CSE 265: System and Network Administration

MF 1:10-2:00pm Mohler 355
W 1:10-3:00pm, 3:10-5:00pm Packard 112

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

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LEHIGH UNIVERSITY

Computer Science and Engineering
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CSE

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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)

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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

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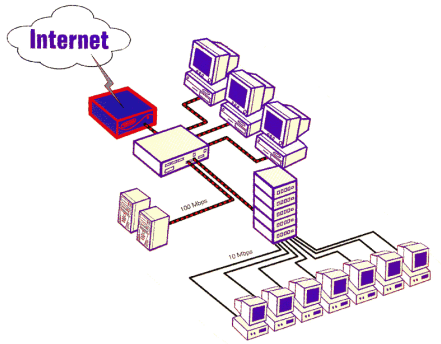
What will it not cover?

- 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



Microsoft Certified Professional Systems Engineer

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What does a sysadmin do?

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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 smoothly
  - Monitor system and network
  - Troubleshoot problems
- Maintain documentation
- Audit security
- Help users, performance tuning, and more!

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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

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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

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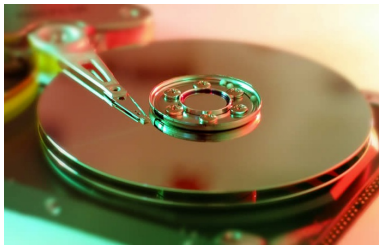
Data Backups



- 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

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Software Installation/Maintenance

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

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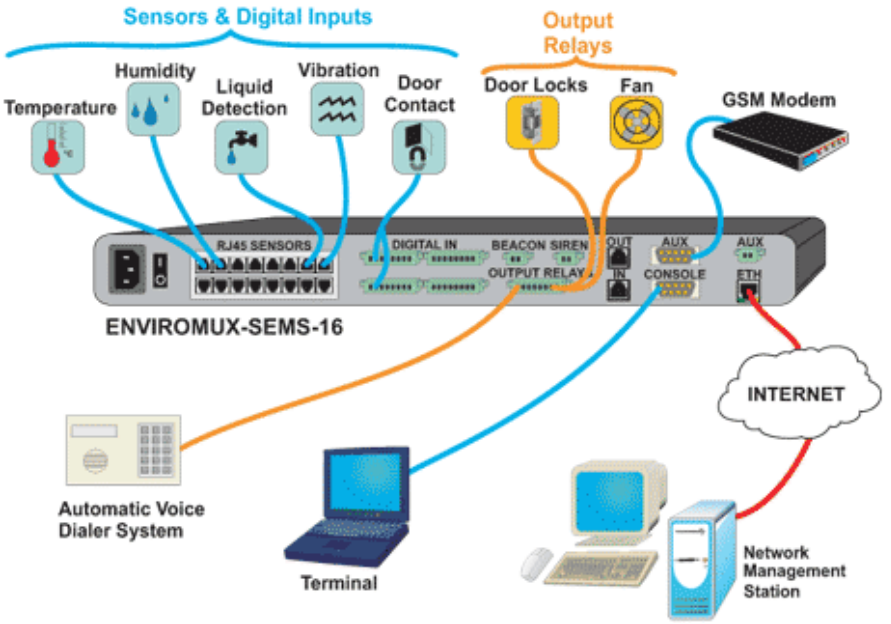
System Monitoring

- Hardware and services functioning and operational
- Capacity
  - Disk, RAM, CPU, network
- Security
  - Passwords
  - Break-ins
- System logs
  - Examination
  - Periodic rotation and truncation
  - Archival storage (at least summaries)



