

COMPUTER HARDWARE Text Book

Intermediate Vocational Course - Ist Year

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Year 2005

PREFACE

This book has been written according to syllabus of Intermediate Vocational Course. This subject has been divided into 5 units which in turn are again divided into chapters to present details, suitable illustrations and exercises are also included.

Constructive criticism and suggestion are invited from students, teachers and readers of this book for the improvement of the standard of the book. I extend my thanks to Mr.B.Anjan Kumar Hardware Eng MIPGS for his co-operation in bringing out this book

INDEX

	PAGENOS
1. Hardware Fundamentals	
Ch 1 Identifying Components & their use	1-10
Ch 2 Measuring Voltages at different levels	11-14
2. Motherboards and their related components	
Ch 1 Motherboards	15-25
Ch 2 Ports	26-37
3. Bios & CMOS	
Ch 1 Bios & CMOS	38-41
Ch 2 Bios features & Configuration	42-52
4. Operating Systems	
Ch 1 Installing different Operating Systems like DOS & Windows	53-59
Ch 2 Troubleshooting through Software	60-64
5. Antivirus Software	
Ch 1 Viruses	65-71
Ch 2 Installation of Norton Antivirus	72-84
Ch 3 Recovery of System through Antivirus Patches	85-88

Name : Identifying components and their use

1.1.1 What is a computer?

The term computer is used to describe a device made up of electronic and electro mechanical components. The computer itself cannot perform any task and is referred to as hardware.

A computer system consists of three elements.



Fig 1.1.1 Components of a Computer System

1. Hardware
2. Software
3. People

Hardware : The physical components which you can see, touch and feel in the computer system are called hardware Eg monitor, keyboard, mouse etc.

Software : Software is used to describe the instructions that tells the computer how to perform a task. Software is categorized

- 1) System softwares (eg . operating systems, compilers, editors etc)
- 2) Application softwares (MS-word, excel, accounting packages etc)

People : People who operate the computer and also create computer software instructions.

1.1.2 Computer hardware

Basic components in a computer system are central processing unit (CPU), memory, the input device and output device.

Computer systems – Micros, Minis and Mainframes.

Micro computer : Micro computer is also called as personal computer or PC. It has a processor based on a single silicon chip. Personal computers come in three different physical sizes, pocket pc's, lap pc's and desktop pc's. Pocket pc's and lap pc's belong to portable category. Microcomputer is used in small businesses.

Ex : IBM compatible or IBM clone and Apple Macintosh systems.

Multiuser microcomputers. Until recently microcomputers were personal computers for individual use only. But now days several microcomputers can be networked together for simultaneous used by several people.

Mini computers: Mini computer is simply a small mainframe computer. It is a reduced version of mainframe. Attached printers are not so fast. So it has less storage capacity less processing speed of that of mainframe computers. They are usually used by small businesses. For example research groups, engineering firms, colleges etc. use mini computers.

Mainframe computers: A mainframe computer is a large expensive machine whose processing speed is very high and has large amount of secondary storage and fast printers. A large mainframe computer may be used to meet the data processing requirements of the entire organization.

Examples: airline booking systems, Railway booking systems , weather forecast etc.

1.1.3 System types

We can classify systems into the following categories :

8-bit, example : 8085 microprocessor

16-bit, example : 8086, 286, 386 processor

32-bit , example : 486

64-bit, example : Pentium - II

This gives us two basic system types or classes of hardware.

8-bit (PC/XT) class systems

16/32/64 (AT) class systems

Name : Identifying components and their use

PC stands for personal computers, XT stands for eXTended PC, and AT stands for an advance technology PC.

The XT basically was a PC system that included a hard disk for storage in addition to the floppy drive found in the basic PC system. These systems has an 8-bit processor and an 8-bit INDUSTRY STANDARD ARCHITECTURE (ISA) bus for system expansion. Bus is the name given to expansion slots in which additional plug in circuit board can be installed.

16-bit and greater systems are said to be AT class. 16-bit (and latter 32 and 64 bit) processors and expansion slots are included. The first AT class systems had a 16-bit version of the ISA bus which is an extension of the original 8-bit ISA bus found in the PC/XT class systems. Afterwards several expansion slots were developed for AT class systems.

Example

16/32 bit PS/2 microchannel architecture (MCA) bus.

16-bit PC card (PCMCIA) bus

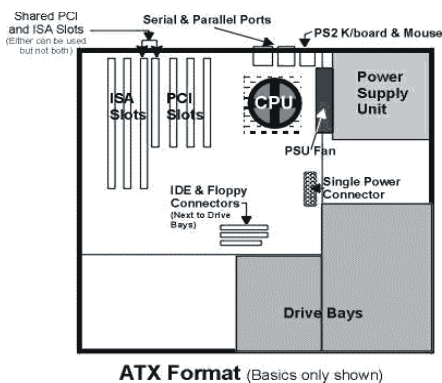


Fig 1.1.2 ATX Format



Fig 1.1.3 PS/2 Port

16 bit ISA bus

16/32 bit Extended ISA(EISA) bus

32/64 - bit card Peripheral Component Interconnect (PCI) bus.

The easiest way to identify a PC/XT system is by the 8-bit ISA expansion slots regardless of the processor present in the system. AT systems can be similarly identified by having 16-bit or greater slots of any type (ISA, EISA, PCI) slots.

1.1.4 System components

Component needed to assemble a basic modern PC system.

- ❖ Motherboard
- ❖ Processor
- ❖ Memory (Primary)
- ❖ Hard disk
- ❖ CD-ROM
- ❖ Floppy Drive
- ❖ Keyboard
- ❖ Mouse
- ❖ Monitor
- ❖ Power Supply
- ❖ Cabinet

Motherboard : motherboard is the important component of the computer as everything else is connected to it. And it controls everything in the system. Motherboard are available in several different shapes.

Motherboard usually contain the following individual components.

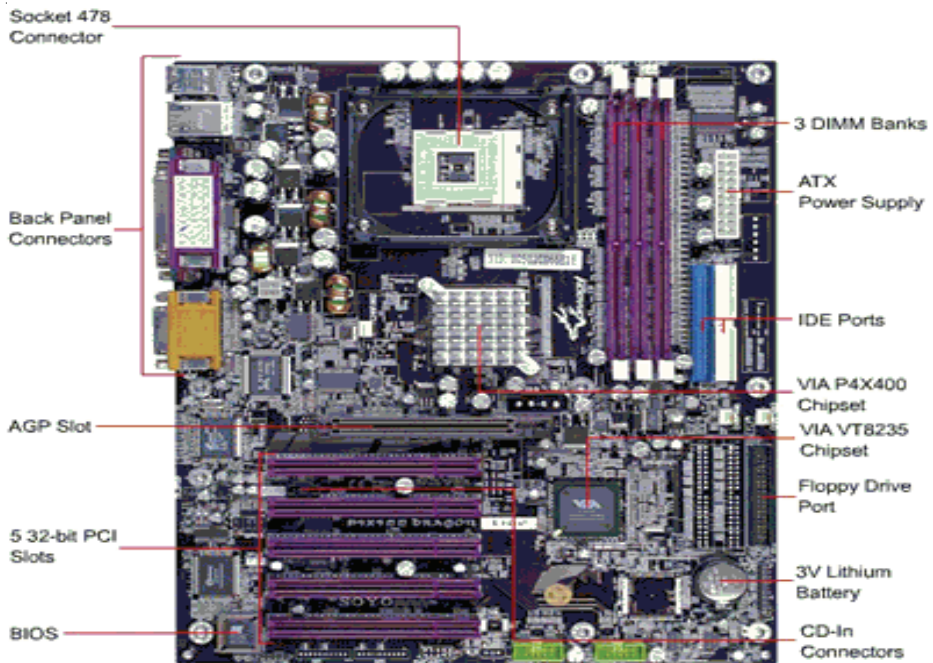


Fig 1.1.4 Motherboard

Name : Identifying components and their use

- 1) Processor slot
- 2) Processor voltage regulators
- 3) Motherboard chipset
- 4) Level 2 cache
- 5) Memory SIMM or DIMM sockets
- 6) Bus slots
- 7) ROM BIOS
- 8) Clock / CMOS battery
- 9) Super I/O chips

Processor



Fig 1.1.5 Processor Chips

The processor is often thought of as the engine of the computer. Then the processor reads the commands from the memory and then executes them. The processor is one of the most expensive parts of the computers and is also one of the smallest parts.

