CS 3841 Operating Systems
An Introduction to Operating Systems

- Objectives
  - Compare and Contrast the User View and System View of an operating system.
  - Explain the difference between user mode and kernel mode within an operating system.
  - Define the term Operating System
  - Draw a representation of a modern computer system.
  - Draw the storage structure hierarchy for a computer system.
  - Explain the difference between a trap and an interrupt.
  - Explain, in the context of an operating system, multiprogramming.
  - Explain, in the context of an operating system, time sharing.

Why are we here?

"I think there is a world market for maybe five computers."

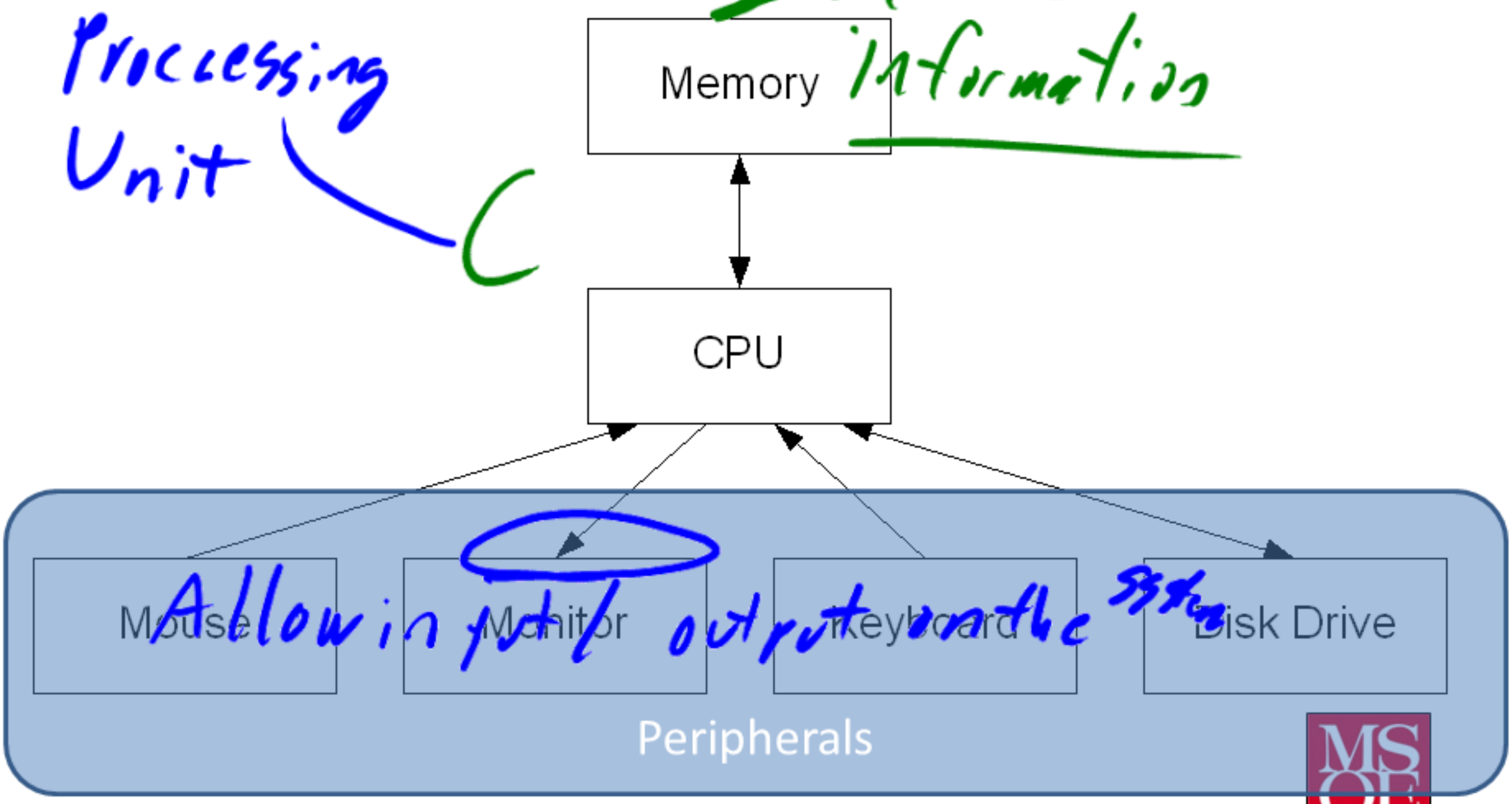
— Thomas Watson, chairman of IBM, 1943.

"If you give someone a program, you will frustrate them for a day;
if you teach them how to program,
you will frustrate them for a lifetime."