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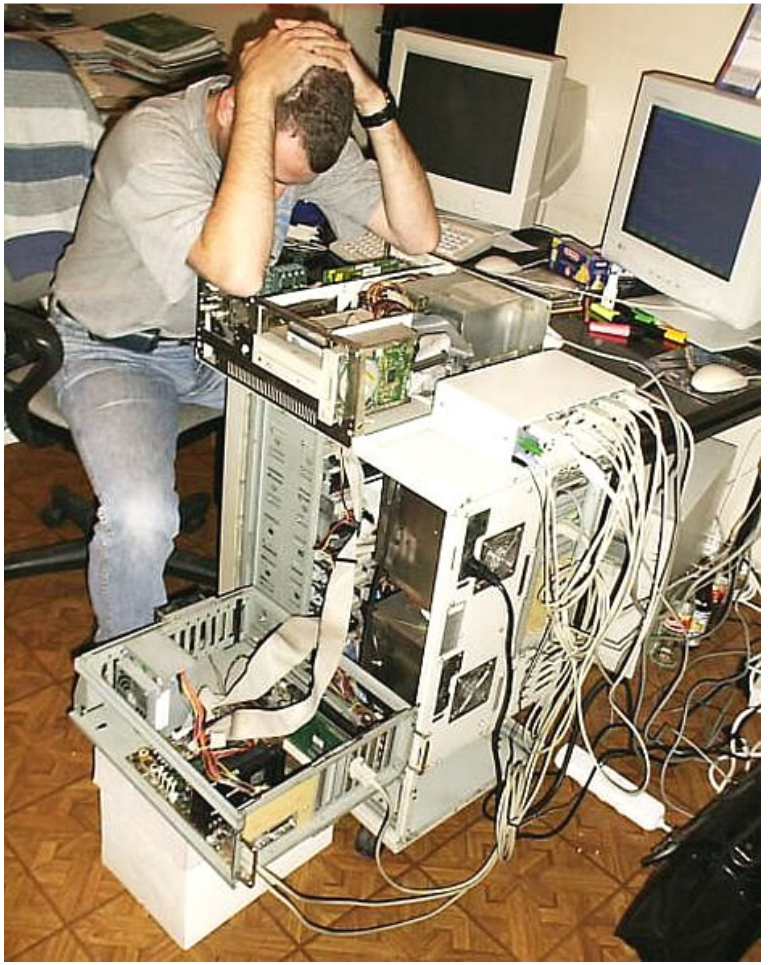
Troubleshooting

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



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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

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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

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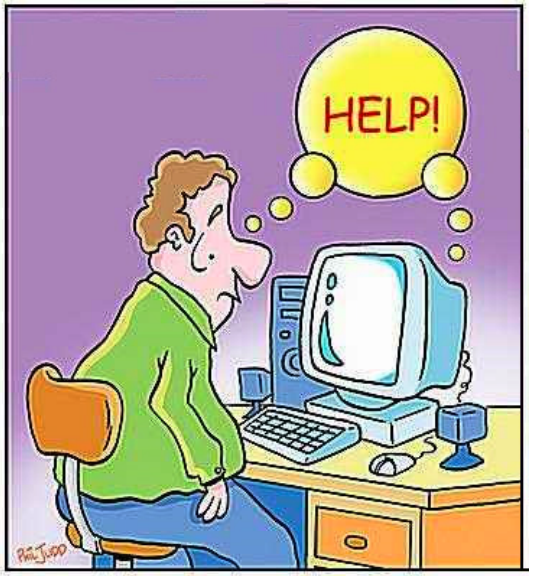
User Assistance

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



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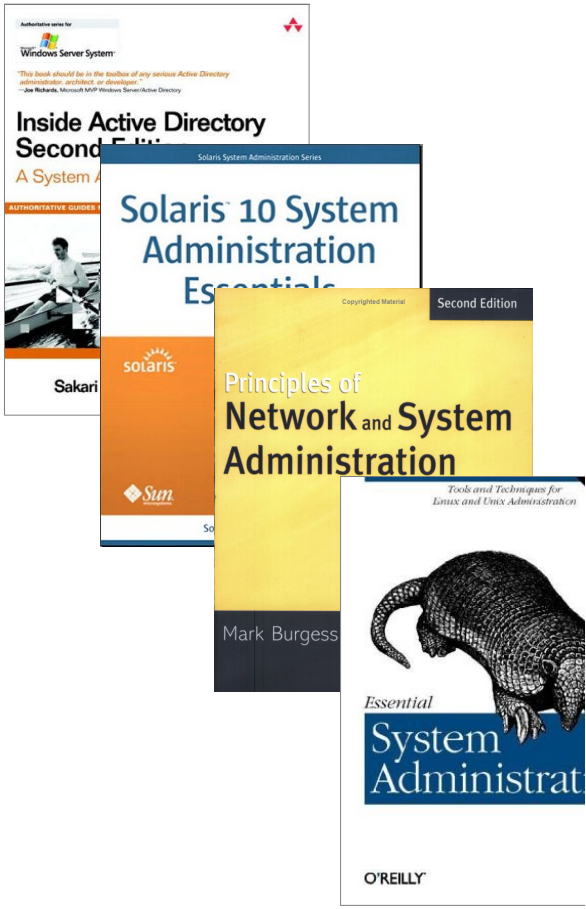
Administration Challenges

- 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!