Primary Memory



Fig 1.1.6 Memory Chips

Memory : Is used to hold programs and data during execution.

Primary memory is often called as RAM(Random Access Memory). It holds all the programs and data the processor is using at a given time. RAM is volatile because its contents are erased when power is switched off.

The other type of system memory is ROM(Read only Memory)which is permanent because its contents are not erased even when power is switched off. It is usually used to load an operating system.

Hard disk drive



Fig 1.1.7 Hard Disk Drive

A hard drive consists of spinning platters made up of aluminum or ceramic that is coated with magnetic media. The platters come in various sizes. The hard drive with many different storage capacities can be created depending upon the density, size and number of platters.

This is also called as Secondary memory. There can be several programs in the system, which cannot be stored in RAM, so we need a very huge non-volatile memory, which can be used for storing all the programs, and data when the system is not in use are called as Hard disks.

CD-ROM drive



Fig 1.1.8 CDROM Drive

CD-ROM stands for compact disk read only memory. It consists of small disks similar to the gramophone records to hold digital information. As the name applies they are read only medium. With the advancement in technology writable CD's are also available.

Floppy Disk Drive



Fig 1.1.9 Floppy Disk Drive

Floppy disks are the slowest and the smallest form of secondary storage. They provide a simple way to carry information from one place to another, and backup small amount of files. In modern days floppy drive component is not as important as it was years ago. All PC's made in the last 10 years use a standard 3 1/2 inch, 1.44 MB capacity floppy drive.

Keyboard

Fig 1.1.10 Keyboard

The keyboard is the main input device for most computers. It is used to input text or enter commands into the PC. Nowadays keyboards with additional features are available like multimedia keyboard, wireless keyboard.

Mouse

Fig 1.1.11 Mouse

With the invention of graphical user interface mouse is used to input information into the computer. Users simply point and click to enter information. The main advantage of mouse over keyboard is simplicity. And there are many operations that are much easier to perform with a mouse than a keyboard.

Monitor

Fig 1.1.12 Monitor

The monitor is the specialized high-resolution screen similar to a television. The video card sends the contents of its video memory to the monitor at a rate of 60 or more times per second. The actual display screen is made up of red, green and blue dots that are illuminated by electron beam from behind. The video card DAC chip controls the movement of the electron beam, which then controls what dots are turned on and how bright they are. Which then determines the picture you see on the screen.

Power supply



Fig 1.1.13 Power Supply(SMPS)

SMPS(Switch Mode Power Supply): The power supply supplies power to every single part in the PC. The main function of the power supply is to convert the 230 V AC into 3.3 V, 5 V and 12 V DC power that the system requires for the operations.

In addition to supplying power to run the system, the power supply also ensures that the system does not run unless the power supplied is sufficient to operate the system properly. The power supply completes internal checks and tests before allowing the system to start. If the tests are successful, the power supply sends a special signal to the motherboard called **Power_Good**. If this signal is not present continuously, the computer does not run. Therefore, when the AC voltage dips and the power supply becomes stressed or overheated, the **Power_Good** signal goes down and forces a system reset or complete shut-down.

Cabin



Fig 1.1.14 Cabinet

The box or outer shell that houses most of the computers. The cabinet actually performs several important functions for your PC including protection to the system components, directing cooling airflow, and allowing installation of and access to the system components. The cabinet often includes a matching power supply and must also be designed with shape of the motherboard and other system components in mind.

Name : Identifying components and their use

Peripheral Devices

Any external device, which is not necessary to perform the basic operation of computer, is called as peripherals. They provide additional computing capabilities. For ex : Printers, Modems, Speakers etc.

Modem



Fig 1.1.15 Modem

Modem (Modulator and Demodulator) is typically used to send digital data over a phone line. The sending modem converts digital data into analog data, which can be transmitted over telephone lines, and the receiving modem converts the analog data back into digital form. This is used to connect to Internet.

A typical arrangement is shown below in fig 1.1.16



Modems are available in different capacities.

- 300 bps - 1960s through 1983 or so
- 1200 bps - Gained popularity in 1984 and 1985
- 2400 bps
- 9600 bps - First appeared in late 1990 and early 1991
- 19.2 kilobits per second (Kbps)
- 28.8 Kbps
- 33.6 Kbps
- 56 Kbps - Became the standard in 1998

- ADSL, with theoretical maximum of up to 8 megabits per second (Mbps)
- Gained popularity in 1999

Printers

The capability to produce a printed version often called a hard copy of a document is the primary function of a printer.

Different types of printers are 1) Laser 2) Inkjet 3) Dot-Matrix.

Summary:

- 1) A computer is made up of electromechanical and electronic components.
- 2) Software is used to make computer usable.
- 3) Based on the microprocessor systems are classified as PC-XT and PC-AT
- 4) Important components of a system are processor, memory, keyboard, mouse, monitor etc.
- 5) SMPS converts AC (Alternate Current) into DC (Direct Current).

Short type Questions: -

1. What is a computer?
2. Name different types of computers?
3. Name the system components?
4. How many types of memories are there?
5. What is SMPS?
6. Which type of input is given to SMPS?
7. What is the difference between ROM and RAM?

Essay type questions: -

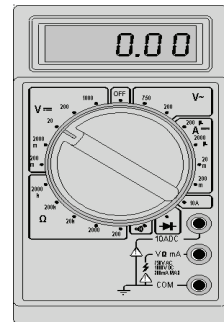
1. Name the types of system components and explain them briefly?
2. What is a MODEM? What is its use?
3. Discuss the use of SMPS?

Name : Measuring Voltages at different levels

1.2.1 What is a multimeter? A meter is a measuring instrument. An **ammeter** measures current, a **voltmeter** measures the potential difference (voltage) between two points, and an **ohmmeter** measures resistance. A **multimeter** combines these functions, and possibly some additional ones as well, into a single instrument.

A multimeter can serve many purposes including checking for voltage signals at different points in a system, testing the output of the power supply and checking for continuity in a circuit or cable.

Fig 1.2.1 Digital Monitor



Digital multimeter (DMM)?

One simple test that you can perform on a power supply is to check the output voltages. This shows whether a power supply is operation correctly and whether the output voltages are within the correct tolerance range.

You must measure all voltages with the power supplies connected to a proper load. Which usually means testing while the power supply is installed in the system.

Measuring voltage: To measure voltage on the system that is operating you must use a technique called back probing on the connectors (These are the red, yellow, orange, black and white wires coming out of power supply). You must measure the voltages when system is powered on. Nearly all the connectors you need to probe have openings in the back where the wires enter the connector.

The meter leads are narrow enough to fit into the connector beside the wire and make contact with the metal terminal inside. The technique is called back probing because you are probing the connector from the back. You must use this back probing technique to perform all of the following measurements.

To test a power supply for the proper output, check the voltage at the Power_Good pin for +3v to +6v of power. If the measurement is not within this range, the system never sees the Power_Good signal and therefore does not start or run properly. In most cases, the power supply is bad and must be replaced.

Continue by measuring the voltage ranges of the pins on the motherboard and

Hard Disk power connectors. If you are measuring voltages for testing purposes any reading within 10 % of the specified voltage is considered acceptable, although most manufactures of high quality power supplies specifies a tighter 5% tolerance. For ATX power supplies, the specification requires that voltages must be within 5% of the rating , except for the 3.3v current which must be within 4%.

Desired Voltage	Loose tolearance		Tight tolerance	
	Min (-10%)	Max(+8%)	Min (-5%)	Max(+5%)
+3.3v	2.97v	3.63v	3.135v	3.465v
+/- 5.0v	4.5v	5.4v	4.75v	5.25v
+/- 12.0v	10.8v	12.9v	11.4v	12.6v

Power_Good signal has tolerances that are different from the other signals, although it is nominally a +5v signal in most systems. The trigger point for Power_Good is about +2.5v, but most systems require the signal voltage to be within the tolerances listed.

