

# HIGH PERFORMANCE RESEARCH COMPUTING

## HPRC Primer

### Introduction to Linux

January 30, 2024

TAMU users: If you're outside campus, activate VPN by [connect.tamu.edu](https://connect.tamu.edu)



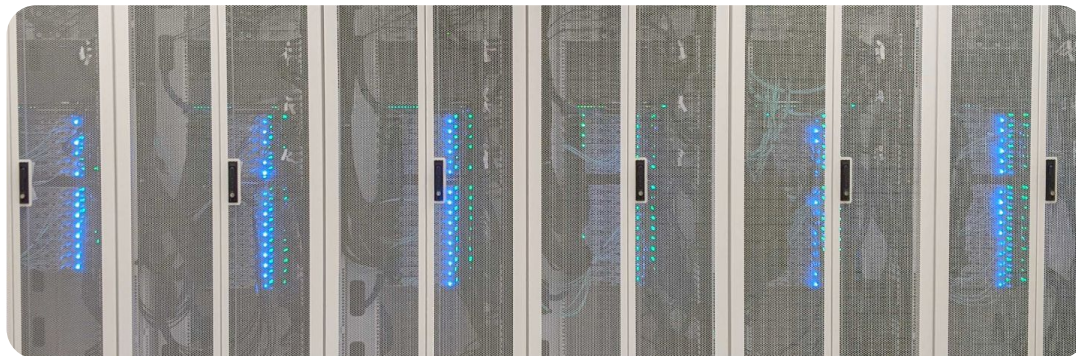
High Performance  
Research Computing

DIVISION OF RESEARCH

# Computing Resources

The HPRC group currently administers four HPC clusters:

- ACES
- FASTER
- Grace
- Terra (retiring soon!)



You'll need one of two options to use them:

Credentials	Clusters	Who
HPRC Account	FASTER, Grace, Terra	Mostly Texas A&M students/staff
ACCESS ID	FASTER and ACES	Researcher or educator at a U.S. academic, non-profit research, or educational institution

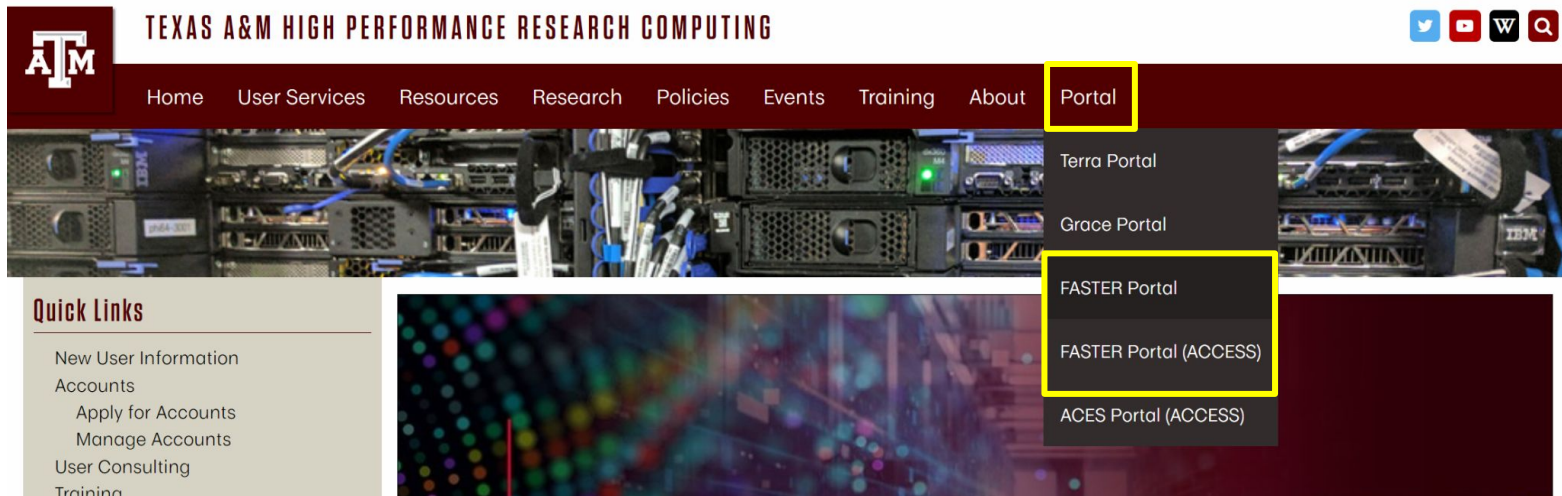
Link to our Knowledge Base: <https://hprc.tamu.edu/kb/>