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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

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Which OS to learn to admin?

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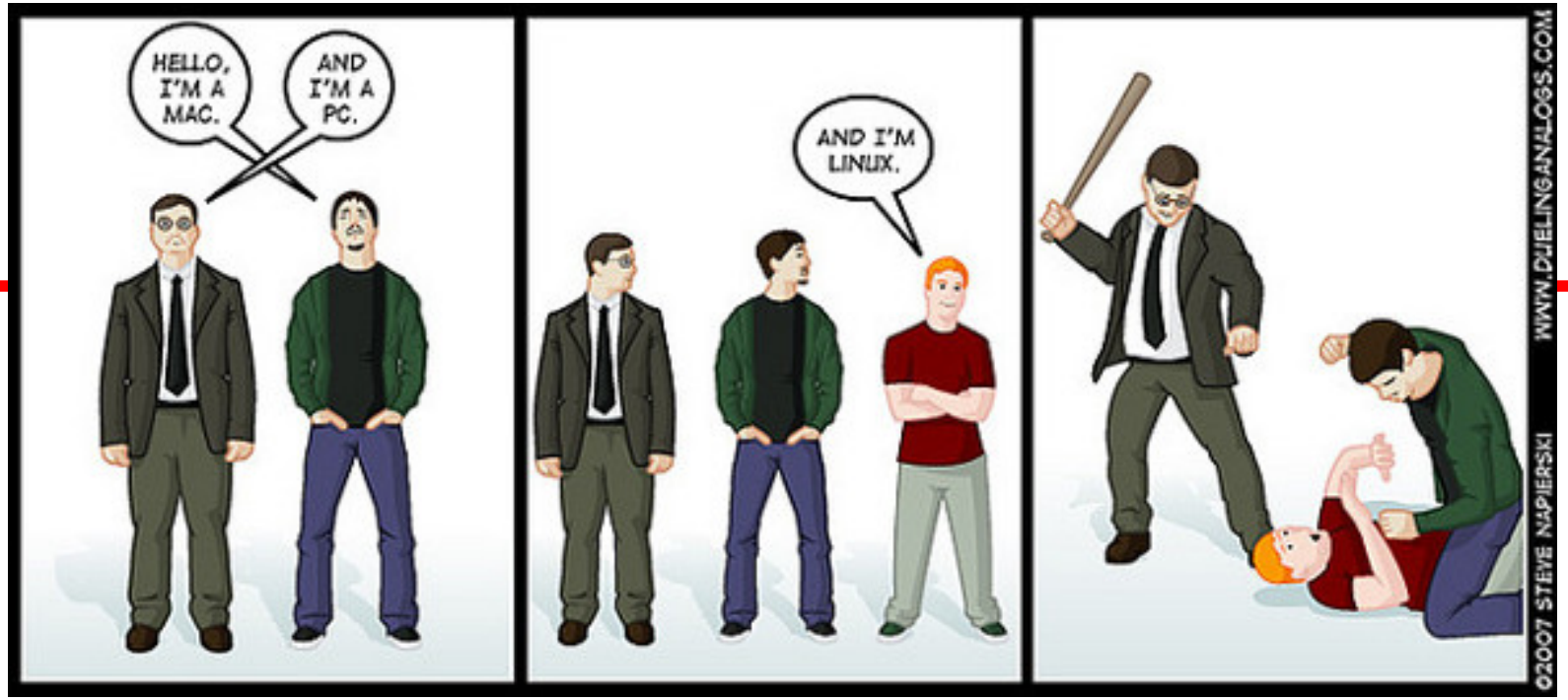
HELLO, I'M A MAC.
AND I'M A PC.
AND I'M LINUX.
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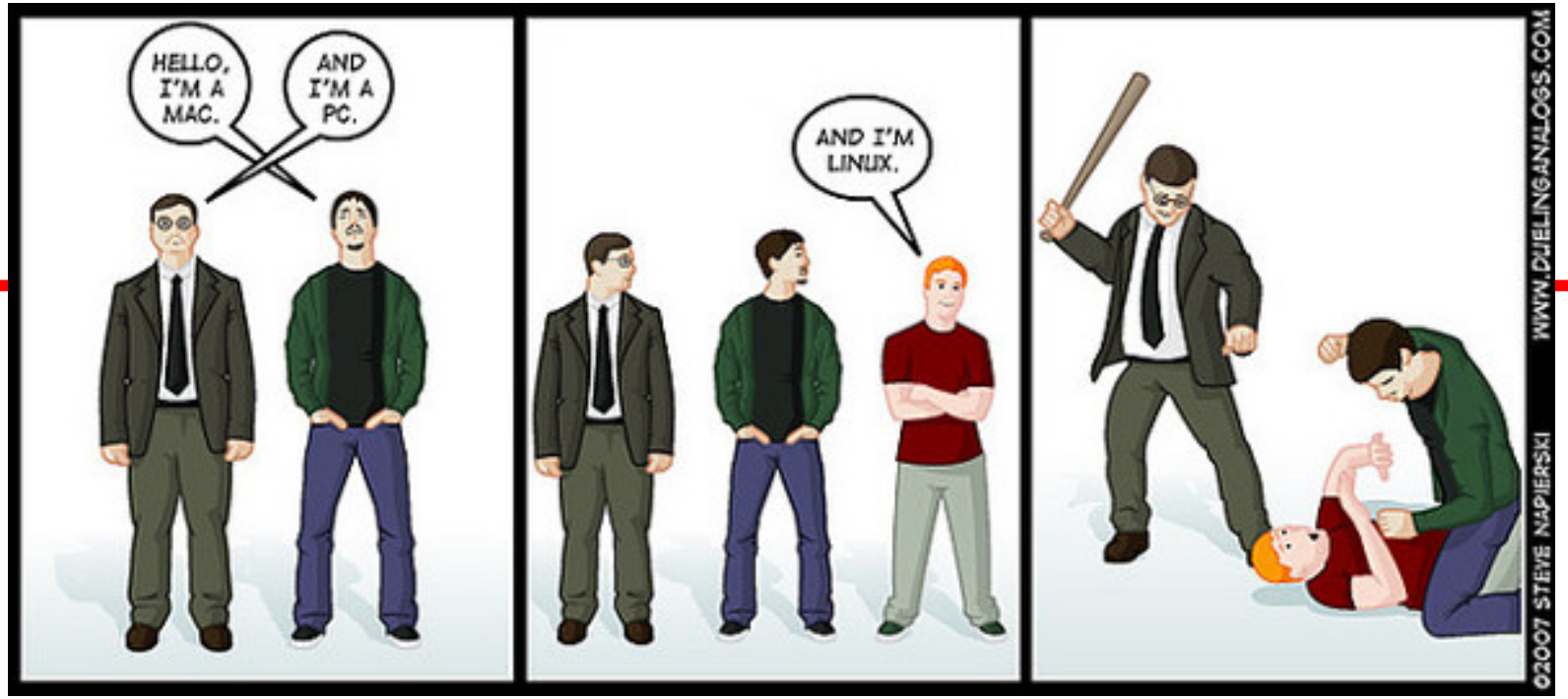
WWW.DUELINGANALOGS.COM



