What Is An Operating System?
Before Operating Systems

◆ What do you do with just computer hardware?
  – If someone gives you a computer with no software whatsoever, how do you get it to do anything?
  – You write a program that runs on the hardware

◆ In the early days, that was the way it worked ...
  – You started with just the bare hardware
  – You wrote a program that did **everything**:
    ◆ Including managing all aspects of the hardware
    ◆ Including solving your particular problem

  – Your program was all the computer did!
Without an Operating System

- Each program runs directly on the hardware
- Each program must do everything
- Each program needs to know the details of the hardware and how to use it
- If the hardware changes, the program must change as well
- The hardware supports only one program at a time - each user must wait until the previous program is done to “share” the hardware with other users.
- Writing programs is incredibly complex and expensive
With an Operating System

- Operating system runs directly on the hardware
- Operating system is in charge of managing the hardware
- Operating system hides the details of hardware from software - provides a much simpler interface for programs
- If hardware changes, software does not - operating system must handle it
- By carefully managing hardware resources, several programs can run at once
- Software becomes much easier and cheaper to develop
So, What Are the Benefits of an OS?

- An operating system manages the computer
  - Programming is easier
  - Using a computer is easier - you no longer need to be an expert to use it

- An operating system hides the hardware
  - Programs are portable
  - Programs are hardware-independent

- An operating system facilitates resource sharing
  - Several users can run several programs at once
  - Saves time and money
How Hardware Resources are Shared

- Memory and disk space
  - programs use different regions

- Printers (and other peripherals)
  - programs line up and wait

- CPU
  - programs time share
  - time is split into slices, with each program getting several slices
Different processes are run for some small amount of time in turns.

Each task believes that it has the whole machine to itself!

Slower than being by itself, but quick enough.
Not Really That Slow In Reality

The network is slow today ... 

Is the computer shared?! 

This user is a slow typer!

This file is taking forever to load!

Use `top` to see the busiest programs!
Exercise

- Use `who` to see how many users are using the system.
- Use `top` to see the busiest processes.
  - press q to quit top
- Use `ps` to see your own processes.