Signal	Minimum	Maximum
Power_good +5v	3.0v	6.0v

Replace the power supply if the voltages are measured out of these ranges. Again, it is worth noting that any and all power supply tests and measurements must be made with the power supply properly loaded, which usually means that it must be installed in a system and the system must be running.

2.1.2 Meters

The DMM has a pair of wires called test leads or probes. The test leads make the connections so that you can take readings, depending on the meters setting; the probes measure electrical resistance, direct current (DC) voltage, or alternating Current (AC) voltage.

Usually, each system-unit measurement settings has several ranges of operations. DC voltage, for example, usually can be read in several scales, to a maximum of 200mv, 2v, 20v, 200v and 1000v. Because computers use both +5v and +12v for various operations you should use the 20v maximum scale for making your measurements. Making these measurements on the 200mv or 2v scale would possibly damage the meter because the voltage would be much

higher than expected.

Using the 200v or 1000v scale works, but the readings at 5v and 12v are so small in proportion to the maximum that accuracy is low.

If you are taking a measurement and are unsure of the actual voltage, start at the highest stage and work your way down.

Using Multimeter to measure voltages:-

Initially you have to check if the current from wall socket is 230 V or not. For this go through the following steps:

- 1) Adjust the multimeter by rotating the knob of the multimeter and set it to any AC voltage higher than 230 V.
- 2) Now put the positive lead (Red) of the multimeter into phase (+ve terminal) and
Negative lead (Black) into neutral (-ve terminal) of the wall socket.
- 3) Note down the readings. Which has to be 230 V. But practically anything between 210
and 230 V is acceptable.

Follow the steps which are given below to check the power in Hard Disk Drive.

- 1) Adjust the multimeter by rotating the knob of the multimeter and set it to any DC voltage higher than 12 v and maximum can be 20v.
- 2) Switch on the system.
- 3) Now put the positive lead (Red) of the multimeter into Red wire from the back of the power connector which goes to Hard disk and Negative lead (Black) into the black wire of the power connector of Hard disk.
- 4) Note down the readings. Which has to be +5 volts. Where as tolerance levels you can find from the above tables 2.1 and 2.2.
- 5) Repeat steps 3 and 4 for the yellow and black wires of Hard disk power connector.

And follow the above procedure to measure the power in the motherboard, CPU fan, Floppy drive, CD ROM etc.

Summary:-

1. Digital multimeters are used to measure power supply in computer.
2. Power_Good signal is necessary to start the system.

Short questions: -

1. What is a Multimeter?
2. What is the difference between multimeter and digital multimeter?
3. What is back probing?]
4. What is Power_Good Signal?

Essay type questions: -

1. How is multimeter used to measure voltages?

2.1.1 What is a Motherboard?

Motherboard is the most important component in any personal computer. It contains almost every important elements of the computer.

Sometimes instead of the calling it “motherboard”, IBM refers to it as “system Board” or “Planner Board”, some other manufacturer refer to this as the “Logic Board”.

The motherboard is the main circuit board inside the PC which holds the processor, memory and expansion slots and connects directly or indirectly to every part of the PC. It's made up of a chipset (known as the “glue logic”), some code in ROM and the various interconnections or buses.

2.1.2 Evolution

The original PC had a minimum of integrated devices, just ports for a keyboard and a cassette deck (for storage). Everything else, including a display adapter and floppy or hard disk controllers, were add-in components, connected via expansion slots.

Over time, more devices have been integrated into the motherboard. It's a slow trend though, as I/O ports and disk controllers were often mounted on expansion cards as recently as 1995. Other components - typically graphics, networking, SCSI and sound - usually remain separate. Many manufacturers have experimented with different levels of integration, building in some or even all of these components. However, there are drawbacks. It's harder to upgrade the specification if integrated components can't be removed, and highly integrated motherboards often require non-standard cases. Furthermore, replacing a single faulty component may mean buying an entire new motherboard.

Consequently, those parts of the system whose specification changes fastest - RAM, CPU and graphics - tend to remain in sockets or slots for easy replacement. Similarly, parts that not all users need, such as networking or SCSI, are usually left out of the base specification to keep costs down.

The basic changes in motherboard form factors over the years are covered later in this section - the diagrams below provide a detailed look at the various components on two motherboards. The first a Baby AT design, sporting the ubiquitous Socket 7 processor connector, circa 1995. The second is an ATX design, with a Pentium II Slot 1 type processor connector, typical of motherboards on the market in late 1998.

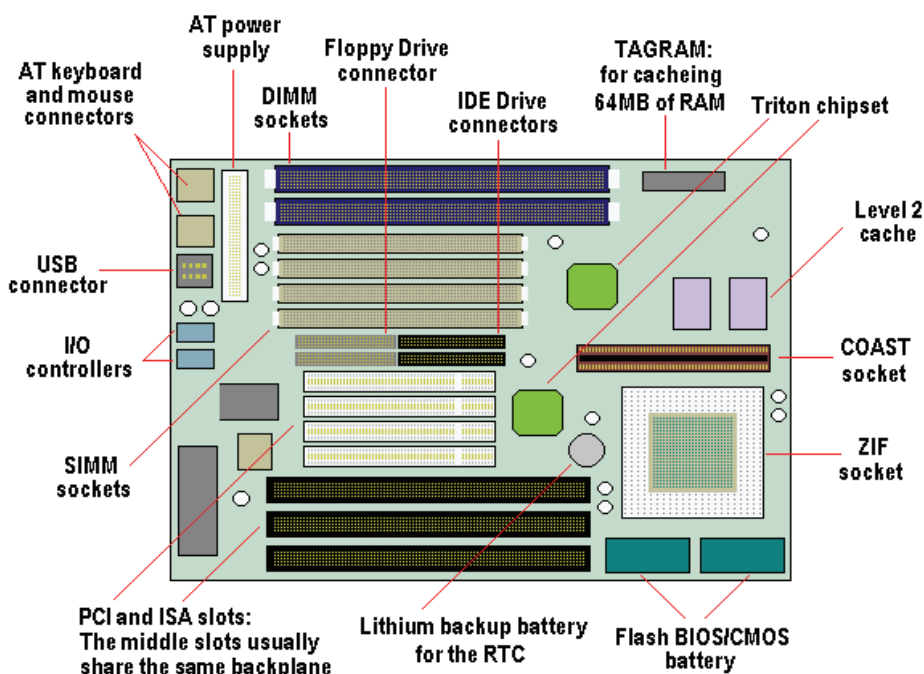


Fig 2.1.1 Baby AT Design

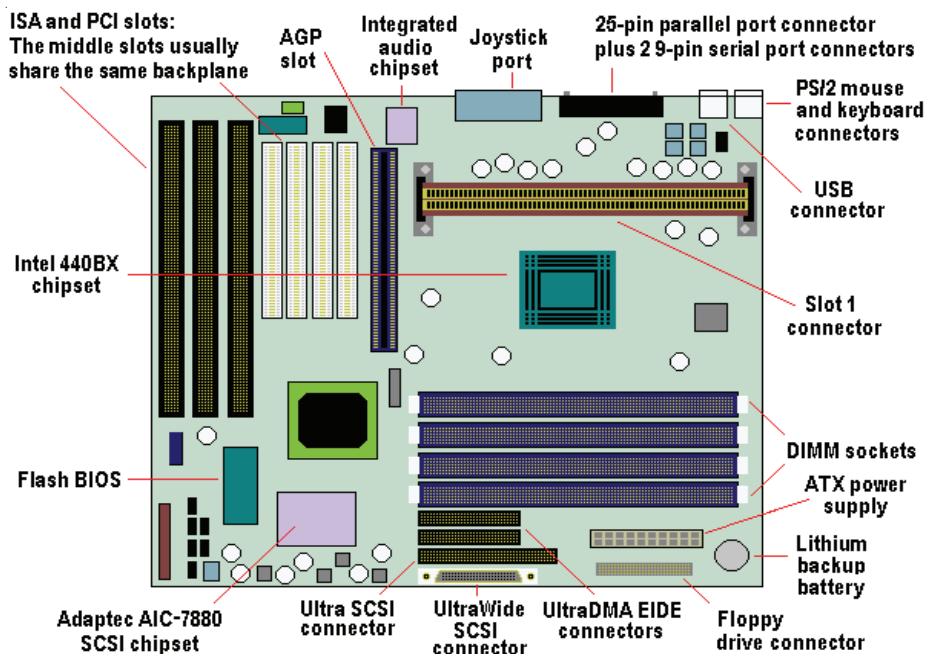


Fig 2.1.2 ATX Design

Motherboard development consists largely of isolating performance-critical components from slower ones. As higher speed devices become available, they are linked by faster buses - and the lower-speed buses are relegated to supporting roles. In the late 1990s there was also trend towards putting peripherals designed as integrated chips directly onto the motherboard. Initially this was confined to audio and video chips - obviating the need for separate sound or graphics adapter cards - but in time the peripherals integrated in this way became more diverse and included items such as SCSI, LAN and even RAID controllers. While there are cost benefits to this approach the biggest downside is the restriction of future upgrade options.

