CS35L – Winter 2019

Slide set:	1.1
Slide topics:	Linux Basics
Assignment:	1

What’s this class about?

“Fundamentals of commonly used **software tools** and environments, particularly **open-source** tools to be used in upper division computer science courses.”

What is open source software?

Source code is publicly available

Anyone is allowed to modify the source code

Examples

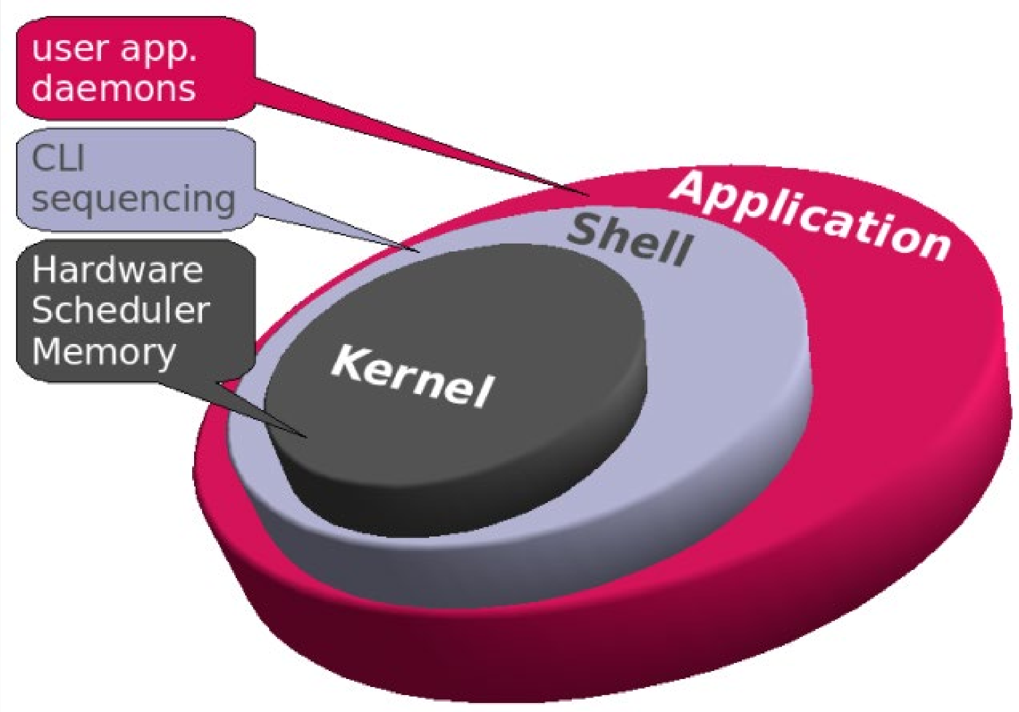
- Firefox
- Android
- Apache

GNU/Linux

Open-source operating system

- **Kernel**: core of operating system
  - Allocates time and memory to programs
  - Handles file system and communication between software and hardware
- **Shell**: interface between user and kernel
  - Interprets commands user types in
  - Takes necessary action to cause commands to be carried out
- **Programs**

GNU/Linux Structure



Which Linux for this course?

Ubuntu Linux Distribution

- Most popular
- Frequently updated, fixed release cycle (6 months)

Seasnet servers(recommended):

- lnxsrv.seas.ucla.edu (*lnxsrv06, lnxsrv07, or lnxsrv09*)
- Username: SEAS ID
- Password: SEAS password
- On Windows: putty
- On Mac: terminal

Command Line Interface vs. Graphical User Interface

CLI	GUI
Steep learning curve	Intuitive
Pure control (e.g., scripting)	Limited control
Cumbersome multitasking	Easy multitasking
Convenient remote access	Bulky remote access

