# PCSM Notes

# CHAPTER 1:

# BASIC COMPUTER CONCEPTS

- Computer systems are composed of *hardware*, *software*, and *firmware*.

- *Hardware* is something you can touch and feel; the physical computer itself is an example of hardware

- *Software* is the operating system and applications that make the hardware work; the software provides instructions for the hardware to carry out. Examples are: Windows XP, Microsoft Office, Adobe Acrobat Reader, and WordPerfect.

- The *operating system* is an important piece of software that coordinates the interaction between hardware and software applications, as well as the interaction between a user and the computer. Operating system examples include: DOS, Windows 98, NT Workstation, Windows 2000, Windows XP, and Unix.

- A ***microcomputer***, also called a computer or PC, is a unit that performs tasks using software and comes in three basic models:

- A ***desktop*** model that normally sits horizontally on top of a desk.

- A ***tower*** model that sits vertically under a desk.

- A ***laptop*** model, which is portable

- The microcomputer consists of:
  - A case (chassis).
  - A ***keyboard*** that allows users to communicate with the computer.
  - A ***monitor*** that displays information.
  - A ***mouse*** that allows data input or is used to select menus or options.

- The two types of keyboard are *mechanical* and *capacitive*.

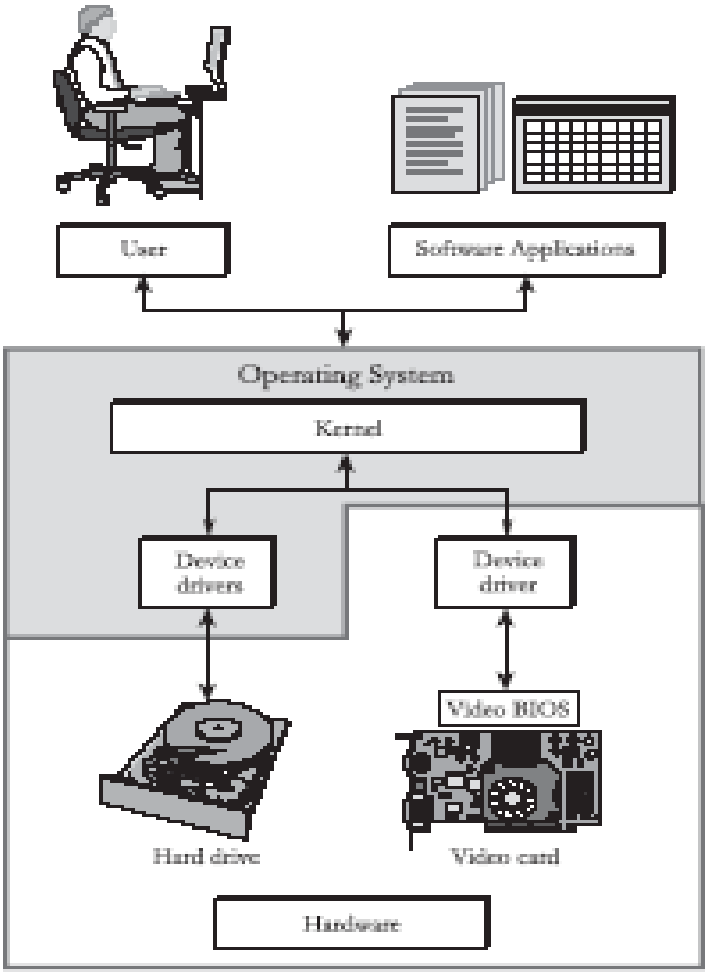
- The ***mechanical keyboard*** is:
  - The cheapest and most common.

  Has mechanical switches that close when a key is depressed

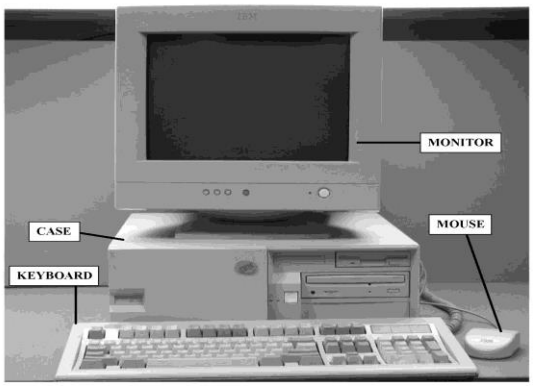
- The ***capacitive keyboard*** is:
  - More expensive, but also more reliable.
  - Uses a change in capacitance to detect when a key is being depressed.

– Usually the quieter of the two keyboards.

Introduction Figure 1: Hardware and Software




Desktop Computer




- Internal components of the computer include:
  - **power supply** - Converts AC voltage from the wall outlet to DC voltage the computer can use, supplies DC voltages for internal computer components and has a fan to keep the computer cool.
  - **floppy drive** - Common storage device that allows data storage to **floppy disks** (storage media) which can be used in other computers.

- **hard drive** - Or hard disk, is a common storage device for maintaining files inside the computer, usually mounted below or beside the floppy drive.
- **CD drive** - Holds disks (CDs) that have data, music, or software applications.
- **DVD (Digital Versatile Disk) drive** - Popular alternative to a CD drive that supports CDs as well as music and video DVDs.

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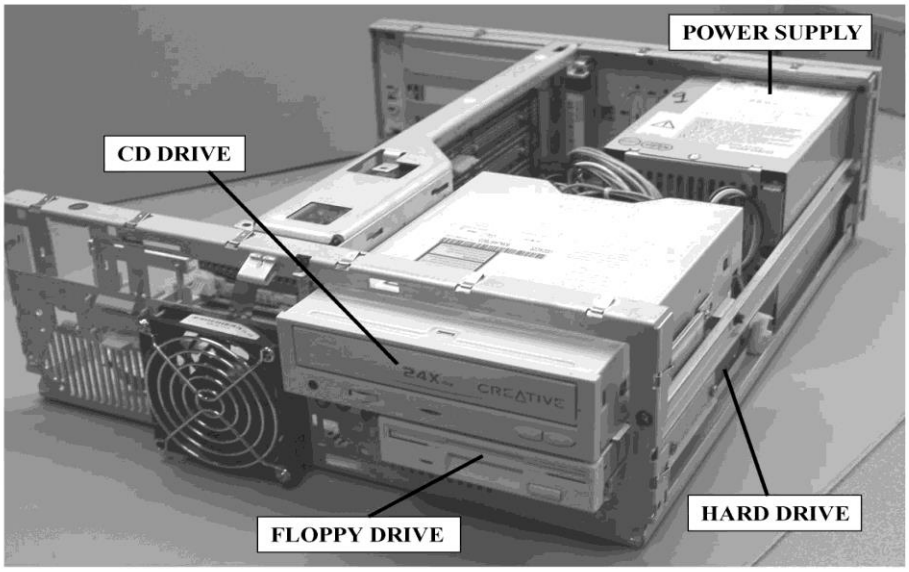
**Desktop Computer with Hard Drive, Floppy Drive, CD Drive, and Power Supply**




**More internal components of the computer are:**

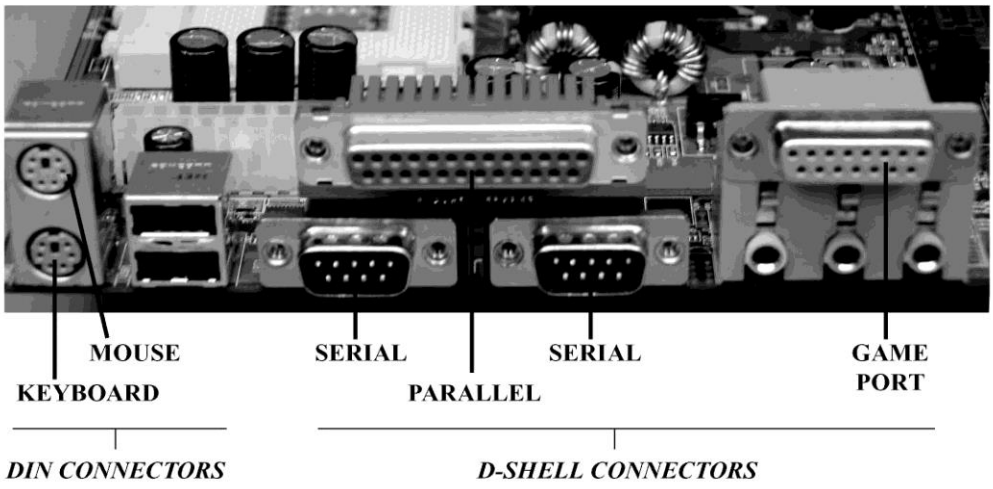
- **Motherboard** - The main circuit board that contains most of the electronics and is the largest electronic circuit board in the computer, all computer components connect to, or communicate through, the motherboard.
- **Adapters** - Smaller electronic circuit cards that normally plug into an expansion slot on the motherboard allowing other devices to interface with the motherboard, they also may control some devices.
- **Expansion slot** - A special connector on the motherboard that allows an adapter to plug in and connect to the motherboard.
- **Riser board** - A small board with expansion slots that plugs into the motherboard and allows adapters to connect at a different angle.

**Internal components of the computer also include:**

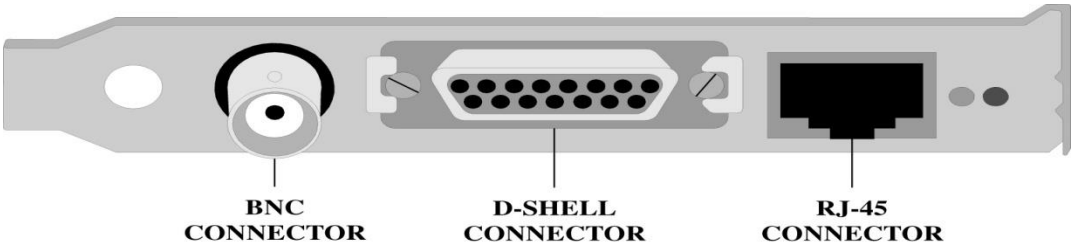
- **Memory** - This important component holds applications, part of the operating system, and user documents or images; types are:
- **RAM (Random Access Memory)-** volatile memory (loses data inside the chips when power is shut off) that holds applications and user data while the computer is operating.

- **ROM (Read-Only Memory)-** non-volatile memory (retains data when power is shut off).
- **ROM BIOS-** an important chip on the motherboard that holds the start-up software for the computer to operate, and software instructions for communication of the input/output devices and important hardware parameters.
- Turning the computer on with the power switch for a computer that is not running is known as a **cold boot**; a user can use this technique when running POST is required to help diagnose a problem.
- **A warm boot** is performed when a computer that is already on is restarted without using the power switch. This can be accomplished by pressing the CTRL, ALT, and DEL keys at the same time, or pressing the computer's reset switch. This can be helpful when a technician has made changes to the files that execute when the computer powers on and needs these changes to take effect, it does not run POST.
- **Port** – Is a connector on the motherboard or on a separate adapter that allows a device to connect to a computer; these may include keyboard, mouse, serial, parallel, network, sound, or video ports.
- **Integrated motherboards** – Motherboards with ports built into them.
- **Male ports** – Have pins that protrude out from the connector and require a cable with a female connector.
- **Female ports** – Have holes in the connector to accept the male cable's pins.
- **D-shell connector** – A connector with more pins or holes on the top row than on the bottom so a connected cable can only be attached in one direction and not accidentally connected the wrong way; generally represented with the letters DB and the number of pins such as, DB-9, DB-15, or DB-25.

DIN and D-Shell Connectors



- **Network ports** – Used to connect a computer to other computers, including a server and are available in two types-*Ethernet* and *Token Ring*; a network cable connects to the network port.
- **Ethernet** – These adapters are the most common type of network card with BNC, RJ-45 (most common today), a 15-pin female D-shell connector (sometimes called AUI), or any combination of all of them.
- The BNC connector attaches to a thin coax cable.
- The 15-pin D-shell (AUI) connector attaches to thick coax cable.
- The RJ-45 connects to UTP (Unshielded Twisted Pair) cable.
- **Game ports** – A 15-pin D-shell connector for attaching gaming devices like a joystick that is sometimes confused as a network connector.




**Support and maintenance tools**

A variety of hardware, software and information resources are available for use during troubleshooting procedures.

**Hardware & software tools**

The tools that you should have available when troubleshooting a pc include:

1. A good set of screw-drivers.
2. Antistatic wrist strap, antistatic mat and antistatic bags ( for removing and storing components)
3. Software system testing utilities e.g. Symantec's Norton utilities, Eurosoft's PC check among others.
4. A digital multimeter for checking power supply voltages.
5. A supply of spare known-good components for replacement testing.

**Information resources.**

The internet is useful resources you can use to gain information about a particular device or application or to learn how others have dealt with a particular problem you are having.

The first place to look for information is on the manufacturer's website.

Other more generic troubleshooting sites are: www.pcguide.com, www.everythingcomputers.comwww.pcsupport.about.com

# CHAPTER 2:

# POWER SUPPLY

• PCs use DC voltage but power companies supply AC voltage.

• The power supply in a computer converts high-voltage AC power to low-voltage DC power.

The primary functions of a pc power supply are voltage conversion, rectification, filtering, regulation, isolation, cooling and power management.

- ***Voltage conversion*:** involves changing the 110V AC primary power source into the +12V DC and +5V DC used by older systems and the +3.3V Dc used by newer computer systems.
- ***Rectification*:** This function is directly involved with converting the AC power of power source to DC power needed by the PC's components.
- ***Filtering*** : rectification usually introduces a ripple in the DC voltage which, which filtering smoothes out.
- *Regulation*: along with filtering, voltage regulation removes any line or load variations in the DC voltage produced by the power supply.
- ***Isolation*:** refers to separating the AC power supply from the converted, rectified, filtered, and regulated DC power.
- ***Cooling* :** the system fan, which controls the air flow through the system case, is located inside the power supply.
- ***Power management*:** -Modern computers have energy-efficiency tools and power management functions that help reduce the amount of electrical power used by the PC.

  In areas where the power source is already a DC, the power supply performs all of the same tasks, except rectification.

  In addition to providing converted power to motherboard and other parts, the power supply sends a very important signal to the motherboard through its umbilical connection – the **power_good** (or **pwr_ok** on an ATX form factor power supply) signal.

## Power supply components.

- *Bipolar transistor:* an active semi-conductor device that amplifies an electrical current.
- *Metal oxide semiconductor field effect transistor*- a transistor type that uses a layer of oxide as insulation between its conducting channel and gate terminal.

- *Silicon controlled rectifier:-* a thyrisor type designed specifically for unidirectional power switching and control.
- *Thyristor:-* a semiconductor device that can be switched between off and on states. Thyristors are used for power switching applications.

## Form Factors

Power supplies, like motherboards are available in a variety of different form factors, typically matching the form factor of the motherboard and system case as listed below:

- *PC XT*: - it was placed in the rear right corner of the case, and an up-and down toggle switch on the exterior was used to power it on/off.
- *PC AT* – was little larger, had slightly different shape, and had about three times the power wattage of the PC XT.
- *Baby AT* :- smaller version of AT form factor. It is only 2 inches narrower than the AT, with the same height and depth. It is also compatible with the AT form factor, in either desktop or case styles
- *LPX* / slimline/ PS2: has reduced height and general dimension, while maintain the same power production, cooling ability and connector as baby AT and AT.
- *ATX:* here the LPX of the AC power pass-through outlet used for PC monitors are removed
- *NLX:* uses the same power supply as ATX.
- *SFX:* was designed for use in the microATX and FlexATX form factors.

## Protecting the PC

Power supply accounts for nearly a third of the problems of a PC. Generally what causes the most problems with a power supply is the AC power source, which is usually an unreliable, noisy, and fluctuating electrical noise.

Common electrical problems :

a) *Spikes:* an electrical spike is an unexpected, short-duration, high-voltage event on the AC power line. Spikes can be caused by lightening strikes, gerenator switchesovers, power pole incidents.To protect against spikes – use surge suppressor or Ups that includes surge suppression.
b) *Blackouts:* is a total loss of power. Can last between split second to days. The best defense against a blackout is a UPS.
c) *Brownouts:* is the opposite of a spike,except that a brownout can last for a relatively long time.If the voltage lingers too long below the normal point,the result can be the same as blackout, or worse. Brownouts can destroy components by causing a power supply to draw too much current to make up for the low voltage.
d) *Power surge:* or overvoltage, is a high- voltage situation that raises the voltage above normal levels ,much like a spike but for longer period of time.A surge suppressor or a UPS ,which absorbs an increase in power is a good protection against power surge.
e) *Noise:* Electrol magnetic interference and radio frequency interfereance are the two main causes of line noise on Ac power line.UPS is the best bet to filter out line noise.

TYPES OF UPS DEVICES

A UPS is a large battery and a battery charger that provides a Pc /server protection against short term power outages,surges,spikes and brownouts. A UPS monitors its input voltage ,and when the voltage level more than a certain percentage from normal it switches to provide electrical service from its battery.

UPS units are units are available in two categories:

a) Standby UPS – it generally does nothing more than provide a battery backup to the pc connected to it as a safe guard against a power failure.In standby mode, the Ups draws the Pc.
b) Online /Inline UPS – Provides power to a pc through an Ac power service provided from the UPS's battery and a power inverter that converts the battery's Dc power to Ac power.

**Power supply problems**

Power supply is a very important computer component but it is also the one most likely to fail.

Three conditions require that you check out or troubleshoot the power supply:

•**Upgrading the system**—Suppose you are planning a big upgrade (new motherboard, new hard drive, digital versatile disk (DVD), and the works) and you are worried that your power supply may be too weak to handle the new load. When upgrading, remember that a power supply is rated by its power output in watts. You can get from 100- to 600-watt power supplies to fit the common form factors (ATX and LTX). A power supply rated between 230 to 350 watts works well for most average systems, unless you are planning to build a super server with quad Pentium III Xeons, a DVD, an internal tape drive, and four or five internal small computer system interface (SCSI) drives, in which case you'll need to look into the WTX form factor.

•**Intermittent problems**—If you have tried everything you can to track down an intermittent problem on the motherboard without isolating the problem, the power supply may be the real culprit if the problem is at all related to a power issue. But how can you tell whether the power supply is going bad? Some of the telltale signs that can tip you off that the power supply is on its way to failure are overheating, occasional boot failures or errors, frequent parity errors, noisy operation, or mild electrical shocks when you touch the case.

**Catastrophic problems**—If smoke is coming out of the power supply or off the motherboard, it is very likely that the power supply has gone awry and needs to be replaced. If the system fan has stopped turning, then you absolutely need to replace the power supply. You should also test the motherboard with a new power supply, and be on watch for parity errors, system lockups that are becoming more frequent, and disk read and peripheral input/output (I/O) errors. These are signs of damaged motherboard components beginning to fail.

Steps you should use any time you suspect the power supply to be the source of a PC problem include:

1. First, determine that the problem is not something as trivial as a blown fuse caused by a legitimate overload. Be sure to remove the source of the overload before beginning work.
2. Try to classify the problem by when it is occurring and what it is affecting. The categories you might use are:
   - BIOS, boot, or startup problem
   - An output power-related problem
   - Excessive noise, ripple, or other power conversion errors
   - Catastrophic failure that poses danger to the system or the operator (especially the technician)
3. Determine, based on the form factor, what the proper output voltages should be, and measure the output of the appropriate pins.

**POST Power Problems**

You may run into situations that require you to know the symptoms that indicate a power supply problem. A few of the leading symptoms that indicate an ailing power supply are:

- The power light on the front panel is off.

- The power supply fan isn't operating.
- The computer sounds either a continuous beep or doesn't beep at all.
- The computer sounds a repeating short beep.
- The computer displays either a POST error in the 020 - 029 series **(Power_Good** signal error) or a parity error.

**UPS Characteristics**

- Characteristics you should keep in mind when choosing a UPS include:

- **Simple or interactive displays**—to give a warning near the end of its charge.

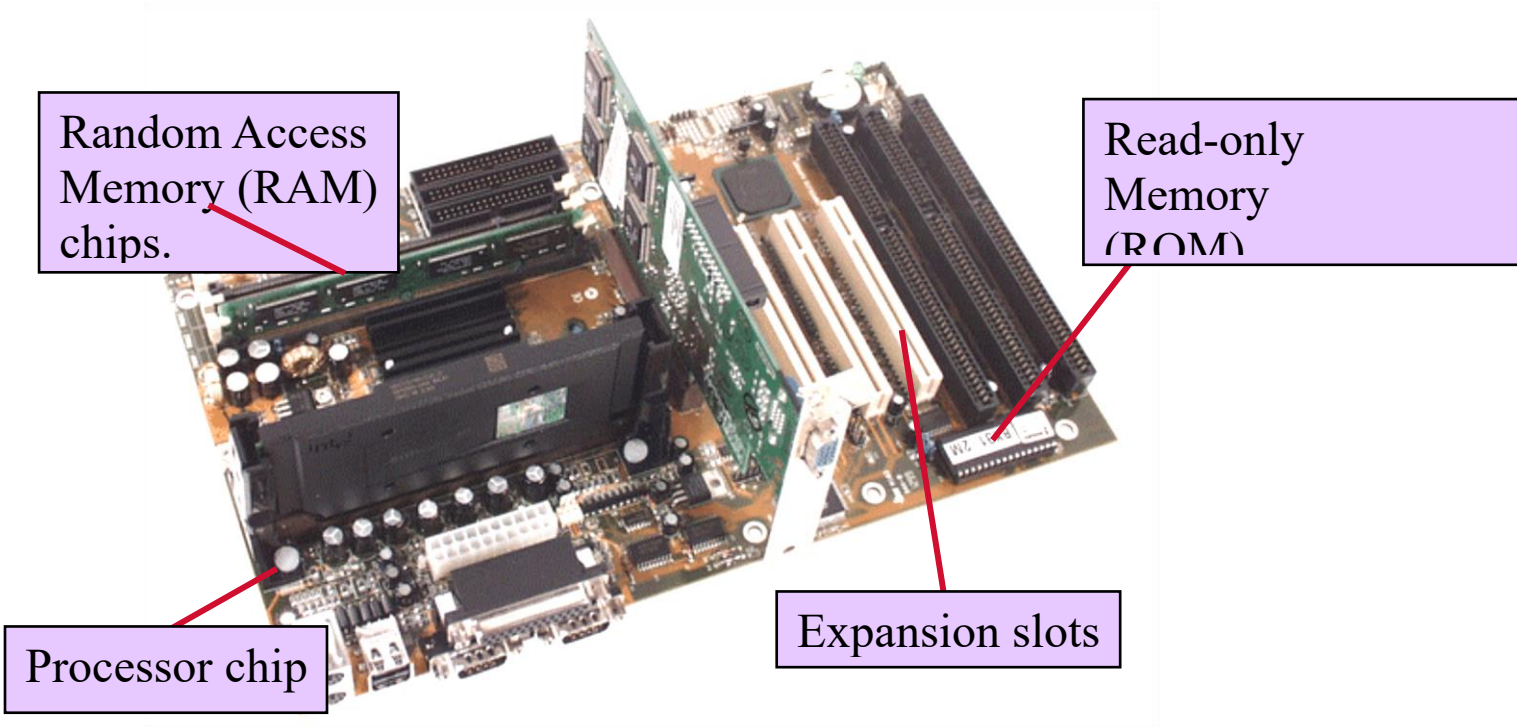
- **Warning mechanisms**—A UPS designed to support a single computer will generally have a serial "heartbeat" cable that is attached to a serial (Com) port on the PC. The UPS generates a regular signal that is monitored by a background process running on the PC. If the UPS fails to signal (i.e., misses too many heartbeats), the monitoring software (typically supplied by the UPS's manufacturer or it could be a part of the PC's operating system) tries to gracefully shut down the PC.
This is a very important feature for servers that cache a lot of data in memory instead of on a hard disk to speed data access times. In this case, should the power suddenly fail, all of the cached data would be lost if it could not be saved to disk before a shutdown or sync request

- ***Software interfaces***—The software monitor that interacts with the UPS in real time (see previous description of warning mechanisms) is typically supplied by the manufacturer of the UPS. At a minimum, these software programs monitor the heartbeat signal sent by the UPS to indicate that power is still available. Should the UPS stop sending the signal, the software begins the process of performing a system shutdown

- **Line conditioners and alarm systems**—A true line conditioner (also known as a power conditioner) filters the incoming power to isolate line noise and keep voltage levels normal. It isolates the input power source from the output power in a transformer stage. A line conditioner cannot protect against a power outage, but it can smooth out any intermittent under- and overvoltage events (surges and spikes, respectively) that occur on the input source.

