UTSA®

The University of Texas at San Antonio

University Technology Solutions

Express Linux Tutorial

Quickly Learn Basic Linux Commands

Co-Authored by Ritu Arora and Brent League

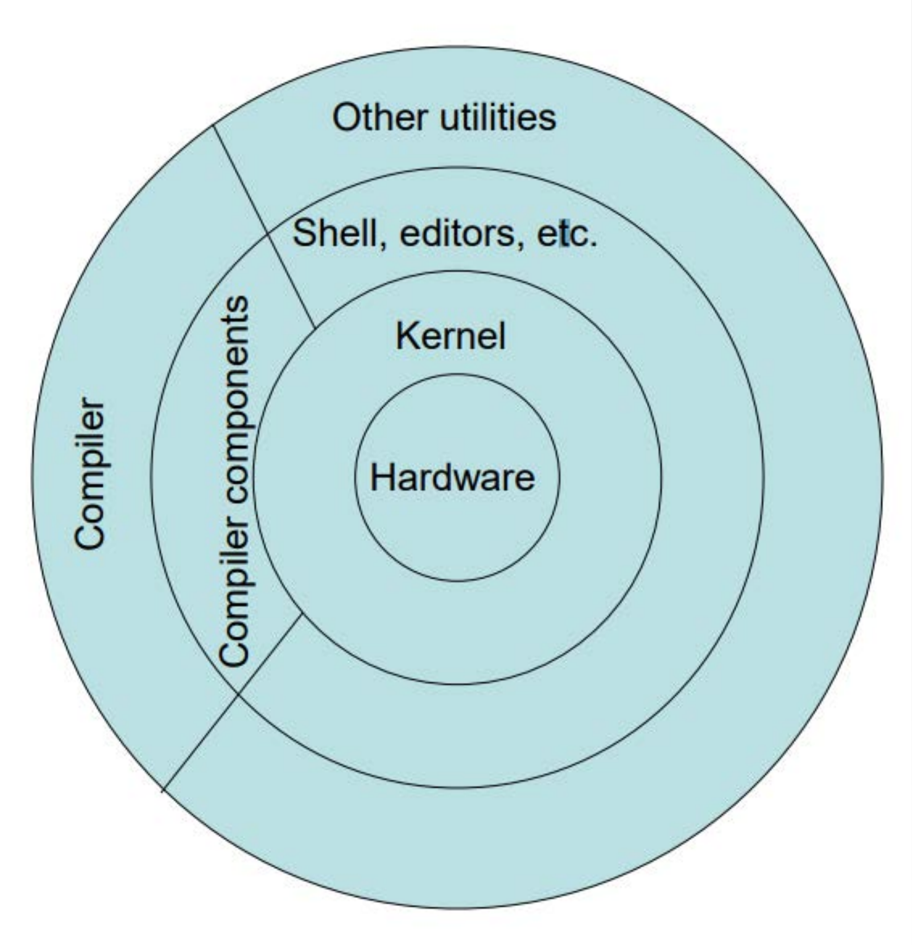
Overview

- Definition of Operating System (slide 3)
- Access to Linux (slide 7-14)
- Basic Commands (slide 16-27)
- Other Useful Commands (slides 29 -40)

What is an Operating System?

- Software interface between the user and the computer hardware
- Controls the execution of other programs
- Responsible for managing multiple computer resources (CPU, memory, disk, display, keyboard, etc.)
- Examples of OS: Windows, Unix/Linux, OS X

How does the Linux OS Work?



- Linux has a kernel and one or more shells
- The shell is the command line interface through which the user interacts with the OS. Most commonly used shell is “bash”
- The kernel sits on top of the hardware and is the core of the OS; it receives tasks from the shell and performs them