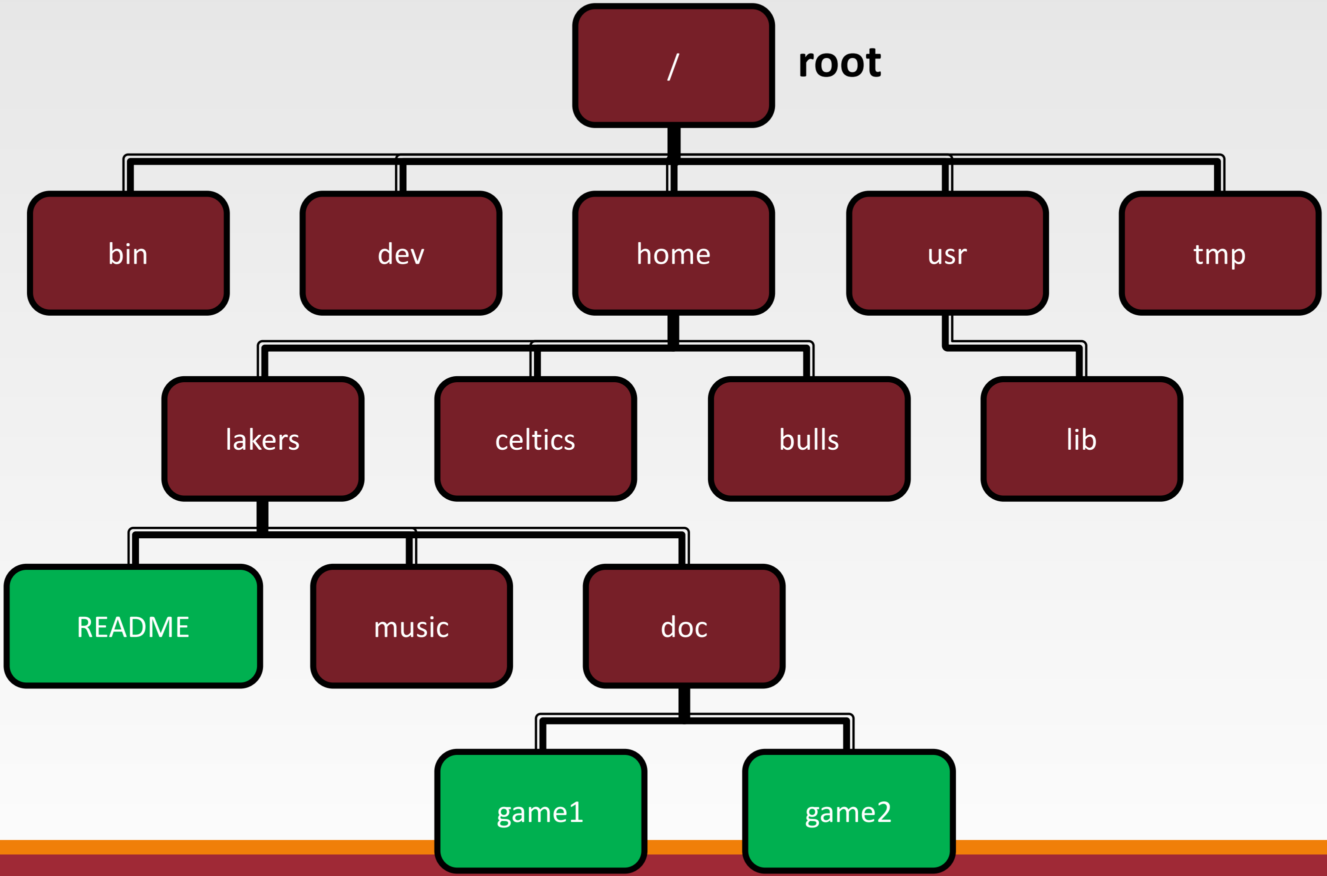
Files and Processes

Everything is either a **process** or a **file**:

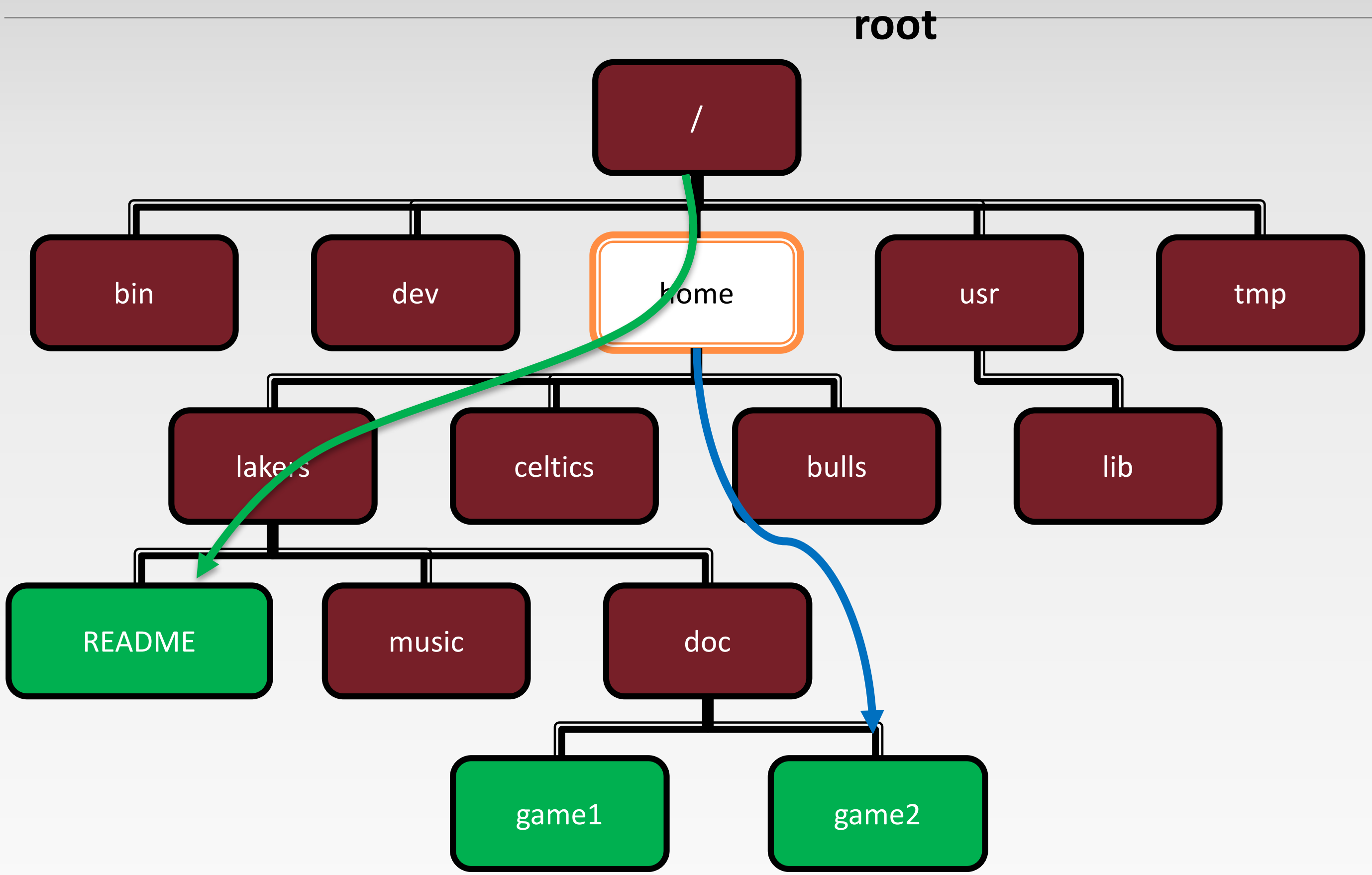
- **Process**: an executing program identified by PID
- **File**: collection of data
  - A document
  - Text of program written in high-level language
  - Executable
  - Directory
  - Devices