2.1.2 Motherboard Form Factors

Early PCs used the AT form factor and 12in wide motherboards. The sheer size of an AT motherboard caused problems for upgrading PCs and did not allow use of the increasingly popular slimline desktop cases. These problems were largely addressed by the smaller version of the full AT form factor, the Baby AT, introduced in 1989. Whilst this remains a common form factor, there have been several improvements since. All designs are open standards and as such don't require certification. A consequence is that there can be some quite wide variation in design detail between different manufacturers' motherboards

There are several common form factors used for PC motherboards. The form factors refer to the physical dimensions and size of the board, and dictates what type case the motherboard will fit into. The PC motherboard form factors generally available include the following.

Baby – AT	NLX
LPX	Backplane systems
ATX	Proprietary designs

BAT(Baby –AT)

The Baby AT (BAT) format reduced the dimensions of the motherboard to a typical 9in wide by 10in long, and BAT motherboards are generally characterised by their shape, an AT-style keyboard connector soldered to the board and serial and parallel port connectors which are attached using cables between the physical ports mounted on the system case and corresponding connectors located on the motherboard.

With the BAT design the processor socket is located at the front of the motherboard, and full-length expansion cards are intended to extend over it. This means that removing the processor requires the removal of some or all expansion cards first. Problems were exacerbated by the increasing speeds of Pentium-class processors.

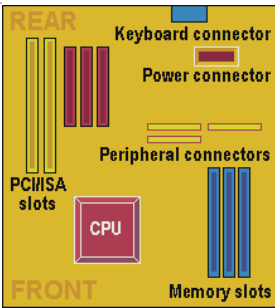


Fig 2.1.3 Baby –AT Motherboard

System cooling relied on the AT power supply blowing air out of the chassis enclosure and, due to the distance between the power supply and the CPU, an additional chassis fan or active heatsink became a necessity to maintain good airflow across the CPU. AT power supplies only provide 12V and 5V outputs to the motherboard, requiring additional regulators on the motherboard if 3.3V components (PCI cards or CPUs) are used. Sometimes a second heatsink was also required on these voltage regulators and together the various additional heat dissipation components caused serious obstruction for expansion slots.

Some BAT designs allow the use of either AT or ATX power supplies, and some ATX cases might allow the use of a Baby-AT motherboard.

ATX

The Intel Advanced/ML motherboard, launched in 1996, was designed to solve these issues and marked the beginning of a new era in motherboard design. Its size and layout are completely different to the BAT format, following a new scheme known as ATX. The dimensions of a standard ATX board are 12in wide by 9.6in long; the mini ATX variant is typically of the order 11.2in by 8.2in.

The ATX design gets round the problem by moving the CPU socket and the voltage regulator to the right-hand side of the expansion bus. Room is made for the CPU by making the card slightly wider, and shrinking or integrating components such as the Flash BIOS, I/O logic and keyboard controller. This means the board need only be half as deep as a full size Baby AT, and

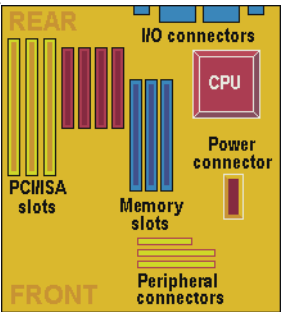


Fig 2.1.5 ATX Motherboard

there's no obstruction whatsoever to the six expansion slots (two ISA, one ISA/PCI, three PCI).

The ATX uses a new specification of power supply that can be powered on or off by a signal from the motherboard. This allows notebook-style power management and software-controlled shutdown and power-up. A 3.3V output is also provided directly from the power supply. Accessibility of the processor and memory modules is improved dramatically, and relocation of the peripheral connectors allows shorter cables to be used. This also helps reduce electromagnetic interference. The ATX power supply has a side vent that blows air from the outside directly across the processor and memory modules, allowing passive heatsinks to be used in most cases, thereby reducing system noise.

Mini-ATX is simply a smaller version of a full-sized ATX board. On both designs, parallel, serial, PS/2 keyboard and mouse ports are located on a double-height I/O shield at the rear. Being soldered directly onto the board generally means no need for cable interconnects to the on-board I/O ports. A consequence of this, however, is that the ATX needs a newly designed case, with correctly positioned cut-outs for the ports, and neither ATX no Mini-ATX boards can be used in AT-style cases.

NLX

Intel's NLX design, introduced in 1997, is an improvement on the LPX design for low-profile systems, with an emphasis on ease of maintenance. The NLX format is smaller, typically 8.8in wide by 13in long, so well suited for low-profile desktop cases.

All expansion slots, power cables and peripheral connectors are located on an edge-mounted riser card, allowing simple removal of the main motherboard, which is mounted on rails in the chassis. It uses a full-width I/O shield to allow for different combinations of rear-panel I/O. The design allows for use of an

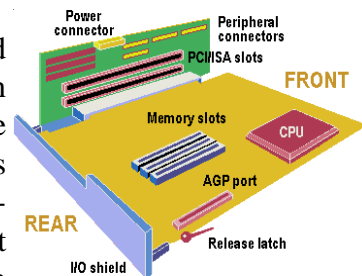


Fig 2.1.6 NLX Motherboard

AGP card, but the slot must be on the motherboard, which reduces the ease of maintenance when such a card is implemented.

AGP card, but the slot must be on the motherboard, which reduces the ease of maintenance when such a card is implemented.

Proprietary designs motherboards that are not one of the standard form factors such as Fullsized –AT, Baby- AT, ATX or NLX are called as proprietary.

Backplane systems: One type of proprietary design is the backplane system. These systems donot have a motherboard, the components normally found on the motherboard are located on an expansion adapter card plugged into a slot. In these systems, the board with the slots is called a backplane rather than a motherboard. Systems using this type of constructions are called backplane systems.

2.1.3 Motherboard components

A conventional motherboard comprises of various components such as

- Expansion slots
- CPU(Main Processor)
- Coprocessor
- Memory
- BIOS and
- Support circuits of chipset for interrupt, DMA etc.

Expansion Slots

What is expansion slot?

The expansion slots are long thin connectors on the motherboard, near the backside of the computer. Various expansion cards are connected to the motherboards through data, address and control lines/buses on these slots.

One can connect various expansion cards such as display card, hard drive controller, sound card, network card, modem card etc. on these slots.

When an adapter card is connected to the expansion slot, it is actually connected to the data, address and control bus on the motherboard.

What is a Bus?

A bus is an **electronic path** on which signals are sent from one part of the computer to another.

These buses are categorizes according to the number of BINARY DIGITS (bits) that they can transfer at a time.

- If the data bus is 8 bit wide then it can transfer 8 bits of information at a time and called an 8 bit bus.
- On a 8 bit data bus transferring 16 bit data requires two data transfers

Another very common term while talking about bus is , its “bandwidth”.

- The bandwidth of a bus is the measure of data that can fit in the bus at a given time.

You can increase the data movement through a bus either by increasing the bus width(from 8 bit to 16 bit) or by increasing the bus bandwidth (8 Mhz to 20 Mhz).

This is similar to the way you can increase water output from a pipe, either you can increase the pipe diameter or you can increase the water flow.

Data Bus : Is a set of wires or tracks on the motherboard. Data bus is used to transfer data from one part of the computer to another part.