Linux File System

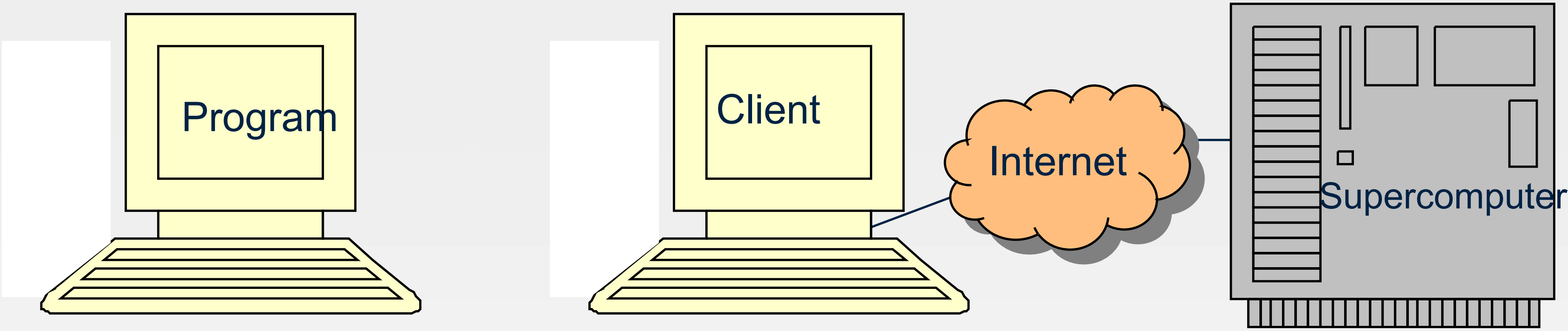
- A file is a basic unit of storage and should have a name associated with it – please note – Linux is case-sensitive
- Files are organized into directories and sub-directories
- A directory in Linux is a special file
  - A directory is similar to a “Folder” in Windows OS
- In Linux, paths begin at the root directory which is the top-level of the file system and is represented as a forward slash (/)
  - Relative path versus absolute path
- Forward slash is used to separate directory and file names

Overview

- Definition of Operating System
- Access to Linux
- Basic Commands
- Other Useful Commands

Local Access vs. Remote Access

- Local (Desktop/Laptop)
- Remote (Servers)



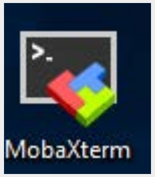
Install Linux locally on your computer, or access a Linux system remotely

