File System

1. File System

1.1 CSCI 330

1.2 UNIX Shell: traditional user interface

1.3 Invoking a Terminal

1.4 Command Line Structure

Command Line Structure

% command [-options] [arguments]

- Command prompt
- Command name
- Command modifier: usually one character preceded by + or – sign
- Arguments can be:
  1. names of files
  2. more information
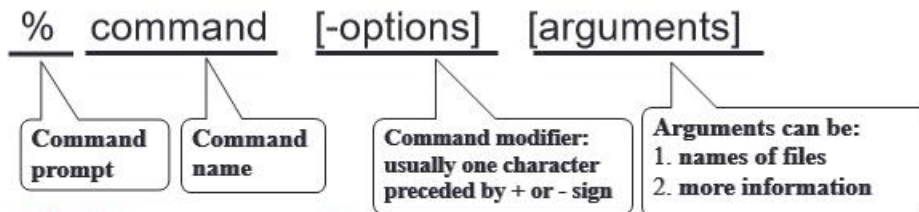
- UNIX is case sensitive
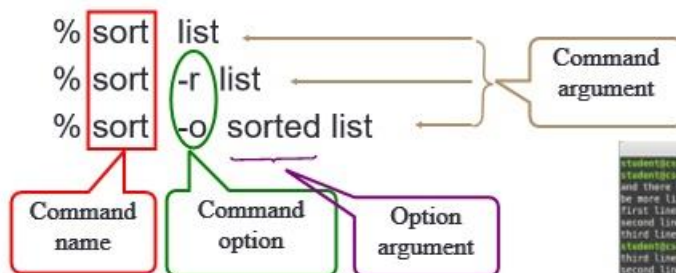- Must be a space between command, options and arguments
- No space between the plus or minus sign and option letter
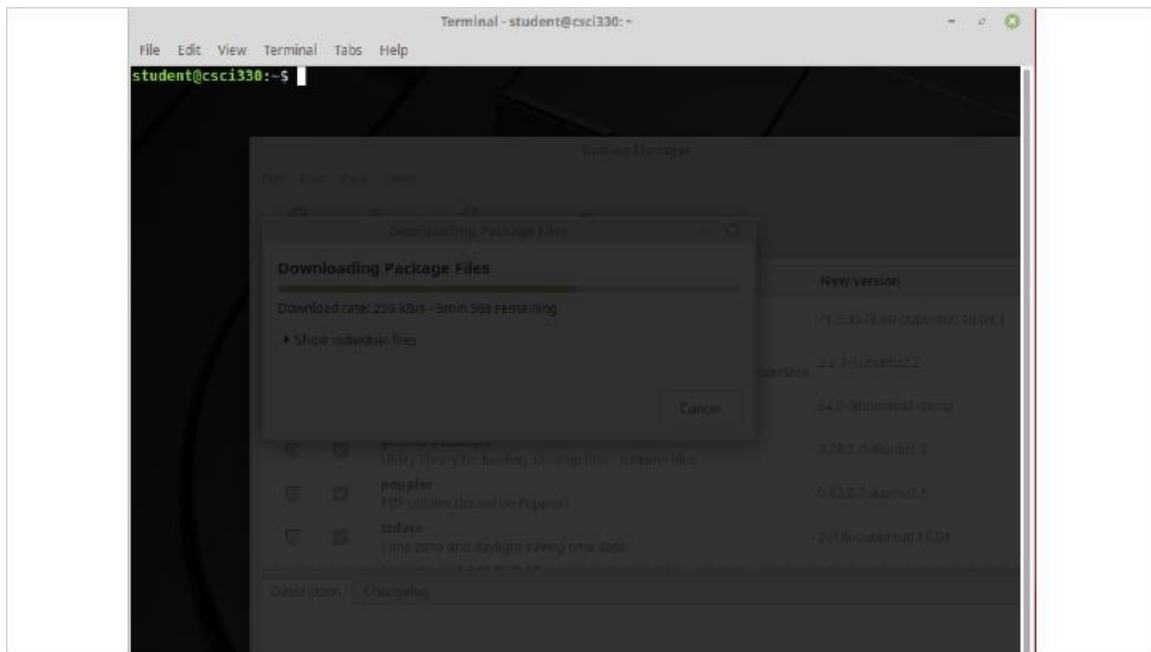- Fields enclosed in [ ] are optional

