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# CSE 390a

## Lecture 1

introduction to Linux/Unix environment

slides created by Marty Stepp, modified by Josh Goodwin

<http://www.cs.washington.edu/390a/>

# Lecture summary

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

# Course Introduction

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- Me:
  - Josh Goodwin, dravir@cs
  - Office hours: Thursdays 1:30-2:30 CSE216
- CSE390a
  - Replaces what used to be CSE303
  - Collection of tools and topics not specifically addressed in other courses that CSE majors should know
    - \*nix CLI, Shell scripting, compilation tools (makefiles), version control...
  - Credit / No Credit course, determined by short weekly assignments and a final exam

# Operating systems

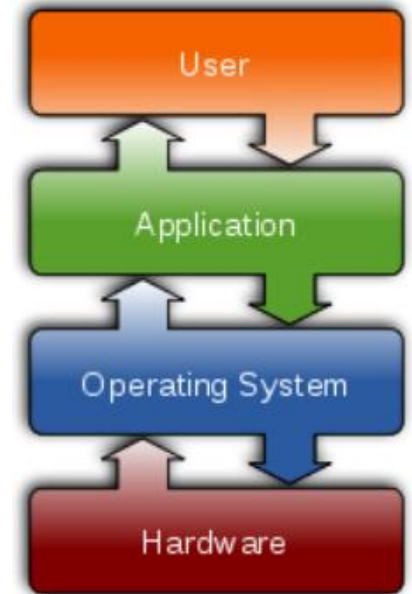
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- What is an OS? Why have one?
- What is a Kernel?

# Operating systems

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- **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:

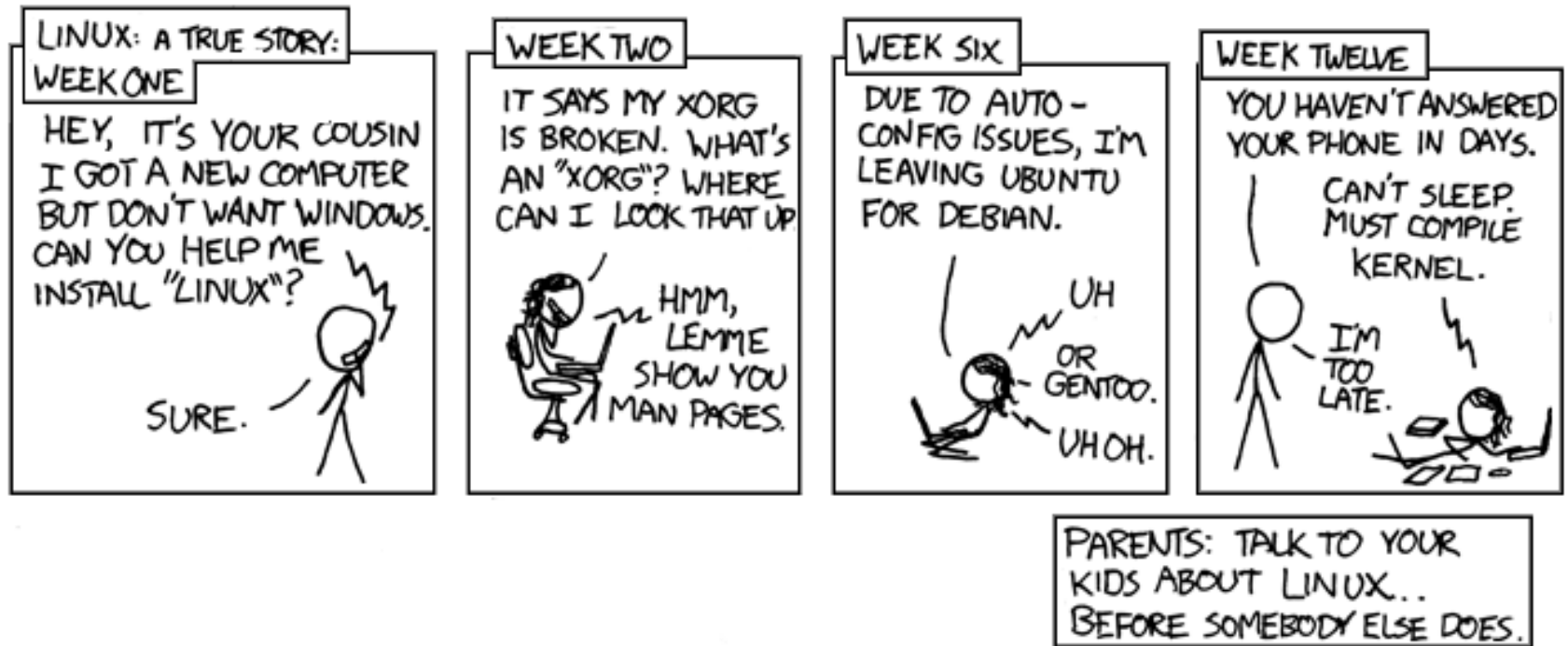
- written in a high-level language (C)
- virtual memory
- hierarchical file system; "everything" is a file
- lots of small programs that work together to solve larger problems
- security, users, access, and groups
- human-readable documentation included



