CSE 390a
Lecture 1

introduction to Linux/Unix environment

slides created by Marty Stepp, modified by Jessica Miller & Ruth Anderson
http://www.cs.washington.edu/390a/
Lecture summary

• Course introduction and syllabus

• Unix and Linux operating system

• Introduction to Bash shell
Course Staff

• Me:
  - Meg Campbell, meganca@cs
  - Office hours: Mon 10:30-11:30am, Thurs 11am-12pm, CSE 614
Course Introduction

• CSE390a
  ▪ Collection of tools and topics not specifically addressed in other courses that CSE majors should know
    • *nix command line interface (CLI), Shell scripting, compilation tools (makefiles), version control...
  ▪ Credit / No Credit course, determined by short weekly assignments and a “final” assignment
Operating systems

- What is an OS? Why have one?
- What is a Kernel?
Operating systems

- **operating system**: Manages activities and resources of a computer.
  - software that acts as an interface between hardware and user
  - provides a layer of abstraction for application developers

- **features provided by an operating system:**
  - ability to execute programs (and multi-tasking)
  - memory management (and virtual memory)
  - file systems, disk and network access
  - an interface to communicate with hardware
  - a user interface (often graphical)

- **kernel**: The lowest-level core of an operating system.
Unix

• brief history:
  - Multics (1964) for mainframes
  - Unix (1969)
  - K&R
  - Linus Torvalds and Linux (1992)

• key Unix ideas:
  - written in a high-level language (C)
  - virtual memory
  - hierarchical file system; "everything" is a file
  - lots of small programs that work together to solve larger problems
  - security, users, access, and groups
  - human-readable documentation included
On to Linux

LINUX: A TRUE STORY:
WEEK ONE
Hey, it's your cousin I got a new computer but don't want Windows. Can you help me install "Linux"?

Sure.

WEEK TWO
It says my XORG is broken. What's an "XORG"? Where can I look that up?

Hmm, lemme show you man pages.

WEEK SIX
Due to auto-config issues, I'm leaving Ubuntu for Debian.

Uh or Gentoo. Uhoh.

WEEK TWELVE
You haven't answered your phone in days. Can't sleep. Must compile kernel.

I'm too late.

Parents: talk to your kids about Linux... before somebody else does.

Courtesy XKCD.com
Linux

• **Linux**: A kernel for a Unix-like operating system.
  - commonly seen/used today in servers, mobile/embedded devices, ...

• **GNU**: A "free software" implementation of many Unix-like tools
  - many GNU tools are distributed with the Linux kernel

• **distribution**: A pre-packaged set of Linux software.
  - examples: Ubuntu, Fedora

• **key features of Linux**:  
  - **open source software**: source can be downloaded  
  - free to use  
  - constantly being improved/updated by the community
Linux Desktop

- X-windows
- window managers
- desktop environments
  - Gnome
  - KDE

- How can I try out Linux?
  - CSE basement labs
  - at home (install Linux via Live CD, virtual machine, etc.)
  - attu shared server

- The Linux help philosophy: "RTFM" (Read the F***ing Manual)
Things you can do in Linux

- Load the course web site in a browser
- Install and play games
- Play MP3s
- Edit photos
- IM, Skype
• **shell**: An interactive program that uses user input to manage the execution of other programs.
  - A command processor, typically runs in a text window.
  - User types commands, the shell runs the commands
  - Several different shell programs exist:
    - bash: the default shell program on most Linux/Unix systems
    - We will use bash
    - Other shells: Bourne, csh, tsch

• Why should I learn to use a shell when GUIs exist?
Why use a shell?

Why should I learn to use a shell when GUIs exist?

