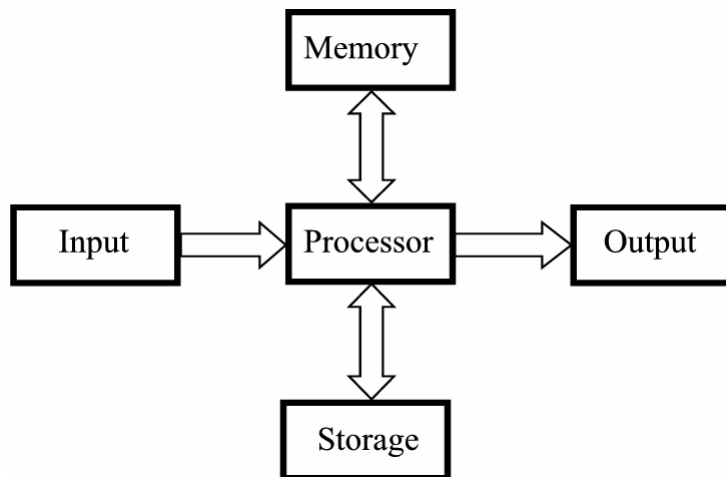


# Computer Hardware: A Quick Overview

- In this section of notes you will learn/relearn about the basic parts of a computer and how they work.

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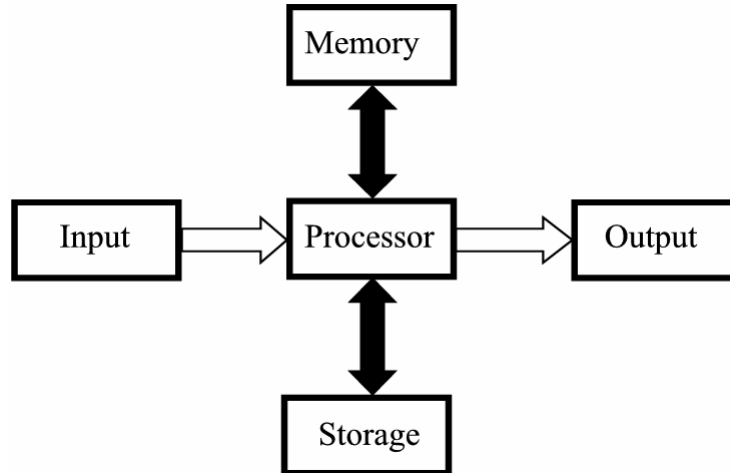
## High Level View Of A Computer