# Chapter 3

# MOTHERBOARD/SYSTEM BOARD/PLANAR




The motherboard is a large printed circuit board that is home to many of the most essential parts of the computer:

- Microprocessor
- Chipset
- Memory sockets and RAM (random access memory) modules
- Cache memory
- IDE (integrated drive electronics), EIDE (Enhanced IDE.
- Expansion bus
- Parallel and serial ports
- Mouse and keyboard connectors

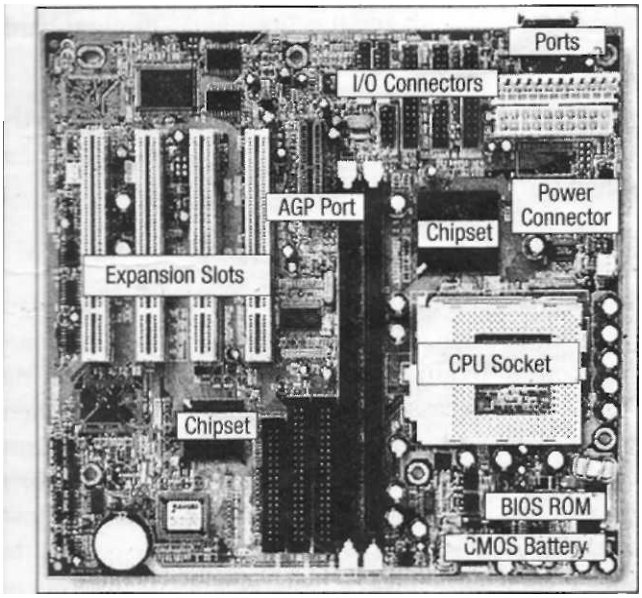
The *mainboard* or *system board*, of the computer is the glue that binds all PC's components together.

**Motherboard Designs**
There are two design approaches for mainboards in a PC: the true motherboard design and the backplane design.

Figure 1.1 identifies each of the following major parts of the motherboard:

1. Ports
2. Expansion slots

3. AGP (accelerated graphics port) slot
4. CPU (central processing unit) slot and socket
5. Chipset
6. Power connector




7. Memory sockets
8. I/O connectors
9. CMOS (complementary metal oxide semiconductor) battery
10. ROM BIOS

**Backplanes**

There are actually two types of *backplane* mainboards: passive and active- A *passive backplane* mainboard is only a receiver card with open slots into winch a processor card, which contains a CPU and its support chips, and I/O (input/output) cards, which provide bus and device interfaces, are plugged. These add-in cards are referred to as *daughterboards.* The backplane interconnects the system components through a bus and provides some basic data buffering services. The backplane design is popular with server type computers and is quickly upgraded or repaired. This design type provides the advantage of getting a server back online with only the replacement of a single slotted card, instead of replacing the whole mainboard.

An *active backplane* design, also called an intelligent backplane design, adds some CPU or controller-driven circuitry to the backplane board that can speed along the processing. The CPU itself is still on its own card, which provides for easy replacement.

**Motherboard Form factors**

| Style | Width (inches) | Length (inches) | Introduced | Location of adapter slots | Case type |
|---|---|---|---|---|---|
| IBM PC | 8.5 | 13 | 1981 | onboard | IBM PC |
| IBM PC XT | 8.5 | 13 | 1982 | onboard | IBM PC XT |
| AT | 12 | 11-13 | 1984 | onboard | AT Desktop or Tower |
| Baby AT | 8.5 | 10-13 | 1983 | onboard | Baby AT Desktop or Tower |
| LPX | 9 | 11-13 | 1987 | Riser | Low profile |
| Micro- AT | 8.5 | 8.5 | Early 90's | onboard | Baby AT Desktop or Tower |
| ATX | 12 | 9.6 | 1996 | onboard | ATX Desktop or tower |
| Mini-ATX | 11.2 | 8.2 | 1996 | onboard | Smaller ATX Desktops |
| Mini-LPX | 8-9 | 10-11 | 199x | Riser | Low profile |
| Micro-ATX | 9.6 | 9.6 | 1997 | onboard | Low profile |
| NLX | 8-9 | 10-13.6 | 1997 | Riser | Low profile |
| Flex-ATX | 9 | 7.5 | 1999 | onboard | Flexible design |

**AT and Baby AT**

The IBM PC XT had a motherboard that measured 8.5 inches wide by 13 inches deep, which was the same size as the earlier IBM PC motherboard. However, the XT increased the number of adapter card slots from 5 to 8, and the cassette tape interface port was replaced by the 5.25-inch floppy drive that would become the standard for storing and transferring information between computers.

**LPX and Mini-LPX**

Originally created by Western Digital as a way to build slim line cases, the LPX and Mini-LPX form factors have been copied by many other companies resulting in many variations on the originals.

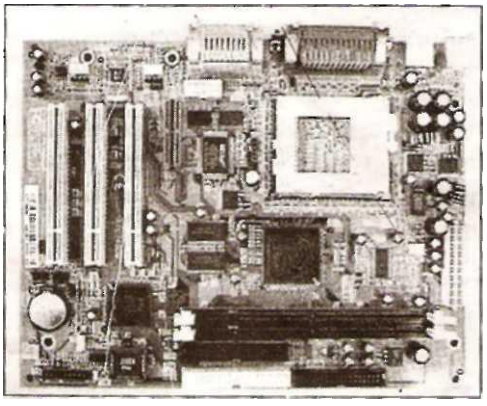


Figure 1.3 Micro-AT System

Actually, the LPX and mini-LPX specifications are more of a general motherboard category than a specific form factor.

**ATX and Mini-ATX Form Factors**

The ATX form factor was developed and released by Intel in 1995 with the goal of "improving the end-user experience," as well as that of the manufacturers. The ATX form is an improvement over the form factors that preceded it because it is a published and continuously maintained standard. This guarantees compatibility among all ATX system cases, system boards, and power supplies.

The ATX form factor is based on the Baby AT board size, but it involves more than just a compatible board size and mounting specification. Intel started over with ATX, rotating the board 90 degrees and incorporating new mounting locations and power supply connections. All I/O connections are located on the back of the board in a two-row block that is able to fit many configurations with bezels.

The ATX specification also defines the mini-ATX sub specification, which has a board size of 11.2 inches by 8.2 inches. Other sub specifications of the ATX fit factor you may encounter are the Micro-ATX and the Flex-ATX.

**NLX Form Factor**

NLX is a new, standardized, low-profile motherboard form factor. It is designed to support a number of current and emerging microprocessor technologies along with many newer developments, including support for AGP video adapters, and tall memory modules and DIMMs. The NLX form provides more flexibility for the system-level design and for easy removal and replacement of the motherboard, allegedly without tools. The NLX motherboard measures about 8 inches by 1 inches and uses a plug-in riser board for its expansion bus support. The riser board attaches to the edge of the mainboard.

## Selecting a Motherboard

- **Three types of motherboards you can select:**
  - A board providing the most room for expansion
  - A board suiting the computer's current configuration
  - A board falling in between current and future needs
- **Some questions to ask when picking a motherboard**
  - What form factor does the motherboard use?
  - Does the motherboard provide proper CPU support?
  - What type of BIOS does the motherboard use?
  - Does the board fit the case you plan to use?
  - What is the warranty on the board?
- **Embedded (on-board) component**
  - Component located on the board
  - Avoid board with too many embedded components

- Such boards do not easily accept add-on devices

**Replacing a Motherboard**

- **Overview of the replacement process**

1. Verify that you have selected the right motherboard
2. Determine the power configuration settings
3. Remove components to reach the old motherboard
4. Set any jumpers or switches on the motherboard
5. Install the processor and processor cooler
6. Install RAM into appropriate slots on motherboard
7. Install the motherboard
8. Attach cabling (case switches, power supply, drives)
9. Install the video card on the motherboard

**Installing the Motherboard in the Case**

- **Overview of the eight general steps:**

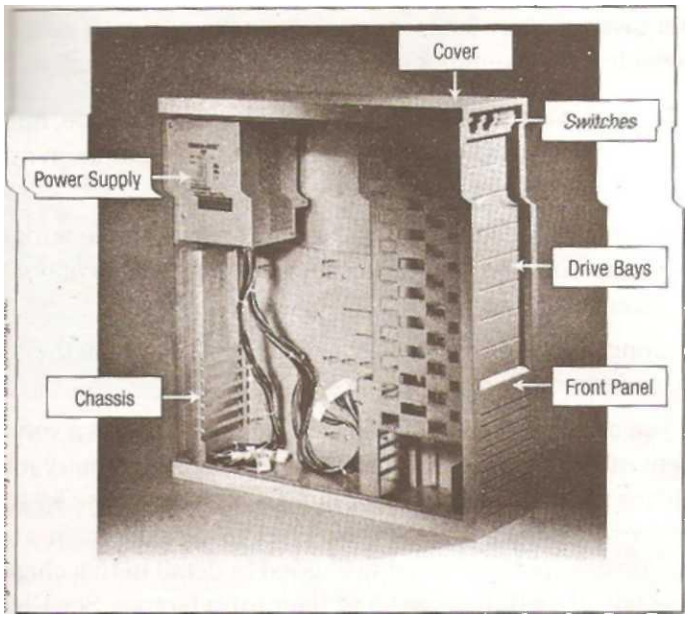
1. Install the faceplate (I/O shield)
2. Install the standoffs (spacers)
3. Secure the motherboard in the case
4. Connect the power cord to the PI power connection
5. Connect 4-pin auxiliary power cord to motherboard
6. Connect the wire leads from front panel of case
7. Refer to manual to verify wire to pin connection
8. Connect USB connection (if present) to USB ports

# Computer cases / system case

*The system case comprises six major components namely:*

- Chassis
- Cover
- Power supply
- Front panel
- Switches
- Drive bays

Although it is not actually a physical component in the hardware sense, the case's form factor is very important. It describes the shape and size of the case and the way the case components fit together.




PC cases come in all sorts of sizes, shapes, colors, and even animals. The variances in size and shape are driven primarily by the form factor of the case, but increasingly, case designers are adding color, new plastic and metal materials, and even character faces to case designs in an attempt to make them less boring and more appealing to a wider audience.

The most common system components found inside the PC's case are:

- *Chassis*—The chassis is the skeletal framework that provides the structure, rigidity, and strength of the case and plays a major role in the cooling system of the case.
- *Cover*—The cover, along with the chassis, plays an important role in the cooling, protection, and structure of the PC.
- *Power supply*—to rectify (which means to convert) AC power into DC power for use by the PC'slnternal electronics. However, it also houses and powers the main system cooling fan.
- *Front panel*—In addition to giving the PC its looks and providing placement of the power and reset switches, the front panel provides the user with information on the PC's status and a means of physically securing the PC.
- *Switches*—The two main switches on most newer systems, the power switch and the reset button, are on the front panel. If the power switch is not on the front panel, it is very likely either on the right-rear corner or near a corner on the back of the PC.
- *Drive bays*—Beginning with the PC XT, disk drives with removable media have been mounted in the case so that they can be accessed on the front panel. Typically, the drive bays house 5.25-inch and 3.5-inch disk drives, such as for floppy disks, CD-ROMs (compact disk-read only memory) and DVDs (digital versatile disks), and removable hard drives.

**Types of cases**

*Toolless Cases*

Many name-brand PCs feature a case that has one or two large knobby screws on the back panel of the case. This case design is called "toolless" because you should be able to remove and replace the screws with your fingers

without the need for screwdriver or other tools. The cover pieces are held firmly in place by spring lips that apply pressure to chassis points.

*Screwless Cases*

Screwless case covers have several individual cover pieces, generally one piece to a side. The key to removing this type of case cover is to remove the locking panel, which is usually the front panel, to unlock the remaining panels of the case. The front panel is attached by a spring clip. Pull up and lift off one or more

*Release-Button Cases*

On release-button cases, which are common on Compaq desktop models, the case is removed by pressing springed release buttons located on the front or rear of the PC. When you press the release buttons, the cover, which includes the front, rear, top, and sides, lifts straight off the case.

*Front-Screw Cases*

On front-screw cases, the screws that hold the cover on the PC are located on the front panel, usually hidden behind sliding tabs or a snap-on panel. Remove the screws (and possibly some on the rear panel as well) and pull the case forward and off.

## System Case Form Factors

As mentioned previously, the *form factor* of a PC case defines its style, size, shape, internal organization, and its compatible components.

The three most popular types of case form factors are the Baby AT, ATX, and NLX

- *Baby AT*—Although virtually obsolete by today's standards, the Baby AT fom factor still has a very large installed base from its popularity in past years.
- *ATX*—The ATX form factor is the *de facto* standard for motherboards, power supplies, and system cases. Virtually all Pentium-based systems use the ATX form factor.
- *NLX*—The NLX form factor, which is also called the slimline form factor, is popular for mass-produced desktop systems.

Some of the other form factors that have been used or are still in use for system cases include:

- *PC XT*—This form factor was used on the original desktop PCs, the IBM PC and its successor, the PC XT. The case was made of heavy-gauge steel and was U-shaped.
- *AT*—The IBM PC AT, although not much different on the outside from its predecessors, was quite different on the inside. The motherboard and power supply, which were much larger, were repositioned inside the case.
- *LPX*—Although never officially accepted as a standard form factor, the LPX the oldest of the "low profile" form factors. Over the past 10 years, it has been one of the most popular slimline form factors sold. Slimline cases are a little shorter than Baby AT or ATX cases. This lower profile is achieved by moving expansion cards to a riser board that mounts horizontally instead of vertical in the case, thereby saving inches of height.
- *MicroATX* and *FlexATX*—These two ATX-based form factors define specific tions for smaller versions of the ATX motherboard. MicroATX and FlexATX do not define case form factors, but manufacturers are designing cases to

# CHAPTER 4

# MICROPROCESSORS

## Objectives

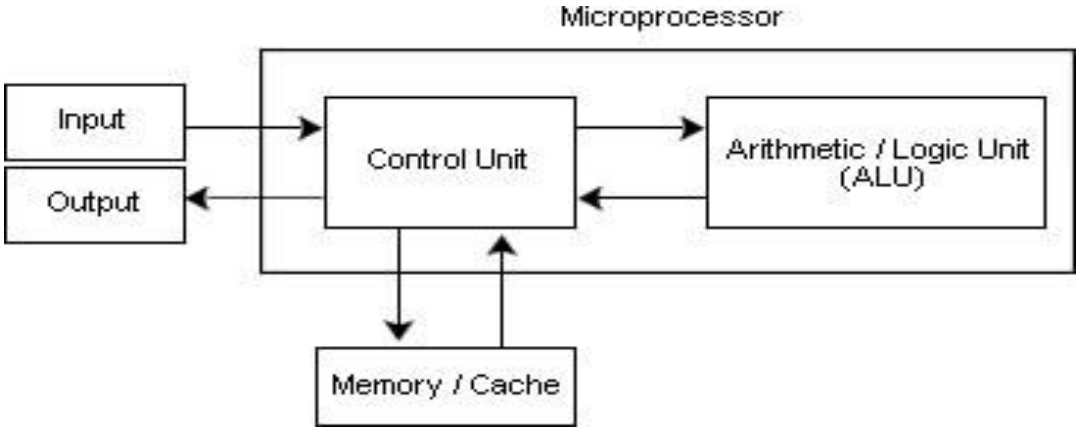
- Discuss the working of microprocessor
- Discuss the various interfaces of microprocessor
- List the types of microprocessors
- Discuss the evolution of microprocessors
- List the various microprocessor designs
- Install the microprocessor
- Configure the microprocessor
- Upgrade the microprocessor
- Troubleshoot the microprocessor

**Microprocessor**

- Is a chip
- Has transistors built into it
- Has cache to store information

**Working of the Microprocessor**

- Accepts data
- Processes data
- Stores data
- Sends output data




**Parts of microprocessor**

- Arithmetic and Logic Unit -Performs all arithmetic and logical operations
- Control Unit - It supervises/ monitors all the operations carried out in the computer
- Prefetch Unit
- Bus Unit
- Decode Unit
- Data and instruction cache
- Registers - Holds the data temporarily for processing

**Interface of Microprocessor**

- Steps followed by the microprocessor to interface with a device:
    - Checks the status of the device.
    - Requests the device for transferring data.
    - The device sends the data request to the microprocessor.
    - The microprocessor sends the required data to the device.

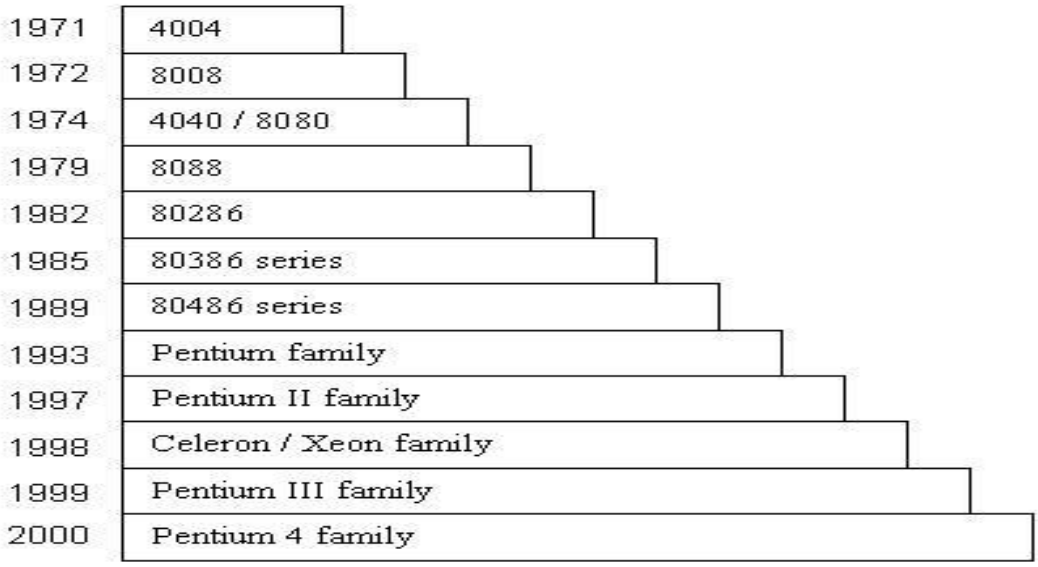
**Packaging of microprocessor**

- Types of microprocessor packaging:
    - Pin Grid Array (PGA)
    - Staggered Pin Grid Array (SPGA)
    - Single edge contact (SEC) and single edge processor packaging (SEPP)

**Types of microprocessor**

- Based on the number of instructions built into it, they can be classified as:
    - Complex Instruction Set Computing (CISC) – Many instructions built into it
    - Reduced Instruction Set Computing (RISC) – Instructions built into the microprocessor

**Microprocessors Timeline**




**Intel Pentium Microprocessor**

- Designed to work with everyday applications
    - Word processors
    - Spreadsheets
    - Multimedia applications
    - Games
- Versions
    - Pentium I
    - Pentium II
    - Pentium III
    - Pentium IV

**Pentium I**

- Released in 1993
- First chip from the fifth generation of microprocessors
- Has a 5-stage data pipeline for executing instructions

**Pentium II**

- Released in 1997
- Available on a daughter card that has L2 cache
- Has a 14-stage data pipeline for executing instructions

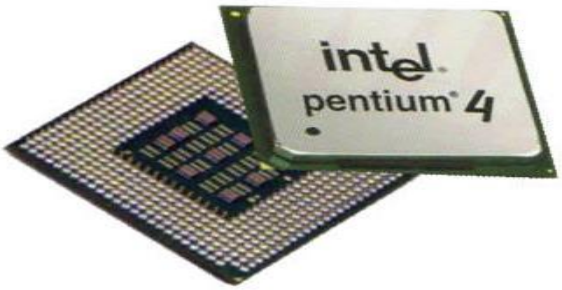
**Pentium III**

- Released in 1999
- Has a unique Processor Serial Number (PSN) embedded in the chip

- Has a 10-stage data pipeline for executing instructions

**Pentium IV**

- Released in 2000
- Enables to work with applications that require a lot of processing
- Has a 20-stage data pipeline for executing instructions
- Available in the following editions:
    - Hyper-Threading (HT)
    - HT Extreme




**Intel Centrino Mobile Technology**

- Released in the year 2003
- Uses the SSE instruction set
- The components that constitute this technology are:
    - Intel Pentium M Processor
    - Intel 855 chipset family
    - Intel PRO/Wireless 2100 Network connection

**Intel Pentium M**

- Small in size
- Consumes less energy and prolong the battery life
- Used in
    - Laptops
    - notebook computers

**Intel Celeron**

- Cheaper and economical
- Used for running applications that do not require a lot of processing


**Intel Xeon**

- Heavy-duty microprocessors
- Used to power servers and workstations on a network
- Supports multiprocessors

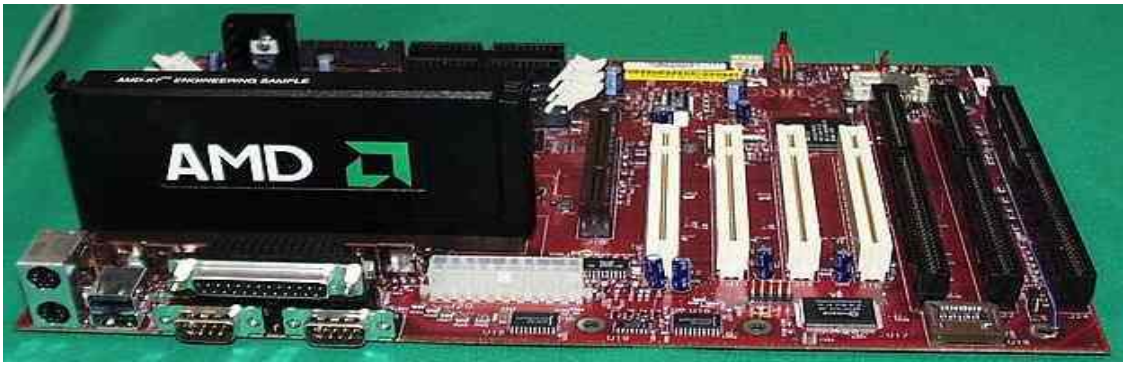

**Intel Itanium**

- Used to power network servers and workstations
- Can execute three instructions at a time
- Is a Reduced Instruction Set Computing (RISC) based microprocessor and has limited instructions built into the microprocessor


**Advanced Micro Devices (AMD)**

- Created in the year 1969
- Developed
    - Duron
    - Athlon

- Uses Slot A to connect the AMD microprocessor to the motherboard




**Microprocessor Design**

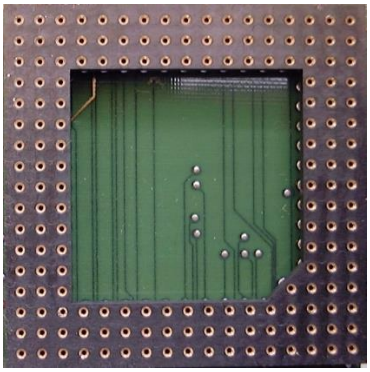
- Specifies the type of the microprocessor that can be installed on the motherboard
- Uses the
    - Socket
    - Slot

**Microprocessor Socket**

- Connects the microprocessor to the motherboard
- Available as
    - Zero Insertion Force (ZIF) uses a lever to install the microprocessor
    - Low Insertion Force (LIF) requires little force to install the microprocessor

**Socket 1**

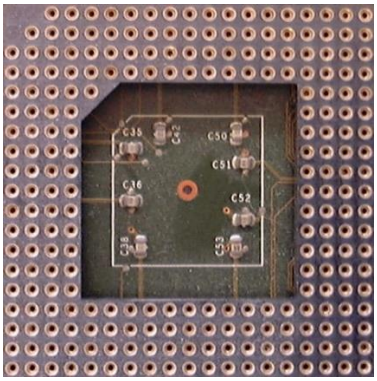
- 169 pins arranged in three rows
- Supplies maximum 5 volts to the microprocessor
- Supports the 80486 and 80486 Overdrive microprocessor



**Socket 2**

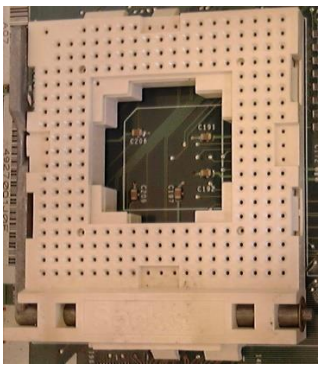
- 238 pins arranged in four rows
- Supplies maximum 5 volts to the microprocessor

