### Introduction to Linux – Part 2

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### **Linuxclass Server**

☐ Get a temporary account (or use your own CHPC account)
☐ Virtual Machine FastX portal: <a href="https://linuxclass.chpc.utah.edu:3300">https://linuxclass.chpc.utah.edu:3300</a>
<ul> <li>□ Open a XFCE Terminal</li> <li>□ Adjust Font size: Edit → Preferences → Appearance → Click on Font → adjust Font Size</li> </ul>
<ul><li>☐ Use Bash shell (quick check: echo \$SHELL);</li><li>☐ How to change to bash: /bin/bash</li></ul>
☐ Copy and Paste issue on Mac;
□Prepare example data (if you missed Part 1) □cd ~
☐mkdir LinuxClass
☐cd LinuxClass
□wget <a href="https://home.chpc.utah.edu/~u6047586/CHPCPresentation/shell-lesson-data.zip">https://home.chpc.utah.edu/~u6047586/CHPCPresentation/shell-lesson-data.zip</a>
□unzip shell-lesson-data.zip
□cd shell-lesson-data

### **Editors**

There are many choices – a few are:

□nano



□vi/vim



**□**emacs



#### **Nano Editor**

To start either

nano

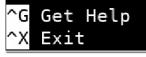
OR

nano filename

-- if filename exists, it will open file in editor; if it does not, this will be the name used when you save the file.

if you start nano without a filename it will prompt you for a name when you "WriteOut" using ^O (Ctrl + O)

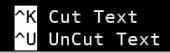
^?  $\rightarrow$  Ctrl + a specific Key; How to quit nano session: ^X  $\rightarrow$  Ctrl + x

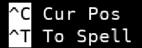


```
^O WriteOut
^J Justify
```









#### Vi editor

☐ Another common choice ☐ Start with the command vi or vi filename ui at CHPC is actually vim, which is an improved version of vi More feature rich, takes more time to learn ☐ Not going into detail but we do provide a vi cheat sheet and a vi graphical cheat sheet — linked on the presentation page https://www.chpc.utah.edu/presentations/IntroLinux3parts.php ☐ There is also a tutor program — start with command vimtutor which is a great tool to learn to use the program  $\square$  How to quit Vi session (discard changes): ESC  $\rightarrow$  : (SHIFT +:)  $\rightarrow$  q!

# Loops

- ☐ Used when you want to preform the same action many times, such as on multiple files
- ☐ There are a number of ways you can do this
- ☐One option
  - ☐ List multiple arguments for a command to act upon
  - □ Example (go to the LinuxClass/shell-lesson-data/exercise-data/creatures directory):
    - □head -n 3 basilisk.dat minotaur.dat unicorn.dat
- ☐Another option do a loop with a for/do statement

# **Loop Terminology**

☐ in bash syntax a loop looks like:

```
Bash

for thing in list_of_things
do
    operation_using $thing # Indentation within the loop is not required, but aids legibility
done
```

- □ In this loop **thing** is a **variable**. During execution **\$thing** is set to the first item in the list, the operation(s) is done, then it goes to the second and repeats the operation(s), etc until it reaches the last item in the list. Then the loop is exited.
- ☐ You can choose anything for **thing** (eg mything, item, myfile...) however, your choice of the what to use for thing should help a person reading the file understand what the loop is doing and what it is acting upon
- □ Examples of list\_of\_thing: 2 4 6 8 10 ← a list of numbers

{2..10..2} {start..end..step} ← A number range

fileA fileB fileC fileD ← a list of filenames

file\* ← a list of filenames represented by wildcard

\$variable or (command) representing a list:  $(ls) \leftarrow variable$  or command

#### **Exercise**

☐ in bash syntax a loop looks like:

```
for thing in list_of_things
do
    operation_using $thing  # Indentation within the loop is not required, but aids legibility
done
```

- ☐Go to the directory shell-lesson-data/exercise-data/proteins and write a loop that lists all of the pdb files
- ☐Write a loop that prints all file names can use **echo** command
- ☐ Build upon this loop by adding another command
  - □Copy each file to a new name based on the existing name, <file>.pdb to orig-<file>.pdb
- ☐Add another command to the loop to make a single file that has the content of all of the pdb files in this directory
  - ☐ can use redirect >, >>

```
for file in *.pdb

do

echo $file

cp $file orig-$file

cat $file >> all.pdb

done
```

#### Exercise - Nelle's Data

- □ To process her data files Nelle will need to run an analysis on each of her sample files in north-pacific-gyre. The files to be processed have the consistent names of NENExxxxA.txt and NENExxxxB.txt
   □ The analysis requires running a script more on this next time written by her supervisor is called goostats.sh; this script acts on one sample file at a time; it requires two arguments the input file name and the output file name.
  - □bash goostats.sh <INPUT> <OUTPUT>
- □ Nelle decides to call the output file **stats-NENExxxA.txt** prepending the filename with **stats-**
- ☐She is being careful so she wants to test (using echo instead of running the script
- ☐ Hint start with 1 file and run test to create the two arguments. You can prepend a variable with additional information: stats-\$variable

