# HIGH PERFORMANCE RESEARCH COMPUTING

# HPRC Primer

# Introduction to Linux

August 27, 2024

TAMU users: If you are outside campus, activate VPN by connect.tamu.edu

High Performance
Research Computing
DIVISION OF RESEARCH

# Computing Resources

The HPRC group currently administers four HPC clusters:

- ACES
- FASTER
- Grace
- Launch

You will need one of two options to use them:

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

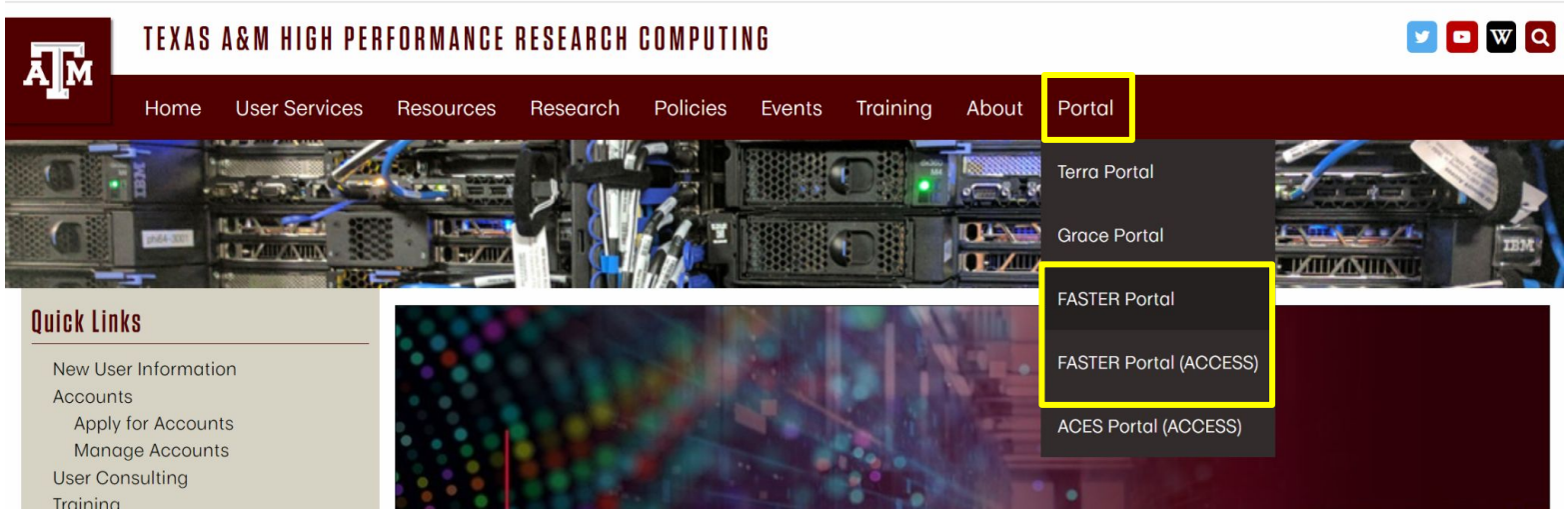
Link to our Knowledge Base: https://hprc.tamu.edu/kb/