- Supports the 80486 OverDrive and Pentium OverDrive microprocessors



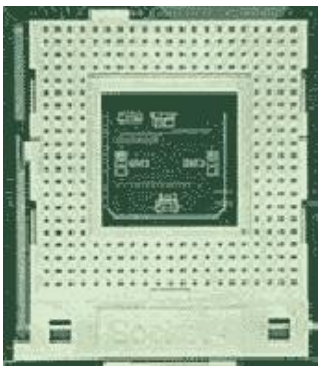
**Socket 3**

- 237 pins arranged in four rows
- Supplies 3.3 to 5 volts to the microprocessor
- Voltage can be adjusted using the jumpers on the motherboard
- Supports the 80486, AMD, Cyrix and Pentium OverDrive microprocessors



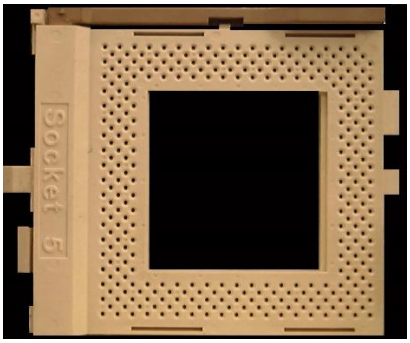
**Socket 4**

- 273 pins arranged in four rows
- Supplies maximum 5 volts to the microprocessor
- Supports the Pentium  and Pentium Overdrive microprocessors



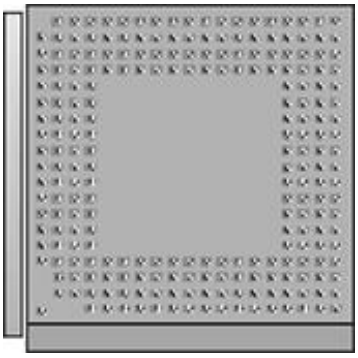
**Socket 5**

- 320 pins arranged in five rows
- Supplies maximum 3.3 volts to the microprocessor
- Supports the Pentium, Pentium with MMX and Pentium OverDrive microprocessors



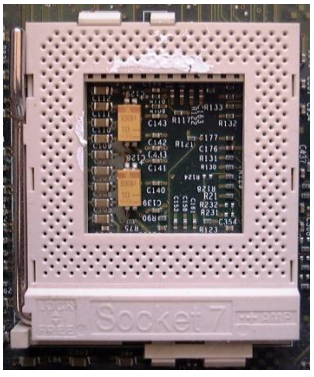

**Socket 6**

- 235 pins arranged in four rows
- Supplies maximum 3.3 volts to the microprocessor



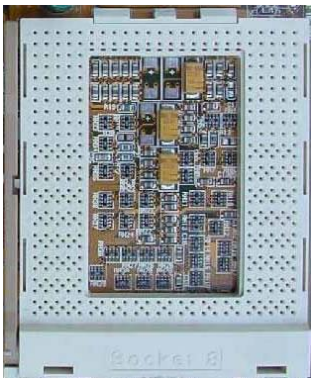
**Socket 7**

- 321 pins in five rows
- supplies 2.5 to 3.3 volts to the microprocessor
- This socket supports the Pentium, Pentium with MMX and Pentium OverDrive microprocessors



**Socket 8**

- 387 pins arranged in five rows
- Supplies 3.1 to 3.3 volts to the microprocessor
- Supports the Pentium Pro microprocessors



**Socket 370**

- 370 pins arranged in six rows
- Has L2 cache built into the microprocessor
- Supports Celeron 2 and Pentium III microprocessors


**Socket 462**

- Known as Socket A
- Has 462 pins but 9 pins are blocked
- Has the L2 cache built into the microprocessor
- Supports the Athlon and Duron microprocessors


**Socket 478**

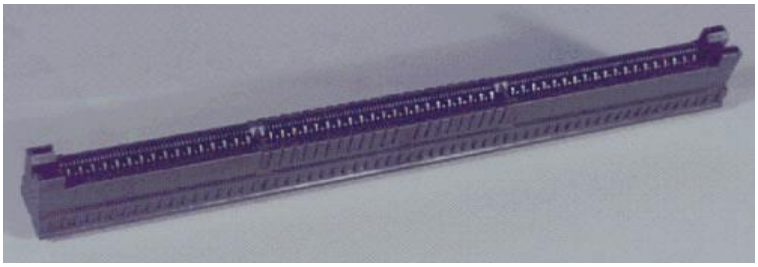
- 478 pins
- Has the L2 cache built into the microprocessor
- Supports the Intel Pentium 4 microprocessor

**Slot 1**

- Supports microprocessors that have 242 pins
- Microprocessor is mounted on a card that uses Socket 8
- Supplies 2.8 to 3.3 volts to the microprocessor
- Supports the Pentium II, III, and Celeron microprocessors

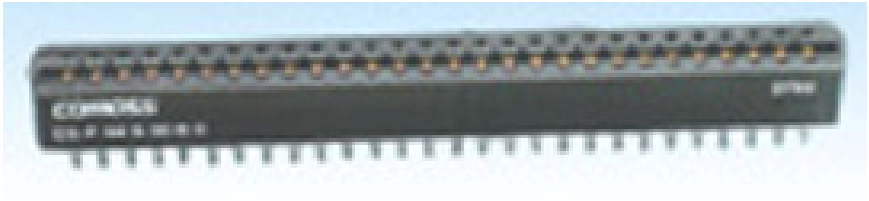
**Slot 2**

- Supports microprocessors that have 330 pins
- Supports the Pentium Xeon microprocessors
- Found on server motherboards



**Slot A**

- Created by AMD
- Supports the Athlon microprocessors
- Uses the EV6 protocol for increased speed



**Install Microprocessor in ZIF socket - I**

1. Check voltage requirements
2. Wear an anti-static wristband
3. Place motherboard on work desk
4. Take microprocessor out from anti-static bag
5. Check that all pins on underside of microprocessor are straight

**Install Microprocessor in ZIF socket – II**

6. Locate socket where microprocessor must be installed
7. Find lever located besides the socket for microprocessor
8. Raise lever so that it is at right angle with motherboard
9. Align notch on microprocessor with alignment notch on motherboard socket
10. Gently, place microprocessor in the socket
11. Push lever back down such that it is parallel to motherboard and locked in place

**Configuring the Microprocessor**

- Possible by adjusting the jumpers or by changing the system BIOS
- Overclocking the microprocessor to perform faster

**Upgrading the Microprocessor**

- Improves the speed and performance of the system and to keep the system up to date

- To upgrade
    - Replace old microprocessor with new and better microprocessor
    - Replace old processor card on the slot with a new card

**Troubleshooting the Microprocessor**

- Troubleshooting microprocessor techniques solve the problems that arise due to the improper functioning of the microprocessor.
- General problems are:
    - ✓ Overheating
    - ✓ Slow Processing or Hanging Issues
    - ✓ No display

**Summary - I**

- The microprocessor is the heart of the system.
- Microprocessors process the data using instructions.
- CISC microprocessors have many instructions built into the microprocessor.
- RISC microprocessors have limited instructions built into the microprocessor.
- The speed of the microprocessor depends on various factors, such as the number of instructions it processes, the bandwidth and the clock speed.
- Transistors in the microprocessor boost the data signals on the processor.
- Intel Pentium microprocessors are designed to work with everyday applications such as word processors, spreadsheets, multimedia applications, and games.

**Summary – II**

- Intel Pentium M microprocessors are used for laptops and notebook computers.
- Intel Celeron microprocessors are cheaper and more economical than the Pentium microprocessors.
- Intel Celeron microprocessors have a smaller cache size than the Pentium microprocessors.
- Intel Xeon microprocessors power servers and workstations on a network.
- Intel Itanium is an RISC microprocessor that powers network servers and workstations.
- AMD Duron and Athlon are economical microprocessors.
- The socket on the motherboard connects the microprocessor to the motherboard.

**Summary - III**

- The microprocessors available on cards use motherboards that have a slot to install the microprocessor.
- The different parts of the microprocessor work together to process the data and give the user valuable information.

- Data and information flows from the microprocessor to the different devices connected to the system using the bus.
- Configuring the microprocessor is possible by adjusting jumpers on the motherboard or using the system BIOS.
- Overclocking the microprocessor increases the speed of the processor.
- To upgrade a microprocessor, we replace the microprocessor in the system with a new and better microprocessor.
- By troubleshooting, we can solve the microprocessor problems like overheating and slow processing.

# Chapter 5

# MEMORY

Refers to electronic components of the PC that store data and instructions either temporarily or in various degrees of permanently.

Technically memory is the storage device on the computer, including the hard disk, floppy disks, ROM, RAM and cache. However in its more common usage, memory is the part of the computer's hardware that is used to hold data and instructions before and after they are passed to the CPU for analysis and execution.

## Types of main memory

There are two types of main memory, **Random Access Memory (RAM)** and **Read Only Memory (ROM)**


**Random Access Memory (RAM)**

- ✓ holds its data as long as the computer is switched on
- ✓ All data in RAM is lost when the computer is switched off
- ✓ Described as being volatile
- ✓ It is direct access as it can be both written to or read from in any order
- ✓ Its purpose is to temporarily hold programs and data for processing. In modern computers it also holds the operating system.

**Read only Memory ( ROM)**

- ✓ ROM (Read Only Memory) is used to store the instructions provided by the
- ✓ manufacturer, which holds the instructions to check basic hardware interconnecter and
- ✓ to load operating system from appropriate storage device

**TYPES OF RAM**

1. **Dynamic Random Access Memory** (DRAM)

- Contents are constantly refreshed 1000 times per second
- Access time 60 – 70 nanoseconds

**Note**: a **nanosecond** is one **billionth** of a second!

2. **Synchronous Dynamic Random Access Memory** (SDRAM)

- Quicker than DRAM
- Access time less than 60 nanoseconds

**3. Direct Ram bus Dynamic Random Access Memory (DRDRAM)**

- New type of RAM architecture
- Access time 20 times faster than DRAM
- More expensive

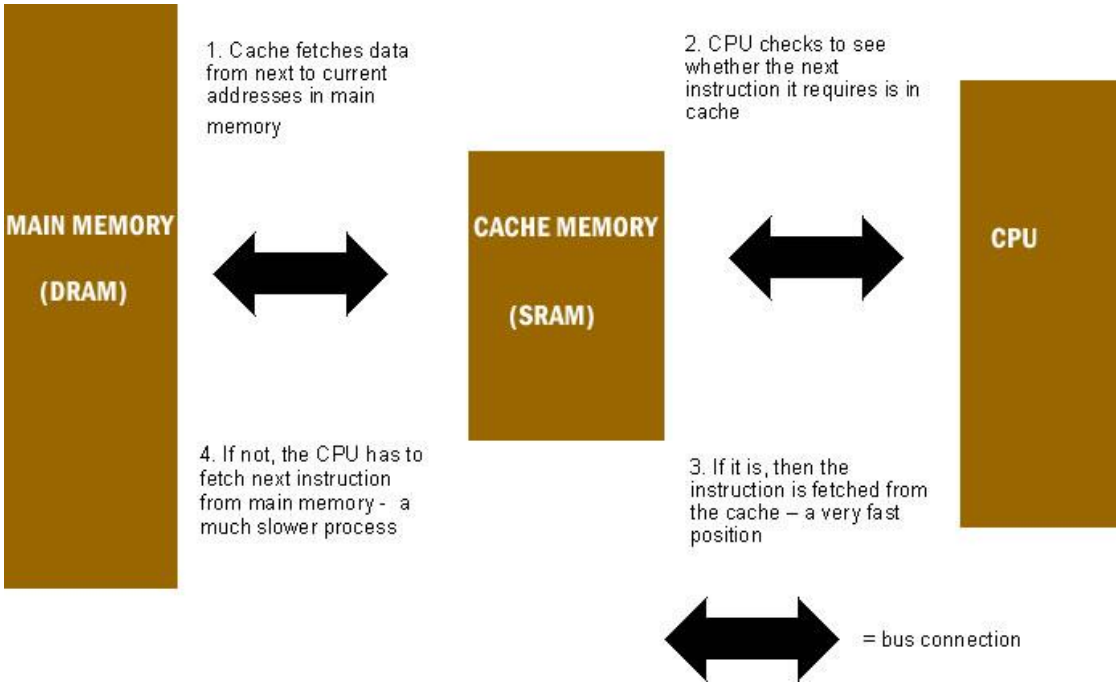
**4. Static Random Access Memory** (SRAM)

- Doesn’t need refreshing
- Retains contents as long as power applied to the chip
- Access time around 10 nanoseconds
- Used for **cache** memory
- Also for **date and time** settings as powered by small battery

**5. Cache memory**

- Small amount of memory typically 256 or 512 kilobytes
- Temporary store for often used instructions
- **Level 1** cache is built within the CPU (internal)
- **Level 2** cache may be on chip or nearby (external)
- Faster for CPU to access than main memory

**The operation of Cache memory**




**6. Video Random Access Memory**

- Holds data to be displayed on computer screen
- Has two data paths allowing READ and WRITE to occur at the same time
- A system's amount of VRAM relates to the no. of colors and resolution

**7.Virtual Memory.**

- Uses backing storage e.g. harddisk as a temporary location for programs and data where insufficient RAM available.
- Swaps programs and data between the hard-disk and RAM as the CPU requires them for processing
- Virtual memory is much slower than RAM

**Types of Rom**

- **PROM** ( programmable Read Only Memory) –type of ROM that can be written to by the user. Data is held permanently once it is written.
- **EPROM** – (Erasable programmable Read Only Memory) – can be programmed by the user but it can be erased. Its removed from the computer to be erased by use of EPROM erasers.
- **EAPROM** (Electrically Alterable Programmable Read Only Memory) – it can be read, erased and deleted. It is erased without removing it from the computer . however the erasing and writing is very slow which limits the use of these memory.
- **EEPROM** (Electrically erasable Programmable Read Only Memory) – similar to EAPROM

**Memory configurations**

- The elementary unit of memory is a bit. A group of 4 bits is called a nibble and a group of 8 bits is called a byte. One byte is the minimum space required to store one character.

Other units of memory are:

- 1 KB (Kilo Byte) = 210 bytes = 1024 bytes
- 1 MB (Mega Byte) = 210 KB = 1024 KB
- 1 GB (Giga Byte) = 210 MB = 1024 MB
- 1 TB (Tera Byte) = 210 GB = 1024 GB
- 1 PB (Peta Byte) = 210 TB = 1024 TB

# CHAPTER 6:

# DISKS AND DRIVES

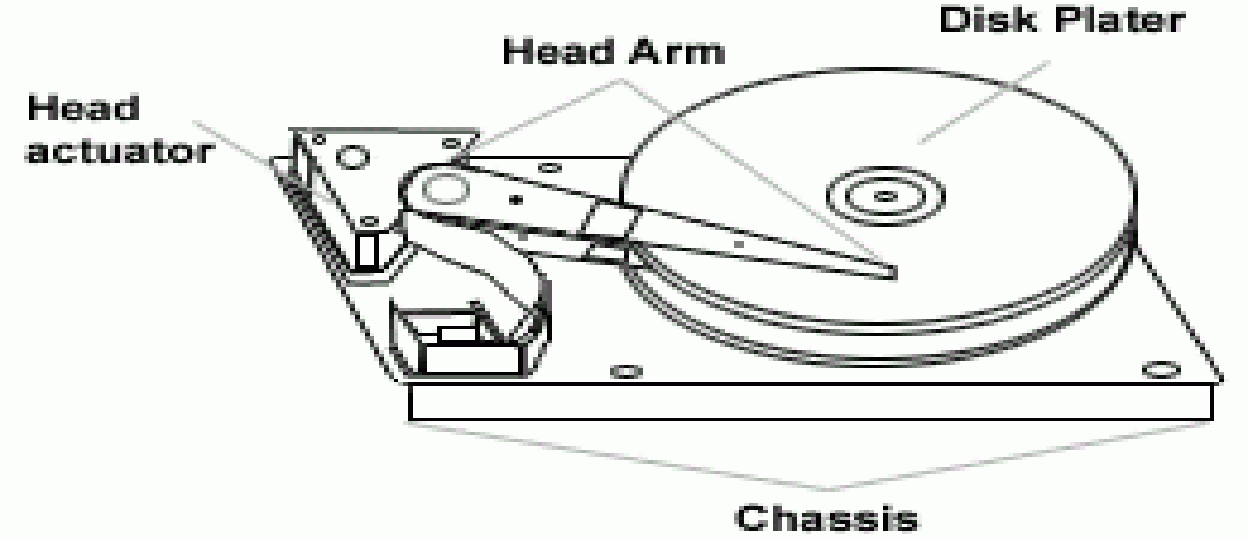
- It is a  data storage device in a computer.
- It is a secondary storage device.
- Its stored in  0 (or) 1.
- The operating system, software  and most other files are stored in the HDD.
- Its invented in 1954 by ibm.

Nowaday,HDD with3.5 inch or 5.25 inch platters in different capacities, such as 10GB,20GB,40GB,80GB etc.


Main components for Hard disk drive

- Disk platter

- Stepper motor
- Spindle motor
- Read and write head
- Arm




DISK PLATTER

The platter is made up of a magnetic material, in the flat disk part of the drive.

Data is stored in the platter.

Each set of magnetic particles is collection a unit called a bit.

New hard-drive technology uses thin-film metals and glass platters to increase efficiency and drive storage capacity.

STEPPER MOTOR

1. Use stepper motors for controlling read/write head position.
2. Stepper motors usually use +12V power, but some new low-power drives use +5V power source.

SPINDLE MOTOR

1. It controls the platter.
2. It's motor rotates at a speed of 3600 to 10,000 r.p.m.
3. All the platter moves in the same direction

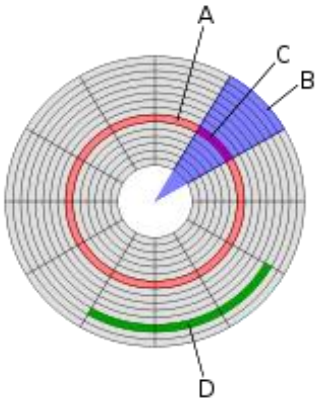
READ AND WRITE HEAD

1. The heads read and write the information to the drive platter.
2. The head writes magnetic information on the platter

HEAD ARM

1. Used for read and write operations.

Disk structures




(A) **Track** - The HDD is divided into number of concentric circles called tracks. Circular path in sector is called track.
(B) **Sector** -Data storage area in one track multiple divided into the multiple block is called sector. Each sector can have 512 bytes of the data.
(C) **Cylinder** - A set of corresponding tracks in all sides of a hard disk is called cylinder
(D) **Storage capacity** Its having a fourmula shown below:

storage capacity=number of cylinder's*tracks per cylinder*sector per tracks*bytes per sector.

Partition for HDD

*1.Primary Partition:*

- Windows operating systems must be located in a primary partition.
- Only primary partitions can be used to boot the operating system.

*2.Extended Partition:*

- A hard disk may contain only one extended partition.
- the extended partition can be subdivided into multiple *logical partitions* (Other than OS is a Extended Partition).

*3.Logical Partition:*

- Linux operating systems can be installed into (and run from) logical partitions.

*4.Active Partition*:

- Only one partition on a computer can be set as an **active partition** or **bootable partition**.
- For example, if you are using Microsoft Windows the partition that contains Windows is the active partition.

***File system in HDD***

1. FAT (File Allocation Table)
2. NTFS (New Technology File System)

| **FAT File systems** | **NTFS File system** |
|---|---|
| *Its not a security* | secure |
| *Partition size is max 32GB* | *Partition size is 1 (Tera Bytes)* |
| *Does not support data compression* | It supports *data compression* |
| *Does not support disk quota* | *Its support disk quota* |
| *Window os conformability (95,98.ms-dos)* | Window os conformability ( 2000,xp ,vista,win 7 ) |

*HDD Capacity and Size Information*

When purchasing a hard disk drive, the term megabytes, gigabytes or terabytes may be confusing terms. The following table gives you an example of each of these terms and how they compare to other sizes.

| **Term** | **Equal to** |
|---|---|
| Bit | 0 or 1 |
| Kb(Kilobit) | 1,024 bits |
| Byte | 8 bits (approximately one character in a Word document) |
| KB(Kilobyte) | 1,024 bytes |
| MB(Megabyte) | 1,024 Kilobytes or 1,048,576 Bytes |
| GB(Gigabyte) | 1,024 Megabytes or 1,073,741, 824 Bytes |
| TB(Terabyte) | 1,024 Gigabytes or 1,099,511,627,776 Bytes |
| PB(Petabyte) | 1,024 Terabytes or about 1,000,000,000,000,000 Bytes |
| EB(Exabyte) | 1,024 Petabytes or about 1,000,000,000,000,000,000 Bytes |
| ZB(Zetabyte) | 1,024 Exabytes or about 1,000,000,000,000,000,000,000 Bytes |
| YB(Yottabyte) | 1,024 Zetabytes or about 1,000,000,000,000,000,000,000,000 Bytes |

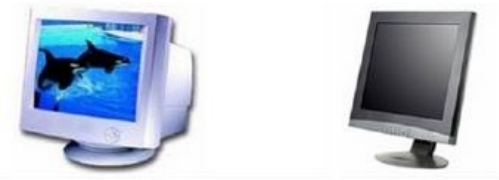
***Note:*** *Example: 1 GB = 1,024 MB but for easy calculations, normally we just say 1 GB = 1,000 MB by ignoring 24 MB size. Also, 1 MB = 1,000 KB, etc.*

# CHAPTER 7:

# DISPLAY TECHNOLOGY

Most desktop displays use liquid crystal display (LCD) or cathode ray tube (CRT) technology. Nearly all portable computable devices such as laptops use LCD technology due to their slimmer design and lower consumption. Monitors using LCD technology (also called flat panel or flat screen displays) are replacing the CRT on most desktops.

MONITOR



*CRT Monitor* *LCD Monitor*

The most frequently used output device is the monitor. Also known as display screens or simply as screens, monitors present visual images of text and graphics .The output from monitor is often referred to as soft copy. Monitors vary in size, shape, and cost.

FEATURES

The most important characteristic of a monitor is its clarity. Clarity refers to as the quality and sharpness of the displayed images. It is a function of several monitor features including;

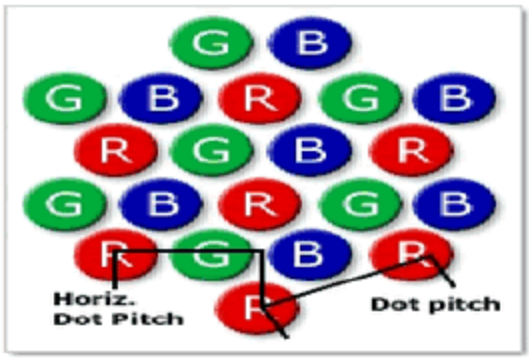
1. Resolution
2. Dot pitch
3. Refresh rate
4. Size

RESOLUTION

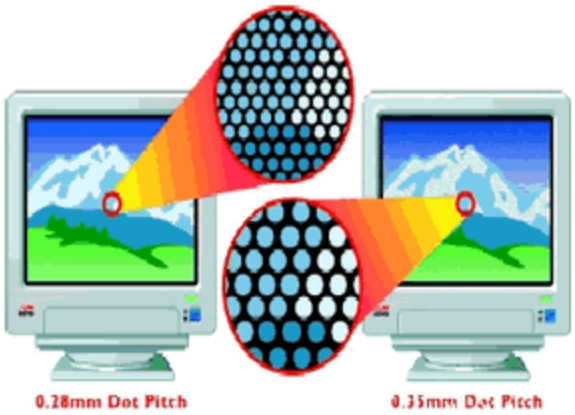
Resolution is one of the most important features .Images are formed on a monitor by a series of dots or pixel. Resolution is expressed as a matrix of these dots or pixels. For example, many monitors today have a resolution of 1,280 pixel columns by 1,024 pixel rows for a total of 1,310,720 pixels. The higher a monitors resolution (the more pixels) the greater the clarity of image produced.

DOT PITCH

Dot pitch is the term used to define the diagonal distance between the two closest dots of the same color, usually expressed in hundredths of millimeters as shown in the figure below. For example, you might see 0.25 dots pitch. Generally speaking, the smaller the pitch, the greater the number. The lower the dot pitch (the shorter the distance between pixels), the higher the clarity of images produced.




Colour Dots and Dot Pitch




Dot Pitch of a Monitor (Closer the Dots, Sharper the Image)

REFRESH RATE

This indicates how often a displayed image is update or redrawn on the monitor .Most monitors operate at a rate of 75 hertz which means that the monitor is redrawn 75 times each second. Images displayed on monitors with refresh rates lower than 75 hertz appear to flicker and can cause eye strain. The faster the refresh rate (the more frequently images are redrawn), the better the quality of images displayed.

