Slide 1

Administrivia

- Reminder: Homework 6 was due last Monday. Homework 7 was due last Wednesday. Late penalties go into effect a week after due date.

Slide 2

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 — Using Application Programs

- Most X-based applications support a common set of command-line parameters (e.g., `-geometry` to set initial size and position).

- `.Xresources` can provide other configuration information.

- To copy and paste text — highlight with left mouse button, paste with middle mouse button. Works with all "standard" X applications (whatever that means!).

Slide 3

A Little About X — Writing 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.)

  Also try wxWidgets (cross-platform GUI library).

Slide 4

Slide 5

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." (Similarly: "A mouse is a device for selecting xterms.")

Slide 6

A Little About X — Remote Access

- Can start a second X server on Linux machines via:

  `X :1 -query machine -once`

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

- Lab machines set up now so that when you `ssh -X` 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.)

- VNC (Virtual Network Computing) is another protocol for remote access. Try `vncviewer`. (Doesn't seem to work on lab machines. "To be investigated.")

Minute Essay

- None — sign in.

Slide 7