Address Bus : is a set of wires or tracks on the motherboard Printed Circuit Board(PCB) which is used to specify address of a memory location

Depending on the width and the technology, the expansion slot bus can be divided into the following categories.

8 bit ISA

16 bit ISA

MCA

EISA

VESA local bus or VL bus

PCI local Bus

CPU (Main Processor)

The main component of any motherboard is the main processor chip which controls all the inner functions of the system. The CENTRAL PROCESSING UNIT(CPU) functions as the brain of every PC.

It is usually inserted into the socket and is not soldered onto the motherboard as many other chips are normally done, this makes its replacement, in case of any problem, very easy.

Some of the common CPU chips are inter 8088,8086,80286,80386,80486, Pentium, Pentium MMX, Pentium –II, Pentium III, Pentium – IV etc.

Coprocessor

What is a coprocessor?

Coprocessor is a special purpose microprocessor, which is used to speed up main processor job by taking over some of the main processors work. Most common type of coprocessor is a math coprocessor.

Coprocessor chips are used to help the main processor in carrying out its various functions.

A math coprocessor helps main processor in performing mathematical calculations.

Older system (XT, AT, AT-386) required a coprocessor chips to be inserted into special socket on the motherboard, but the current generation of CPU's have math coprocessor built inside the main processor itself.

Memory

What is a memory?

Memory is the place where computer stores the *program* (set of instructions telling the computer what to do), and data that help the program in carrying out its operations.

For example, a marks sheet printing program will require students roll number, name and marks obtained in various subjects etc. as data.

There is basically two type of memory used in a computer which are discussed in the previous chapter.

- RAM memory
- ROM memory

RAM memory

RAM or random access memory is a read/write type of memory which is used by the processor to keep program, data and intermediate results during program executions.

It is VOLATILE type of memory, which loses its content when the power supply to it is switched off.

The physical installation of RAM memory on the motherboard can take place in various ways.

- DIP (dual In-line Pin) memory chips were used on initial motherboards.
- Later SIMM (single inline memory modules) became common.
- Currently DIMM (dual inline memory modules) are most common memory module.

Bit is a binary digit that is either 0 or 1.

Nibble is collection of 4 bits.

Byte is collection of 8 bits.

Kilobyte is 1024 bytes

Megabyte is 1024 Kilobytes

Gigabyte is 1024 Megabytes

Read Only Memory(ROM)

ROM or Read Only Memory, as its name suggest is a read only type of memory it cannot be written. Data is written into it by the manufacturer.

- On major advantage with the ROM is, ROM is Non-Volatile type of memory i.e it does not lose its content when the power supply to it is switched off.
- A motherboard normally contains one or more of these ROM chips.
- The memory capacity of a ROM varies from one type of system to another. 64 KiloByte (KB) was normally sufficient for a XT system, whereas as AT system requires 256KB of ROM.

BIOS

What is BIOS?

BIOS is an abbreviation if Basic Input Output System. It is one of the most important program stored in the ROM.

BIOS program lets your application program and the hardware such as floppy disk, hard disk, video adapter etc. communicate with each other.

It is pronounced “bye-os”.

- The BIOS also contains a program called Power-On-Self-Test or POST. This post program checks the motherboard and other devices connected to the computer during the system power-on time.

IBM made the original BIOS for their copyright product, but many compatible BIOS program BIOS program are available from Award, Phoenix, American Megatrends Inc. (AMI) etc. various manufacturers.

CMOS(Complementary Metal Oxide Semiconductor) Memory

In old IBM XT or compatible system, BIOS, with the help of jumpers, detected what all components are connected to the computer system.

- IBM AT and higher systems do not contain these jumper switches and instead use a CMOS memory to store the system configuration, date, and time etc. information.

- This CMOS memory receives power from a battery accompanying it, this battery helps it retain the information stored in it even when the system is switched off.

When an AT or higher system is switched on, BIOS matches the information stored inside the CMOS with the components connected to the system and if it finds some mismatch or error, the BIOS displays some error message, explaining the problem.

Cache Memory:

A small amount (normally less than 1MB) of high-speed memory residing on or close to the CPU. Cache memory supplies the processor with the most frequently requested data and instructions. Level 1 cache (primary cache) is the cache closest to the processor. Level 2 cache (secondary cache) is the cache second closest to the processor and is usually on the motherboard.

Support Chips/Chipsets

Apart from the processor chip and the memory, Motherboard also contains many controller chips and other devices which everything together.

- A typical system required interrupt controller, DMS controller, Timer chip, Clock chip, Bus controller chip, I/O peripheral interface chip etc, to make the computer work as a complete unit.
- The IBM PC, XT, AT, Pentium etc. use standard Inter chips intended for any computer built around an Intel CPU.
- Modern developments in electronics have made it possible to produce VERY LARGE SCALE INTEGRATED CIRCUITS(VLSIC), and now just two or three of these VLSIC chips can do the work which were previously performed by dozens of different chips.
- These set of VLSIC chips are called 'CHIPSETS'.
- A typical chipset contains in one or two VLSIC chips all the support logic required by the processor to function as a complete system.
- Many of these chipset maker include serial and parallel ports, floppy and hard disk controllers, USB support, LAN and audio support, and display adapter on the chipset itself.

Large-scale integration along with high –capacity memory chips has let to even fewer components on a PC's motherboard.

Motherboard Configuration

A typical motherboard has several options and proper configuration is required to select the required hardware setup.

- Most of the PC and XT class motherboards are set/configured using jumpers or switches on the motherboard.
- In the AT and later machines, the configuration options are stored in CMOS RAM and are set using the SETUP utility in the BIOS ROM.

The motherboard configuration should always be perfect, as an incorrectly setup motherboard can cause the system to malfunction or even crash.

Summary

1. Motherboard is the main circuit of PC.
2. It holds important components like CPU, Memory, SMPS etc.
3. Integrated motherboards have features such as graphics, LAN, audio, etc integrated onto the motherboard and aim at providing solutions for the cost-conscious users.
4. Form factors of motherboard are Baby-AT, ATX, NLX, LPX.
5. To identify motherboard model, see the white sticker on the side of the last ISA slot or the prints on the board itself.

Short questions :-

1. What is a motherboard?
2. Name the components of a motherboard?
3. What is Cache Memory?
4. What is an integrated motherboard?
5. How can I identify the model and manufacturer name for my motherboard?

Essay Type questions: -

1. Explain briefly about the Motherboard Form Factors?
2. Briefly explain the components of Motherboard?

Ports

2.2.1 Introduction

The most basic communication ports in any PC system are the **serial and parallel ports**. The serial ports were originally used for devices that must communicate bi-directional with the system. Such devices include modems, mice, scanners and any other devices that “talk to” and receive information from the PC. Newer parallel port standards now allow the parallel port to perform high-speed bi-directional communications.

1.2.2 Serial ports

How Serial Ports work?

Considered to be one of the most basic external connections to a computer, the **serial port** has been an integral part of most computers for more than 20 years. Although many of the newer systems have done away with the serial port completely in favor of USB connections, most modems still use the serial port, as do some printers, PDAs and digital cameras. Few computers have more than two serial ports.



Fig 2.2.1 Two serial ports on the back of a PC

Essentially, serial ports provide a standard connector and protocol to let you attach devices, such as modems, to your computer.

UART Needed

All computer operating systems in use today support serial ports, because serial ports have been around for decades. Parallel ports are a more recent invention and are much faster than serial ports. USB ports are only a few years old, and will likely replace both serial and parallel ports completely over the next several years.

The name “serial” comes from the fact that a serial port “serializes” data. That is,

it takes a byte of data and transmits the 8 bits in the byte one at a time. The advantage is that a serial port needs only one wire to transmit the 8 bits (while a parallel port needs 8). The disadvantage is that it takes 8 times longer to transmit the data than it would if there were 8 wires. Serial ports lower cable costs and make cables smaller.

Before each byte of data, a serial port sends a start bit, which is a single bit with a value of 0. After each byte of data, it sends a stop bit to signal that the byte is complete. It may also send a parity bit.