SCREEN SIZE

Screen size or viewable size is measured by the diagonal length of a monitor's viewing area. Common sizes are 15,17 19 and 21 inches .The smaller the monitor the better quality of images displayed.

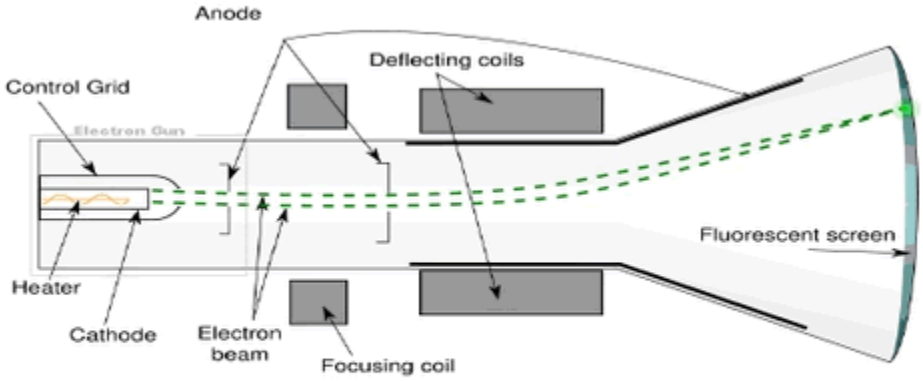

CATHODE RAY TUBE (CRT)

The most common type of monitor for the office and home is the cathode –ray - tube (CRT).These monitors are typically placed directly on the system unit or on the desktop.

CRT's are similar in size and technology to televisions. Compared to other types of monitors, their primary advantages are low cost and excellent resolution. Their primary disadvantage is that they are bulky and occupy a considerable amount of space on the desktop.

CRT Monitor

- The CRT is the main component of a traditional monitor. The rear of the CRT holds a cylinder that contains one or more **electron guns** as shown below.
- Most **color monitors** have **three guns** in back – one for each of the colors **red, green** and **blue.** This combination usually refereed as **RGB** allows the visual production of all colors.




**Internal Architecture of a CRT Monitor**

The wide end of the CRT is the display screen which has a phosphor coating (a substance that can emit light when hit with radiation) called fluorescent screen. When active, the guns beam a stream of charged electrons onto the fluorescent screen. When the phosphor coating is hit with the right amount of energy, light is produced in a pattern of very small dots. This same technology is used in x-ray imaging oscilloscope and other CRT devices .Similarly monitors emit x-radiation .There is one dot for each primary color (RGB), and the dots are grouped in patterns close together .The name for a collection of all dots in specific location is a pixel (which stands for picture elements).

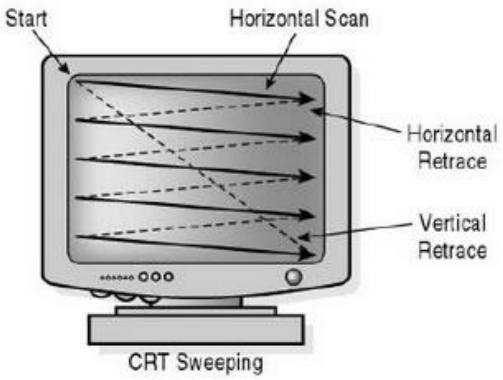
***Note***

The terms anode and cathode are used in electronics as synonyms for positive and negative terminals. For example, you could refer to the positive terminal of a battery as the anode and the negative terminal as the cathode. In monitor, since image is formed by electron beam (negative charge) so it's called as a cathode ray tube or CRT monitor.

IMAGE FORMATION AND REFRESH RATES

The human eye perceives the collection of pixels at the front of a CRT as a compound image, in much the same way as it interprets the pattern in ink dots in newspaper halftone as a photograph. The persistence is used to define how long the phosphors on the screen remain excited and emit light.

The image on the screen is not painted all at once. The stream is directed in rows; usually starting in an upper left corner .A series of raster lines are drawn down the face of the screen by electron beam reaches the lower right (see example below)



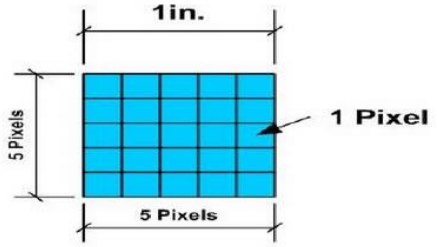

**Horizontal and Vertical Scan Path of Electron Gun**

The persistence rate (how long a given line is visible) must hold enough to allow formation of a complete image, but not so long that it blurs the dots painted in the next pass

These raster passes take place very quickly .The time required to complete a vertical pass **(vertical refresh rate ( VRR)** the time required to pass once from right to left (horizontal retrace )is known as as the **horizontal refresh rate (HRR)** Generally speaking, faster is better. If the vertical refresh rate is too slow, it can cause flicker, which is not only annoying ,but but can lead to eye strain .The larger the CRT ,the faster the refresh rate must be to cover the entire area within the amount of time needed to avoid flicker. At **640 *480 resolutions**, the minimum refresh rate is **60 Hz**; at **1600 *1200** the minimum rate is **85Hz**

SCREEN RESOLUTION

The term **resolution** refers to the **degree of detail** offered in the presentation of an image .The method of measurement varies, based on the medium –photographic lenses, films and papers are measured using lines per inch, whereas computer monitor manufacturers express resolution in **pixels per inch**. The greater the number pixels per inch, The greater the number pixels per inch, the smaller the detail that can be displayed and consequently, the sharper the picture becomes.




**Pixels or Dots per Inch**

Monitor resolution is usually expressed as a *b where a is the number of horizontal pixels,and b is the number of vertical pixels as shown in the figure above .For example ,640* 480 means that the monitor resolution is 640 pixels horizontally by 480 pixels vertically.

Modern monitors usually offer a variety of resolutions with different refresh rate .Price and quality should be compared at the maximum for both ,along with two other factors ,dot pitch and colour depth.

## COLOUR DEPTH

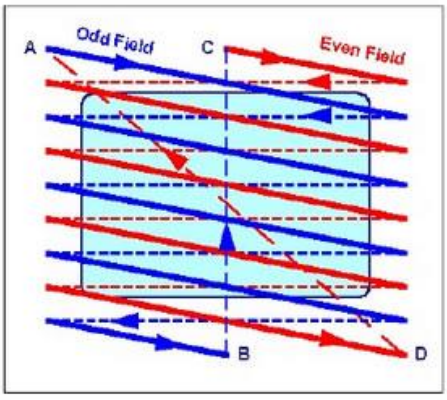
Colour depth is a computer graphics term describing the number of bits used to represent the colour of a single pixel in a bitmapped image .The number of of distinct colours that can be represented by a piece of hardware or software .Colour depth is sometimes reffered to as bit depth because it is directly related to the number of bits used for each pixel A 24-bit video adapter, for example. has a colour depth of 2 to the $24^{th}$ power(about 16.7 million) colours one would say that its colour depth is 24 bits.

OTHER CONSINDERATIONS IN CHOOSING MONITORS

1. COST AND PICTURE AREA.
   The CRT is the most expensive part of the monitor .Graphical user interface (GUI) operating systems have increased the demand for bigger screens, to allow for more working area so that users can have more applications open at once or more working room for graphics

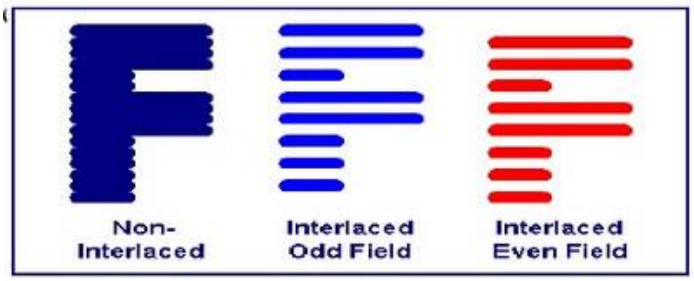
2. BANDWIDTH
   Bandwidth is used to denote the greatest number of times an electron gun can be turned on and off in 1 second. Bandwidth is a key design factor because it determines the maximum vertical refresh rate of a monitor, measured in megahertz (MHz).Higher numbers are better.

3. INTERLACING
   Interlacing refreshes the monitor by paining alternate rows on the screens and then coming back and sweeping the sets of rows that were skipped the first time around as shown in the figure below .This increase the effective refresh rate but can lead to eye strain.Interlacing is found on less expensive monitors ,and it should be avoided unless achieving the very lowest cost is the client's key concern.




**Interlacing**

Figure below shows the image comparison between non-interlaced image and interlaced image. When interlacing is used only certain part of image is formed by either interlaced odd field or interlaced even field. Both odd and even interlaced field combines to form a complete image




**Interlaced and Non-Interlaced Images**

4. POWER SAVING FEATURES

Monitors constitute a large percentage of the power consumed by a workstation even when not actively in use(i.e. during screen blanking).In order to reduce the power consumption, the Video Electronics Standards Association (VESA) has defined a Display Power Management Signaling (DPMS) standard which can be used to greatly reduce the amount of power being used by a monitor during screen blanking. DPMS can be configured in one of three ways; using hardware, software or a combination of both.

TURNING THE MONITOR'S DISPLAY

- In most cases ,the monitor must be adjusted for a proper picture when the screen resolution or refresh rate is changed or a new display card is added to the system.
- The Dell M1110 Colour Monitor is equipped with direct access on- screen display(OSD),which allows you to adjust the monitor by selecting adjust, a second control with the front-panel buttons. Additonally a secondary OSD function is available.
- Monitor care and troubleshooting are usually simple tasks .Here are some General guidelines to follow.

I. Make sure the enclosure is properly ventilated .Covering the opening on the case can lead to overheating. Dust the unit at regular intervals

II. Clean the face of the CRT gently; Follow the instructions in the product manual. In most cases, this means dusting the glass with a clean soft cloth. Do not use window cleaners that contain solvents on the unit

III. Make sure that all driver settings are kept with the operating guidelines of the product. Never operate at higher resolutions or refresh rates than these specified by a vendor ,and stay within the limits of the display adapter

IV. Use any automatic energy-conservation features supported by the hardware and operating system. Employ a screen saver on older models that lack energy-saving features. If possible ,do not turn the monitor on and off more than twice a day

- When a monitor fails to operate or produces improper image ,check the following;

I. Check all the cables ,including power and display.

II. Check the front panel controls. Make any appropriate minor adjustments that are needed.

III. Check the front panel controls. Make any appropriate minor adjustments minor adjustments that are needed.

IV. Check and, if needed, reinstall the display drivers. Make sure all settings are within required limits .Reinstall by returning to a plain 16- color, VGA display mode adding resolution; then increase the refresh rate.

V. Try another display adapter; then, if the problem is still unresolved, try another computer.

VI. If the monitor still shows problems, refer to a specialist for further tests.

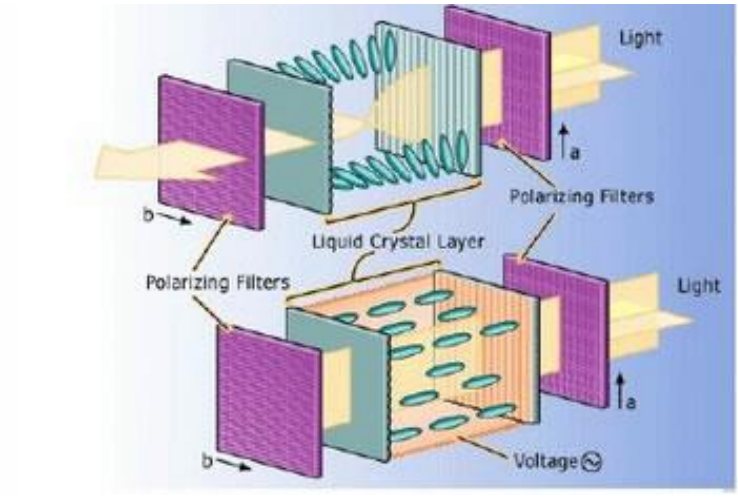
FLAT PANEL OR LIQUID CRYSTAL DISPLAY (LCD)

- **Flat panel displays (FPDs)** are thin ,bright display outputs than are gaining a foothold on desktops as a replacement for traditional CRT monitors.
- They are often called as **Liquid Crystal Display** or **LCD monitor** in short.
- The most obvious benefit is the small amount of desk space required, because there is no big case housing the electronic gun, nor a heavy glass front.
- They are thinner and lighter and draw much less power than CRT.
- FPDs are two to three times brighter than CRT. Since the screen is flat, this means that there is no distorted image at the edge of the viewing area, as there is with curved CRT.
- FPDs are generally easier on the eyes and don't require a "warm-up" period to reach full color saturation.

**A Flat Panel LCD Display**

HOW FLAT PANELS WORK

- FPDs create an image made of pixels ,just like their CRT counterparts ,but they use different technology to accomplish a task




A pair of polarizing filters layers work with the liquid crystals to control emitted light. As light passes through the first filter (a) only vertically aligned light waves remain. If the liquid crystals are in their natural state they are twisted which causes the light wave to turn horizontally. If an electric field is applied the liquid crystals straighten and the cell doesn't bend the light. Since the second filter (b) only lets horizontal light waves through, light that passes through the straight liquid crystals is blocked by the second filter.

- Several different types of FPDS are available today, varying in cost, image quality, and several other factors that affect both suitability to different computing applications and user acceptance.
- LCD screens are found in laptop computers, digital clocks and watches, microwave ovens, CD players and many other electronic devices

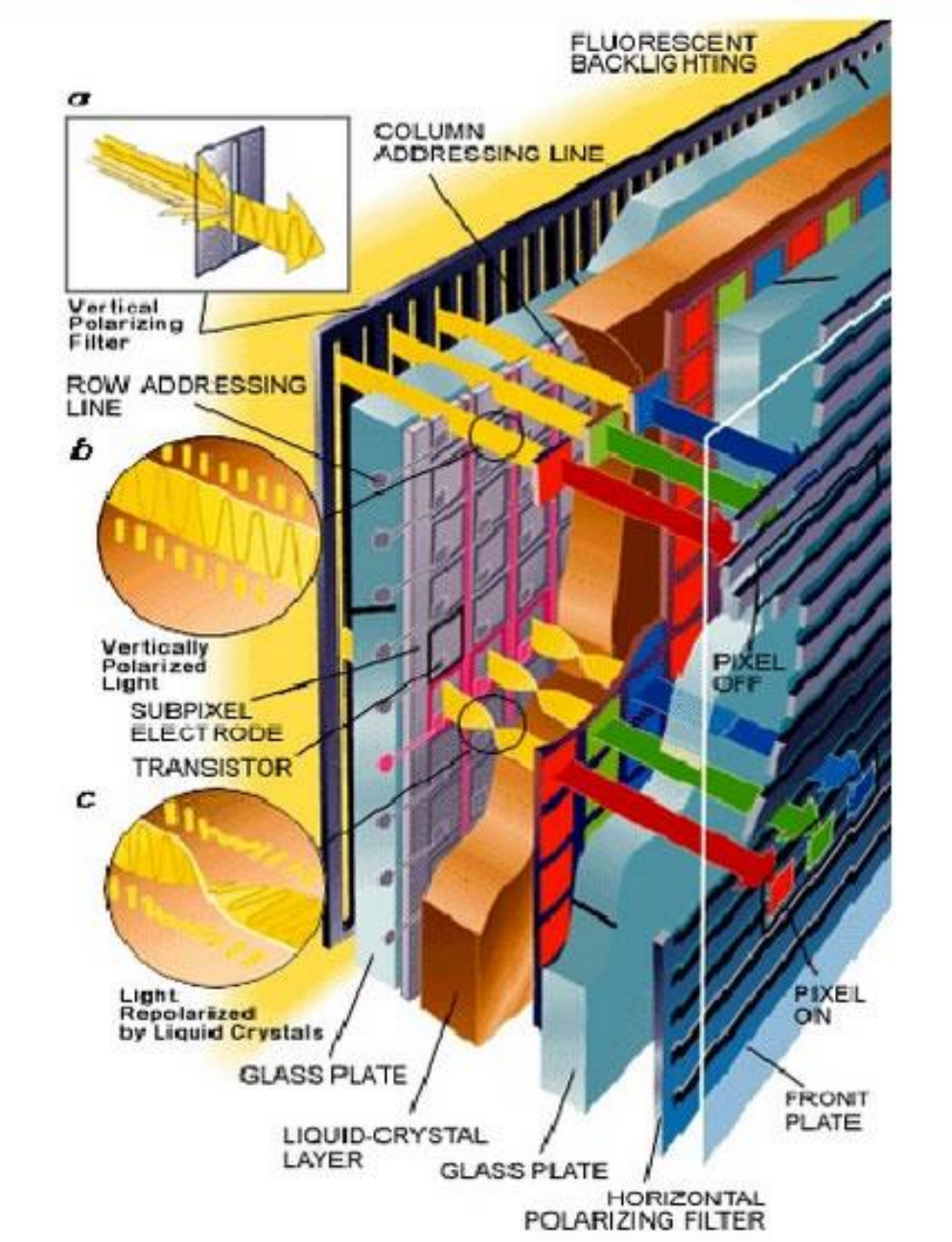
TYPES OF LCD

1. **PASSIVE-MATRIX DISPLAYS (PMDs)**
   PMDs are the simplest, and they have been used in calculators and watches since 1970. PMDs are too slow for today's demanding multimedia PCs.

   This type of LCD screen contains a series of wires that criss-cross each other. At the intersection of each wire contains a single LCD element that allows light to be passed through. A passive-matrix display does not provide the same quality as an active-matrix display can.

2. **ACTIVE-MATRIX DISPLAYS (AMDs)**

AMDs use thin film transistors (TFTs); TFT also describes this type of display. Each pixel is formed by a TFT and each pixel control on-off state to form image. TFT makes up the majority of both laptop and desktop FPDs today. The image is formed by an array of LCDs on a wired grid. The result is a faster response than the passive array.




## 3. PLASMA DISPLAY PANEL(PDPs)

PDPs work much like the fluorescent lights found in most offices by energizing an inert gas. Phosphor films are used to produce a colour image. This technology is used to manufacturer very large FPDs. Like fluorescent light, PDPs are relatively inexpensive to produce, but lower contrast and brightness, as well as higher relative power consumption, have thus far limited their use of PC applications.

**FLAT PANEL AND CRT DISPLAY COMPARISON.**

| **Type of Display** | **FPD** | **CRT** |
|---|---|---|
| Cost | More expensive.<br>Few manufacturers;<br>Less expensive to operate due to lower power consumption | Wider range of vendors, lower initial cost, high cost to operate due to higher electrical power demands |

| | | |
|---|---|---|
| Compatibility | Limited selection of display adapters, fewer supported resolutions | Wide range of display adapters and drivers for most popular resolutions |
| Ergonomics | Flicker-free operation at all resolutions, better brightness and contrast, optimal viewing angles, no noticeable distortion at edges. | No fall-off of image quality at reasonable viewing angles; wider range of resolution to meet user's needs and working conditions. |
| Size | Smaller "footprint" on desk, light weight. | Larger for given screen size, much heavier construction. |
| Emissions | Lower radio and virtually no magnetic emissions. | Electron gun and phosphors create both RF ( Radio frequency interference) and radition |

**DISPLAY ADAPTERS**

- A CRT monitor of FPD device is only half of computer's display system; it must be matched to a display adapter, also commonly referred to as graphics adapter, video card, or video controller, normally found inside CPU as shown in Figure 10-18 whose function is to generate and output images to a display.
- The term is usually used to refer to a separate, dedicated expansion card that is plugged into a slot on computer's motherboard.
- Some video cards offer added functionalities, such as video capture, TV tuner adapter, MPEG -2 and MPEG – 4 decoding or even FireWire, mouse, light pen or joystick connectors.

**EVOLUTION OF THE DISPLAY ADAPTOR**

- The display adapter and has gone through several major evolutions as the nature of PC computing has changed from simple word processing and number crunching to the graphics – intensive world of Microsoft Windows and multimedia.
- Video cards' history starts in the 1960s, when printers were replaced with screens as visualization element.Video cards were needed to create the first images .

**EVOLUTION OF THE DISPLAY ADAPTOR**

- The first video card ,which was released with the first IBM PC ,was developed by IBM in 1981.The monochrome Display Adapter (MDA) could only work in text mode representing 25 *80 lines in the screen .It had a 4KB video memory and just one colour.
- VGA was widely accepted ,which lead some corporations such as ATI ,Cirrus Logic and S3 to work with that video card ,improving its resolution and the number of colours it used and so was born the SVGA (Super VGA ) standard,which reached 2MB of video memory and 1024 * 768 dots of resolution at 256 colour mode.
- The evolution of video cards took a turn for the better In 1995 with the release of first 2D/3D cards ,developed by Matrox ,Creative S3 and ATI,among others.Those video cards followed the SVGA standard,but incorporated 3D functions .In 1997,3dfx releaed the graphics chip Voodoo,which was very powerful and included new 3D effects.
- From 1999 until 2002 ,NVIDIA controlled the video card market with the GeForce family.The improvements carried out in these years were focused in 3D algorithms and graphics processor clock rate

- In 2006 ,the leadership of the video cards market was disputed between NVIDIA and ATI with their biggest selling models GeForce and Radeon respectively.

RESOLUTION STANDARDS

UXGA stands for Ultra Extended Graphics Array.UGA is the newest and highest standard.Although not as widely as the XGA and SXGA monitors,its popularity is expected to increase dramatically as 21 inch monitors become more widely used.UXGA monitors are primarily used for high engineering design and graphic arts .

| STANDARD | PIXELS |
|---|---|
| SVGA | 800*600 |
| XGA | 1,024 * 768 |
| SXGA | 1280*1024 |
| UXGA | 1600 *1,200 |

# Chapter 8:
# COMPUTER ASSEMBLY & DISASSEMBLY

## LAB 1 – Disassemble a PC

**Objectives:**

- Disassemble a generic PC
- Verify the correct orientation of the interface cables

**Background:**

In this procedure you will start a computer to verify that it is operating properly. Then you will disassemble the computer. You will go through all the steps of disassembly.

Most PCs are capable of working with several different types of disk storage devices. The drives that are normally included as standard equipment with a PC are a 3 1/2 inch floppy disk drive (FDD), a multi- gigabyte hard disk drive (HDD), and a CD-ROM drive. These units can typically be found in the front section of the system unit.

**Resources:**

You will work in teams. The following resources will be required:

1. PC Tool Kit
2. Antistatic Wrist Strap
3. Personal computer (PC)
4. Operating system installed (MS-DOS, MS Windows
5. 95/98/2000/Millennium)

***NOTE***: This lab assumes an AT-type PC is used. If an ATX-type PC is used some modifications might need to be made in the step-by-step procedures, i.e. the video and input/output ports may be located on the motherboard instead of interface cards.

**Step 1 – Booting up the computer**

a) Push the power button to turn the computer on. The computer should do a quick memory test (some numbers will count on the screen).
b) The computer will boot up to an MS-DOS screen and should show a "C" prompt that should look something like this: C:>
c) Push the power button to turn the computer off.

**Step 2 – Identify the adapter cards**

a) Unplug the power cord from the back of the computer.
b) Remove the screws on the back panel of the computer cover.
c) Take off computer cover.
d) Identify the video card. It is the one that the monitor is (was) plugged into.
e) Write down the slot that it is plugged into in Table 1-1. Slots are numbered from right to left starting at slot

1 [looking from the front of computer to the back].

f) Identify the serial port mount. It is the one with a D25-pin male port and a D9-pin male port.
g) Write down the slot that it is plugged into in Table 1-1.
h) Identify the parallel port mount. It is the one with a D25-pin female port.
i) Write down the slot that it is plugged into in Table 1-1.

**Step 3 – Disconnect the external cables**

a) Disconnect the keyboard from the back of the computer.
b) Disconnect the mouse (PS/2 or Serial).
c) Disconnect the video cable.

**Step 4 – Disconnect all internal ribbon cables**

a) Disconnect the IDE ribbon cable from the hard drive.
b) Disconnect the IDE ribbon cable from the CD-ROM.
c) Disconnect the IDE ribbon cable(s) from the system board.
d) Disconnect the FDD ribbon cable from the floppy disk drive.
e) Disconnect the FDD ribbon cable from the system board.
f) Remove all the ribbon cables from the computer.

