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."
Matrix Reloaded
Interesting ports on 10.2.2.2:
(The 1539 ports scanned but not shown below are in state: closed)

Port: 22/tcp
No exact

Nmap run completed -- 1 IP address (1 host up) scanned
sshnuke 10.2.2.2 -rootpw="Z1ON0101"
Connecting to 10.2.2.2:ssh ... successful.
Attempting to exploit SSHv1 CRC32 ... successful.
Resetting root password to "Z1ON0101".
System open: Access Level <9>
ssh 10.2.2.2 -l root
root@10.2.2.2's password:

RF-CONTROL> disable grid nodes 21 - 48
Warning: Disabling nodes 21-48 will disconnect sector 11 (27 nodes)

ARE YOU SURE? (y/n) y
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
THE UNIX CD BOOKSHELF
6 Bestselling Books on CD-ROM

Includes a Bonus Book!
UNIX in a Nutshell

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:  
  \textit{CS homepage} -> \textit{Course Home Pages} -> V22.0468-001  
  \url{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
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 \(\text{IBM}\)
- SunOS, Solaris \(\text{Sun}\)
- Ultrix, Digital Unix \(\text{Compaq}\)
- HP-UX \(\text{HP}\)
- Irix \(\text{SGI}\)
- UnixWare \(\rightarrow\) Novell \(\rightarrow\) SCO \(\rightarrow\) Caldera \(\rightarrow\) SCO
- Xenix: \(\text{Microsoft}\) \(\rightarrow\) 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
Today: Unix is Big

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.
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

LinuxWorld Expo: Google gives testimony to Linux scalability
Co-founder details products, projects deployed on open-source OS
By Paul Krell
SAN FRANCISCO -- It Internet search services vendor Google is any indication, Linux is ready for prime time.

"I think Linux has really enabled Google to grow to create a cost-effective computing platform," said Google president and co-founder Sergey Brin during a keynote presentation at Linux World Conference & Expo on Tuesday.

The company has deployed its applications on 15,000 computers that handle an index of more than 9 billion documents and more than 150 million daily searches, Brin said.

Now, you be the judge.

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Disney, DreamWorks, Pixar Go Linux

Posted by Hemos on Wed Jul 27, '05 03:19 PM from the moving-into-the-future dept.

robinrowe 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
The Open Source Threat

By Cynthia L. Webb
washingtonpost.com Staff Writer
Tuesday, September 7, 2004; 9:34 AM

Open-source software, namely Linux, is ripping 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


- **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?*
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

• 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.

• Build prototypes quickly (high level interpreted languages)

<table>
<thead>
<tr>
<th>Command</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>who</td>
<td>755</td>
</tr>
<tr>
<td>awk</td>
<td>3,412</td>
</tr>
<tr>
<td>sort</td>
<td>2,614</td>
</tr>
<tr>
<td>uniq</td>
<td>302</td>
</tr>
<tr>
<td>sed</td>
<td>2,093</td>
</tr>
</tbody>
</table>

9,176 lines
The UNIX Philosophy

• 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

..continued
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

User Space
- shell scripts
- system calls

Kernel
- signal handler
- device drivers
- scheduler
- swapper

Devices
- terminal
- disk
- printer
- RAM

Utilities
- C programs
- compilers
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)**

- **Cygwin (GPL)**
  - [http://www.cygwin.com](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.
 */

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