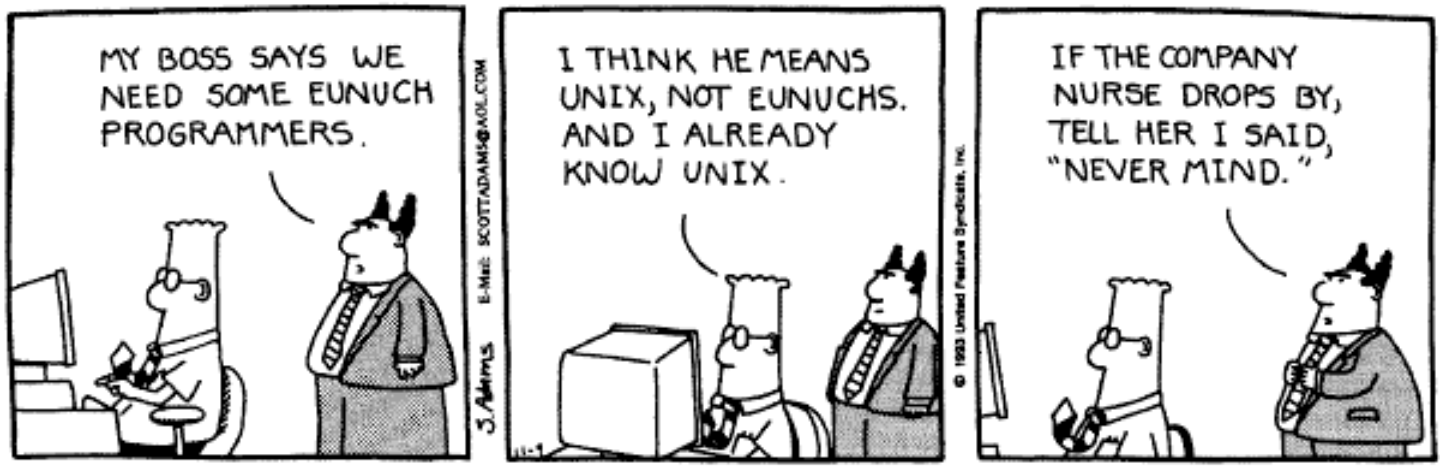
MY BOSS SAYS WE NEED SOME EUNUCH PROGRAMMERS.
I THINK HE MEANS UNIX, NOT EUNUCHS. AND I ALREADY KNOW UNIX.
IF THE COMPANY NURSE DROPS BY, TELL HER I SAID, "NEVER MIND."
E-Mail: SCOTTADAMS@AOL.COM
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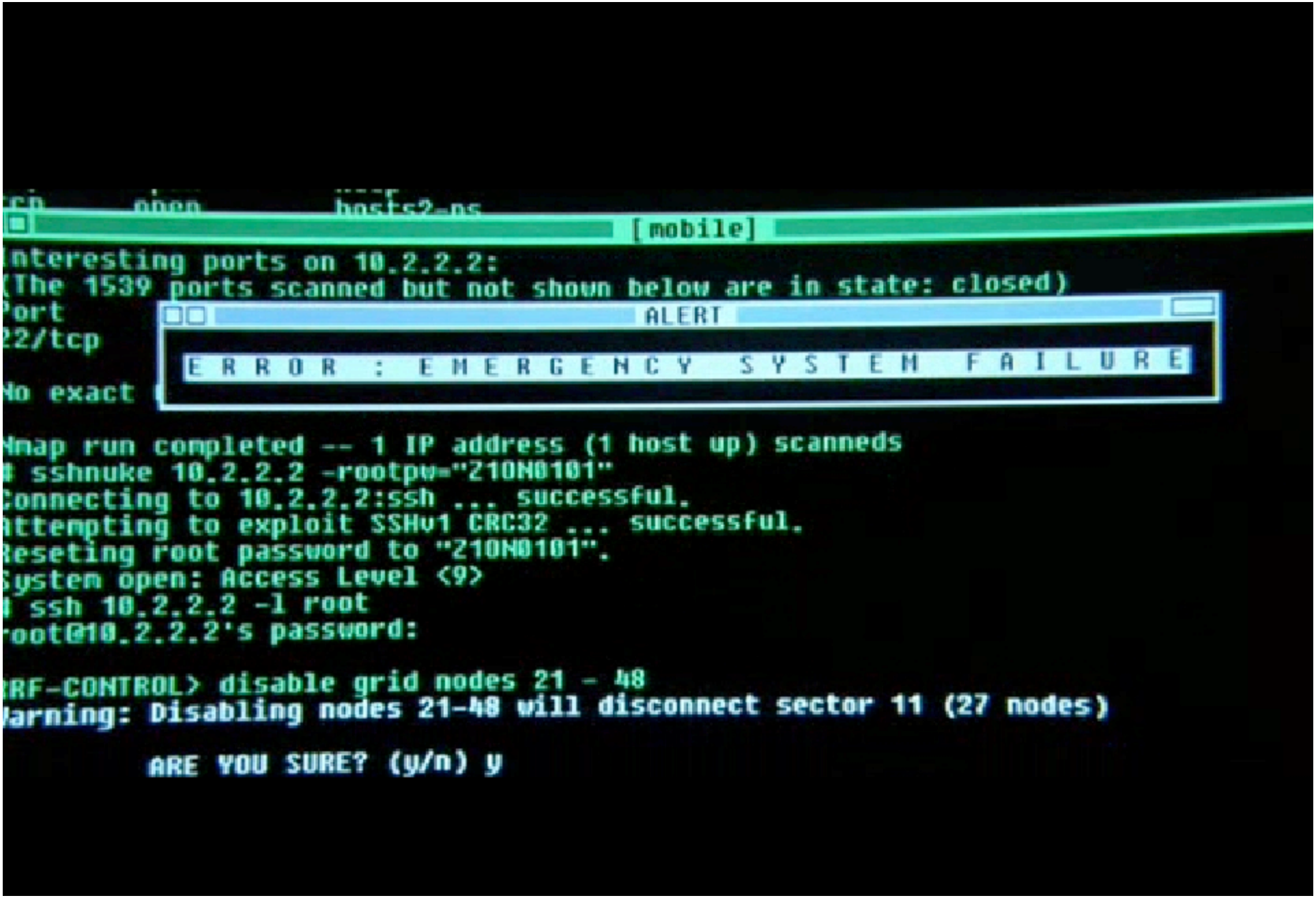
Matrix Reloaded


[mobile]
Interesting ports on 10.2.2.2:
(The 1539 ports scanned but not shown below are in state: closed)
Port
22/tcp
No exact
ALERT
ERROR : EMERGENCY SYSTEM FAILURE
Nmap run completed -- 1 IP address (1 host up) scanneds
sshnuke 10.2.2.2 -rootpw="Z1ON0101"
Connecting to 10.2.2.2:ssh ... successful.
Attempting to exploit SSHv1 CRC32 ... successful.
Reseting root password to "Z1ON0101".
System open: Access Level <9>
ssh 10.2.2.2 -l root
root@10.2.2.2's password:
CRF-CONTROL> disable grid nodes 21 - 48
Warning: Disabling nodes 21-48 will disconnect sector 11 (27 nodes)
ARE YOU SURE? (y/n) y

UNIX Tools – Lecture 1

Mehryar Mohri

What will we cover?