Linux File System Layout

Tree structured hierarchy

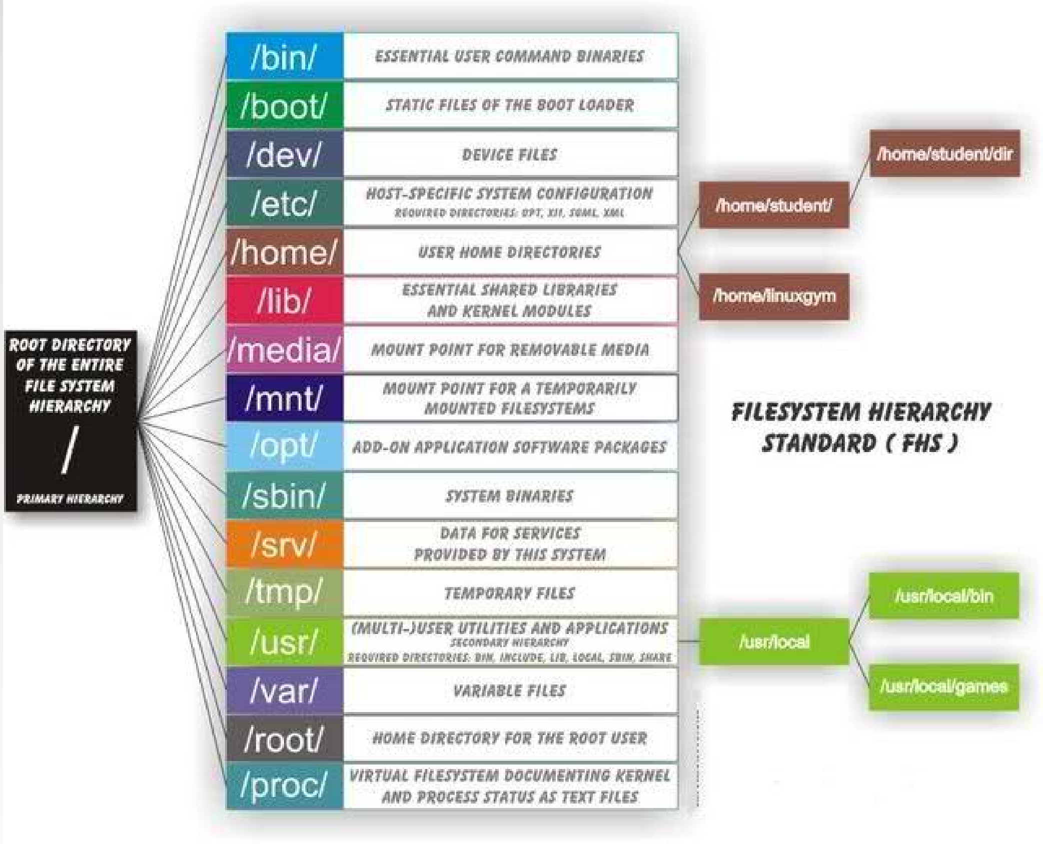


Absolute Path vs. Relative Path



Current directory: home

Linux Directory Structure



ROOT DIRECTORY OF THE ENTIRE FILE SYSTEM HIERARCHY

/

PRIMARY HIERARCHY

/bin/	ESSENTIAL USER COMMAND BINARIES
/boot/	STATIC FILES OF THE BOOT LOADER
/dev/	DEVICE FILES
/etc/	HOST-SPECIFIC SYSTEM CONFIGURATION REQUIRED DIRECTORIES: OPT, X11, SGML, XML
/home/	USER HOME DIRECTORIES
/lib/	ESSENTIAL SHARED LIBRARIES AND KERNEL MODULES
/media/	MOUNT POINT FOR REMOVABLE MEDIA
/mnt/	MOUNT POINT FOR A TEMPORARILY MOUNTED FILESYSTEMS
/opt/	ADD-ON APPLICATION SOFTWARE PACKAGES
/sbin/	SYSTEM BINARIES
/srv/	DATA FOR SERVICES PROVIDED BY THIS SYSTEM
/tmp/	TEMPORARY FILES
/usr/	(MULTI-)USER UTILITIES AND APPLICATIONS SECONDARY HIERARCHY REQUIRED DIRECTORIES: BIN, INCLUDE, LIB, LOCAL, SBIN, SHARE
/var/	VARIABLE FILES
/root/	HOME DIRECTORY FOR THE ROOT USER
/proc/	VIRTUAL FILESYSTEM DOCUMENTING KERNEL AND PROCESS STATUS AS TEXT FILES

The Basics: Moving Around

pwd: print working directory

cd: change directory

- **~** home directory
- **.** current directory
- **/** root directory, or directory separator
- **..** parent directory

The Basics: Shell

<up arrow>: previous command

<tab>: auto-complete

!!: replace with previous command

![*str*]: refer to previous command with str

man

Extensive documentation that comes preinstalled with almost all substantial Unix and Unix-like operating systems

Usage

- read a manual page for a Linux command
  - **man <**command_name**>**
  - **man** section command_name
  - 1 User Commands 2 System Calls 3 C Library Functions 4 Devices and Special Files 5 File Formats and Conventions 6 Games et. al. 7 Miscellanea 8 System Administration tools and Daemons
  - Hit “q” to get out of man page

The Basics: Dealing with Files

mv: move/rename a file

cp: copy a file

rm: remove a file

- r: remove directories and their contents recursively

mkdir : make a directory

rmdir: remove an empty directory

ls: list contents of a directory

- d: list only directories
- a: list all files including hidden ones
- l: show long listing including permission info
- s: show size of each file, in blocks