# 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

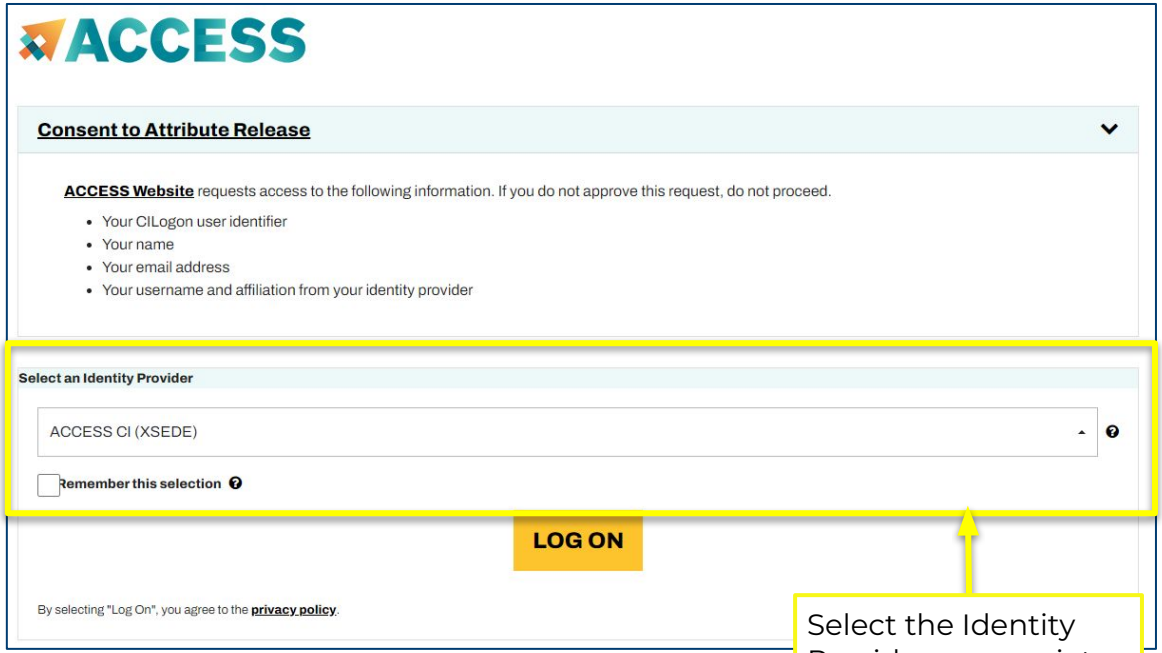
# HPRC Portal

- HPRC webpage: hprc.tamu.edu
  - TAMU: portal-faster.hprc.tamu.edu
  - ACCESS: portal-faster-access.hprc.tamu.edu



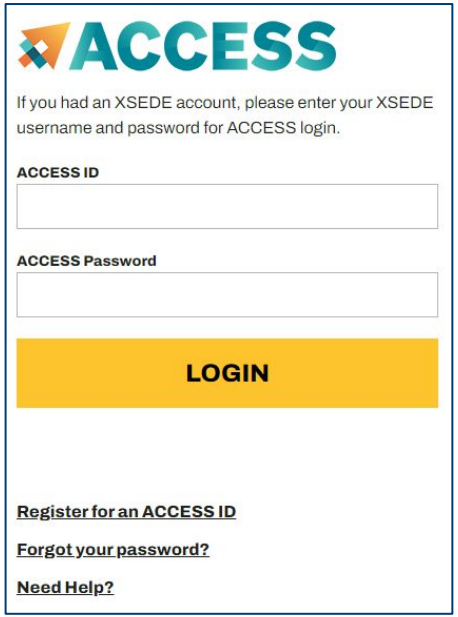
# HPRC Portal (ACCESS)

