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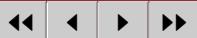
## Introduction to Computer Hardware

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## Topics

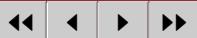
- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
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- Troubleshooting

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## Processor

- Processor is the brain of your computer.
- Some key concepts
  - Clock : In a computer, clock speed refers to the number of pulses per second that sets the tempo for the processor.
  - Cache
    - \* A small but fast memory area.
    - \* Levels of cache exists.
  - Bus (FSB and BSB) : Collection of wires connecting different devices.
  - Pipeline : Implementation technique where multiple instructions are overlapped.

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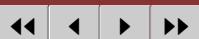
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## Processor contd...

- 32/64 bit processors
  - The amount of data a processor can process in a clock cycle.
- Clock speed and overclocking
  - $\text{BUS SPEED} \times \text{MULTIPLIER} = \text{CPU SPEED (Clock)}$
- Which processor is faster?
  - $100\text{MHz} \times 10.0 = 1000 \text{ MHz}$
  - $133\text{MHz} \times 7.5 = 997.5 \text{ MHz}$

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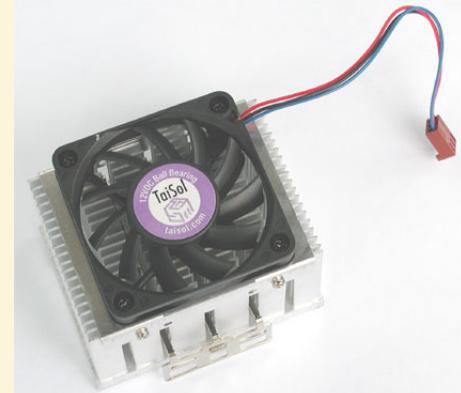
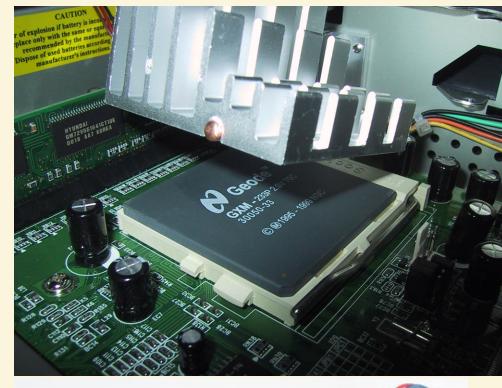
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## Some commercially available processors

- Pentium I-IV
- Celeron
- Athlon
- Duron
- Cyrix C3
- Itanium (64 bit)
- Opteron (64 bit)



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## Processor contd...

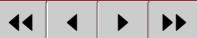
- How do you pick a processor for your system?
  - Performance & Cost
- How to measure performance?
  - Clock speed is one measure of computer “power”, but it is not always directly proportional to the performance level.
  - The type of microprocessor, the bus architecture, and the nature of the instruction set, all make a difference.
    - \* examples : P4 3.06 GHz, P4 3.0B GHz, P4 3.0C GHz
  - Check for bus speed and cache size as well.

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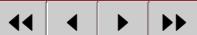
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## RAM

- What is RAM?
  - Random Access Memory.
  - RAM is volatile.
- Broadly classified as
  - Static RAM.
  - Dynamic RAM.

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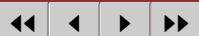
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## RAM contd...

- Static RAM

- Fast, has lower access time.
- Typical access times 5-25 ns.
- Expensive.
- Cache memory is Static RAM.

- Dynamic RAM

- Slower, has higher access time than Static RAM.
- Typical access times 60-120 ns.
- Much cheaper than SRAM.
- Main Memory is Dynamic RAM.

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## RAM contd...

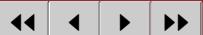
- Memory Bandwidth is proportional to System Bus speed.
- Dynamic RAM are further classified as
  - EDORAM (Extended DataOut DRAM).
  - SDRAM (Synchronous DRAM) : PC100, PC133.
  - DDR SDRAM (Double Data Rate SDRAM)- Allows activation of the output operation to occur on both rising and falling clock edge and hence doubles the speed of operation.
  - RDRAM (Rambus DRAM) - Developed by Rambus and Intel, can support very high bus speeds.