What is a computer?
One Model

Central Processing Unit

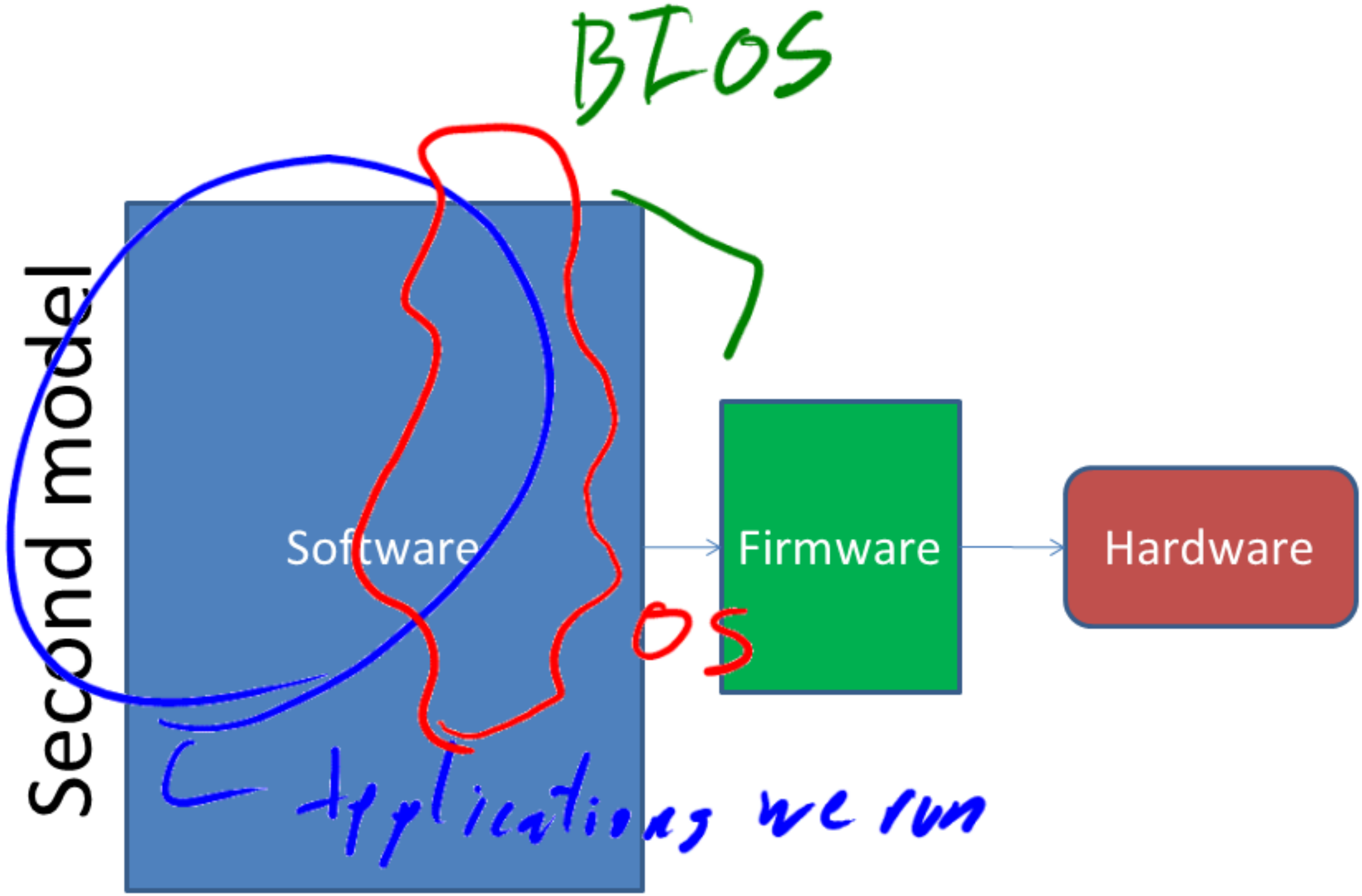
