

Introduction to Linux

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Command Line Interface (CLI)



Help

- User Guide

arch.jhu.edu/guide

arch.jhu.edu/support/faq/

arch.jhu.edu/support/

- Ticket

help@rockfish.jhu.edu

- User ID at Rockfish.
- Detailed explanation of the problem/issue.
- Add snapshots if possible.
- Path to the working directory, scripts and (slurm) output files.

- Training workshop - interactive

- Google

<https://info-ee.surrey.ac.uk/Teaching/Unix/>



JOHNS HOPKINS
UNIVERSITY

Advanced Research
Computing at Hopkins

github.com/tsaiweiwu/arch



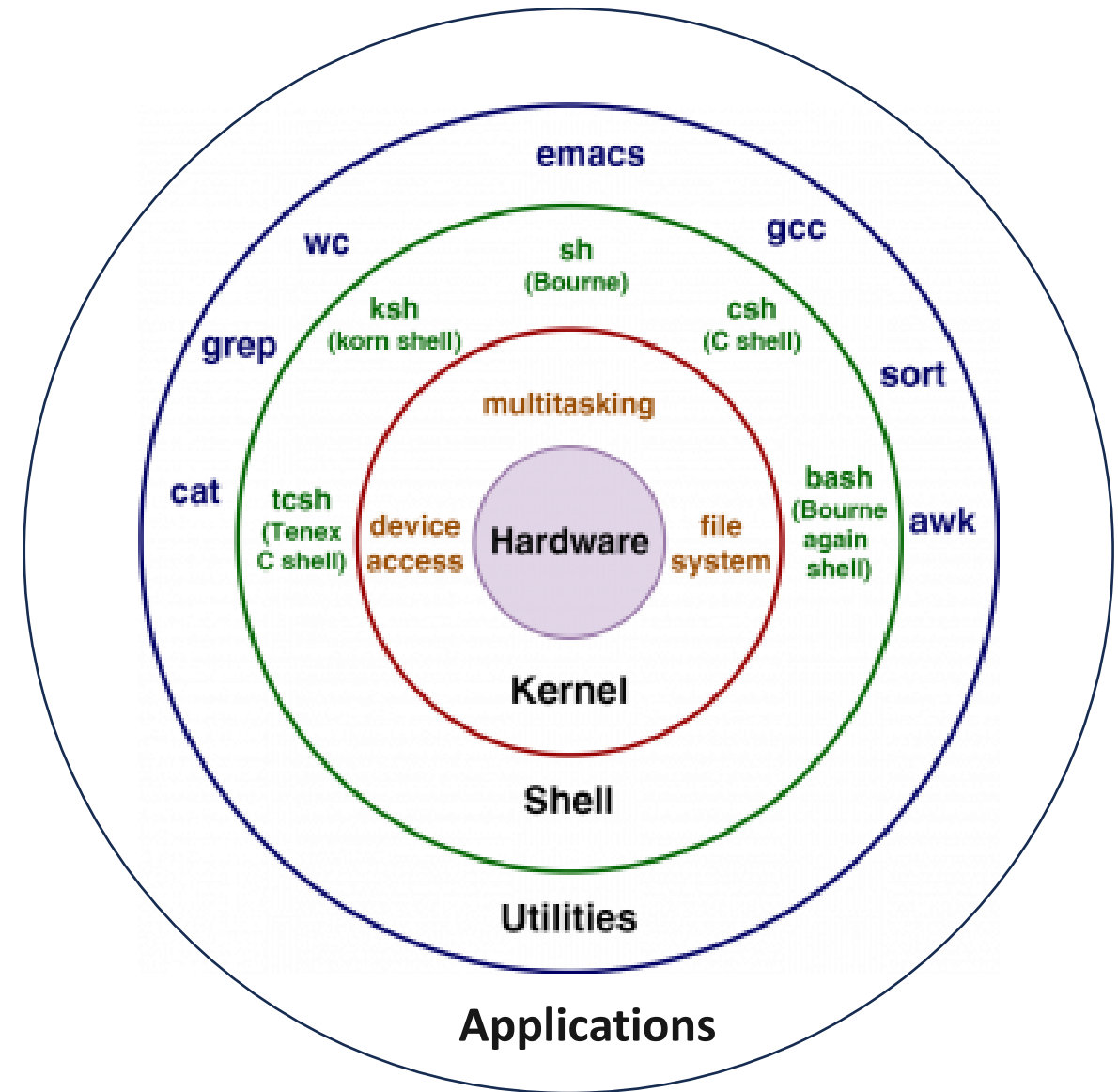
Outline

- Linux Architecture
- Connection and File Transfer
- Login Page
- Environment variables + Hidden Files
- Basic Commands
- Command Redirections
- File Permissions
- Text Editor
- Bash Script