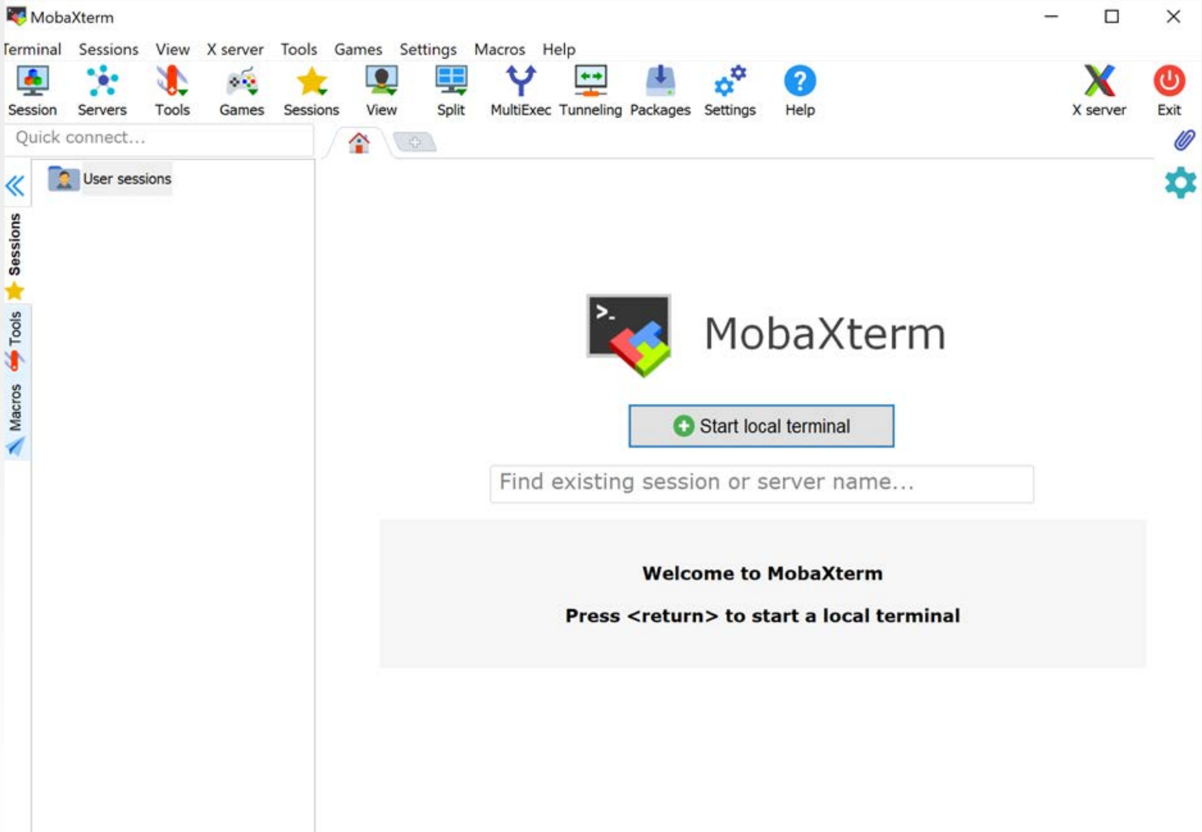
Access to Linux from a Windows Computer

- For local access to Linux
  - Install Linux on a USB stick: http://www.pendrivelinux.com/
    - http://www.pendrivelinux.com/all-in-one-usb-dsl/
    - http://www.ubuntu.com/download/desktop/create-a-usb-stick-on-windows
  - Use Virtual Box (runs as a windows process) https://www.virtualbox.org/
- For remote access to a Linux system, use client programs (like MobaXterm, SSH Secure Shell Client or Putty) on a Windows computer
  - MobaXterm https://mobaxterm.mobatek.net/download-home-edition.html
  - PuTTY http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
- Video showing the usage of SSH secure shell client https://www.youtube.com/watch?v=cigMNqXIkRE

Using MobaXterm Client - Step 1

After installing MobaXterm on Windows, click the shortcut on your desktop and the following window will appear.



