CSE 390a
Lecture 1

introduction to Linux/Unix environment

slides created by Marty Stepp, modified by Jessica Miller
http://www.cs.washington.edu/390a/

Lecture summary

- Course introduction and syllabus
- Unix and Linux operating system
- introduction to Bash shell

Course Introduction

- Me:
  - Jessica Miller, jessica@cs
  - Office hours: TBA

- 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

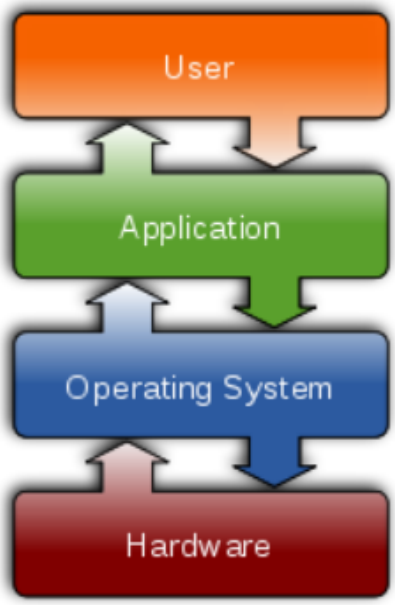
Operating systems

- 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

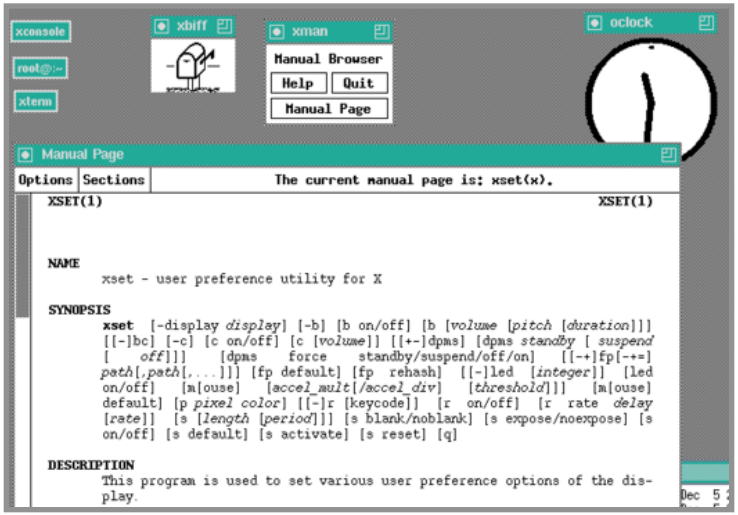
- features provided by an operating system:
  - ability to execute programs (and multi-tasking)
  - memory management (and virtual memory)
  - file systems, disk and network access
  - an interface to communicate with hardware
  - a user interface (often graphical)