Stores information



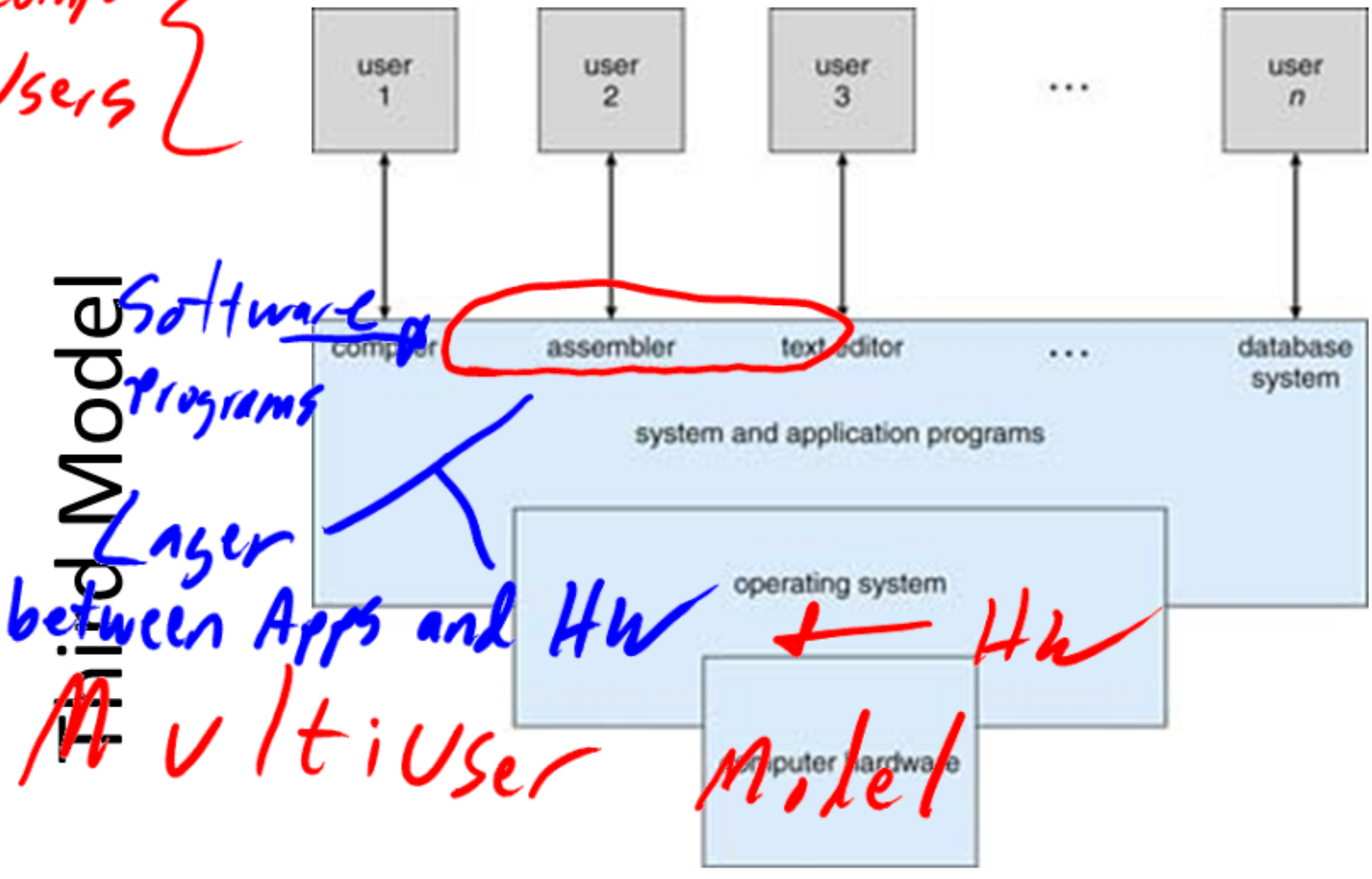
Allow input/output devices

What is a computer?