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## Computer Buses

- Connect the different parts of the computer together



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## Buses

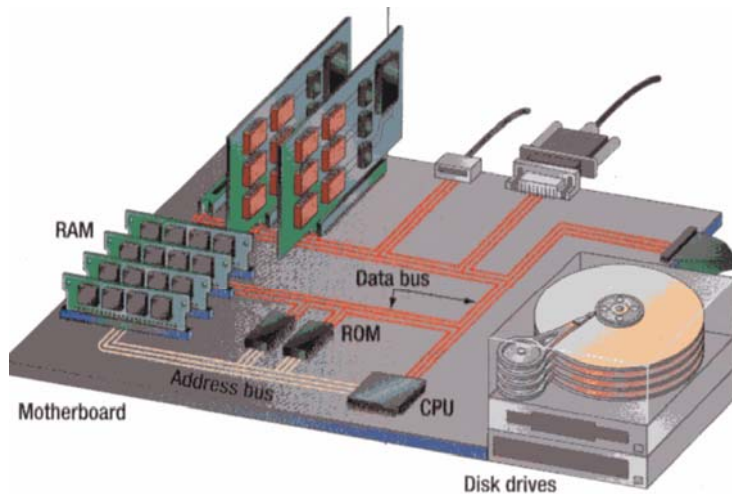
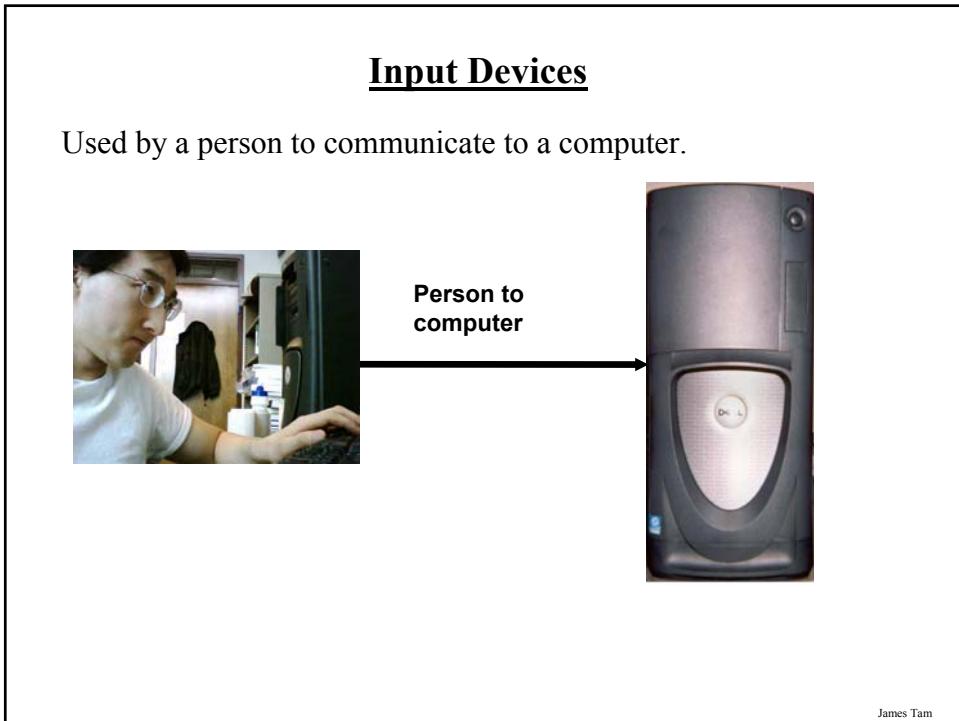
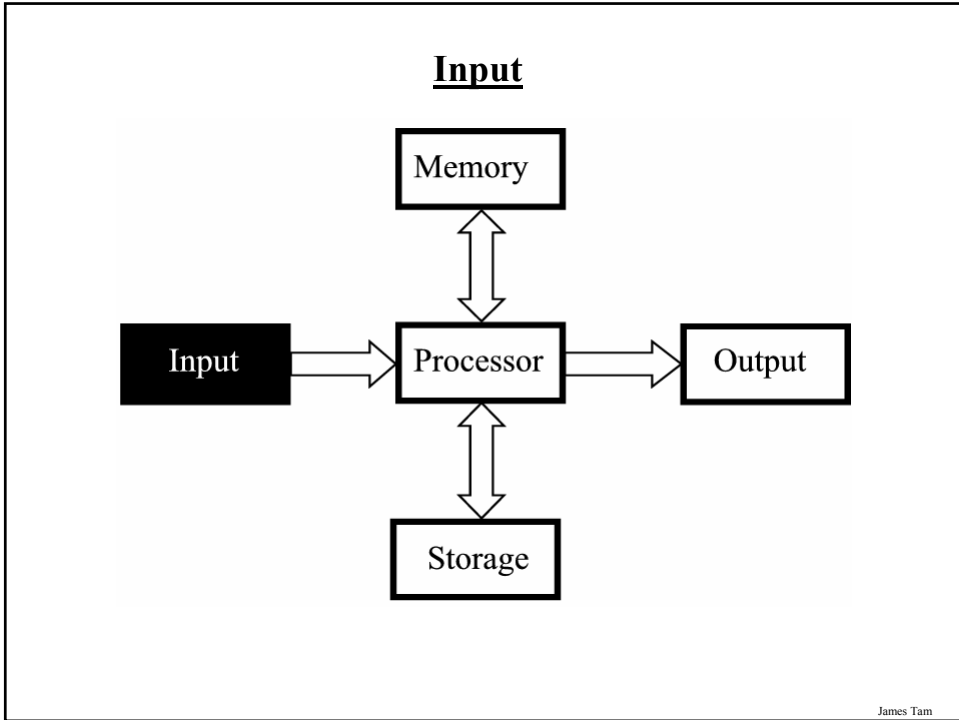


Image from Peter Norton's Computing Fundamentals (3<sup>rd</sup> Edition) by Norton P.