# Your Login Password

- Do NOT share your password
- Do NOT share your account
- Texas law and TAMU regulations prohibit the sharing and/or illegal use of computer passwords and accounts

# HPRC Portal

- HPRC webpage: [hprc.tamu.edu](http://hprc.tamu.edu)
  - TAMU: [portal-faster.hprc.tamu.edu](http://portal-faster.hprc.tamu.edu)
  - ACCESS: [portal-faster-access.hprc.tamu.edu](http://portal-faster-access.hprc.tamu.edu)



The screenshot shows the top navigation bar of the Texas A&M High Performance Research Computing website. The main navigation menu includes: Home, User Services, Resources, Research, Policies, Events, Training, About, and Portal. The Portal menu is open, showing a list of links: Terra Portal, Grace Portal, FASTER Portal, FASTER Portal (ACCESS), and ACES Portal (ACCESS). The FASTER Portal and FASTER Portal (ACCESS) items are highlighted with a yellow box. In the top right corner, there are social media icons for Twitter, YouTube, and Facebook. Below the navigation bar, there is a banner image of server racks and a 'Quick Links' section on the left with a list of links: New User Information, Accounts, Apply for Accounts, Manage Accounts, User Consulting, and Training.

# HPRC Portal (ACCESS)

If you chose the second option on the previous slide, you'll get the ACCESS CILogon OpenID Connect page.

Log-in using your ACCESS credentials. Create an account if you do not already have one.

The screenshot shows the ACCESS CILogon OpenID Connect page. At the top left is the ACCESS logo, and at the top right is the "Powered By CILogon" logo. Below the logos is a dark blue header with the text "Consent to Attribute Release" and a dropdown arrow. The main content area contains the following text: "TAMU FASTER ACCESS OOD requests access to the following information. If you do not approve this request, do not proceed." followed by a bulleted list: "Your CILogon user identifier", "Your name", "Your email address", and "Your username and affiliation from your identity provider". Below this is another dark blue header with the text "Select an Identity Provider". Underneath is a selection box with "ACCESS CI (XSEDE)" and a question mark icon. There is also a checkbox labeled "Remember this selection" with a question mark icon. A yellow box highlights the "ACCESS CI (XSEDE)" selection and the "Remember this selection" checkbox, with a yellow arrow pointing to the text "Select the Identity Provider appropriate for your account". At the bottom of the selection area is a "Log On" button. Below the "Log On" button is the text: "By selecting 'Log On', you agree to the [privacy policy](#)."

Select the Identity Provider appropriate for your account

The screenshot shows the ACCESS CILogon login page. At the top left is the ACCESS logo. Below it is the text "Login to CILogon". There are two input fields: "ACCESS Username" and "ACCESS Password". Below the password field is a checkbox labeled "Don't Remember Login". At the bottom of the form is a "Login" button. Below the login form is the CILogon logo and the text: "CILogon facilitates secure access to CyberInfrastructure (CI)."

# Linux Using the Portal - Shell Access

TAMU HPRC OnDemand (FASTER)

Files ▾

Jobs ▾

Clusters ▾

Interactive Apps ▾

Dashboard ▾



>\_faster Shell Access

Starts an in-browser  
Linux terminal on  
FASTER

Convenient  
shell access  
anywhere  
with a web  
browser

OnDemand provides an integrated, single access point for all of your HPC resources.