- Operating system overview
- UNIX utilities
- Scripting languages
- Programming tools
- Administration
- Security
- Networking

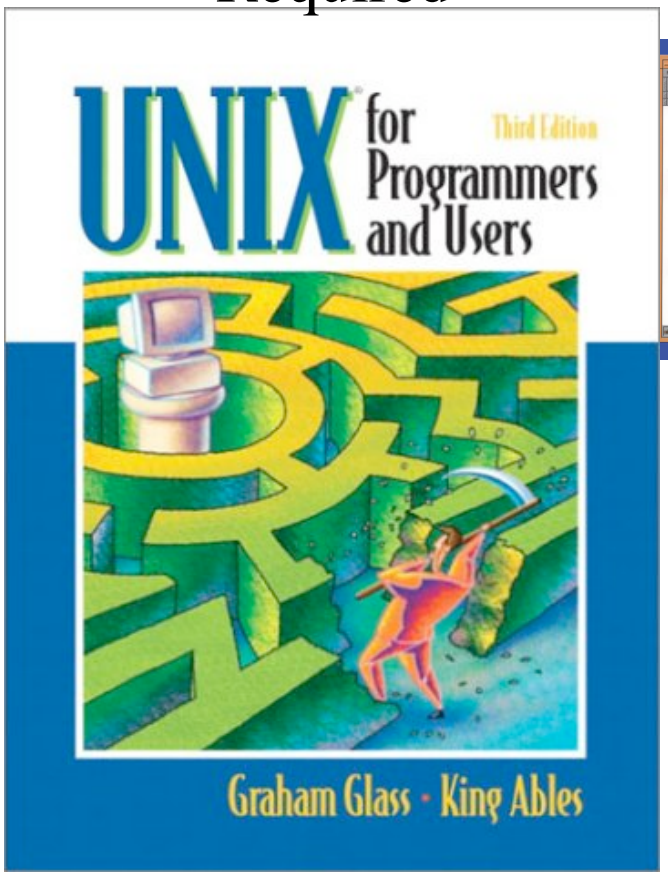
Who cares, how do I get an A?