Linux Architecture

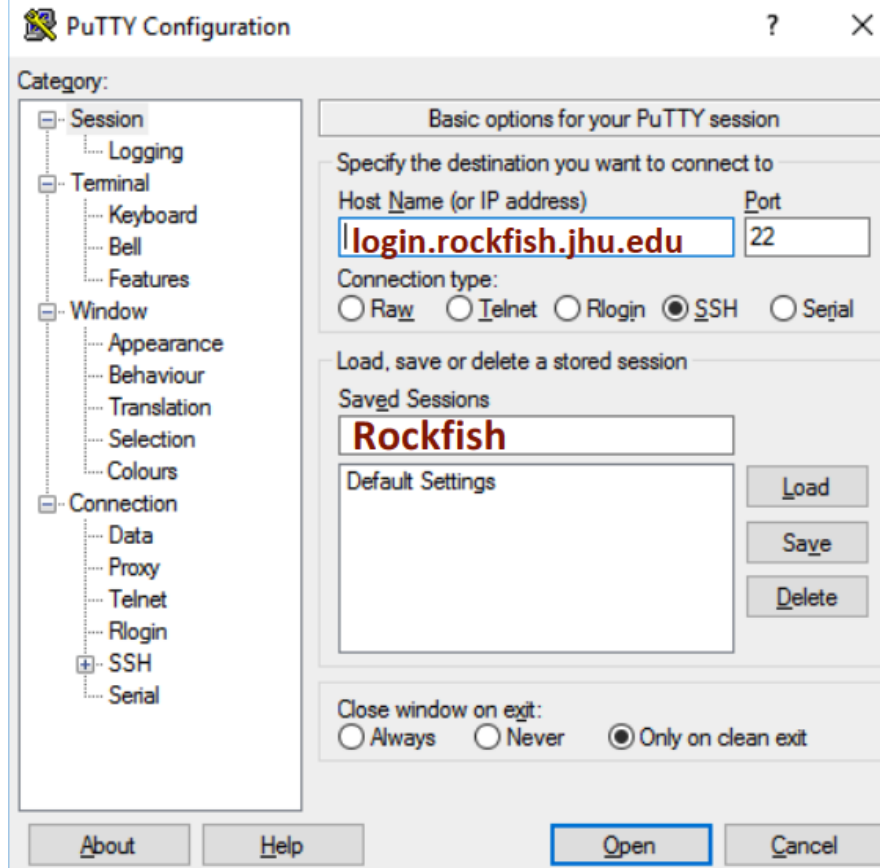
- Hardware: CPU, RAM, IO, GPU
- Kernel: core of OS
- Shell: bash
- Utilities:
 - basic commands
 - text editor - vi, emacs, nano
 - compilers - gcc, intel, aocc, nvcc



<https://puneetpanwar.com/introduction-to-linux-command-line/>

Connection

Putty interface



cli {

- Putty
- MobaXterm
- SecureCRT
- PowerShell
- Windows Sub-Linux System

windows

- Open OnDemand (OOD)
(requires JHU VPN)
portal.rockfish.jhu.edu

web

cli

- Putty
- MobaXterm
- SecureCRT
- Terminal

Mac



6 simple ways to open Terminal on Mac

Connection with CLI

Secure Shell

```
$ ssh -l userid login.rockfish.jhu.edu
```

```
$ ssh userid@login.rockfish.jhu.edu
```

```
$ ssh -XY userid@login.rockfish.jhu.edu
```

For Graphical Applications, but X11 forwarding is painfully slow!!
Use OOD instead.

File Transfer with CLI

environment variables

\$HOME = ~ = /home/\$USER

Secure Copy **For small data**

transfer from local machine to Rockfish

```
$ scp local_file userid@login.rockfish.jhu.edu: ~
```

```
$ scp -r local_dir userid@login.rockfish.jhu.edu: $HOME
```

transfer from Rockfish to local machine

```
$ scp userid@login.rockfish.jhu.edu:/path/to/file .
```

Type these scp commands
in your Local Terminal

Globus **For Large data set**



File Transfer with globus.org

use JHED to create an account
on coldfront.rockfish.jhu.edu

Log in to use Globus Web App

Use your existing organizational login

e.g., university, national lab, facility, project

Johns Hopkins

By selecting Continue, you agree to Globus [terms of service](#) and [privacy policy](#).

Continue



Globus uses CILogon to enable you to Log In from this organization. By clicking Continue, you agree to the [CILogon privacy policy](#) and you agree to share your username, email address, and affiliation with CILogon and Globus. You also agree for CILogon to issue a certificate that allows Globus to act on your behalf.