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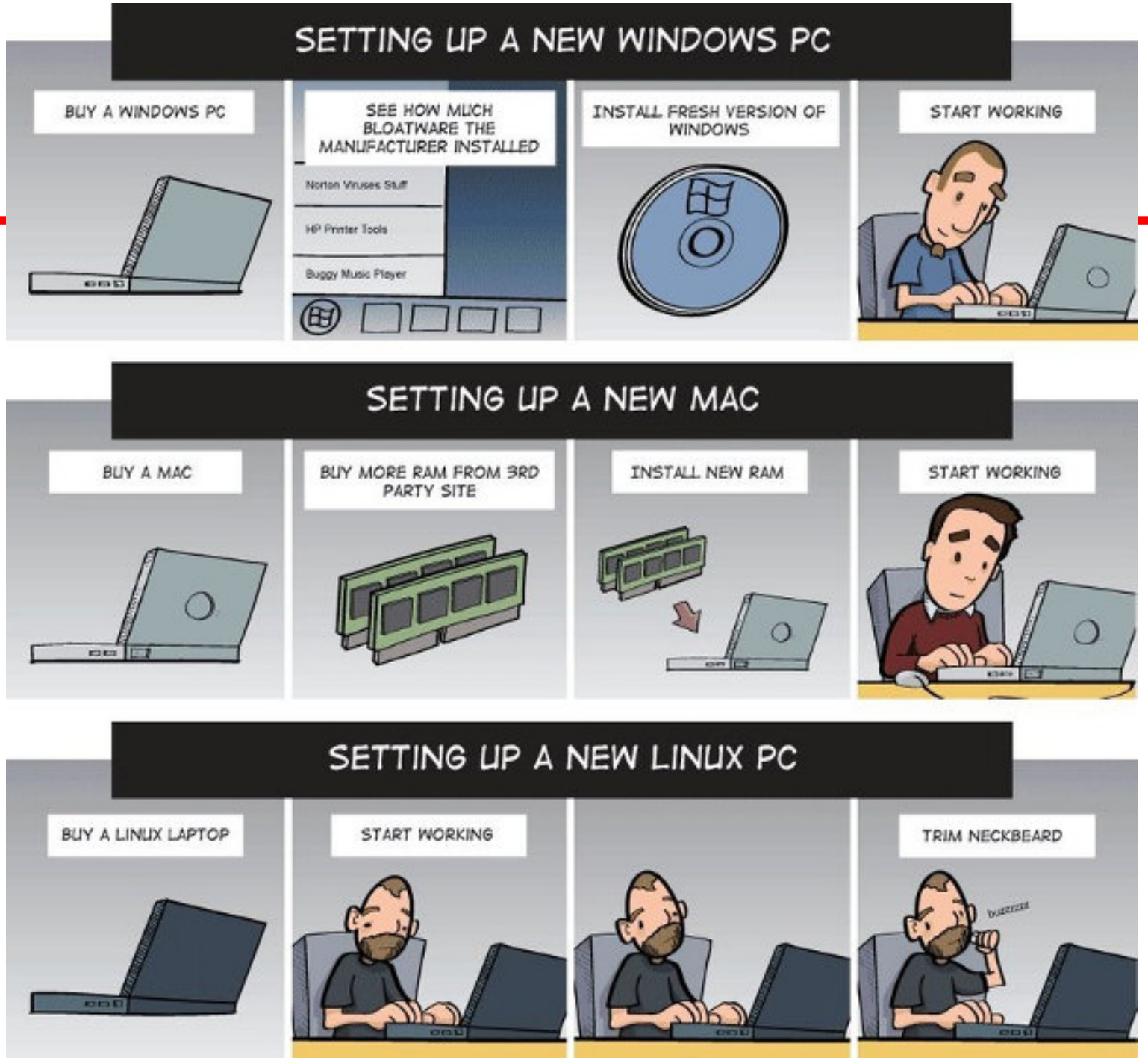

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Why (Red Hat/CentOS) Linux?

- 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

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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.

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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

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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 (Jan 2016) kernel release is 4.4

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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

