Unix/Linux Tutorial

EECE 5640

Fall 2017

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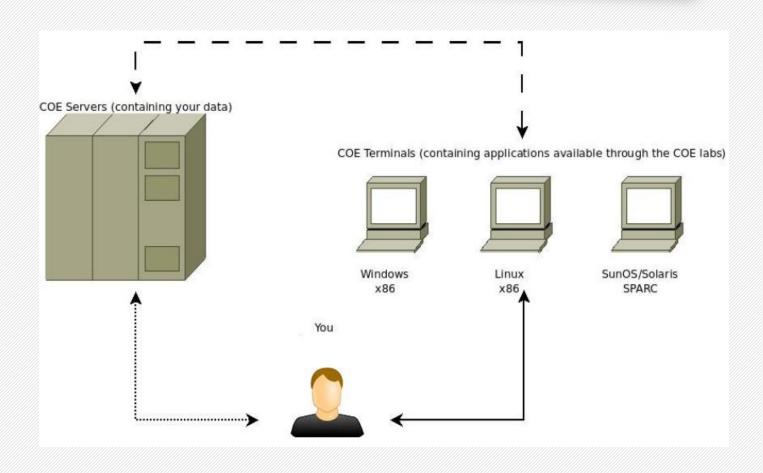
Goal

- To provide you with simple information of what you can do on a server and how to interact with it through different commands
- We will test all of the commands and see some of the examples for bash files/scripts that we can create
 - This means we will go back and forth between presentation and commandline

COE Lab

- Access COE computer through putty/SSH
- Open putty
 - Connect to gateway.coe.neu.edu
 - Enter COE username and password
- Once connected to the COE network, you can access the rest of the computers using ssh
 - ssh -p 27 lingate
 - This is no longer necessary as the login nodes are quite powerful. You can run everything there.

COE Lab Architecture



Access COE Lab remotely

SSH

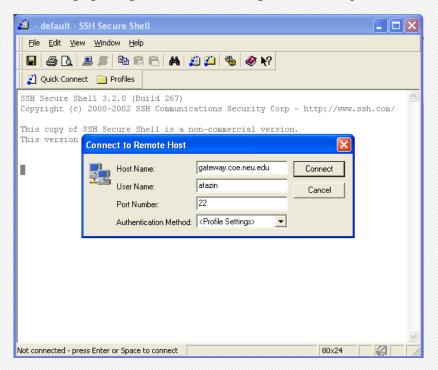
- "secure shell": a network protocol for secure data communication
- Typically used to log into a remote machine and execute commands in command-line

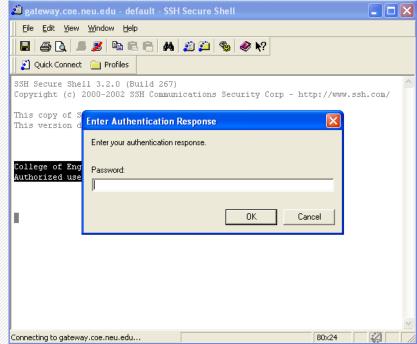
SSH tools

- In Windows: putty
- In Linux/Mac: ssh is already installed, can be used directly from a terminal

SSH

Logging into the gateway server





SSH – Using Putty

 http://www.chiark.greenend.org.uk/~sgtatham/putty/ download.html

ategory:	_	
□ Session Logging Terminal Keyboard Bell Features Appearance Behaviour Translation Colours Connection Data Proxy Telnet Rlogin Serial	Basic options for your PuTTY session	
	Specify the destination you want to Host Name (or IP address) 220.69.186.77	o connect to Port
	Connection type: ○ Raw ○ Telnet ○ Rlogin ○ SSH ○ Seri	
	Load, save or delete a stored sess Saved Sessions 220.69.186.77 Default Settings 220.69.186.77 220.69.187.115 220.69.187.93 cabernet.icu.ac.kr redwine.icu.ac.kr whitewine.icu.ac.kr	Load Save Delete
	Close window on exit: C Always C Never © Only on clean exit	