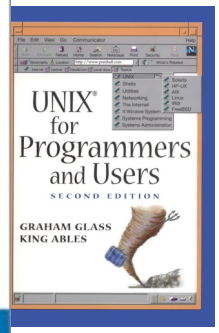
- Assignments: 30%
- Project: 35%

- Midterm: 15%
- Final: 20%

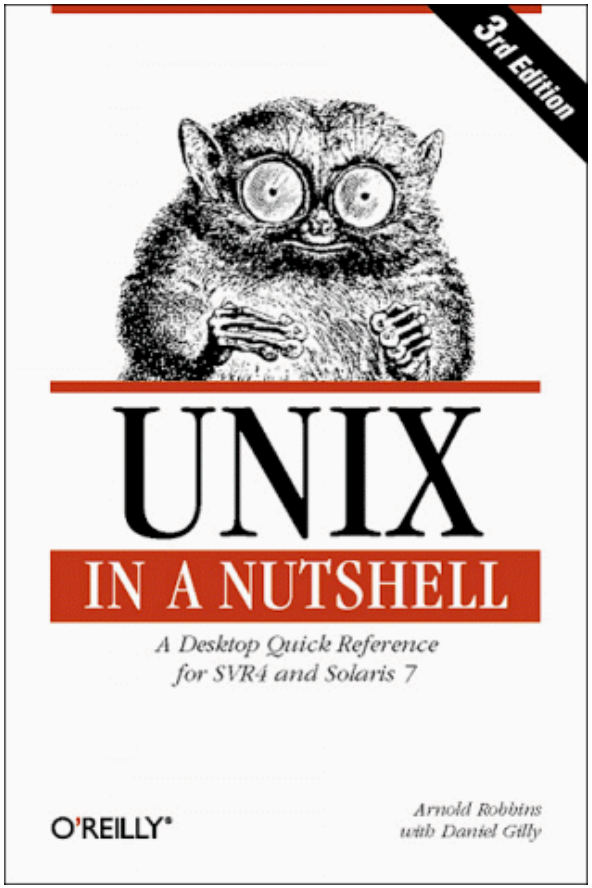
Books

Required





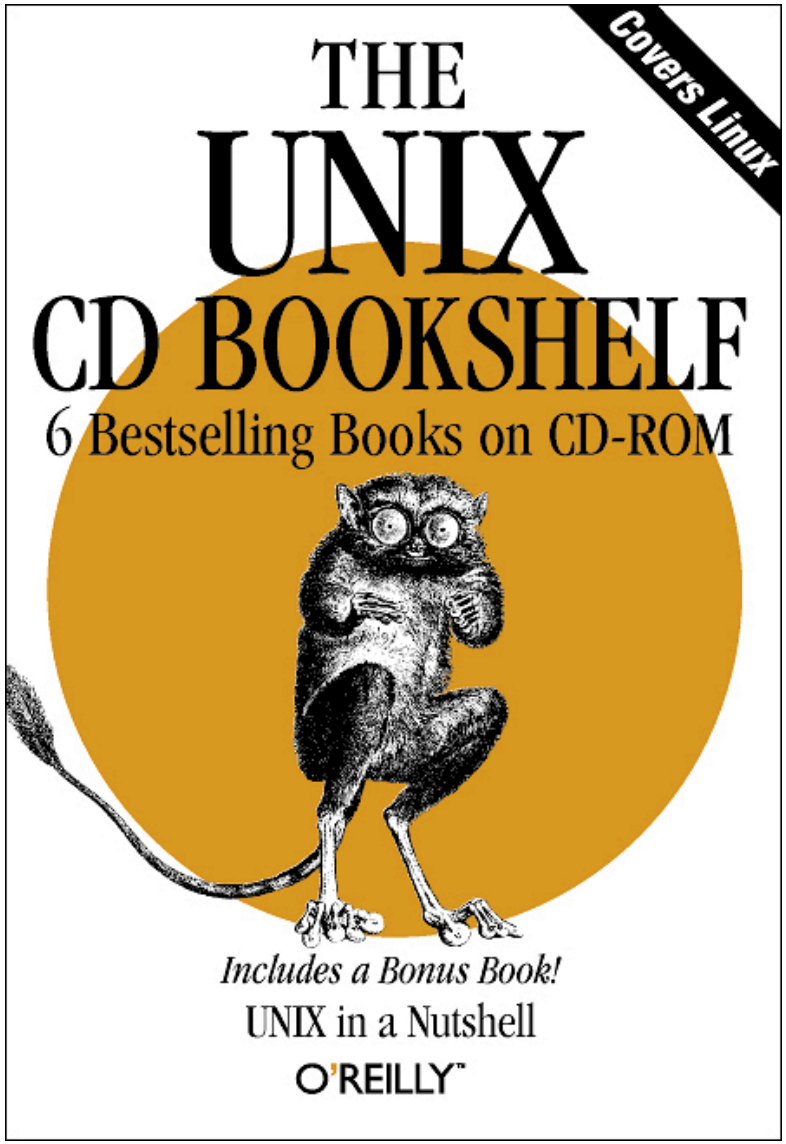
Recommended

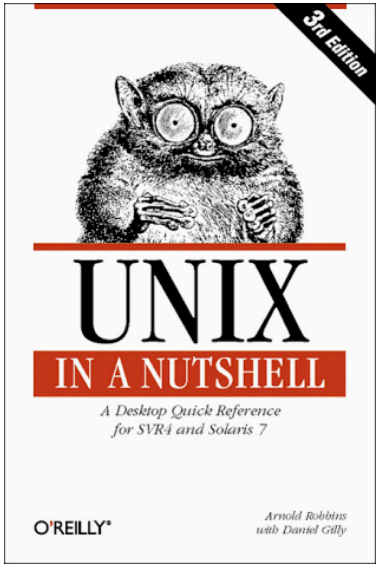


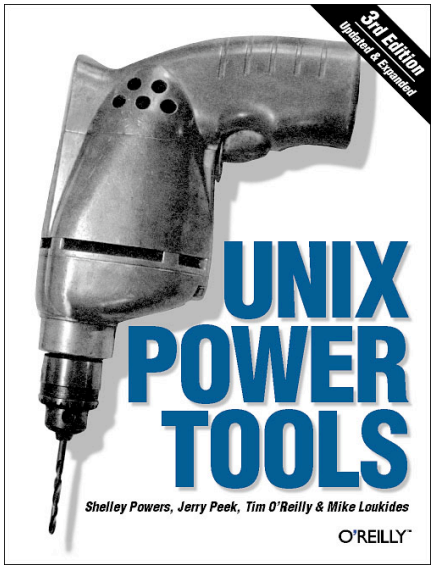
http://proquest.safaribooksonline.com

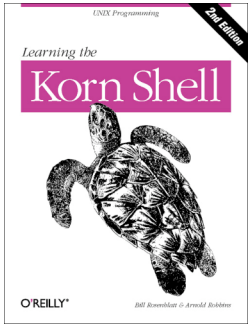
Available Free Online

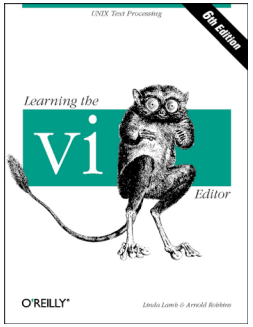
http://proquest.safaribooksonline.com

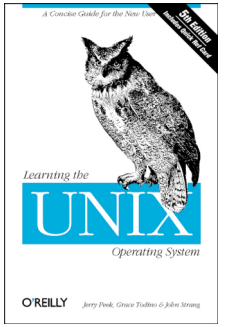


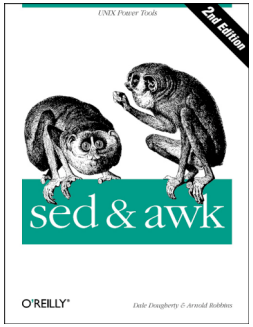






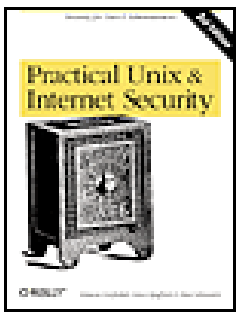


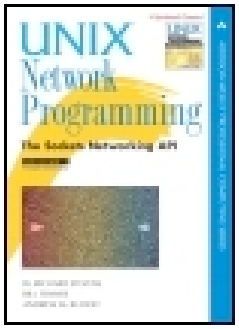


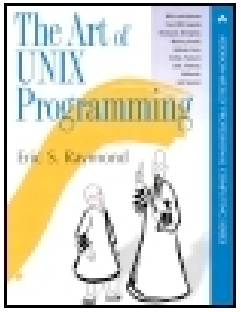


More Books Available Free Online

http://proquest.safaribooksonline.com







Use the Web!

- Wikipedia: **`http://wikipedia.org`**

- **`http://google.com/linux`**

Administrivia

- Make sure you have an account
- Sign up for the mailing list
- Check the website regularly:
  CS homepage -> Course Home Pages -> V22.0468-001
  `http://cs.nyu.edu/courses/spring07/V22.0468-001/`
- Office hour: To be announced
- Grader: Frank Demarco,
  frank.s.demarco@gmail.com
- Assignment 0 is due before class next week

