CS2042 - Unix Tools

Fall 2010

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based on slides by David Slater

September 8, 2010

Course Information

- **When**: September 8th - October 4rd; 3 times a week
- **Where**: MWF 12:20 - 1:10 in Phillips 203
- **Drop Deadline**: September 15th, one week into the course
- Passing grade for completing all assignments successfully

Course Information

- Office Hours: ??
- Email: hussam at cs.cornell.edu
- Website: **http://www.cs.cornell.edu/courses/cs2042/**
  - Still waiting on server permission
- CMS: **http://cms.csuglab.cornell.edu**
- If you preregistered you should be on CMS

Course Goals

- Overall Goal: Gain an understanding of the Unix environment and simple shell scripts
- More specifically
  - Files
  - Security
  - Text Processing
  - Regular Expressions
  - The Shell Environment
  - A variety of Shell commands
  - Basic Shell Scripting

Prerequisites

- Not assuming any previous experience with the UNIX environment
- Basic understanding of programming helpful
  - (but probably not even necessary)

What Is Unix?

- One of the first widely-used operating systems
- Basis for many modern OSes
- Helped set the standard for multi-tasking, multi-user systems
- Strictly a teaching tool (in its original form)

Short history of UNIX

'60s The ambitious project **MULTICS** (Multiplexed Information and Computing System) fails, but a number of seminal ideas (like pipes and shells) are proposed

'69 Ken Thompson, Dennis Ritchie (et al.) start working on a file system, and name their system UNICS, which is later changed to UNIX.

- UNIX was "small, simple and clean", and distributed freely to many universities, where it becomes popular

Short history of UNIX

'73 Thompson and Ritchie rewrote UNIX in C (while most of the operating systems at that time were written in assembly)

'81 Berkley UNIX 4.1 BSD: vi, C shell, virtual memory

'91 Linux, GNU, and others: similar to UNIX, but their source code rewritten, very popular and widespread, free

- Currently, X/Open is responsible for developing UNIX
- Many Linux Distributions: Ubuntu, Fedora, Debian, ...

Current UNIX Flavors

- Berkeley Software Distribution (BSD)
- Suns Solaris
- GNU/Linux
- Apple OSX

Berkeley Software Distribution

- Developed by students and faculty at UC Berkeley
- Forked from the proprietary version back in the 80s
- Has since split into many additional flavors - namely,
- NetBSD, OpenBSD, and FreeBSD
- Spawned a popular open-source software license (the BSD License!)
- Primary competitor to Linux among free OSes

Solaris

- Commercial offshoot of BSD
- Designed to run on Suns SPARC servers, since ported to x86
- Most of the source code was recently released for the OpenSolaris project

Linux!

- Pieced together by a Finnish guy named Linus Torvalds
- starting in 1991
- Built over the internet using message boards (Usenet)
- Designed to a UNIX-like standard, but not a direct descendant

Note:

Linux technically only refers to the OSs core, or kernel - without other programs it cant really do anything.

GNU

GNU = Gnu is Not Unix

- Movement in the 80s to build a free OS
- Created many very popular tools
- Unix like but uses no Unix code

Stallman says:

There really is a Linux, and these people are using it, but it is just a part of the system they use. Linux is the kernel: the program in the system that allocates the machines resources to the other programs that you run. Linux is normally used in combination with the GNU operating system: the whole system is basically GNU with Linux added, or GNU/Linux.

GNU/Linux

Like BSD, GNU/Linux has a variety of flavors called "distributions". These versions generally have different design goals (security, speed, desktop use) and package a unique set of tools with the kernel to achieve them.