The Basics: Changing File Attributes

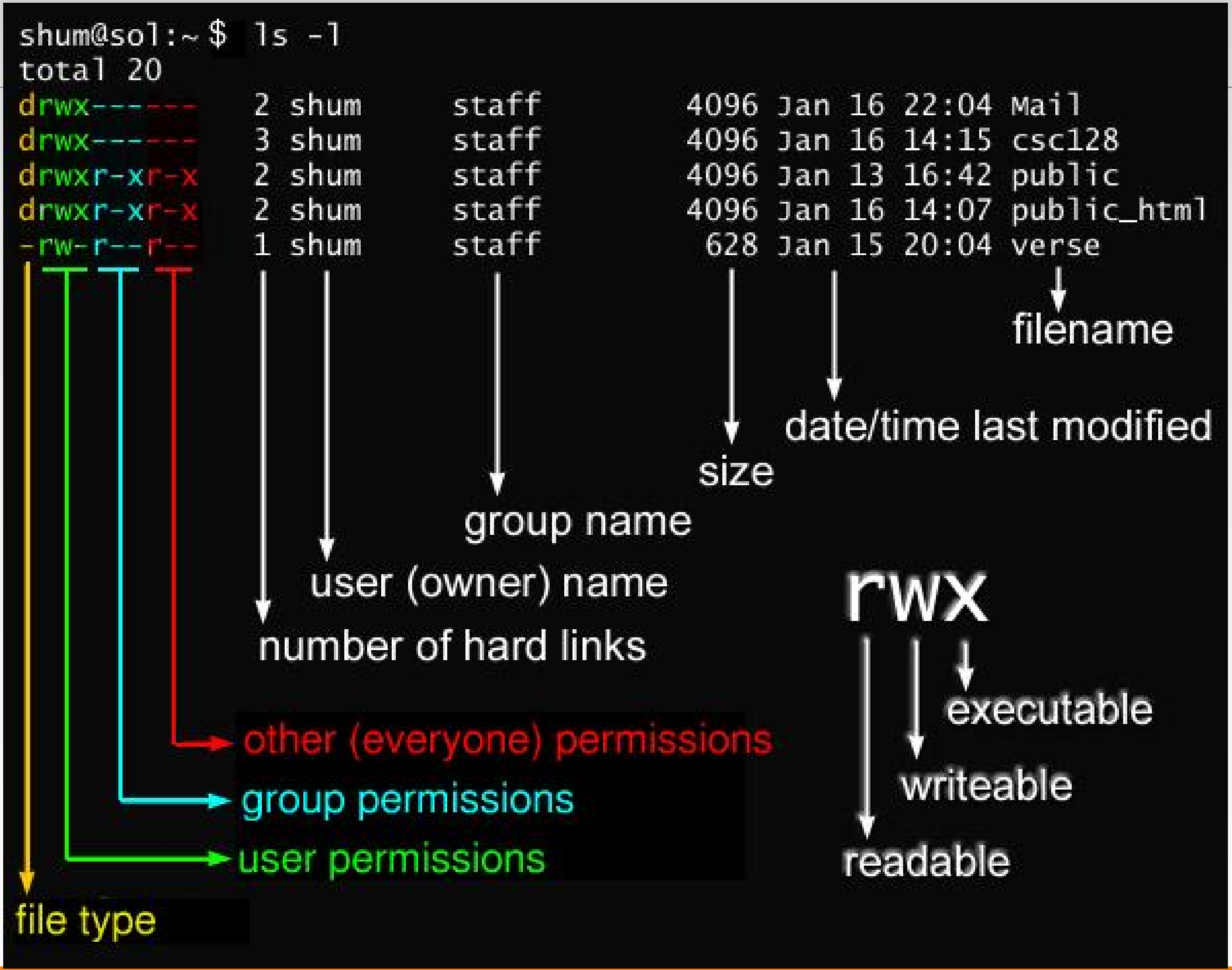
ln: create a link

- Hard links: point to physical data
- Soft links aka symbolic links (-s): point to a file

touch: update access & modification time to current time

- touch *filename*
- touch -t 201101311759.30 *filename*
  - Change filename's access & modification time to (year 2011 January day 31 time 17:59:30)

Linux File Permissions

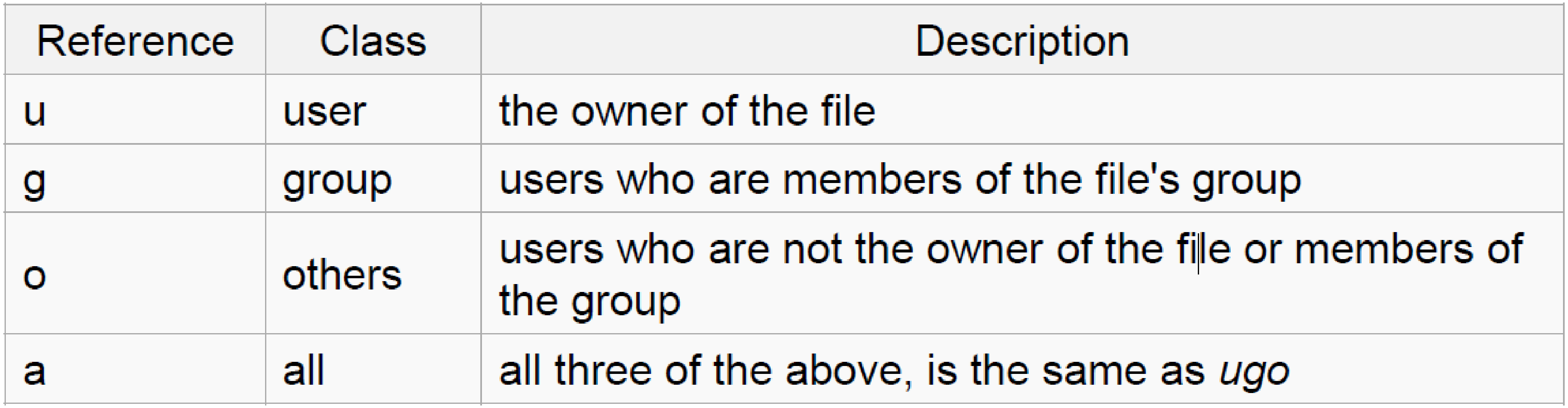


```
shum@sol:~$ ls -l
total 20
drwx------  2 shum     staff       4096 Jan 16 22:04 Mail
drwx------  3 shum     staff       4096 Jan 16 14:15 csc128
drwxr-xr-x  2 shum     staff       4096 Jan 13 16:42 public
drwxr-xr-x  2 shum     staff       4096 Jan 16 14:07 public_html
-rw-r--r--  1 shum     staff        628 Jan 15 20:04 verse
```