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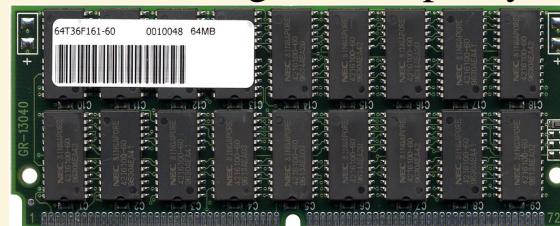
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## RAM contd...

- Memory Slots/Sockets on Motherboard
  - SIMM (Single In-Line Memory Module)
    - \* Smaller in length and capacity than DIMM.



- DIMM (Dual In-Line Memory Module)
  - \* Larger in length and capacity than SIMM.



- SIMM and DIMM are just packaging types only and do not affect the performance.

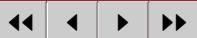
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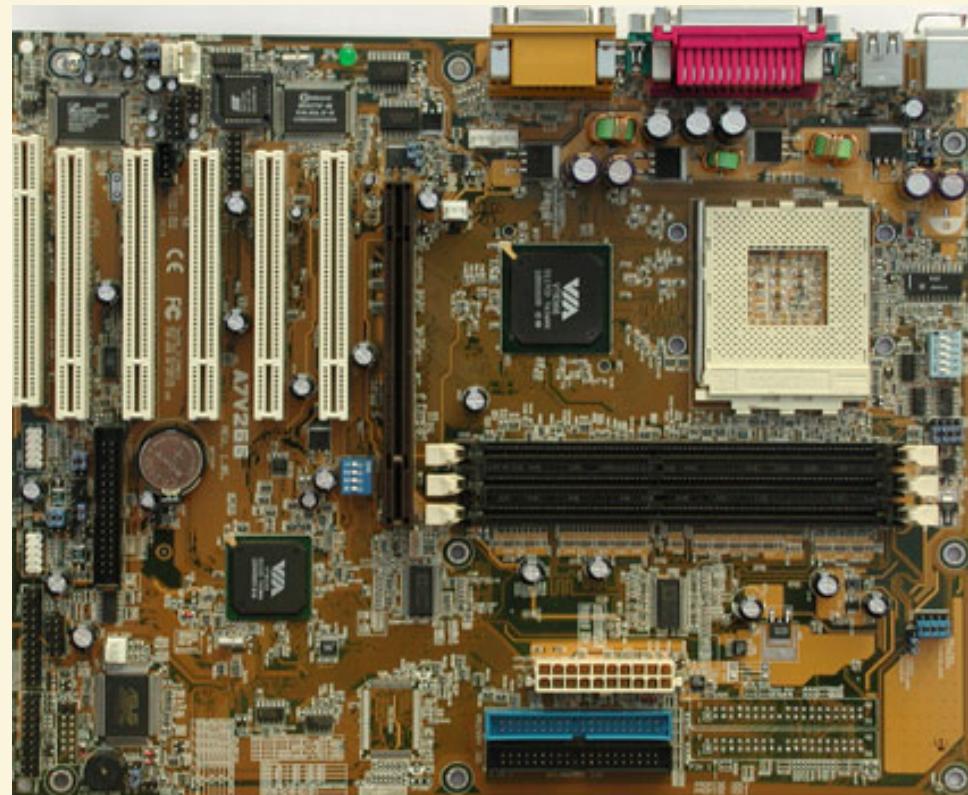
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## Motherboard

- The main circuit board which connects all the device on a micro-computer; Also called main board or system board.



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## Motherboard contd...

