CS 35L: Software Construction Lab

Lab 6

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Week 1 Lecture 1

Course Logistics

- TR 12pm-1:50pm, BH 3760
- Office Hours: Tue 2pm-3pm and Wed 12pm-1pm (tentative), BH 3256S-A
- Course Website: https://web.cs.ucla.edu/classes/winter20/cs35L/
  - Syllabus, assignments, deadlines, grading policies
- Piazza: https://piazza.com/ucla/winter20/cs35l/home
- Email: hengda.shi@cs.ucla.edu
- Don’t buy Beaglebone yet (keep it for CS 111 if you already bought it).
- PTE

Grading Policy

- 10 Assignments (50%)
  - Assignments 2-9 and their schedule are tentative. Changes will be noted in news.
  - SEASnet account is mandatory, please create the account ASAP.
- Final Exam (50%)
  - Open book and open note
- Late penalty: 2^N% deduction for N days late
  - 1% for 0-1 day late, 2% for 1-2 day late, 4% for 2-3 day late, etc.
- Week 10 assignment (must be submitted on time)
  - 10 minutes presentation from selected CS news publications
  - 5 pages report (12pt Times New Roman font, double-spacing, one-inch margins all around)
  - A schedule signup sheet will be up later in the quarter
- Assignment 1 due on 13th Jan 23:55pm

SEASnet Account

- Create an account: https://www.seas.ucla.edu/acctapp/
- Connect to linux server
  - ssh <seasnet username>@lnxsrv07.seas.ucla.edu
  - lnxsrv06, lnxsrv07, lnxsrv09, or lnxsrv10
  - `export PATH="/usr/local/cs/bin:$PATH"`
- Or, install PuTTY SSH client (for Windows users) : Follow instructions on http://www.seasnet.ucla.edu/lnxsrv/

Syllabus

1. Introduction, files and editing
2. Commands and basic scripting
3. More scripting, VMs, and construction tools
4. Change management basics
5. Low-level construction and debugging
6. Systems programming
7. Faults, failures, errors, and holes
8. Security basics
9. Advanced change management
10. Trends in computing research and development

Introduction to Linux

What is Linux?

- Linux is a family of open source Unix-like operating systems
- Linux operating systems are based on linux kernel first released on Sep 17, 1991 by Linus Torvalds
- Kernel
  - The core of any operating systems
  - Allocate time and memory to programs
  - Allows communication between different processes: inter-process communication (IPC)
- Linux is typically packaged in Linux distributions
- Examples of Linux distributions: Ubuntu, centOS, RedHat, Debian, Arch
- Linux distribution = GUI + GNU utilities (cp, mv, ls etc…) + installation and management tools + GNU compilers (c/c++) + Editors(vi/emacs) + ….

What is an Operating System?

- Software program that enables computer hardware to communicate and operate with the computer software.
- Manages memory, processes, other softwares and hardwares
- Computer is useless without an OS!
- Brief history of Operating Systems: http://bit.ly/2QSdGxx

Multiuser and Multi-process Operating System

- Allow many users to work on the same computer at the same time (as long as they have their own terminal)
- Allows many processes, programs and applications to run simultaneously.
- Supports multiprocessing and multitasking
- Multitasking OS examples
  - Windows
  - Linux
  - Unix

Processes

- A computer program in action
- A process will be constantly changing as the machine code instructions are executed by processor.
- Each process is assigned a pid (process id)
- To see current processes running, use command `ps`
- To send signals to a process, use command `kill`
- To list all signals, use `kill -l`

Open Source Software

- What is an open source software?
- Source code is publicly available
- Modification by any individual is allowed on a global scale
- It is free for use
- Examples: Firefox, Android, Linux

CLI vs. GUI

CLI (Command Line Interface)

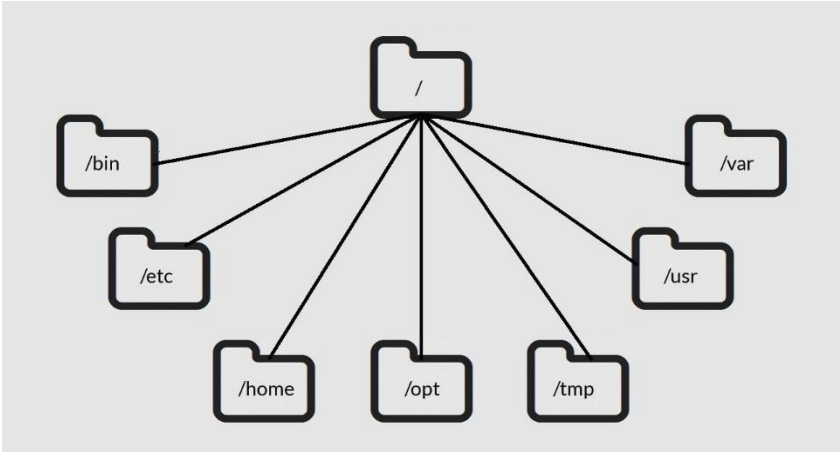
- Steep learning curve
- Pure control (e.g., scripting)
- Cumbersome multitasking
- Speed: Hack away at keys
- Convenient remote access

