in the Terminal

# 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>`
`touch <dir>`

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

```
$ touch hello
```

```
$ mkdir DEMO
```

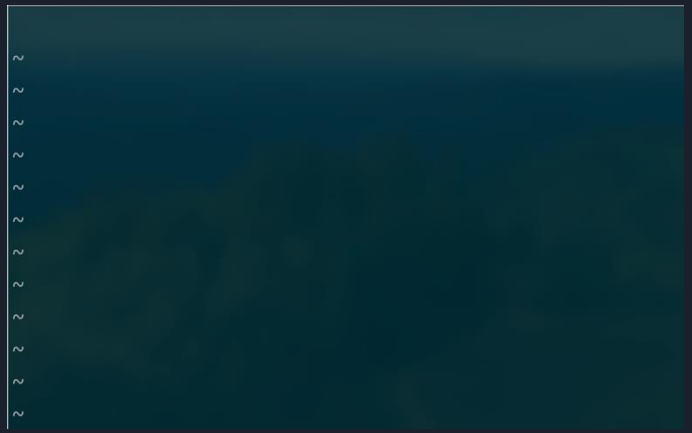
```
$ touch hello
```

**NOTE: Case-Sensitive!**

# Editing Files

- Text Editors
  - Creating/Editing/viewing code, text and data
    - .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<br>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/
```

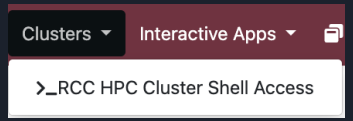
```
$ rm *.txt
```

# Hands-On Practice (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`

# 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 `testing` to `testing.txt`
  5) Copy `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) `$ cp 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 | ADJECTIVES | NOUN |
| --- | --- | --- |
| Do X | Using method Y | At location Z |
| ls | -l -a | /gpfs/home/hl21b/ |

**ls = list ← VERB**

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

**/gpfs/home/hl21b/ = 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 hl21b hl21b  4096 Mar 6 16:33 bioinformatics2022Fall
```



# Demystifying the File Permissions

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




```
-rwxr-x---  1 hl21b hl21b 14019 Apr 13 20:45 backup-40
```

# Locating Files in the Linux File System

`find <path> <expression>`

Search for files and directories

`<expression>:name, type, size`

Criteria to filter the search result

```
$ find . -type d -name backup-409
```

# Essential Information 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
```

# Built-in Linux Help

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



# Session Control Commands

| | |
|---|---|
| `clear` | Clear the terminal screen |
| `history` | Show the history of issued commands |
| `q` | Exit from less/man/etc |
| `exit` | Exit the terminal |

# Advanced Terminal Keystrokes

| | |
|---|---|
| *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 |

# Register For an FSU RCC Account

# Register For an Account

## Faculty Requirements

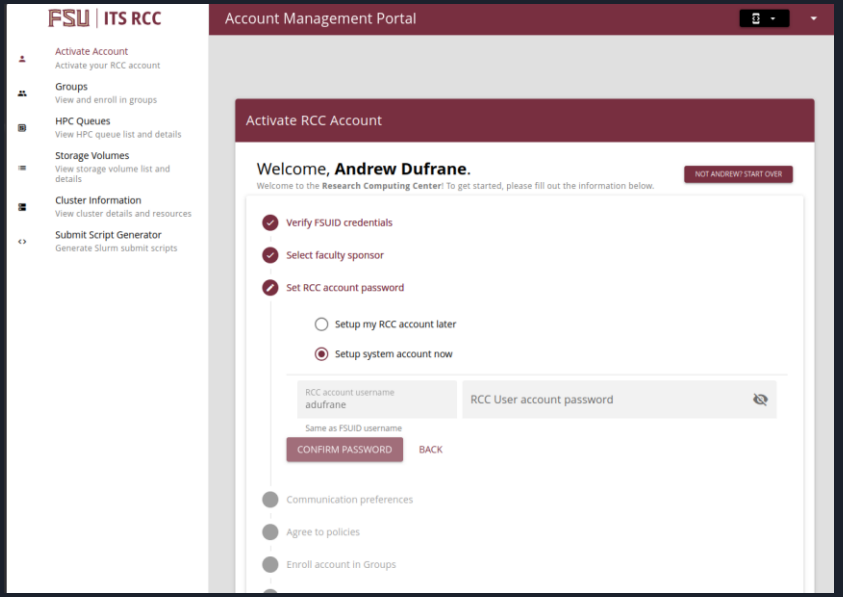
- FSU ID and password

## Student Requirements

- FSU ID and password
- Faculty Sponsor

## Guest (non-FSU)

- Guest FSU ID
- Faculty Sponsor




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

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

# Resources

- FSU Research Computing Center
  - Location: Dirac Science Library 151
  - RCC Website
  - RCC Documentation
  - HPC Drivers Ed

- Free Linux Resources
  - Linux Cheat Sheet
  - Free Linux Book
  - Open Vim
  - Vim Genius

# Post-Workshop Practice

- 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 your `FSUID`

  4) Copy the file `testing.txt` into the newly renamed `FSUID` Folder

# Post-Workshop Practice

5) Check the file `testing.txt` located within your `FSUID` folder

6) Show the full path of your current working directory

7) Navigate to the parent directory of your current location

8) Navigate 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 Post-Workshop Practice

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

Survey