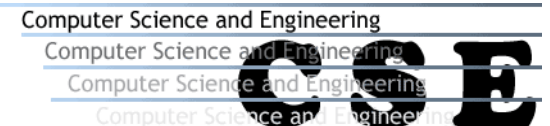


CSE 265: System and Network Administration

WF 9:10-10:00am Packard 258
M 9:10-11:00am Packard 112

<http://www.cse.lehigh.edu/~brian/course/sysadmin/>
Find syllabus, lecture notes, readings, etc.

Instructor: Prof. Brian D. Davison
davison@cse.lehigh.edu
<http://www.cse.lehigh.edu/~brian/>



Who is this course for?

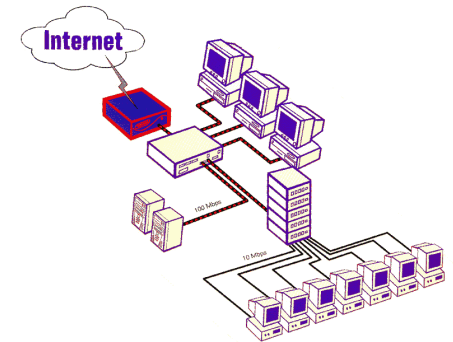
- Students interested in learning
 - The roles and responsibilities of a computer systems and network administrator
 - How to configure & manage their own linux systems
 - How to diagnose and debug problems
 - How some of the major system services operate
 - Why they need to be nice to the sysadmin
- UNIX/Linux familiarity helpful and programming experience required (CSE17)

What will the course cover?

- Understand the role & responsibilities of a system administrator
- Configure the Linux operating system
- Describe the system boot process
- Setup and manage user accounts and groups
- Manage the resources and security of a computer running Linux
- Make effective use of Unix utilities and scripting languages (bash, Perl)
- Configure and manage simple network services on a Linux system
- Develop an appreciation of the documentation available as part of an installed Unix/Linux system

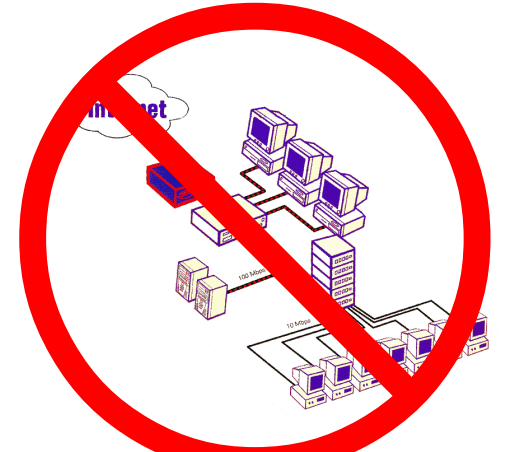
What will it not cover?

- Networking in depth
 - Take CSE342 instead
- Network security in depth
 - Take CSE343 instead
- Windows administration
- Many hardware issues
- All the details needed for certification
 - Lots of certification courses available



What will it not cover?

- Networking in depth
 - Take CSE342 instead
- Network security in depth
 - Take CSE343 instead
- Windows administration
- Many hardware issues
- All the details needed for certification
 - Lots of certification courses available



What does a sysadmin do?

What does a sysadmin do?

- User account management
- Hardware management
- Perform filesystem backups, restores
- Install and configure new software and services
- Keep systems and services operating
 - Monitor system and network
 - Troubleshoot problems
- Maintain documentation
- Audit security
- Help users, performance tuning, and more!

User Account Management

- User Ids
- Mail
- Home directories (quotas, drive capacities)
- Default startup files (paths)
- Permissions, group memberships, accounting and restrictions
- Communicating policies and procedures
- Disabling / removing user accounts



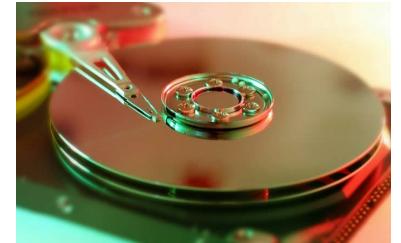
Hardware Management

- Capacity planning
- Inventory
- Hardware evaluation and purchase
- Adding and removing hardware
 - Configuration
 - Cabling, wiring, DIP switches, etc.
- Device driver installation
- System configuration and settings
- User notification and documentation