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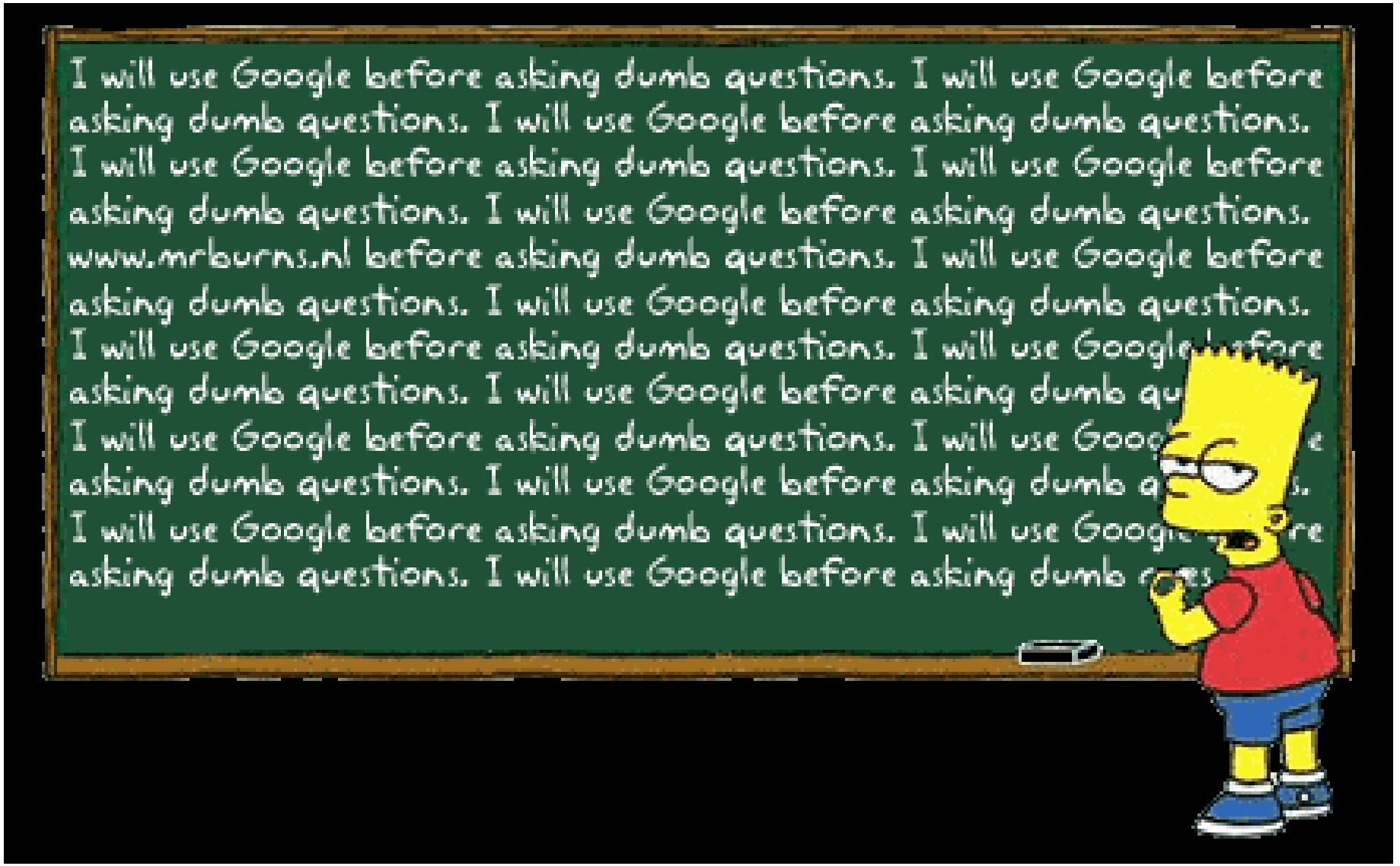
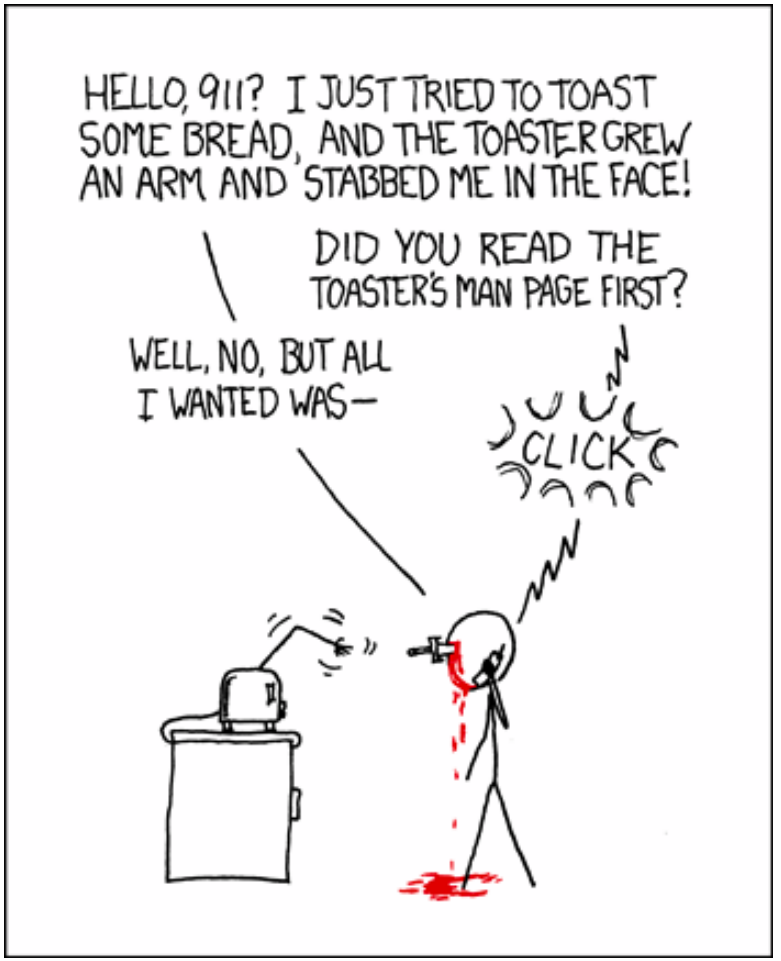
Where to get answers


