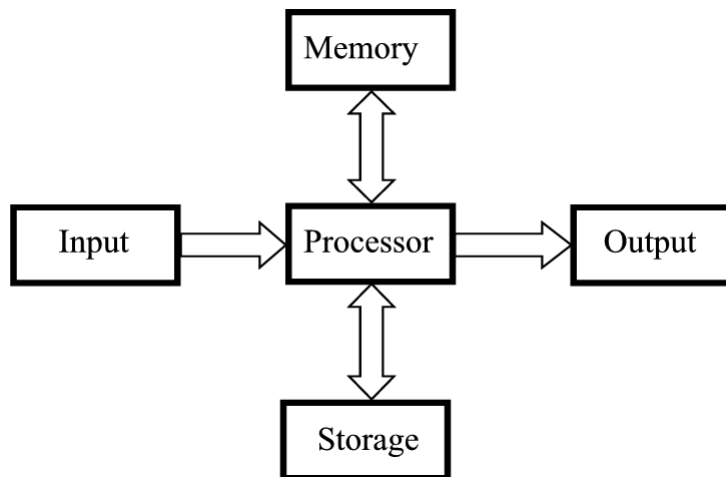


## Introduction To Computers

In this section you will learn what are the basic components of a computer.

James Tam

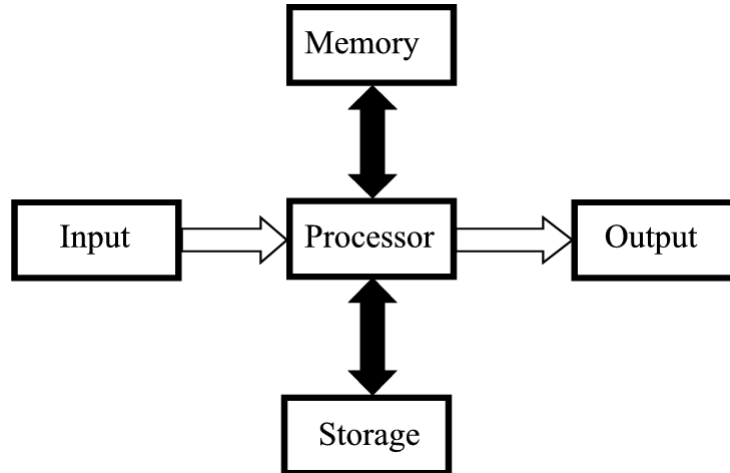
## High Level View Of A Computer



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## Computer Buses

- Connect the internal workings of the computer



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## Types Of Buses

- Data buses
  - Are used to transmit information to the different parts of the computer
- Address buses
  - Indicate where the information is supposed go

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## Buses

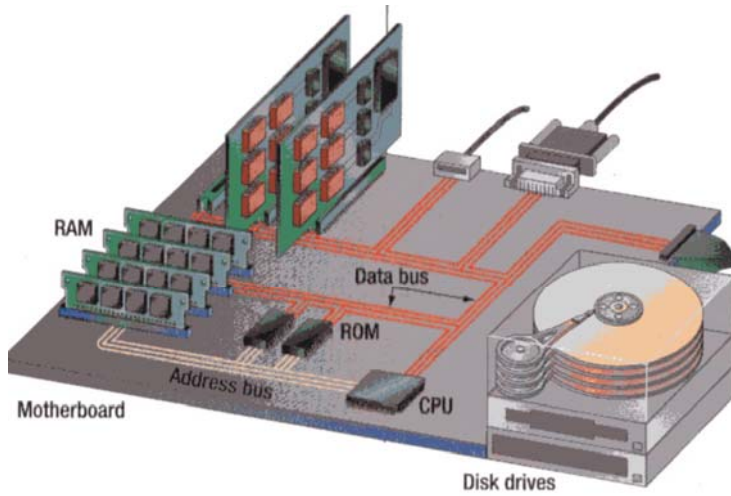
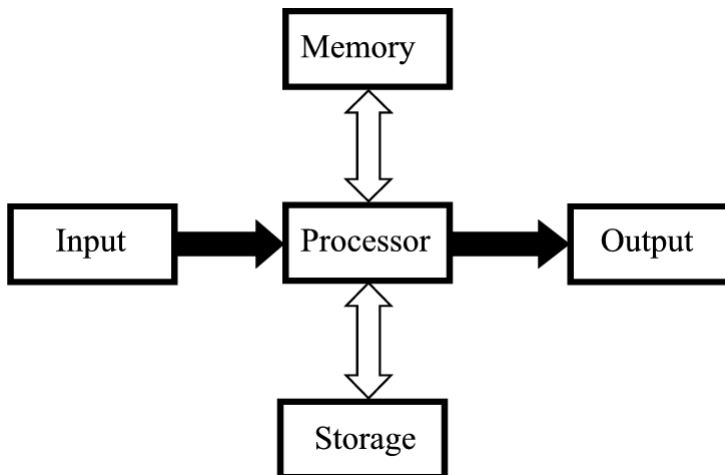