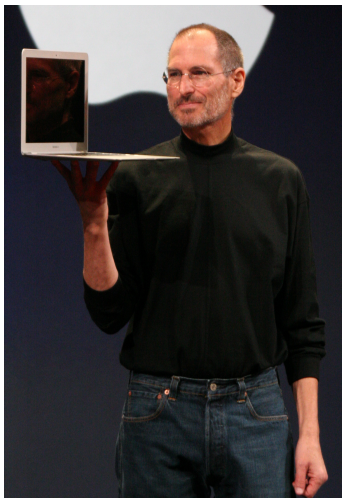
- Hundreds of distributions
- Popular distributions include RedHat, Ubuntu, SuSE, Slackware, Gentoo

Saying "GNU/Linux" every time is tedious, so we will just refer to the entire system as "Linux".

Apple OSX

built using a BSD-based kernel which was renamed "Darwin"

- Arguably the most popular desktop version of UNIX
- A pretty, easy to use experience built on a powerful frame



Steve Jobs Says:

What can the fully compliant UNIX technology in Leopard do? It can run any POSIX-compliant source code. Help you make the most of multicore systems. Put a new tabbed-interface Terminal at your fingertips. Introduce a whole host of new features that make life easier for every developer. Really, what cant it do?

Advantages/Disadvantages: BSD

Pros

- Reliable and very secure
- Usable on almost anything that uses electricity
- Most flexible license
- Free!

Cons

- Least community/professional support
- Many flavors to choose from
- You thought Linux was for nerdy outsiders?!

Advantages/Disadvantages: Solaris

Pros

- Built specifically for the hardware it runs on
- Scales really well as system size/load increases
- Lots of support from Sun as well as the community

Cons

- You are paying for Sun's support and probably the hardware
- Primarily for server use, not super desktop-friendly

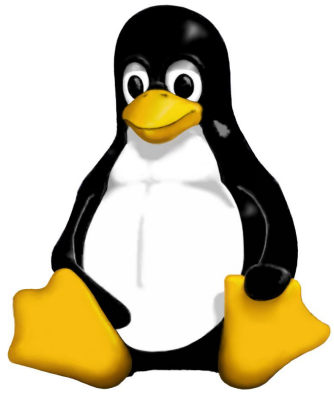
Advantages/Disadvantages: Linux

Pros

- Huge community support base
- Free (unless you want professional support)
- Free software to do almost anything
- "`wine`" allows you to run almost any windows program
  - (even WoW if you are into that sort of thing)

Cons

- Dizzying array of distribution choices
- Lacks some widely-used software (Office, Photoshop etc)