**Step 5 – Disconnect the power supply connections**

a) Disconnect the power connector from the hard drive.
b) Disconnect the power connector from the CD-ROM.
c) Disconnect the power connector from the floppy drive.
d) Disconnect the power connector from the tape drive.
e) Disconnect the power connectors from the system board [notice the orientation].

**Step 6 – Remove the adapter cards**

a) Unscrew the video card from the back panel, and then remove it and place it into an anti-static bag.
b) Unscrew the serial mount from the back panel, and then remove the ribbon cables from the system board [notice the orientation].
c) Repeat step b to the parallel mount.
d) Unscrew any other adapter cards that might be installed in this PC and remove them from the PC.

**Step 7 – Disconnect all front panel connections**

a) Remove the power switch connector.
b) List the color of the wires in Table 1-2.
c) Remove the speaker connector.
d) List the color of the wires in Table 1-2.
e) Remove the power LED connector.
f) List the color of the wires in Table 1-2.
g) Remove the hard drive LED connector.
h) List the color of the wires in Table 1-2.
i) Remove the reset switch connector.
j) List the color of the wires in Table 1-2.

**Step 8 – Remove the drives from the chassis**

a) Remove the hard drive [notice type of screws used].
b) Remove the CD-ROM drive [notice type of screws used].
c) Remove the floppy drive [notice type of screws used].

**Step 9 – Remove the system board mount and the system board**

a) Remove the screws from the system board mount.
b) Pull the system board mount and the system board from the chassis.
c) Remove the system board mounting screws from the system board.
d) Remove the system board.

**Step 10 – Remove the power supply**

a) Remove the switch mounting screw from the switch mount at the front of the chassis.
b) Remove the four screws from the back of the chassis that hold the power supply onto the chassis.
c) Remove the power supply.

**Table 1-1**

| Adapter Card | Slot |
|---|---|
| Video Card: | |
| Network Card: | |
| Serial Port Mount: | |
| Parallel Port Mount: | |

**Table 1-2**

| Cable | Color/Orientation |
|---|---|
| Power Switch: | |

| | |
|---|---|
| Speaker: | |
| Power LED: | |
| IDE LDE: | |
| Reset: | |

# LAB 2 – Reassemble a PC

**Objectives:**

- Reassemble a generic PC [disassembled in Lab 1].
- Verify the correct orientation of the interface cables.

**Background:**

In this procedure, you will reassemble the PC that was disassembled in Lab 1. You will go through all the steps of reassembly. After reassembling the PC, you will start the computer to verify that it is operating properly.

**Resources:**

You will work in teams. The following resources will be required:

- PC Tool Kit
- Antistatic Wrist Strap
- Disassembled personal computer (PC)
- Operating system installed on hard drive (MS-DOS, MS Windows 95/98/2000/Millennium)

***NOTE***: As in Lab 1, this lab assumes an AT-type PC is used. If an ATX-type PC is used some modifications might need to be made in the step-by-step procedures, i.e. the video and input/output ports along with the IDE ports may be located on the motherboard instead of interface cards.

**Step 1 – Install the power supply**

a) Place the power supply back into the chassis.
b) Insert the four screws through the back of the chassis; these hold the power supply onto the chassis.
c) Attach the switch mounting screw through the switch mount at front of the chassis.

**Step 2 – Attach the system board mount and the system board**

d) Place the system board on the system board mounts.
a) Install the system board mounting screws through the system board.
b) Install the system board mount and the system board into the chassis.

c) Install the screws through the system board mount.

**Step 3 – Attach all the front panel connections**

a) Find the speaker connection and connect it to the motherboard where it is labeled "Speaker."
b) Find the power LED connector and connect it to the motherboard where it is labeled "Power LED."
c) Find the hard-disk drive LED connector and connect it to the motherboard [or interface card] where it is labeled "HDD LED."
d) Find the reset switch connector and connect it to the motherboard where it is labeled
e) "Reset."

**Step 4 – Install the drives into the chassis**

a) Install the CD-ROM drive [remember the type of screws used in Lab 1].
b) Install the Floppy drive [remember the type of screws used in Lab 1].
c) Install the hard drive [remember the type of screws used in Lab 1].

**Step 5 – Install the adapter cards**

a) Make sure the cards are lined up properly with the slots. It will require a firm push to get the cards reseated in the motherboard expansion slot.
b) Install the video card into the slot recorded in Table 1-1 [Lab 1], and screw it into the back panel.
c) Repeat step a on the network card.
d) Repeat step a on the sound card.
e) Repeat step a on all the other adapter cards removed in Lab 1.

**Step 6 – Connect the power supply connections**

a. Connect the power connectors to the system board [notice the orientation]. b. Connect the power connector to the CD-ROM.
b. Connect the power connector to the floppy drive.
c. Connect the power connector to the hard drive.

**Step 7 – Connect all internal ribbon cables**

a) Connect the floppy disk drive ribbon cable to the floppy disk drive.
b) Connect the floppy ribbon cable to the system board, striped side to pin 1.
c) Connect the hard disk drive cable to the motherboard in the Primary IDE controller, striped side to pin 1.
d) Plug the middle of the connector into the hard drive, striped side to pin 1, and plug the
e) end into the CD-ROM drive, striped side to pin 1 [If there were two IDE cables, then plug the second cable into the motherboard's Secondary IDE controller and then to the CD-
f) ROM].

**Step 8 – Connect the external cables**

a) Plug the keyboard into the keyboard connector. Make sure the orientation is correct;
b) otherwise you could bend pins and ruin the keyboard.
c) Plug the mouse (PS/2 or Serial) into the port you removed it from.
d) Plug the monitor into the video card. The connector is keyed and can only be plugged in one way. Be careful not to bend the pins, as this will ruin the monitor.

e) Plug in the power cord.
f) e. Replace the cover of the computer. f. Replace the cover screws.

***NOTE***: Assembly is complete. You need to reboot the computer to see if it is still working properly.

Step 9- Booting up the computer

a) Push the power button to turn the computer on. The computer should do a quick memory test (some numbers will count on the screen).
b) The computer will boot up to an MS-DOS screen and should show a "C" prompt that
c) should look something like this: C:>
d) Push the power button to turn the computer off.

## Electronic waste management

Electronic waste (e-waste) is a term that is used loosely to refer to obsolete, broken, or irreparable electronic devices like televisions, computer central processing units (CPUs), and computer monitors (flat screen and cathode ray tubes), laptops, printers, scanners, and associated wiring. Rapid technology changes have led to increasingly large e-waste surpluses. Electronic devices, particularly older units in use today or in storage, contain a host of hazardous constituents such as lead, mercury, or chromium, as well as plastics treated with brominated flame retardants.

**Is e-Waste Hazardous?**

E-waste is not hazardous waste per-se. However, the hazardous constituents present in the e-waste render it hazardous when such wastes are dismantled and processed, since it is only at this stage that they pose hazard to health and environment.

**Toxic constituents in e-waste**

| COMPONENTS | CONSTITUENTS |
|---|---|
| Printed circuit boards | Lead & cadmium |
| Cathode ray tubes (CRTs) | Lead oxide & Cadmium |
| Switches & flat screen monitors | Mercury |
| Computer batteries | Cadmium |
| Capacitors and transformers | Poly Chlorinated Bi-phenyls (PCB) |
| Printed circuit boards, plastic casings cable | Brominated Flame Retardant |
| Cable insulation/coating | Poly Vinyl Chloride (PVC) |

**Current e-waste Disposal Methods**

- Incineration

- Acid Baths
- Landfills

The state of things

- Electronics contain over 1000 different materials, many of them toxic
- In the US, end of life electronics end up in landfills or are exported to developing countries
- Developing countries are the worlds dumping grounds for electronic waste

## Why is this problem?

- Landfill disposal allows heavy metals to leach into ground water
- Incineration makes hazardous material airborne
- Acid baths are dangerous and cause water and soil contamination
- Exported materials are handled improperly
    - Most e-waste goes to China, India, and Africa
        - Workers are untrained and uneducated in safe handling of electronic waste
        - No environmental protection laws

## Environmental Impacts

- Studies conducted in China discovered heavy contamination in e-waste recycling regions
    - Soil, air, water, and sediments all contained high levels of contamination
        - Trace metals (Lead, Zinc, Nickel, Copper, Mercury, and Cadmium)
        - Polychlorinated Biphenyls
        - Polycyclic Aromatic Hydrocarbons
        - Dioxins

## Methods of disposal

1) Redesign of computer components
    - Simplification of the deconstruction process
2) Home appliance manufacturers must take back and recycle end-use products
3) Consumer Education
    - Easy to access information about where to dispose of unwanted electronics
4) Updated Sorting Methods
    - Automated sorting processes

# Chapter 9
# Software Installation

# Operating System Installation

## Chapter Objectives

- Explore the hardware and software prerequisites for OS installation.
- Explore steps that must be taken before installing or upgrading an OS.
- Explore methods of producing robust reproducible OS installations.
- Explore installation types and techniques.

### Installing an Operating System

1. **Hardware Requirements:** Before you attempt to install an OS on a machine, it would be wise to ensure that the OS in question runs on the hardware that you have available.
2. **Multi-platform OS Support:** Most OS vendors that distribute software that runs on multiple hardware architectures publish a hardware compatibility list (HCL) for their OS.
3. **Single Platform OS Support:** Vendors of single-architecture OS deal with many of the same problems faced by multi-platform vendors.
4. **OS for Intel-based Systems:** Windows is probably the most widely used OS available for Intel-based systems.
    - Windows includes drivers for a wide range of devices that work on Intel-based systems.
    - Versions of Windows produced over the past decade will operate on systems ranging from a 486 chip up to the latest Pentium.
    - The current versions of Windows generally require a Pentium 166 (or better) processor chip, a minimum of 32 megabytes of memory, and 2 gigabytes (or more) of free disk space.
    - Windows may not operate smoothly on some of the older systems, but it will operate.
5. **OS for Intel-based Systems**
    a. Recent releases of Linux are beginning to nip at the heels of Windows in regard to device driver availability, and the number of systems running the OS.
        i. The open-source movement has the advantage of allowing anyone to submit a device driver for their favorite device.
    b. Because there are so many PC systems available, many people know how to write “bad” software for the PC architecture.
        i. This plethora of untested/unsupported software available for the system can lead to security and reliability problems.
        ii. Both Linux, and Windows suffer because of this situation!

6. **OS for Intel-based Systems**

    a. Well behind Windows and Linux, BSD, and Solaris are also available for Intel architecture systems.

        i. Solaris suffers from a lack of device drivers for the latest/greatest devices.

        ii. Solaris also often does not offer device drivers for very old devices.

        iii. Sun discontinued support for the Solaris Intel edition with the release of Solaris 9. They now offer a Linux "solution" in place of Solaris for Intel.

        iv. BSD variants are generally more secure than the competitors, and offer very robust/well tested code, but they have not caught on as general purpose offerings. BSD is often found in research labs, and under the hood of network "appliances" such as firewalls.

7. **OS for Non Intel-based Systems**

    Proprietary hardware architectures may not allow you to run more than one OS.

    a. The "single offering" case greatly simplifies the decision regarding which OS you should load on the machine!

    b. The single OS is also easier for the vendor to support, as the service personnel only have one system to learn.

    c. Single-OS systems are also likely to be replaced by multi-OS systems over time.

        i. **The world of computing is not a "one-size-fits-all" environment!**

        ii. **The UNIX vs. Windows war will be battled for many years.**

8. **OS for Non Intel-based Systems**

    a. Whereas some architectures may only work with one OS, others are blessed with multiple fully supported OS.

        i. Some vendors may provide full support for their proprietary OS but partial support for a second OS.

        ii. More often than not, the second OS is one of the Linux distributions.

        iii. Vendors such as Hewlett-Packard, IBM, Compaq and others now offer multiple OS for their hardware.

        iv. Other vendors (like Sun) offer a line of Intel based Linux systems, as well as the SPARC based systems.

9. **OS for Non Intel-based Systems:** Other hardware vendors only support their proprietary OS on their hardware.

    – This is true for Sun Microsystems, even though there are Linux distributions that support the SPARC architecture.

        ✓ Although Linux is available for SPARC systems, many software vendors do not port their applications for the Linux/SPARC market.

- ✓ Without applications available for Linux/SPARC, customers stay with the proprietary Solaris OS on Sparc.

**Cataloging Hardware Requirements**

- When you consider the OS hardware requirements, you need to pay close attention to any nonstandard hardware on your system.
- All hardware found on the system should be cataloged.
  - Need to determine if device drivers are available.
  - Need to determine if the hardware is mission critical.
- Looking over the inventory form before attempting to install the latest OS version may make the decision for you.
- PC systems typically force a few more restraints on the system hardware than other architectures.
  - For example, an Intel system requires a VGA display and keyboard in order to boot.
    - ✓ Unfortunately, there are hundreds of display adapters, thousands of keyboards, and tens of thousands of mice available for PCs of different heritage.
- OS designers also impose restraints on the system hardware.
  - Software kernel architectures may impose specific revision-level requirements on the hardware.
    - ✓ For example, Solaris 8 will not boot on the sun4c hardware architecture.

**Installation Time Requirements**

  - When it comes to a discussion of installing an OS, the answer to "what hardware do I need?" is almost as nebulous as the answer to "how long will it take?"
  - When everything goes right, a full OS install might take an hour. But when things go wrong, you might be looking at eight or more hours to get the OS installed and working.
    - How do you estimate the amount of time required for an OS installation?
- Never assume the OS installation will go smoothly.
- Even if you get extremely lucky, and everything does go well, figure on at least two hours just to get a bootable OS on the system media.
- Do not forget that after the OS is installed you will need to install patches and service packs to bring the OS up to date.
- Once the OS is installed and patched, do not forget that you have to install all of the applications users need in order to get their work done.
- Allow time for the appropriate number of reboots during the OS and application installation phases.
- The "load" media for an install can also have a huge impact on the installation.

**Types of Installations**

There are several types of installation models available to work with.

- The installation could be a server or a workstation.
- The goal of the installation could be to set up a machine usable as a desktop workstation, web server, database server, service machine, or interactive system.
- The system could be a diskless host that boots from the network, or a diskful system that serves files to other hosts.

Each of these configurations may require that a particular set of software be installed such that the system performs its duties and users can get some work done.

a) **Windows Installations**

The concept of a problem-free Windows installation may sound foreign to some administrators.

- This is never more apparent than on a dual-boot system.
- However, even the simple task of installing a single version of Windows on a system may hold a few surprises for the administrator.

**Hardware Support Issues**

It is not unusual to find that the version of Windows you want to install does not support the latest hardware available on your system.

Surprises Encountered While Installing Windows

- Windows can have a strange propensity for nondeterministic behavior.
  - You can install it on three identical systems and end up with three completely different problems.
  - It is also possible to follow the same installation procedure and end up with three systems configured differently once the installation is complete.
  - For uniform installations, use the Windows network installation utilities, or tools like ghost" or "PC-rdist" to "push" an image to the new system from a pre-configured repository.

Some of the more common problems encountered while installing Windows include:

- One or more network interfaces may not operate correctly.
  - **Generally, removing the adapter's driver, rebooting the system, and reinstalling the driver will correct this problem.**
- NT 4.0 cannot be installed on systems with a boot partition larger than 4 gigabytes.
  - **This limit requires you to partition system disks larger than 4 gigabytes into (at least) two partitions.**
- The device drivers on the Windows distribution media are often less than optimal.
  - **Display and network drivers seem to be the "big losers" in this respect.**

– Service packs have been issued for all current versions of Windows.

**It is imperative that the sysadmin install these service packs to secure the system against well-known attacks.**

b) **Dual-boot Windows Installations**

The idea behind a dual-boot system is to install two different OS on the bootable medium.

– This allows the user to run either system, which hopefully allows the user more flexibility in performing tasks.

– Unfortunately, creating a dual-boot system is a lot more difficult than it should be, and many times Windows seems to be in the middle of the problems.

– One rule of thumb for installing a dual-boot system that includes Windows is to install the Windows OS first.

– If you are trying to install two versions of Windows, always install the older version first.

• This is often necessary because new versions of Windows often contain changes to the file system, and the old versions do not understand these changes.

**c) Other Installations**

Installing a Solaris/Linux dual-boot Intel system often presents problems for the administrator.

– The Solaris Intel installer limits the number of partitions allowed on a disk where Solaris will be installed.

• **If the disk has more than three partitions, and/or the installation of Solaris would cause the disk to have more than three partitions, the installation will fail.**

– Linux wants a boot partition, and a kernel partition (minimum).

– Solaris also wants a boot partition and a kernel partition.

– If you wanted to build a dual-boot Linux/Solaris system, you would need four partitions. However, Solaris will only allow you to install on a disk with three (or fewer) partitions.

– In this case, install Solaris first, and then install Linux on a separate partition later. Better yet, buy a second disk, and install one OS on each disk!

**d) Desktop Installations**

Installing the OS on a desktop PC is often a very different problem than installing an OS on a corporate database server.

– Generally, desktop computers come in two flavors: systems that contain their own copies of everything and systems that rely on network-based servers for critical applications.

– **Standalone Systems**
Self-contained systems are often referred to as standalone systems, or “thick clients.”

• These machines typically contain the OS, and local copies of all applications required by users of the system.

- The installation of a standalone system will require more time than some other systems, because you have to load the OS, and all of the applications on the local disk.
- Such installations can easily become multi-day tasks!

**Networked Client Systems**

– Systems that rely on network-based servers for critical applications/services are typically referred to as networked client systems, or "thin clients."

- These machines usually contain a copy of the OS, but very little other software gets installed on these systems.
- User files typically reside on a network-based file server.
- Applications may reside on yet another network-based server.
- These systems rely on the network to be operational for the system to be useful.
- Such systems are typically very easy installations.
  – You load the OS, configure the network connection, and possibly configure a few other parameters to allow the system to locate the network-based servers and you are "done".

### e) Server Installations

Installing an OS on a server is often a long, arduous task.

You have to install the OS and configure it to provide services to other computers.

The types of "clients" the server supports will usually complicate this configuration task.

The applications/services provided by the server may provide more complications.

**Homogenous Servers**

The homogenous server is probably the simplest server to install.

This type of server only provides services to clients of the same architecture/kernel architecture.

- **This means that only one version of the OS and all applications need be installed on the system.**

Such systems may be used as a boot server, file server, name server, web server, database server, or many other purposes.

**Heterogeneous Servers**

Heterogeneous servers are probably the most difficult system you will ever have to install.

These systems may provide boot services, applications, and/or file services for a variety of systems of different kernel/hardware architectures.

- For example, a Linux system may be set up to provide file service to Linux, Solaris, and MacOS boxes via NFS, while providing file service to desktop PCs via Common Internet File Services (CIFS) by running the Samba application.
- Such servers are typically very complicated beasts to install and configure.
    - You will have to install copies of multiple OS for the system to function as a boot server.
    - Similarly, you will have to install application binaries for multiple architectures in order to support application services for client machines.

**Planning for an Installation**

The “footprint” or size of the OS should be considered to ensure that the system contains enough disk space.

How that disk space is parceled might play a role in the OS installation.

Similarly the size of the main memory might need to be taken into consideration.

**Disk Space Requirements**

One of the most important decisions you will need to make before you install an OS is how much space to allocate to the system software.

- If you allocate too much space to the system software, users may not have enough space. If you allocate too much space to users, the system may run out of space.
    - Calculate how much space the OS and application binaries will occupy.
    - Once you have a number in mind, double it. In a few weeks or months you will be glad you did.

Every successive release of an OS is larger than its predecessor.

- This is an important point to remember, because you may have to upgrade the OS on a machine two or three times over the lifetime of the hardware.

# Installation Methods

- Current OS are typically distributed on CD or DVD media.
- Older releases were distributed on tape cartridges or floppy diskettes.
- More often than not, the distribution media is bootable, and therefore all you have to do is place the media in the appropriate device and turn on the power.
- The magic of the boot process boots the installation media, and an installation program **guides you through the installation process.**

**Windows Installations**

Most Windows installations give the administrator very few options.

When installing from the distribution media, the administrator selects the partition to install the bits on, answers a few questions about the local environment. The system does the rest without input from the operator.

Unfortunately, the information required during the installation is not all collected up front; the information-gathering process is spread across the entire installation process.

- This makes Windows installation more time consuming than it should be, as the administrator has to sit and wait for the system to ask questions.
- If the questions were all asked up-front, the administrator would be free to attend to other tasks while the bits moved from the CD to the hard drive.

**Windows CD/DVD Installations**

Installation of Windows from CD/DVD media is pretty simple.

- You boot the installation media, answer a few simple questions, and the installer program does the rest for you.
- Unfortunately, because the process is simple, it is not very configurable.
- The media-based installer is geared to the novice administrator's capabilities; hence, the number of decision points and allowable options is very minimal.
- One downside to the CD/DVD installation is that the installation process is just interactive enough that the operator cannot start the installation and leave for an hour or two.

**Network Installations**

If you want to customize the installation process, and/or make it completely automatic, you need to build a network-based installation server.

- Such an installation is referred to as an "unattended" installation in Windows parlance.
- The installation server contains on-line copies of the distribution media, a set of "answer" files that control what parts of the software get installed on the system, and a "boot daemon" that listens for installation requests on the network.
- You can customize the answer files to install the OS and any required applications without operator intervention.
- This is a much more suitable installation method if you have to install 100 computers instead of 2 or 3.

**This method comes with a price: someone has to build (and hopefully test) the answer files.**

```
; Microsoft Windows 2000 Professional, Server, Advanced Server and Datacenter
; (c) 1994 - 1999 Microsoft Corporation. All rights reserved.
;; Sample Unattended Setup Answer File
; This file contains information about how to automate the installation
; or upgrade of Windows 2000 Professional and Windows 2000 Server so the
; Setup program runs without requiring user input.

[Unattended]
Unattendmode = FullUnattended
OemPreinstall = NO
```

```
TargetPath = WINNT
Filesystem = LeaveAlone

[UserData]
FullName = "Your Name Here"
OrgName = "Your Organization Name"
ComputerName = "COMPUTER_NAME"

    [GuiUnattended]
; Sets the Timezone to the Pacific Northwest
; Sets the Admin Password to NULL
; Turn AutoLogon ON and login once
TimeZone = "004"
AdminPassword = *
AutoLogon = Yes
AutoLogonCount = 1

;For Server installs
[LicenseFilePrintData]
AutoMode = "PerServer"
AutoUsers = "5"

[GuiRunOnce]
; List the programs that you want to launch when the machine is logged into for the first time


[Display]
BitsPerPel = 8
XResolution = 800
YResolution = 600
VRefresh = 70

[Networking]
; When set to YES, setup will install default networking components.

    ; The components to be set up are TCP/IP, File and Print Sharing, and

    ; the Client for Microsoft Networks.
InstallDefaultComponents = YES

[Identification]
JoinWorkgroup = Workgroup
```

**UNIX Installations**

Many flavors of UNIX allow (in fact, insist on) significant operator interaction during the installation process.

UNIX installers are often much more willing to allow custom installations than their Windows counterparts.

- This generally infers that the operator needs to be more knowledgeable about the specifics of the system to successfully complete the installation process.
- It also means that unattended installations are not feasible without plenty of advance configuration and planning.

**CD/DVD Installations**

As with Windows distribution media based installations, the installers used by UNIX OS are somewhat automated.

– A difference between UNIX and Windows installers is that MOST UNIX installers ask all of the questions up-front, then use the answers to drive the remainder of the install.

- A typical Solaris 8 installation requires about 20 minutes of operator interaction, then for the next hour (or more) no interaction is required.
- RedHat Linux installations are similar to Solaris in regards to operator interaction.

While MOST UNIX installations often take care of the interactive portion up-front, a few of the installers "hold the user's hand" throughout the installation process (much like Windows).

**Network Installations**

Most versions of UNIX support a network-based installation system of one form or another.

– Like Windows, these installers require a network-based boot server, rules files that dictate how the installation is performed, and a boot daemon that runs on the server to manage the process.

- The Solaris JumpStart package is one such network-based installer.
- Sun's WebStart and the Linux KickStart service are other examples of the automated network-based installer.
- Because there is no official standard for these network-based tools, and each vendor has one (or more) of these installers, describing all of the current offerings is difficult, if not impossible.

**Linux Kickstart**

Linux may be "kickstarted" from a bootable floppy diskette or from a network-based boot server.

- The floppy diskette must contain a configuration file named *ks.cfg*.
  – This file is the Linux equivalent of the Windows "answer file" for an unattended installation.
- To perform a network installation, you need to have a DHCP server running on your network.
- The DHCP server instructs the new system how to contact the boot service machine identified in the ks.cfg file.

