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Introduction to Computer Hardware

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Topics

- **Processor**
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
- Cabinet
- 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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Processor contd...

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

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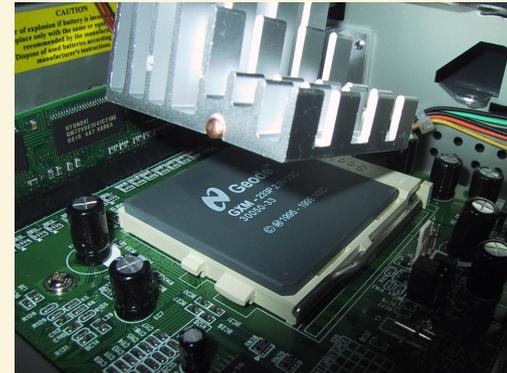
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Some commercially available processors

- 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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RAM

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

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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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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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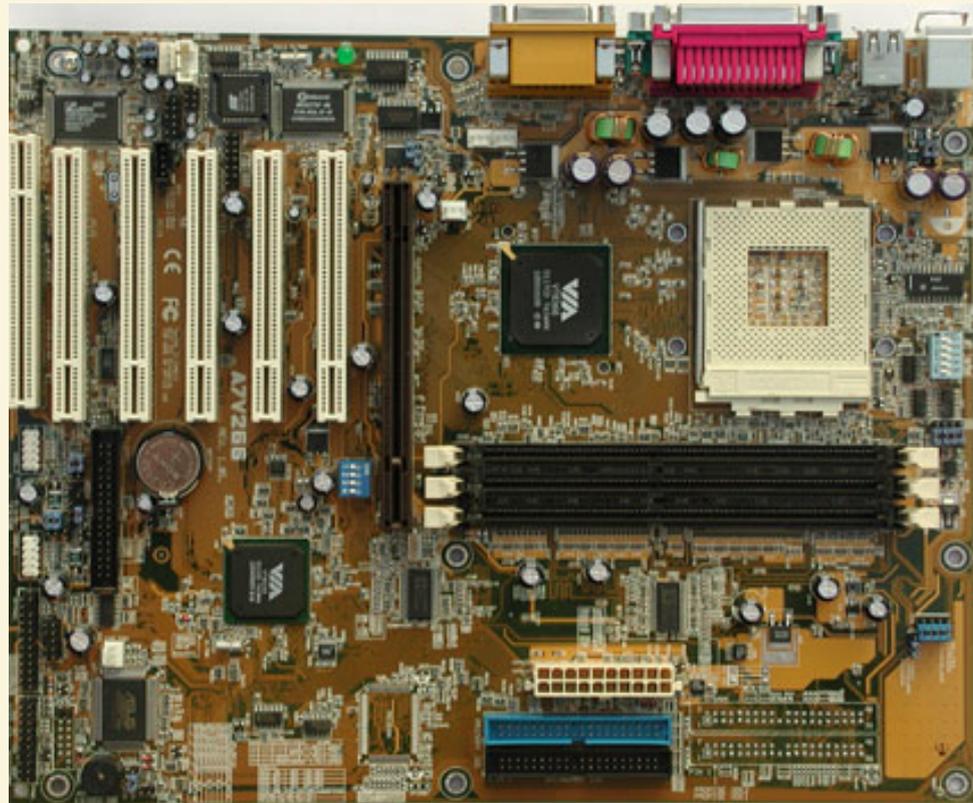
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Motherboard