1.5 Command Line Example

Command Line Example

% sort list
% sort -r list
% sort -o sorted list

- Command argument
- Command name
- Command option
- Option argument

1.6 sort command

1.7 Some Basic Commands

Some Basic Commands

passwd	- change password
ls	- list files
more	- show content of file, page by page
logout	- logout from system
date	- display date and time
who	- display who is on the system
clear	- clear terminal screen
man	- find and display system manual pages

1.8 RTFM: The man Command

RTFM: The man Command

- show pages from system manual

Syntax: man [options] [-S section] command-name

```
% man date
% man -k date
% man crontab
% man -S 5 crontab
```

Caveats:
   Some commands are aliases
   Some commands are part of shell

Section	Description
1	User commands
2	System calls
3	C library functions
4	Special system files
5	File formats
6	Games
7	Misc. features
8	System admin utilities

1.9 man command
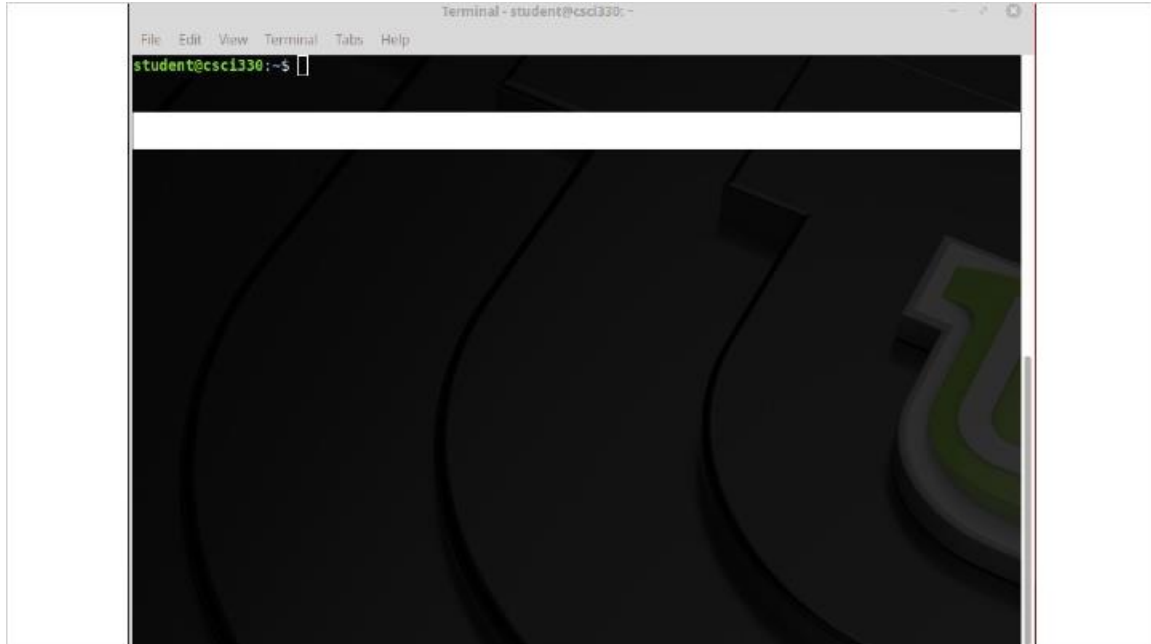
1.10 The Unix file system

The Unix file system

- hierarchical organization of files
  - contains directories and files
  - always single tree
- basic commands to list and manipulate files
  - independent of physical file system organization
- typical Unix file system types
  - ext4
  - also: FAT, NTFS, UDF, …

