SY110
Computer Architecture

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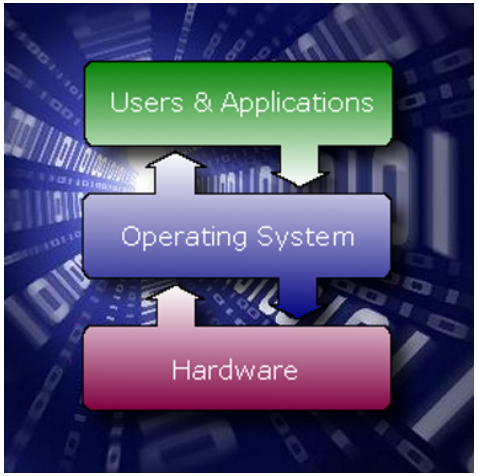
Outline

What is a computer?



High-level view

When we think of a computer, we can think of three major components:

- The user and the programs the user runs
- The Operating System (OS)
- The physical hardware itself

Defining Computers

We'll discuss the components of the physical machine and its hardware components today; later, we will look at the OS and applications later. But first, we need a common understanding of just what "computer" means.

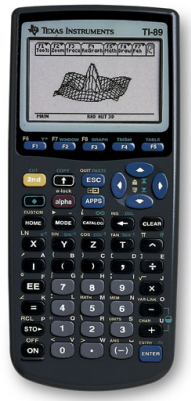
Computer defined

A device that can:

- Accept data input
- Process data
- Output data
- (Optionally) store data

The definition relies on data! Review: what do we mean by data?

Is it a computer?



Computer HW Components

Usually, when we think of a computer, we're thinking of a laptop, PC, or large server. Let's discuss their main components.

Components

- CPU – Central Processing Unit – the brain of the computer; performs operations on the data
- Memory (RAM) – Short-term memory for data the CPU needs to operate on. RAM is *volatile*, power-off = data lost
- Hard drive (HDD) – *Non-volatile* long term memory; usually much larger than RAM, but much slower to access data
- Peripherals – Components attached to the computer, but not part of its core architecture, *e.g.* printers, mice, monitors

Spec Check

CPU Speed and Memory

1. Click "Start" button
2. Select "Control Panel"
3. Click on "System and Security"
4. Select "View amount of RAM and Processor Speed"

How many *bits* of RAM does your machine have?

Hard Drive Capacity

1. Click "Start" button
2. Select "Computer"
3. Right click on "C", choose "Properties"

Spec Check

Peripherals

1. Click "Start" button
2. Click on "System and Security"
3. Under "System", click "Device Manager"

Flash Media

Flash drives

Flash drives (USB sticks) have caused significant problems on DoD networks, and are very rarely allowed on government information systems (I've never seen it). Simply plugging one in can allow malicious code on the flash drive to run on a computer, without any interaction from the user at all.

See a CNET article describing a cyber attack via USB flash drive here:
`http://www.cnet.com/news/bad-flash-drive-caused-worst-u-s-military-breach/`

A closer look – CPU

As discussed, the CPU is the "brain" of the computer. It is responsible for executing instructions required to run the OS and applications on the computer

Fetch-decode-execute cycle

1. First, the CPU **fetches** the next instruction to execute from memory as a block of bytes
2. The CPU then **decodes** the bytes to determine what operation to perform
3. Finally, the CPU **executes** the specified instruction

The CPU repeats these three steps endlessly, and performs them *very* quickly – modern CPUs operate at a *clock speed* of billions of these steps per second (GHz)!

Questions

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