SSH — Using Linux Terminal

```
xiangyu@xiangyu-Dell-XPS720:~$ ssh xili@gateway.coe.neu.edu
College of Engineering, Northeastern University
Authorized users only
Password:
Last login: Sun Sep 8 19:15:05 2013 from dyn-113-53.dhcp
Sun Microsystems Inc. SunOS 5.10 Generic January 2005
Sun Microsystems Inc. SunOS 5.10
                                   Generic January 2005
        By using this system, you consent to the ECC usage policy.
    Please read it at http://www.coe.neu.edu/computer/files/policy.htm.
             Programs that keep running after you log out
   and server programs (ones that open a network port for connections)
           are NOT permitted except for assigned coursework.
If you have questions about a particular program, please see the sysadmins.
               Use ssh to connect to alpha or beta
       if you wish to use cadence on the Solaris workstations
  Run /usr/local/bin/linux-load to see which Linux login hosts are busy.
         Connect using ssh to port 27: ssh -p 27 [hostname]
       Send mail to help@coe.neu.edu if there are any problems.
Checking Quota...
-bash-3.00$
```

Transferring Files

- Two ways to transfer files
 - SFTP or SCP

SCP

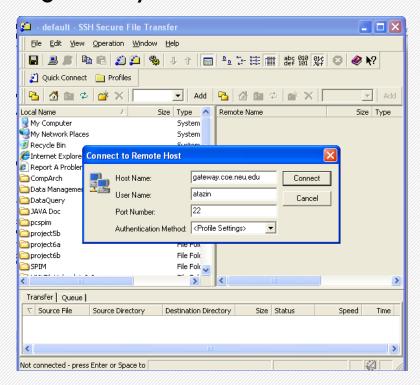
- Command line transfer
 - Use gateway.coe.neu.edu
 - Can move a file from local computer to your account on the COE computers
- Example
 - scp localfile.txt user@gateway.coe.neu.edu:~/localfile.txt
 - scp user@gateway.coe.neu.edu:~/localfile.txt localfile.txt

SFTP

- Secure file transfer protocol
- Implementation has Windows GUI (available on COE Windows machines)
- FileZilla is another option for your personal computer

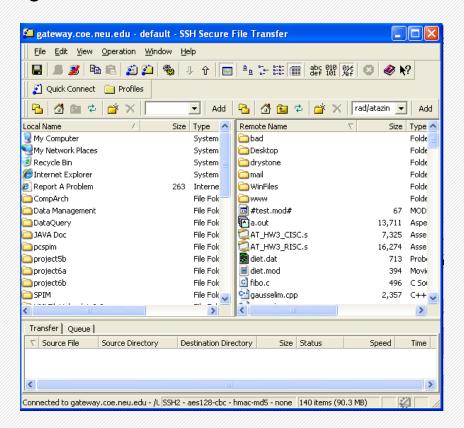
SFTP

• Logging into the gateway server



SFTP

Directory listing



The Shell

- Whenever you login to a Unix system you are placed in a program called the shell
 - Bottom left of your screen
 - To get your work done, you enter commands at this prompt
- The shell acts as a command interpreter
- Takes each command and passes it to the operating system kernel to be acted upon
- It then displays the results of this operation on your screen
- As soon as you login, the shell (bash) will execute the following file:
 - ~\.bashrc
 - · This file configures your shell, and you can modify it to do whatever you want
 - ~\.bash_aliases
 - · This file is to load any "shortcuts" you want to have

General Commands

- Shells
 - Bourne Shell, Bourne-Again Shell, Korn Shell
 - sh, bash, ksh
- Who is connected to the server/workstation?
 - who
- Path
 - echo \$path

General Commands

- Executable location
 - Whereis <filename>
- Full path to Current directory
 - pwd
- Running processes
 - ps
- Close connection
 - exit

Navigation Commands

- Change directory (can receive relative and absolute paths)
 - cd
 - cd .. (change to parent directory)
 - cd ~ (change to home directory)
 - cd / (change to root directory)
- List files and folders
 - Is (Is -a, Is -I, etc)

Navigation Commands

- Execute file
 - ./a.out
- Finding files
 - find / -name game (search starting with root)
- Viewing File Content
 - more/less or cat
- Man pages
 - Man <command>

File and Directory Commands

- Copy file
 - cp file.doc newfile.doc
 - cp filename /tmp
- Copy all files to a directory
 - cp * /home/tom/backup
- Copy recursively
 - cp -R /currentdir/* /home/tom/backup

