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# 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

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

# Course Staff

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- Me:
  - Ruth Anderson, rea@cs
  - Office hours in CSE 460:
    - Mon 2:30-3:30pm,
    - Tues 11am-noon,
    - and by appointment

# Course Introduction

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- CSE390a
  - Collection of tools and topics not specifically addressed in other courses that CSE majors should know
  - CSE 351 may be the first course you take that uses Linux
  - Course Topics: Linux 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

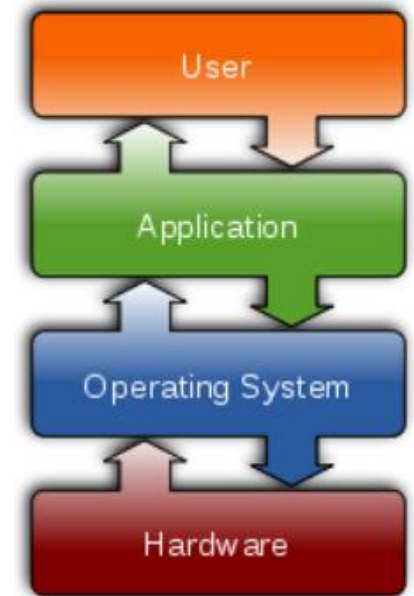
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- What is an OS? Why have one?
- What is a Kernel?

# 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.



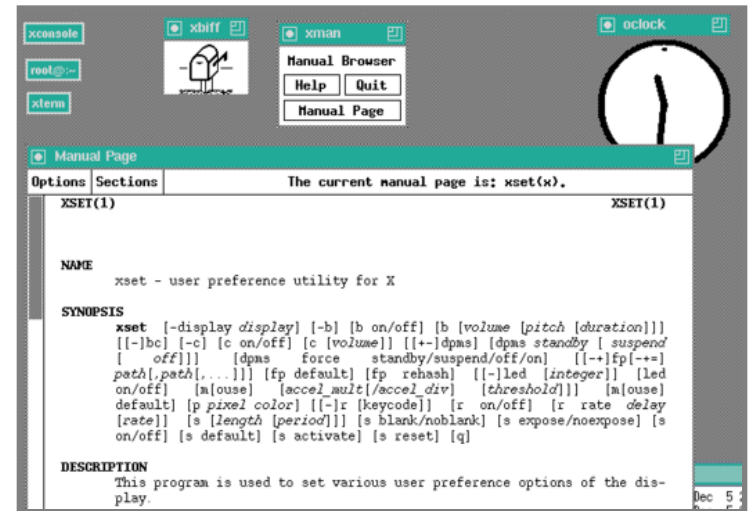
# Unix

- brief history:

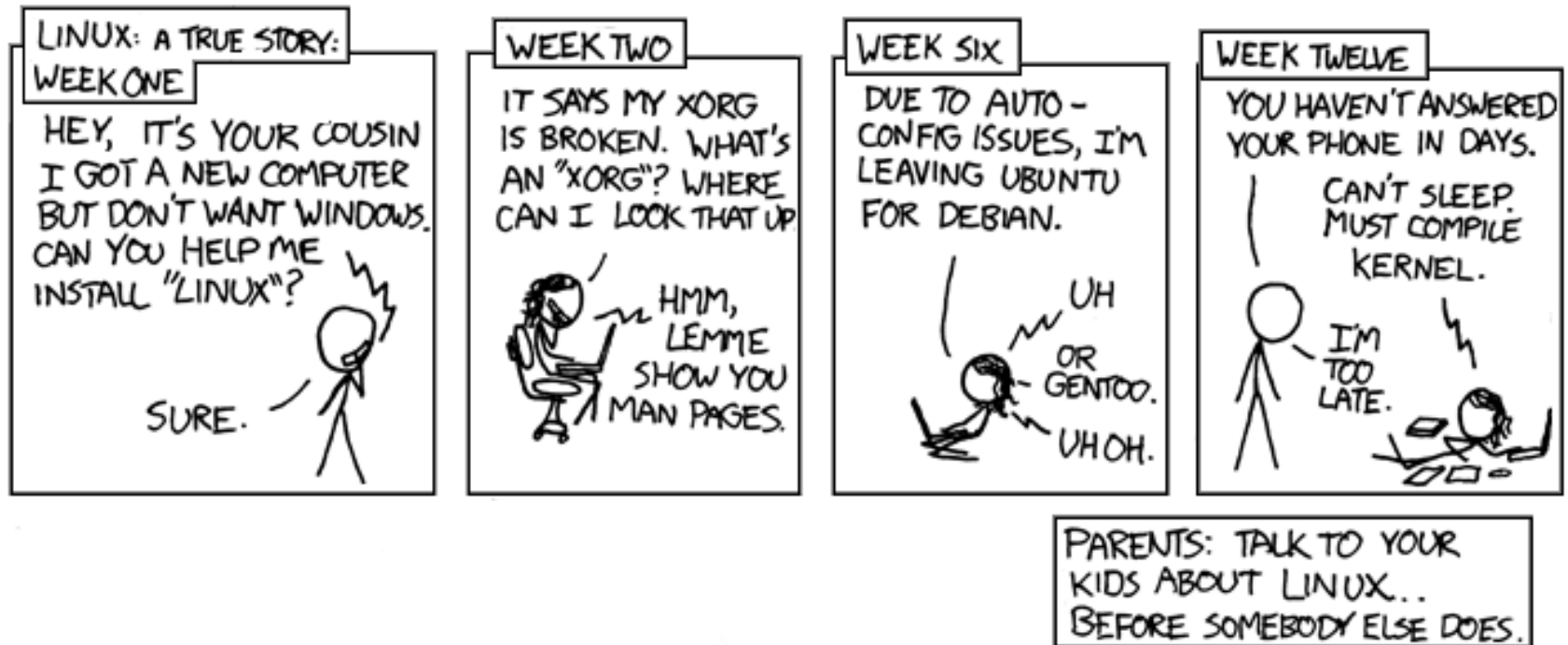
- Multics (1964) for mainframes
- Unix (1969)
- K&R
- Linus Torvalds and Linux (1992)