Image from Peter Norton's Computing Fundamentals (3<sup>rd</sup> Edition) by Norton P.

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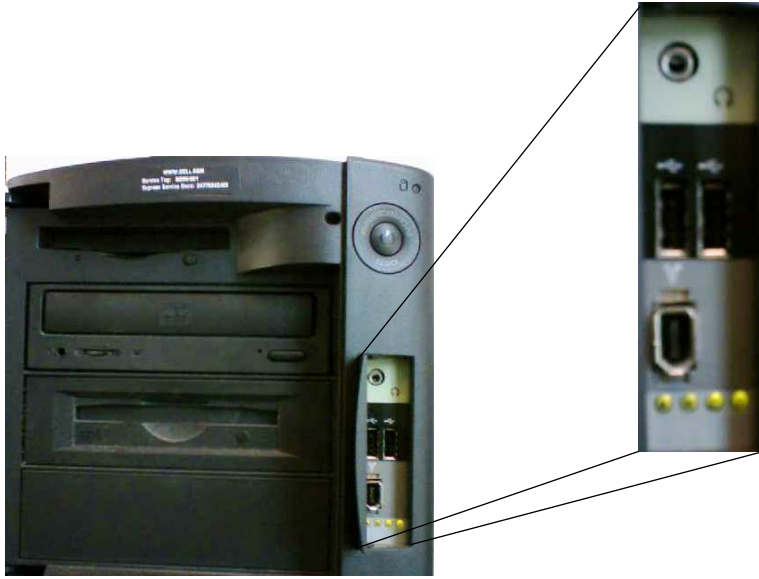
## Ports

- Connects the computer to the outside



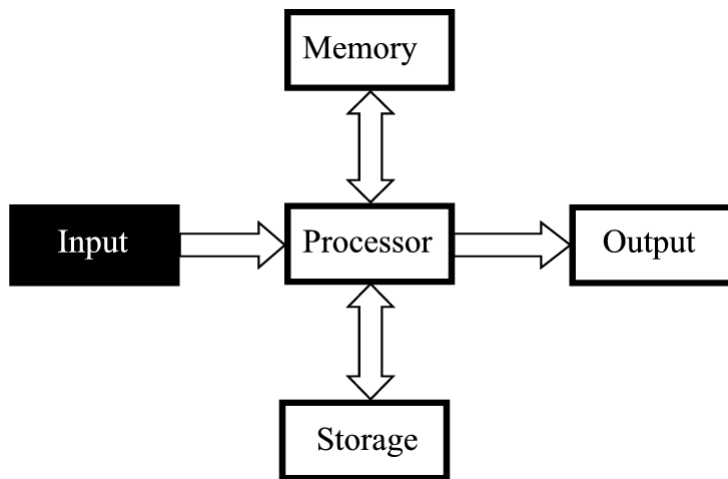
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## Ports



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## Input



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## Input Devices

- Used by a person to communicate to a computer.



