Administrivia

- Homework 9, due next Wednesday: Work through another editor tutorial and tell me what you learned.
- Homework 10, due next Wednesday: Talk about what you learned in the class, what could be better/different if the course is taught again, etc. (Sort of a long version of a minute essay.)
- Estimated grade based on attendance and homeworks 1 through 5 mailed today. Better estimate (up through homework 8) coming by end of week. Curve unlikely — more than half the class had over 90%!
- If you aren’t happy with your likely grade, you can earn up to 30 points of extra credit by doing some extra work. This could be a shell-scripting project, a makefile project, etc. If you want to do this, talk to me by e-mail or in person.

A Little About X (“The X Window System”) — Basic Ideas

- Some operating systems include GUI support in the “kernel”. Unix takes a different, layered approach. Slower, but safer and more flexible.
- Basic idea — separate processing from GUI and allow them to be on the same computer or different computers:
  - X “client(s)” are programs that want to do GUI input/output — e.g., Mozilla, gv, etc.
  - X “server” manages display, accepts input. Can be a process running alongside clients, or a whole operating system (for an “X terminal”), or an application running on a different operating system (“X server/emulator for Windows”).
- X defines protocol for client/server communication.
A Little About X — Application Programs

- How to write a program with a GUI? Can make calls to X library functions directly — set up window(s), main processing loop to handle “events”.
  (Example.)

- Or can use a higher-level “widget set” (buttons, menus, etc.): Motif, GTK, etc.
  (Why several? Well, this is Unix.)

A Little About X — User Interface

- Separate “window manager” controls how user interacts with windows — how they’re arranged on the screen, how the user moves them around, etc.
  Examples include twm, fvwm, Window Maker. (Why several? You know.) switchdesk provides limited ability to change window manager. To tweak further, edit appropriate dot-something files in home directory.

- In addition, can have a “desktop environment” that provides additional features. Examples include CDE (Sun), KDE, Gnome. Desktop environments provide something that looks more like Mac/Windows interface, but at a performance cost.

- A somewhat (but not very) extreme view: “A window manager is a mechanism for managing xterms.”
A Little About X — Tips and Tricks

- To copy and paste text — highlight with left mouse button, paste with middle mouse button. Works with all “standard” X applications.

- Can start a second X server on Linux machines via:
  
  \[ X :1 -\text{query machine} -\text{once} \]

  Switch back and forth with control-alt-F7/F8.

- RH 9 lab machines set up now so that when you `ssh` to another machine and run an X-using application, it automagically displays on your screen. Formerly, you had to set the DISPLAY environment variable and export it.

Course Wrap-Up — What I Hope You Got From This Class

- More things in your “bag of tricks” (see next slide).

- Practice in reading man pages and otherwise learning more.

- Exposure to a different operating system / user interface paradigm — many small programs that work together, information kept in text files, emphasis on being expert-friendly and scriptable, etc.
Course Wrap-Up — Topics

- Shell features — command history, redirecting input and output, scripting features (if/then/else and loops).
- Pipes.
- Filter programs (awk, sed, grep, etc.).
- Text editors.
- \LaTeX.
- make and makefiles.
- Regular expressions (for text editing, grep, etc.).

Minute Essay

- Reminder: Homework 8 due by 5pm today.