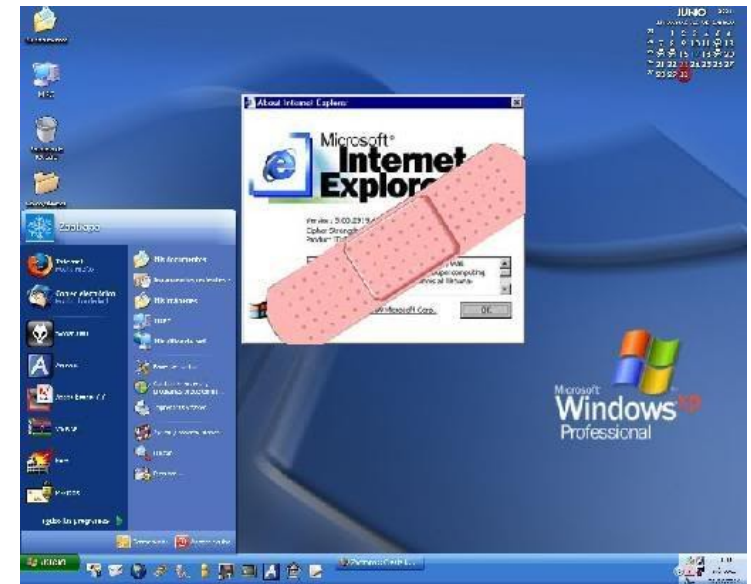
Data Backups

- Perhaps most important aspect!
- Disk and backup media capacity planning
- Performance, network and system impact
- Disaster recovery
 - Onsite/Offsite
 - Periodic testing
 - Multiple copies
- User communication
 - Schedules, restore guarantees and procedures, loss tolerance



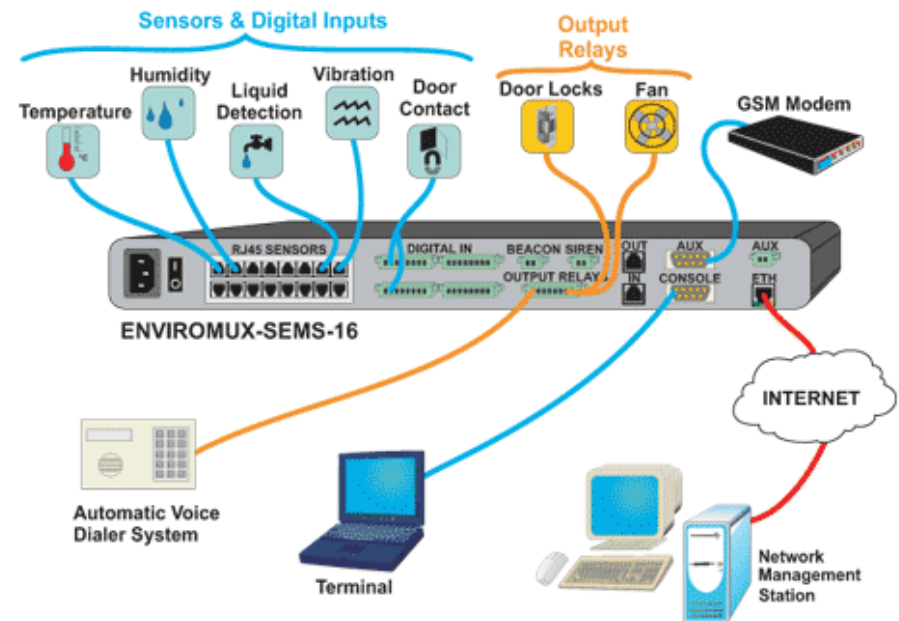
Software Installation/Maintenance

- Evaluation of software
- Downloading and building (compiling and tweaking)
- Installation
- Maintenance of multiple versions
- Security
- Patches and updates
- User notification, documentation



