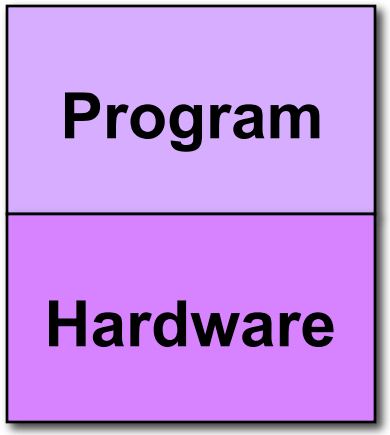
What Is an Operating System?

Before Operating Systems

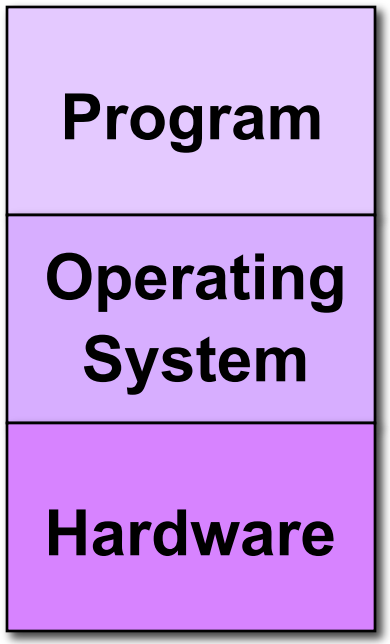
- A computer is a machine designed to run machine instructions on its hardware.
- What do you do with just computer hardware?
  - If someone gives you a computer with no software whatsoever, how do you get it to do anything?
  - You write a program that runs on the hardware
- In the early days, that 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



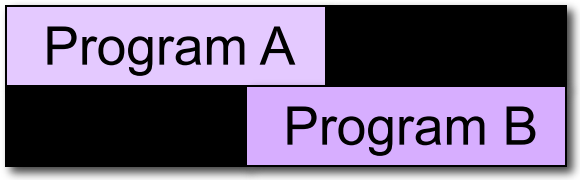
- Operating system runs directly on the hardware
- Operating system is in charge of managing the hardware
- Operating system hides the details of hardware from software - provides a much simpler interface for programs
- If hardware changes, software does not - operating system must handle it
- By carefully 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?

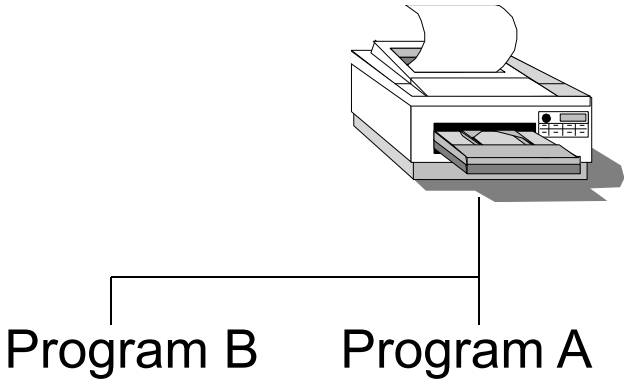
- An operating system manages the computer
  - Programming is easier
  - Using a computer is easier - you no longer need to be an expert to use it
- An operating system hides the hardware
  - Programs are portable
  - Programs are hardware-independent
- An operating system facilitates resource sharing
  - Several users can run several programs at once
  - Saves time and money

How Hardware Resources Are Shared

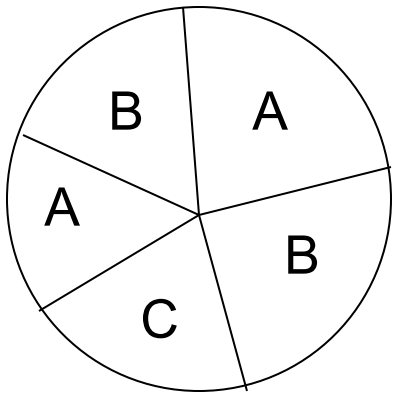
- Memory and disk space
  - programs use different regions



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

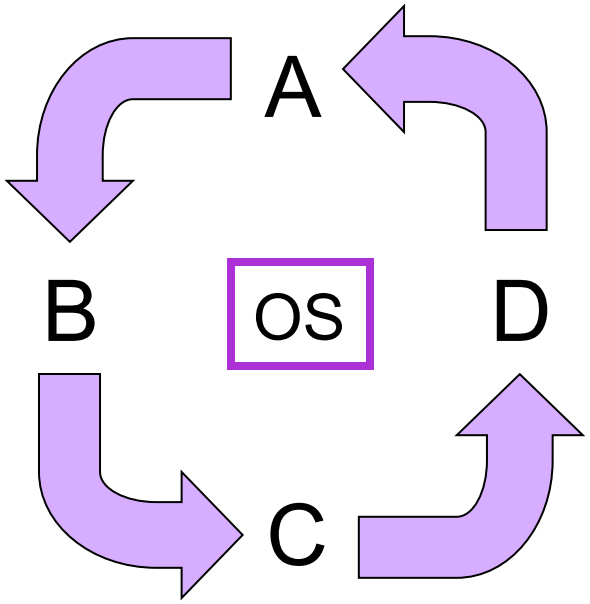


- CPU
  - programs time share
  - time is split into slices, with each program getting several slices