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## Example Input Devices

Keyboard

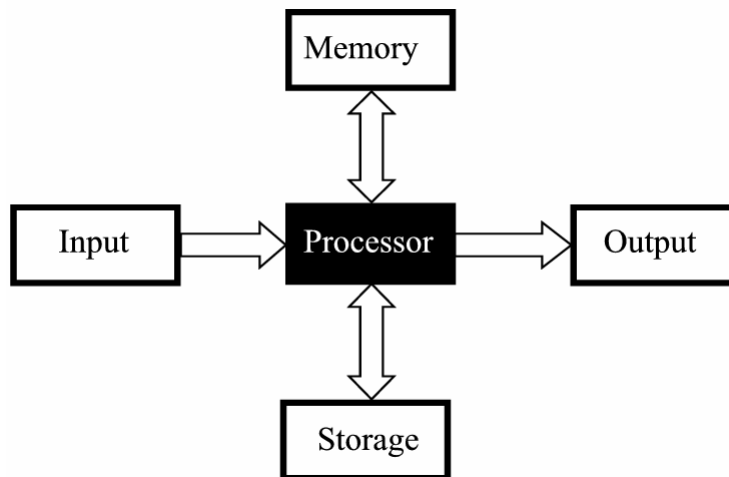


Mouse



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## Processor



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## Processor

The brains of a computer



Image from:  
[www.howstuffworks.com](http://www.howstuffworks.com)

- A common desktop processor



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## The Processor And The Computer

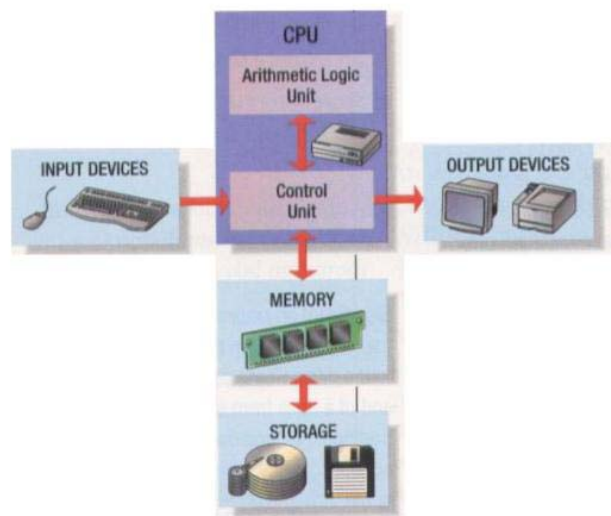
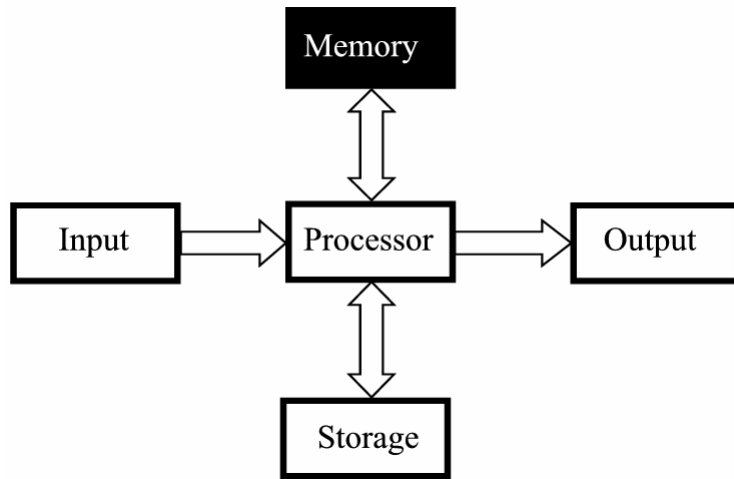


Image from Peter Norton's Computing Fundamentals (3<sup>rd</sup> Edition) by Norton P.