Linux File Permissions

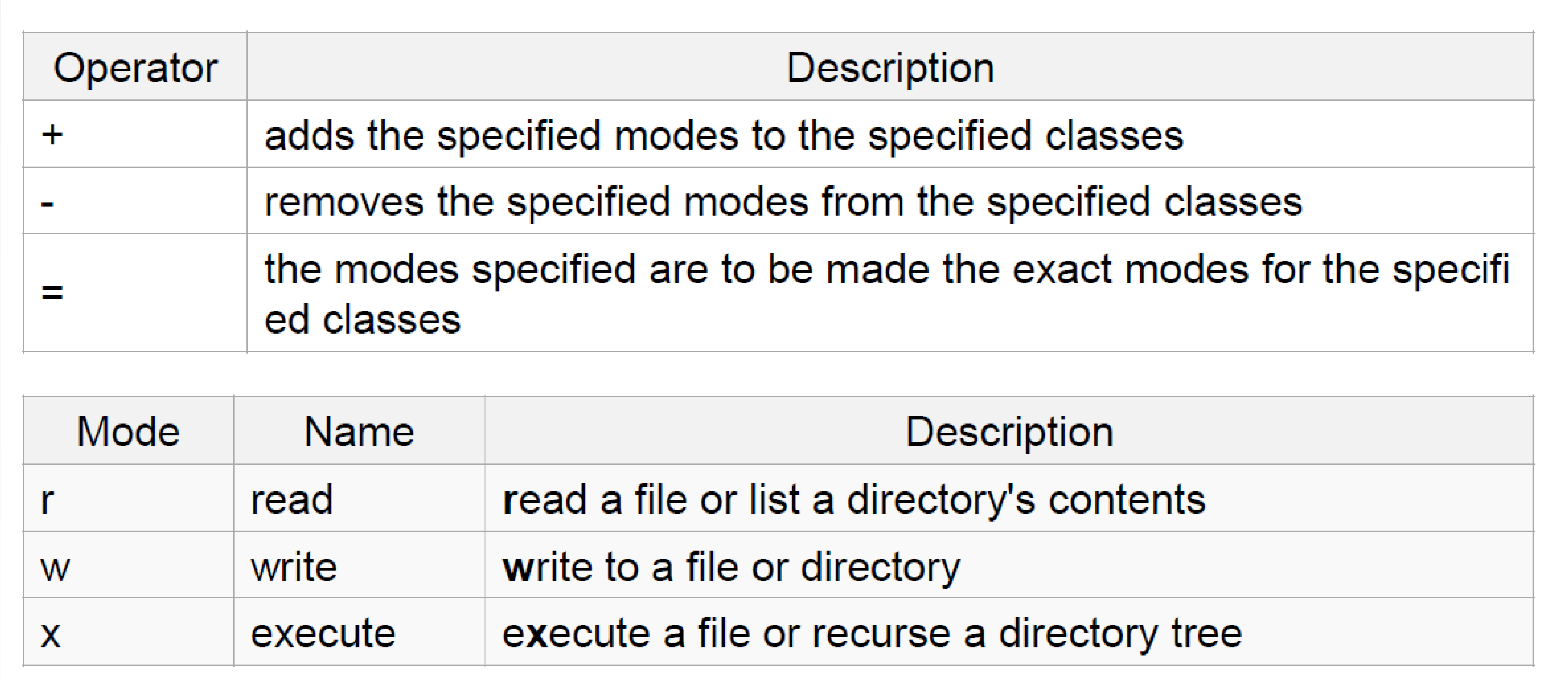
chmod

- read (r), write (w), executable (x)
- User, group, others



Reference	Class	Description
u	user	the owner of the file
g	group	users who are members of the file's group
o	others	users who are not the owner of the file or members of the group
a	all	all three of the above, is the same as *ugo*