- faster
- work remotely
- programmable
- customizable
- repeatable
Shell commands

<table>
<thead>
<tr>
<th>command</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>exit</td>
<td>logs out of the shell</td>
</tr>
<tr>
<td>ls</td>
<td>lists files in a directory</td>
</tr>
<tr>
<td>pwd</td>
<td>outputs the current working directory</td>
</tr>
<tr>
<td>cd</td>
<td>changes the working directory</td>
</tr>
<tr>
<td>man</td>
<td>brings up the manual for a command</td>
</tr>
</tbody>
</table>

$ pwd
/home/iws/rea
$ cd CSE390
$ ls
file1.txt  file2.txt
$ ls -l
-rw-r--r-- 1 rea  fac_cs 0 2012-03-29 17:45 file1.txt
-rw-r--r-- 1 rea  fac_cs 0 2012-03-29 17:45 file2.txt
$ cd ..
$ man ls
$ exit
## Relative directories

<table>
<thead>
<tr>
<th>directory</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.</td>
<td>the directory you are in (&quot;working directory&quot;)</td>
</tr>
<tr>
<td>..</td>
<td>the parent of the working directory (..../.. is grandparent, etc.)</td>
</tr>
<tr>
<td>~</td>
<td>your home directory</td>
</tr>
<tr>
<td>~username</td>
<td>username's home directory</td>
</tr>
<tr>
<td>~/Desktop</td>
<td>your desktop</td>
</tr>
</tbody>
</table>
### Directory commands

<table>
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<td>ls</td>
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<tr>
<td>pwd</td>
<td>output the current working directory</td>
</tr>
<tr>
<td>cd</td>
<td>change the working directory</td>
</tr>
<tr>
<td>mkdir</td>
<td>create a new directory</td>
</tr>
<tr>
<td>rmdir</td>
<td>delete a directory (must be empty)</td>
</tr>
</tbody>
</table>

- some commands (cd, exit) are part of the shell ("builtins")
- others (ls, mkdir) are separate programs the shell runs
Shell commands

- many accept **arguments** or **parameters**
  - example: `cp` (copy) accepts a source and destination file path

- a program uses 3 streams of information:
  - stdin, stdout, stderr (standard in, out, error)

- **input**: comes from user's keyboard
- **output**: goes to console
- **errors** can also be printed (by default, sent to console like output)

- parameters vs. input
  - **parameters**: before Enter is pressed; sent in by shell
  - **input**: after Enter is pressed; sent in by user
Command-line arguments

- most options are a - followed by a letter such as -c
  - some are longer words preceded by two - signs, such as --count

- options can be combined: `ls -l -a -r` can be `ls -lar`

- many programs accept a --help or -help option to give more information about that command (in addition to man pages)
  - or if you run the program with no arguments, it may print help info

- for many commands that accept a file name argument, if you omit the parameter, it will read from standard input (your keyboard)
Shell/system commands

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>man or info</td>
<td>get help on a command</td>
</tr>
<tr>
<td>clear</td>
<td>clears out the output from the console</td>
</tr>
<tr>
<td>exit</td>
<td>exits and logs out of the shell</td>
</tr>
<tr>
<td>date</td>
<td>output the system date</td>
</tr>
<tr>
<td>cal</td>
<td>output a text calendar</td>
</tr>
<tr>
<td>uname</td>
<td>print information about the current system</td>
</tr>
</tbody>
</table>

- "man pages" are a very important way to learn new commands
  - `man ls`
  - `man man`
File commands

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>cp</td>
<td>copy a file</td>
</tr>
<tr>
<td>mv</td>
<td>move or rename a file</td>
</tr>
<tr>
<td>rm</td>
<td>delete a file</td>
</tr>
<tr>
<td>touch</td>
<td>create a new empty file, or update its last-modified time stamp</td>
</tr>
</tbody>
</table>

- caution: the above commands do not prompt for confirmation
  - easy to overwrite/delete a file; this setting can be overridden (how?)

- Exercise: Given several albums of .mp3 files all in one folder, move them into separate folders by artist.
- Exercise: Modify a .java file to make it seem as though you finished writing it on Dec 28 at 4:56am.
Exercise Solutions

- caution: the cp, rm, mv commands do not prompt for confirmation
  - easy to overwrite/delete a file; this setting can be overridden (how?)
    - Use "-i" with the command, “interactive” to prompt before overwrite

- Exercise: Given several albums of .mp3 files all in one folder, move them into separate folders by artist.
  - mkdir U2
  - mkdir PSY
  - mkdir JustinBieber
  - mv GangnamStyle.mp3 PSY/
  - mv Pride.mp3 U2/

- Exercise: Modify a .java file to make it seem as though you finished writing it on Dec 28 at 4:56am.
  - touch -t 201212280456 Hello.java