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

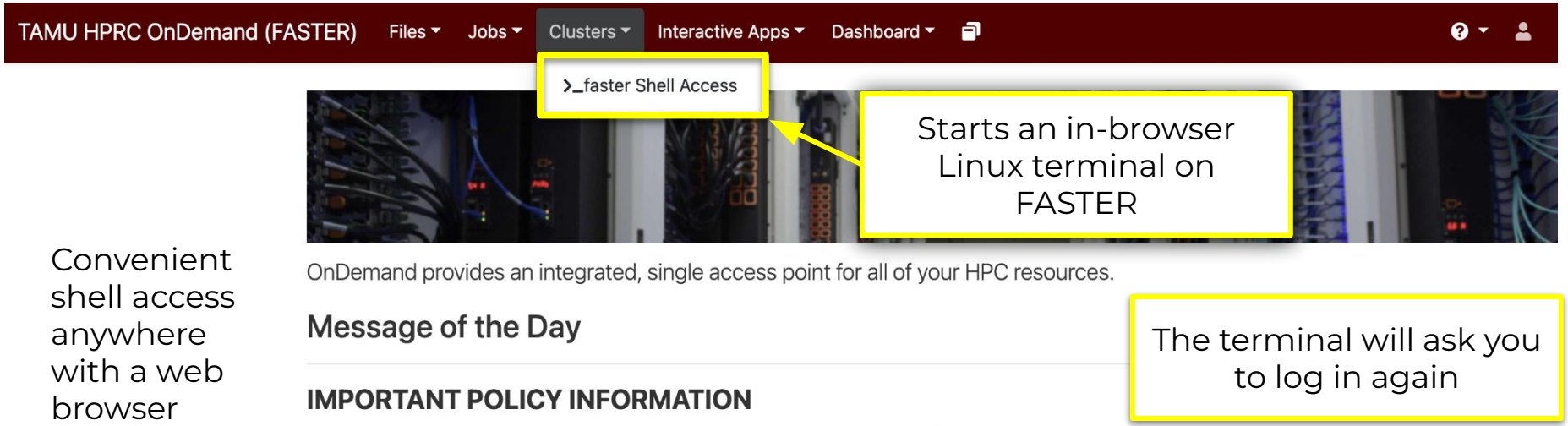



Select the Identity Provider appropriate for your account

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



# Linux Using the Portal - Shell Access




Convenient shell access anywhere with a web browser

# Linux Using SSH

If you're using a terminal application on your own computer instead of the Portal, you can connect to HPRC clusters using the ssh command:

```
ssh -X NetID@faster.hprc.tamu.edu
```

Mac users may need to use ssh -Y to enable X11 so you can view images and use GUI software:

```
ssh -Y NetID@faster.hprc.tamu.edu
```

You may see something like this the first time you connect:

```
Host key not found from the list of known hosts.
    Are you sure you want to continue connecting (yes/no)?
```

Type **yes**, hit enter and you will then see the following:

```
Host faster.hprc.tamu.edu' added to the list of known hosts.
    NetID@faster.tamu.edu's password:
```