Second model



Computer Users



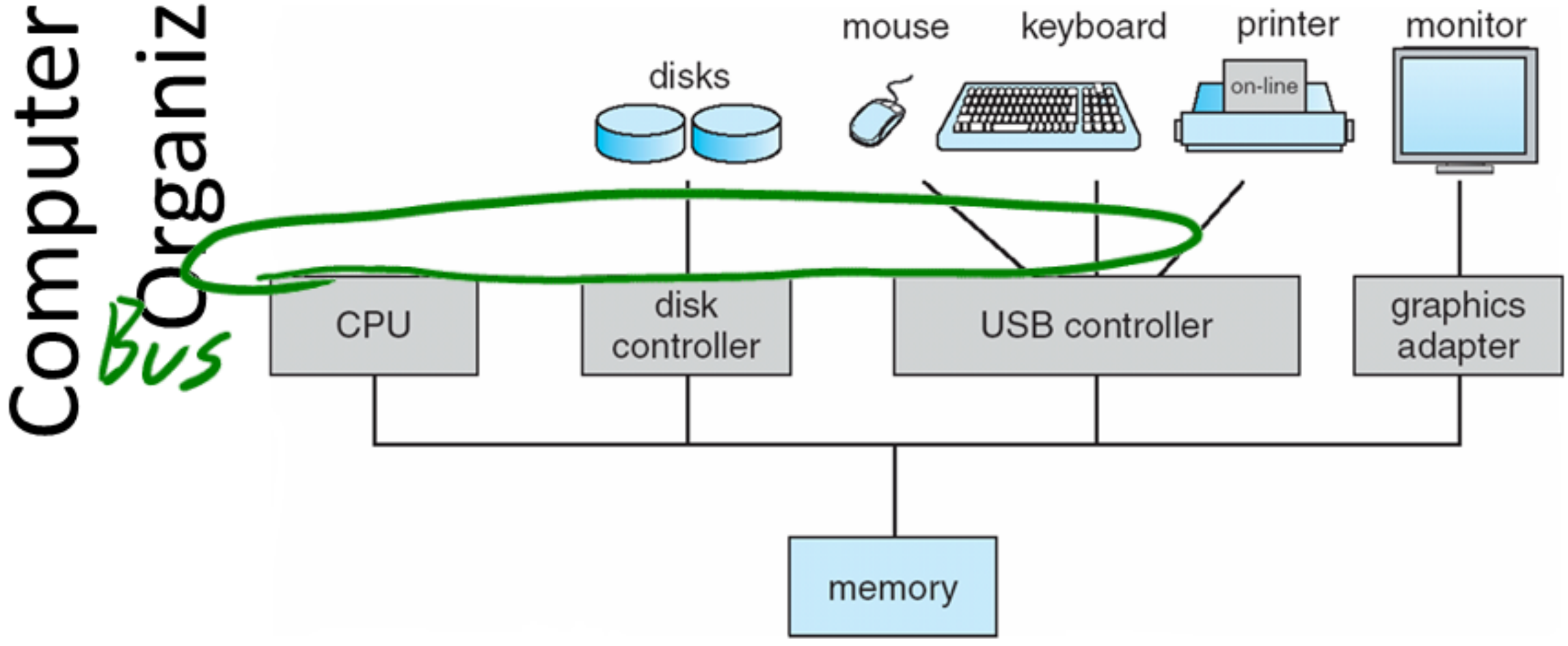
Software Programs

Layer between Apps and Hw

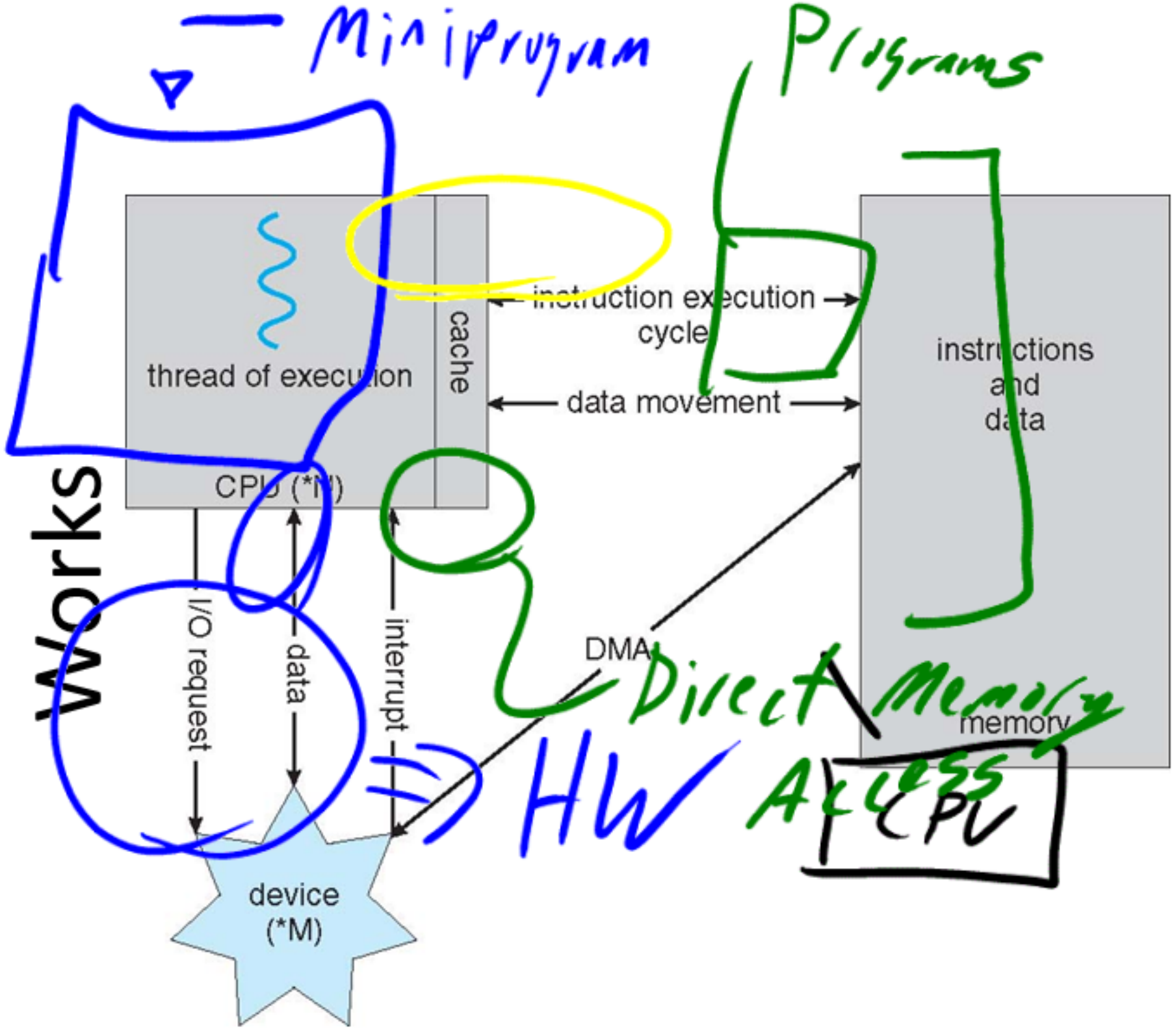
Hw

Multiuser model

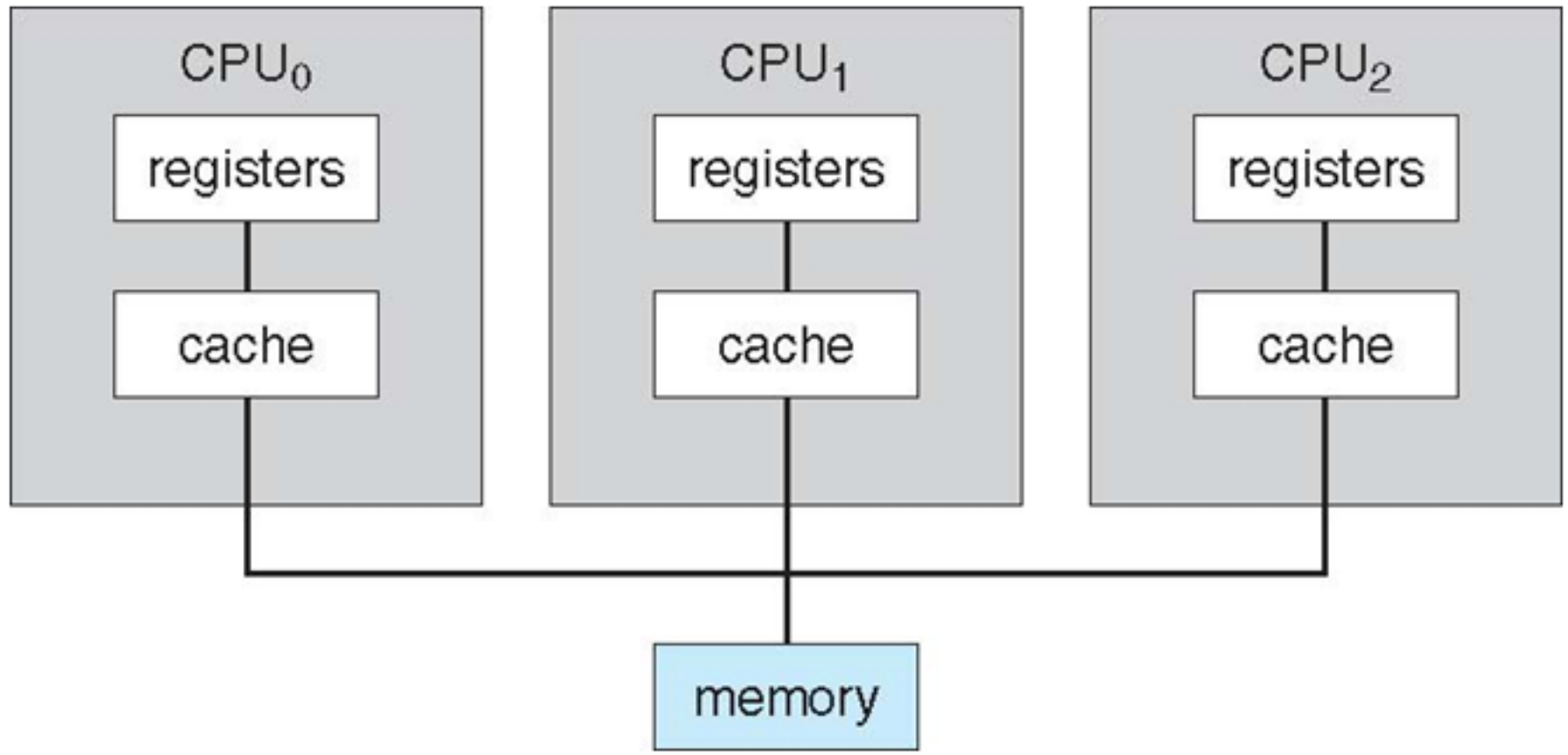
- Computer-system operation
  - One or more CPUs, device controllers connect through common bus providing access to shared memory
  - Concurrent execution of CPUs and devices competing for memory cycles