File and Directory Commands

- Create directory
 - mkdir <dirname>
- Rename file
 - mv <oldfile> <newfile>
- Delete file
 - rm <filename>
- Delete directory recursively
 - rm -R <dirname>
 - BE VERY CAREFUL!!!

```
Seconds% ls -1
total 104
            1 mfuess
                                   7316 Oct 6 15:45 nonres
-rwxr-xr-x
                       systems
            1 mfuess
                       systems
                                   3048 Oct 6 01:12 nonrestoringdiv.c
-rw-r--r--
                                   6879 Oct 6 12:57 nonrestoringdiv.s
            1 mfuess
                       systems
-rw-r--r--
                                  17542 Oct 6 13:44 nonrestoringdiv lingate.s
            1 mfuess
- rw- rw- rw-
                       systems
            2 mfuess
                       systems
drwxr-sr-x
                                   4096 Oct 13 19:03 output
           7 mfuess
                                   4096 Jun 17 20:24 pin-2.6
drwxr-sr-x
                       systems
            1 mfuess
                       systems
                                    102 Oct 7 21:27 pin.log
- rw-----
```

Type of file: - = normal file, d=directory, l=symbolic link, etc...

```
Seconds% ls -1
total 104
            1 mfuess
                       systems
                                   7316 Oct 6 15:45 nonres
- rwxr-xr-x
           1 mfuess
                       systems
                                   3048 Oct 6 01:12 nonrestoringdiv.c
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           1 mfuess
                       systems
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- rw-r--r--
           1 mfuess
                       systems
                                  17542 Oct 6 13:44 nonrestoringdiv lingate.s
- rw-rw-rw-
drwxr-sr-x
            2 mfuess
                       systems
                                   4096 Oct 13 19:03 output
drwxr-sr-x
            7 mfuess
                       systems
                                   4096 Jun 17 20:24 pin-2.6
            1 mfuess
- rw-----
                       systems
                                    102 Oct 7 21:27 pin.log
 Permissions for owner of file: r=read, w=write, x=execute, -=no permission
```

```
Seconds% ls -1
total 104
            1 mfuess
                       systems
                                   7316 Oct 6 15:45 nonres
- rwxr-xr-x
- rw- r-- r--
            1 mfuess
                       systems
                                   3048 Oct 6 01:12 nonrestoringdiv.c
-rw-r--r--
            1 mfuess
                       systems
                                   6879 Oct 6 12:57 nonrestoringdiv.s
- rw- rw- rw-
            1 mfuess
                       systems
                                  17542 Oct 6 13:44 nonrestoringdiv lingate.s
drwxr-sr-x 2 mfuess
                       systems
                                   4096 Oct 13 19:03 output
drwxr-sr-x 7 mfuess
                       systems
                                   4096 Jun 17 20:24 pin-2.6
            1 mfuess
                       systems
                                    102 Oct 7 21:27 pin.log
- rw-----
```

Permissions for members of the group

```
Seconds% ls -1
total 104
-rwxr-xr-x 1 mfuess
                       systems
                                   7316 Oct 6 15:45 nonres
-rw-r--r-- 1 mfuess
                       systems
                                   3048 Oct 6 01:12 nonrestoringdiv.c
-rw-r--r-- 1 mfuess
                       systems
                                   6879 Oct 6 12:57 nonrestoringdiv.s
-rw-rw-rw- 1 mfuess
                       systems
                                  17542 Oct 6 13:44 nonrestoringdiv lingate.s
drwxr-sr-x
          2 mfuess
                       systems
                                   4096 Oct 13 19:03 output
drwxr-sr-x
           7 mfuess
                       systems
                                  4096 Jun 17 20:24 pin-2.6
            1 mfuess
                       systems
                                    102 Oct 7 21:27 pin.log
- rw----
Permissions for everyone
```

```
Seconds% ls -1
total 104
-rwxr-xr-x
            1 mfuess
                       systems
                                   7316 Oct 6 15:45 nonres
            1 mfuess
                       systems
                                   3048 Oct 6 01:12 nonrestoringdiv.c
- rw-r--r--
-rw-r--r-- 1 mfuess
                                   6879 Oct 6 12:57 nonrestoringdiv.s
                       systems
-rw-rw-rw- 1 mfuess
                       systems
                                  17542 Oct 6 13:44 nonrestoringdiv lingate.s
drwxr-sr-x 2 mfuess
                       systems
                                   4096 Oct 13 19:03 output
drwxr-sr-x 7 mfuess
                                   4096 Jun 17 20:24 pin-2.6
                       systems
-rw----- 1 mfuess
                       systems
                                    102 Oct 7 21:27 pin.log
```