# Where Am I?

## pwd  command (print working directory)

Linux commands in green for you to type

```
pwd
```

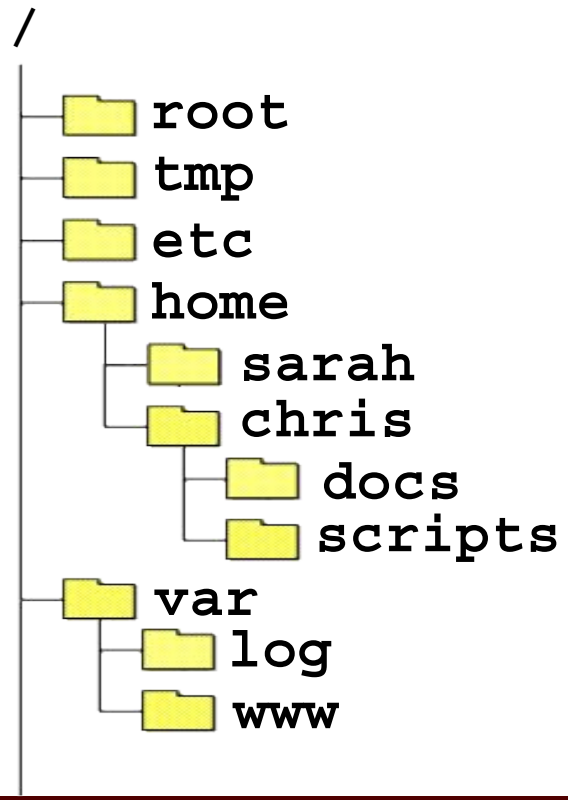
command output in blue

```
/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

# 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:

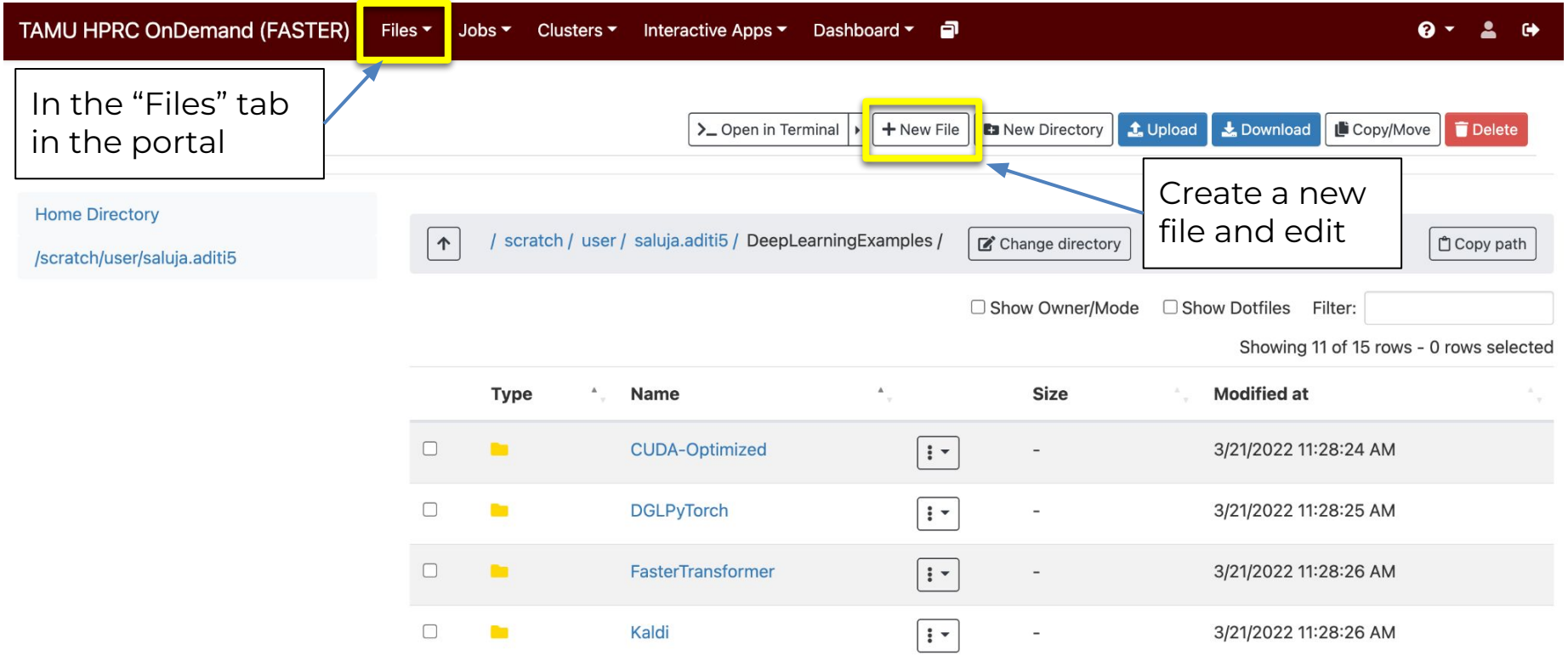
| | |
|---|---|
| **cat** | Writes file content on the standard output* |
| **echo** | Display a text string on the standard output |
| **touch** | Creates a new empty file |
| **nano** | Creates a new file or edit an existing file (text editor) |
| **rm** | Remove a file |

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



# 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 |

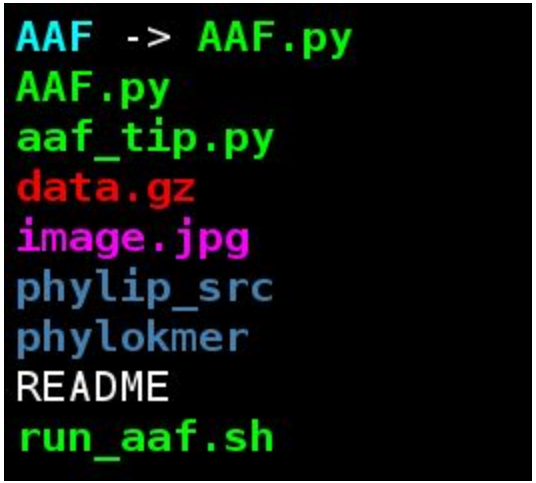
(Sometimes mouse scroll wheel and arrow keys work, too)

| | |
|---|---|
| `/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).




| | |
|---|---|
| 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--`)

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

2. To change the permissions of file2.txt to read and execute for all and write for the user:
   (will be `-rwxr-xr-x`)

```
chmod 755 file2.txt
```

(see next slide for what this number means)

3. To remove the execute permissions of file2.txt for all "other" users:
   (will be `-rwxr-xr--`)

```
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/fall_2024_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.

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

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

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

(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.


# 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

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