OR














Sign in with GitHub



Sign in with Google





Sign in with ORCID iD





Collection Search


Collection

**Rockfish AWS**
Subscribed Mapped Collection (GCS) on **RFDTN02**
Owner: marcc@globusid.org
Domain: m-4c0e79.8b416.0ec8.data.globus.org

**Rockfish dtn01 user data**
Subscribed Mapped Collection (GCS) on RFDTN01
Owner: a933ac1a-c486-473e-81f5-06baeedb08f2@clients.auth.globus.org
Domain: m-6971d6.5e9e0.bd7c.data.globus.org
Description: RFDTN01 endpoint for rockfish cluster data

**Rockfish dtn02 user data**
Subscribed Mapped Collection (GCS) on **RFDTN02**
Owner: a7627ba9-e25e-44bd-9d48-d64aab883008@clients.auth.globus.org
Domain: m-0a4c68.8b416.0ec8.data.globus.org
Description: RFDTN02 endpoint for rockfish cluster data

**rbradle8 rockfish data**
Guest Collection (GCS) on **Rockfish dtn02 user data**
Owner: rbradle8@johnshopkins.edu
Domain: g-0e4811.8b416.0ec8.data.globus.org
Description: Research data example for transfer to other sites.

**rf-genemaprdata**
Guest Collection (GCS) on **Rockfish dtn01 user data**
Owner: kesohku1@johnshopkins.edu
Domain: g-f8e93f.5e9e0.bd7c.data.globus.org
Description: GeneMAP research data on Rockfish cluster

Exercises

1. Connect to Rockfish with the method you like
2. `$ hostname`
3. Downloading files from internet into your `$HOME`
 - `$ wget https://tinyurl.com/training-url-txt`
 - `$ curl -O https://tinyurl.com/training-url-txt`

Exercises

4. Secure copy folders from RF \$HOME to your laptop
 - `$ cat training-url-txt`
 - `$ git clone https://github.com/tsaiweiwu/arch`
5. Secure copy folders from your RF \$HOME to your laptop
 - `$ scp -r user_id@login.rockfish.jhu.edu:$HOME/arch .`

Type the scp commands in your Local Terminal

Login Page

[twu73@login02 ~]\$

- Print working directory

\$ pwd

\$ echo \$PWD

- Change to your \$HOME

\$ cd

\$ cd \$HOME

\$ cd ~

- Change to parent directory

\$ cd .. (one folder up)

\$ cd ../.. (two folders up)

Note: Linux is case sensitive. `cd` \neq `Cd`

```
tsaiwei@DESKTOP-UCTGA49:~$ ssh -Y twu73@login.rockfish.jhu.edu
twu73@login.rockfish.jhu.edu's password:
Warning: No xauth data; using fake authentication data for X11 forwarding.
Last login: Fri Apr 19 11:03:59 2024 from 73.103.78.70
```

```

  _ _ _ _ _
 / _ _ _ _ \
( ( _ _ _ _ )
 \ _ _ _ _ /
  _ _ _ _ _

```

```
[STATUS] loading software modules
[STATUS] modules are Lmod (https://lmod.readthedocs.io/en/latest/)
[STATUS] software is Spack (https://spack.readthedocs.io/en/latest/)
[STATUS] the default modules ("module restore") use GCC 9 and OpenMPI 3.1
[STATUS] you can search available modules with: module spider <name>
[STATUS] you can list available modules with: module avail
[STATUS] loading a compiler, MPI, Python, or R will reveal new packages
[STATUS] and you can check your loaded modules with: module list --terse
[STATUS] to hide this message in the future: touch ~/.no_rf_banner
[STATUS] restoring your default module collection now
[STATUS] quota information listed below, you can view by invoking "quotas.py"
```

MOTD

Home Usage for user twu73 as of Mon Apr 22 18:00:08 2024			
Used	Quota	Percent	Files
13.88 GB	50 GB	N/A	273,244

GPFS Usage for Group rfdadmin: as of Mon Apr 22 18:30:13 2024						
FS	Used	Quota	Used %	Files	Files Quota	Files %
data	50.51 TB	150.00 TB	33.00%	29,756,870	61,440,000	48.00%
scratch4	7.40 TB	10.00 TB	74.00%	7,035,797	20,480,000	34.00%
scratch16	2.43 TB	10.00 TB	24.00%	3,035,106	10,240,000	29.00%

GPFS Usage for Group jaimecomb: as of Mon Apr 22 18:30:13 2024						
FS	Used	Quota	Used %	Files	Files Quota	Files %
data	34.47 GB	1.00 TB	3.00%	28,613	409,600	6.00%
scratch4	695.76 GB	10.00 TB	6.00%	41,988	1,048,576	4.00%
scratch16	67.92 GB	5.00 TB	1.00%	71,203	5,120,000	1.00%

```
[twu73@login02 ~]$
```