Serial ports, also called **communication (COM) ports**, are **bi-directional**. Bi-directional communication allows each device to receive data as well as transmit it. Serial devices use different pins to receive and transmit data — using the same pins would limit communication to **half-duplex**, meaning that information could only travel in one direction at a time. Using different pins allows for **full-duplex** communication, in which information can travel in both directions at once.



Fig 2.2.2 This 40-pin Dual Inline Package (DIP) chip is a variation of the National Semiconductor NS16550D UART chip.

Serial ports rely on a special controller chip, the **Universal Asynchronous Receiver/Transmitter (UART)**, to function properly. The UART chip takes the parallel output of the computer's system bus and transforms it into serial form for transmission through the serial port. In order to function faster, most UART chips have a built-in buffer of anywhere from 16 to 64 kilobytes. This buffer allows the chip to cache data coming in from the system bus while it is processing data going out to the serial port. While most standard serial ports have a maximum transfer rate of 115 Kbps (kilobits per second), high speed serial ports, such as **Enhanced Serial Port (ESP)** and **Super Enhanced Serial Port (Super ESP)**, can reach data transfer rates of 460 Kbps.

The Serial Connection

The external connector for a serial port can be either 9 pins or 25 pins. Originally, the primary use of a serial port was to connect a modem to your

computer. The pin assignments reflect that. Let's take a closer look at what happens at each pin when a modem is connected.



Fig 2.2.3 Close-up of 9-pin and 25-pin serial connectors

9-pin connector:

- 1. Carrier Detect** - Determines if the modem is connected to a working phone line.
- 2. Receive Data** - Computer receives information sent from the modem.
- 3. Transmit Data** - Computer sends information to the modem.
- 4. Data Terminal Ready** - Computer tells the modem that it is ready to talk.
- 5. Signal Ground** - Pin is grounded.
- 6. Data Set Ready** - Modem tells the computer that it is ready to talk.

7. Request To Send - Computer asks the modem if it can send information.

8. Clear To Send - Modem tells the computer that it can send information.

9. Ring Indicator - Once a call has been placed, computer acknowledges signal (sent from modem) that a ring is detected.

25-pin connector:

1. Not Used
2. **Transmit Data** - Computer sends information to the modem.
3. **Receive Data** - Computer receives information sent from the modem.
4. **Request To Send** - Computer asks the modem if it can send information.
5. **Clear To Send** - Modem tells the computer that it can send information.
6. **Data Set Ready** - Modem tells the computer that it is ready to talk.
7. **Signal Ground** - Pin is grounded.
8. **Received Line Signal Detector** - Determines if the modem is connected to a working phone line.
9. Not Used: Transmit Current Loop Return (+)
10. Not Used
11. Not Used: Transmit Current Loop Data (-)
12. Not Used
13. Not Used
14. Not Used
15. Not Used
16. Not Used
17. Not Used
18. Not Used: Receive Current Loop Data (+)
19. Not Used
20. **Data Terminal Ready** - Computer

tells the modem that it is ready to talk.

21. Not Used

22. Ring Indicator - Once a call has been placed, computer acknowledges signal (sent from modem) that a ring is detected.

23. Not Used

24. Not Used

25. Not Used: Receive Current Loop Return (-)

Voltage sent over the pins can be in one of two states, **On** or **Off**. On (binary value “1”) means that the pin is transmitting a signal between -3 and -25 volts, while Off (binary value “0”) means that it is transmitting a signal between +3 and +25 volts...

2.2.3 Parallel ports

How Parallel Ports Work?

If you have a printer connected to your computer, there is a good chance that it uses the **parallel port**. While USB is becoming increasingly popular, the parallel port is still a commonly used interface for printers.



Fig 2.2.4 A typical parallel port on the back of your computer

Parallel ports can be used to connect a host of popular computer peripherals:

Printers

Scanners

CD burners

External hard drives

Iomega Zip removable drives

Network adapters

Tape backup drives

Parallel Port Basics

Parallel ports were originally developed by IBM as a way to connect a printer to your PC. When IBM was in the process of designing the PC, the company wanted the computer to work with printers offered by **Centronics**, a top printer manufacturer at the time. IBM decided not to use the same port interface on the computer that Centronics used on the printer.

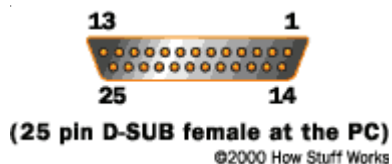


Fig 2.2.5

Instead, IBM engineers coupled a 25-pin connector, **DB-25**, with a 36-pin Centronics connector to create a special cable to connect the printer to the computer. Other printer manufacturers ended up adopting the Centronics interface, making this strange hybrid cable an unlikely de facto standard.

When a PC sends data to a printer or other device using a parallel port, it sends 8 bits of data (1 byte) at a time. These 8 bits are transmitted **parallel** to each other, as opposed to the same eight bits being transmitted **serially** (all in a single row) through a serial port. The standard parallel port is capable of sending 50 to 100 kilobytes of data per second.

DB 25		Centronics 36	
Pin	Signal	Pin	Signal
1	Strobe	1	Strobe
2	data0	2	data0
3	data1	3	data1
4	data2	4	data2
5	data3	5	data3
6	data4	6	data4
7	data5	7	data5
8	data6	8	data6
9	data7	9	data7
10	Acknowledge	10	Acknowledge
11	Busy	11	Busy
12	Paper End	12	Paper End
13	Select	13	Select
14	Auto Feed	14	Auto Feed
15	Error	15	Error
16	Init	16	Init
17	Select In	17	Select In
18	GND	18	GND
19	GND	19	GND
20	GND	20	GND
21	GND	21	GND
22	GND	22	GND
23	GND	23	GND
24	GND	24	GND
25	GND	25	GND
©2000 How Stuff Works		26	GND
		27	GND
		28	GND
		29	GND
		30	GND
		31	Init
		32	Error
		33	Ground
		34	NC
		35	NC
		36	Select In

Table 2.2.1 Comparison of DB-25 and Centronics 36 Parallel ports

SPP/EPP/ECP

The original specification for parallel ports was unidirectional, meaning that data only traveled in one direction for each pin. With the introduction of the PS/2 in 1987, IBM offered a new **bidirectional** parallel port design. This mode is commonly known as **Standard Parallel Port** (SPP) and has completely replaced the original design. Bidirectional communication allows each device to receive data as well as transmit it. Many devices use the eight pins

(2 through 9) originally designated for data. Using the same eight pins limits communication to **half-duplex**, meaning that information can only travel in one direction at a time. But pins 18 through 25, originally just used as grounds, can be used as data pins also. This allows for **full-duplex** (both directions at the same time) communication.

EPP					
Pin	EPP Signal	Pin	EPP Signal	Pin	EPP Signal
1	Write	10	Interrupt	19	Ground
2	Data 0	11	Wait	20	Ground
3	Data 1	12	Spare	21	Ground
4	Data 2	13	Spare	22	Ground
5	Data 3	14	Data Strobe	23	Ground
6	Data 4	15	Spare	24	Ground
7	Data 5	16	Reset	25	Ground
8	Data 6	17	Address Strobe		
9	Data 7	18	Ground		

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Table 2.2.2 EPP Pins

Enhanced Parallel Port (EPP) was created by Intel, Xircom and Zenith in 1991. EPP allows for much more data, 500 kilobytes to 2 megabytes, to be transferred each second. It was targeted specifically for non-printer devices that would attach to the parallel port, particularly storage devices that needed the highest possible transfer rate.

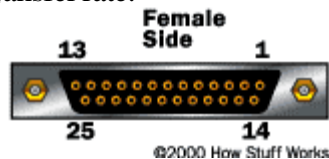


Fig 2.2.6 EPP Parallel Port

Close on the heels of the introduction of EPP, Microsoft and Hewlett Packard jointly announced a specification called **Extended Capabilities Port (ECP)** in 1992. While EPP was geared toward other devices, ECP was designed to provide improved speed and functionality for printers

ECP					
Pin	ECP Signal	Pin	ECP Signal	Pin	ECP Signal
1	HostCLK	10	PeriphCLK	19	Ground
2	Data 0	11	PeriphAck	20	Ground
3	Data 1	12	nAckReverse	21	Ground
4	Data 2	13	X-Flag	22	Ground
5	Data 3	14	Host Ack	23	Ground
6	Data 4	15	PeriphRequest	24	Ground
7	Data 5	16	nReverseRequest	25	Ground
8	Data 6	17	1284 Active		
9	Data 7	18	Ground		

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Table 2.2.3 ECP Pins

In 1994, the IEEE 1284 standard was released. It included the two specifications for parallel port devices, EPP and ECP. In order for them to work, both the operating system and the device must support the required specification. This is seldom a problem today since most computers support SPP, ECP and EPP and will detect which mode needs to be used, depending on the attached device. If you need to manually select a mode, you can do so through the BIOS on most computers.