Cheating

- Don’t

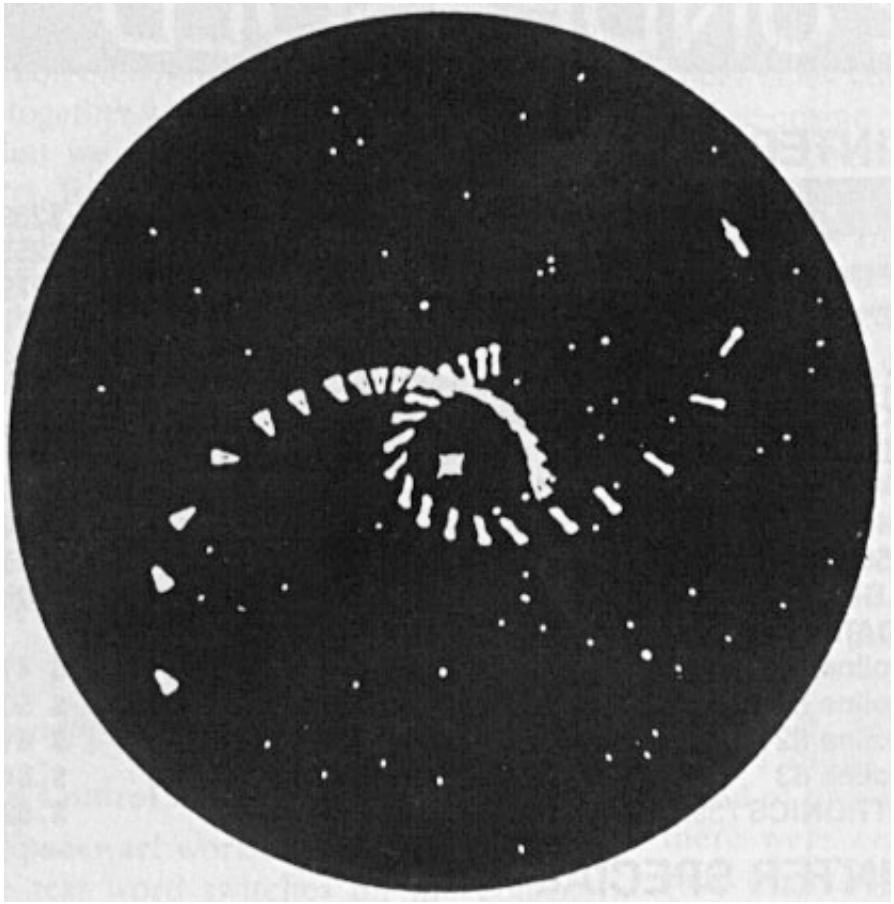
Cheating

- Don’t
- Seriously, don’t

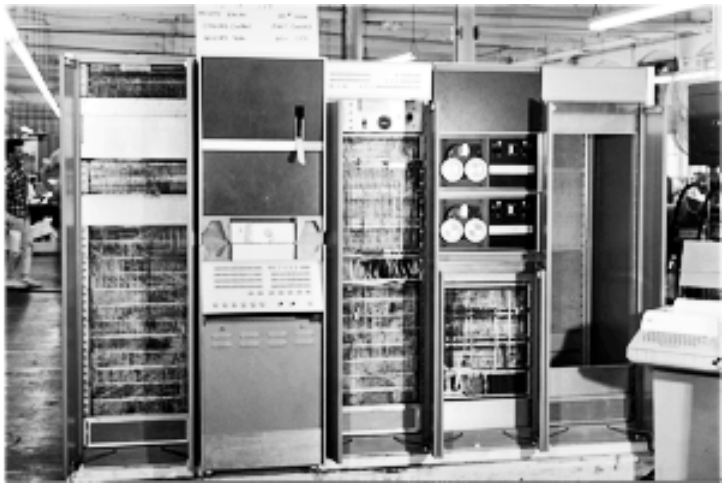
Our Heroes

Ken Thompson Dennis Ritchie

Video Games Spark Innovation



Space Pilot



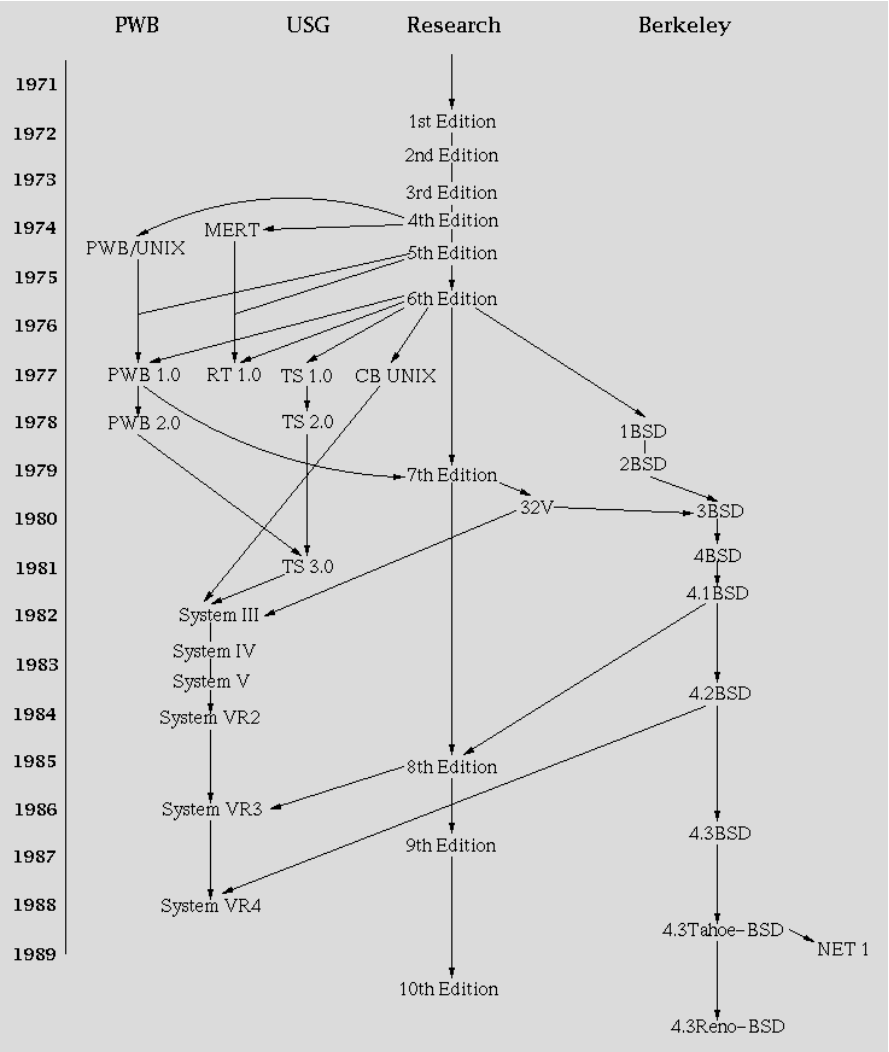
PDP-7

PDP-11

In the Beginning

- UNICS: 1969 – PDP-7 minicomputer
- PDP-7 goes away, rewritten on PDP-11 to “help patent lawyers”
- V1: 1971
- V3: 1973 (pipes, C language)
- V6: 1976 (rewritten in C, base for BSD)
- V7: 1979 (Licensed, portable)

Derivative Systems



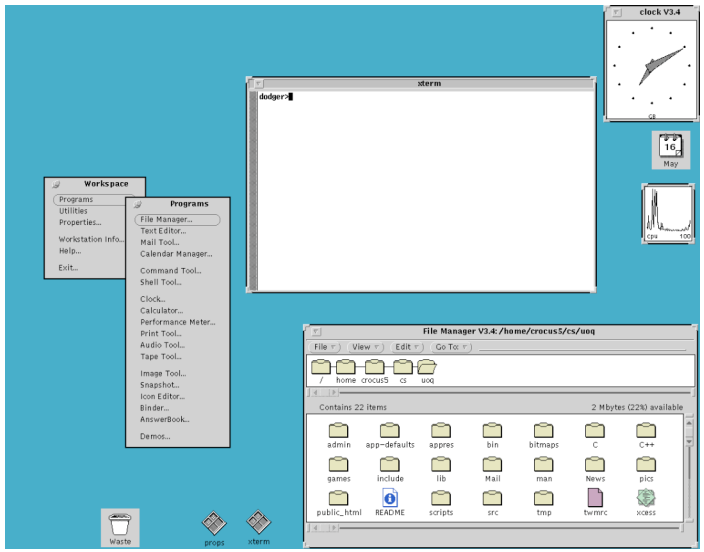
- PWB, MERT
- BSD: Adds many important features (networking, job control).
- AT&T enters the computer business with System III, V

Commercial Success

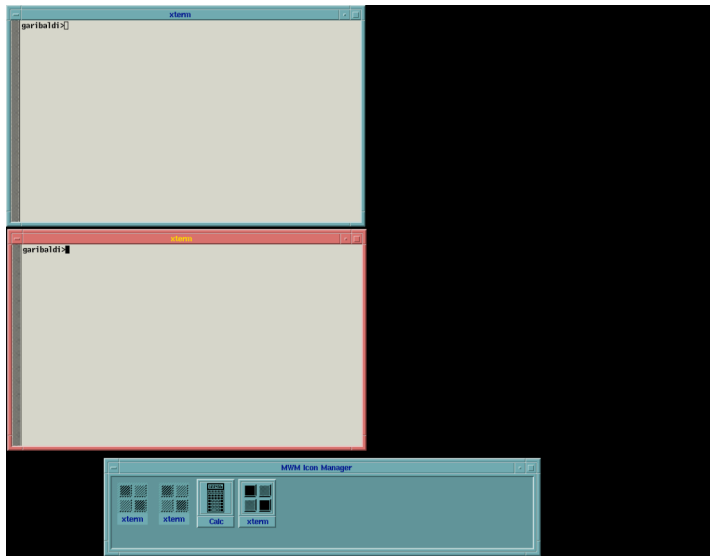
- AIX 
- SunOS, Solaris 
- Ultrix, Digital Unix 
- HP-UX 
- Irix 
- UnixWare -> Novell -> SCO -> Caldera ->SCO
- Xenix:  -> SCO
- Standardization (Posix, X/Open)

...But Then The Feuding Began

- *Unix International* vs. *Open Software Foundation* (to compete with desktop PCs)
- Battle of the Window Managers



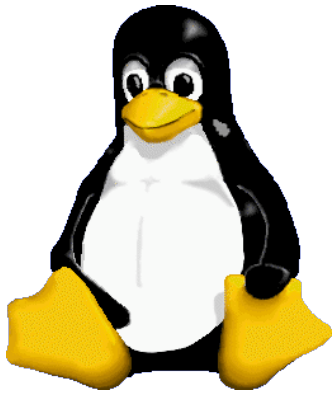
Openlook



Motif

- Threat of Windows NT resolves battle with CDE

Send in the Clones



- **Linux**
  - Written in 1991 by Linus Torvalds
  - Most popular UNIX variant
  - Free with GNU license

- **BSD Lite**
  - FreeBSD (1993, focus on PCs)
  - NetBSD (1993, focus on portability)
  - OpenBSD (1996, focus on security)
  - Free with BSD license
  - Development less centralized

Lou Gerstner gives his keynote address at the eBusiness Conference and Expo in New York.