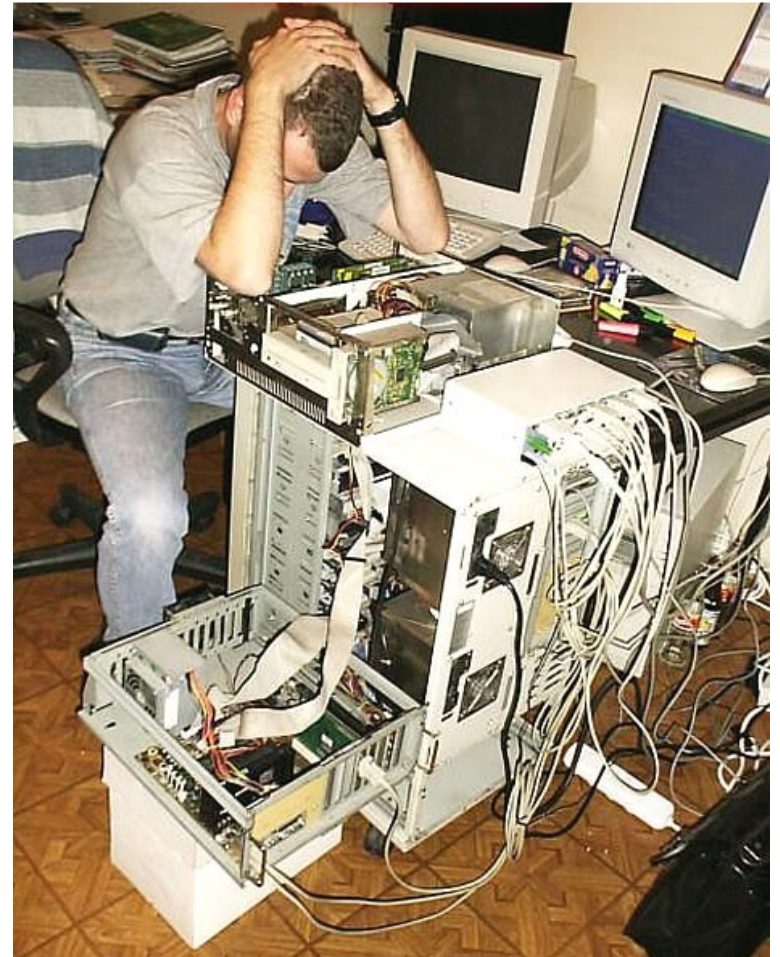
System Monitoring

- Hardware and services functioning and operational
- Capacity
 - Disk, RAM, CPU, network
- Security
 - Passwords
 - Break-ins
- System logs
 - Examination
 - Periodic rotation and truncation



Troubleshooting

- Problem discovery, diagnosis, and resolution
 - Root cause analysis
 - Often quite difficult!
- Often requires
 - Broad and thorough system knowledge
 - Outside experts
 - Luck
- Expediency

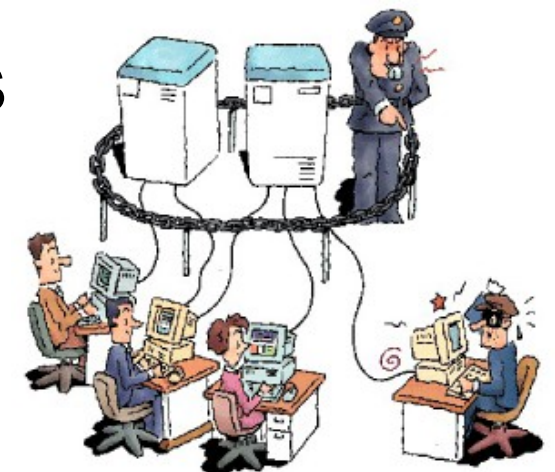


Local Documentation

- Administrative policies and procedures
 - Backup media locations
 - Hardware
 - Location
 - Description, configuration, connections
 - Software
 - Install media (or download location)
 - Installation, build, and configuration details
 - Patches installed
- Acceptable use policies