I will use Google before asking dumb questions. I will use Google before asking dumb questions. I will use Google before asking dumb questions.

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



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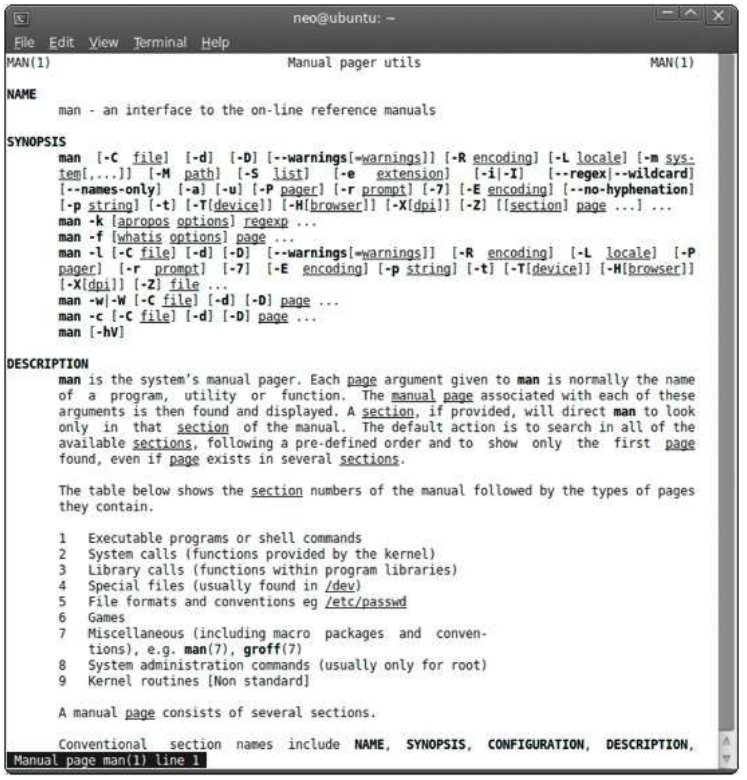
man page organization

- 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



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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 second lab, you will be provided with a hard drive that can be used in the Sandbox lab (PL112)
  - You will administer the OS on it with root privs (superuser).
- 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.
  - http://www.cse.lehigh.edu/~brian/course/sysadmin/

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CSE265 Labs

- Each week I will post the instructions for the lab on the course web pages
  - Normally I won't have a sheet like this
- When you finish each lab, you'll sign the appropriate lab sheet so I can track progress
  - Make sure you are completely ready (with all answers prepared ahead of time)

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