IBM to spend $1 billion on Linux in 2001

By Joe Wilcox
Staff Writer, CNET News.com
December 12, 2000, 8:50 a.m. PT

update IBM chief executive Louis Gerstner said Tuesday that his company will spend $1 billion on Linux next year.

Gerstner made the announcement at the eBusiness Conference and Expo in New York, where IBM also revealed a Linux supercomputer win with Shell Oil.

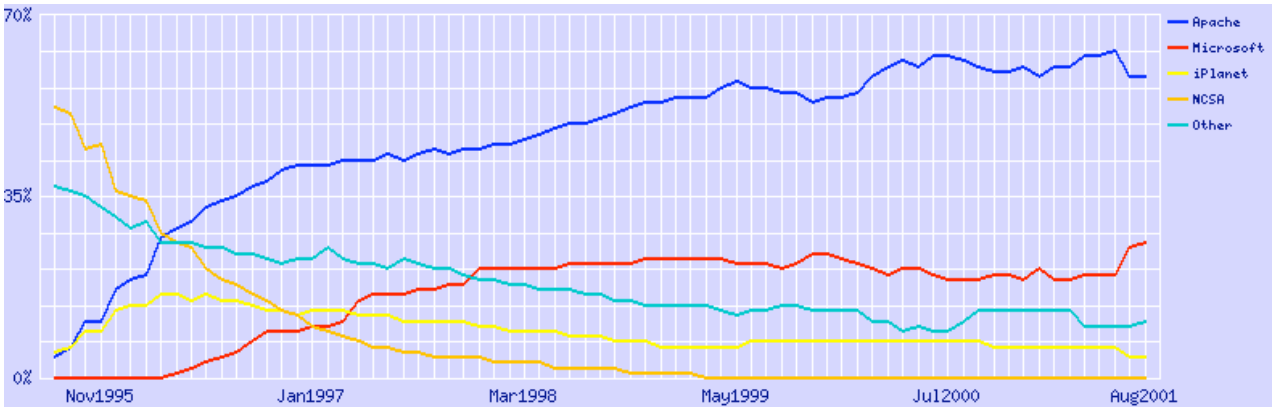
Info appliance makers adopt Linux

Just buzz or actual benefits? More info appliance makers are choosing Linux.

Intel	To use Linux for Intel-branded Web appliances
TiVo	Runs personal video recorder services on Linux
National Semiconductor	Offers Linux choice for its Web Pad platform
Sony	PlayStation 2 development system based on Linux
Transmeta	Bundling Linux for mobile applications with new chip
Lineo	Offers Linux development system for embedded info devices

SOURCE: Company announcements

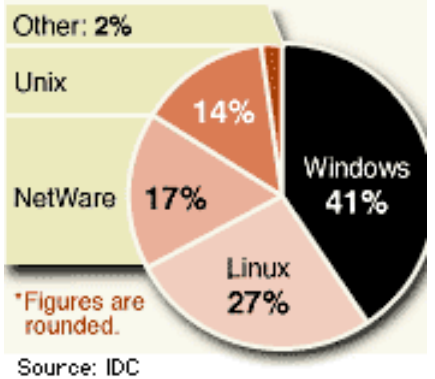
Today: Unix is Big



Server share

Four companies dominated the market for server operating systems last year.

Market share*



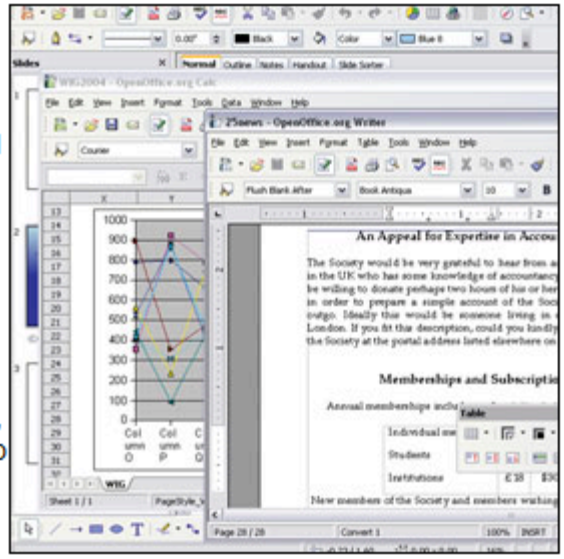
*Figures are rounded.

Source: IDC

Some Desktop Success

Open Office 2.0 Kicks MS Office Around the Block

August 28, 2005

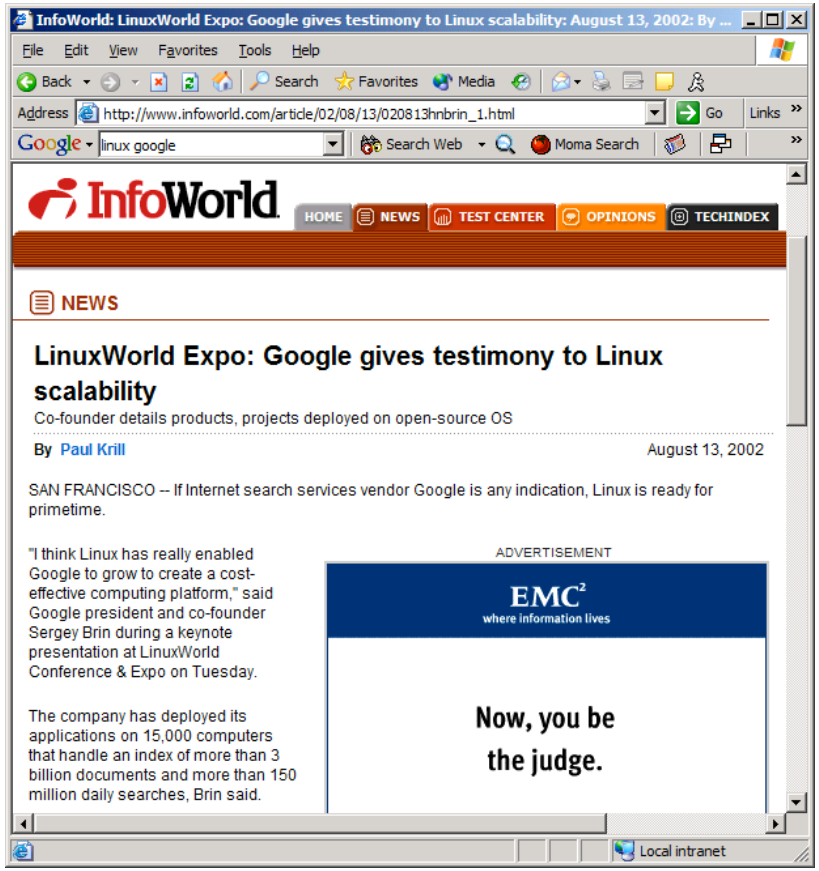


MAJOR UPDATE: By Alice Hill
RealTechNews

We asked our contributing writer David Johnston to do a full review of OpenOffice 2.0. He has been a longtime user of the product (and in fact an earlier version lost some of his important data.) In the meantime, we pointed to a review that PC Magazine did which is also comprehensive (see below), but for RealTechNews readers, please take a look at what David has to report, because this is no try it for a few days and write something up review. This is a complete **hands-on review** from someone who has used the product religiously for years. And I think you'll see why OpenOffice 2.0 truly Kicks MS Office around the block.