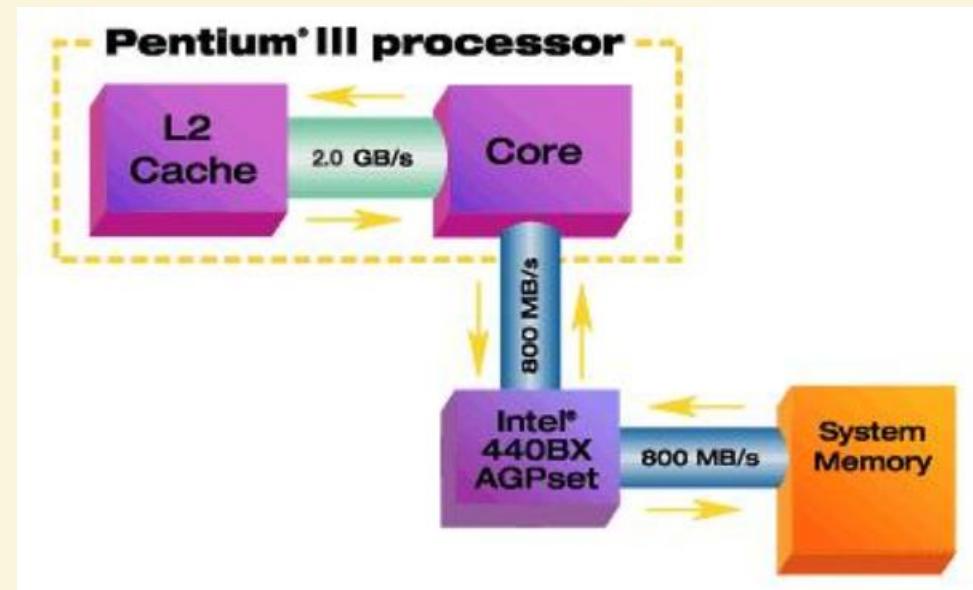
- **Chipset**

- The chipset controls the system and its capabilities. It is the hub of all data transfer.
- Chipsets are integrated, and are not upgradable without buying a whole new motherboard.
- Some of the items it dictates
  - \* Memory controller
  - \* Real-time clock
  - \* Keyboard and mouse controller
  - \* Secondary cache controller
  - \* PCI bridge
  - \* EIDE controller

## Motherboard contd...

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- Motherboards are designed for specific Processors. A single motherboard cannot be used with different types of Processors.
- The different system bus speeds supported by the Motherboard should be of prime consideration.



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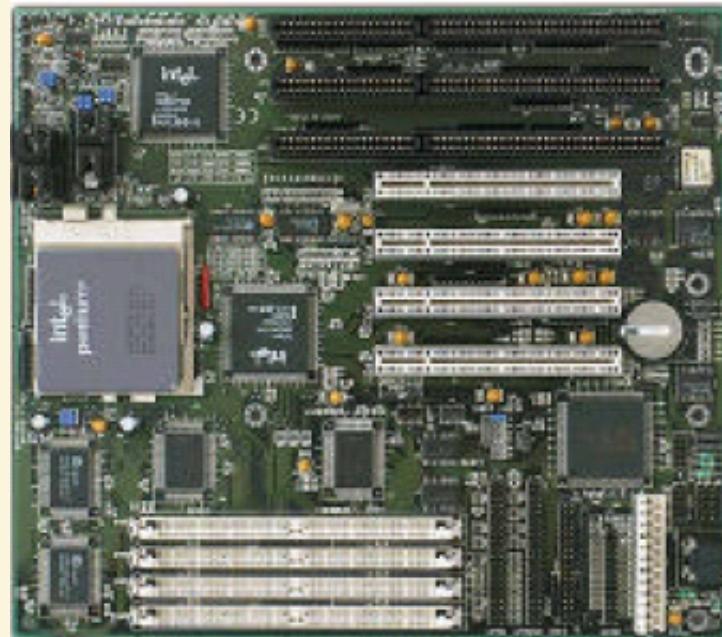
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## Motherboard contd...

- Form Factors

- The form factor is the physical size and dimensions of the motherboard. The form factor determines the general layout, size, and feature placement on a motherboard.
  - \* Baby AT
  - \* ATX
  - \* Proprietary



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## Motherboard contd...

- Onboard devices - Video/Audio/LAN
  - Lower cost.
  - Lesser Flexibility.
- Upgradability
  - Bus speeds supported.
  - Number of expansion slots.
  - Number and Types of IO ports available.

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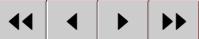
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## Hard Disk

- What is HardDisk?
  - Stores data in magnetic disk like medium
- Non-volatile mass storage device.
- Has very high access time as compared to RAM (10-20 million ns).
- Very cheap as compared to RAM and so large in capacity.



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## Hard Disk contd...

- Interface standards

- IDE (Integrated Drive Electronics)

- \* The hard disk drive includes the drive controller circuitry and hence known as IDE.
    - \* It can support atmost 4 devices.
    - \* 16 bit interface standard; 40 pin/80 pin connector.
    - \* ATA-33/66

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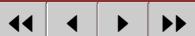
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## Hard Disk contd...