Person to  
computer



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## Example Input Devices

- Keyboard



- Mouse



- Stylus



- Touch screen



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## Keyboards

- Wired
  - Least expensive
  - Requires a physical connection
  
- Wireless
  - Costlier
  - Reduces the number of wires (no direct physical connection between the keyboard and the computer)
  - Can introduce additional issues: battery use, security
  - Types
    - Infrared
      - Similar to a TV remote control
      - Unidirectional / line-of-sight
    - Radio frequency (RF)
      - Omni directional

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## Mice

- Similar to keyboards they can be wired or wireless
- Input method:
  - Roller ball
  - Optical
  - Laser
- Number of inputs

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## Mice: Method Of Input

- Roller ball
  - Employs physical movement
  - Cheap but dirt can interfere with input



- Optical
  - Uses an LED and a reflective surface
  - A little more costly to make but have become the standard



- Laser
  - Employs a laser instead of an LED
  - Allows for more precise work



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## Mice: Number Of Inputs

- Two buttons



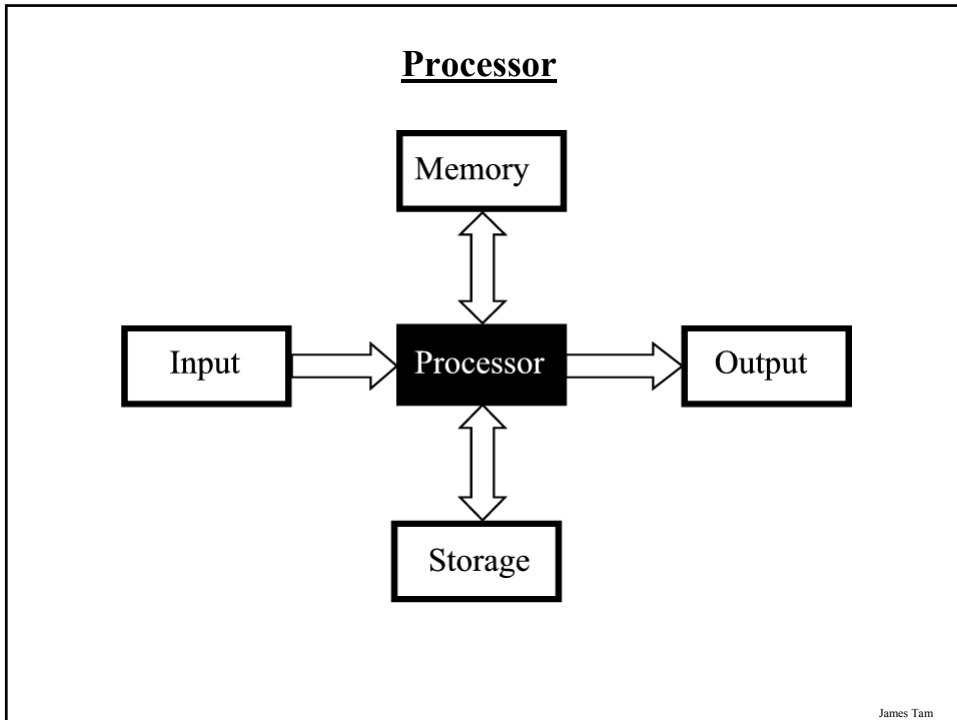
- Scroll wheel



- Back/forward buttons



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### Processor (2)

- With desktop and laptops it's commonly referred to as the Central Processing Unit (CPU).

- Acts as the 'brains' of the computer that comes into play as programs are running e.g., performing calculations, playing a video, manipulating files.

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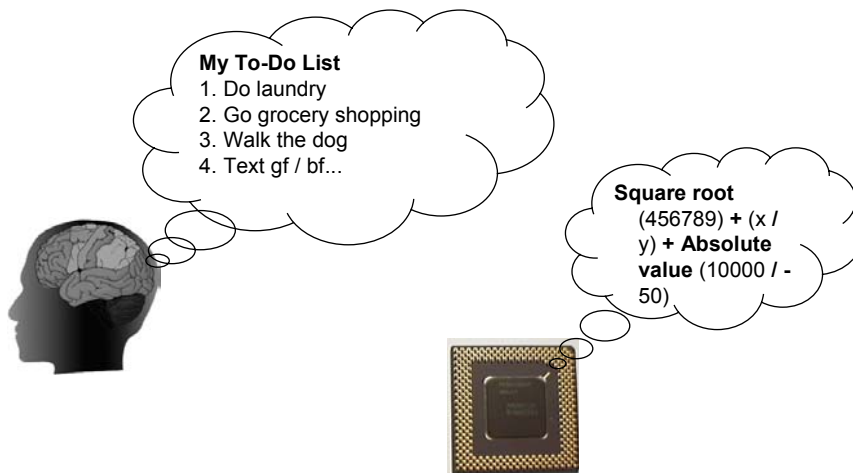
## Processor Speed

