## The Computer System

- The equipment associated with a computer system.

*hardware*  *software*  *people*

- The set of instructions that tell a computer what to do.
- Use the power of the computer for some purpose.

## The PC is an 'Open' Computing Platform

**Anyone can develop hardware and/or software**

Printer    Monitor    System unit
CD-R drive
DVD drive
Floppy disk drive
Hard disk indicator light
Speaker
Keyboard    Mouse

## Computer Hardware Diagram

Memory

Input → Central processing unit (CPU) → Output

Auxiliary Storage    Auxiliary Storage

## 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
  - ◆ ' B ' = 0100, 0010
  - ◆ ' a ' = 0110, 0001
  - ◆ ' 7 ' = 0011, 0111
  - ◆ ' , ' = 0010, 1100
  - ◆ ' $ ' = 0010, 0100

*On = 1*
*Off = 0*

## 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**
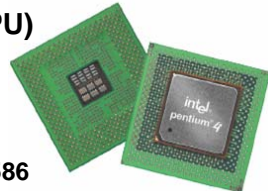
## Types of Memory

- ❖ **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**

## 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**

## 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**



Human hair
Access arm
Read/write head
Smoke particle
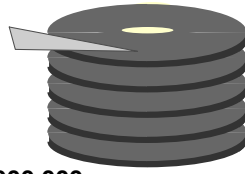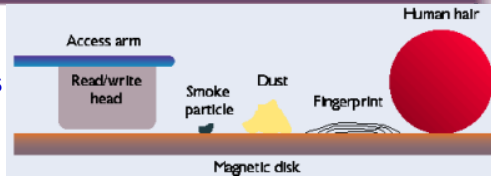Dust
Fingerprint
Magnetic disk

❖ **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**
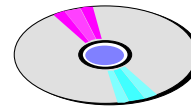❖ **Fast Read and Write Access**
❖ **Large Capacity**
  ◆ **Typically > 40 GBytes = 40,000,000,000**

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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
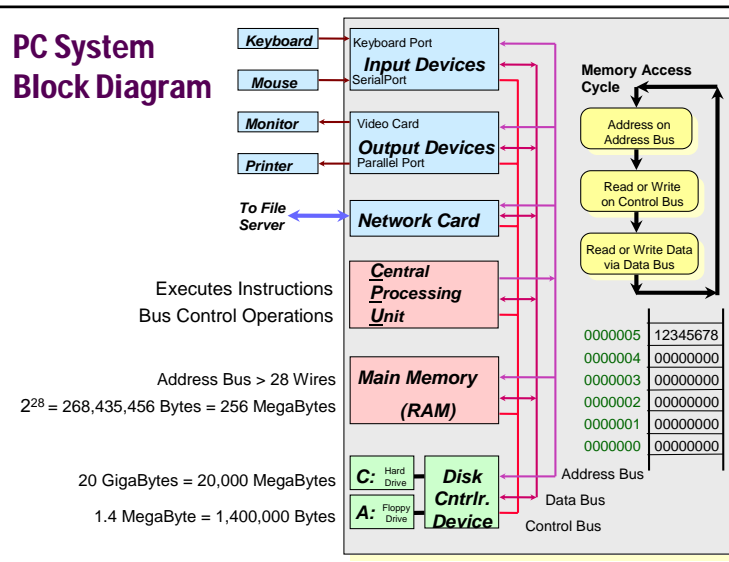  ◆ **Not selectively erasable (Erase entire CD to re-record)**
❖ **DVD =** digital video disk
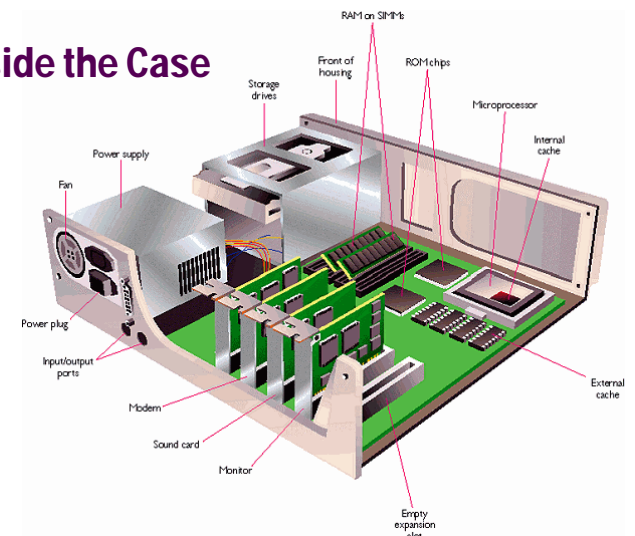  ◆ **Up to 8.5 GB = 8500 MB of data storage per side**
  ◆ **Available as DVD-ROM, DVD-R, DVD-RW**

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**PC System Block Diagram**

Keyboard — Keyboard Port
*Input Devices* — Serial Port
Mouse

Monitor — Video Card
*Output Devices* — Parallel Port
Printer

To File Server — Network Card

*Central Processing Unit*

Executes Instructions
Bus Control Operations

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

*Main Memory (RAM)*

20 GigaBytes = 20,000 MegaBytes

1.4 MegaByte = 1,400,000 Bytes

C: Hard Drive
A: Floppy Drive
*Disk Cntrlr. Device*

Memory Access Cycle
Address on Address Bus
Read or Write on Control Bus
Read or Write Data via Data Bus

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

Address Bus
Data Bus
Control Bus

## Inside the Case



RAM on SIMMs
Front of housing
ROM chips
Storage drives
Microprocessor
Power supply
Internal cache
Fan
Power plug
Input/output ports
External cache
Modem
Sound card
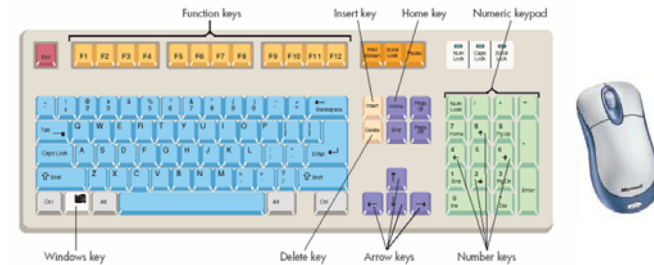Monitor
Empty expansion slot

## 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**          ◆ **Scanner**
◆ **Mouse**             ◆ **Optical character recognition**
◆ **Trackball**         ◆ **Bar code reader**
◆ **Joystick**          ◆ **Handwriting recognition**
◆ **Voice Input**       ◆ **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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