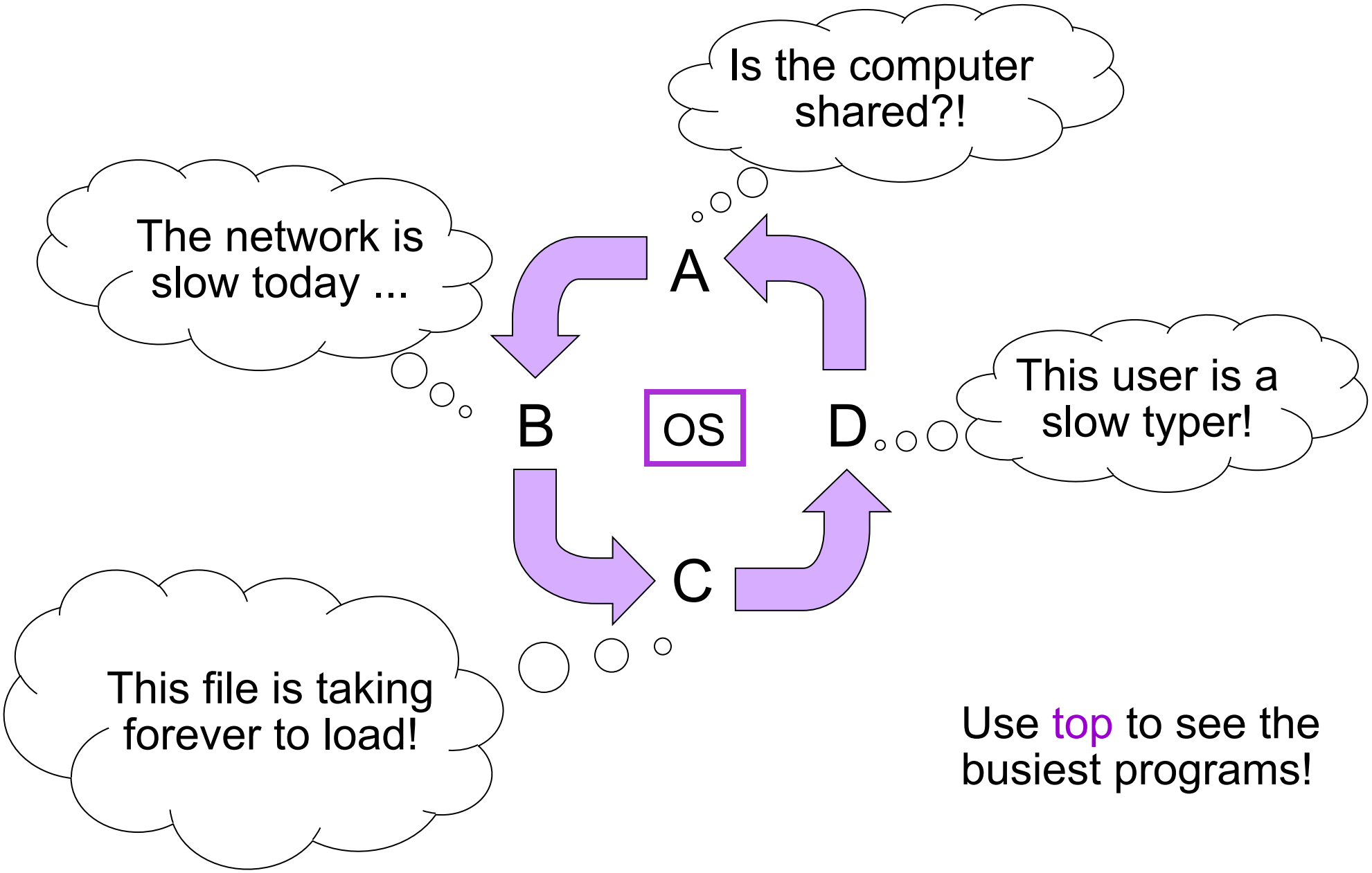
Time Sharing Explained

- 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



Use top to see the busiest programs!

What Is an Operating System?

- An operating system is system control program for a computer.
- It manages the computer's hardware and provides a convenient and safe environment.
- It allocates computer resources.
- It schedules tasks.
- It provides an interface to the user.

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 top −u your_username to see processes related to you.
- Use ps to see your own processes.