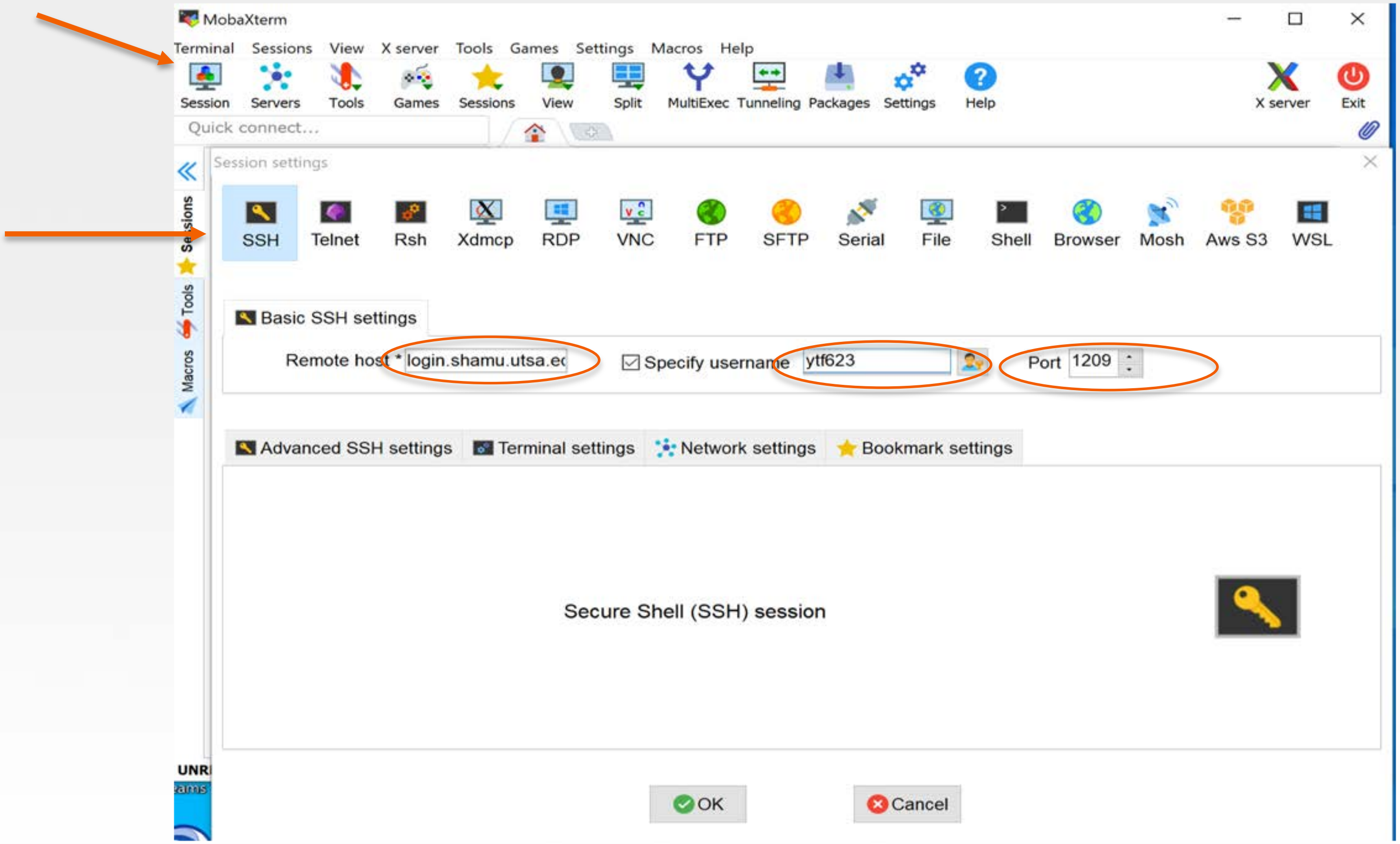

MobaXterm
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
X server Exit
Quick connect...
User sessions
Sessions
Tools
Macros
MobaXterm
Start local terminal
Find existing session or server name...

Welcome to MobaXterm

Press <return> to start a local terminal

Using MobaXterm Client - Step 2

- Cick on "Session", then click "SSH“ in the next window that opens. Enter the host name you are trying to connect to, your username, and the TCP port provided by your administrator, and then click “OK