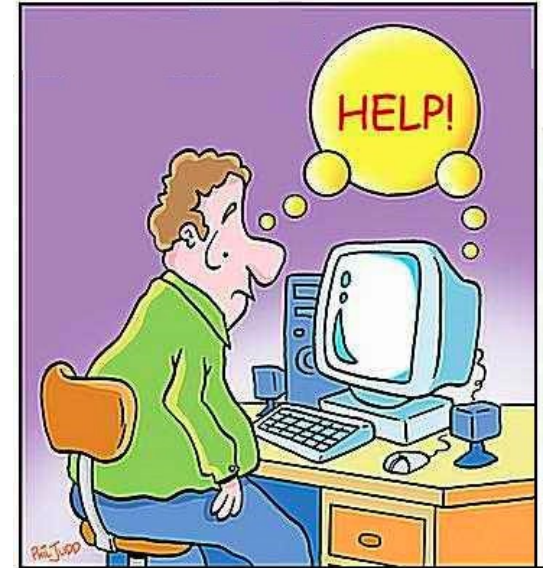
Security Concerns

- System logging and audit facilities
 - Evaluation and implementation
 - Monitoring and analysis
 - Traps, auditing and monitoring programs
- Unexpected or unauthorized use detection
- Monitoring of security advisories
 - Security holes and weaknesses
 - Live exploits



User Assistance

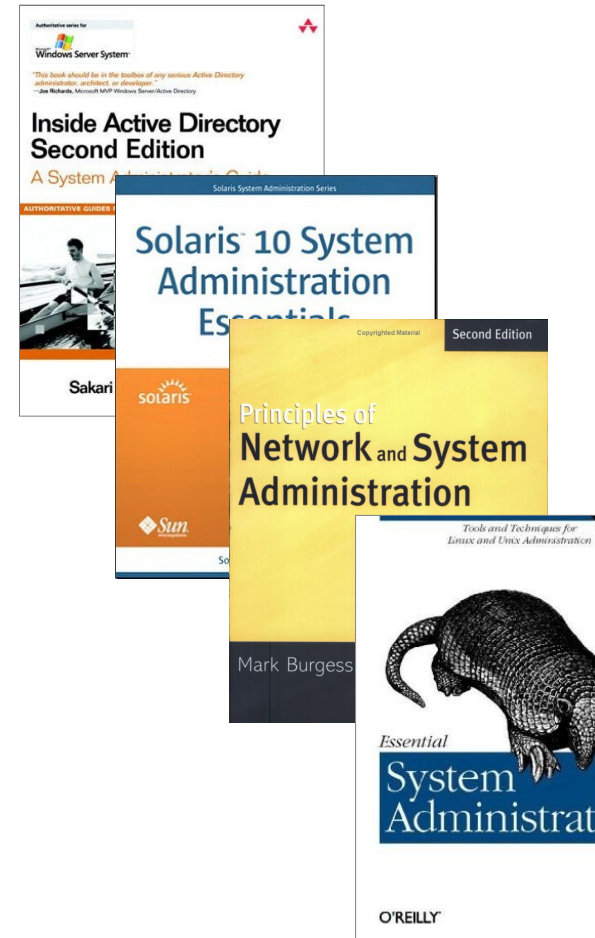
- Time intensive!
- Techniques
 - Help desks
 - Trouble-ticket systems
- Software availability and usage
- Software configuration settings
- Hardware usage, maintenance, and troubleshooting
- Writing FAQs



Administration Challenges

– Need

- Broad knowledge of hardware and software
 - To balance conflicting requirements
 - Short-term vs. long-term needs
 - End-user vs. organizational requirements
 - Service provider vs. police model
 - To work well and efficiently under pressure
 - 24x7 availability
 - Flexibility, tolerance, and patience
 - Good communication skills
- People think of sysadmins only when things don't work!



Admins for Developers

- DevOps (development operations)
 - A methodology of software development, emphasizing communication, collaboration, and integration between software developers and IT operations people (e.g., system administrators)
- Automates, manages:
 - Release management
 - Quality testing
 - Configuration management
 - Developer tools (IDEs, issue trackers, etc.)
- Hugely important at companies like Facebook, Google

Which OS to learn to admin?