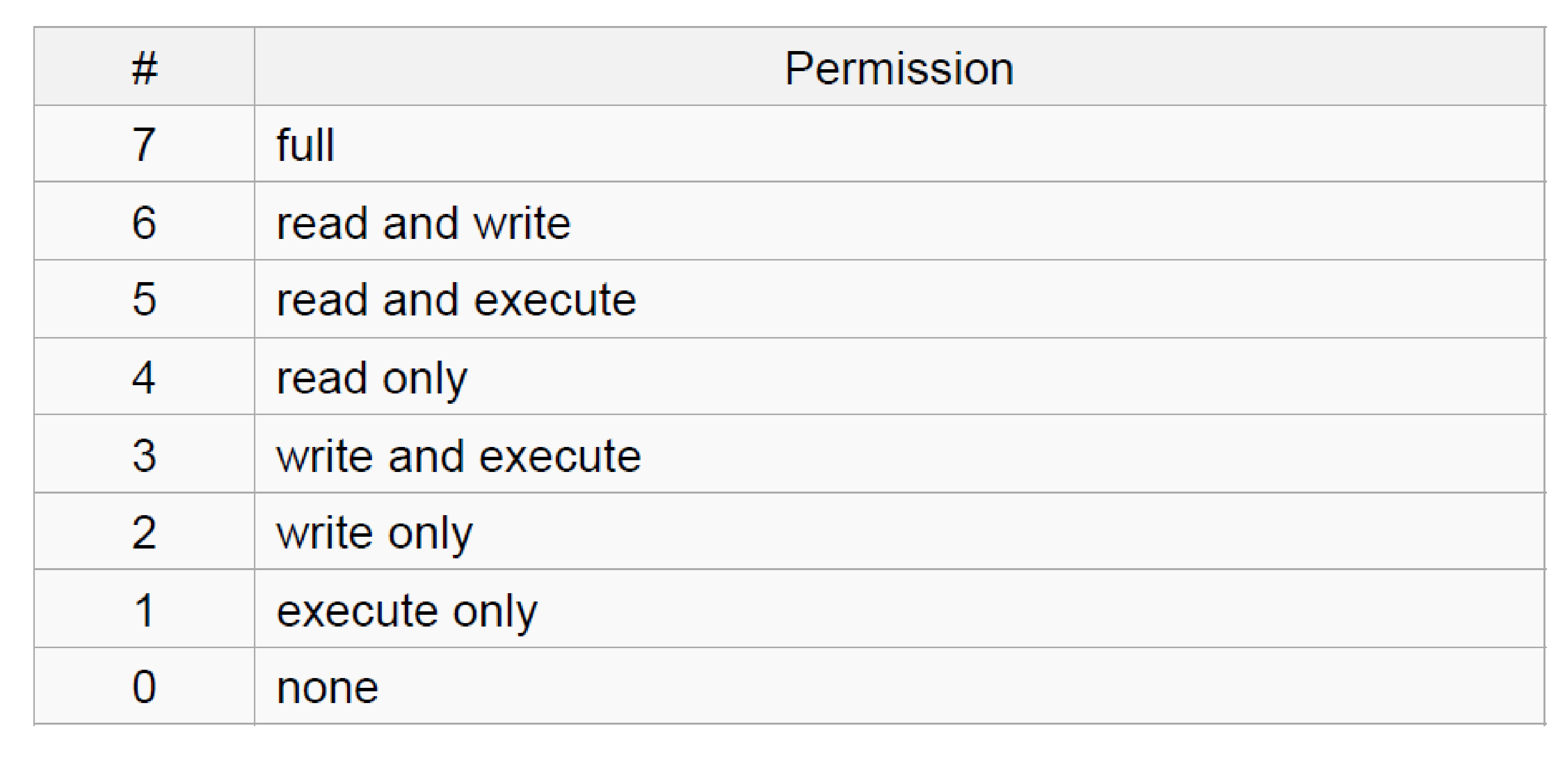
The Basics: chmod (symbolic)



Operator	Description
+	adds the specified modes to the specified classes
-	removes the specified modes from the specified classes
=	the modes specified are to be made the exact modes for the specified classes

Mode	Name	Description
r	read	**r**ead a file or list a directory's contents
w	write	**w**rite to a file or directory
x	execute	e**x**ecute a file or recurse a directory tree

The Basics: chmod (numeric)



#	Permission
7	full
6	read and write
5	read and execute
4	read only
3	write and execute
2	write only
1	execute only
0	none

- Usage

– chmod [''references''][''operator''][''modes''] ''file1'' ...
Example: **chmod** ug+rw mydir, **chmod** a-w myfile,
Example: **chmod** ug=rx mydir, **chmod** 664 myfile

The Basics: find

-type: type of a file (e.g: directory, symbolic link)

-perm: permission of a file

-name: name of a file

-user: owner of a file

-maxdepth: how many levels to search

File Name Matching

?: matches any single character in a filename

*: matches one or more characters in a filename

[]: matches any one of the characters between the brackets. Use ‘-’ to separate a range of consecutive characters.

find Examples

Examples

- find . -name my*
- find . -name my* -type f
- find / -type f -name myfile –print

wh… Commands

whatis <command>: returns Name section of man page

whereis <command>: locates the binary, source, and manual page files for a command