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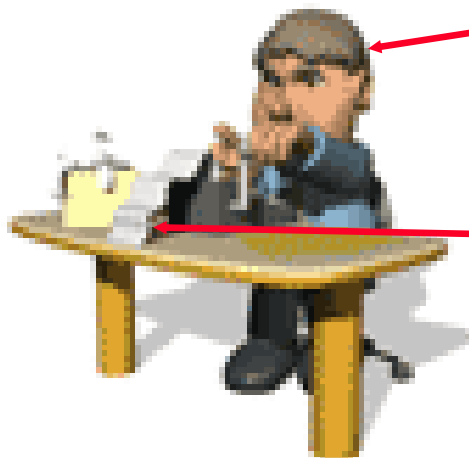
## Memory



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## Memory

It is used as temporary storage for the computer:



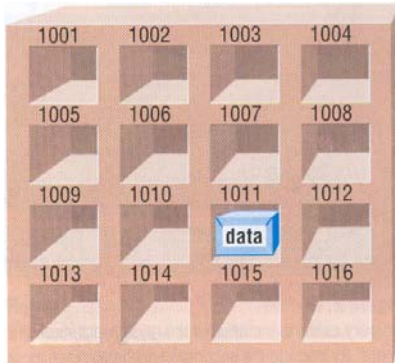
**Processor:**  
'brains' that  
performs the  
calculations

**Memory:**  
stores  
information  
needed by the  
processor

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## Memory

The most common type of memory in the computer is RAM (Random Access Memory):



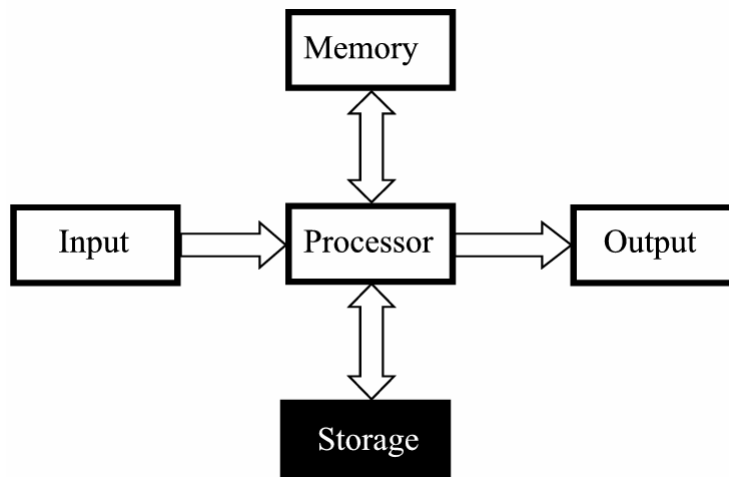
Random access  
doesn't mean chaotic  
or haphazard but it  
means that access  
does not have to be  
sequential but can  
occur anywhere

Picture from Computers in your future by Pfaffenberger B

Also note that RAM is volatile (information is stored so long as there is power).

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## Storage



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## Storage

Used to store information that is not currently needed

- e.g., a program that is installed but not currently running.

Also used to store information that is too large to put in RAM

- e.g., a large video

Storage is non-volatile

- What is stored there remains even after the power is off

Can store more information than RAM but it is significantly slower

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## Common Types Of Storage

### 1. Magnetic

- Floppy disks
- Zip disks
- Hard drives

### 2. Optical

- CD-ROM
- DVD

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## Magnetic Storage Devices

- Include floppy disks, zip disks, hard drives
- All use magnetism to store information:



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## Optical Storage Devices

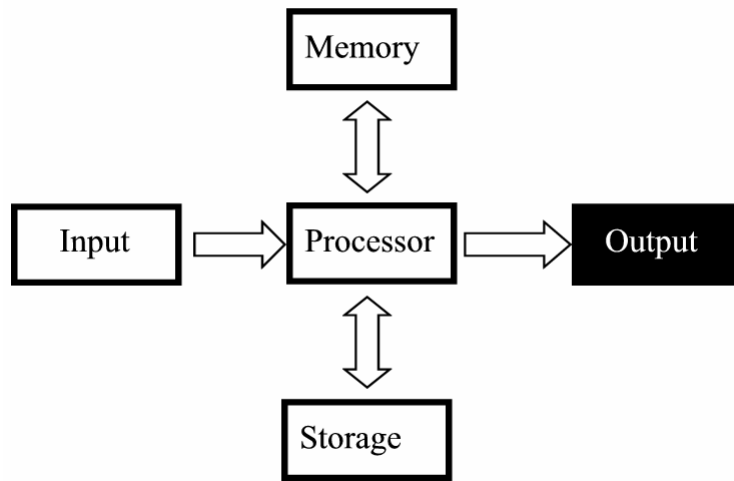
Use lasers to store and retrieve information (CD's and DVD's)

Categories:

- Can only read information off the disc (CD-ROM, DVD-ROM)
- Can read and also record information to the disk (CD-R, DVD-R, DVD+R)
- Can read, record and also re-write information multiple times (CD-RW, DVD-RW, DVD+RW)

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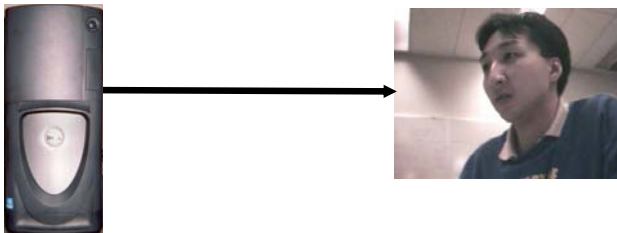
## Output



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## Output Devices

Displays information from the computer to a person.



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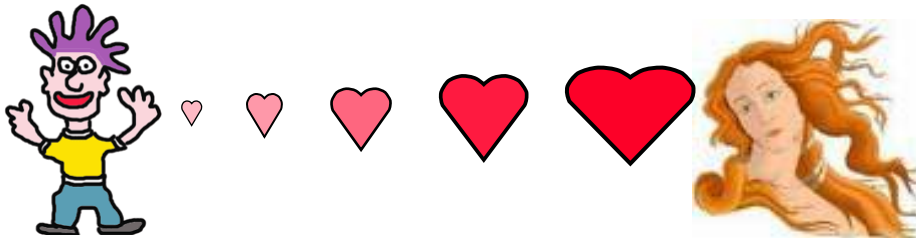
## The Most Common Output Device: The Monitor



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## How Does A Person Work?

In many shades of grey (subtleties and ambiguities can exist)



...i.e., people are complex with many possible states (some of which may be conflicting)

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## How Does A Computer Work?

Simple: something is either in one state or another.

Yes,  
Positive,  
On

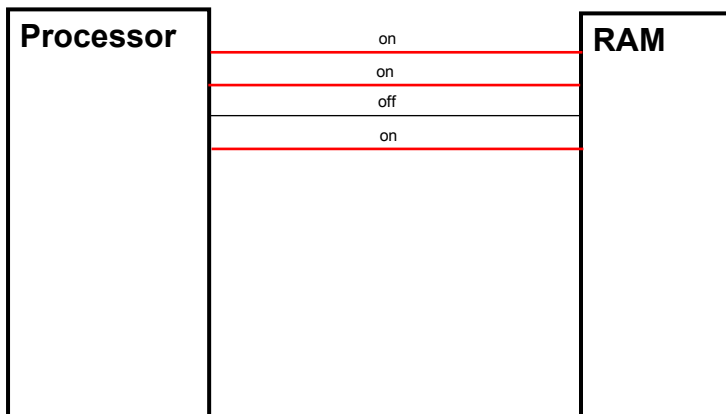
No,  
Negative,  
Off

All parts of modern computers work this way.

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## Computer Buses: How Information Is Transmitted

- Carries information between the different parts of the computer.
- Information is transmitted via electrical currents on wires.