- Determined by many factors
- Traditionally there were two main factors:
  - Processor model e.g., Intel processors: Celeron vs. Pentium
  - Clock speed:
    - Generally the higher the number, the faster the processor
    - However GHz (Giga Hertz) is faster than MHz (Mega Hertz)

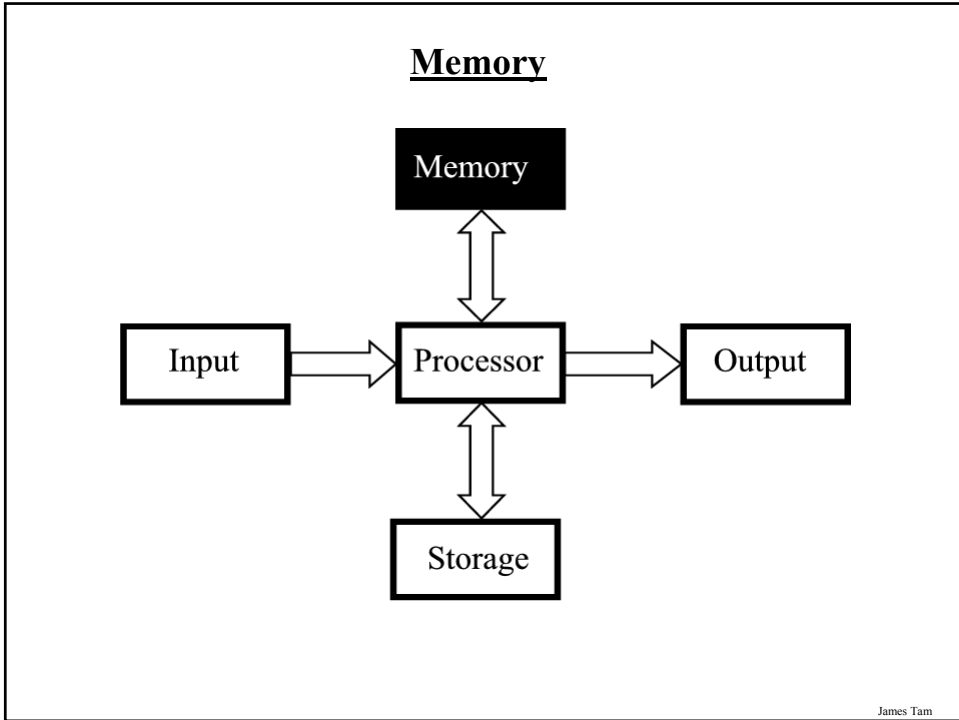
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## Storage Of Information: Processors

- The processor has a small amount of memory that is fast but very low in storage capacity.



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### Memory

- It is used as temporary storage for the computer:

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

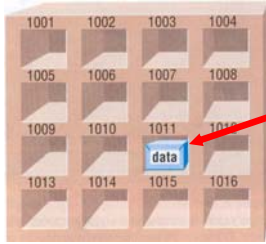
**Memory:**  
stores information needed by the processor

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## Memory (2)



- Main memory is used to store information that is currently needed by the computer (e.g., a program running now) but won't fit into the processor's memory.
- Memory is organized into numbered 'slots' with each slot storing at most one piece of information.



### **RAM (Random Access Memory)**

- A common type of memory included with every computer
- Random access refers to direct access: A particular slot can be directly accessed without accessing previous slots.