The Kickstart process requires a "rules" file to control the installation.

– The *ks.cfg* file contains several directives that tell the installer how, and what, to install on the system.

- The format of the *ks.cfg* file is as follows.
  **<command section>**
  **<a list of %pre, %post, and/or %packages directives>**
  **<installclass>**

The easiest way to create a Kickstart file is to use the *Kickstart configurator* utility supplied on the distribution media.

To start a Kickstart install, you use a special boot floppy.

- The boot floppy may contain a CD-ROM or network "boot block." In either case, you start the boot with the following command.
  Boot: linux ks=floppy # ks.cfg resides on the floppy
  # ks.cfg resides on NFS fileserver
- Boot: linux ks=nfs:<server_name:>/path_to_ks.cfg

Solaris Network Boot Service Daemon

- To provide a Solaris installation server, you must build and configure a system that will listen for install requests, and know how to deliver the proper files to the host being installed.
  - This requires the sysadmin to complete the following two major tasks.
    - Build a server, install the boot server software, and configuration files.
    - Install the binaries to be served on the boot server.

**Saving Critical Data**
In the event your installation involves the upgrade from an old version of an OS to a new version, there is another critical point to consider.

- What do you do with all of the old files on the system when you get ready to install the new software?
  - If the system is a standalone desktop, and you have a new OS (as well as new applications to install), you may not need to worry about saving anything from the old system.
  - More often than not, however, before an old OS is shut down for the last time there are several files you may wish to save.

- **You are strongly advised to make a full backup of every file on the system.**

Servers often present an even bigger challenge when you are upgrading an OS.

- For instance, because you may not have to change the partitioning to load a new OS, it would help to know how the disks on the system are currently partitioned.
- Printing out information regarding current disk partitions may be very helpful information during the upgrade.
- Saving the password file, NIS name, server maps, user files, and other critical information before you begin the installation procedure is always strongly recommended.
- Again, err on the side of caution, and perform a full file system backup before you begin the upgrade. Nine out of ten times you will be glad you spent the extra time to do so.

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# Summary

- Installing an OS is a huge undertaking.
- There are no set formulas for how it should be done.
- Early steps in the planning should include checking that the new software will run on the hardware.
- Determination of the type of installation, homogenous server, heterogeneous server, standalone system, thick client, or thin client should also be addressed before beginning the installation process.
- System types to be supported and the intended use of the system must also be factored into installation planning.
- Application availability should be checked, and rechecked.
- If mission-critical applications are not available for the OS to be installed, you may have to change your plans.


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# Chapter 10:

# FAULT FINDING AND TROUBLESHOOTING

The focus of this chapter is on generic approaches you can use to troubleshoot and repair a PC, including a generic troubleshooting process and some suggestions on how to make troubleshooting easier and involve less guesswork.

**The Need for a Troubleshooting Plan**

One of the true frustrations about problems on a PC is that in most cases they are not what they seem. The problem could be software-related—but which software? The problem could be hardware-related—but which hardware? What exactly was going on when the problem first occurred? Are you sure?

Even with years of experience and training, PC technicians can apply solutions that do not solve the real problem.

**Elements of a Troubleshooting Plan**

A troubleshooting plan can be a written checklist that you use for any problem, or just a routine procedure that you follow each time a problem occurs, with adjustments for the situation. Whatever form your plan takes, as long as it works and is used, it will be the right plan.

The elements that should be included in any troubleshooting plan are:

- Maintenance journal
- Diagnostic checklist or questions
- Identification of possible causes
- Identification of possible solutions
- Application and testing of solution
- Follow-up

*The Maintenance Journal*

In this journal, you record the hardware installed in the PC when it is installed, all preventive maintenance activities, all software updates or additions, and all hardware installations and upgrades. In addition, any problems that occur and the actions you take to resolve them should be recorded in the journal. When it comes to troubleshooting a PC, having a record of the hardware and software life of the PC can be very helpful in trying to pin down a problem and devise a solution.

**A General Troubleshooting Process**

When a problem does happen on a PC, the information you have collected in the maintenance journal and a systematic problem-solving approach for isolating the problem are your best bets for finding and fixing the problem quickly.

**Using a Systematic Problem-Solving Approach**

By using a systematic approach to identifying a problem, you reduce the chance of leaving out anything you should have considered. The standard problem-solving process has six steps:

1) *Identify the problem.* This part of the process is typically the most difficult. The problem may not actually be what it seems. You need to gather all of the data you can about the problem.
2) *Identify possible causes*. Any problem, such as the system locking up after running a few minutes, can have several causes, all of which need to be identified and considered. You can then rank the possible causes by the most likely to the least likely.
3) *Identify possible solutions.* You should identify a solution for each of the possible causes you have identified. A possible cause could have more than one possible solution, in which case you need to rank the solutions by which will yield the most positive results.
4) *Analyze the possible solutions.* If two solutions will produce the same result, other considerations may be involved. Perhaps, one is less expensive or adds value to the PC.
5) *Apply a solution*. From your analysis of the possible solutions, you shoul pick the one that looks most promising and implement it.
6) *Test the solution.* If it solves the problem and provides the desired result, be sure you update the maintenance journal and all other pertinent documentation. If it doesn't solve the problem, you may need to repeat as much of the problem-solving process as necessary to find a better fix.

*Not every problem requires that you formally and methodically work through these steps individually. Some problems are very apparent, and the fix is obvious but you should practice applying this technique on every problem for a while*

**Working through the Problem**

Even when you use a systematic approach to isolate a problem and you find solution, you should do some things to ensure that you have the best possible information available for your decisions. In most cases, this involves making sure you ask the right questions, either of a user or of yourself. The following are t types of questions to ask:

- Did the problem first happen immediately after a change was made to the PC?
- How did the problem manifest itself?
- Was a beep code sounded or an error message displayed to indicate or describe the problem?
- Has the problem component ever worked correctly?
- When did you first notice the problem?
- What software applications or operating server services were active when ti problem happened?
- Has the same problem occurred in the past?
- If the problem has occurred in the past, how recently and how often?
- What activity was the user doing at the time the problem appeared?
- Were any configuration changes made during the current session that required a restart that was not performed?

You may also want to ask about environmental conditions:

- Have unusual electricity events occurred recently?
- Have any uncommon heating or cooling changes or problems been experienced in the room?
- Is the user new to the PC?
- Has the PC been moved recently?

**Reproducing the Problem**

Another very important step in identifying the problem is the ability to reproduce it. Document in detail what you think may be an incidental problem that you cannot reproduce. Chances are that you are unable to reproduce the problem because you are unable for some reason to create the same set of conditions that caused it in the first place. That doesn't mean it will never happen again, and when it does, you need to be able to look back and compare the conditions that caused it in each instance. If you are dealing with an intermittent problem, you should document the answers to the questions in the preceding section and any other facts you have gathered.

**Eliminating Possible Causes**

Perhaps the best way to eliminate a possible cause is to remove it from the system and retest. This is true of hardware and software elements that you believe may be causing a problem. For example, if you think a conflict exists between two pieces of application software, you should stop one of the software programs to see if the problem clears up. This same principle applies to hardware problems. If you think a problem is being caused by conflicts between devices or expansion cards, you should open the case, remove the suspected component, am restart the system. If the problem disappears, you have found the cause; otherwise, keep eliminating devices until the problem goes away. If you must remove all of the expansion cards before a problem clears up, you may also need to begin reinserting the cards in the reverse order to which you took them out to see when the problem reappears.

Another excellent way to isolate a hardware problem on a PC is to use the ***known good method***. The known-good method involves replacing the suspected hardware with another of the same make, model, and type that you absolutely know to be good. If the problem goes away, you have a bad part; otherwise, keep testing.

## Applying a Solution

In most situations, the fix to a problem is obvious, especially with software issues. If two applications have conflicts, not running them together, upgrading one or both, or reinstalling one or both will usually fix the problem. Always check the software manufacturer's Web site for information relating to a problem. You may also want to check the operating system manufacturer's Web site for information on this and similar problems with the software in question. If no information on your problem is available from either the application or operating system manufacturer, report the software conflict and problem to them, if for no other reason than to put it on the record.

If the problem is a hardware issue, check to see if the hardware is under warranty and, if so, what restrictions the warranty imposes before you begin making too many changes. Never make changes that would void a device's warranty. Contact the manufacturer with all of your information and work with its technical support people to devise a solution to the problem.

**Troubleshooting Tools**

A variety of hardware, software, and information resources are available for use during troubleshooting procedures.

*Hardware and Software Tools*

- The tools that you should have available to troubleshoot a PC include the following:
- A good set of screwdrivers, including a Phillips screwdriver
- Antistatic wrist strap, antistatic mat, and antistatic bags (for removing and storing components)

- Software system testing utilities, such as AMIDiag software from American Megatrends, Inc., Symantec's Norton Utilities, and Eurosoft's PC check, among others
- A digital multimeter for checking power supply voltages
- A supply of spare known-good components for replacement testing

Your senses are probably the most important "tools" when troubleshooting a PC. For example, your eyes or nose will find a burned out component faster than any other tool.

**Information Resources**

The Internet and Web are full of information resources you can use to gain in information about a particular device or application, or to learn how others have dealt with a problem you are having. Chances are pretty good that you are not the first to have whatever problem you are having.

# Chapter 11:

# COMPUTER SUPPORT

## On-line Support

If you are familiar with the concept of remote controlling a computer then this should be nothing new to you.

Online support technicians use a special piece of software depending on what kind of PC problem you have, that you download to your computer. The download is very small and quick. This allows them to connect to your computer securely as if they were sitting in front of it. There is no need for a technician to come to your home. Most importantly, you still have the ultimate control over your computer.

You can sit there and watch them work making sure that your important data stays private. If for any reason you want to disconnect the session, with one simple click you can disconnect the **computer repair technician** and it's impossible for them to get back in to your PC.

**Advantages**

1. Getting PC help from an online computer repair service will be faster than from a local computer repair service.
2. You won't have to unhook your computer and load it up in the car. You won't have to wait on a service person to visit your home or business. You won't have to work within standard business hours. These are huge advantages if you need your computer fixed fast.

   Online computer repair services might not be able to fix every problem under the sun, but if they can fix yours, they're often the better, and for sure the fastest, bet.

## Running a help desk call management

Setting up a helpdesk for your business can be a daunting task. But it's not as difficult to set up a great helpdesk for your business and providing the best support experience you can is an easy way to get ahead in business.

**Planning: Choose Your Software**

The first thing you need to do is decide on the backbone that'll be running your helpdesk. The software that every member of your support staff relies on needs to be top-notch, reliable and offer the features that your specific business needs to do a stellar job.

If you're going to be running a call center, you'll need to take a different approach — tools from proprietary companies like Interactive Intelligence will prove useful.

If you're setting up a call center, you'll want to have an online ticketing system to complement it — many customers are averse to making calls for support these days — and there are plenty of options. From the free, open source to commercial solutions such, there's bound to be a package that suits the size and needs of your operation.

**Remote Assistance Solutions**

For web and tech businesses, a helpdesk that offers remote assistance should be a necessity. It allows support staff to achieve resolutions faster than ever before, removing the variable that is the customer's ability to follow instructions over the phone or by email.

**Knowledgebase & Canned Replies**

As anyone who runs a support helpdesk will tell you, the vast majority of support requests you will receive will be quite common — meaning that your team can drastically reduce response time by developing a set of canned replies that can be quickly personalized and sent off for most inquiries.

Most companies will have an idea of the questions that are most likely to pop up before the helpdesk is launched and can create an initial set of responses for these, but it's essential to monitor queries and look for trends. These trends can signal the need for a canned reply or knowledgebase article, or may be cause to look into having certain features simplified and made more easily apparent for the average user.

**Prioritization**

It's important to have a good prioritization system that support staff can use to judge the order in which tickets need to be dealt with based on a set of standards.

Tickets that have been in the system for too long should be dealt with first, and issues with payments are generally of much higher importance than issues with the technology itself. Dealing with people's money is always a sensitive issue.

**Reporting**

Setting up a helpdesk with robust reporting helps support managers to identify problems with your helpdesk and refine the approach. Are customers receiving responses in a timely fashion? Are their problems resolved in a timely fashion? Such metrics may speak to your management, the work ethic of your staff, or their effectiveness.

Good reporting will allow you to find problematic staff or issues that take longer to resolve than others across the board, even when your overall statistics are looking good. Constant iteration towards greater efficiency and effectiveness in every area of the helpdesk is vital to building a reputation for excellent customer service.

**Customer Feedback**

Customer feedback should be combined with reporting in reviews of your helpdesk's performance. There's a human aspect to the support experience that can't be captured by quantitative reports.

Perhaps your idea of a fast average response time conflicts with that of users. There are always customers who are unreasonable complainers, but a high volume of feedback of this nature is cause for concern and may require you to shift your expectations.

If your staff is reporting a resolution for a ticket but feedback indicates that the customer hasn't been satisfied, you need to look at that particular employee's approach to providing support.

What's most important to look for in customer feedback, however, is how they felt about your staff and their attitudes. Did they have a pleasant, welcoming experience where they felt staff were happy to solve their issue? Or did they feel that their support person was condescending — a common problem with those who have some sort of technological superiority complex?

The attitude of your support staff can sometimes be overlooked in business, and that's a big mistake. There are few better ways to develop loyal relationships with your users than by providing them with the best support experience of their life.

# Planning and providing staff training.

- Training is a process by means of which individuals acquire skills necessary to perform particular tasks.
- Includes the following:
    - Tasks.
    - Education.
    - Knowledge.
    - Mind set.

**The Purpose of training**

- Improve job performance.
- Helps to achieve personal goals.
- Increase skills inventories.
- Enhance ability to contribute to the organization.
- Money spent is money earned in its intangibility.

**Assessing training needs:**

- Should be based on assessments of first the existing staff and then the new staff.
- Bearing in mind new equipment, new standards and procedures if introduced by the management.
- Long term employees need refresher skills on equipment, automated systems and cross training.

**Approaches to training**

- On the job versus Off the job type.
- Structured Versus unstructured.
- Individual Versus group.
- Training methods.

**Training Methods**

- Lecture Demonstration
- Role Playing.
- Seminars
- Individual assignments.
- Field Trips.
- Case studies.
- Panels.
- Programmed Instruction.

**Location**

- On site or off site.
- Off site training is good for groups of individuals who are working in different sites to assemble at a common point.
- Managerial training should be done off site on in training rooms.
- While technical training should be done on site.

# Health & safety

### Emergency Procedures

- Know the emergency procedures for your workplace, memorize exit routes
- Know where fire extinguishers, first-aid kits, alarms, assembly points are located
- Locate master cut-off switch for power supply to computers

Working with computers for long periods of time can cause:

- Neck and Back Problems.
- Eyestrain.
- Repetitive Strain Injury (RSI)

#### Neck & Back Problems

Many computer users suffer serious back problems.  This is due to poor posture or an awkward position sitting at a desk/computer.

Solutions to Neck & Back Problems:

- An adjustable chair to avoid awkward posture.
- Sit with your back straight and head up.
- Use a footrest.

#### Eyestrain

Eyes can become strained after staring at a computer screen for a long time, particularly if working in bad light or with a flickering screen.

Solutions to Eyestrain:

- Take regular breaks – do not work for more than 1 hour at a time.
- Windows around you must have blinds to avoid glare from the sun.
- Have regular eye tests.

#### Repetitive Strain Injury

Repetitive Strain Injury (RSI) is damage to the fingers and wrists due to repeated movements over a long period of time e.g. keying letters into keyboard.

Solutions to RSI:

- Keep your elbows close to your sides.
- Use wrist rests and avoid bending your wrists.
- Take a break from typing per hour
- Use alternative technologies (e.g.  voice recognition)

# Chapter 12

## PC Security

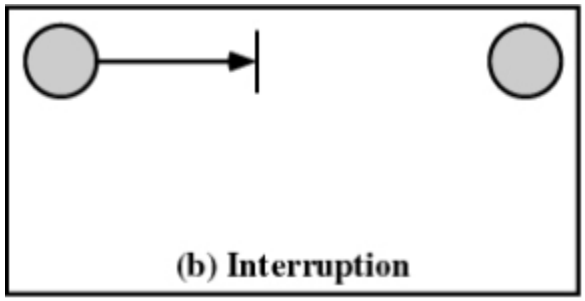
## Computer and Network Security Requirements

- **Confidentiality:** Requires information in a computer system only be accessible for reading by authorized parties
- **Integrity:** Assets can be modified by authorized parties only
- **Availability:** Assets be available to authorized parties
- **Authenticity:** Requires that a computer system be able to verify the identity of a user

## Types of Threats

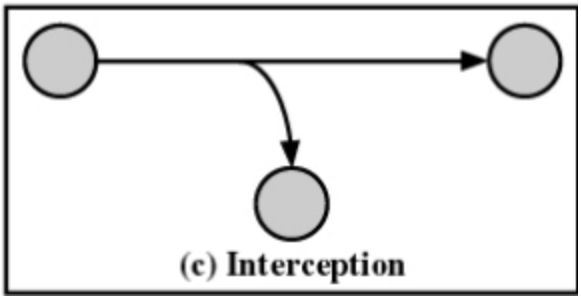
## a) Interruption

- An asset of the system is destroyed of becomes unavailable or unusable
- Attack on availability
- Destruction of hardware
- Cutting of a communication line
- Disabling the file management system



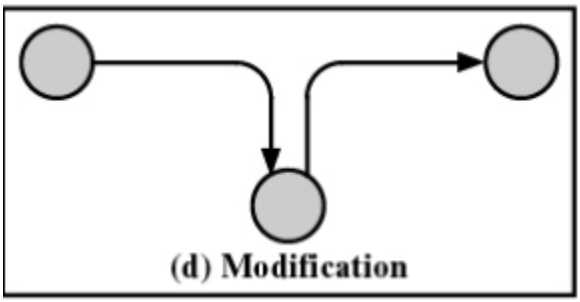

## b) Interception

- An unauthorized party gains access to an asset
- Attack on confidentiality
- Wiretapping to capture data in a network
- Illicit copying of files or programs



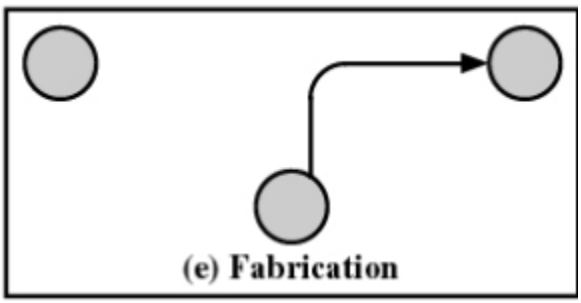

## c) Modification

- An unauthorized party not only gains access but tampers with an asset
- Attack on integrity
- Changing values in a data file
- Altering a program so that it performs differently
- Modifying the content of messages being transmitted in a network




## d) Fabrication

- An unauthorized party inserts counterfeit objects into the system
- Attack on authenticity
- Insertion of spurious messages in a network
- Addition of records to a file




# Computer System Assets

**Hardware**

- Threats include accidental and deliberate damage

**Software**

- Threats include deletion, alteration, damage
- Backups of the most recent versions can maintain high availability

**Data**

- Involves files
- Security concerns from availability, secrecy, and integrity
- Statistical analysis can lead to determination of individual information which threatens privacy

**Communication Lines and Networks – Passive Attacks**

- Release of message contents for a telephone conversion, an electronic mail message, and a transferred file are subject to these threats
- Traffic analysis
    - encryption masks the contents of what is transferred so even if obtained by someone, they would be unable to extract information

**Communication Lines and Networks – Active Attacks**

- Masquerade takes place when one entity pretends to be a different entity
- Replay involves the passive capture of a data unit and its subsequent retransmission to produce an unauthorized effect
- Modification of messages means that some portion of a legitimate message is altered, or that messages are delayed or reordered, to produce an unauthorized effect

**Communication Lines and Networks – Active Attacks**

- Modification of messages means that some portion of a legitimate message is altered, or that messages are delayed or reordered, to produce an unauthorized effect
- Denial of service prevents or inhibits the normal use or management of communications facilities
    - Disable network or overload it with messages

# Protection

**No protection**

- Sensitive procedures are run at separate times

**Isolation**

- Each process operates separately from other processes with no sharing or communication

**Share all or share nothing**

- Owner of an object declares it public or private

**Share via access limitation**

- Operating system checks the permissibility of each access by a specific user to a specific object
- Operating system acts as the guard

**Share via dynamic capabilities**

- Dynamic creation of sharing rights for objects

**Limit use of an object**

- Limit no only access to an object but also the use to which that object may be put
- Example: a user may be able to derive statistical summaries but not to determine specific data values

# Protection of Memory

- Security
- Ensure correct function of various processes that are active

# User-Oriented Access Control

**Log on**

- Requires both a user identifier (ID) and a password
- System only allows users to log on if the ID is known to the system and password associated with the ID is correct
- Users can reveal their password to others either intentionally or accidentally
- Hackers are skillful at guessing passwords
- ID/password file can be obtained

# Data-Oriented Access Control

- Associated with each user, there can be a user profile that specifies permissible operations and file accesses
- Operating system enforces these rules
- Database management system controls access to specific records or portions of records

## Access Matrix

**Subject:** An entity capable of accessing objects

**Objec**t: Anything to which access is controlled

**Access rights:** The way in which an object is accessed by a subject

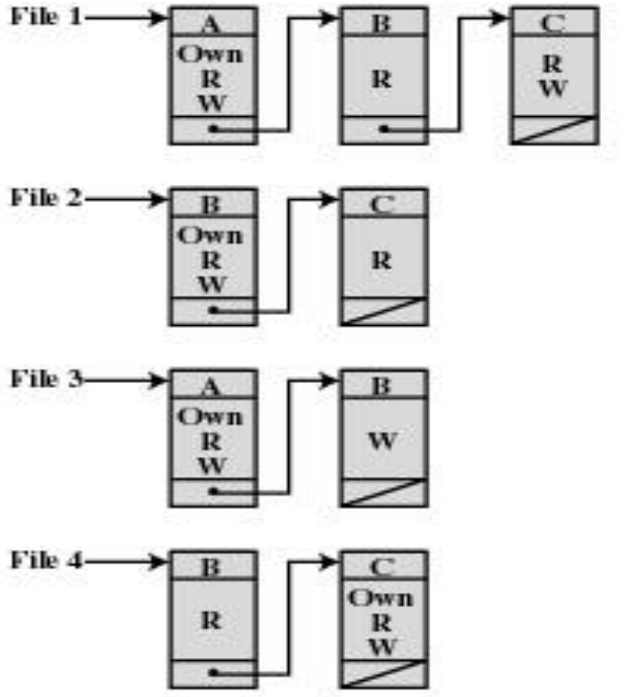
| | File 1 | File 2 | File 3 | File 4 | Account 1 | Account 2 |
|---|---|---|---|---|---|---|
| User A | Own<br>R<br>W | | Own<br>R<br>W | | Inquiry<br>Credit | |
| User B | R | Own<br>R<br>W | W | R | Inquiry<br>Debit | Inquiry<br>Credit |
| User C | R<br>W | R | | Own<br>R<br>W | | Inquiry<br>Debit |

(a) Access matrix

**Figure 15.4 Example of Access Control Structures**

## Access Control List

- Matrix decomposed by columns
- For each object, an access control list gives users and their permitted access rights

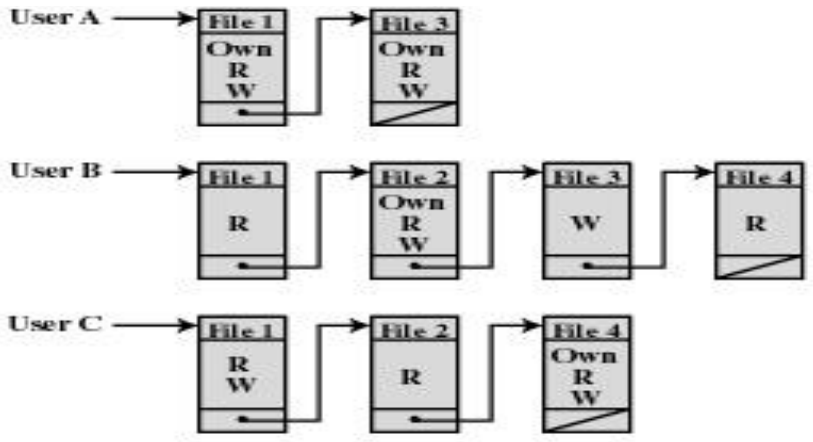



(b) Access control lists for files of part (a)