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

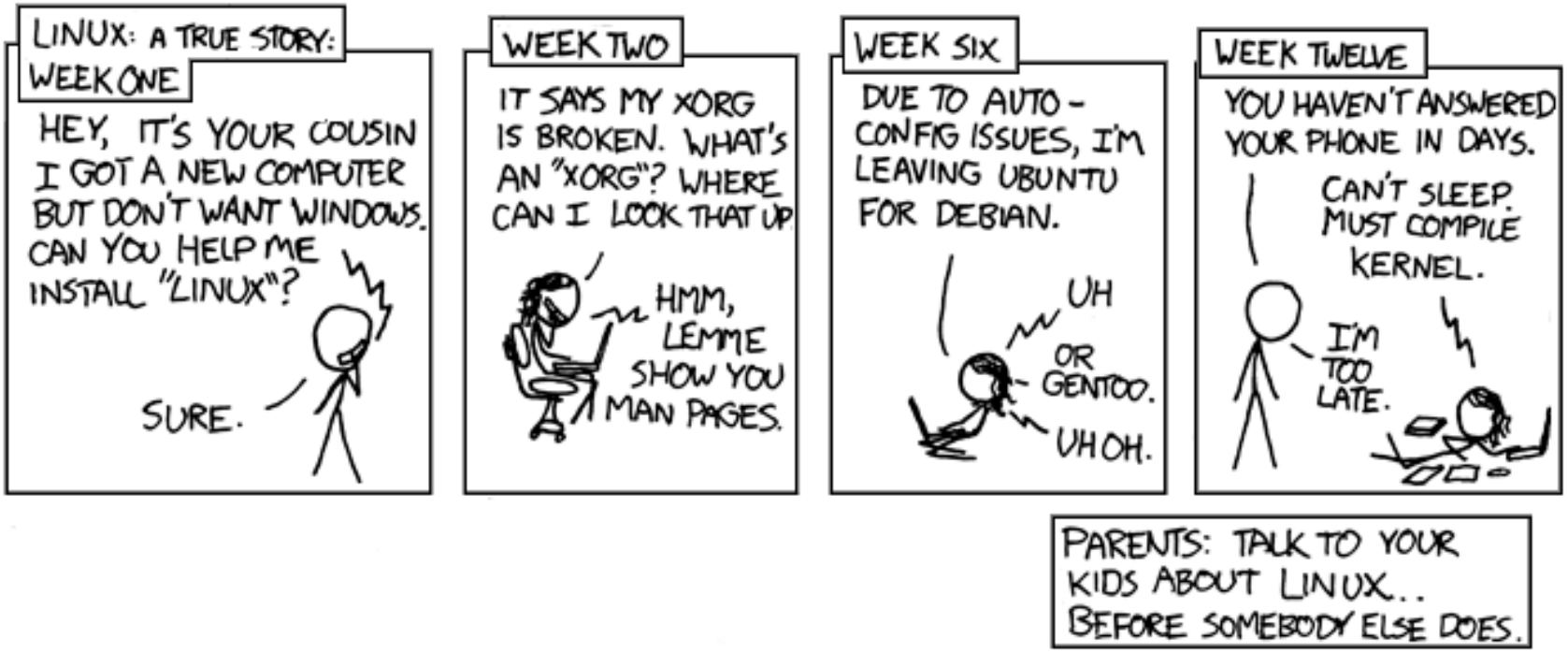
Unix

- 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



Courtesy XKCD.com

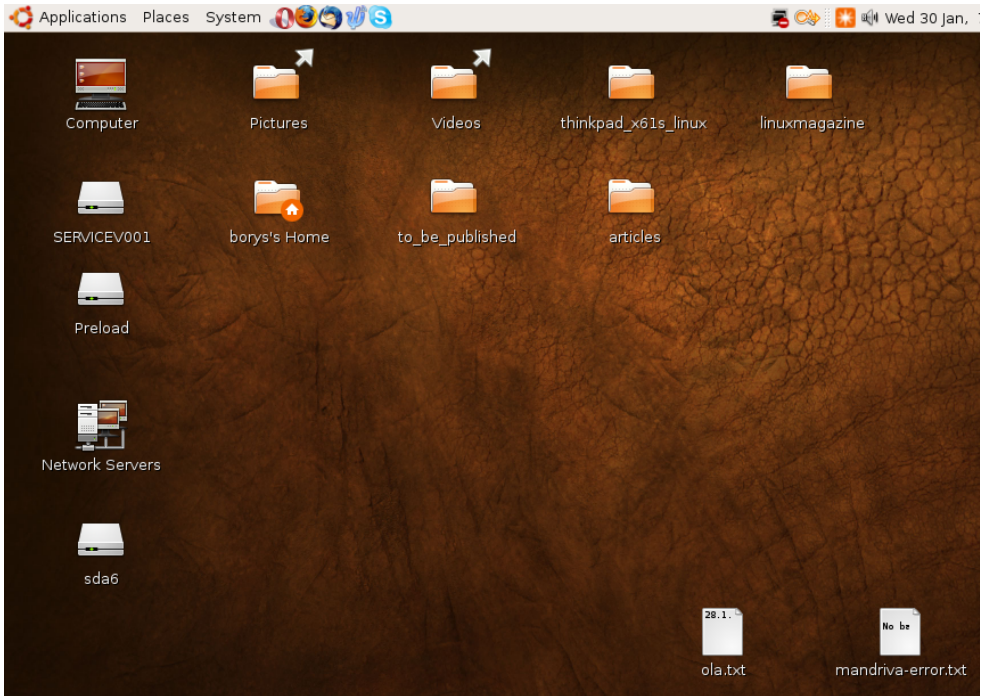
Linux

- **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

Features of Linux

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



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

- The Linux help philosophy: "RTFM" (Read the F***ing Manual)

Exercises

- Install Linux and boot it up successfully.
- Load the course web site in Linux.
- Install a new game on Linux and play it.
- Get Linux to play an MP3.

Shell

- **shell**: An interactive program that uses user input to manage the execution of other programs.
  - `bash` : the default shell program on most Linux/Unix systems

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

Shell

- **shell**: An interactive program that uses user input to manage the execution of other programs.
  - `bash` : the default shell program on most Linux/Unix systems

- Why should I learn to use a shell when GUIs exist?
  - faster
  - work remotely
  - programmable
  - customizable
  - repeatable

- input, output, and errors
- directories: working/current directory, home directory

Shell commands

command	description
`exit`	logs out of the shell
`ls`	lists files in a directory
`pwd`	outputs the current working directory
`cd`	changes the working directory
`man`	brings up the manual for a command

```
$ pwd
/homes/iws/dravir
$ cd CSE390
$ ls
file1.txt file2.txt
$ ls -l
-rw-r--r-- 1 dravir vgrad_cs 0 2010-03-29 17:45 file1.txt
