
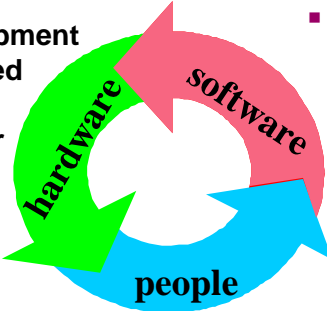



The Computer System

- The equipment associated with a computer system.





- The set of instructions that tell a computer what to do.

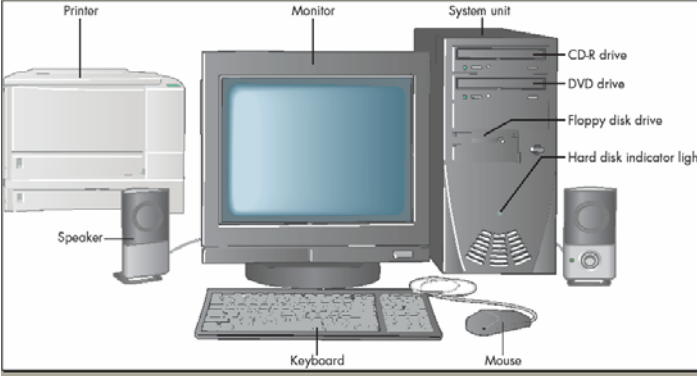


- Use the power of the computer for some purpose.

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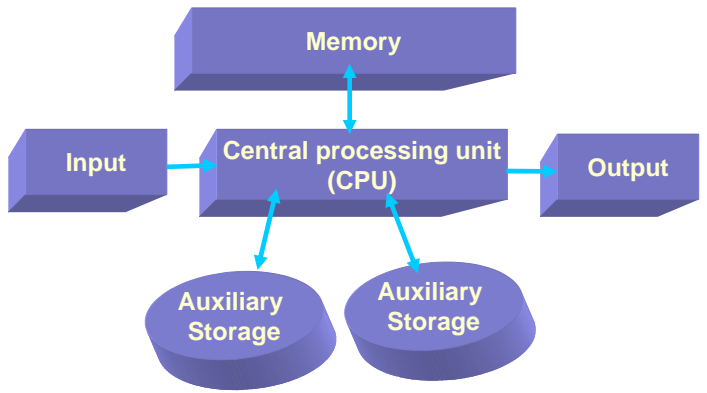
The PC is an 'Open' Computing Platform

Anyone can develop hardware and/or software



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Computer Hardware Diagram



```

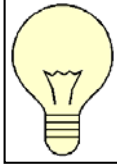
    graph TD
      Input[Input] --> CPU[Central processing unit (CPU)]
      CPU --> Output[Output]
      CPU <--> Memory[Memory]
      CPU --> AS1[Auxiliary Storage]
      CPU --> AS2[Auxiliary Storage]
  
```

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Data and Information Representation


- ❖ A Computer is a collection of millions of electronic switches (On or Off)
- ❖ A *bit* or binary (base 2) digit has one of two values: 1 or 0
- ❖ A *byte* is a group of 8 bits
- ❖ All information is represented in a computer using binary number data
- ❖ Characters are represented using *ASCII Code* with one byte/character

◆ 'A' = 0100, 0001	◆ '7' = 0011, 0111
◆ 'B' = 0100, 0010	◆ ', ' = 0010, 1100
◆ 'a' = 0110, 0001	◆ '\$' = 0010, 0100



On = 1

Off = 0



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The Microprocessor

- ❖ **Central Processing Unit (CPU)** is the “brain” of the PC controlling all data flows
- ❖ **PC CPU chips were Intel**
 - ◆ 8086, 80286, 80386, 80486, 80586
 - ◆ AMD and Cyrix develop competing compatible chips
- ❖ **Intel trademarked 80586 as the *Pentium***
 - ◆ Pentium II, Pentium III, Pentium IV
 - ◆ The new processors are Dual Core: Intel 2 Duo
- ❖ **Clock speeds usually differentiates chips**
 - ◆ FSB (Front Side Bus): 800 MHz = 800 Million Cycles/Sec.
 - ◆ CPU (Internal): 2 GHz = 2 Billion Cycles per Second



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Types of Memory

- ❖ **ROM**
 - ◆ Read Only Memory = Data is stored permanently
 - ◆ Retains all data on Power Off (Non-Volatile)
 - ◆ Usually used for Boot Programs like BIOS
 - ◆ BIOS = Basic Input/Output System
- ❖ **RAM**
 - ◆ Random Access Memory = Read/Write Memory
 - ◆ Loss of data on Power Off (Volatile)
- ❖ **Specified by storage size and speed**
 - ◆ 1 Kilobyte = 1 Thousand = 1,000 bytes
 - ◆ 1 Megabyte = 1 Million = 1,000,000 bytes
 - ◆ 1 Gigabyte = 1 Billion = 1,000,000,000 bytes
 - ◆ 1 Terabyte = 1 Trillion = 1,000,000,000,000 bytes