Basic SSH settings

Remote host * login.shamu.utsa.ec

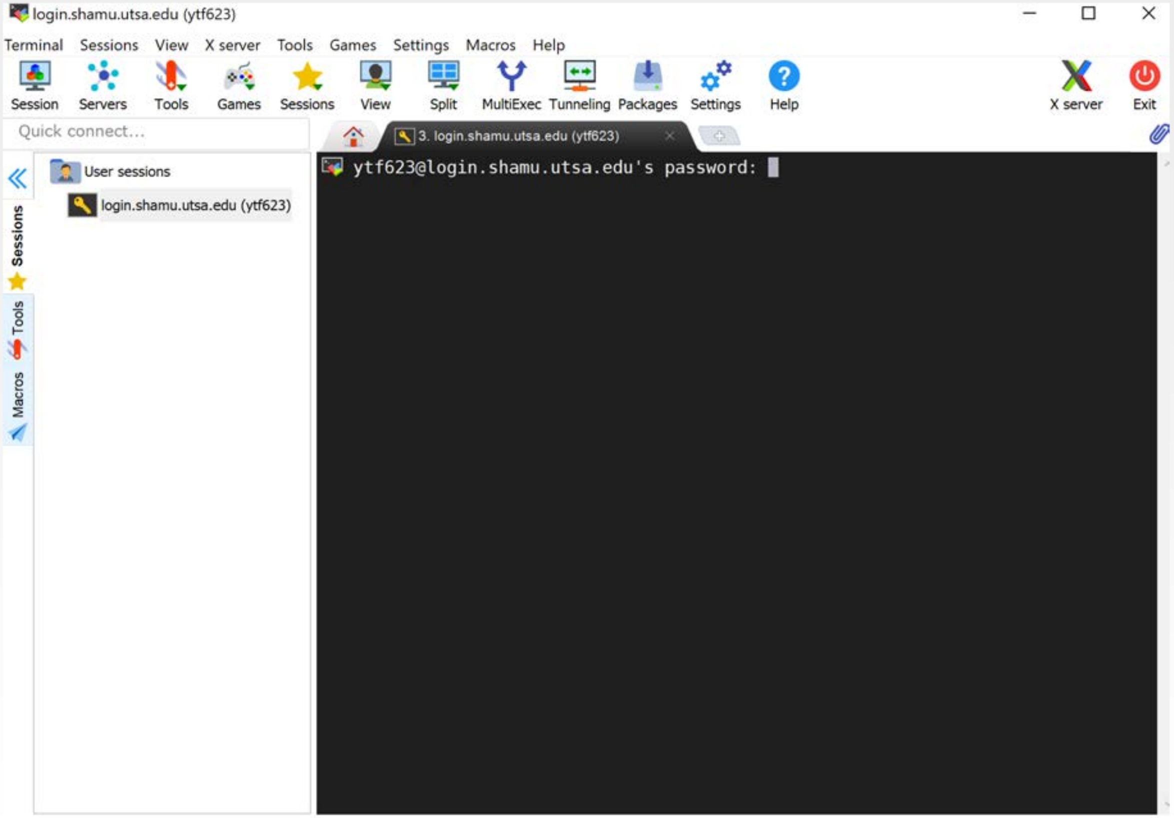
☑ Specify username ytf623

Port 1209

Secure Shell (SSH) session

Using MobaXterm Client - Step 3

- After clicking OK on the previous screen, you will be prompted to enter a password. Type your password and hit the enter key.