- Interface standards contd...
  - SCSI (Small Computer System Interface)
    - \* General purpose interface standard used for connecting many types of devices to the PC.
    - \* Supports 7 to 15 different devices like hard disk, scanner, CD ROM etc.
    - \* 32 bit interface standard and more expensive than IDE.
    - \* Allows simultaneous access for faster data transfer.

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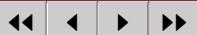
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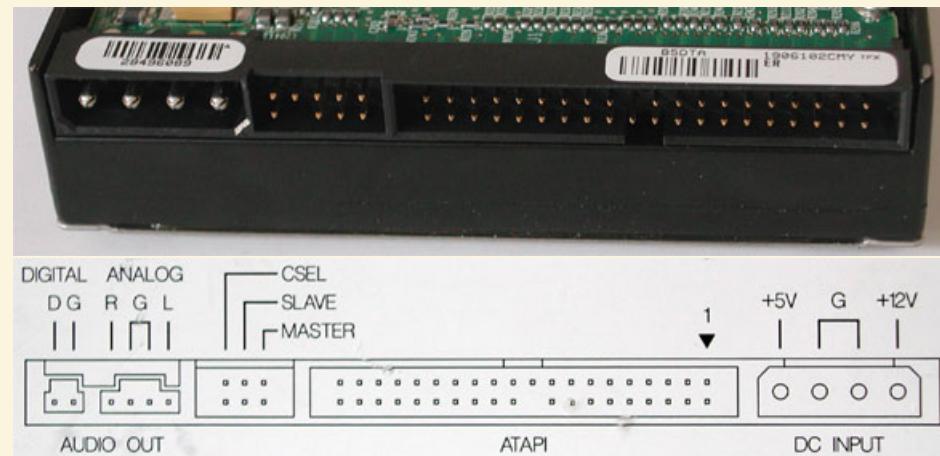
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- Connecting Multiple IDE Harddisks/CD-Roms
  - Primary/Secondary and Master/Slave settings
  - Jumper settings



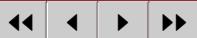
- Performance parameters
  - Rotation speed.
  - Average seek time.

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## Video Card

- What's a Graphics Card?

- A modern graphics card is a circuit board with memory and a dedicated processor.
- Converts digital information into the pixels to display it on the monitor.

- Frame Buffers

- The card simply holds a frame of information that is sent to the screen.
- Pixel updates are done by the microprocessor.
- Slow.

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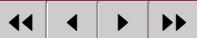
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## Video Card contd...

- Graphics accelerators with GPU
  - Pixel updates are done by the GPU.
  - GPU is optimised for graphics operations.
  - Reduces load on the main processor.

## Bus Interfaces PCI

- Peripheral Components Interconnect

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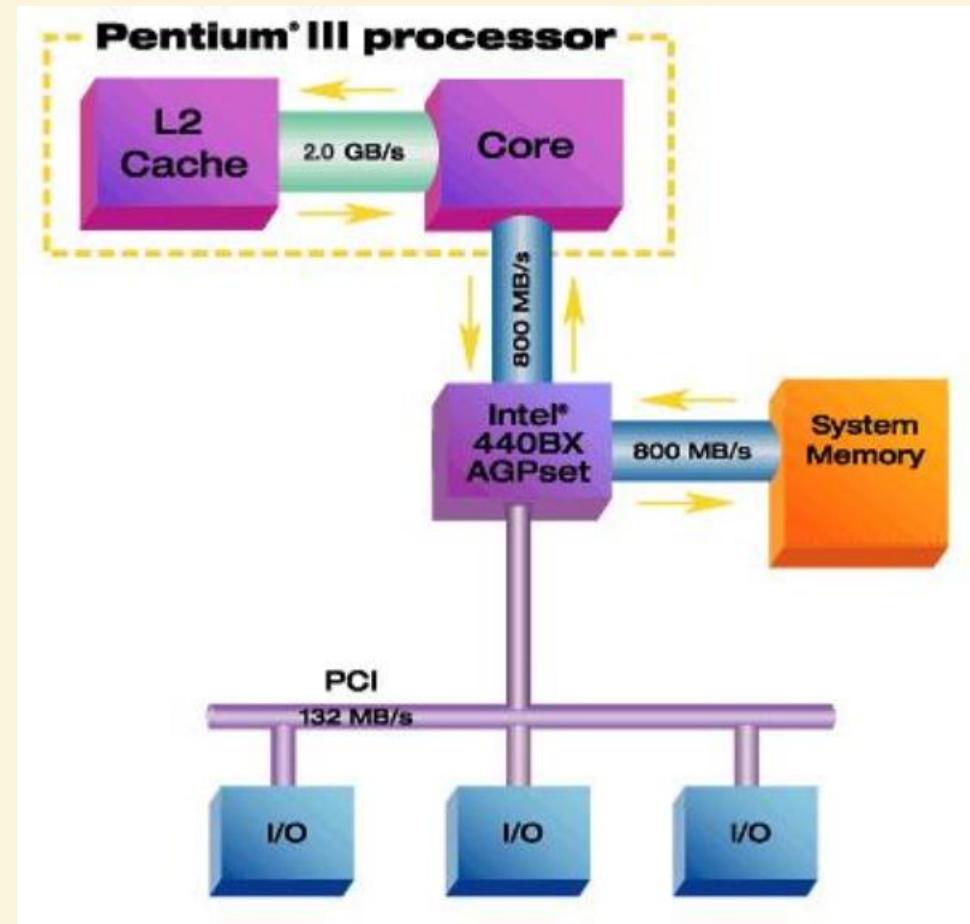
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## Bus Interfaces AGP