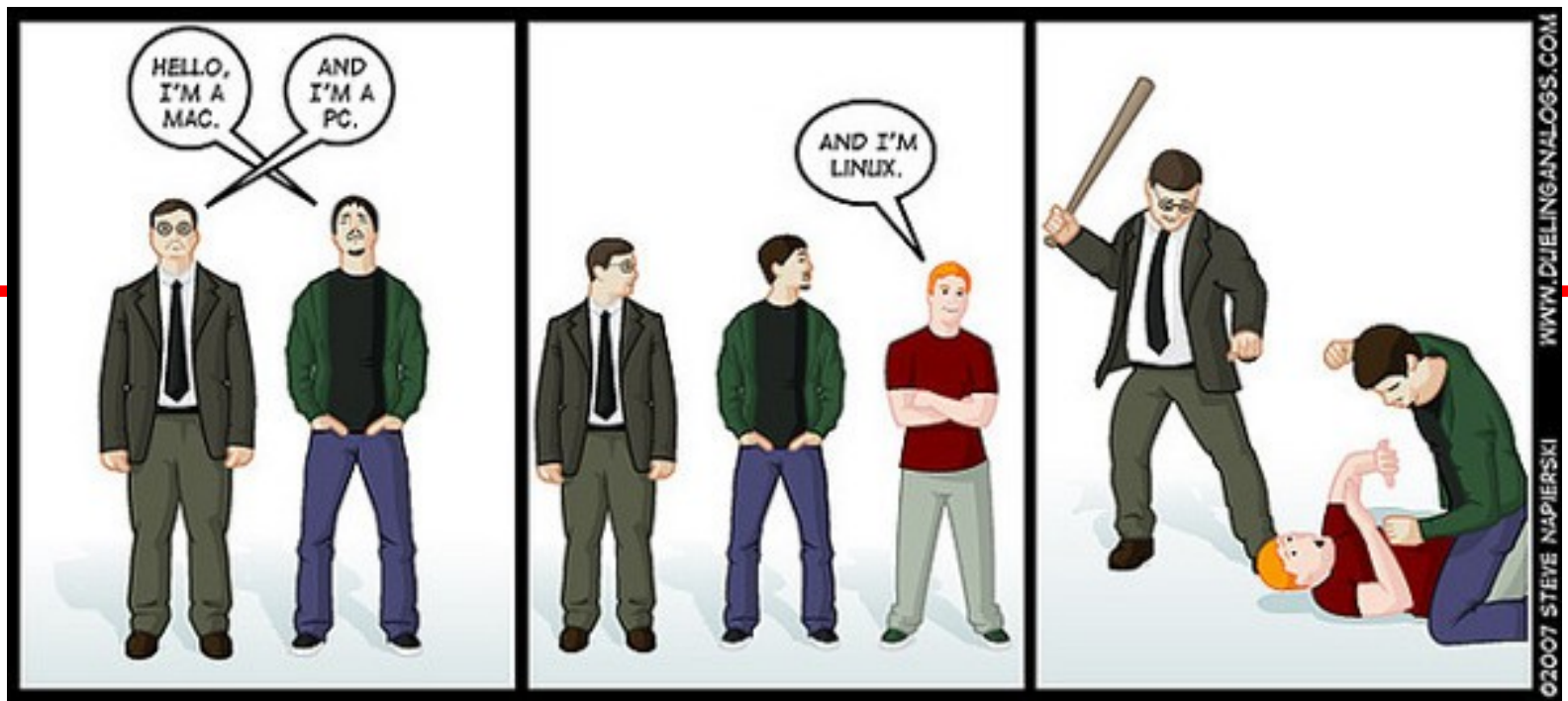
I'm a Mac



I'm UNIX



I'm Vista



SETTING UP A NEW WINDOWS PC

BUY A WINDOWS PC



SEE HOW MUCH BLOATWARE THE MANUFACTURER INSTALLED



INSTALL FRESH VERSION OF WINDOWS



START WORKING

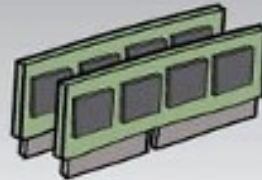


SETTING UP A NEW MAC

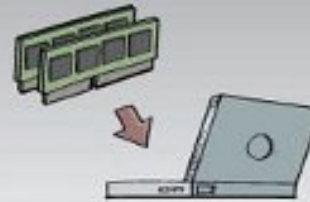
BUY A MAC



BUY MORE RAM FROM 3RD PARTY SITE



INSTALL NEW RAM



START WORKING



SETTING UP A NEW LINUX PC

BUY A LINUX LAPTOP



START WORKING



TRIM NECKBEARD



AN UPDATE IS AVAILABLE FOR YOUR COMPUTER

stickycomics.com

COOL, MORE
FREE STUFF!



linux

NOT AGAIN!



windows

OOH, ONLY
\$99!



mac

Why (Red Hat/CentOS) Linux?