How a Modern Computer Works

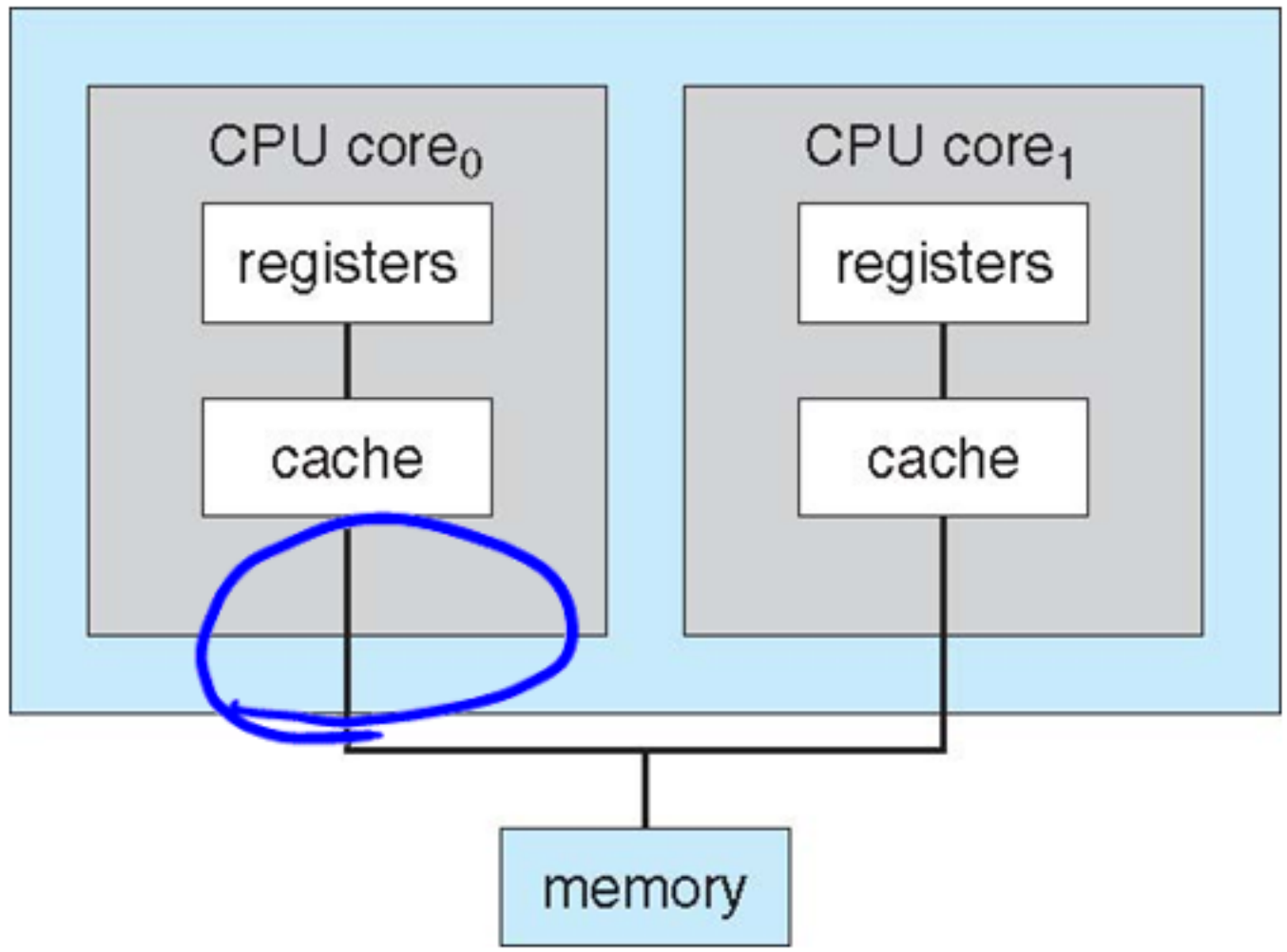


Symmetric Multiprocessing Architecture



A Dual-Core Design

Multiple CPU cores busy



What are the pieces of an operating system?