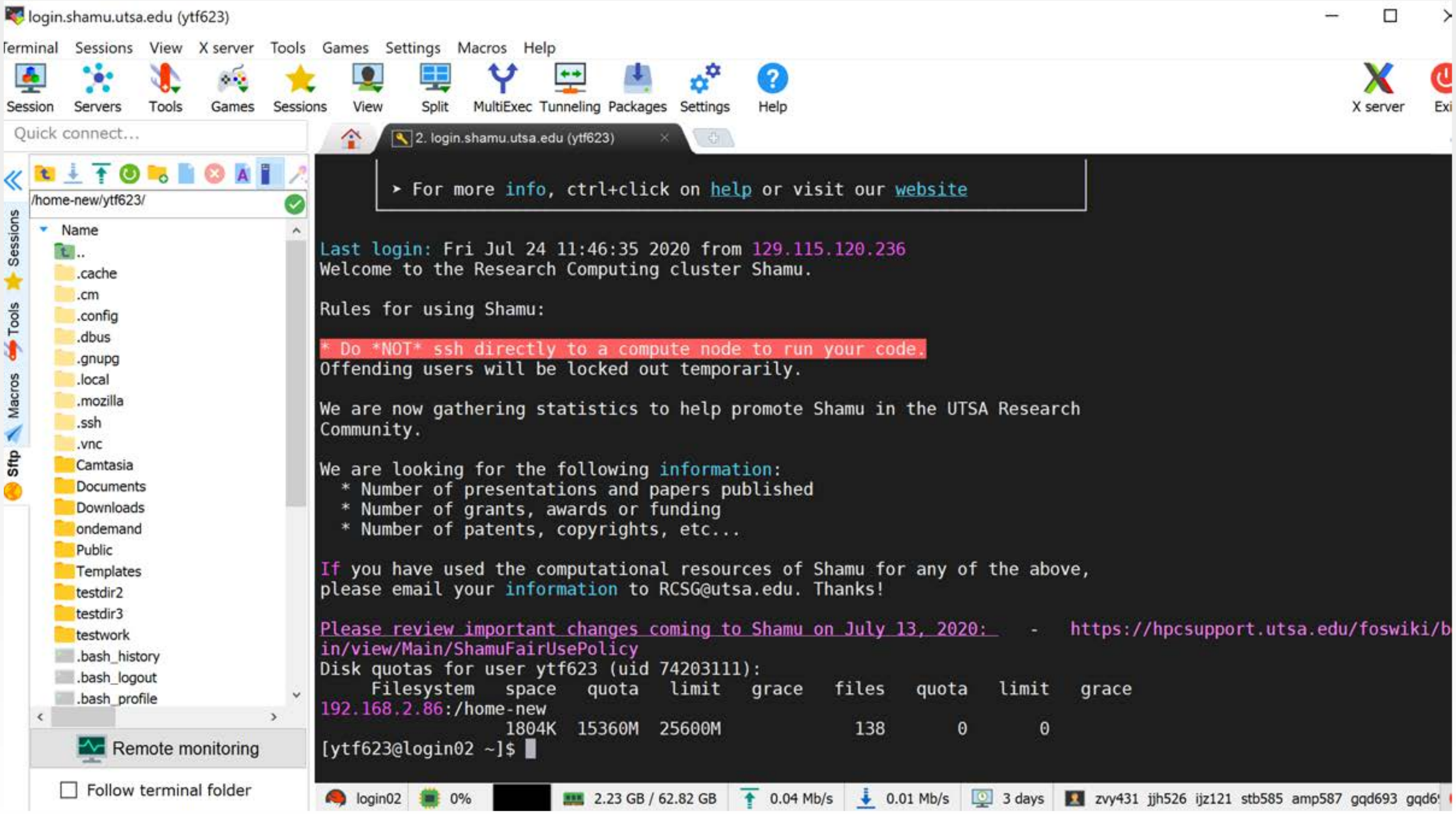


login.shamu.utsa.edu (ytf623)
Terminal Sessions View X server Tools Games Settings Macros Help
Session
Servers
Tools
Games
Sessions
View
Split
MultiExec
Tunneling
Packages
Settings
Help
X server
Exit
Quick connect...
3. login.shamu.utsa.edu (ytf623)
User sessions
login.shamu.utsa.edu (ytf623)
Sessions
Tools
Macros

```
ytf623@login.shamu.utsa.edu's password:
```

Using MobaXterm Client - Step 4

- You can now enter commands at the command prompt, or you can use the graphical interface in the left pane to view your file structure and open certain types of files.



login.shamu.utsa.edu (ytf623)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help
X server Exi
Quick connect...
2. login.shamu.utsa.edu (ytf623)
Sessions Tools Macros Sftp
Remote monitoring
☐ Follow terminal folder

```
/home-new/ytf623/
Name
..
.cache
.cm
.config
.dbus
.gnupg
.local
.mozilla
.ssh
.vnc
Camtasia
Documents
Downloads
ondemand
Public
Templates
testdir2
testdir3
testwork
.bash_history
.bash_logout
.bash_profile
```

```
   ▸ For more info, ctrl+click on help or visit our website

Last login: Fri Jul 24 11:46:35 2020 from 129.115.120.236
Welcome to the Research Computing cluster Shamu.

Rules for using Shamu:

* Do *NOT* ssh directly to a compute node to run your code.
Offending users will be locked out temporarily.

We are now gathering statistics to help promote Shamu in the UTSA Research
Community.

We are looking for the following information:
  * Number of presentations and papers published
  * Number of grants, awards or funding
  * Number of patents, copyrights, etc...

If you have used the computational resources of Shamu for any of the above,
please email your information to RCSG@utsa.edu. Thanks!

Please review important changes coming to Shamu on July 13, 2020:    -   https://hpcsupport.utsa.edu/foswiki/b
in/view/Main/ShamuFairUsePolicy
Disk quotas for user ytf623 (uid 74203111):
     Filesystem   space   quota   limit   grace   files   quota   limit   grace
192.168.2.86:/home-new
                  1804K  15360M  25600M             138       0       0
[ytf623@login02 ~]$ █
```

```
login02   0%   [redacted]   2.23 GB / 62.82 GB   0.04 Mb/s   0.01 Mb/s   3 days   zvy431 jjh526 ijz121 stb585 amp587 gqd693 gqd6
```

For Mac Users

- You can have remote access to servers through your “Terminal” application (Look under “Applications” -> “Utilities”)
- After opening the terminal, type the SSH command below (replace `username` with your actual username) – you will be prompted for password after that

```
staff$ ssh -p 1209 username@login.shamu.utsa.edu
```

Interacting with the Shell

- Type a command (**`ls`**) at the prompt (**`login3$ `**) and press ENTER Example: **`login3$ ls`**
- Shell starts a new process for executing the requested command, the new process executes the command and the shell displays any output generated by the command
- When the process completes, the shell displays the prompt and is ready to take the next command
- Specific information is passed to the command via more arguments
- The shell is killed by “**exit**” or **CTRL-D**

```
 login3$ exit
logout
```

Overview

- Definition of Operating System
- Access to Linux
- Basic Commands
- Other Useful Commands

Basic Commands (1)

- To print the name of the current/working directory, use the pwd command

```
login4$ pwd
/home-new/username
```

- To make a new directory, use the `mkdir` command

```
login4$ mkdir ssc222
```

- To change your working directory, use the `cd` command

```
login4$ cd ssc222
```

Basic Commands (2)

- To create a new file use the `vi` command (see cheat-sheet)
  ```
  login4$ vi test.txt
  ```
  - Press i to start inserting text
  - Type some text: `Hello Class 222`
  - To save and quit, press “ Esc ” key, and enter `:wq!` (press the enter key after typing `:wq!`)
  - To quit without saving, press “ Esc ” key if in insert mode, and enter “ `:q!` ”

- To display the contents of the file, use the `cat`(short for concatenation) command
  ```
  login4$ cat test.txt
  ```

Basic Commands (3)

- To list the contents of a directory, use the `ls` command

```
login4$ ls
```

- To see all files and directories, including hidden ones use the `-a` flag with the `ls` command. Hidden files have a “.” in front of them

```
login4$ ls –a
```

Note: your current working directory can be checked by using the pwd command.