1.11 Directory terminology

Directory terminology

- Root Directory: /
  - top-most directory in any UNIX file structure
- Home Directory: ~
  - directory owned by a user
  - default location when user logs in
- Current Directory: .
  - default location for working with files
- Parent Directory: ..
  - directory immediately above the current directory

1.12 Path: list of names separated by "/"

Path: list of names separated by "/"

- Absolute Path
  - Traces a path from root to a file or a directory
  - Always begins with the root (/) directory
    Example: `/home/student/Desktop/assign1.txt`
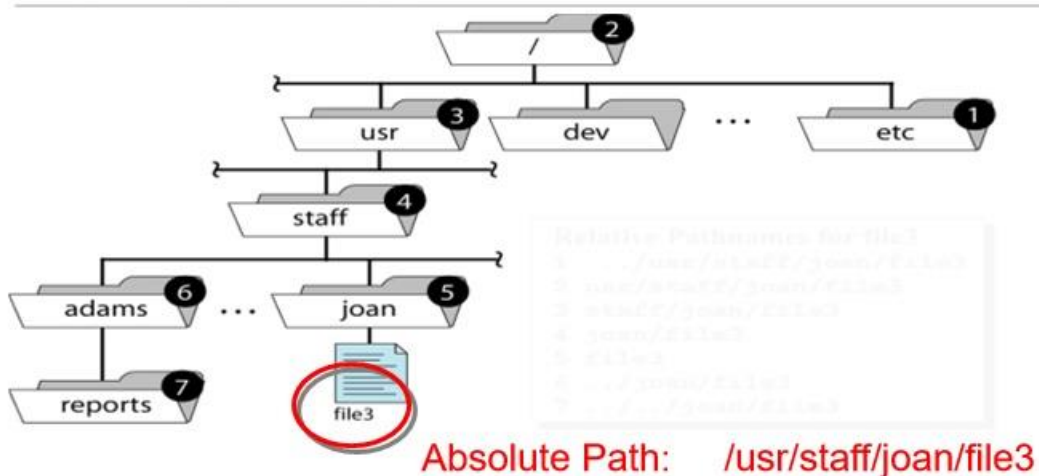- Relative Path
  - Traces a path from the current directory
  - No initial forward slash (/)
    - dot (.) refers to current directory
    - two dots (..) refers to one level up in directory hierarchy
    Example: `Desktop/assign1.txt`

1.13 Path to file3

Path to file3

Absolute Path: /usr/staff/joan/file3

1.14 Directory commands

Directory commands

- **pwd**   to show path of current working directory
- **cd**   to change the current working directory

- **mkdir**   to create a new directory

- **rmdir**   to delete an empty directory
  - use "**rm -r**" to remove non-empty directory

1.15 List directory content

List directory content

most frequently used file system command:

Syntax:

                ls [options] [path]

- common options:
    - -a   show all files
    - -l   show long version of listing

- many more options …
    - -t   show files sorted by time stamp
    - -S   show files sorted by file size
    - -r   show files in reverse sorted order

1.16 Long List Option

Long List Option

```
% ls -al        List all files in current directory       . is current directory
total 126          in long format                         .. is parent directory
drwxr-xr-x 13 ege   csci 1024 Apr 26 15:49 .
drwxr-xr-x 15 root root  512 Apr 24 15:18 ..
-rwxr--r--  1 ege   csci  885 Dec  2 13:07 .login        dot (.)
-rwx------  1 ege   csci  436 Apr 12 11:59 .profile      names
drwx------  7 ege   csci  512 May 17 14:11 330           are
drwx------  3 ege   csci  512 Mar 19 13:31 467           hidden
drwx------  2 ege   csci  512 Mar 31 10:16 Data          files
-rw-r--r--  1 ege   csci   80 Feb 27 12:23 quiz.txt
                                                          directories
```

File Type | Permissions | Links | Owner | Group | File Size | Last Mod | Filename | plain file

1.17 File System Commands

File System Commands

- Copying files or directories

  Syntax: **cp source(s) target**

  - source(s) is one or more items to copy
  - target is either name of copied item, or directory
  - commonly used options:
    - **-i** if "target" exists, then prompts for confirmation before overwriting
    - **-r** recursively copy entire directories
    - **-p** preserve access times and permission modes

- Moving files or directories

  Syntax: **mv source(s) target**

1.18 Renaming files or directories

Renaming files or directories

• use "mv"

Example: rename file "unix" to "csci330"

```
% mv unix csci330
```

Caveat:
  what happens if "csci330" exists and is a directory ?

