Introduction to Computer Hardware
Topics

- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
- Cabinet
- Troubleshooting
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.
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?**
  - $100\text{MHz} \times 10.0 = 1000\text{ MHz}$
  - $133\text{MHz} \times 7.5 = 997.5\text{ MHz}$
Some commercially available processors

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

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

• What is RAM?
  – Random Access Memory.
  – RAM is volatile.

• Broadly classified as
  – Static RAM.
  – Dynamic RAM.
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.
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.
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.
Topics

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

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

- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
- Cabinet
- Troubleshooting
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.
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
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.
Hard Disk contd...

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

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

- Processor
- RAM
- Motherboard
- HardDisk
- Cards
- Ports
- BIOS
- Peripherals
- Cabinet
- Troubleshooting
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.
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
Bus Interfaces AGP

- Accelerated Graphics Port
On board Graphics Accelerator

- On board graphics accelerators share system memory.
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.
Video Card contd...

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

• Choosing a soundcard
  – Integrated or External add-on card.
  – CPU Utilization.
  – Sound reproduction capabilities (dolby, 5.1 channels etc.).
  – Cost.
Network Interface Card

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

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

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

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

• Processor
• RAM
• Motherboard
• HardDisk
• Cards
• Ports
• BIOS
• Peripherals
• Cabinet
• Troubleshooting
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.
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.
CD ROM/Writable

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

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

- Form Factor
- AT Cases
- ATX Cases
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).
ATX Cases

• Newer Motherboards (Pentium based m/c)
• Advantages
  – Efficient cooling.
  – Easy accessibility for upgades.
  – I/O are fixed onboard.
Topics

• Processor
• RAM
• Motherboard
• HardDisk
• Cards
• Ports
• BIOS
• Peripherals
• Cabinet
• Troubleshooting
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.
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.
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.
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