2.2.4 What is USB?

Anyone who has been around computers for more than two or three years knows the problem that the Universal Serial Bus is trying to solve — in the past, connecting devices to computers has been a real headache



Fig 2.2.7 USB Connector

- Printers connected to parallel printer ports, and most computers only came with one. Things like Zip drives, which need a high-speed connection into the computer, would use the parallel port as well, often with limited success and not much speed.
- Modems used the serial port, but so did some printers and a variety of odd things like Palm Pilots and digital cameras. Most computers have at most two serial ports, and they are very slow in most cases.
- Devices that needed faster connections came with their own cards, which had to fit in a card slot inside the computer's case. Unfortunately, the number of card slots is limited and you needed a Ph.D. to install the software for some of the cards.
- The goal of USB is to end all of these headaches. The Universal Serial Bus gives you a single, standardized, easy-to-use way to connect up to **127 devices** to a computer.
- Just about every peripheral made now comes in a USB version. A sample list of USB devices that you can buy today includes:

Name : Motherboard

1. Printers
2. Scanners
3. Mice
4. Joysticks
5. Flight yokes
6. Digital cameras
7. Webcams
8. Scientific data acquisition devices
9. Modems
10. Speakers
11. Telephones
12. Video phones
13. Storage devices such as Zip drives
14. Network connections

How USB Ports Work ?

Just about any computer that you buy today comes with one or more **Universal Serial Bus** connectors on the back. These USB connectors let you attach everything from mice to printers to your computer quickly and easily. The operating system supports USB as well, so the installation of the device drivers is quick and easy, too. Compared to other ways of connecting devices to your computer (including parallel ports, serial ports and special cards that you install inside the computer's case), USB devices are incredibly simple! Just about any computer that you buy today comes with one or more **Universal Serial Bus** connectors on the back. These USB connectors let you attach everything from mice to printers to your computer quickly and easily. The operating system supports USB as well, so the installation of the device drivers is quick and easy, too. Compared to other ways of connecting devices to your computer (including parallel ports, serial ports and special cards that you install inside the computer's case), USB devices are incredibly simple!

USB Connections

Connecting a USB device to a computer is simple — you find the USB connector on the back of your machine and plug the USB connector into it.



Fig 2.2.8 USB Connections

If it is a new device, the operating system auto-detects it and asks for the driver disk. If the device has already been installed, the computer activates it and starts talking to it. USB devices can be connected and disconnected at any time.

Many USB devices come with their own built-in cable, and the cable has an “A” connection on it. If not, then the device has a socket on it that accepts a USB “B” connector.

The USB standard uses “A” and “B” connectors to avoid confusion:



Fig 2.2.9A typical “A” connection



Fig 2.2.10 Typical “B” connection

“A” connectors head “**upstream**” toward the computer.

“B” connectors head “**downstream**” and connect to individual devices.

By using different connectors on the upstream and downstream end, it is impossible to ever get confused — if you connect any USB cable’s “B” connector into a device, you know that it will work. Similarly, you can plug any “A” connector into any “A” socket and know that it will work.

Summary:

1. The main type of ports available on a PC are Serial port, Parallel port, USB port.
2. Serial port allows you to connect to Mouse, Modem etc.
3. Parallel port allows you to connect to Printers.
4. USB allows you to connect you to Webcam, Videophones, Scanners etc.

Short Type Questions:

1. Name the different types of ports in a Computer?
2. Name few devices that connect to Parallel Port?
3. What is USB port?
4. In how many forms serial port is available?
5. What is the maximum number of devices which you can connect using USB?
6. What is the use of USB 'A' connector and USB 'B' connector?
7. Expand ECP, EPP and SPP?

Essay type Questions:

1. Explain briefly how serial port works?
2. Explain briefly how parallel port works?
3. Explain about UART and its need?

BIOS & CMOS

3.1.1 Introduction: All motherboards must have a special chip containing software called the ROM BIOS or BIOS. BIOS stand for Basic Input Output System.



Fig 3.1.1 BIOS Chip

BIOS in most PCs has four main functions

POST (Power-On Self Test): The POST tests your computers processor, memory, chipset, video adaptor, Hard disks, Floppies, keyboard and other important components.

Bootstrap Loader: A routine that finds the operating system and loads it in RAM.

BIOS- Basic Input Output System: This refers to the collection of drivers for the various hardware components attached to the computers.

CMOS setup : This is normally a menu driven program that allows you to configure the motherboard and chipset settings, along with date and time, passwords, disk drives, and other basic system settings.

Some older PC's cannot co-operate with all the modern hardware because their BIOS doesn't support that hardware. The operating system cannot call a BIOS routine to use it; this problem can be solved by replacing your BIOS with a newer one, that does support your new hardware, or by installing a device driver for the hardware.

3.1.2 Bootstrap loader

Definition: A routine that finds the operating system and loads or boots it. If an operating system is found it is loaded and given control of your computer

This program doesn't have the full functionality of an operating system, but is tailor-made specifically so that it is capable of loading enough other software for the operating system to start. Often, multiple-stage boot loaders are used, in which several small programs summon each other, until the last of them loads the operating system. The name *bootstrap loader* comes from the image of one pulling oneself up by one's bootstraps

This program doesn't have the full functionality of an operating system, but is tailor-made specifically so that it is capable of loading enough other software for the operating system to start. Often, multiple-stage boot loaders are used, in which several small programs call upon each other, until the last of them loads the operating system.

Boot loaders may face peculiar constraints, especially in size; for instance, on the IBM PC and compatibles, the first stage of boot loaders is always 512 bytes in length and ends with the AA55h value (which the BIOS looks at to ensure that it is a proper boot loader).

Second-stage boot loader

The small program is most often not itself an operating system, but only a second-stage boot loader, such as NTLDR, LILO or GRUB. It will then be able to load the operating system proper, and finally transfer execution to it. The system will initialize itself, and may load device drivers and other programs that are needed for the normal operation of the OS.

3.1.3 Booting

In computing, **booting** is a bootstrapping process that starts operating systems when the user turns on a computer system. A **boot sequence** is the set of operations the computer performs when it is switched on which load an operating system.

In modern PC machines the way a computer boots is roughly:

1. A BIOS (basic I/O system), stored in ROM, contains

the program that checks the disk drives for a MBR (master boot record).

2. The program found at the MBR is the boot loader which is specific to the OS being booted.
3. The boot loader finds the OS and prepares the hardware (memory, disk, etc.) for starting the OS.
4. The OS finishes initializing itself then starts optional services and device drivers before the machine begins to respond to normal input.

In the case of a network boot, where a machine may be diskless, the sequence is essentially the same, but the BIOS is in the ROM of a network card which fetches the boot loader program from the network.

The boot process is considered complete when the computer is ready to interact with the user or the operating system is capable of running ordinary applications. Typical modern PCs boot in about a minute (of which about 15 seconds are taken by the preliminary boot loaders, and the rest by the one loading the operating system), while large servers may take several minutes to boot and to start all services - to ensure high availability, they bring up some services before others.

Most embedded systems must boot almost instantly — for instance, waiting a minute for the television to come up is not acceptable. Therefore they have their whole operating system in ROM or flash memory, so it can be executed directly.

Summary:

1. BIOS stands for Basic Input Output System.
2. BIOS has four components.
3. The steps for the system to start is called booting sequence.
4. Bootstrap loader is a program, which pulls part of the operating system from hard disk.
5. Bootstrap loader is multistaged.
6. BIOS includes low level routines which can directly talk to hardware.