**Figure 15.4 Example of Access Control Structures**

## Capability Tickets

- Decomposition of access matrix by rows
- Specifies authorized object and operations for a user




(c) Capability lists for files of part (a)

**Figure 15.4 Example of Access Control Structures**

## Intrusion Techniques

- Objective of intruder is the gain access to the system or to increase the range of privileges accessible on a system
- Protected information that an intruder acquires is a password

## Techniques for Learning Passwords

- Try default password used with standard accounts shipped with computer
- Exhaustively try all short passwords
- Try words in dictionary or a list of likely passwords
- Collect information about users and use these items as passwords
- Try user's phone numbers, social security numbers, and room numbers
- Try all legitimate license plate numbers for this state
- Use a Trojan horse to bypass restrictions on access
- Tap the line between a remote user and the host system

## ID Provides Security

- Determines whether the user is authorized to gain access to a system
- Determines the privileges accorded to the user
  - Guest or anonymous accounts have mover limited privileges than others
- ID is used for discretionary access control
  - A user may grant permission to files to others by ID

## Password Selection Strategies

**Computer generated passwords**

- Users have difficulty remembering them
- Need to write it down
- Have history of poor acceptance

**Reactive password checking strategy**

- System periodically runs its own password cracker to find guessable passwords
- System cancels passwords that are guessed and notifies user
- Consumes resources to do this
- Hacker can use this on their own machine with a copy of the password file

**Proactive password checker**

- The system checks at the time of selection if the password is allowable
- With guidance from the system users can select memorable passwords that are difficult to guess

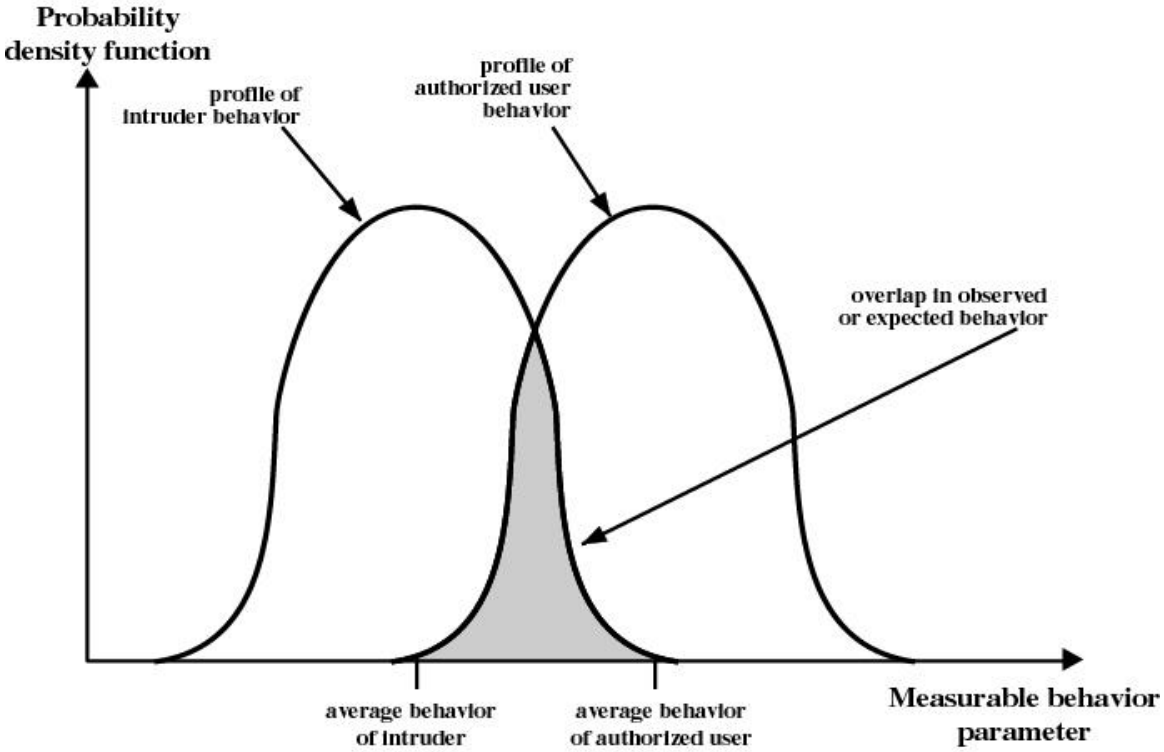



**Figure 15.6 Profiles of Behavior of Intruders and Authorized Users**

# Intrusion Detection

- Assume the behavior of the intruder differs from the legitimate user
- Statistical anomaly detection
  - Collect data related to the behavior of legitimate users over a period of time
  - Statistical tests are used to determine if the behavior is not legitimate behavior

- Rule-based detection
  - Rules are developed to detect deviation form previous usage pattern
  - Expert system searches for suspicious behavior
- Audit record
  - Native audit records
    - All operating systems include accounting software that collects information on user activity
  - Detection-specific audit records
    - Collection facility can be implemented that generates audit records containing only that information required by the intrusion detection system

# Malicious Programs

- Those that need a host program
  - Fragments of programs that cannot exist independently of some application program, utility, or system program
- Independent
  - Self-contained programs that can be scheduled and run by the operating system

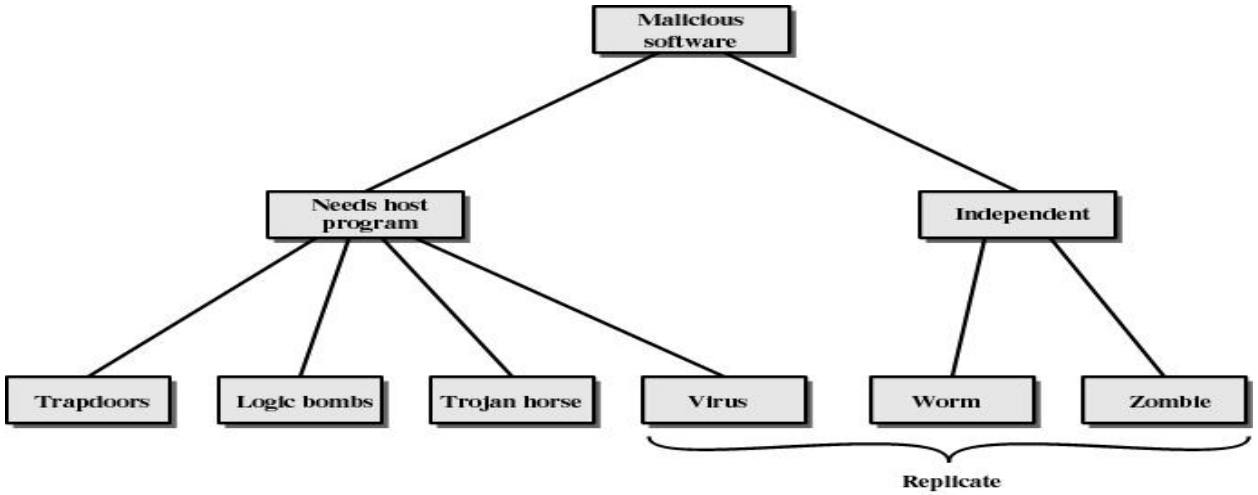



**Figure 15.7 Taxonomy of Malicious Programs**

# Trapdoor

- Entry point into a program that allows someone who is aware of trapdoor to gain access
- used by programmers to debug and test programs
  - Avoids necessary setup and authentication
  - Method to activate program if something wrong with authentication procedure

# Logic Bomb

- Code embedded in a legitimate program that is set to “explode” when certain conditions are met
  - Presence or absence of certain files
  - Particular day of the week
  - Particular user running application

# Trojan Horse

- Useful program that contains hidden code that when invoked performs some unwanted or harmful function
- Can be used to accomplish functions indirectly that an unauthorized user could not accomplish directly
  - User may set file permission so everyone has

# Viruses

- Program that can “infect” other programs by modifying them
  - Modification includes copy of virus program
  - The infected program can infect other programs

# Worms

- Use network connections to spread form system to system
- Electronic mail facility
  - A worm mails a copy of itself to other systems
- Remote execution capability
  - A worm executes a copy of itself on another system
- Remote log-in capability
  - A worm logs on to a remote system as a user and then uses commands to copy itself from one system to the other

# Zombie

- Program that secretly takes over another Internet-attached computer
- It uses that computer to launch attacks that are difficult to trace to the zombie’s creator

# Virus Stages

**Dormant phase**

- Virus is idle

**Propagation phase**

- Virus places an identical copy of itself into other programs or into certain system areas on the disk

**Triggering phase**

- Virus is activated to perform the function for which it was intended
- Caused by a variety of system events

**Execution phase**

- Function is performed

# Types of Viruses

**Parasitic**

- Attaches itself to executable files and replicates
- When the infected program is executed, it looks for other executables to infect

**Memory-resident**

- Lodges in main memory as part of a resident system program
- Once in memory, it infects every program that executes

**Boot sector**

- Infects boot record
- Spreads when system is booted from the disk containing the virus

**Stealth**

- Designed to hide itself form detection by antivirus software
- May use compression

**Polymorphic**

- Mutates with every infection, making detection by the "signature" of the virus impossible
- Mutation engine creates a random encryption key to encrypt the remainder of the virus
    - The key is stored with the virus

# Macro Viruses

- Platform independent
    - Most infect Microsoft Word
- Infect document, not executable portions of code
- Easily spread
- A macro is an executable program embedded in a word processing document or other type of file
- Autoexecuting macros in Word
    - Autoexecute
        - Executes when Word is started

- Automacro
  - Executes when defined event occurs such as opening or closing a document
- Command macro
  - Executed when user invokes a command (e.g., File Save)

# Antivirus Approaches

- Detection
- Identification
- Removal

# Generic Decryption

**CPU emulator:** Instructions in an executable file are interpreted by the emulator rather than the processor

**Virus signature scanner:** Scan target code looking for known

**Emulation control module:** Controls the execution of the target code

# Digital Immune System

- Developed by IBM
- Motivation has been the rising threat of Internet-based virus propagation
  - Integrated mail systems
  - Mobile-program system

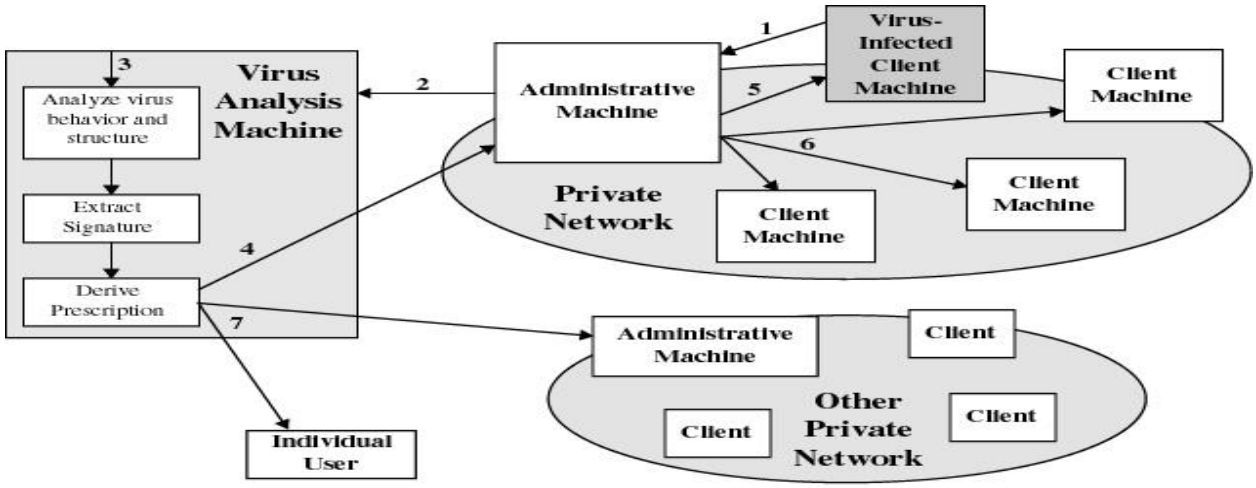



**Figure 15.8 Digital Immune System**

# E-mail Virus

- Activated when recipient opens the e-mail attachment
- Activated by open an e-mail that contains the virus
- Uses Visual Basic scripting language

- Propagates itself to all of the e-mail addresses known to the infected host

# Trusted Systems

- Multilevel security
  - Information organized into categories
  - No read up
    - Only read objects of a less or equal security level
  - No write down
    - Only write objects of greater or equal security level

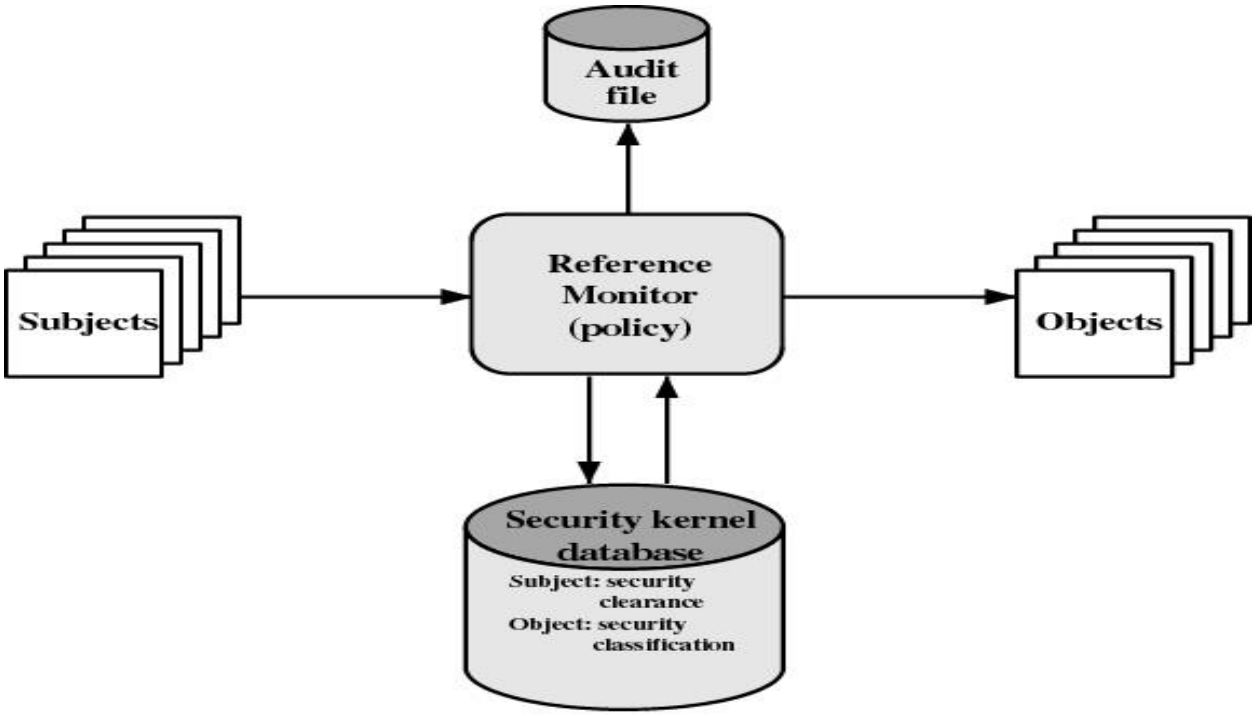
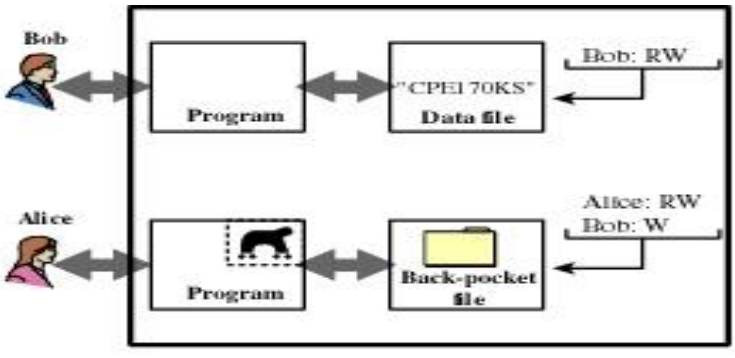



**Figure 15.9 Reference Monitor Concept**

# Trojan Horse Defense




(a)

**Figure 15.10 Trojan Horse and Secure Operating System**

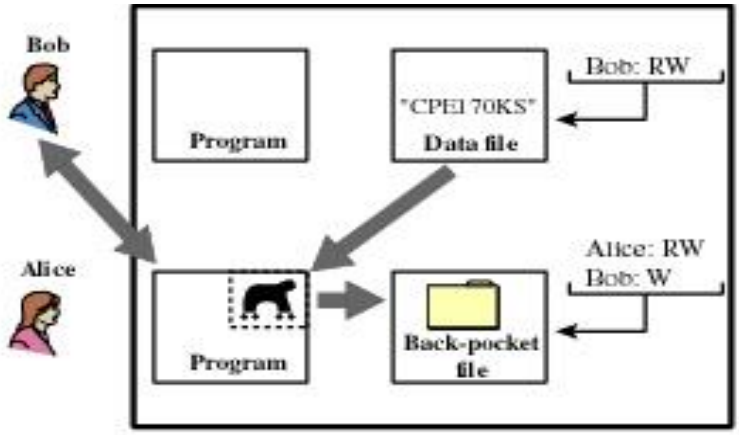



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**Figure 15.10 Trojan Horse and Secure Operating System**

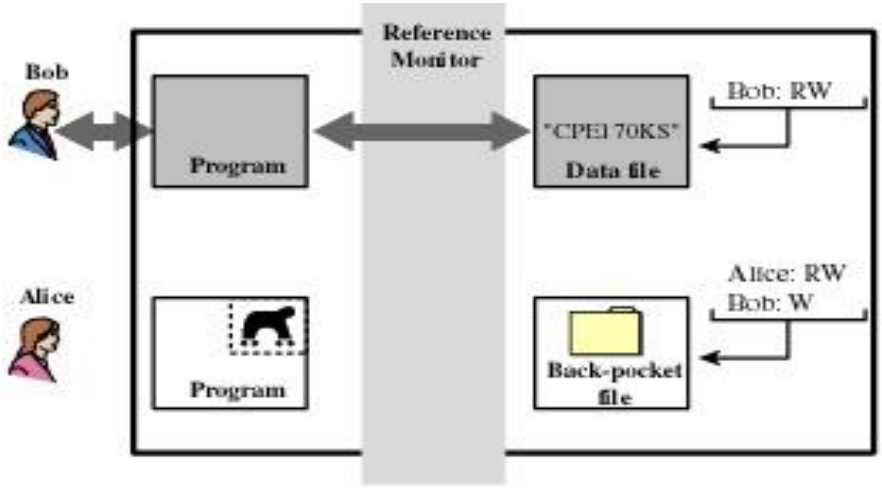


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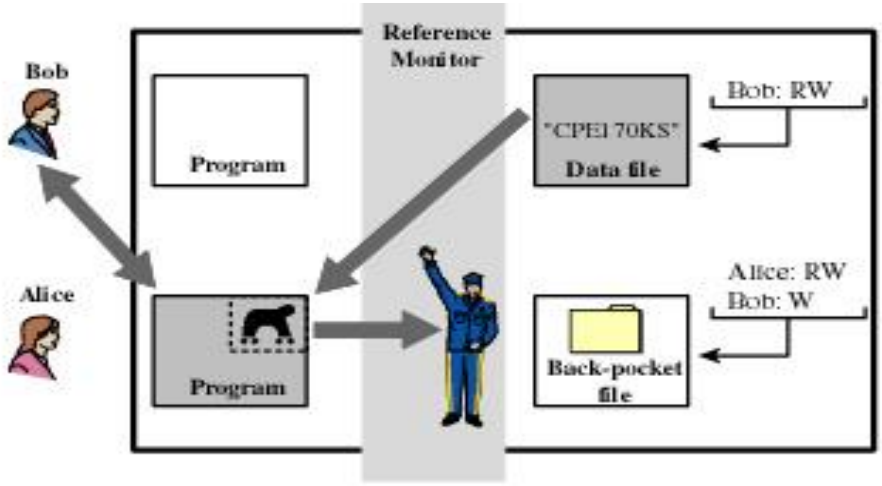
**Figure 15.10 Trojan Horse and Secure Operating System**




(d)

**Figure 15.10 Trojan Horse and Secure Operating System**

# Windows 2000 Security

**Access Control Scheme**

- Name/password
- Access token associated with each process object indicating privileges associated with a user

# Access Token

**Security ID:** Identifies a user uniquely across all the machines on the network (logon name)

**Group SIDs:** List of the groups to which this user belongs

**Privileges:** List of security-sensitive system services that this user may call

**Default owner:** If this process crates another object, this field specifies who the owner is

**Default ACL:** Initial list of protections applied to the objects that the user creates

# Security Descriptor

**Flags:** Defines type and contents of a security descriptor

**Owner:** Owner of the object can generally perform any action on the security descriptor

**System Access Control List (SACL):** Specifies what kinds of operations on the object should generate audit messages

**Discretionary Access Control List (DACL):** Determines which users and groups can access this object for which operations

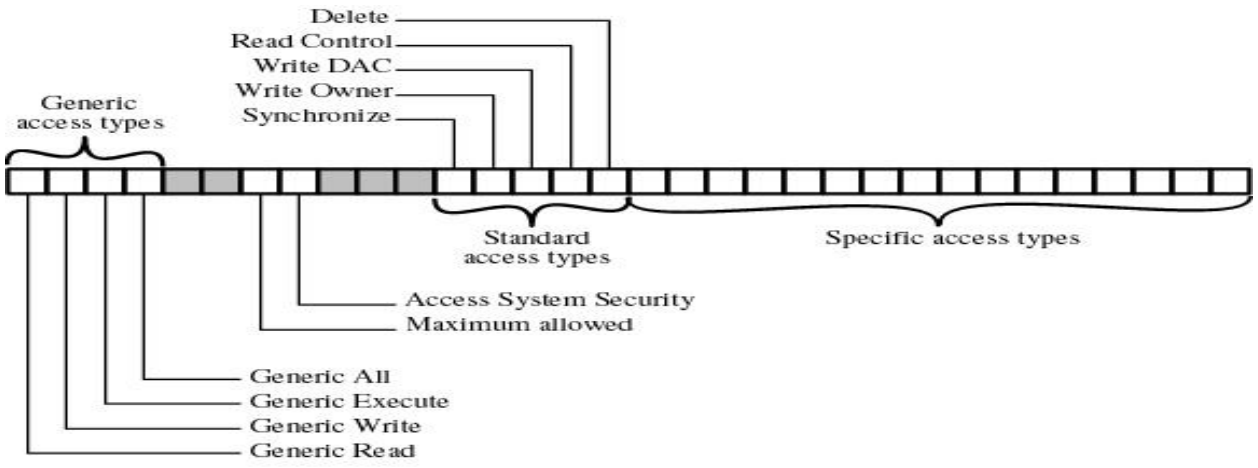



**Figure 15.12 Access Mask**

# CHAPTER 13

# SYSTEM SELECTION &ACQUISITION

## Factors for success

It’s good to know and realize how hard it is to succeed in selecting and acquiring the right system. This helps to put expectations into right place

There are various reasons why IS-projects fail but what helps to succeed in information systems projects?

- Management support
- Commitment and feedback from client and end-user
- Motivated and competent people working in the project
- Realistic goals
- Properly done requirements specifications
- Sufficient monitoring and guiding

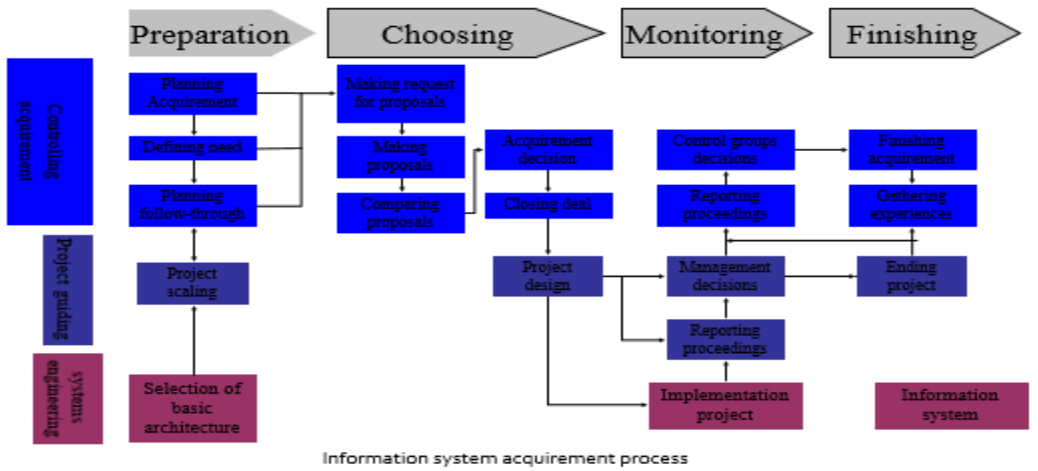
## Introduction

Acquisition & selection of the right system goes through the following 4 processes

**Main phases in the process**

- Preparation
- Choosing
- Monitoring
- Finishing

**Acquisition chart**




Information system acquirement process

**Preparation**

**The overview of acquiring information system**

- Strategic planning
- Planning of strategic goals for information technology (IT), organization's business activities strategies and operational activities of a company
- In larger companies strategic plans are usually checked in 1-2 year periods and many times IS-projects are launched from these plans.