Picture from Computers in your future by Pfaffenberger B

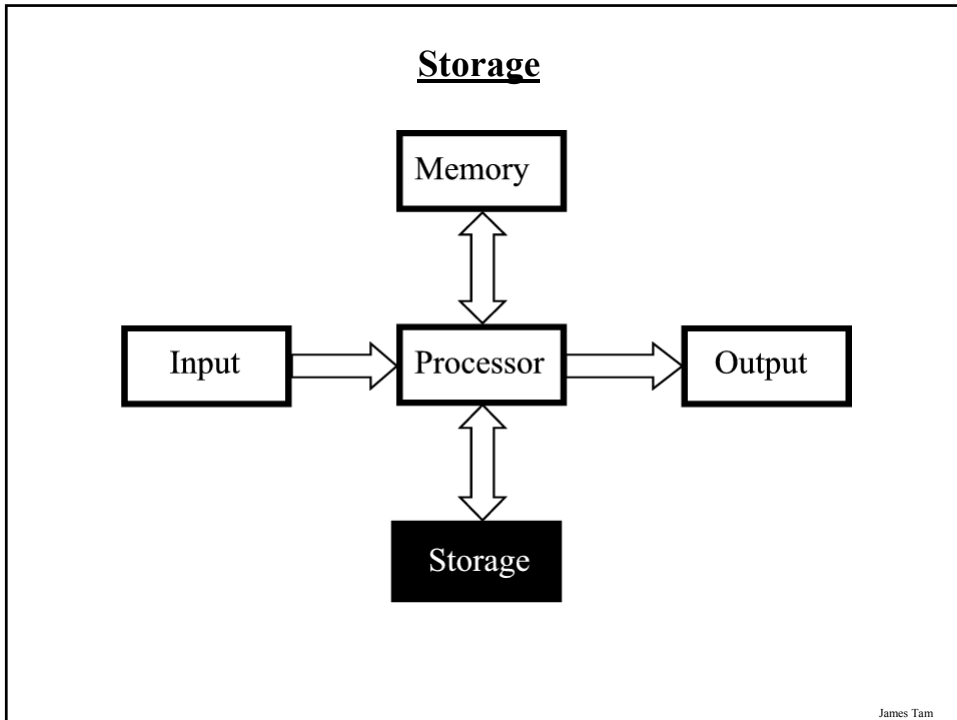
- Also note that RAM is volatile (information is stored so long as there is power).

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## Memory (3)

- When buying memory:
  - Larger units are better (stores more)
  - Again Giga is larger than Mega


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**Storage Vs. Memory**


Memory (e.g., RAM)

- The information stored is needed now (running program)
- Keep the information for a shorter period of time (usually volatile)
- Faster
- More expensive
- Low storage capacity (e.g., 1/4 to 2 DVD's)



Storage (e.g., Hard disk)

- The information stored is not needed immediately but may be needed later (installed program)
- The information is retained longer (non-volatile)
- Slower
- Cheaper
- Higher storage capacity (~50 – 200 DVDs)



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## Common Types Of Storage

1. Magnetic
  - Floppy disks
  - Zip disks
  - Hard drives
2. Optical
  - CD-ROM
  - DVD
3. Solid state
  - Flash memory

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## 1. Magnetic Storage Devices

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



- Like other storage devices it's non-volatile but is care must be taken to avoid magnetic fields, dusty or smoky environments, or physical jolts (the latter especially when reading or writing information)

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## 2. Optical Storage Devices

- Use lasers to store and retrieve information (CD's and DVD's).
- The storage capacity difference is approximately 1:8 (CD:DVD).
- 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).
- Optical storage devices aren't as susceptible to as many problems as magnetic devices but care must be taken not to scratch or otherwise damage the surface.

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## 3. Solid State Storage Devices: Flash Memory

- Portable but can store a large amount of information (~1/8 DVD – 4 DVD's of information)



- Solid state devices are fairly sturdy (come in a protective case) but reasonable care must still be taken e.g., don't remove the device when information is being written to it.

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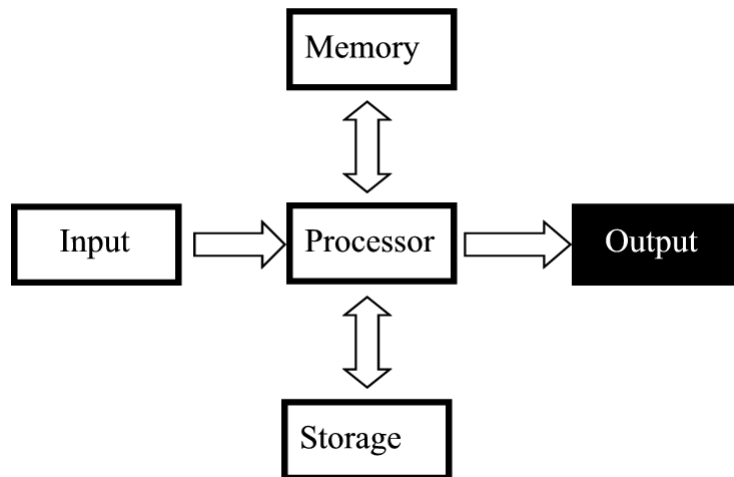
## Buying Storage For Your Computer