## Message of the Day

### IMPORTANT POLICY INFORMATION

- **Unauthorized use of HPRC resources is prohibited and subject to criminal prosecution.**
- **Use of HPRC resources in violation of United States export control laws and regulations is prohibited. Current HPRC staff members are US citizens and legal residents.**
- **Sharing HPRC account and password information is in violation of State Law. Any shared accounts will be DISABLED.**
- **Authorized users must also adhere to ALL policies at: <https://hprc.tamu.edu/policies>**

The terminal will ask you  
to log in again

# Where Am I?

pwd command (print working directory)

Linux commands in green for you to type

```
pwd
```

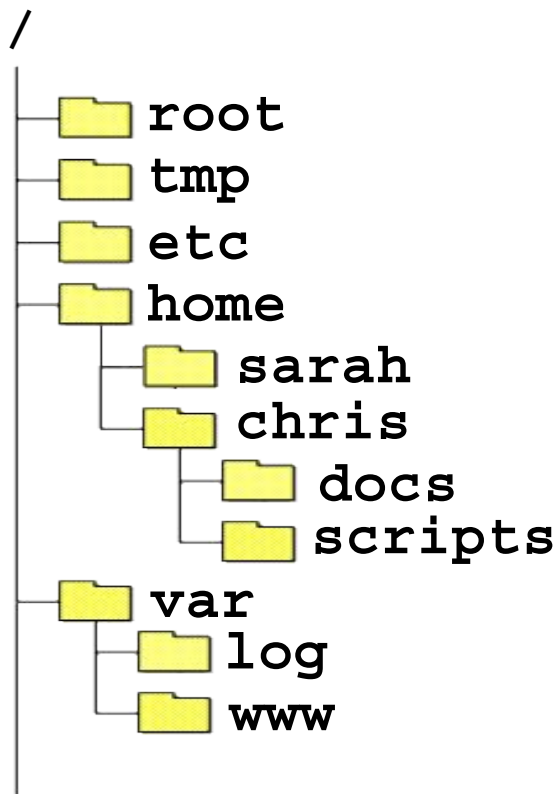
command output in blue

```
/home/username
```

list contents of your working directory

```
ls
```

# Navigating the Linux Directory Structure



```
/  
/root  
/tmp  
/etc  
/home  
/home/sarah  
/home/chris  
/home/chris/docs  
/home/chris/scripts  
/var  
/var/log  
/var/www
```



# Common Directory Commands

```
mkdir my_dir
```

`mkdir` to make a new directory

```
cd my_dir
```

`cd` to change to another directory

```
cd ..
```

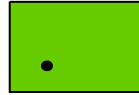
`cd` back out of the current directory

```
rmdir my_dir
```

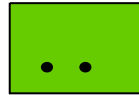
`rmdir` to remove an empty directory

# Directory Shortcuts

Linux has several  
special shortcuts to  
save you typing:



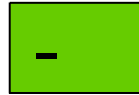
= directory you're in right now  
(the "current working directory")



= directory that contains the one  
you're in now ("parent directory")



= your home directory



= the directory you were in  
before this one

# Changing Directories: cd

Return to your home directory:

```
cd
cd ~
cd ~/
cd $HOME
```

Switch to the parent directory of the current directory:

```
cd ..
```

Return to previous directory:

```
cd -
```

```
cd $HOME
mkdir temp
mkdir temp/dir1
cd temp
pwd
cd dir1
pwd
cd ../..
pwd
cd -
pwd
cd ..
pwd
cd ~
pwd
```

# Absolute vs. Relative Path

```
/  
/root  
/tmp  
/etc  
/home  
/home/sarah  
/home/chris/project  
/home/chris/docs/README  
/var  
/var/log  
/var/www
```

If you are in the `project` directory

```
pwd
```

```
/home/chris/project
```

The relative path to the `README` file is `../docs/README`

```
ls ../docs/README
```

The absolute path to the `README` file `/home/chris/docs/README`

```
ls /home/chris/docs/README
```

# Common Commands

Let's start working with content in our directories.