- 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



# On to Linux



Courtesy XKCD.com



# Linux

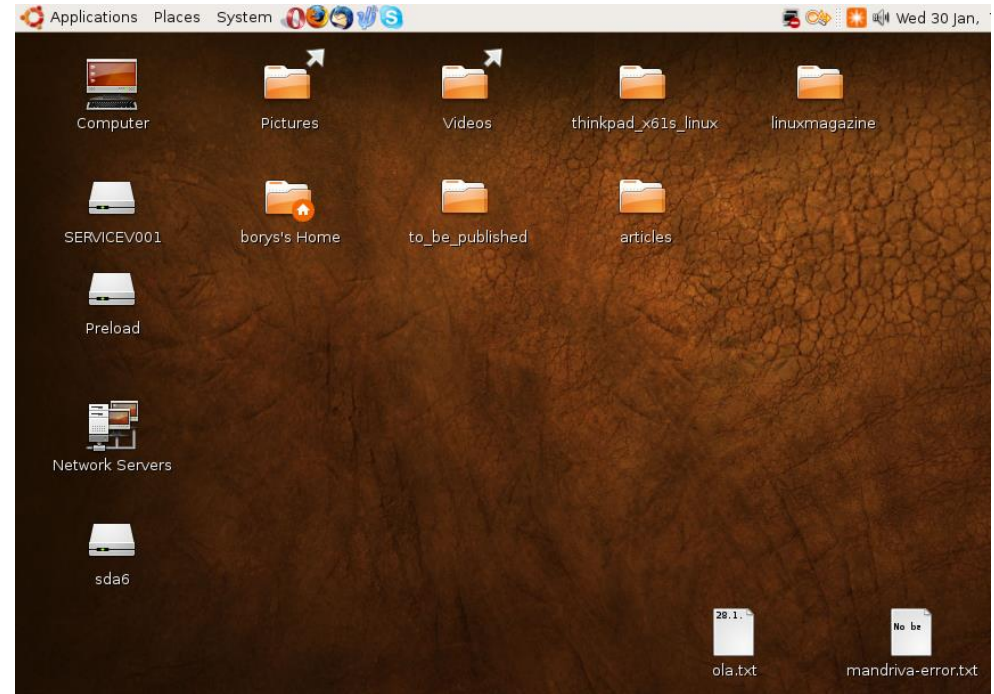
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- **Linux:** A kernel for a Unix-like operating system.
  - commonly seen/used today in servers, mobile/embedded devices, ...
- **GNU:** A "free software" implementation of many Unix-like tools
  - many GNU tools are distributed with the Linux kernel
- **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 Virtual machine
  - CSE basement labs
  - attu shared server



# Things you can do in Linux

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- Load the course web site in a browser
- Install and play games
- Play MP3s
- Edit photos
- IM, Skype

# Shell

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- **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?

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

# 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/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

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

# 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)

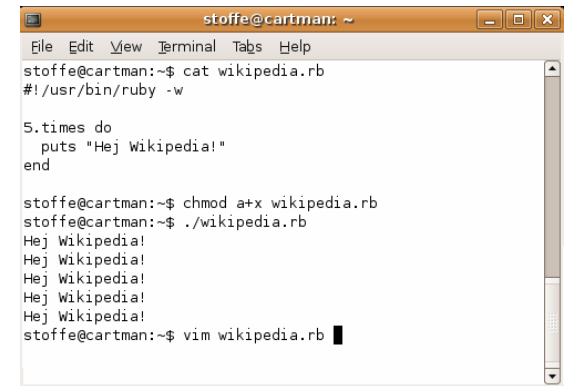
- some commands (`cd`, `exit`) are part of the shell ("builtins")
- others (`ls`, `mkdir`) are separate programs the shell runs



# 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
```

# 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
- 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

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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 Dec 28 at 4:56am.

# Exercise Solutions

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- 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`