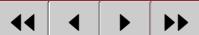
- Accelerated Graphics Port

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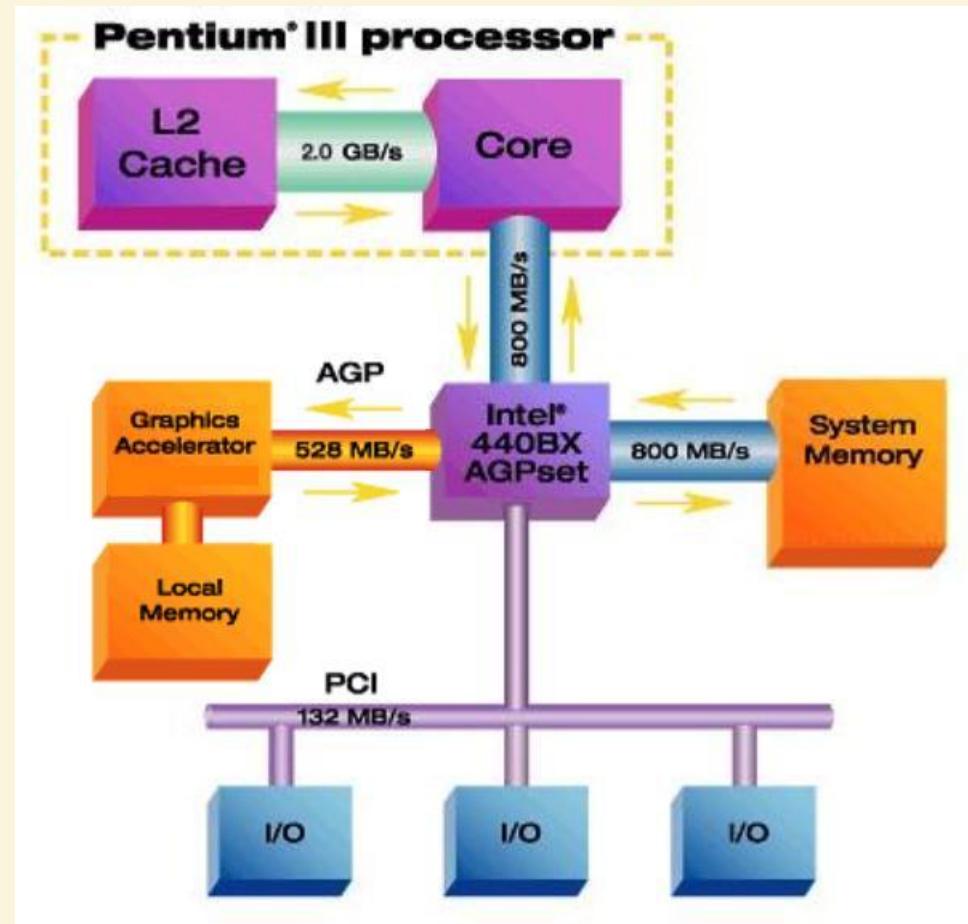
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## On board Graphics Accelerator

- On board graphics accelerators share system memory.