Start with these basic commands:

<code>cat</code>	Writes file content on the standard output*
<code>echo</code>	Display a text string on the standard output
<code>touch</code>	Creates a new empty file
<code>nano</code>	Creates a new file or edit an existing file (text editor)
<code>rm</code>	Remove a file

Let's print some output and make a new file:

```
echo "Hello World"  
touch new.txt  
nano new.txt  
cat new.txt
```

\*Usually "standard output"  
just means your screen, but  
it can be moved

# Using the Portal File Editor

TAMU HPRC OnDemand (FASTER)

Files

Jobs

Clusters

Interactive Apps

Dashboard

?

In the "Files" tab in the portal

Open in Terminal

+ New File

New Directory

Upload

Download

Copy/Move

Delete

Home Directory

/scratch/user/saluja.aditi5



/ scratch / user / saluja.aditi5 / DeepLearningExamples /

Change directory

Create a new file and edit

Copy path

Show Owner/Mode

Show Dotfiles

Filter:

Showing 11 of 15 rows - 0 rows selected

Type	Name	Size	Modified at
<input type="checkbox"/>	CUDA-Optimized	-	3/21/2022 11:28:24 AM
<input type="checkbox"/>	DGLPyTorch	-	3/21/2022 11:28:25 AM
<input type="checkbox"/>	FasterTransformer	-	3/21/2022 11:28:26 AM
<input type="checkbox"/>	Kaldi	-	3/21/2022 11:28:26 AM

# History of Your Commands

Your commands are saved to a file in your home directory ( `.bash_history` )

You can use the up/down arrows to scroll through previous commands

Type **history** to see your previously entered commands

```
history
```

```
History of your commands
```

```
history | tail
```

```
See the last 10 commands
```

Search your command history using `|` and `grep`

```
history | grep echo
```

# Linux Commands Have Options

Leave a space between the command and the options

Spell out a full option with a double-dash:

```
ls --all
```

--all show all files, including  
hidden files which begin with '.'

Single dash lets you abbreviate:

```
ls -a -l
```

-a (shorter version of --all)  
-l show file details

You can also combine (short) options behind one single dash:

```
ls -al
```

-a (same function as above)  
-l (same function as above)

Remember directory shortcuts:

. current working directory  
.. parent directory



# Search for Linux Commands Options

Search the manual page for the Linux command `ls`

```
man ls
```

```
f
```

move down (forward) one page

```
b
```

move up (back) one page

(Sometimes mouse scroll wheel and arrow keys work, too)

```
/all
```

search the man page for the text 'all'

```
n
```

search forward for next found match

```
N
```

search backwards next found match

```
g
```

go to first line

```
G
```

go to last line

```
q
```

quit

# Linux Terminal Attributes

Depending on your terminal, you've probably been seeing different colors as you navigate.

File and directory names are colored based on their attributes such as permissions and extension (file type).

```
AAF -> AAF.py
AAF.py
aaf_tip.py
data.gz
image.jpg
phylip_src
phylokmer
README
run_aaf.sh
```

TURQUOISE	Symbolic link
GREEN	Executable file
RED	Compressed files
PURPLE	Image files
BLUE	Directories
WHITE	Text files

**Note:** These colors are not Linux-universal and can depend on the different terminal emulator or shell.

# Changing Attributes: chmod

Set limits on who can modify files and directories with 'chmod'

Follow the instructions at right to make some example files and check their details.

```
mkdir data
cd data
touch file1.txt
touch file2.txt
ls -l
```

You should see a bunch of dashes and letters to the left. Those are the permissions.