- Need to use some OS to make ideas concrete
- Really only two choices:
 - Windows (I'm not qualified)
 - UNIX (and UNIX-like OSes such as Linux)
- Both are useful and common in the real world
- Linux is popular, free, and usable on personal machines, but also handles large-scale services
- Red Hat/CentOS is relatively polished, popular
 - I've been using it since ~1996
 - There are, of course, many alternatives



What is Linux?

much is courtesy of www.kernel.org

- Linux is a clone of the operating system Unix, written by a loosely-knit team of hackers across the Net.
- Like any modern full-fledged Unix, Linux includes:
 - true multitasking
 - proper memory management and virtual memory
 - shared libraries and shared copy-on-write executables
 - TCP/IP networking
- Linux really refers to the kernel – most commands and apps are really separate programs, not specific to Linux, and often are part of the Free Software Foundation's GNU project.
- Linux was first developed for 32-bit x86-based PCs (386 or higher). These days it also runs on dozens of other processors.

Brief history of UNIX



- Originated as a research project in 1969 at AT&T Bell Labs
 - Made available to universities (free) in 1976
- Berkeley UNIX started in 1977 when UCB licensed code from AT&T.
- Berkeley Software Distribution started in 1977 with 1BSD, and ended in 1993 with 4.4BSD
- Licensing costs from AT&T increased, so Berkeley attempted to remove AT&T code, but ran out of funds before completion.
- Final release of AT&T-free code called 4.4BSD-Lite.
 - Most current BSD distributions (FreeBSD, NetBSD, OpenBSD) are derived from 4.4BSD-Lite.
- Most commercial versions of UNIX (Solaris, HP-UX) are derived from the AT&T code