More Basics: Look these up

cat

head

tail

du

ps

kill

diff

cmp

wc

sort

Connecting to SEAS from OS X or Linux

Terminal

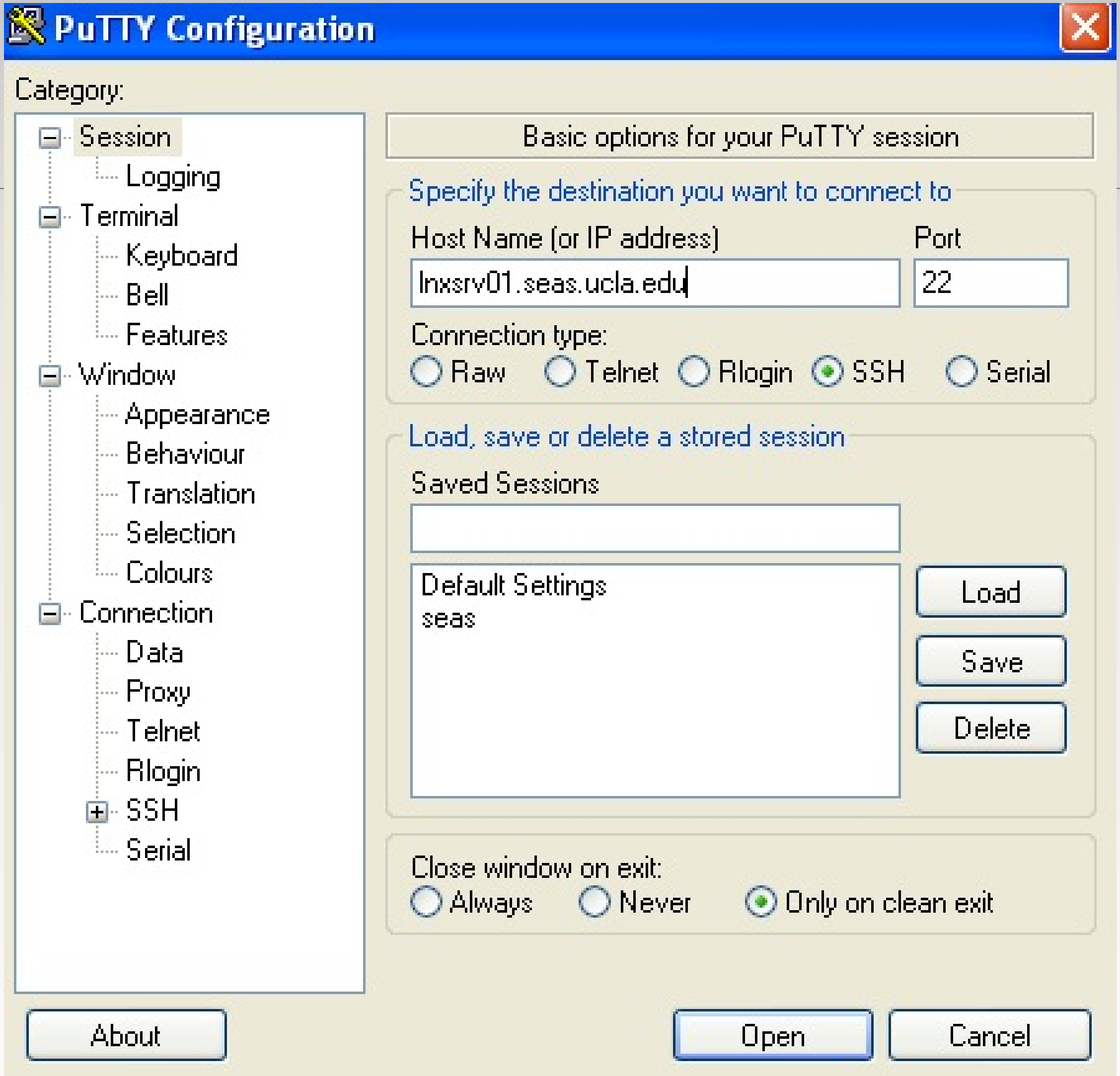
- $ ssh username@lnxsrv.seas.ucla.edu
- Username = your SEAS username

Connecting to SEAS from Windows

Putty

- Recommended
- Small and easy to use
- Host name: lnxsrv.seas.ucla.edu
- User name: your SEAS user name

Putty



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): lnxsrv01.seas.ucla.edu

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Load, save or delete a stored session

Saved Sessions:

Default Settings
seas

Close window on exit: ○ Always ○ Never ● Only on clean exit

Assignment 1 – Example ans1.txt

ans1.txt is specifically for LABORATORY section

1. Here is the answer to question 1
2. Here is the answer to question 2
3. Here is the answer to question 3

…..

Assignment 1 – Example key1.txt

key1.txt is specifically for HOMEWORK section

1. C-s H E L L O W O R L D
2. C-s H T M L
3. C-d
4. C-n
5. M-x goto-line Enter 1 2 3 Enter