GUI (Graphical User Interface)

- Intuitive
- Limited Control
- Easy multitasking
- Limited by pointing
- Bulky remote access

Unix File System Layout

- Everything is a file
  - A wide range of I/O resources including documents, directories, hard-drives, modems, keyboards, printers, etc. are just streams of bytes exposed through file system namespace
  - No additional command is required to find your CPU information. The CPU information is kept in a file located in **/proc/cpuinfo**. Run command $ cat /proc/cpuinfo will give you the CPU information
  - More information: http://bit.ly/36zKWA8
- Absolute Path vs. Relative Path
  - Absolute Path starts with “/”, the root directory
  - e.g. /usr/bin/python, /usr/local/bin
  - Relative Path starts with everything else
  - e.g. ../../home/cs35l, ./cs35l
  - Relative Path is relative to the current directory



Shell

- Outermost layer around the kernel; hence called shell!
- Examples:
  - CLI shell in Windows:
    - Command Prompt
  - CLI shell in UNIX:
    - bash, zsh, fish, etc.

Linux Commands

Moving Around

- pwd: print working directory
- cd: change working directory
- ~: home directory
- .: current directory
- /: root directory, or directory separator
- ..: parent directory

Dealing with Files

- mv <source> <dest>: move/rename a file (no undos!)
- cp <source> <dest>: copy a file
- rm <file>: remove a file
- touch <file>: creates a file
- mkdir <directory>: make a directory
- rmdir <directory>: remove a directory
- ls [option] <directory>: 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
  - -h: show size with unit suffixes: Byte, Kilobyte, Megabyte, Gigabyte, Terabyte and Petabyte

File I/O and redirection

- cat <file>: print contents in file
  - cat /proc/cpuinfo
- echo <string>: print string or environment variables
  - echo “hello world”
  - echo $PATH
- > file: write stdout to a file
- >> file: append stdout to a file
- < file: use contents of a file as stdin

Mini-task with files

- Create two files
  - $ touch foo.txt
  - $ touch bar.txt
- Add text into the files and print it
  - echo "Cat" > foo.txt
  - echo "Dog" > bar.txt
  - cat foo.txt bar.txt (concatenates the output)
  - Output:

History

- <up arrow>: previous command
- <tab>: auto-complete
- !!: replace with previous command
- ![str]: refer to previous command with str
- ^[str]: replace with command referred to as str
- history: show a list of commands executed in the past

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*

File Permissions (cont'd)

- 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

- 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	read a file or list a directory's contents
w	write	write to a file or directory
x	execute	execute a file or recurse a directory tree

File Types

- Three types of files
  - Regular files
  - Special files (This category has 5 sub-types)
  - Directories
- How to identify file type?
  - ls -ld foo.txt
  - -rw-r--r-- 1 cs35lt6 taaccts 4 Jan 6 10:04 foo.txt

    ↑

    File type

  - The first character identifies the type of the file
  - **-** : regular file, **d** : directory, **c** : character device file, **b** : block device file, **s** : local socket file, **p** : named pipe, **l** : symbolic link

Documentations

- man command
- 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>
  - q - quit man page
  - /<KEYWORD> - search in man page
    - n - next occurrence
    - N - previous occurrence

ln command

- ln command make links between files
- Two types of links
  - Symbolic Links
    - Create a link to the original file
    - The link will not be able to point to the original file if the original got deleted
  - Hard Links
    - Create an actual mirrored copy of the original file
    - If the original file is removed, the linked file is unaffected

wh commands

- whatis <command>: returns name section of man page
- whereis <command>: locates the binary, source, and manual page files for a command
- which <command>: locates only the binary

find command

- -type: type of a file (e.g,, directory, symbolic link)
- -perm: permission of a file
- -name: name of a file
- -prune: don’t descend into a directory
- -o: or
- -ls: list current file

Linux Wildcards

- Asterisk (*) - matches one or more occurrences of a character
  - $ touch file1 file2 file3 # create three files named file1, file2, and file3
  - $ ls -la f* # list all files and directories start with character f
- Question Mark (?) - matches on a single occurrence of character
  - $ touch file1 file2 file3 f foo # create five files named file1, file2, file3, f, and foo
  - $ ls -la f? # no matches found
- Brackets ([]) - matches any single occurrence of characters in the bracket
  - $ touch fim flm film fm # create four files fim, flm, film, fm
  - $ ls -la f[il]m # output only fim and flm

Other Useful Commands

- diff - compare files line by line
- cmp - compare two files byte by byte
- wc - print newline, word, and byte counts for each file
- sort - sort or merge records (lines) of text and binary files
- head - display first lines of a file
- tail - display the last part of a file
- top - display and update sorted information about processes
- du - display disk usage statistics

Task 1 (Hint: use “wc” command)

- Create 2 .txt files and add multiple lines in each one of them
- Get the line count for each of these files

Assignment 1

- Submit on CCLE under your Lab <number> (if specified)
- No submissions will be accepted via email
- Test your files on seasnet linux server before submitting
- key1.txt should record keystrokes of Homework
- ans1.txt should have keystrokes and answers of the lab assignment
- For Lab 1.3, search programs under “/usr/bin”.