Number of links to file or directory contents.

```
Seconds% ls -1
total 104
            1 mfuess
                                   7316 Oct 6 15:45 nonres
-rwxr-xr-x
                       systems
            1 mfuess
                                   3048 Oct 6 01:12 nonrestoringdiv.c
                       systems
- rw-r--r--
            1 mfuess
                                   6879 Oct 6 12:57 nonrestoringdiv.s
- rw-r--r--
                       systems
-rw-rw-rw- 1 mfuess
                                            6 13:44 nonrestoringdiv lingate.s
                       systems
                                  17542 Oct
drwxr-sr-x 2 mfuess
                       systems
                                   4096 Oct 13 19:03 output
drwxr-sr-x 7 mfuess
                       systems
                                   4096 Jun 17 20:24 pin-2.6
- rw-----
            1 mfuess
                       systems
                                    102 Oct 7 21:27 pin.log
              Owner
```

```
Seconds% ls -l
total 104
             1 mfuess
                        systems
                                    7316 Oct 6 15:45 nonres
- rwxr-xr-x
             1 mfuess
                                    3048 Oct 6 01:12 nonrestoringdiv.c
                        systems
-rw-r--r--
             1 mfuess
                        systems
                                    6879 Oct 6 12:57 nonrestoringdiv.s
-rw-r--r--
             1 mfuess
                                   17542 Oct 6 13:44 nonrestoringdiv lingate.s
                        systems
- rw-rw-rw-
             2 mfuess
                        systems
drwxr-sr-x
                                    4096 Oct 13 19:03 output
             7 mfuess
drwxr-sr-x
                        systems
                                    4096 Jun 17 20:24 pin-2.6
             1 mfuess
                        systems
                                     102 Oct 7 21:27 pin.log
- rw-----
                        Group
Seconds% ls -l
total 104
```

```
1 mfuess
- rwxr-xr-x
                        systems
                                    7316 Oct 6 15:45 nonres
             1 mfuess
                                    3048 Oct 6 01:12 nonrestoringdiv.c
-rw-r--r--
                        systems
             1 mfuess
                        systems
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-rw-r--r--
- rw-rw-rw-
             1 mfuess
                        systems
                                             6 13:44 nonrestoringdiv lingate.s
drwxr-sr-x
             2 mfuess
                        systems
                                    4096 Oct 13 19:03 output
drwxr-sr-x
             7 mfuess
                        systems
                                    4096 Jun 17 20:24 pin-2.6
             1 mfuess
                        systems
                                     102 Oct 7 21:27 pin.log
- [W-----
                                          Date
```

```
Seconds% 1s -1
total 104
             1 mfuess
                        systems
                                    7316 Oct 6 15:45 nonres
-rwxr-xr-x
             1 mfuess
                        systems
                                    3048 Oct 6 01:12 nonrestoringdiv.c
- FW- F-- F--
             1 mfuess
                        systems
                                    6879 Oct 6 12:57 nonrestoringdiv.s
- rw-r--r--
-rw-rw-rw- 1 mfuess
                        systems
                                   17542 Oct 6 13:44 nonrestoringdiv lingate.s
                                    4096 Oct 13 19:03 output
drwxr-sr-x
             2 mfuess
                        systems
             7 mfuess
                                    4096 Jun 17 20:24 pin-2.6
drwxr-sr-x
                        systems
             1 mfuess
                        systems
                                     102 Oct 7 21:27 pin.log
- rw-----
                                                 Time
Seconds% ls -1
total 104
             1 mfuess
                                    7316 Oct 6 15:45 nonres
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                        systems
             1 mfuess
                                             6 01:12 nonrestoringdiv.c
-rw-r--r--
                        systems
                                    3048 Oct
             1 mfuess
                        systems
                                             6 12:57 nonrestoringdiv.s
-rw-r--r--
                                    6879 Oct
-rw-rw-rw- 1 mfuess
                        systems
                                   17542 Oct
                                             6 13:44 nonrestoringdiv lingate.s
drwxr-sr-x 2 mfuess
                        systems
                                    4096 Oct 13 19:03 output
drwxr-sr-x 7 mfuess
                       systems
                                    4096 Jun 17 20:24 pin-2.6
            1 mfuess
                                     102 Oct 7 21:27 pin.log
                        systems
- [W-----
                                                      Name
```

- To change permissions of a file or directory you use the following command:
 - Chmod 775 <files>
- Each number applies to the permissions column as a bit mask.
- There are many ways of using chmod so you can use man chmod to better understand the command.

gcc Compilation

- Compile file
 - gcc myfile.c (produces a.out executable)
- Build output to an output file
 - gcc myfile.c -o myfile
- Generate assembly
 - gcc -S myfile.c
- Compiler optimization levels
 - gcc -O<n> myfile.c

Text Editors

- Emacs
- Vi
- Pico
- Many more...