#### Exercise - Nelle's Data Answer

```
☐ To make sure getting all of the files
   for datafile in NFNF*A.txt NFNF*B.txt
   do
      echo $datafile
   done
☐ Test getting the output file name
   for datafile in NENE*A.txt NENE*B.txt
    do
      echo $datafile stats-$datafile
   done
☐ Executing the script across all files
   for datafile in NENE*A.txt NENE*B.txt
   do
     echo $datafile
     bash goostats.sh $datafile stats-$datafile
    done
```

#### Some other useful Linux commands

On your own – Use and explore options of these commands

```
□cut-e.g. cut -d , -f 2,3 animals.csv
  □Example file: shell-lesson-data/exercise-data/animal-counts
  □-d (delimiter) -f (column ids)
  ☐ Prints selected parts of lines from file to standard output (screen)
□du - e.g. du -h or du -sh
  □Scan a given file/directory (and subdirs) and report space usage; -s give
    summary of total usage, -h gives it in "human readable" format of K, M, G
\Boxdf – e.g. df – h
  Overview of file system disk space usage (-h: human readable)
□ln-e.g. ln -s ~/bin/model.exe shortcut2model.exe
  create a link between files (In -s FILE LINK)
```

#### **Linux File Permissions**

```
□ Each Linux file belongs to a specific owner/user (u) and a specific group (g)
■Shown with 1s -1
    -rw-rw-r-- 1 u0028729 chpc 86 Jul 30 02:41 notes.txt
   □-: file; d: directory
      : user (u); | : group (g); | : others (o)
   \Box \mathbf{r}: readable; \mathbf{w}: writable; \mathbf{x}: executable ("cd"-able for directory); -: no permission
       examples: rwx; r-x; r--; ---;
□chmod – to change permissions of file or directory (only User or Root/Admin can do it)
□Examples:
    □chmod u=rwx file ← Set User permissions to Read Write and Exec
    \Boxchmod g+x file \leftarrow Grant Group Executable permission
   □chmod o-rwx *.c. ← Remove all permissions for Others (not User,
     not Group)
□ Executable files (programs and scripts) must have executable permissions; directories must be executable in order to be able to cd into them
    Uchmod +x *.sh
```

# Login Scripts & Environment Variables

- □In your home directory are a number of dot files .bashrc and .custom.sh, .tcshrc and .custom.csh Depending on your shell choice, the appropriate pair of these are executed during login.

  □These set the environment (as environment variables) needed for you to work on CHPC resources
- ☐ Commands to check your environment: env or printenv
- ☐Some important variables
  - □\$USER
  - □\$HOME
  - □\$PATH paths to search for commands
  - □\$LD\_LIBRARY\_PATH paths to search for libraries when linking a program (more on that later)

#### **Processes**

☐ A Process is a running Linux program ☐ Each process has a PID (Process ID) ☐ top displays processes and resource usage in real time (Ctrl + C to quit)  $\Box$ top –u <user> □Ctrl + C to quit **ps** reports a snapshot of current processes  $\square$ ps, ps x Display ALL of your processes □ps ax Display ALL processes □ps aux Display ALL processes (more detailed) ☐ **kill PID** kills the process with the specified PID **kill -9 PID** kills the process with the specified PID if a kill does not work pkill -u <username> kill all processes under a username

# Monitoring processes/usage

- ☐ uptime how long the system has been running
- ☐ **free** free –h, memory and swap usage
- enhanced top
  - ☐ atop (available on CHPC clusters)
  - ☐ htop (available on CHPC clusters)
- □ sar historical system usage report (cpu, memory, I/O...)

#### **Other Job Controls**

Note: here "Job" means a local process (not a Slurm Job)

☐ Example: sleep 10 VS sleep 10 &

☐ Ctrl+C (^C) terminate the currently running process ☐ Ctrl-Z (^Z) suspends/pauses the currently running process ☐ Example: ping www.byu.edu (check if a address is reachable) ☐ jobs: lists all jobs, with their number ☐ **fg** %n: bring a program back to the foreground (and continue/resume execution) □ bg %n: puts current or specified job (%n) in the background (and continue/resume execution) ■ & (ampersand) runs the job in the background

### Moving files to/from CHPC

https://www.chpc.utah.edu/documentation/data services.php ☐ Can mount CHPC file systems on your local machine (Windows, Mac or Linux), must be on campus or using the campus VPN ☐ Windows – there are graphical tools such as WinSCP ☐ Mac, Windows, Linux, cloud options — CyberDuck, FileZilla\* ☐ Linux **scp** command (secure shell copy) – to copy files between linux systems wget – to download from web with URL **url** is another option ☐ For larger data sets – look into the Data Transfer Nodes (DTNs) and transfer tools such as **Globus**, see https://www.globus.org/quickstart https://www.chpc.utah.edu/documentation/data\_services.php

### **Have Questions?**

helpdesk@chpc.utah.edu