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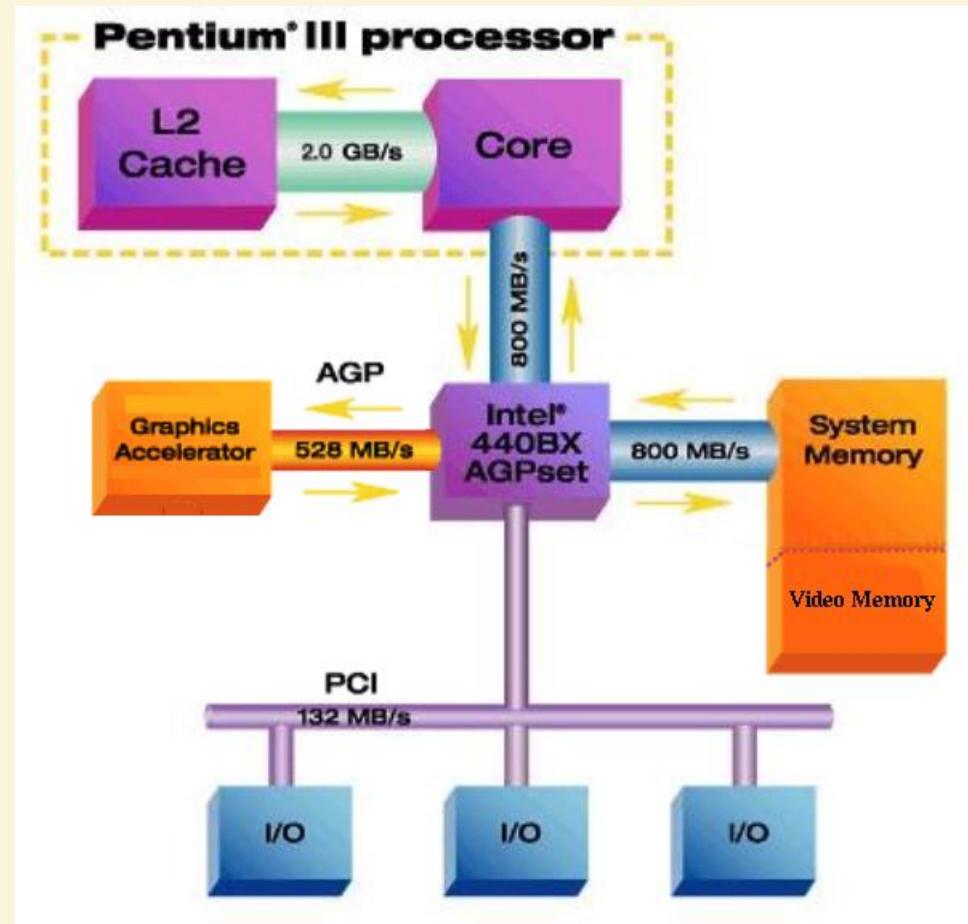
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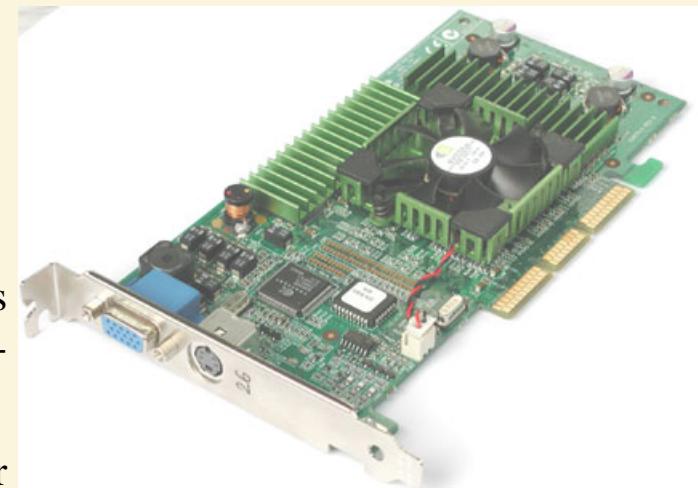
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## Video Card contd...

- Wide range of cards
  - 3D Acceleration.
  - Video Memory.
- Modern day Graphics cards are more powerful than Pentium processor!
- Expensive component of your Computer.



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## Video Card contd...

- Choosing a Graphic card
  - PCI or AGP.
  - Integrated or Add-on card.
  - Non-Accelerated or 3D accelerated.
  - Cost.

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## Sound Card

- Converts digital data (bits) into analog sound wave and vice-versa.