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## Monitors: How Images Are Drawn

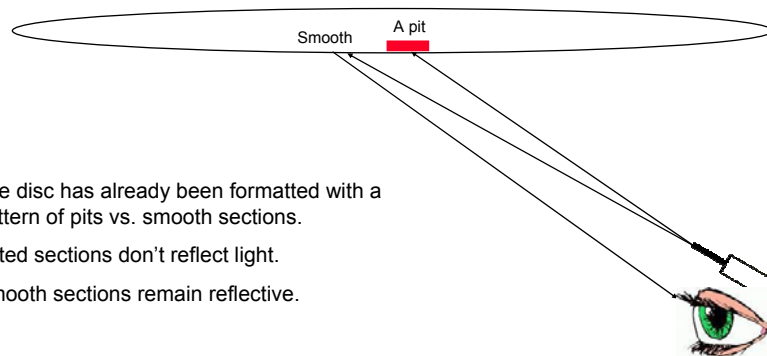
Images and text are drawn with tiny dots (Pixels: *P*icture *e*lements)

A

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## Optical Drives: Reading Information

CD-ROM, DVD-ROM

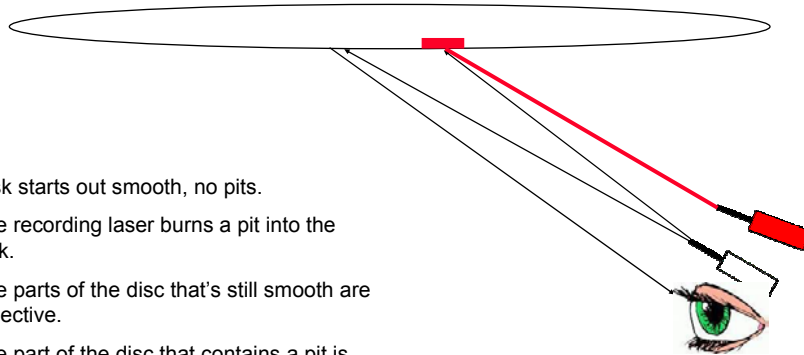


- The disc has already been formatted with a pattern of pits vs. smooth sections.
- Pitted sections don't reflect light.
- Smooth sections remain reflective.

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## Optical Drives: *Recording And Reading* Information

CD-R, DVD-R, DVD+R

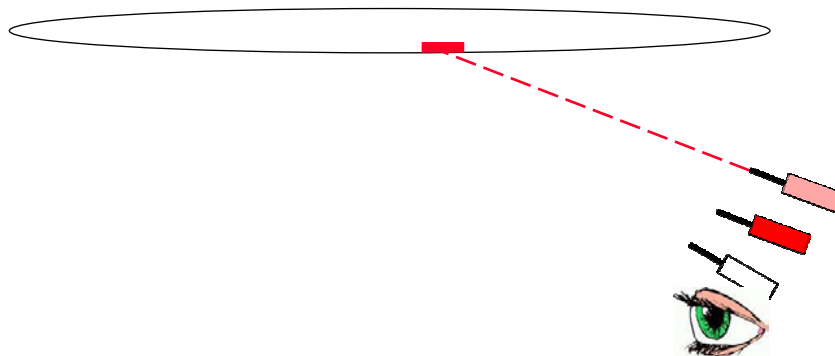


- Disk starts out smooth, no pits.
- The recording laser burns a pit into the disk.
- The parts of the disc that's still smooth are reflective.
- The part of the disc that contains a pit is non-reflective.

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## Optical Drives: *Re-Writing*

CD-RW, DVD-RW, DVD+RW

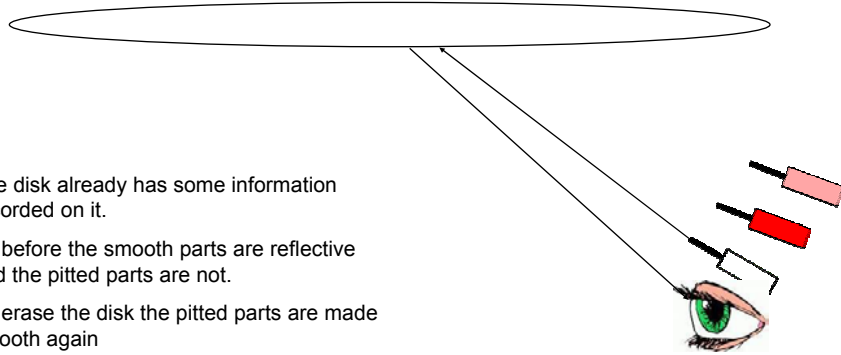


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## Optical Drives: Re-Writing

