Announcements

- Final is May 20, 1996 1:30-3:30 PM
  - in Chemistry Room 115 (same room as lecture)
- Reading: none
- Course evaluations were distributed

Distributed Batch Queuing

- Problem: Many sequential compute bound jobs
- Environment: lots of semi-autonomous workstations
- Solution:
  – support submitting jobs to a pool of workstations
    • find “idle” workstations and use them
  – should look like they are running on a local workstation
- Issues:
  – what if the workstation “owner” returns?
    • need to checkpoint job and migrate it
  – how to make remote jobs look like local jobs?
- Examples:
  – Condor (aka IBM load leveler)
  – Piranha

Display and Window Management

- The screen is a resource in a workstation system
  - multiple processes desire to access the device and control it
  - OS needs to provide abstractions to permit the interaction
- Services
  - protection
  - windows
  - multiplex keyboard and mouse
  - configuration and placement
- Issues
  - how to get good performance and remain device independent
  - how much policy to dictate to users

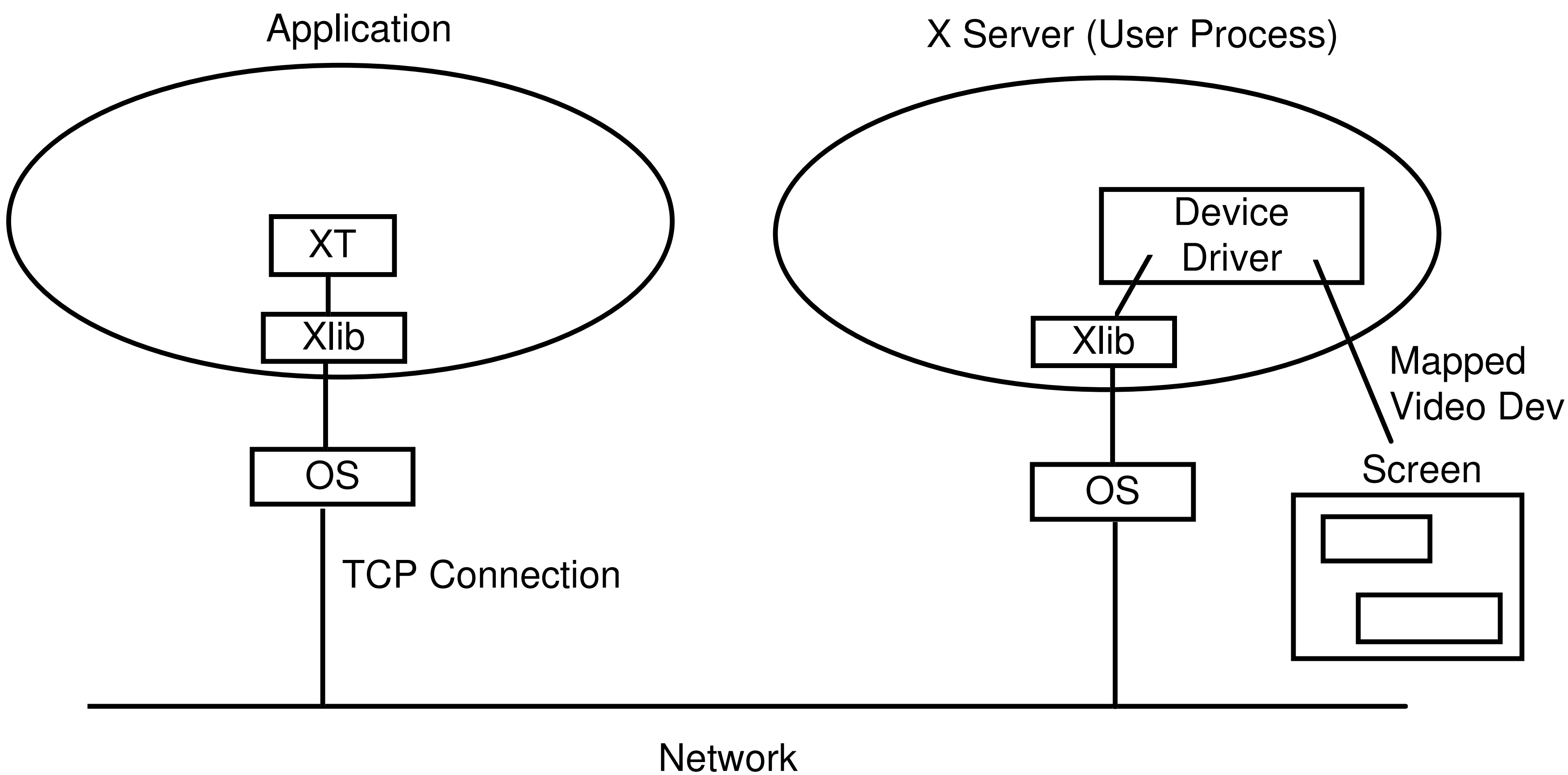
X Window System

- Designed for mid range workstations
  - very little policy
  - supports network display services
    - applications can run one place and display another
    - server is the display
    - clients are programs that contact to the server
  - basic protocol called X11r6
  - event based programming model
    - next event loop in application
  - typical requests
    - create window, draw line, draw circle, display text
  - typical events
    - key pressed, mouse moved, window (or part) now visible

X Libraries

- Programming raw X is tedious
- Many libraries exist to make it easier
  - libraries are linked into applications
  - X toolkit
    - object oriented interface plus widget library
    - widgets: buttons, menus, text, lists, etc.
    - provides main message loop
  - Motif
    - like X tool kit but “standardized”
    - more stylish look and feel
  - Tcl/Tk
    - Tk is the X interface (sort of Motif like)
    - TCL is a language for describing applications

X Windows


Application
X Server (User Process)
XT
Xlib
OS
Device
Driver
Xlib
OS
Mapped
Video Dev
Screen
TCP Connection
Network

X Window Security

- Sever can limit what machines and users can connect and create windows
  - uses normal network based security protocols
  - also has a simple mode based on host names
- Window protection
  - can restrict access to only those windows the process has created