I/O
⇒ GUI
⇒ Keyboard
⇒ Mouse
⇒ Touchpad

Storage
⇒ Floppy
⇒ Hard Drive
⇒ USB flash

Memory Manage

Kernel

Networks
- Ethernet
Wireless

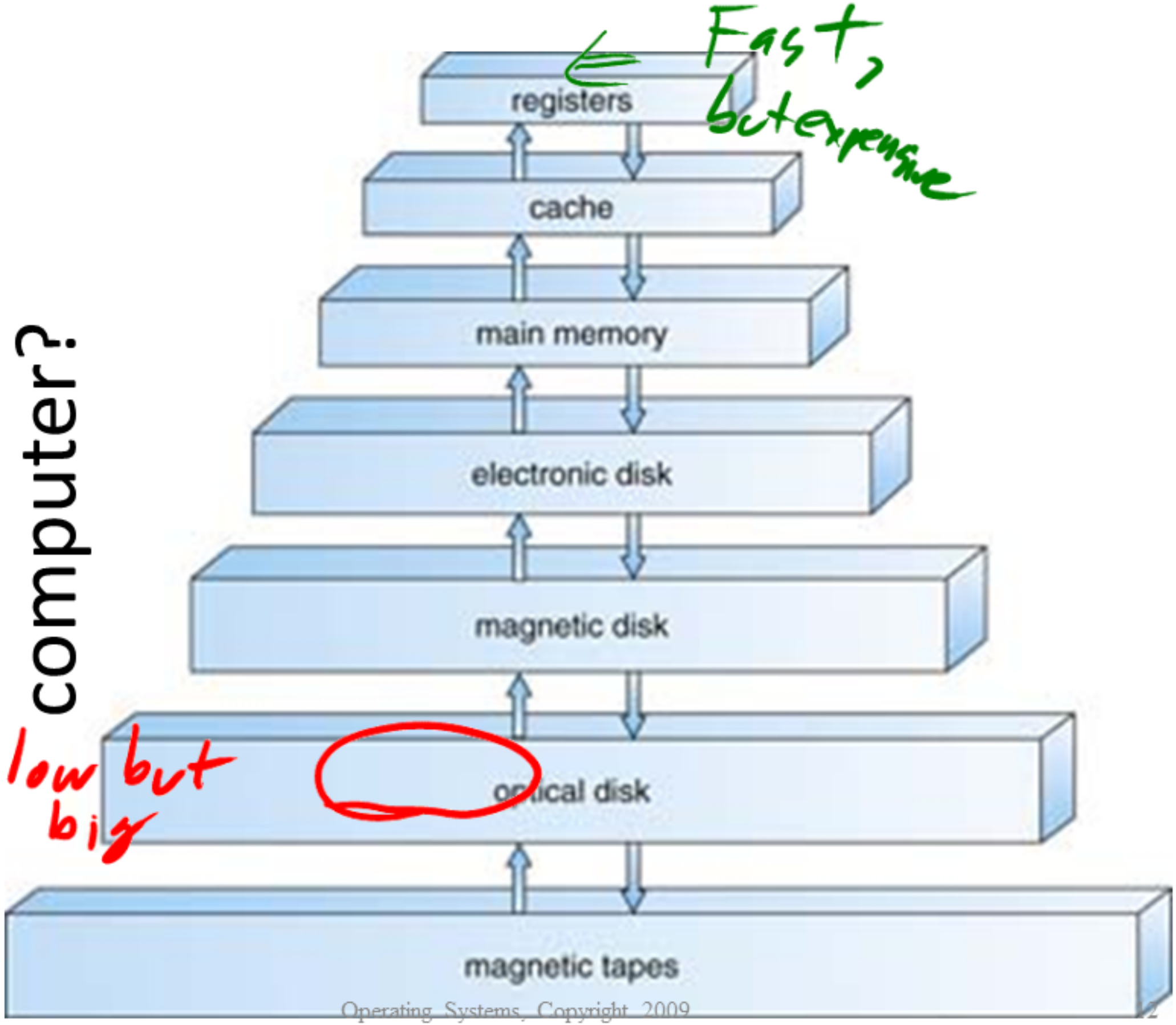
Bluetooth
Wireless USB

next

What are the pieces of an operating system?

- I/O
  - GUI
  - Keyboard Management
  - Mouse manipulation
  - Touchpad manipulation
- Storage (File Systems)
  - Floppy drive
  - Hard drive
  - Flash drive
- Network Interface
  - ethernet
  - Wireless
  - Bluetooth
  - Wireless USB

What is the memory hierarchy for a typical computer?



Two models

- User view
  - The concept of an operating system from the users perspective
  - Typically defined by the scope of the services

Downward

Two models

- System view
  - The view of the operating system from the hardware's standpoint
  - OS viewed as a manager of computer hardware

- Software error or request creates **exception** or **trap**
  - Division by zero, request for operating system service

Cause a hardware access for an OS service to run.

Security through operating systems

- What forms of security does an operating system offer?