Basic Commands (4)

- To copy contents of one file to another, use the `cp` command

```
 login4$ cp test.txt copytest.txt
 login4$ cp test.txt test3.txt
```

 One more example:

```
 login4$ mkdir junk
 login4$ cp test.txt ./junk/test2.txt
```

(The command above copies a file to the sub-directory `junk`)

```
 login4$ cd junk
 login4$ ls
 login4$ cd ..
```

- To go a level up from the current working directory

```
login4$ cd ..
```

Exercise -1 (Part A)

- Run the following commands to make a directory:

```
login1$ mkdir ssc229
login1$ cd ssc229
```

- Create a file using vi command in `ssc229` (see slide 17)

```
login1$ vi test.txt
```

- Run the following commands in the `ssc229` directory

```
login1$ cp test.txt test2.txt
login1$ mkdir junk
login1$ mkdir junk2
login1$ cp test2.txt ./junk/test2.txt
login1$ cp test2.txt ./junk2/test2.txt
login1$ ls
```

Exercise -1 (Part B)

- Run the following commands starting from the `ssc229` directory that you created in Part A of Exercise-1

```
login1$ ls
login1$ cd junk
login1$ ls
login1$ cd ..
login1$ cd junk2
login1$ ls
login1$ cd ..
login1$ ls
login1$ cp test.txt test3.txt
```

Basic Commands (5)

- To remove a file, use the `rm` command

```
login4$ rm test2.txt
```

- To remove a directory, use the “ `–r` ” option with the `rm` command

```
login4$ rm -r junk2
```

- You can also use the `rmdir` command to remove an empty directory

```
login4$ rmdir junk2
```

Note: `rmdir` command does not have `–r` option

Basic Commands (6)

- A file can be renamed by moving it. The same can be achieved by using the mv command

```
login4$ mv test3.txt newtest3.txt
```

- Use the man command to get more information about a command – it is like using help in Windows

```
login4$ man rmdir
```

- Use the diff command to see the differences in two files

```
login4$ diff test.txt newtest3.txt
```

Basic Commands (7)

- Previously executed commands in a shell can be viewed by using the `history` command. For example:

```
 login4$ history
   1   man ls
   2   ls -ltr
   3   ls -l -t -r
   4   ls -ltr
   5   history
```

Basic Commands (8)

- If the contents to display are more than one page, you could use the `more/less` command for paging through text a screenful at a time

```
login4$ more test.txt
login4$ less test.txt
```

(`less` allows both fwd and bwd movement)

Basic Commands (9)
Creating a tarball

- TAR (Tape Archive) command bundles files and sub-directories together and creates an archive (known as tar file or tarball)

- To create a tarball of all the files and sub-directories in the directory ssc229 that you created in Exercise 1, use **c** flag:

```
tar -cvf mytar.tar *
```

- To extract the contents of a tar file use **x** flag:

```
 login1$ tar -xvf mytar.tar
```

Basic Commands (10)
Creating a Compressed tarball

- To compress the tar file as it is being created use **z** flag with **c** flag :

```
login1$ tar -cvzf mytar.tar.gz
```

- To extract the contents of a compressed tar file use **x** flag:

```
login1$ tar -xvf mytar.tar.gz
```

Note: the **c**, **v**, and **f** flags mean create a new archive, be verbose so that the files being archived are listed, and write the archive to a file.