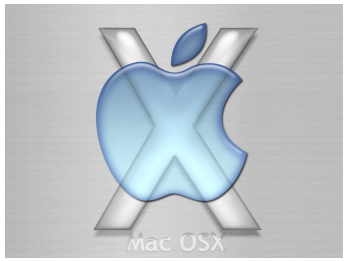
Advantages/Disadvantages: OSX

Pros

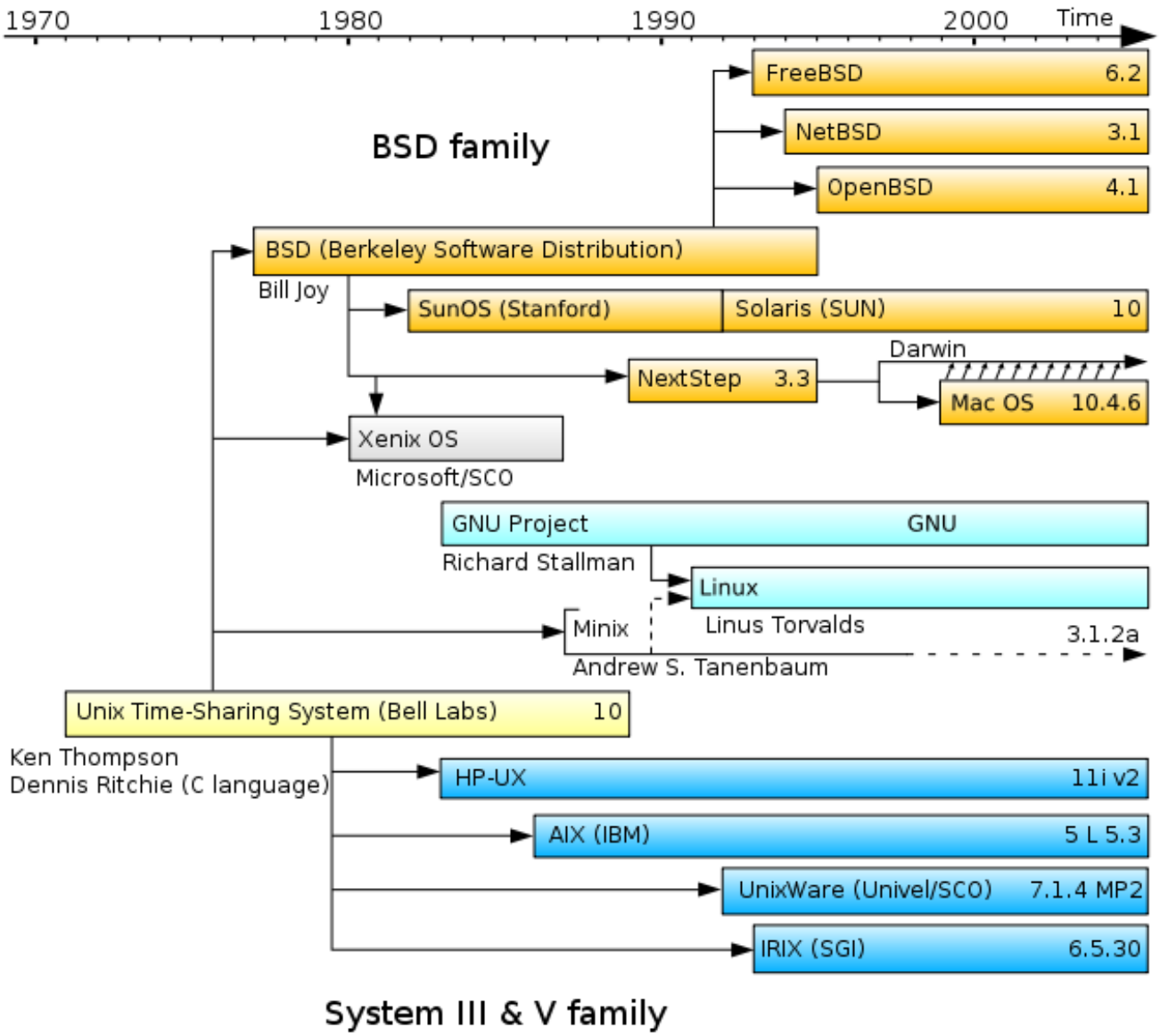
- User friendly and just works
- Fully-featured GUI with a powerful terminal
- Supports most of the software the others lack

Cons

- Definitely paying for this one!
- Closed-source, not as flexible as Linux
- Only runs on hardware purchased from Apple (without breaching the EULA)