- Has Digital Signal Processor, RAM, ADC and DAC.
- Has jacks for speaker, microphone, line in, line out and joysticks.

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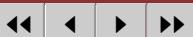
## Sound Card contd...

- Choosing a soundcard

- Integrated or External add-on card.
- CPU Utilization.
- Sound reproduction capabilities (dolby, 5.1 channels etc.).
- Cost.

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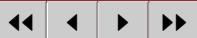
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## Network Interface Card

- Connects PC to LAN (Local Area Network).
- Ethernet, Token Ring.
- Speeds
  - 10Mbps
  - 100Mbps
- Onboard or Add-on Card?



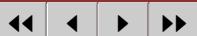
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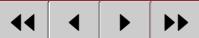
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## Ports

- Serial

- Serial port “serializes” data.
- Mouse, Modems etc use Serial port.



DB9 Male

- Parallel

- Bits transmitted in parallel.
- Used primarily for Printers.



DB25 Male (A)

- PS/2

- Used to interface keyboards and pointing devices.
- Frees the serial port for other devices.



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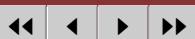
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## Ports contd...

- USB

- Data transfer rate 12Mbps/480Mbps.
- Multiple devices supported on the bus (127).
- Hot pluggable, Plug-and-play.
- Provide power through the cable.
- Host based.



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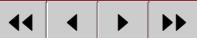
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## Ports contd...

- Firewire (IEEE 1394)
  - Originally created by Apple and standardized in 1995.
  - Fast transfer of data (up to 400 Mbps/800Mbps).
  - Multiple devices supported on the bus (63).
  - Hot pluggable, Plug-and-play.
  - Provide power through the cable.
  - Peer to peer.
  - Supports synchronous devices.

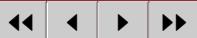
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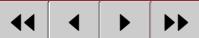
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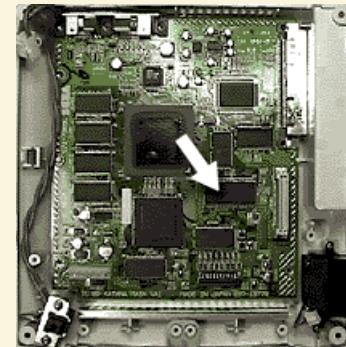
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## BIOS

- What is it? - Basic Input Output System
- Why is it necessary?
  - boot up
- Important Functions
  - Check CMOS Set-up.
  - POST - Power On Self Test.
  - Display system setting.
  - Initiate bootstrap sequence.

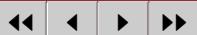


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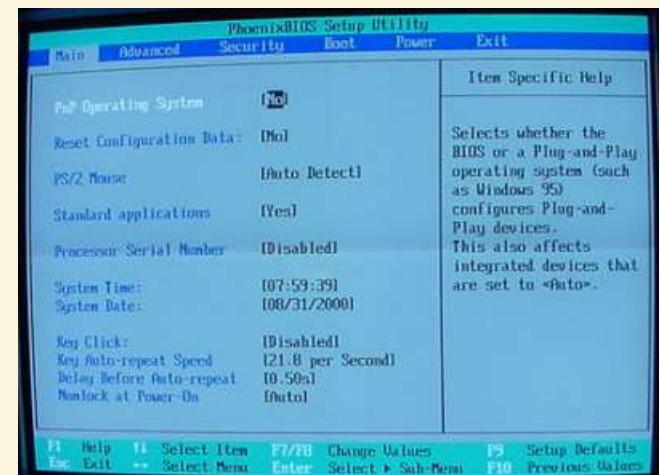
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- ## Configuring BIOS
- System Time/Date.
  - Boot Sequence.
  - Plug and Play.
  - Drive Configuration.
  - Security.
  - Power Management.



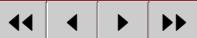
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## Topics

- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- **Peripherals**
- Cabinet
- Troubleshooting

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## Keyboard

- Switching action.
- No. of keys.
- Control, Functional, Special, Alpha-Numeric Keys.
- Connects to PC using PS/2 connector.

## Mouse

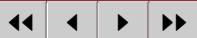
- Different shapes and size.
- 2 and 3 buttons mouse.
- Scroll mouse.
- Connects to PC using PS/2 connector.