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Types of RAM Memory

- ❖ **Registers are in Microprocessor**
 - ◆ Small (64KB) and Fast (CPU speed 2GHz=500 picoSec)
- ❖ **Cache (1MB) and Fast (1GHz=500 picoSec)**
 - ◆ L1 = Internal to Microprocessor (1MB and 1.6GHz)
 - ◆ L2 = External to Microprocessor (2MB and 1GHz)
- ❖ **RAM Memory**
 - ◆ Large (Compared with Registers and Cache)
 - ◆ Windows XP: 256MBytes minimum, typically 512MBytes
 - ◆ Windows Vista: 1GB minimum, typically 2GBytes
 - ◆ Fast (Compared with Auxiliary Storage)
 - ◆ Accessed at FSB (Front Side Bus) speeds
 - ◆ Typically (800 MHz = 1.25 nanoSeconds)
 - ◆ 1 KHz = 1 milliSecond = 1 mS
 - ◆ 1 MHz = 1 microSecond = 1 uS
 - ◆ 1 GHz = 1 nanoSecond = 1 nS
 - ◆ 1 THz = 1 picoSecond = 1 pS

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Auxiliary Storage = Nonvolatile but Slower

- ❖ **Hard disk**
 - ◆ Magnetic Storage
 - ◆ 40 GigaBytes to 1 TeraByte
 - ◆ Data Transfer = 100 MB/sec
 - ◆ File Access Time = 10mS
- ❖ **Removable storage**
 - ◆ USB Thumb Drives (Silicon)
 - ◆ Data Transfer = 8 MB/sec
 - ◆ CD-ROM (Optical)
 - ◆ CD-R/CD-RW (Optical)
 - ◆ DVD/DVD-R/DVD-RW (Optical)
 - ◆ Zip Disks (Magnetic)
 - ◆ Floppy Disk (Slowest, 1970's)



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Anatomy of Hard Disk

- ❖ A hard disk contains **metal platters** coated with magnetic compound
- ❖ An access arm moves the read/write head over the tracks on a hard disk
- ❖ Fast Read and Write Access
- ❖ Large Capacity
 - ◆ Typically > 40 GBytes = 40,000,000,000

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Optical Disks

- ❖ Optical disks are 5.25" plastic disk with a reflective layer
- ❖ Inside the optical drive is a laser used to read data or write to an optical disk
- ❖ CD-ROM = **compact disk, read-only memory**
 - ◆ Usually 650 MB or 700MB of storage
- ❖ CD-R = **compact disk, record**
 - ◆ Write Once, Read Many
- ❖ CD-RW = **compact disk, read write**
 - ◆ Not selectively erasable (Erase entire CD to re-record)
- ❖ DVD = **digital video disk**
 - ◆ Up to 8.5 GB = 8500 MB of data storage per side
 - ◆ Available as DVD-ROM, DVD-R, DVD-RW

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PC System Block Diagram

Executes Instructions
Bus Control Operations

Address Bus > 28 Wires
 $2^{28} = 268,435,456$ Bytes = 256 MegaBytes

20 GigaBytes = 20,000 MegaBytes
1.4 MegaByte = 1,400,000 Bytes

0000005	12345678
0000004	00000000
0000003	00000000
0000002	00000000
0000001	00000000
0000000	00000000

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Inside the Case

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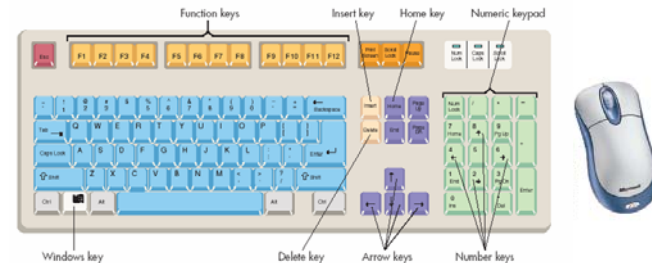
Peripheral Devices Connection Ports

- ❖ Video Port = connects monitor
- ❖ Keyboard/Mouse Port = PS/2 Port
- ❖ Serial Port = 9 or 25 pins, mouse, modem
- ❖ Parallel Port = 25 holes, LPT1, LPT2
- ❖ Game Port = joystick
- ❖ USB Ports = Universal Serial Bus
- ❖ Fire Wire Port = High Speed Port
- ❖ Audio In Port = Microphone
- ❖ Audio Out Port = Speakers



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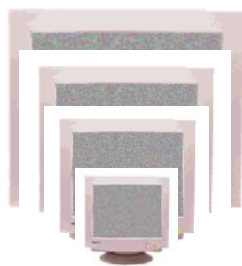
Peripheral Input Devices



- ◆ Keyboard
- ◆ Mouse
- ◆ Trackball
- ◆ Joystick
- ◆ Voice Input
- ◆ Scanner
- ◆ Optical character recognition
- ◆ Bar code reader
- ◆ Handwriting recognition
- ◆ Touch screens

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Peripheral Output: Display Monitor



- ❖ Resolution is expressed in picture elements or *pixels*
 - ◆ VGA = 640 x 480
 - ◆ SVGA = 800 x 600
 - ◆ XGA = 1024 x 768
 - ◆ SXGA = 1400 x 1050
 - ◆ UXGA = 1600 x 1200
- ❖ Higher the resolution, the more you can see
- ❖ Larger monitors enable higher resolutions
- ❖ A graphics card speeds processing

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Peripheral Output: Printer

- ❖ Ink Jet
 - ◆ Inexpensive Printer
 - ◆ Expensive Ink Cartridges
- ❖ Laser
 - ◆ Higher Quality
 - ◆ Grayscale = Inexpensive
 - ◆ Color = Expensive
- ❖ Four-in-one functionality
 - ◆ Printer, scanner, fax, copier
- ❖ Network printer
 - ◆ Best in Offices



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