- Rules of thumb:

- In terms of storage capacity larger numbers are better (stores more)
- Tera is largest unit, which is better than Giga, which in turn is larger than Mega

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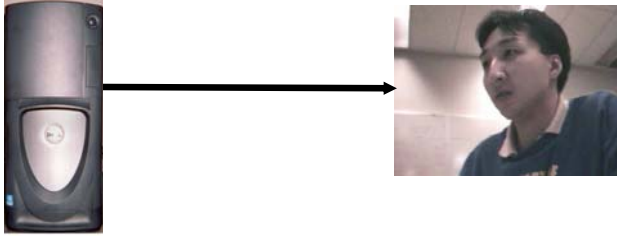
## Output



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## Output Devices

- Communicating information from the computer.



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## The Most Common Output Device: The Monitor



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## The Most Common Output Device: The Monitor

- Common monitor technologies:
  1. CRT (Cathode Ray Tube)



2. LCD (Liquid Crystal Display)



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## How Information Is Shown On Monitors

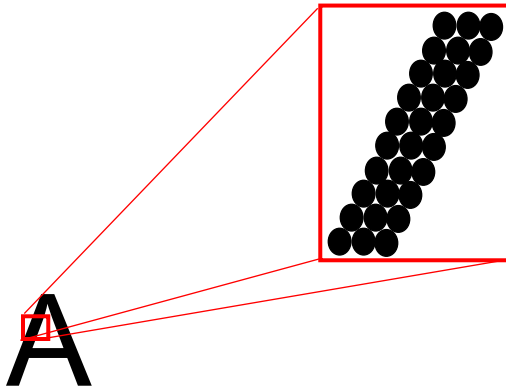
- Images and text are drawn with tiny dots (Pixels: Picture elements)

A

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## How Information Is Shown On Monitors

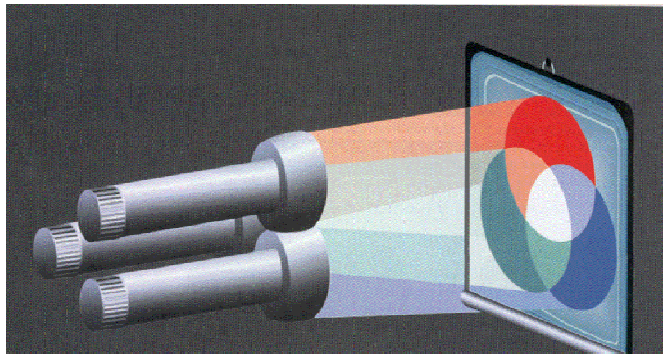
- Images and text are drawn with tiny dots (Pixels: *P*icture *e*lements)



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### 1. CRT Monitors

- The pixels are drawn with light 'guns'

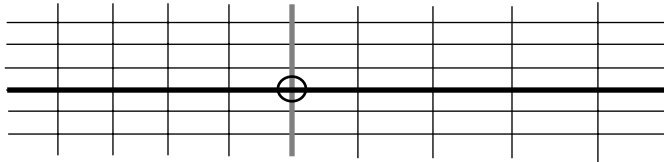


Picture from Computer Confluence by Beekman G.

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## 2. LCD Monitors

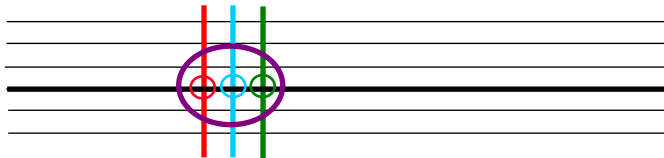
- Employ a conductive grid for each row and column.
- The meeting of a row and column allows light to be emitted (a pixel can be seen).