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



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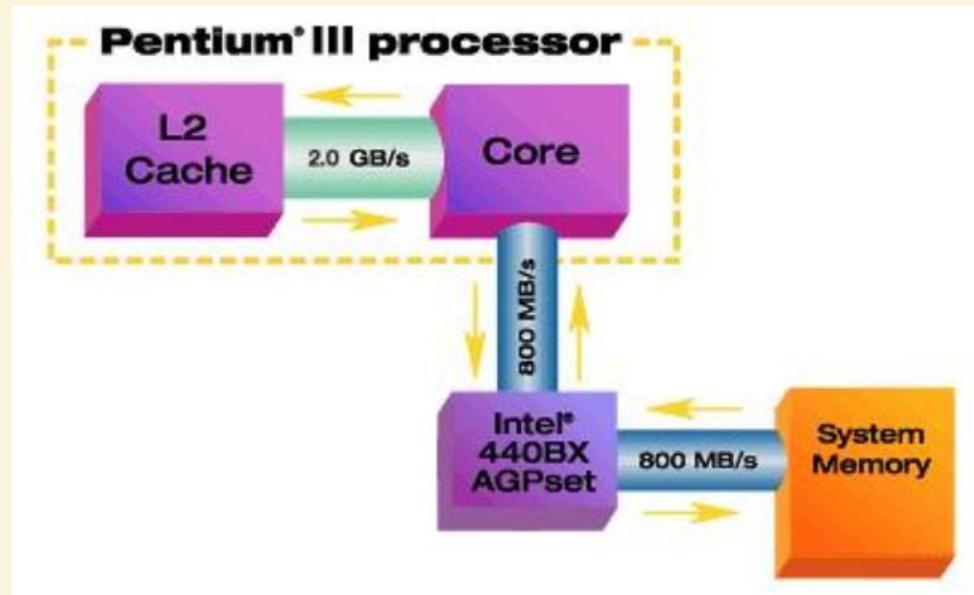
Motherboard contd...

- 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...

- 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.

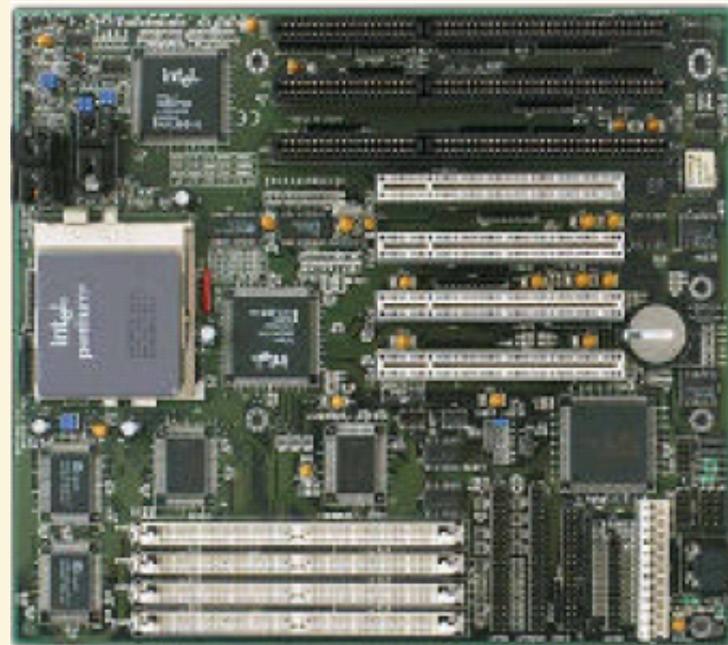


Motherboard contd...

- 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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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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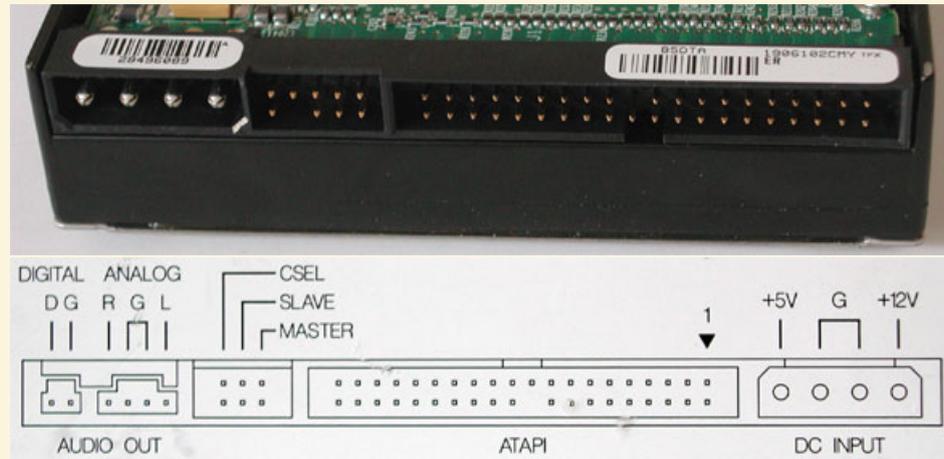
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Hard Disk contd...

- Interface standards contd...
 - SCSI (Small Computer System Interface)
 - * General pupose 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 simultanous access for faster data transfer.

Hard Disk contd...