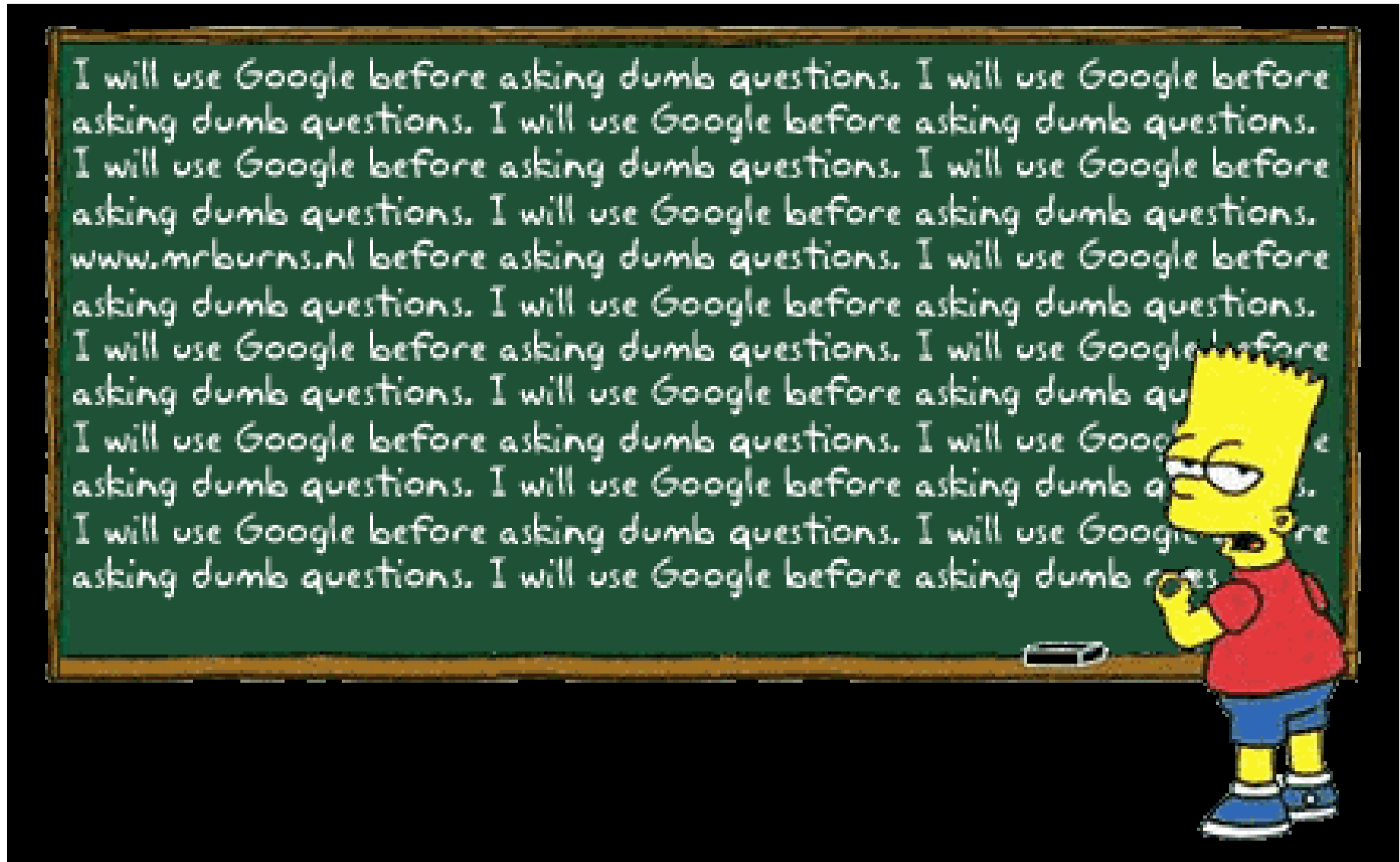
Brief history of Linux

- Created as a personal project (and still controlled) by Linus Torvalds, a Finnish graduate student, in 1991
- Conceived as an offshoot of Minix (a model OS)
 - Not derived from AT&T or BSD UNIX code
- Red Hat (one of many Linux vendors) founded in 1993
- Kernel v1.0 released 1994
- Most recent (Aug 2014) kernel release is 3.16.1

Where to get answers

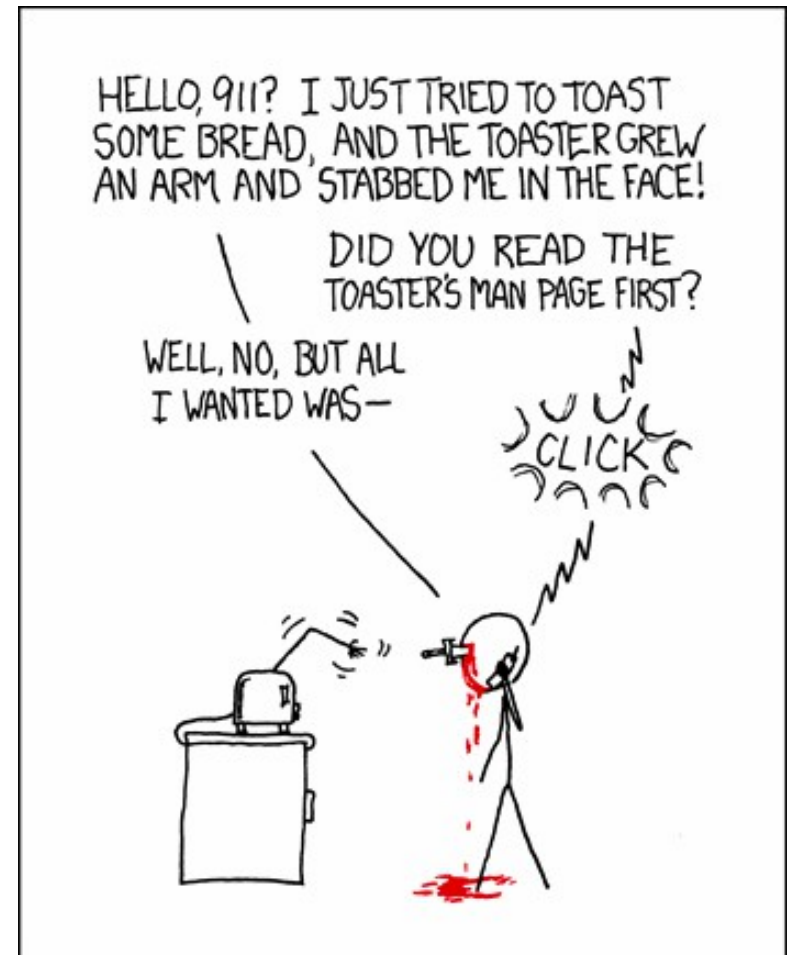
- Linux/UNIX documentation can be found in many places
 - Manual pages (man pages, using man command)
 - Texinfo documents (read with info command)
 - HOWTOs – focused descriptions of a topic
 - Distribution-specific documentation
 - Your favorite Web search engine
 - Will typically find online versions of the above