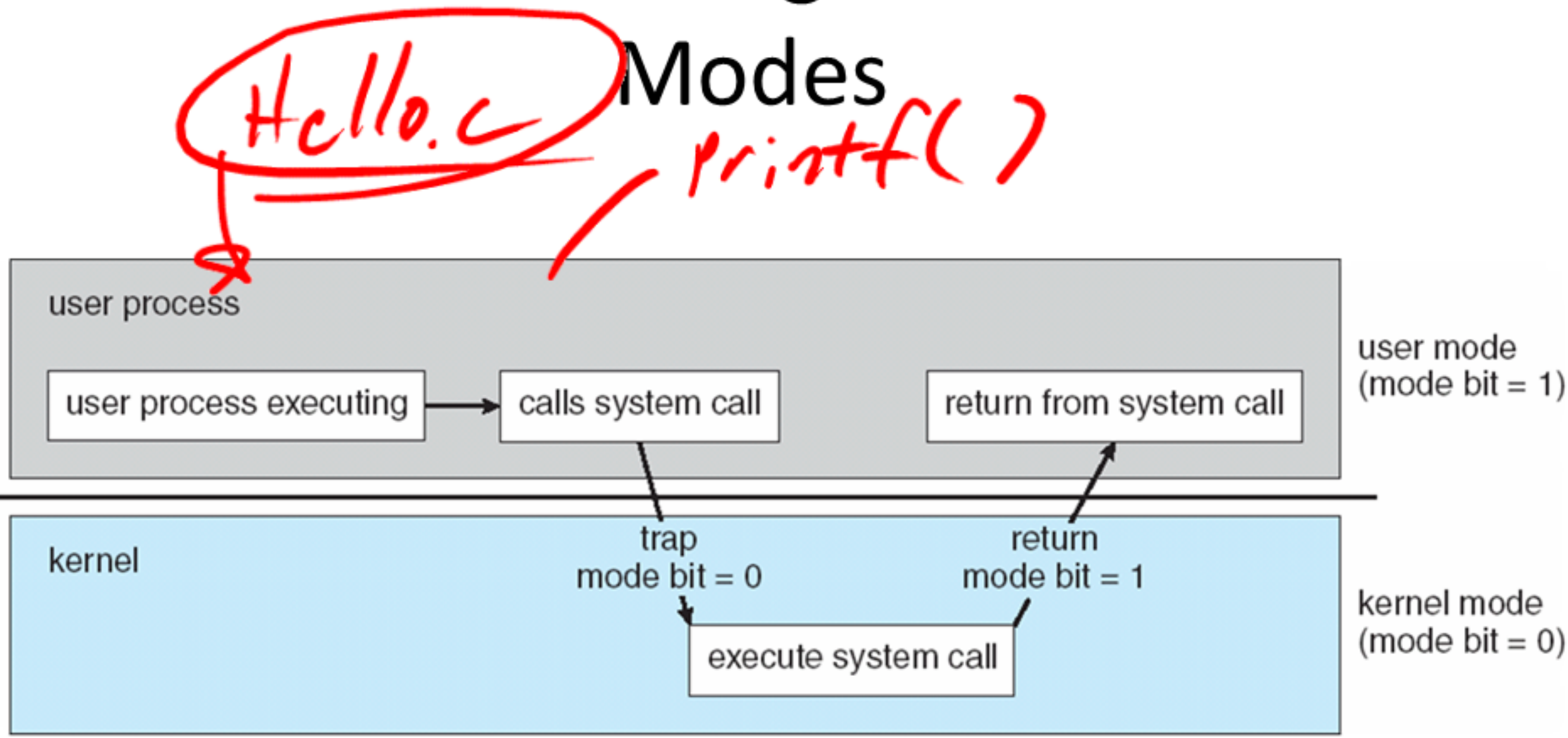
Security through operating systems

- Authentication
- File Security

Dual Mode Operation

- Kernel Mode
  - Also referred to as supervisor mode, system mode, or privileged mode
  - Protects the operating system from errant users
  - Typically used for Device driver code, timers, interrupts, etc.
- User mode
  - General mode in which the system operates
  - Trying to execute a privileged instruction will cause an exception handler to execute

Transitioning Between Modes



- **Multiprogramming**
  - Multiprogramming organizes jobs (code and data) so CPU always has one to execute
  - One job selected and run via **job scheduling**
  - When it has to wait (for I/O for example), OS switches to another job

- **Timesharing (multitasking)** is logical extension in which CPU switches jobs so frequently that users can interact with each job while it is running, creating **interactive** computing
  - **Response time** should be < 1 second
  - Each user has at least one program executing in memory ⇨ **process**
  - If several jobs ready to run at the same time ⇨ **CPU scheduling**
  - If processes don't fit in memory, **swapping** moves them in and out to run

Operating System

- "OS is simply the software that controls your computer and tells it what to do. Your computer must have an OS installed before it can do anything useful or fun."
  – Support.apple.com

Operating System

- "An operating system is a collection of system programs that control computer and any other peripherals connected to it. The program that hides the truth about the hardware from the programmer and present and a nice simple view a named file that can be read & written as "operating system". Operating system shields the programmer from the interface, the abstraction offers by the operating system is slower & easier to use than the underlying hardware."

- - Oscience.info