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## 2. Colour LCD Monitors

- Use three sub pixels:
  - One wire for each row
  - One wire for each sub-pixel
  - One colour filter for each colour (red, blue, green)



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## Common Characteristics Of Monitors

- Size
- Resolution
- Aspect ratio
- Dot pitch
- Response time
- Contrast

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## Computer Monitors: Size

- Measured diagonally



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## Computer Monitors: Resolution

- Columns of pixels x Rows of pixels

Col 1, Row 1	Col 2, Row 1	Col 3, Row 1	...	Col [c], Row 1
Col 1, Row 2				Col [c], Row 2
Col 1, Row 3				Col [c], Row 3
:				:
Col 1, Row [r]	Col 2, Row [r]	Col 3, Row [r]	...	Col[c], Row[r]

- For a given monitor size, the higher the resolution the sharper the image.
- Common resolutions:  
- 800 x 600, 1280 x 1024...1600x1200.

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## Monitor Resolution: Tradeoff

- Keep in mind that a higher resolution may result in a sharper display but objects will be smaller.

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My Desktop: 800x600



James Tam

My Desktop: 1600x1200



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## Computer Resolution: LCD Monitors

- Native resolution: is the best (only) resolution for displaying information. (Other resolutions may be possible by simulating the resolution or graphical effects).

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## A Game Running At The Native Resolution: Sharp



Icewind Dale © Black Isle (from [www.gamespot.com](http://www.gamespot.com))

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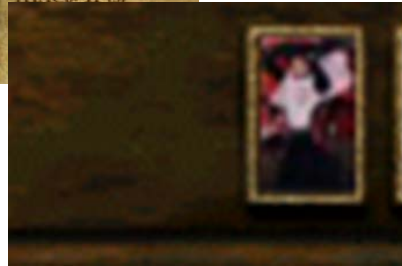
## A Game Running Not Running At The Monitor's Native Resolution: Reduced Quality



Original image



Image at non-native resolution



Thumbnail image at non-native resolution

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## Aspect Ratio

- Determined by the ratio of the horizontal and vertical resolution.
- Full screen: 4:3 is common for productivity and even gaming e.g., 1024x768, 1600x1200 etc.
- Widescreen: 16:9, 16:10 e.g., 1680 x 1050

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## Viewing A Widescreen Video On A Full Screen Display

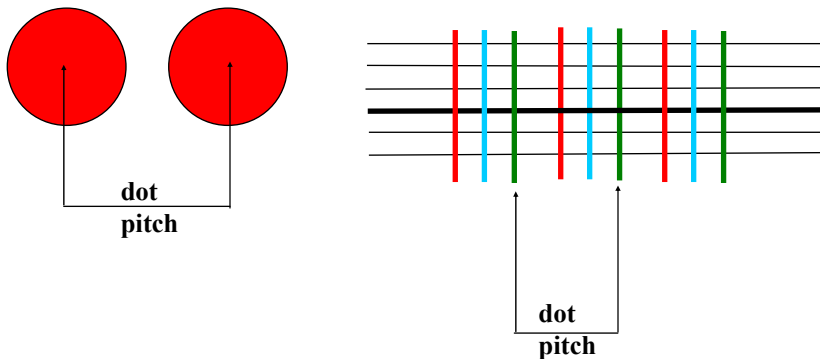


Screenshots from Terminator 2: Judgment Day © Universal

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## Computer Monitors: Dot Pitch

- Dot pitch is the distance between picture elements e.g., the center of each color dot or “colored” wire (mm).



- Common values for monitors today (August 2008) ~0.29 mm to 0.25 mm.

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## **Computer Monitors: Response Time**

- Refers to how quickly pixels can change colors as measured in a thousandth of a second (millisecond).
- Typical response times ~2 – 8 milliseconds.
- Slower response time (larger numbers) may have noticeable detrimental effects when parts of the screen must be quickly redrawn.

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## **Slow Response Time: Ghosting During Fast Movement**



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## **Slow Response Time May Even Result In Blurriness For Less Dynamic Displays**



From [www.d-silence.com](http://www.d-silence.com)

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## **Computer Monitors: Contrast**

- Contrast is difference in light intensity between the brightest white and the deepest black.
- It's typically expressed as a ratio (all things being equal the larger the number the greater the contrast and the better the image quality will be).
- Typical listed contrast ratios: ~600:1 to 8000:1, many averaging 2000:1.