Where to get answers



man pages

- Usually my first resource
- Provide OS installation-specific information
- Man pages document (almost) every command, driver, file format, and library routine
- “man -k topic” will list all man pages that use topic
- Parameters are not the same for every UNIX, e.g.:
 - Linux: man 4 tty
 - Solaris: man -s4 tty



man page organization

- Man pages are divided into sections (somewhat Linux specific)
 - 1: User-level commands and applications
 - 2: System calls and kernel error codes
 - 3: Library calls
 - 4: Device drivers
 - 5: Standard file formats
 - 6: Games and demonstrations
 - 7: Miscellaneous files and documents
 - 8: System administration commands
 - 9: Obscure kernel specs and interfaces
- Some sections are subdivided
 - 3M contains pages for math library
 - Section “n” often contains subcommands (such as bash built-in cmds)
- Sections 6 and 9 are typically empty

```
neo@ubuntu: ~
File Edit View Terminal Help
MAN(1) Manual pager utils MAN(1)
NAME
man - an interface to the on-line reference manuals
SYNOPSIS
man [-C file] [-d] [-D] [--warnings=warnings] [-R encoding] [-L locale] [-m sys-
tem[...]] [-M path] [-S list] [-e extension] [-i-I] [--regex|--wildcard]
[--names-only] [-a] [-u] [-P pager] [-r prompt] [-7] [-E encoding] [--no-hyphenation]
[-p string] [-t] [-T[device]] [-H[browser]] [-X[dpi]] [-Z] [[section] page ...] ...
man -f [whatis options] page ...
man -k [apropos options] regexp ...
man -l [-C file] [-d] [-D] [--warnings=warnings] [-R encoding] [-L locale] [-P
pager] [-r prompt] [-7] [-E encoding] [-p string] [-t] [-T[device]] [-H[browser]]
[-X[dpi]] [-Z] file ...
man -w|-W [-C file] [-d] [-D] page ...
man -c [-C file] [-d] [-D] page ...
man [-hV]
DESCRIPTION
man is the system's manual pager. Each page argument given to man is normally the name
of a program, utility or function. The manual page associated with each of these
arguments is then found and displayed. A section, if provided, will direct man to look
only in that section of the manual. The default action is to search in all of the
available sections, following a pre-defined order and to show only the first page
found, even if page exists in several sections.
The table below shows the section numbers of the manual followed by the types of pages
they contain.
1 Executable programs or shell commands
2 System calls (functions provided by the kernel)
3 Library calls (functions within program libraries)
4 Special files (usually found in /dev)
5 File formats and conventions eg /etc/passwd
6 Games
7 Miscellaneous (including macro packages and conven-
tions), e.g. man(7), groff(7)
8 System administration commands (usually only for root)
9 Kernel routines [Non standard]
A manual page consists of several sections.
Conventional section names include NAME, SYNOPSIS, CONFIGURATION, DESCRIPTION,
Manual page man(1) line 1
```

Where do we go from here?

- In this course, I'll assign homework projects that require root access on a RHEL/CentOS 6 system.
- In our next lab, you will be provided with a hard drive that can be used in the Sandbox lab (PL112) with the OS, and root privileges so that you will administer it.
- In addition, you can (and should) use the departmental workstations (also running CentOS) for most things, and to explore a working system
- See course web page for syllabus and schedule for topics and readings.

CSE265 Labs

- Each week I will post the instructions for the lab on the course web pages
- Today I have a hand-out to get you started
- If the computer in front of you is not on, please turn it on now
- If the computer in front of you is waiting for a keyboard press before allowing you to log in, please do so
- When you finish each lab, you'll sign the appropriate lab sheet so I can track progress