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`