Why Window Systems?

- Increased usability due to
  - Visibility
  - Graphical representation of programs
  - Seeing multiple environments at once
  - Direct Manipulation
- Enables powerful graphics programs
  - Pixar: [http://www.pixar.com](http://www.pixar.com)
  - [http://slashdot.org/articles/03/02/09/1637254.shtml?tid=106](http://slashdot.org/articles/03/02/09/1637254.shtml?tid=106)

Window Systems and Unix

- Most Unix users can be considered experts, and are fiercely protective of the command line
- All current Unix systems have a built-in window system, due to the obvious advantages of a graphical user interface

X Windows

- Practically all Unix window systems are based on X Windows (XFree86)
- Standard Version: X11R6
- Complex system with many parts
  - X11:
    - Manages the screen space
    - Draws simple graphics
    - Assigns rectangular regions to various programs
**X’s Client-Server Architecture**
- X is actually meant to work over the network
- X server: software that runs on the machine where the program’s output will be displayed
- X client: program running on the same or another machine
- Client sends drawing and other X commands to the server, which displays the results

**Historical Use of X**
- Users sat at “X terminals” – graphical terminals that only knew how to run an X server
- They logged in to other Unix machines remotely and ran X clients there
- This gave users the benefits of a window system without the need for a full-featured computer on every desk

**Features of X**
- Transparent remote execution
- Gives programs their own virtual screen
- Includes important windowing concepts
  - Window damage
  - Window reveal events
  - Backing store
- X11 programs are highly portable

**Desktop Environments**
- Purpose is to integrate the various interface components into a cohesive, consistent whole
- Provides file managers (Nautilus), handles desktop icons, and overall desktop operations
- Can handle window operations or use a window manager
- Popular desktop environments
  - GNOME (GTK+)
  - KDE (Qt)
  - XFce (GTK+)
Window Managers

- Not part of X11 itself; run on top of X11
- Place borders and decorations on windows
- Handle input from users
- There are many, many choices with different “look and feel”
- [http://xwinman.org/](http://xwinman.org/)