Open Office 2.0
By David Johnston
Contributing Writer, RealTechNews

Linux at Google & Elsewhere



Disney, DreamWorks, Pixar Go Linux

Posted by Hemos on Wed Jul 27, '05 03:19 PM

from the moving-into-the-future dept.

robinsrowe writes *"Most of the major studios use Linux -- such as DreamWorks with more than 1,500 Linux desktops and 3,500 Linux servers. The MovieEditor Conference is an all-day event on computer-based filmmaking in downtown Los Angeles on August 3rd. Studio technology chiefs and other experts discuss ongoing work using Linux in feature animation and visual effects. Presented in collaboration with LinuxMovies.org."*

Darwin

- Apple abandoned old Mac OS for UNIX
  - Purchased NeXT in December 1996
  - Unveiled in 2000
  - Based on 4.4BSD-Lite
  - Aqua UI written over Darwin
  - Open Source

Why did UNIX succeed?

- Technical strengths!
- Research, not commercial
- PDP-11 was popular with an unusable OS
- AT&T's legal concerns
  - Not allowed to enter computer business but needed to write software to help with switches
  - Licensed cheaply or free

The Open Source Movement

- Has fueled much growth in UNIX
  - Keeps up with pace of change
  - More users, developers
    - More platforms, better performance, better code

- Many vendors switching to Linux

washingtonpost.com

The Open Source Threat

By Cynthia L. Webb
washingtonpost.com Staff Writer
Tuesday, September 7, 2004; 9:54 AM

Open-source software, namely **Linux**, is nipping more sharply at the heels of **Microsoft**, leading the software giant to defend itself more fiercely than ever against the insurgent rise of freely distributed, collaboratively coded programs.

The Redmond, Wash.-based software giant acknowledged Linux is a growing challenge to its business in its 10-K filing with the **Securities and Exchange Commission**. Microsoft "is facing growing pressure from open-source software across every segment of its business -- a competitive threat that could have significant consequences for its financial future going forward," eWeek reported. "While Microsoft often mentions Linux and open-source software as a potential threat to its business, it seems to be treating the threat far more seriously and describing it as more pervasive than in previous official filings."

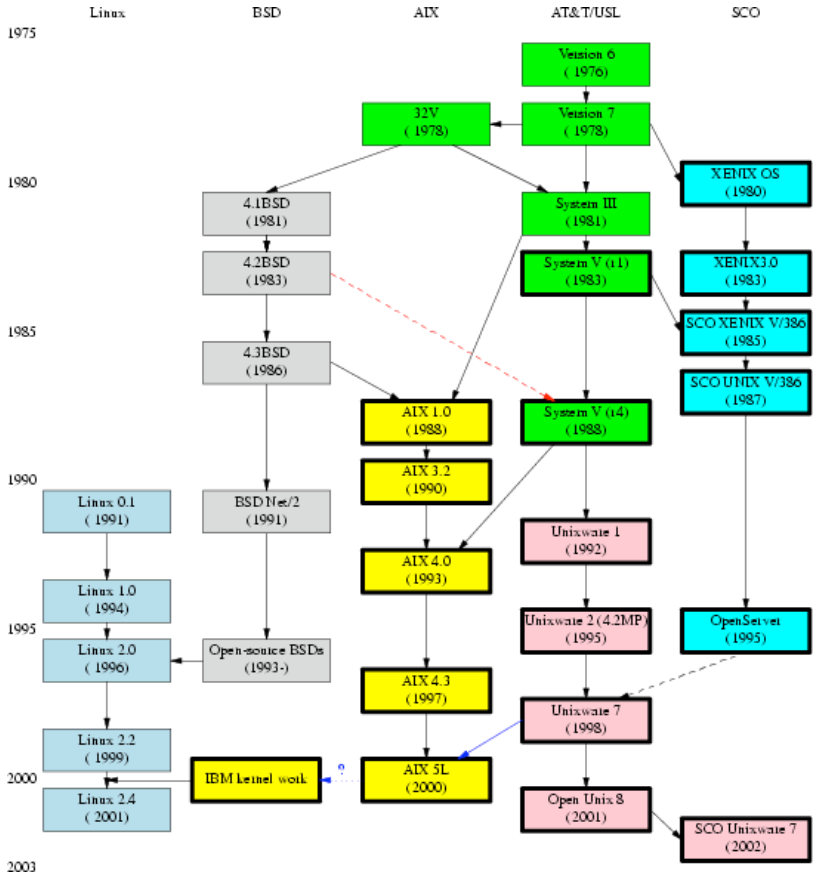
Linux "is making inroads in servers and PCs," Australian IT said in its coverage of the filing. Here's what Microsoft had to say: "To the extent open source software products gain increasing market acceptance, sales of our products may decline, which could result in a reduction in our revenue and operating margins." More from the filing: "We continue to watch the evolution of open-source software development and distribution and continue to differentiate our products from competitive products, including those based on open-source software. We believe that Microsoft's share of server units grew modestly in fiscal 2004, while Linux distributions rose slightly faster on an absolute basis." And Microsoft's filing also offers this survey of its competitors: "**IBM**'s endorsement of Linux has accelerated its acceptance as an alternative. ... Linux's competitive position has also benefited from the large number of compatible applications now produced by many leading commercial software developers as well as non-commercial software developers," Microsoft said.

SCO vs. Linux

- **Jan 2002**: SCO releases ***Ancient Unix*** : BSD style licensing of V5/V6/V7/32V/System III
- **March 2003**: SCO sues IBM for $3 billion. Alleges contributions to Linux come from proprietary licensed code
  - AIX is based on System V r4, now owned by SCO
- **Aug 2003**: Evidence released
  - Code traced to Ancient UNIX
  - Isn't in 90% of all running Linux distributions
  - Already dropped from Linux in July
- **Aug 2005**: Linux Kernel Code May Have Been in SCO

Does Linux borrow from ancient UNIX or System V R4?