**Yearly plans**

- Budgeting for development projects
- More specific plans on goals and business activities regarding IT

**Changing organizational functions**

- Every IS-project mean a change in the way things have been done before and may require large organizational changes

# The overview of acquiring information system

Preparing to IS project investments: -This takes significant part of managements time and interest

- Choosing between readymade system and tailored system
- Readymade system benefits
  - ✓ Possibility to reduce costs if suitable system is found
  - ✓ Existing references and support functions
  - ✓ continuous development of system
  - ✓ Usually better documentation
  - ✓ Fast implementation
  - ✓ Less testing needed
  - ✓ Functions that were not thought about but are useful
- Readymade system downsides
  - ✓ Costs start to increase if tailoring has to be done
  - ✓ Maintenance costs may become significant because version upgrades etc.
  - ✓ TCO (total cost of ownership) costs should be considered and possibly contact references in order to find out hidden costs
  - ✓ Dependency on vendor
  - ✓ People have to adapt to system, the system is not made to people
- systems development
  - ✓ answers to specific needs of client
  - ✓ unique, more competition has more difficulties to copy new functions and ideas

- ✓ Also compatibility to customers infrastructure, culture and standards should be checked, integrating to existing systems might be difficult
- ✓ systems development models (waterfall model etc.) are usually chosen by system vendor but client should verify that documentation is made with common notations (UML etc.) and that requirements specifications and planning is done carefully enough
- ✓ testing and support is possibly inadequate
- ✓ Acquiring hardware and services

- Leasing of hardware and outsourcing the maintenance should be considered

## Preparing the acquirement

- The bigger the system more careful planning it needs
- Planning of acquiring is very important to the success of the project. Most important part of planning is requirements specifications
- Resources invested in planning mostly pay multiple times themselves back in later phases of the project
- Why? Business case
  - Goals
  - Costs vs. profits
    - swot-analyses
  - How to measure success or failure of project

- What? Solution
  - Description of system, problem or need
  - Outlining acquirements borders
- How? Leading the project through
  - Scheduling, phases and decision points
  - Resourcing of project
  - Buy or make IS? How to choose a vendor?
  - Project management, who, when, how?
  - Managing documents from project and project documentation
  - Problem solving, responsibilities, criterion for ending the project
- Acquirement plan
  - Plan is based on scheduling and phasing of project

- Schedule needs flexibility even if it is very detailed, progress of the whole project cannot be delayed because of one little detail. Also alternative routes to finishing project in problem situations should be considered and planned
- Testing should be considered already at this point incase testing needs special arrangements:
  - Partners and other outer parties involved
  - Is infrastructure sufficient?

# Describing the need

- As part of acquirement plan, the need for acquirement is defined into need of change of present situation
- Benefits have to be bigger than costs, unless the change is forced in example because of changes in laws etc.
- It's best to do requirement specification as detailed as possible before choosing the supplier of IS.
- Expectations for the results of the project may differ, so mutual vision of final product with every participating party should be accomplished through communication

# Goals, costs and benefits

- Many companies define that IT-investments should return the investment (TCO) back in 2-3 years' time including interests
- Usually investments are big in early stages but benefits grow in the late stages of product lifetime
- Investment calculation
  - Divides into one-time investments
    - Licencies
    - hardware
    - bought services (installations etc.)
    - training of own employees
    - own one-time project work
  - and continuous investments
    - maintenance
    - leasing payments
    - help-desk services
- If requirements of system has been done thoroughly enough it is possible to evaluate the costs, using functional size measurement (FSM) combined into databases of past experiences. There are public databases and privately owned databases, a few companies have their own.
- Function points are used as metrics for size in FSM

- To count function points, for example use cases, data model and outer ”links” of the system should be modeled
- Examples of benefits:
    - Reducing costs in material and/or personnel costs
    - Increases in sales
    - Competitive advantage
    - All benefits cant be measured in money, because all requirements are not quantitative and neither are their benefits
- Decision making criterion
    - At this point main criterions which are needed for acquiring decision regarding vendor and system are represented
- Also choice of letting present situation continue should be considered

**Scheduling and phases**

- The whole project is divided into continuous phases, phases are marked into a schedule, between phases are decision points where decision on moving to next stage is made
- Depending on phasing model the phases may differ
    - models:
        - Waterfall model
        - Iterative phasing
        - incremental phasing
        - etc.

# Architecture

- Technical architecture of IS here means for example
    - Operating system
    - Database system
    - Programming languages
    - Etc.
- Choosing technical architecture depends on:
    - existing architecture and IS´s
    - infrastructure
    - resources and services available
    - Functional requirements

# Software components

- Markets for readymade software components that can be reasonably easily integrated into a system are not developed.
- There are problems with immaterial and copyright issues.
- How is future development handled on the part of bought component (especially in case of bankruptcy of vendor)

# Services required

- Responsibilities and work should be divided in a written contract between vendor and customer
- Requirements management can be made by own employees, vendor or outside consultant. This is very important part of project and should be carefully considered between options. Even in case of readymade system requirements specifications has to be made.
- Outside consultant can be very helpful in:
    - choosing vendor
    - making requirements specifications
    - investigating market for readymade software or components
    - planning testing and approval of final product
    - helping communication between client and vendor

# Acquirement policy

- In most cases call for bids is arranged after decision of using a vendor. It takes time and resources but is the only effective way of making sure that vendor and the price is right
- In acquirement plan communication and process of dealing with vendors should be stated. How informing contestants and communication is dealt, e-mail, written letter, fax, etc. What is the timetable and how answers are supposed to be sent.
- Many companies have ”IT-partners” as a regular vendor, but these companies should also be compared to others
- Pricing can be by the hour or as a whole sum for the project. Some newer model combine these two
- Contract policy should be stated in the acquirement plan, it´s possible to use IT2000 or other contract models as a core for the contract
- Contract flexibility should also be stated. which are the things that are necessities and which are optional, these constrains should be mentioned also in request for proposal
- Acquirement plan should also tell which standards are used in the project.

# Acquirement organization

- Client should be ready to allocate enough resources for use of vendors who wish to clarify issues from request for proposal. These persons need to have enough technical competence and business understanding to answer the questions.
- acquirement organization should be shown as part of acquirement plan and it should show:
    - who prepares and executes the choosing process
    - Who makes the acquirement decision
    - Who participate in execution, controlling, steering and finishing of the project
- Acquirement organization must have the authority to make decisions it needs

# Controlling the whole acquirement

- Responsible people and units for controlling and preparing the decisions have to be named
- A deciding group should be formed of technical and business professionals and a project manager should be appointed to lead the group
- A deciding group is not necessarily the same as project team who handle the implementation
- A steering group is formed of business and information management professionals
- Decision for acquiring is made by the responsible party in organization, basing the decision on recommendations by deciding group, steering group and management group
- Each project reports proceeding of project to steering group
- Project is formed of project group and management group, both have members from client and vendor. Project group reports to management group.
- In small projects management group and steering group can be the same
- A steering group is formed of business and information management professionals
- Decision for acquiring is made by the responsible party in organization, basing the decision on recommendations by deciding group, steering group and management group
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- In small projects management group and steering group can be the same

# Project management procedure

- Management procedure of project should described for example:
    - controlling resources (estimated and used hours and money)
    - controlling schedule
    - controlling other quality issues

- documenting plan
- problem and risk management
- support and quality control plans
- publicity plan
- criteria for canceling the project

# Problem and risk management procedure

- Risk analysis is used to supplement SWOT-analysis
- In risk analysis threats to accomplishing the goals of a project, evaluation of probability and criticality of risks and measures to minimize effects of risks are researched
- Risk analysis should be done several times in a project
- In next list there are examples of risks that can be noticed in acquirement planning and decision

**Examples of risks**

| | |
|---|---|
| Business risks | ❖ Planned change cannot be implemented<br>❖ Needs or settings of business are changed<br>❖ Needs of business actions are not known well enough |
| Risks involving the complexity of project | ❖ Project is big<br>❖ Project is on territory of several organizational units<br>❖ Project needs uniting of several different skills<br>❖ Requirements for security and usability are high<br>❖ Project has several simultaneous phases<br>❖ Project is not enough well phased<br>❖ Project is dependent of results of other projects<br>❖ Success depends on synchronizing the operations of outside organizations<br>❖ Success needs combining of different business cultures |
| Human resource involved risks | ❖ Technology used, operating area, methods and working habits are known poorly<br>❖ Little experience on project work or project leading<br>❖ Poorly motivated and committed users<br>❖ Users are inexperienced on technology and its implementing, testing and training<br>❖ Management is not committed to project<br>❖ Project members do not have enough time<br>❖ Expected changes in personnel in project members during project |

| | |
|---|---|
| Risks in implemented technology | ❖ New and untested technology<br>❖ Unestablished technology<br>❖ Scaling of capacity is unsuccessful<br>❖ Peripherals, computers, software has to be tailored a lot |
| Risks involving clients, partners and vendors | ❖ Vendor or partner is not financially solid or is wrong size compared to project<br>❖ Vendor or partner does not have time for this project<br>❖ Many partners in one project<br>❖ Responsibilities and who does what is not clear on contract<br>❖ Effects on clients functions are not known |
| Risks in project management | ❖ Poor project culture: Project management processes and techniques are on poor level<br>❖ Project manager or project member are not familiar with and/or do not use the newest techniques and instruments<br>❖ During project lots of demands for changes arise<br>❖ Management or steeringgroup is too big and unefficient |
| Risks involving outcome of the project | ❖ Risks of using the projects outcome has not been analysed properly<br>❖ Reactions of clients, users, etc. are stronger and more negative than expected<br>❖ Outcome of project is too difficult to use<br>❖ Outcome of project is not flexible enough<br>❖ Technology becomes too old-fashioned before the end of products economiclife-cycle<br>❖ Availability and continuing of maintenance and support is unsure<br>❖ Security of information is not adequate<br>❖ Currency rates, evolving of prices or taxation becomes uneconomic |

# Choosing

- Choosing solution and vendor
  - Making request for proposal
  - Comparing proposals
  - Decision
  - Contract
  - Preliminary project plan

# Starting choosing process

- Before beginning choosing process one should check that acquirement plan is made properly and that requirements specifications are done thoroughly
- It´s important to consider choosing as a project with beginning, goals, results, schedule etc.
- Choosing group is ideal with 3-6 persons who have knowledge about buying, project work, technical and methodological knowledge about IS projects and business point of view

# Group that chooses vendor

- Knowledge about buying process
- Knowledge about evaluation of solution requirements, knowledge about functional, technical and quality requirements and features
- Knowledge about software projects and systems development for estimating project plans schedule and costs
- Evaluation of prices and charging requires economical and investment knowledge as well as knowledge about market prices, cheapest is probably not the best solution, also vendor should have some knowledge of background of a client

# Call for bids

- Call for bids is based on acquirement plan, some parts of acquirement plan are described more specifically, especially evaluation procedure of vendors and proposals
- Should be short and compact, bigger totalities should be presented in appendixes as well as parts that are not as important
- It´s important to prepare the call for bids well, because it determines the quality of proposals one is about to receive
- Non-disclosure agreement (NDA) should be made if there is information that company wishes not to be public

# Call for bids

- If a company receives many proposals it is reasonable to make rounds of calls for bids, after every round some of possible vendors are dropped from next round. Usually it is polite to have more specific proposals in the later rounds so that as little extra work as possible is made
- General view of call for bids should be done first
    - Background, need and target of acquirement
    - Goals of acquirement, how functionality of acquirement is linked to needs of change
    - Acquirements interest group are the parties that are involved in using the final product and who are involved in the project
    - Constrains are things that are not included in acquisition
- Functional requirements are modelled as use cases,  processes of functions, ÉR-model and contacts with other systems, also frequency and volume data can be displayed
- Requirements of quality. ISO 9126  divides quality of software systems into 6 parts:
    - Functionality
    - Reliability
    - Usability
    - Efficiency

        - Maintainability
        - Portability
- Other technical requirements display the different technical surroundings and environments that the solution is build in and where it needs to work (databases, programming languages etc.)

# Phasing, scheduling and responsibilities

- Typically systems development model is used in phasing the project
- In call for bids there is schedule where important dates are, when will the bid have to be in, when decision is made, when the kick-off meeting for project is and when IS should be ready for use
- Project members are probably the most important factor to the success of project, especially project leader is important, there for it is recommended to ask the vendor to show CV:s of the project members

# Contract terms

- Written contract can be validated by lawyers or experienced person who used to make contracts
- It's possible to use IT2000 model for contracts, or use the model from vendor
- Payments should phased with project phasing so that vendors interest is to get phases ready to be paid for them, it's also reasonable to define a warranty sum which is paid after the warranty time is over
- It´s also wise to determine the costs of maintenance and owner of source code at the contract
- Also issues of copyright have to be checked if used ready-made software or components as part of system

# Pricing

- It's possible to use different pricing models:
    - Pricing by the hour
        - Risk is mainly on client
    - Pricing by contract
        - Risk is mainly on vendor
    - Pricing by sharing risks
        - Vendor represents an estimate from hours needed to finish the project and the costs for it. If the the hours are not enough to complete the project the next hours are much cheaper. A certain max sum can be set. There have to be a way for both parties to control the working hours needed for project. If all the hours are not needed the difference can be given to project members as a motivational bonus
- Pricing by function points
        - In call for bids the "size" of project is represented and it is asked to give price per function point

- The positive side of this model for vendor is that changes of system will be priced automatically, for client this reduces the risks because the vendor is committed to certain price per point
- Also a effective tool for change management because the price of each change is easily calculated

# Requirements for vendors

- Most important requirements for vendors are
  - financial state of vendor
  - references of vendor
  - using of sub-contractors
- These requirements save time and resources, if a vendor does not meet the criteria they don´t make the bid or bid is easy to drop out

# Criteria for evaluation

- Criterions on which the vendor and their solution is evaluated by is listed and described in call for bids
  - criterions have different value to decision
  - unconditional criterions, failing these leads to disqualification
  - Arguments on reasons for different values of criterions
  - Keeping the right to disqualify all bids

# Instructions for bids

- Scheduling following phases:
  - more detailed questions and answers about IS
  - How will the bids be handled with client
  - When is it possible to get more information about selection, how and when do they want more info
  - When will the first bid round end and how is it informed
- How long does offer have to be valid
- Its recommended to give specific form for bid to vendors to fulfill to help comparison of bids

# Comparing bids

- Bids are evaluated first separately
  - the best offers will be taken to next round (comparing more than three is difficult)

- Then bids are evaluated together and compared to each other, this also may mean new more explicit call for bids for the chosen ones or winner might be chosen through negotiations and more specific evaluation of bids
- Giving points
    - Each member of group that chooses vendor gives points to his/hers special knowledge area, after each part of each bid has been thoroughly evaluated the group together decides the points given to the certain answer
    - Points will be put into a chart where bids can be evaluated simultaneously
- After finalists are clear they should be met face to face in order to find out compatibility of habits and organizations, how easy or hard it would be to work together

# Objectives of evaluation in bids

- Organization of vendor
- Vendors view on acquisition
- Offered solutions and services
- Implementation plan
- Project organization and plans
- Prices
- Terms of contract
- Terms of payment and schedule of payment
- Availability of maintenance
- Copyright and source code issues
- Warranty

# Possible problems in comparison

- Functional specifications are not done well enough
- Bids are non-comparable
    - Maybe tactic of vendor to try to underline good sides of own solution
    - Most often is result for call for bids which is not made properly or is contradicted or not enough specific
    - Missing of choosing criterion
    - Wrong people in group that chooses the vendor
    - Hidden costs
    - Effect of emotions in choosing
    - Lack of ability to see the big picture

- Too much value on points given for bid
- Foreign vendors

# Making acquirement decision

- Confirms the vendor which had a best bid
- Decides that investment is worth doing
- Argumentation of acquirement
- Checking investment calculations
- Confirming schedule and phasing
- Confirming funding
- Notifying results to all parties involved in process

# Monitoring

- Audits on progress of project should be held with project group and steering group at steady pace
- In planned decision points the results of phases are accepted
- In project group, steering group and management group changes to project are discussed and decided
- Management group is leading the project

# Finishing

- On finishing phase conclusion on acquirement and project are compiled and restored for future learning processes
- Project manager writes final report on project, then the report is compared to original project plan
- It´s important to learn from what was done right and what went wrong
- Management group verifies the final report
- Functions of company should be adjusted to new circumstances as rapidly as possible to fully benefit from the new IS

# CHAPTER 14:

# EMERGING TRENDS IN ICT

1. **Software –as-a-Service (SaaS)** – Delivery model for software in which yo pay for software on a pay-per-use basis instead of buying the software outright.

- Use any device anywhere to do anything
- Pay a small fee and store files on the web
- Access those files later with your " regular" computer
- Makes use of an application service provider

2. **Push, not pull, technologies and personalization**

We live in "pull" environment i.e you visit websites and request for information about products and services. The future is "push " environment in which businesses come to you with products and services based on your profile. Businesses will know so much about you that they can tailor and customize offerings.

3. **F2b2C – Factory-to-business-to-consumer.**

A consumer communicates through a business on the Internet and directly provides product specifications to a factory that makes the customized and personalized product to the consumer's specifications and then ships it directly to the consumer.

- The business (small b) is only an intermediary between the consumer (capital C) and the factory (capital F)
- A form of disintermediation
- Disintermediation - the use of the Internet as a delivery vehicle, whereby intermediate players in a distribution channel can be bypassed

4. **Physiological Interaction**

Now, you use keyboards, mice, and the like. These are physical interfaces

Physiological interfaces will actually capture and use your real body characteristics

- Voice
- Iris scan
- And the like

5. **Immortal Avatars**

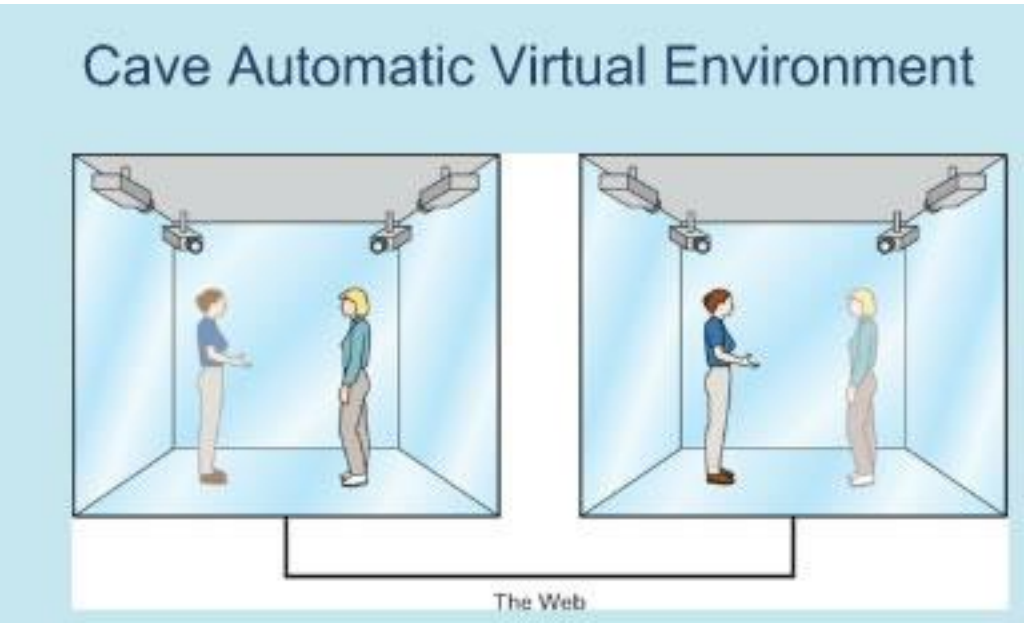
Imagine speaking to your great, great, great grandchildren about the wonders of the 21st century long after your physical body has decomposed!!

6. **Ubiquitous Computing**

Connecting everything to the web and monitoring of house pets, plants, operation of appliances.


7. **Cave Automatic Virtual Environment**

- **Cave automatic virtual environment (CAVE)** - special 3-D virtual reality room that can display images of people and objects in other CAVEs
- These are holographic devices
- Holographic device - creates, captures, and/or displays images in 3-D form




Possible Application of CAVE

- Visit friends and family without getting on an airplane
- Customer service - the agent will appear next to you when you make a call
- The possibilities are limitless

## 8. Virtual Reality

***Virtual reality*** - three-dimensional computer simulation in which you actively and physically participate

- Uses 3 unique devices
  - Glove
  - Headset
  - Walker

*Glove* - input device; captures movement and strength of your hands and fingers

*Headset* (head-mounted display) - I/O device; captures your head movement; screen covers your field of vision

*Walker*- input device; captures movement of your feet as you walk or turn

Virtual Reality Applications

Matsushita - design your own virtual kitchen

Volvo - demonstrate car safety features

Airlines - train pilots for adverse weather conditions

Motorola - train assembly line workers

Health care - train doctors in surgery on virtual cadavers.

## 9. Biometrics

Biometrics - the use of physiological characteristics - fingerprint, iris, voice sound, and even breath - to provide identification

That's the narrow definition

Can also create custom-fitting clothes using biometrics

**Biometric Security**

Best security is 3-step

- What you know (password)
- What you have (card of some sort)
- Who you are (biometric)

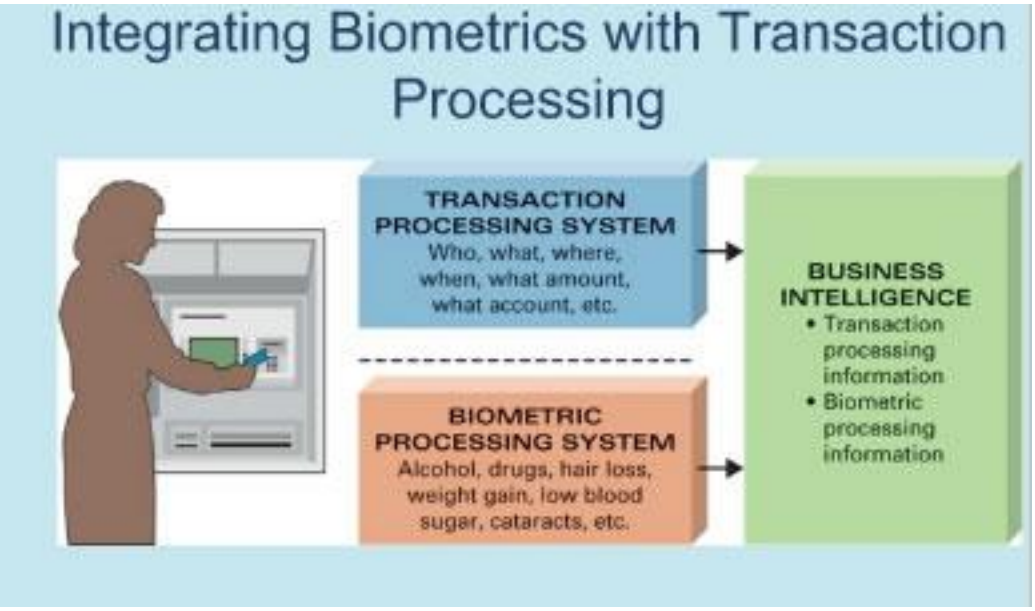
Today's systems (ATMs for example) use only the first two. One reason why identity theft is so high.

**Integrating Biometrics with Transaction Processing**

TPS - captures events of a transaction

Biometric processing system - captures information about you, perhaps...

- Weight loss
- Pregnancy
- Use of drugs
- Alcohol level
- Vitamin deficiencies




- Is this ethical?
- Can banks use ATMs and determine if you've been drinking?
- How will businesses of the future use biometric information? Ethically? Or otherwise?