- 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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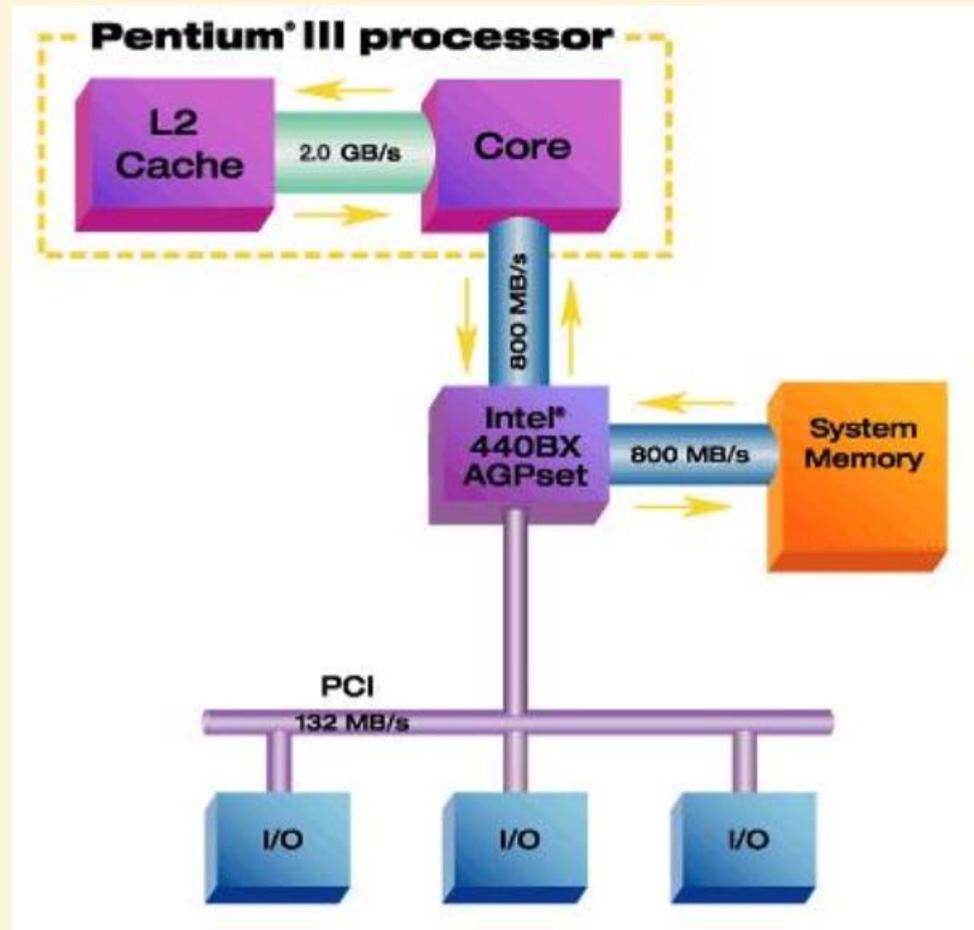
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Video Card contd...