UNIX vs. Linux



- In the 90's, Thompson/Ritchie developed Plan 9 which applied UNIX ideas to distributed systems
- Plan 9 evolved into Inferno, used for set top boxes
- Lucent had problems, many people left
- Thompson retired, now at startup
- Ritchie still at Lucent

The UNIX Philosophy

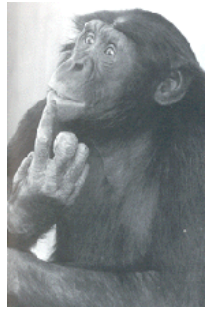
- Small is beautiful
  - Easy to understand
  - Easy to maintain
  - More efficient
  - Better for reuse

- Make each program do one thing well
  - More complex functionality by combining programs
  - Make every program a filter

The UNIX Philosophy

..continued

- Portability over efficiency
  - Most efficient implementation is rarely portable
  - Portability better for rapidly changing hardware
- Use flat ASCII files
  - Common, simple file format (yesterday's XML)
  - Example of portability over efficiency
- Reusable code
  - Good programmers write good code;
    great programmers borrow good code



The UNIX Philosophy

..continued

- Scripting increases leverage and portability

```
print $(who | awk '{print $1}' | sort | uniq) | sed 's/ /,/g'
```

List the logins of a system's users on a single line.

`who`	`755`
`awk`	`3,412`
`sort`	`2,614`
`uniq`	`302`
`sed`	`2,093`

9,176 lines

- Build prototypes quickly (high level interpreted languages)

The UNIX Philosophy

..continued

- Avoid captive interfaces
  - The user of a program isn't always human
  - Look nice, but code is big and ugly
  - Problems with scale
- Silence is golden
  - Only report if something is wrong
- Think hierarchically

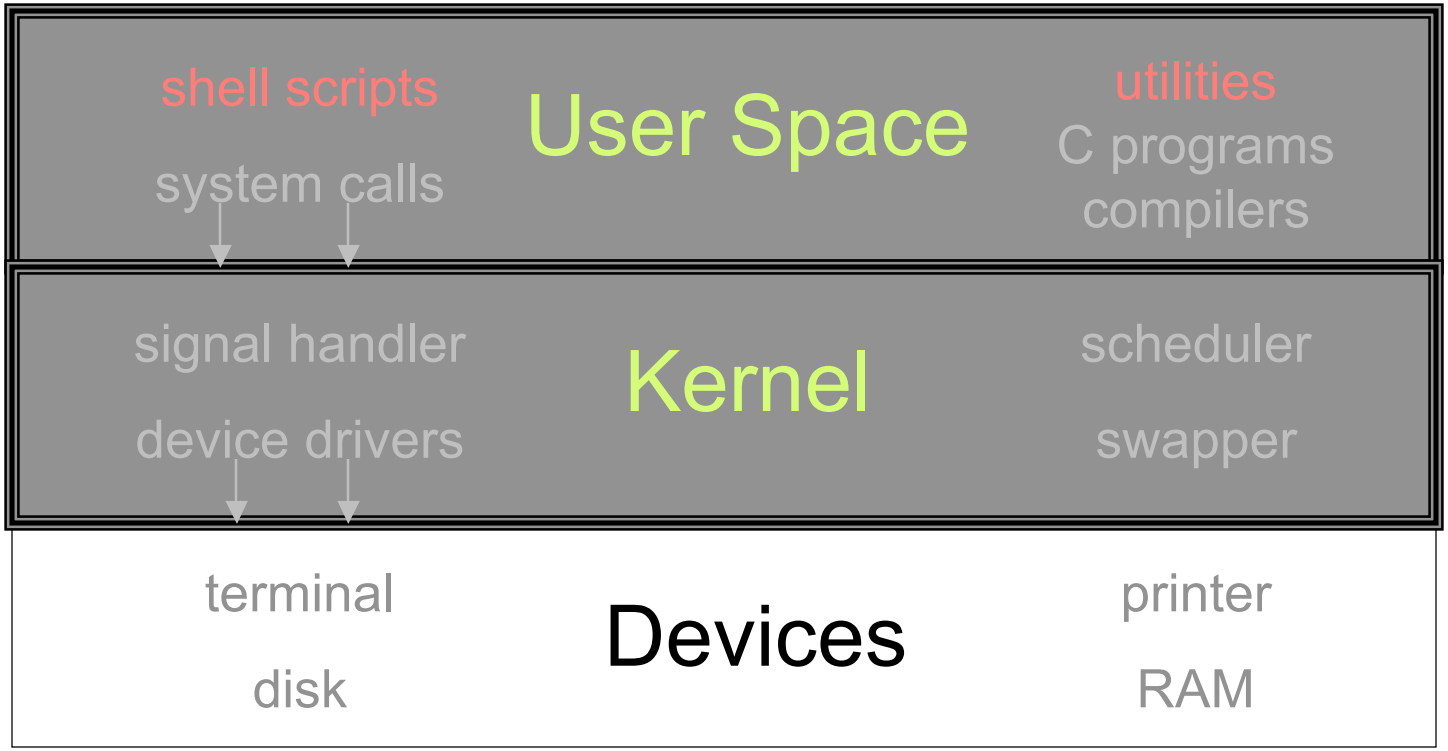
UNIX Highlights / Contributions

- Portability (variety of hardware; C implementation)
- Hierarchical file system; the file abstraction
- Multitasking and multiuser capability for minicomputer
- Inter-process communication
  - Pipes: output of one programmed fed into input of another
- Software tools
- Development tools
- Scripting languages
- TCP/IP

The Operating System

- Kernel: Performs critical system functions and interacts with the hardware
- Systems utilities: Programs and libraries that provide various functions through systems calls to the kernel

UNIX Structural Layout



Kernel Basics

- The kernel is …
  - a program loaded into memory during the boot process, and always stays in physical memory.
  - responsible for managing CPU and memory for processes, managing file systems, and interacting with devices.

Kernel Subsystems

- Process management
  - Schedule processes to run on CPU
  - Inter-process communication (IPC)
- Memory management
  - Virtual memory
  - Paging and swapping
- I/O system
  - File system
  - Device drivers
  - Buffer cache

System Calls

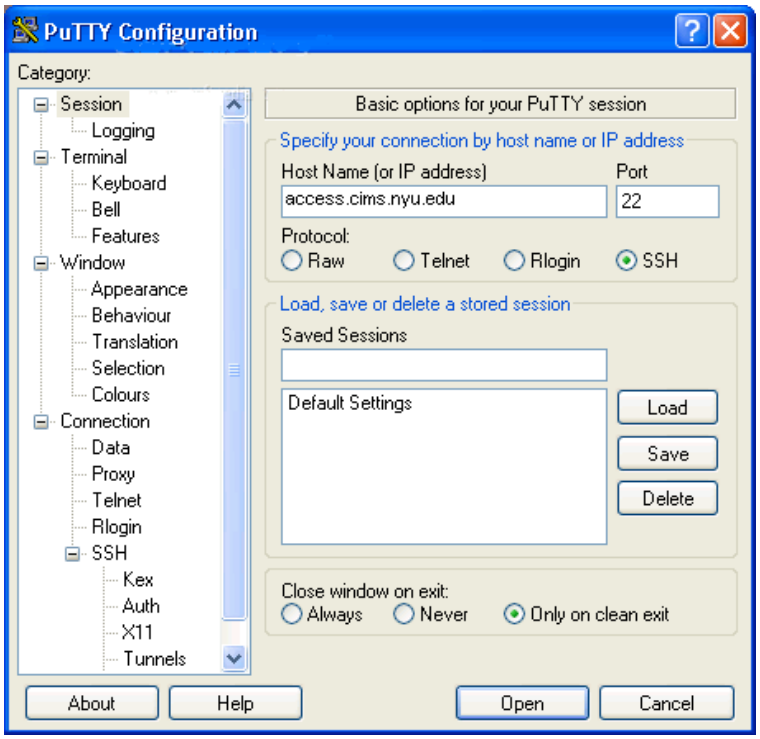
- Interface to the kernel
- Over 1,000 system calls available on Linux
- 3 main categories
  - File/device manipulation
    - e.g. `mkdir()`, `unlink()`
  - Process control
    - e.g. `fork()`, `execve()`, `nice()`
  - Information manipulation
    - e.g. `getuid()`, `time()`