-rw-r--r-- 1 dravir vgrad_cs 0 2010-03-29 17:45 file2.txt
$ cd ..
$ man ls
$ exit
```

Relative directories

directory	description
`.`	the directory you are in ("working directory")
`..`	the parent of the working directory (`../..` is grandparent, etc.)
`~`	your home directory (on many systems, this is `/home/`***`username`***)
`~`***`username`***	***`username`***'s home directory
`~/Desktop`	your desktop

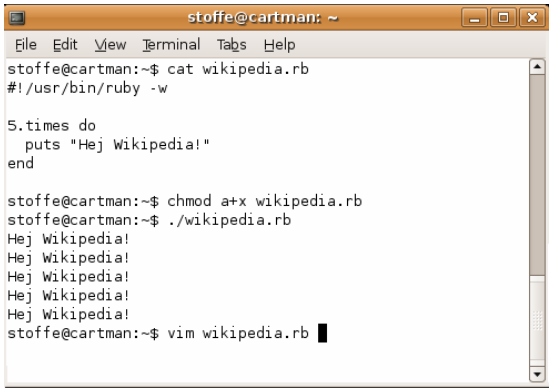
Directory commands

command	description
`ls`	list files in a directory
`pwd`	output the current working directory
`cd`	change the working directory
`mkdir`	create a new directory
`rmdir`	delete a directory (must be empty)

- 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`
- parameters can be combined: `ls -l -a -r` can be `ls -lar`
- many programs accept a `--help` or `-help` parameter 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 parameter, if you omit the parameter, it will read from standard input (your keyboard)
  - note that this can conflict with the previous tip

Shell/system commands

command	description
`man or info`	get help on a command
`clear`	clears out the output from the console
`exit`	exits and logs out of the shell

command	description
`date`	output the system date
`cal`	output a text calendar
`uname`	print information about the current system

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

```
man ls
man man
```

File commands

command	description
`cp`	copy a file
`mv`	move or rename a file
`rm`	delete a file
`touch`	create a new empty file, or update its last-modified time stamp

- 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 March 15 at 4:56am.