Environment Variables

- Print environment variables

```
$ printenv
```

```
$ printenv | grep HOME
```

```
$ echo $PATH
```

Hidden Files

- Hidden files names start with with a period

```
~/.bashrc
```

```
~/.bash_profile
```

```
~/.bash_history
```

```
~/.bash_logout
```

<https://www.howtogeek.com/435903/what-are-stdin-stdout-and-stderr-on-linux/>

Basic commands

ls	shows files
mv	move or rename files/dir
mkdir	create a folder
cp [-r]	copy files or folder
rm [-r]	remove files or folder

hostname	shows the name of the node
who	list users on the node
{ top -u \$USER	displays a user's processes
htop	
history	shows the history of your commands
cat	
{ more / less	view files
head / tail	
touch	create a file

Basic commands – Con'td

list files

\$ ls -l long format

\$ ls -a hidden files

\$ ls -h human-readable

\$ ls -d folders

\$ ls -r reverse order

\$ ls -t modification time

\$ ls -alrt combination

Type `$ man ls` to see all the flags it can take

Command Redirect Exercises

- `stdin, stdout, stderr`
- `>, >>, |, &`
- `tee` (output to screen and also to a file)
- `command 2>&1 | tee command.log`
- `ls > File11 ; cat File11`
- list all files in Training and 'pipe' them into file File11
- `ls -l >> File11 ; more File11`
- List (long format) all files in Training and append the output (stdout) into File11
- `ls -lR 2>&1 | tee Capture ; more Capture`
- list all directories (recursively) and display stdout to the screen and into a file

File Permissions

```
$ ls -l
```

of hard links

file size in bytes

```
drwxr-xr-x. 4 root root 68 Jun 13 20:25 tuned
-rw-r--r--. 1 root root 4017 Feb 24 2022 vimrc
```

file permissions

d is a directory

— is a file

ℓ is a soft link

owner group

Time of the last
modification

File Permissions

```
drwxr-xr-x
-rw-r--r--
  u   g   o
```

Permission	Meaning for files	Meaning for directories
read (r)	Contents of the file can be displayed	Contents of directory can be listed
write (w)	File can be modified or deleted	Files can be created in or deleted from directory
execute (x)	File can be run like a program	Directory can be entered (i.e., the cd command works)

- u=user, g=group, o=others
- r=read=4, w=write=2, x=execute=1
- \$ chmod g+r <file>
- \$ chmod -w <file>
- \$ chmod 755 <file>

- rwx = 7
- rw- = 6
- r-- = 4

Exercises

1. Check the hostname Type “hostname”
 2. Type “pwd”
 3. Go back to \$HOME dir
 4. List (long format) all files and directories in your HOME dir.
 5. Redirect the output to a file
 6. Check if the remove command is set to ask for removal
 7. Type “man rm”
1. Create a directory called “Junk2021”
 2. List permissions for Junk2021
 3. Change permissions to User RWX only
 4. Change directory to Junk2021

Text Editor - Nano

\$ nano

\$ nano filename.txt

nano's shortcuts

Ctrl+S Save current file

Ctrl+O Offer to write file ("Save as")

Ctrl+X Close buffer, exit from nano

```
#!/bin/bash
#SBATCH --job-name=Simple
#SBATCH --nodes=1
#SBATCH -t 30
#SBATCH --ntasks-per-node=1
#SBATCH --partition=defq
#SBATCH --reservation=Training      ### Just for training sessions
#SBATCH --mail-type=end
#SBATCH --mail-user=jcombar1@jhu.edu

source /data/apps/go.sh      #### for safety reasons

nl      #### find out what modules are loaded

hostname      #### type the name of the compute node

sleep 300      ### sleep for 120 to check job
echo "This is it, I am leaving node, Job completed"
```

^G Get Help	^O Write Out	^W Where Is	^K Cut Text	^J Justify	^C Cur Pos
^X Exit	^R Read File	^_ Replace	^U Uncut Text	^T To Linter	^_ Go To Line

Bash Scripts

- Anything you can run normally on the command line can be put into a script and it will do exactly the same thing.
- Create a simple bash script

```
myscript.sh
1. #!/bin/bash
2. # A sample Bash script, by Ryan
3.
4. echo Hello World!
```

- How do you run a bash script, e.g. myscript.sh?

\$./myscript.sh -> **NOT WORKING, Why?**

\$ bash myscript.sh

Exercises

1. Create a folder Junk2024 and cd into the folder
2. Create a file called “exercise1.txt”
3. Find permissions for “exercise1.txt”
4. Add group read and group execute permissions to the file
5. Edit exercise1.txt (use nano or vi)
6. Add; echo “This is my first script”
7. Execute the script “./exercise1.txt
8. Remove dir Junk2021

Questions?

THANK YOU.

help@rockfish.jhu.edu