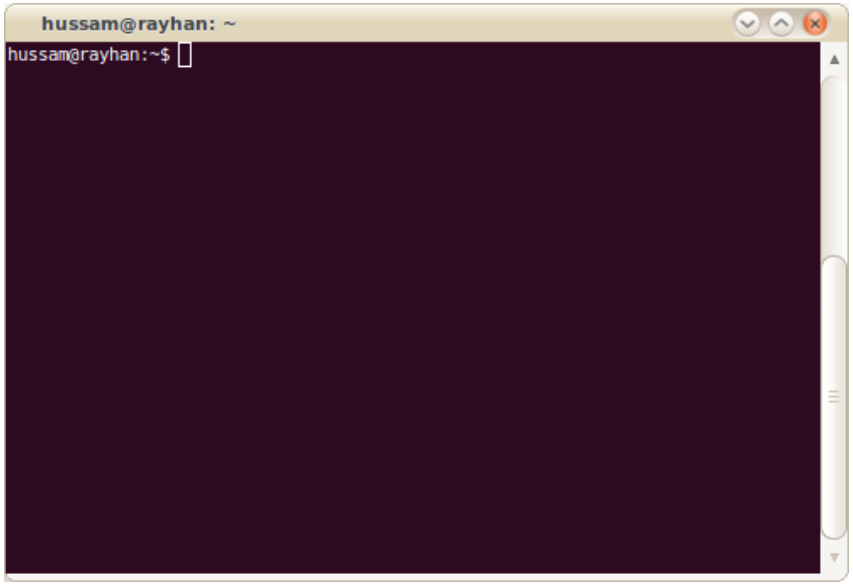
RoadMap


1970
1980
1990
2000
Time
FreeBSD 6.2
NetBSD 3.1
OpenBSD 4.1
BSD family
BSD (Berkeley Software Distribution)
Bill Joy
SunOS (Stanford)
Solaris (SUN) 10
Darwin
NextStep 3.3
Mac OS 10.4.6
Xenix OS
Microsoft/SCO
GNU Project
GNU
Richard Stallman
Linux
Linus Torvalds
Minix
3.1.2a
Andrew S. Tanenbaum
Unix Time-Sharing System (Bell Labs) 10
Ken Thompson
Dennis Ritchie (C language)
HP-UX 11i v2
AIX (IBM) 5 L 5.3
UnixWare (Univel/SCO) 7.1.4 MP2
IRIX (SGI) 6.5.30
System III & V family

Why Linux?

- IT'S FREE
- More widely used than BSD or Solaris
- Easy to find beginner's guides online if you need them
- Basic tools are pretty much standardized

What is the course about?



Powerful text based program launcher. We will learn how to string together simple programs to perform powerful tasks

Unix shells

A shell is a program that allows the user to interact with the UNIX system:

- read user's input and parses it
- evaluates special characters
- setup pipes, redirections, and background processing
- find and setup programs for execution

For Example...

Help, all my images are named wrong!

2007-09-24-picturename.jpg

should be

24-09-2007-picturename.jpg

```
for fn in *.jpg
  do mv $fn `echo $fn |\
  sed `s/([0-9]+)-([0-9]+)-([0-9]+)/\3-\2-\1/'`
done
```

For Example...

What commands do I use most?

```
history | awk '{print $2}' | sort | uniq -c | sort -nr |head

229 screen
146 exit
136 ls
81 vi
64 w
47 math
43 cp
33 cd
25 who

23 history
```

Unix Shells

There are primarily two "families" of unix shells:

- Bourne shell (AT&T) *sh* $\Rightarrow$ *ksh* $\Rightarrow$ *bash*
- C shell (Berkley) *csh* $\Rightarrow$ *tcsh*
- We focus on bash: easy syntax and default in many systems

Getting to a UNIX Shell

If you are registered for the course, you have an account with the CS undergrad lab. To access it go to

http://www.csuglab.cornell.edu/userinfo/

You can ssh into the machines in the lab. Instructions are available at the csuglab webpage. For windows machines,can use Putty (free) or Secure Shell (not free) to connect. If you are using any other system you should have the simple tool `ssh`:

Example Login:

```
ssh ha232@linus.csuglab.cornell.edu
```

Installing Linux on your machine

Most modern Linux distros (distributions) are easy to install.

- Disk repartitioning and dual boot automatically set up for you (so you can have Windows and Linux side by side)
- To install Linux:
  1. Download a Linux iso file (CD image file)
     - www.opensuse.org
     - www.ubuntu.com
     - www.fedoraproject.org
  2. Burn the iso image into a CD
  3. Boot your computer from the CD and follow the simple install wizard
  4. Enjoy! :-)

Other Options

If you have a windows machine, there are a few other options:

- cygwin: a Linux-like environment for Windows (http://www.cygwin.com/)
- wubi: Ubuntu Linux installer for windows. Can dual boot windows and ubuntu without repartitioning (http://wubi-installer.org/)
- any linux live cd (http://www.livecdlist.com)
- Linux on a flash drive!
- VMWare: run any Unix environment within windows

None of the assignments "should" require you to be logged into the csug machines.