- 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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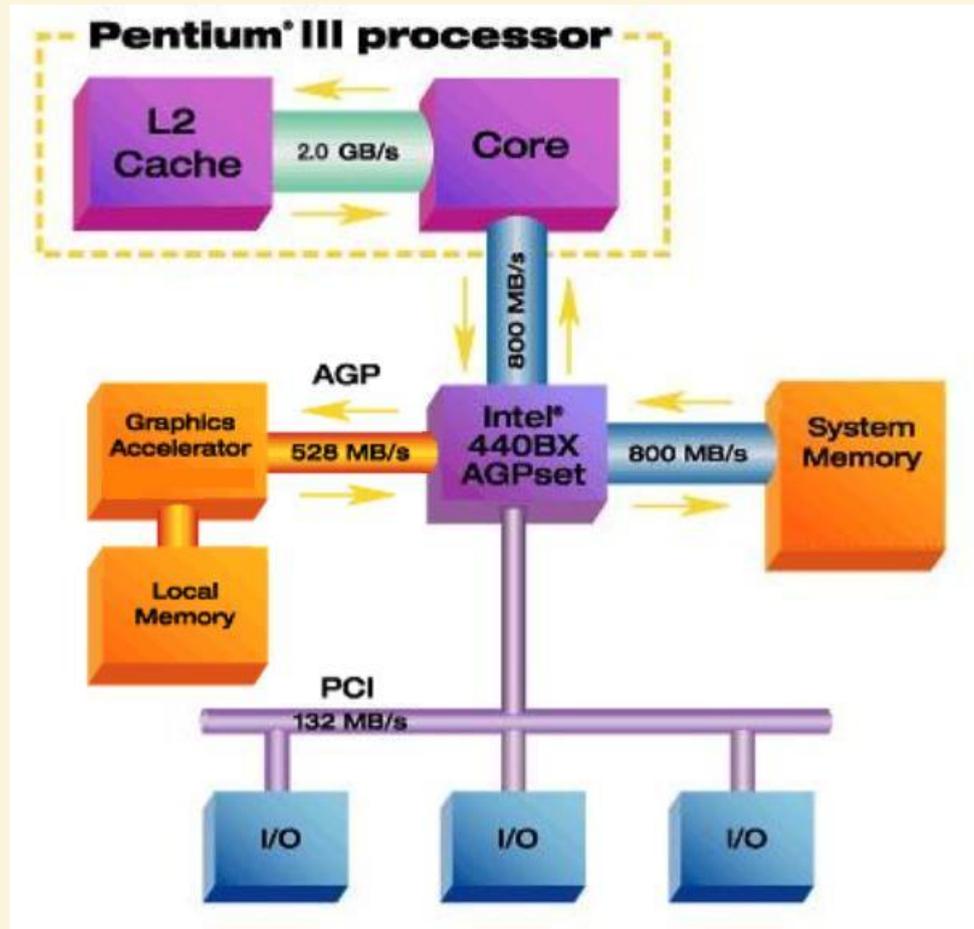
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Bus Interfaces AGP

- Accelerated Graphics Port



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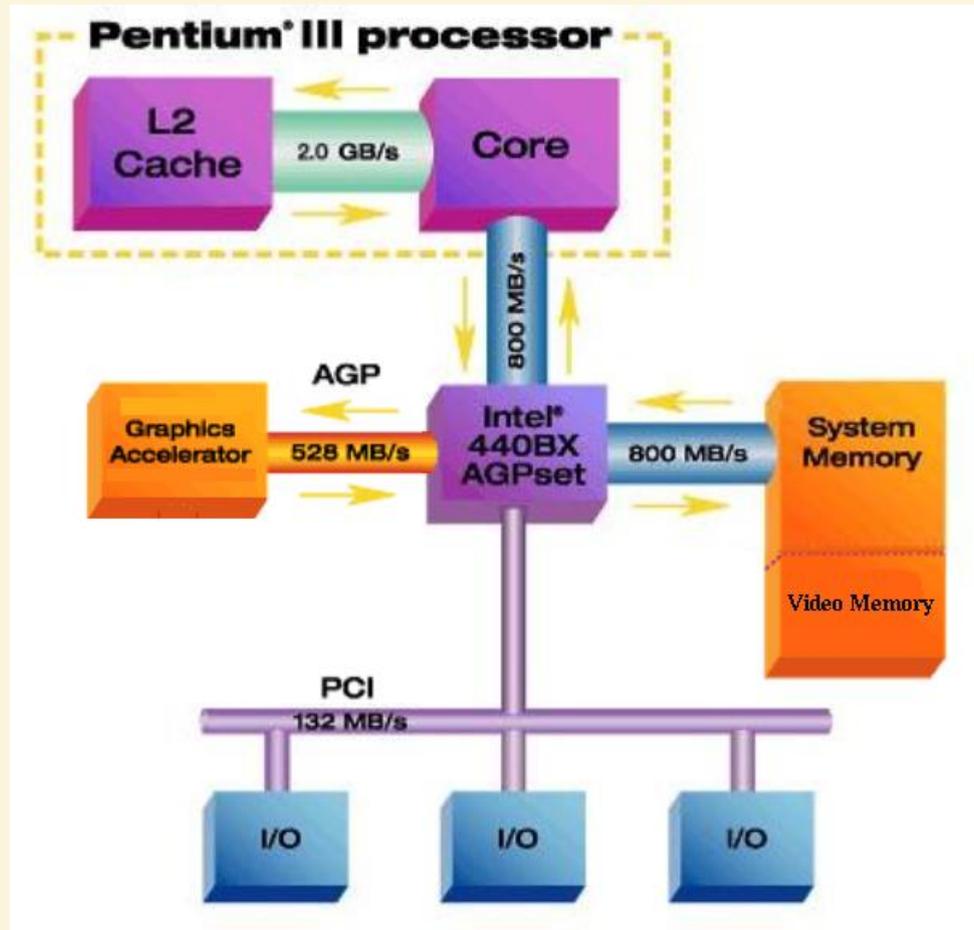
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On board Graphics Accelerator

- On board graphics accelerators share system memory.