Logging In

- Need an account and password first
  - Enter at **`login:`** prompt
  - Password not echoed
  - After successful login, you will see a shell prompt
- Entering commands
  - At the shell prompt, type in commands
    - Typical format: **command** *options arguments*
    - Examples: **`who`**, **`date`**, **`ls`**, **`cat myfile`**, **`ls -l`**
  - Case sensitive
- **`exit`** to log out

Remote Login

- Use Secure Shell (SSH)
- Windows
  - e.g. PuTTY



- UNIX-like OS
  - ssh name@access.cims.nyu.edu

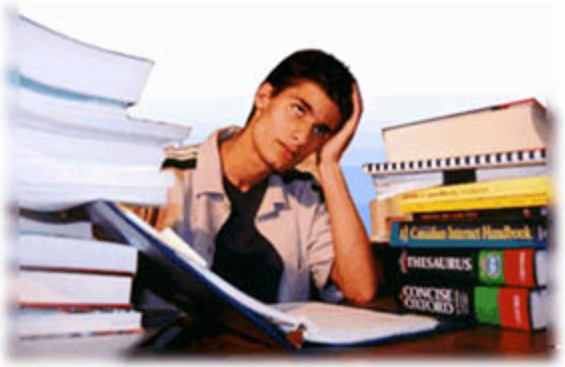
UNIX on Windows

Two recommended UNIX emulation environments:

- **UWIN (AT&T)**
  - **`http://www.research.att.com/sw/tools/uwin`**
- **Cygwin (GPL)**
  - **`http://www.cygwin.com`**

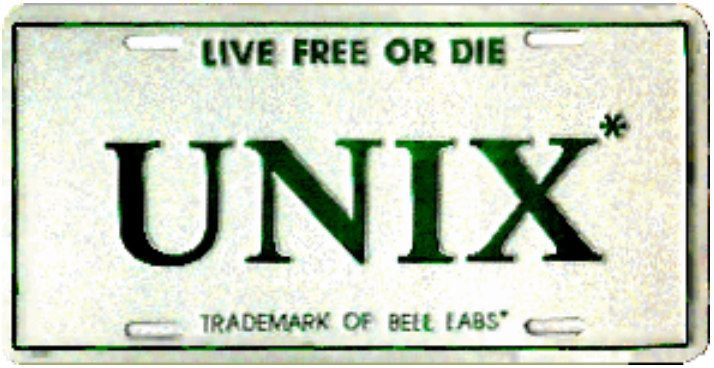
Assignment 0

- Get an account
- Log in and run a program
- Join the mailing list
- Email your login and password to your grader



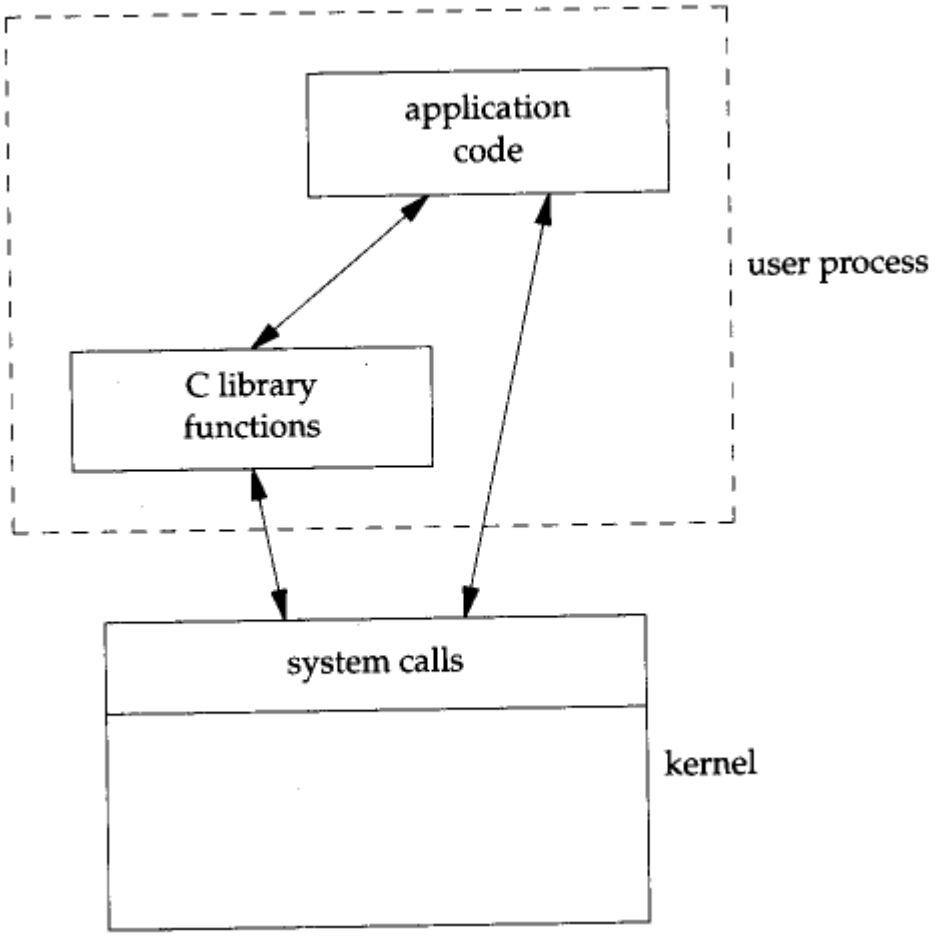
Next Time

- Basic UNIX concepts
- Introduction to the shell
- Introduction to basic commands



System Calls

- The kernel implements a set of special routines
- A user program invokes a routine in the kernel by issuing a hardware TRAP
- The trap switches the CPU into a privileged mode and the kernel executes the system call
- The CPU goes back to user mode
- A C language API exists for all system calls



SCO: Line by Line Copying

System V Code

```
/*
 * Allocate 'size' units from the given map.
 * Return the base of the allocated space.
 * In a map, the addresses are increasing and
the
 * list is terminated by a 0 size.
 * The swap map unit is 512 bytes.
 * Algorithm is first-fit.
 *
 * As part of the kernel evolution
toward modular naming, the
 * functions malloc and mfree are
being renamed to rmalloc and
rmfree.
 * Compatibility will be
maintained by the following
assembler code:
 * (also see mfree/rmfree below)
 */
```

…

Linux Kernel Code

```
/*
 * Allocate 'size' units from the given map.
 * Return the base of the allocated space.
 * In a map, the addresses are increasing and
the
 * list is terminated by a 0 size.
 * Algorithm is first-fit.
 */

ulong_t
atealloc(
      struct map *mp,
     size_t size)
{
     register unsigned int a;
     register struct map *bp;
     register unsigned long s;
```

…