1. To change the user's permissions of file1.txt to read, write, execute:  
(will be `-rwxrw-r--`)
2. To change the permissions of file2.txt to read and execute for all and write for the user:  
(will be `-rwxr-xr-x`)
3. To remove the execute permissions of file2.txt for all "other" users:  
(will be `-rwxr-xr--`)

```
chmod u+rwx file1.txt
```

```
chmod 755 file2.txt
```

↑ (see next slide for what this number means)

```
chmod o-x file2.txt
```

# Changing Attributes: chmod

```
chmod [options] [permission mode] [target_file]
```

0 = No permission  
1 = Execute permission  
2 = Write permission  
3 = Write and execute permissions  
4 = Read permission  
5 = Read and execute permissions  
6 = Read and write permissions  
7 = Read, write, and execute permissions

u = user  
g = group  
o = other  
  
r = read  
w = write  
x = execute  
-x = remove executable permissions  
+x = enable executable permissions

Note the permissions display format is - uuugggooo

# Shell Script Exercise

A *script* will let you perform multiple commands at once.

We've created an example script, which you can copy and run yourself.

Navigate to your home directory

```
cd $HOME
```

Copy the script to your home directory

```
cp /scratch/training/spring_24_primers/my_script.sh .
```

# Shell Script Exercise

View (or edit) the shell script

```
nano my_script.sh
```



make your shell script executable

```
chmod 755 my_script.sh
```

run your shell script

```
./my_script.sh
```

```
#!/bin/bash
# HPRC shell script exercise

my_var="People"

echo "Howdy $my_var" > output.txt

mkdir script_output

mv output.txt script_output

cd script_output

cat output.txt
```

# Shell Script Explanation

The “shebang”; all bash scripts must have this at the very top so the computer knows how to run it.

script

make your shell script executable

```
chmod 755 my_script.sh
```

Pound signs start comments. They're for you to leave notes; the computer doesn't do anything with them. (The shebang is the exception!)

```
#!/bin/bash
# HPRC shell script exercise

my_var="People"

echo "Howdy $my_var" > output.txt

mkdir script_output

mv output.txt script_output

cd script_output

cat output.txt
```

# Shell Script Explanation

View (or edit) the shell script

A “variable.” Call later with ‘\$’ to reuse stored data.

make your shell script executable

The ‘>’ redirects the output to the filename you provide.

run your shell script

(Commands we’ve seen previously)

```
#!/bin/bash
# HPRC shell script exercise

my_var="People"

echo "Howdy $my_var" > output.txt

mkdir script_output

mv output.txt script_output

cd script_output

cat output.txt
```



# Shell Script Exercise

View (or edit) the shell script

```
nano my_script.sh
```



make your shell script executable

```
chmod 755 my_script.sh
```

run your shell script

```
./my_script.sh
```

```
#!/bin/bash
# HPRC shell script exercise

my_var="People"

echo "Howdy $my_var" > output.txt

mkdir script_output

mv output.txt script_output

cd script_output

cat output.txt
```

# Exit your terminal

`exit`

exit the terminal session

To fully logout of the FASTER portal, you need to exit the browser.



**HIGH PERFORMANCE  
RESEARCH COMPUTING**  
TEXAS A&M UNIVERSITY

Thank you

*Any questions?*

# Need Help?

First check the FAQ <https://hprc.tamu.edu/kb/FAQ/Accounts/>

- FASTER User Guide <https://hprc.tamu.edu/kb/User-Guides/FASTER/>
- Email your questions to [help@hprc.tamu.edu](mailto:help@hprc.tamu.edu)

Help us help you -- provide the following info:

- Which cluster you're using
- Your username
- Job id(s) if any
- Location of your jobfile, input/output files
- Application used, if any
- Module(s) loaded, if any
- Error messages
- Steps you have taken, so we can reproduce the problem

# Continued Learning

[Intro to HPRC Video Tutorial Series](#)

[HPRC's Knowledge Base](#)