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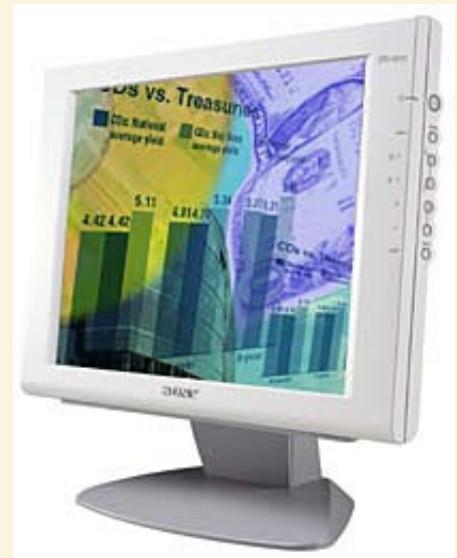
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## Monitor

- Cathode Ray Tube Monitor.
- Size - 15" to 21".
- Resolution.
  - CGA : 320 X 200 (4)
  - EGA : 640 X 350 (16)
  - VGA : 640 X 480 (256)
  - SVGA : 1280 X 1024 (16.7 million)
- Display Quality - Refresh rate.
- Interlaced/Non-interlaced.
- Flat panel - LCD and Plasma.



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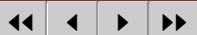
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## CD ROM/Writable

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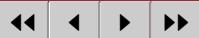
- Speed - 12x, 24x, 48x, 52x etc.
- Sturdier, Unaffected by magnetic fields.

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## Printer

- Impact Printer - Dot matrix
  - Selection : Speed, Unidirectional / Bidirectional.
  - Adv. : Inexpensive, Multi-copy forms.
  - Disadv. : Slow, Loud, Graphics of low Quality
- Non-impact Printer
  - Inkjet
  - Thermal
  - Laser
  - Adv. : Quiet, Can handle graphics, Varieties of fonts.
  - Disadv. : Expensive.

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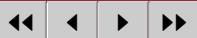
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## Modem

- Speed - 56k, 33.6k, 28.8k
- Internal Modem
  - Resides on the expansion board on the slot of the motherboard.
  - Does not require separate power adapter.
  - Cheaper than external modem.
  - Has natural protection inside PC cabinet.



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## Modem contd...

- External Modem

- Resides on a self-contained box outside the PC.
- Requires external power adapter.
- Connected to PC's serial port via the cable.
- Easy to install and troubleshoot such as resetting the modem.
- Expensive than internal modems.



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## Topics

- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
- Cabinet
- Troubleshooting

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## Cabinet

- Form Factor
- AT Cases
- ATX Cases



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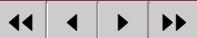
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## AT Cases

- Older Motherboards (pre-pentium)
- Advantages
  - Well Established standard make.
  - Easy and cheap design.
- Disadvantages
  - Inefficient cooling.
  - CPU socket location.
  - Not suitable for P-II (& higher).

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## ATX Cases

- Newer Motherboards (Pentium based m/c)
- Advantages
  - Efficient cooling.
  - Easy accessibility for upgrades.
  - I/O are fixed onboard.

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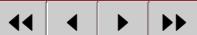
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## Topics

- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
- Cabinet
- **Troubleshooting**

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## Troubleshooting

- You are not the first one to face the trouble.
- Some simple solutions.
  - Check connections.
  - Ensure that cards are inserted properly.
  - Clean the devices.
  - Check if minimum things needed to boot are present - motherboard, processor, a full bank of memory, videocard and a drive to boot.

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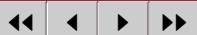
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## Troubleshooting contd...

- The PC doesn't start at all
  - Count the number of beeps.
  - No beeps - possible problem with BIOS or motherboard.
- The PC starts - partially
  - No signal on the monitor.
  - Video signal present with error message.
  - OS starts.
  - OS does not start - Hard-disk problem.

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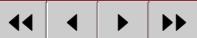
## Troubleshooting contd...

- Video

- No video at all.
- Snow on the screen.
- The picture is horrible. Bad colors, dots, and streaks.
- Random, changing characters on the screen.
- The screen rolls upward or to the side.

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## Troubleshooting contd...

- Hard Drive

- Not bootable : A Hard Drive must be formatted and partitioned before it can be used.
- Not detected by the BIOS - Check on a different m/c.
  - \* It works fine.
  - \* It does not work.

- Others

- System forgets time/settings



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