

## STAT:5400 (22S:166) Computing in Statistics

### Introduction

Lecture 2  
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## Structure of Linux environment: like an upside-down tree

- directories
- subdirectories
- files

### Home directories

- smart for multi-user system to provide each user private place to store files
  - called “home directory” in Linux
- you are only *regular* user who can access files in your home directory
  - *system administrator* also can
  - we will see later how to use **chmod** command to give access to other people
- when you log in to Linux, you automatically end up with your home directory as the current directory

### The “shell”

- shell: program that sends commands typed at the keyboard to the operating system to perform
- several shells available in UNIX and Linux
  - C shell ( csh )
    - \* developed for Berkeley UNIX
  - T C shell (tcsh)
    - \* default in our Linux network
    - \* enhanced version of C shell
  - Bourne Shell (sh) and its extensions
    - \* Bourne Again Shell (bash)
    - \* highly programmable Korn shell (ksh )
- you can run a shell other than default shell simply by typing its name
  - e.g., if you start up in tcsh and wish to switch to ksh, type **ksh**, and a Korn shell will start up

## shell command to list the contents of a directory

- `ls` command lists the contents of a Linux directory
  - unless options are used, `ls` gives just names of files and subdirectories
  - all options start with an “-”
  - example: `ls -l` gives “long listing”
  - here’s part of its output for the contents of my directory for this course

```
drwx----- 2 kcowles faculty 8192 Aug 20 14:09 hw
drwx----- 2 kcowles faculty 96 Aug 20 14:21 labs2005
drwx----- 2 kcowles faculty 96 Aug 11 14:43 lects
drwx----- 2 kcowles faculty 8192 Aug 22 13:24 lects2005
-rw----- 1 kcowles faculty 1013 Jul 30 16:24 online.resources
-rw----- 1 kcowles faculty 8 Aug 22 12:46 questionnaire.aux
-rw----- 1 kcowles faculty 1492 Aug 22 12:46 questionnaire.dvi
-rw----- 1 kcowles faculty 5348 Aug 22 12:46 questionnaire.log
-rw----- 1 kcowles faculty 1497 Aug 22 12:46 questionnaire.tex
```

- first character of an entry is almost always either
  - \* “-” — entry is a file
  - \* “d” — entry is a directory

- next nine characters show the security mode (explained in next section)
- username of owner of file
- group owner of file
  - \* subset of people with accounts on the system to which the owner belongs
  - \* we may choose to give them special access to this file
- size of file in bytes
- date and time when file was last modified
- filename

## File security in Linux

- many PC users unfamiliar with the idea of file security
- Windows didn’t use to need security because it is a single-user OS
- Linux is a multi-user OS, so it has security to prevent people from accessing each other’s confidential files
- Linux computers are not vulnerable to viruses and worms that infect a computer by altering files or writing new ones

## Security characters in long listing

- three sets of three characters
  - first set for user
  - second set for group
  - third set for other (everyone in the world)
- letters r, w, and x mean different operations one can perform on a file
  - r — you can read the file’s contents
  - w — you can write or change the file’s contents
  - x — you can execute the file (given only for programs and directories)
- 9 security characters as a group are called the *security mode* of the file

## Changing file permissions: “chmod”

- **chmod** stands for “change mode”
- first argument specifies which set(s) (user, group, or other) of 3 characters you want to modify
- second argument is a + (if you wish to add permissions) or a - (if you want to take them away)
- third argument is which permission(s) you want to change

- examples:
  - `chmod g+r questionnaire.tex`
    - would give the group (in this case **faculty**) read permission for this file
  - `chmod a+rx hw`
    - would give “all” (user, group, and other) read and execute permission for the directory **hw**

## Using “wildcards” to save typing

- wildcard allows you to specify more than one file in one command
- **\*** matches any number of characters
- to execute command on all files in the current directory, specify **\*** as the filename; e.g.

```
chmod o-rx *
```

- to execute a command on all the files with filename **questionnaire** regardless of their extension, use **questionnaire.\*** as the filename
- other filename character is **?**, which matches exactly 1 character

## Limitation of Linux security

- to be able to give special access permissions to a certain group of people, must get system administrator to create a group containing those people
- impossible to give different sets of access permissions to a different groups of people because any file or directory can have only one group owner
- fix will be implemented in future version of Linux

## Learning which groups you are in

- enter
  - `groups`

## Printing

- basic Linux print commands
  - **lpr** — send file to printer
  - **lpq** — display print queue
  - **lprm** — remove file from print queue
- examples:
  - **lpr thoughts**  
sends file named “thoughts” to default printer
  - **lpr -PCLAS\_STAT-SH374-BW thoughts**  
sends same file to a printer called **CLAS\_STAT-SH374-BW**; names of printers are determined by system administrator

## lpq

- **lpq** is used to check status of print jobs
- **lpq** without any arguments produces status of all print jobs in default print queue

```
[kcowles@p-lnx402 ~]$ lpq
CLAS_STAT-SH374-BW is ready
no entries
```

```
[kcowles@p-lnx402 lects2005]$ lpr root.ps
[kcowles@p-lnx402 lects2005]$ lpr lect01.ps
[kcowles@p-lnx402 lects2005]$ lpq
```

```
CLAS_STAT-SH374-BW is ready and printing
```

Rank	Owner	Job	File(s)	Total Size
active	kcowles	127	root.ps	99328 bytes
1st	kcowles	128	lect01.ps	116736 bytes

- can use **-P** option to get status of print jobs in a different queue

```
lpq -P CLAS_STAT-SH241-BW
CLAS_STAT-SH241-BW is ready
no entries
```

## Canceling print jobs with lprm

- **lprm** is short for “line printer remove”
- use the *job number* to specify which one to cancel

```
[kcowles@p-lnx402 lects2005]$ lprm 127
[kcowles@p-lnx402 lects2005]$ lpq
CLAS-STAT-SH374-BW is ready and printing
Rank  Owner  Job    File(s)          Total Size
active kcowles 128    lect01.ps        116736 by
```

## Canceling other kinds of jobs

- Use **ps** to list running jobs
- **u** option restricts to your own (the user’s) jobs

```
[kcowles@p-lnx402 ~]$ ps -u
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
kcowles   4277  0.0  0.0  44720 1468 pts/0    Ss   09:01   0:00 -csh
kcowles   4299  0.0  0.2  63740 5860 pts/0    S+   09:01   0:00 pine
kcowles   4307  0.0  0.0  44720 1476 pts/1    Ss   09:10   0:00 -csh
kcowles   4374  0.0  0.1  58936 3096 pts/1    S+   09:36   0:01 vim lect2
kcowles   4575  2.0  0.0  44508 1424 pts/2    Ss   10:05   0:00 -csh
kcowles   4596  0.0  0.0   4580   708 pts/2    R+   10:05   0:00 ps u
```

- **pid** is the process i.d.
- use **kill <pid>** to cancel a process that you are unable to terminate in a normal way
  - **kill** tries to allow the process to clean up after itself as it shuts down
  - sometimes a process is so out-of-control that it ignores the signal to die
  - **kill -9 <pid>** is command to “kill immediately”

## Using man pages to learn about commands

- entire contents of Linux manual is online
- **man** command
- use with **-k** option to find all commands that contain a word of interest in their short description in the manual; e.g.

```
- man -k find
```