1.19 Deleting files or directories

Deleting files or directories

Syntax: `rm path-list`
• Commonly used options:
  - `-f` force remove regardless of permissions
  - `-i` prompt for confirmation before removing
  - `-r` removes everything under the indicated directory
Example: remove file "old-assign"
  ```
  % rm unix/assign/old-assign
  ```

1.20 Linking Files

Linking Files

- Allows one file to be known by different names
- Link is a reference to another file stored elsewhere

- 2 types:
  - Hard link (default)
  - Symbolic link (a.k.a. "soft link")

Syntax: `ln [-s]  target  local`

1.21 Symbolic Link

Symbolic Link

- Refers to target file via path

- Created without checking the existence or permissions of target file
- Can be circular linked to another symbolic link
- Can cross physical file systems

1.22 Hard Link

Hard Link

- Refers to target file by its inode number
  - inode number of a file is unique only within physical device file system

- Checks for the existence of target file
- Other file continues to exist as long as at least one directory contains it
- Cannot link to a file in a different physical file system

1.23 Locating Files: find

Locating Files: find

Syntax: find path-list expression(s)

- "find" recursively descends through directories in path-list and applies expression to every file

Examples:
- find . -name "*.txt"
- find /tmp -empty -delete

1.24 Many more commands …

Many more commands …

- **touch**

  updates time stamp on file or directory,
  can be used to create new, empty file

- **cat**

  displays content of file(s)

- **more, less or pg**

  displays file contents one page at a time

1.25 … more commands …

… more commands …

- head

  displays the beginning portion of indicated file(s);
  the default head size is 10 lines

- tail

  displays the ending portion of indicated file(s)

- wc

  count file content

  common options:
  -l   display the number of lines
  -w   display the number of words
  -c   display the number of characters

1.26 Comparing Files: diff

Comparing Files: diff

- compare two files line by line

Syntax: `diff   [options]   file-1   file-2`

- reports a series of commands that can be used to convert the first file to the second file via the "`patch`" command

1.27 Compress File Contents

Compress File Contents

- utilities to compress and uncompress files
- common on Linux:
  - gzip, gunzip, zcat
  - file extension: .gz
- Example:
  ```
  % gzip assign1.txt
  % zcat assign1.txt.gz
  % gunzip assign1.txt.gz
  ```

Also:
bzip2
zip/unzip

1.28 Sorting Files

Sorting Files

Syntax: `sort   [options]   file-name`

- Commonly used options:
  - -r   sort in reverse order
  - -n   numeric sort
  - -t   field delimiter (default: blank)
  - -k   field1[,field2]
  - -f   ignore case

1.29 User's Disk Quota

User's Disk Quota

- quota is upper limit of
  - amount disk space
  - number of files

  for each user account

- command: quota -v
  - displays the user's disk usage and limits

- 2 kinds of limits:
  - Soft limit: ex. 100MB
    - Maybe exceeded for one week
    - System will nag
  - Hard limit: ex. 120MB
    - Cannot be exceeded

1.30 Sending Files to the Printer

Sending Files to the Printer

Syntax: `lpr   [options]   file`

- option `-P` to specify printer: lpcsl   (others: lpfrl)

Example:
```
% lpr   -P lpcsl   assign1.cc
```
- other commands:
  - `lpq`   show print job queue
  - `lprm`   remove job from queue

1.31 Summary

Summary

- shell is traditional command line user interface

- hierarchical organization of files

- basic commands to list and manipulate files