CD-RW, DVD-RW, DVD+RW

- The disk already has some information recorded on it.
- As before the smooth parts are reflective and the pitted parts are not.
- To erase the disk the pitted parts are made smooth again



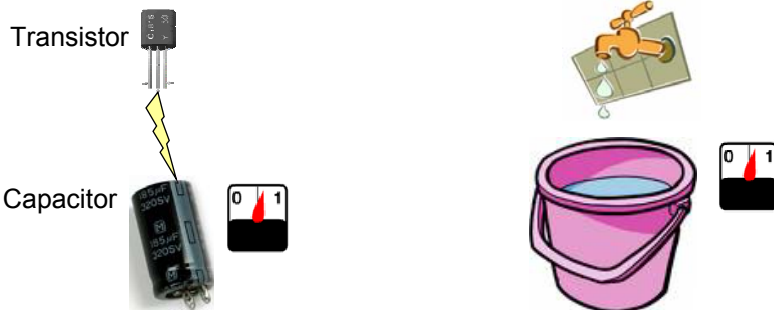
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## RAM: Storing Information

Information is stored in RAM based on power levels (on or off)

The smallest unit of storage is a bit (*binary digit*)

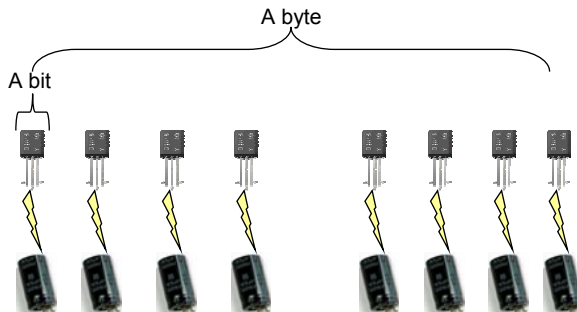
- *Binary*: A bit can have two states (on/off)
- Information about a particular bit is stored in a capacitor (stores electricity)
- Power to the capacitor is controlled through a transistor



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## RAM: Storing Information

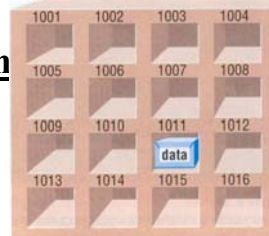
- By itself a bit is useless (it can't store a useful amount of information = 2 possible states)
- Bits must be combined together before information can be stored
  - Q: How many states can be represented with 2 bits? 3 bits? 4 bits?
- The next unit of storage is a byte = 8 bits (256 possibilities)



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## RAM: Storing Information

- RAM is a collection of 'slots' where information is stored.
- Each slot is a collection of bits.
- The number of bits that are grouped together at a location is typically 8 bits (byte).
  - e.g., a 1 Gigabyte stick of RAM has ~1 billion slots with each slot consisting of a byte



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## Storing Text Information In RAM

- Text is stored in using the American Standard Code for Information Interchange (ASCII)
- Eight bits/one byte (256 combinations) is used to store information about a single text character:

Combination number	Bit pattern	Value represented at that combination
48 - 57	00110000 - 00111001	'0' to '9'
65 - 90	01000001 - 01011010	'A' to 'Z'
97 - 122	01100001 - 01111010	'a' to 'z'

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## You Should Now Know

- What are common units of measurement for the computer
- What are the basic parts of the high level view of a computer
- The role of the processor in a computer
- What are the characteristics of RAM
- How does DRAM work
- The difference between storage and memory
- What are the different categories of storage devices as well as common examples of each
- How binary is used to store information on several different kinds of hardware

James Tam