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Video Card contd...

- Wide range of cards
 - 3D Accelration.
 - 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-Accelrated or 3D accelrated.
 - 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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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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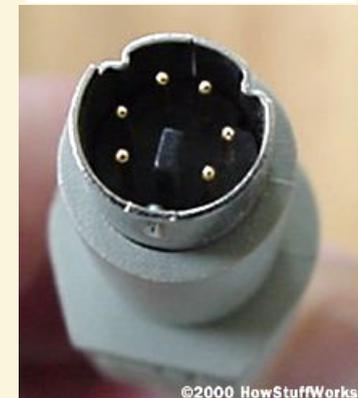
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Ports

- Serial
 - Serial port “serializes” data.
 - Mouse, Modems etc use Serial port.
- Parallel
 - Bits transmitted in parallel.
 - Used primarily for Printers.
- PS/2
 - Used to interface keyboards and pointing devices.
 - Frees the serial port for other devices.



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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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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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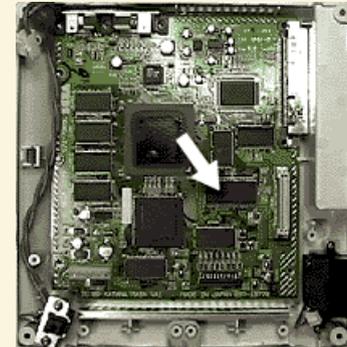
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BIOS

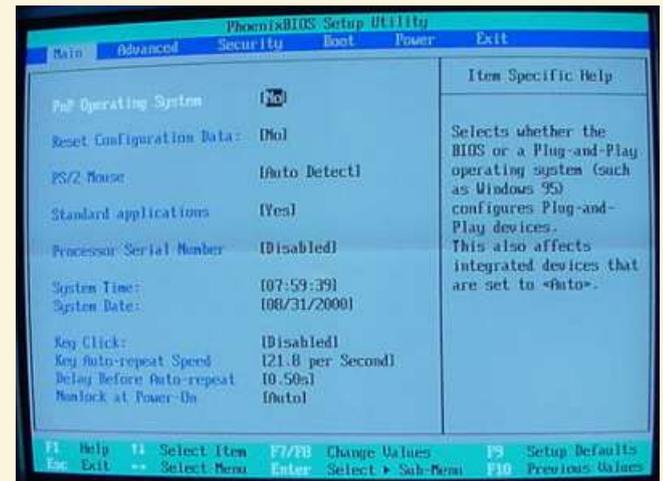
- What is it? - Basic Input Output System
- Why is it necessary?
 - boot up
- Important Functions
 - Check CMOS Set-up.
 - POST - Power On Self Test.
 - Display system setting.
 - Initiate bootstrap sequence.



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Configuring BIOS

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



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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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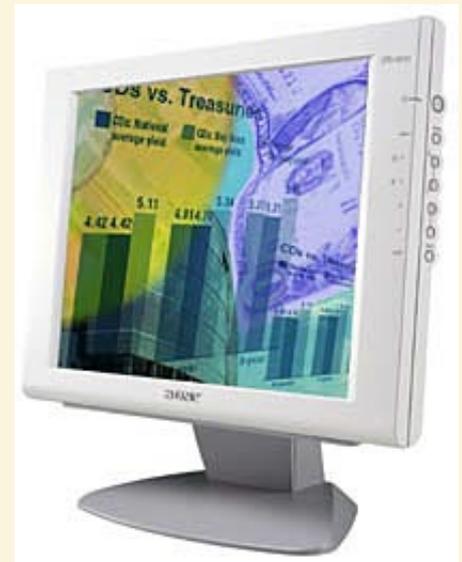
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Monitor

- 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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CD ROM/Writable

- 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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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.



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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Cabinet

- Form Factor
- AT Cases
- ATX Cases



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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 upgades.
 - I/O are fixed onboard.

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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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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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