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## Computer Monitors: Summary

Characteristic	Common values	What's better: Smaller or larger numbers?
Size	19 to 27+ inches	Larger
Resolution	800x600 to 1600x1200	Larger
Aspect ratio	Full screen: 4:3 Wide screen: 16:9, 16:10	Widescreen works better for viewing many videos and movies
Dot pitch	0.25 – 0.29 millimeters	Smaller
Response time	2 – 8 milliseconds	Smaller
Contrast	600:1 to 8000:1	Larger

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## An Important Peripheral: A Printer

### •Common types

- Inkjet



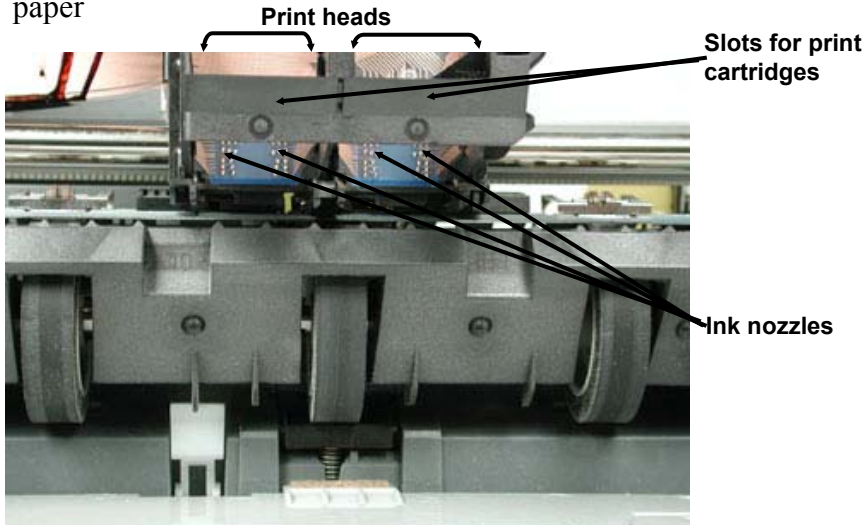
- Laser



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## How Inkjet Printers Work.

- Use a series of nozzles to spray drops of ink directly on the paper



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

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## How Laser Printers Work

- Use a laser to produce patterns on an ink drum using static electricity.

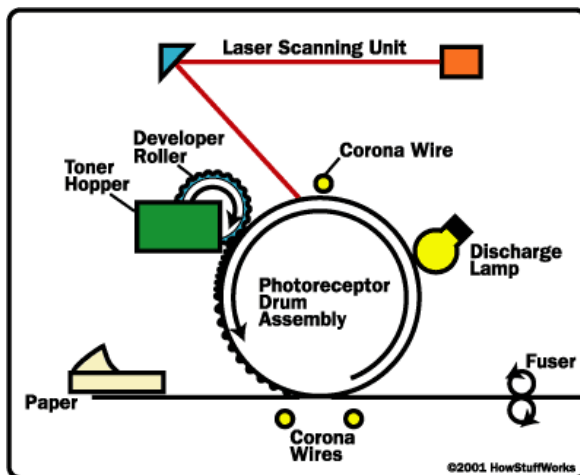


Diagram from [www.howstuffworks.com](http://www.howstuffworks.com)

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## **You Should Now Know**

- What are the 5 parts of the high-level computer
- How buses and ports connects the inner parts of the computer and the computer to the outside (respectively)
- What are some common (and not so common) input devices
- How wired and wireless input devices work as well as some of the issues associated with each
- How different types of mice and inputs for mice work
- The role that the processor plays in the computer, characteristics that determine processor speed
- The purpose of memory (RAM) in the computer, how does it work

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## **You Should Now Know (2)**

- What are different types of computer storage and how does each one work
- What is the difference between storage and memory
- What are the different types of monitors and how does each one work
- What are some of the common characteristics of computer monitors
- What are some common criteria used in making a purchasing decision for a computer
- How do ink-jet and laser printers work

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