Vi

- Console (screen) oriented text editor
- Has two modes of operation
 - Command mode with commands which cause action to be taken on the file
 - Insert mode in which entered text is inserted into the file

Vi Command Mode

 To enter command mode hit ESC, type the command, and hit RETURN

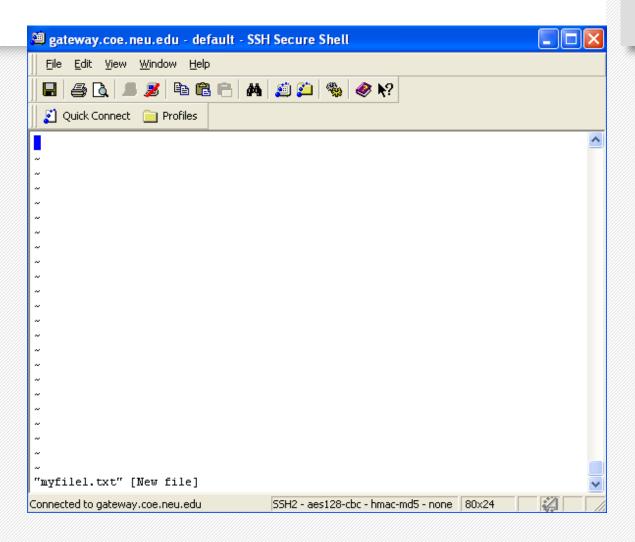
Vi Commands

- Start Vi
 - vi myfile.txt
- Save modified file
 - ESC, :w<return>
- Save modified file and exit Vi
 - ESC, :x<return>
- Exit Vi without saving changes
 - ESC, :q!<return>

Vi Insert Mode

- Can edit text
- Can move cursor using arrow buttons
- To enter this mode and exit command mode hit ESC and then hit s.

Vi User Interface



- Pipes and redirections
 - Passing the output of a command to the next one
 - Examples:
 - Is -la | head -1 # transfers the output of Is command to head
 - cat file | grep -c # same
 - ./command > file.log #stores command output in the file
- Grep
 - grep searches input files for lines containing a match to a given pattern list
- Sed
 - The sed stream editor is a text editor that performs editing operations on information coming from standard input or a file
- Awk
 - Awk is both a programming language and text processor that can be used to manipulate text data in very useful ways

Connecting to the COE machines

- ssh <user>@gateway.coe.neu.edu
 - Input password
 - You're set
- There are multiple login nodes each contain a different /tmp/ folder. You can connect to Theta (where the file is, by using the following command in the coe login server).
 - ssh -p 27 Theta
 - Input password again

- Hands on experiment example
- Copy /tmp/linux_tutorial/tutorial.tar.gz into your home directory
- Unzip file (using alias shown before)
- Lots of experiments results. Look at the directory structure. Read some of these log files.
- 1. Find a command using pipes that can find the GPU execution time for all experiments for "cuda-basic", remove the expression "Total GPU Execution Time" to just display the actual time, and store it in a file.
- Example output of how each line should look:

results/zorder-sobel/tree/cuda-basic/4-1.log: 5.944800 ms

- 2. What would you change if you only want to keep the time for the experiment and remove everything else?
- 3. Why is this useful?

Answers (there are many ways of doing this)

- grep "GPU Execution Time" results/*/*/cuda-basic/*.log | sed "s/Total
- 1. Command: GPU Execution Time\://" > file.log
- 2. Command: grep "GPU Execution Time" results/*/*/cuda-basic/*.log | awk '{print \$5} > file2.log
- 3. When you're running multiple experiments, you can search for information and display it however you want in a very convenient manner

Simple Scripting

- Lets look at the examples available on the scripts folder.
- What do they do?

Any questions?

- You can ask on Piazza
- How to use a command?
 - Use man <command>
 - You can ask Google!

Find out More

http://www.mcsr.olemiss.edu/unixhelp/

Or..... use google ©