Overview

- Definition of Operating System
- Access to Linux
- Basic Commands
- Other Useful Commands

Check Username and Group

- Three types of users: owner or user, group, all others
- To check the login name use the command **`whoami`** or **`echo $USER`**
- To check the groups you are a member of use the command **`groups`**
  - Members of a Linux group can share files with each other
  - Each account is assigned a primary group, and an account can be a member of multiple groups
- To check your user id, or group id use the command **`id`**

File Permissions (1)

- Users typically perform the following operations on files:
  - Read files (using more, cat, *etc.*)
  - Write files (using >, vi, *etc.*)
  - Execute commands in a file (executables, *etc.*)
- Each file has three permissions – read, write and execute (`rwx`)
- Person creating the file is the owner or user and can modify permissions as desired
  - Owner can modify permissions on files to grant or revoke access to other users

File Permissions (2)

- To check the file permissions use the `-l` flag with the `ls` command

```
login4$ ls -l
total 24
drwx------  2 username G-25072 4096
Jan 17 14:07 junk
drwx------  2 username G-25072 4096
Jan 17 14:15 junk2
-rw-------  1 username G-25072   65
Jan 17 13:59 test.txt
```

File Permissions (3)

- chmod command is used to change permissions on a file

- To add specific permission use chmod +
  - To add write permission to all users use:
    `chmod a+w filename`
  - To add read permission to only the users in your group use:
    `chmod g+r filename`
  - To make a file executable and runnable by any user
    `chmod a+x myfile`

- To remove specific permission use chmod –

- Add and remove permissions can be combined in a single step
  - **`chmod u+x,g+r,o-rwx filename`**

File Permissions (4)

- Instead of using alphabets u, g, o for user, group, and others we can use numbers to specify file permissions

```
rwx = 111 = 7
rw- = 110 = 6
r-x = 101 = 5
r-- = 100 = 4
-wx = 011 = 3
-w- = 010 = 2
--x = 001 = 1
--- = 000 = 0
```

- `chmod go+rx filename` = `chmod 755 filename`

(assuming the user already has the `r`, `w`, and `x` permissions.)

Directory Permissions

- To check the contents of a file with `ls` command, you would need read permission
- To add or remove files in a directory, you would need write and execute permission
- To change to a directory or to go through its contents, you would need execute permission
- To list files in a directory using `ls –l` command you would need read and execute permissions

Redirecting Output

- By default, the output is displayed on the screen

- “ > ” symbol can be used to redirect the output to a file or a utility (*e.g.,* `ls`). Example:

```
 ls -ltr > myContent
```

- The “ | “ symbol is used to connect the output of one process to the input of another process

```
ls -l | wc -l
```

`wc` counts the number of lines

Other Directives

- “ < ” symbol is used for input redirection

```
mail -s "SSC 222/292" name@utsa.edu <
test.txt
```

- “ >> ” symbol is used for appending output to a file

```
login4$ cat test3.txt >> test.txt
```

- “ ; ” is used to execute multiple commands in one step

```
login4$ clear;date
```

Adding Content to a File

- You can add content to a file as follows

```
login4$ cat > test.txt
This is what I am entering from the console
CTRL-D
login4$ cat test.txt
This is what I am entering from the console
```

- You can append content to a file as follows

```
login4$ cat >> test.txt
Appending more lines
CTRL-D
```

Editing in Unix

- Text-mode editors that do not require an X-server to be running on your PC
  - pico is easiest editor to learn
  - emacs is most powerful editor and has a built-in tutorial
  - vi is present on essentially all Unix systems
  - GNU nano was supposed to be a free replacement of the pico editor
- If you have an X-server running
  - textedit
  - xedit

Data Transfer Using **scp** or WinSCP

- If your local computer is a Mac or a Linux laptop, you can use the `scp` commands to transfer data to and from a remote resource like Stampede

```
localhost% scp filename
username@shamu.utsa.edu:/path/to/project/directory
```

- If you are using a Windows computer, you can download and use the WinSCP application (GUI-based), or download and use Cygwin (command-line based, can run the aforementioned commands)
  - For small amounts of data, you may also use the "File Transfer Window" available in the SSH client – drag an drop the files across the local laptop and a remote resource

Process and Process Control

- ps – display process information on the system
- `kill` *`pid`* – terminates the process id
- `^c` (CTRL+c) terminates the running program

```
login4$ ps
  PID TTY          TIME CMD
20482 pts/32   00:00:00 bash
21035 pts/32   00:00:00 ps
```

References

- http://www.cs.jhu.edu/~joanne/unixRC.pdf
- http://www.digilife.be/quickreferences/qrc/vi%20reference%20card.pdf
- http://www.tacc.utexas.edu/documents/13601/118360/LinuxIntro_HPC_09+11+2011_hliu.pdf