The screenshot shows a classic X Window System desktop. At the top, there are several window titles: 'xconsole', 'xbiff', 'xman', and 'oclock'. The 'xman' window is active and displays the manual page for 'xset(1)'. The manual page content is as follows:

```
XSET(1) XSET(1)
NAME
    xset - user preference utility for X
SYNOPSIS
    xset [-display display] [-b] [b on/off] [b [volume [pitch [okration]]
    [[-]bc] [-c] [c on/off] [c [volume]] [[+]-]dps] [dps standby [ suspend
    [ off]]] [dps force standby/suspend/off/on] [[-+]fp[+]=]
    path[,path,...]]] [fp default] [fp rehash] [[-]led integer] [led
    on/off] [a[mouse] {accel_mult[/accel_div] [threshold]]] [a[mouse]
    default] [p pixel color] [[-]r [keycode]] [r on/off] [r rate delay
    [rate]] [s [length [period]]] [s blank/noblank] [s expose/noexpose] [s
    on/off] [s default] [s activate] [s reset] [q]
DESCRIPTION
    This program is used to set various user preference options of the dis-
    play.
Dec 5
```

# On to Linux



Courtesy XKCD.com

# Linux

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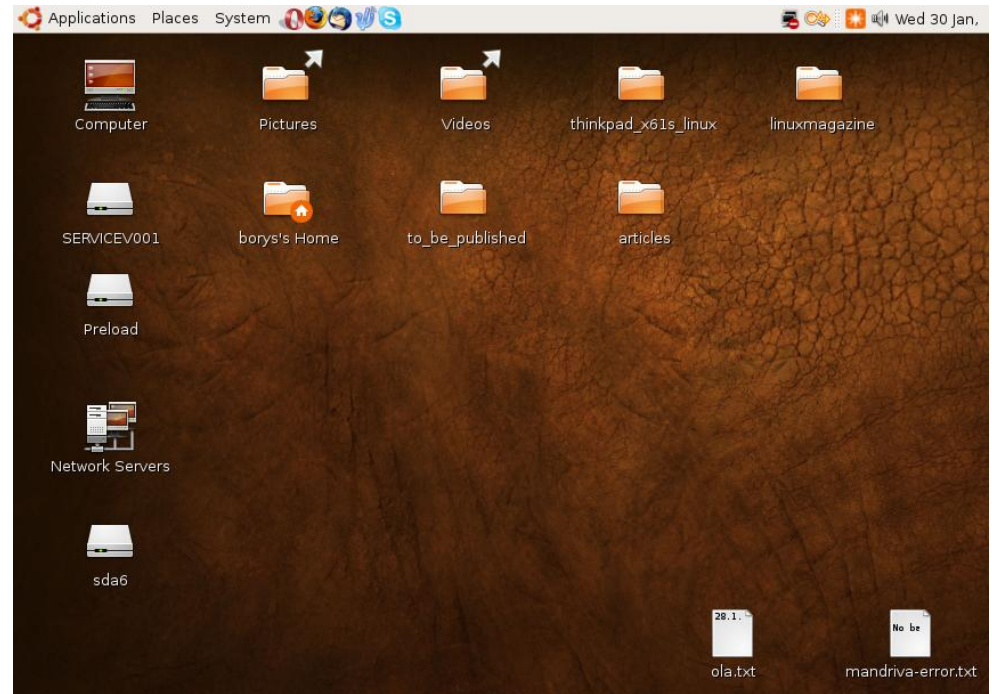
- **Linux:** A kernel for a Unix-like operating system.
  - commonly seen/used today in servers, mobile/embedded devices, ...
- **GNU:** A "free software" implement of many useful Unix-like tools.
  - many GNU tools are distributed with the Linux kernel
- **distribution:** A pre-packaged set of Linux 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 (Live CD, VirtualBox, etc.)
- The Linux help philosophy: "RTFM" (Read the F\*\*\*ing Manual)



# Exercises

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- 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

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- **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

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- **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

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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
```

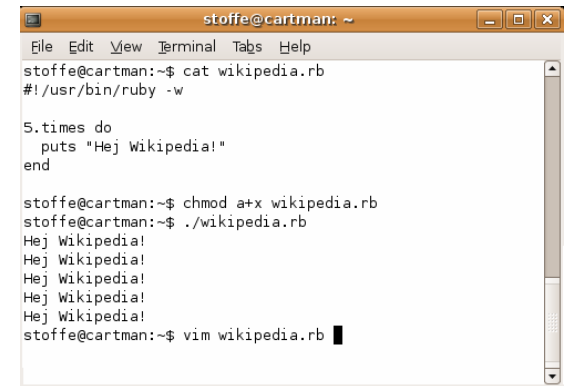
# Relative directories

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/ <i>username</i> )
~ <i>username</i>	<i>username</i> 's home directory
~/Desktop	your desktop

# Shell commands

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- 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



```
stoffe@cartman: ~  
File Edit View Terminal Tabs Help  
stoffe@cartman:~$ cat wikipedia.rb  
#!/usr/bin/ruby -w  
  
5.times do  
  puts "Hej Wikipedia!"  
end  
  
stoffe@cartman:~$ chmod a+x wikipedia.rb  
stoffe@cartman:~$ ./wikipedia.rb  
Hej Wikipedia!  
Hej Wikipedia!  
Hej Wikipedia!  
Hej Wikipedia!  
Hej Wikipedia!  
Hej Wikipedia!  
stoffe@cartman:~$ vim wikipedia.rb
```

# Directory commands

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command	description
<code>ls</code>	list files in a directory
<code>pwd</code>	output the current working directory
<code>cd</code>	change the working directory
<code>mkdir</code>	create a new directory
<code>rmdir</code>	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



# Command-line arguments

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- 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

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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

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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.