Short type questions:

1. Expand BIOS?
2. What is boot sequence?

3. Name few companies who make BIOS?
4. What are the different components of BIOS?
5. Define bootstrap loader? List the stages in it?

Long type questions:

1. Describe different steps of booting a system?

3.2.1 :

Standard BIOS features include date and time, Floppy Disk Drive, VGA/EGA.,
HALT, IDE

Advanced BIOS features includes

Virus Program - Will scan your hard drive at startup and warn you of trouble. Enable or disable as you wish.

Cache – Allows the system to use the cache memory

Quick POST - Allows BIOS to boot-up faster by skipping some tests.

Boot Sequence - Controls the order in which bootable information is searched.

Swap Floppy Drives – Used if you have two floppy drives and you wish to assign the A and B drives letters interchangeably

Fast A20 Gate – Is used to increase speed of the computer.

- **Typematic Rate Settings** - This deals with the rate by which holding a keyboard character down produces repeated characters on the screen.
- **Boot Numlock**
- **CPU Serial Number** - This identifies the CPU serial number in Intel CPUs.
- **Video BIOS Shadow** –

Advanced Chipset Settings

You should not need to bother with this section. However, some basic settings are provided for your information. You may enable or disable the following:

- **Chipset Special Features**
- **L2 Cache Size** –

- **DRAM Parity Checking –**
- **DRAM Parity/ECC Mode –**
- **DRAM Clock Control –**
- **DRAM Frequency –**
- **AGP Mode –**
- **AGP Aperture –**

There will most likely be many more options available to you. It is best to leave these alone at least for the initial boot-up, and maybe best left alone permanently.

Power Management

This is for sophisticated tweaking, which we are **not** doing now. Your manual will best describe the different options available, if you are interested. But for now, and maybe forever, leave at default (disable) as available.

Integrated Peripherals

Enable the ports you intend to use, disable the ports you intend not to use:

IDE Ports -

USB

Serial & Parallel Ports

Motherboard Integrated Hardware –

Expansion Card Hardware - If you are using one or more expansion cards and your motherboard also has the same options, you need to disable the motherboard options to allow the use of the expansion cards.

PnP/PCI Configuration

This section controls aspects of “Plug-n-Play” and the PCI bus. Most selections should be left at default; but two deserve your attention:

- **PnP OS Installed**
- **Reset Configuration Data –**

PC Health

Also known by other names, this section monitors some very basic operational settings, such as voltage levels, fan speed, internal processor temperature. In some versions you can set the temperature at which the computer would automatically shut down.

SoftMenu / Frequency-Voltage Control

This is for use by those with “jumperless” motherboards. This section allows you to control computer settings related to minute voltage settings, CPU multiplier selection, and the system bus speed.

Defaults

In many BIOS versions, a few clicks will set all default settings automatically without your need to attend to individual settings. Some versions offer “Fail-safe” defaults as well as “Optimized” defaults. If a Default section is available in your BIOS version, feel free to use it.

Passwords

Many BIOS versions have a Password section to allow for the use of passwords. If you use it, be very sure to record your password somewhere safe. Should you loose it, the entire BIOS system will lock and you will only be able to use your computer after the entire BIOS system is reset.

There are two passwords, which we can set.

- 1) System Password: This feature helps user to set password to protect unauthorized users from using the system.
- 2) CMOS setup Password: This allows the system administrator to only set the system configuration for the users.

3.2.2 Configuration of system through BIOS

CMOS (Complementary Metal Oxide Semi-Conductor) :

You can change hardware configurations that are stored in the CMOS, or Complementary Metal Oxide Semiconductor.

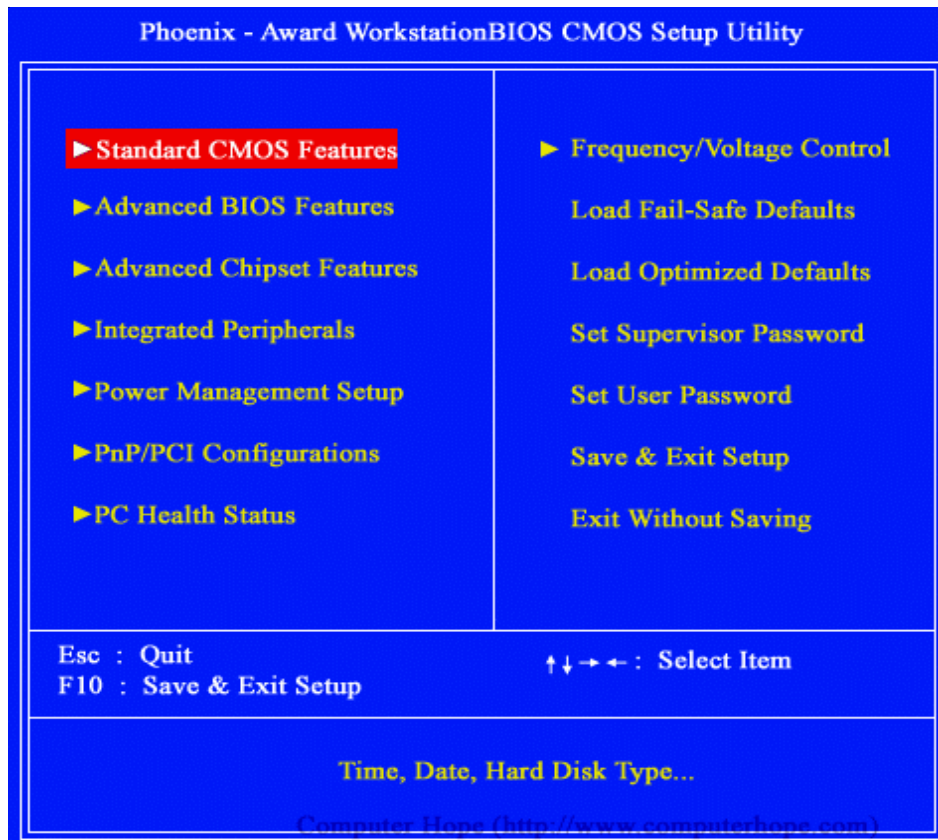


Fig 3.2.1 CMOS setup

Note: The above CMOS setup varies from manufacturer to manufacturer

To perform its tasks, the BIOS need to know various parameters (hardware configuration). These are permanently saved in a little piece (64 bytes) of CMOS RAM (short: CMOS). The CMOS power is supplied by a little battery, so its contents will not be lost after the PC is turned off. Therefore, there is a battery and a small RAM memory on board, which never (should...) lose its information. The memory was in earlier times a part of the clock chip, now it's part of such a highly Integrated Circuit (IC). CMOS is the name of a technology which needs very low power so the computer's battery is not too much in use.

Your PC's performance can be highly affected by the CMOS settings. The reason for this is that the CMOS setup allows you to specify how fast your computer reads from memory, whether or not your cache is enabled or disabled, whether or not your CPU's cache is enabled or disabled, how fast your PCI bus communicates with its adaptor cards, plus a lot more. For more information on optimizing these performance

settings,

Additionally, the CMOS setup allows you to specify disk drive and memory configuration. In order for your hard drive to work with your system, it must be configured in the CMOS setup. The exception to that rule is SCSI drives with adaptor cards, as most have their own built in BIOS. Floppy drives can be setup in the CMOS as well; a: can be made to be b: in many systems, and other configuration options can be changed as well.

Getting Into CMOS setup

Before you can begin BIOS configuration, it is necessary to get into the BIOS Setup Utility. As computers become more powerful and faster, so the boot up has become faster. In fact, Microsoft now has what is called Rapid Booting in which their systems boot up within seven seconds.

The BIOS Setup Utility is entered during the booting-up of the system. You enter by pressing the correct key. That means you have to act very quickly in order to enter BIOS. Luckily, the use of the Pause button (upper right-hand corner of the keyboard) can help.

The first thing you must do is to discover what letter or key on the keyboard you must press (at exactly the right time) in order to get into BIOS. Wouldn't you know, each manufacturer uses a different key. The one you need to use could be F1, F2, Alt, Ctrl, or any other key. During boot up, the BIOS entrance page will flash on the screen for a second or two. You may have to boot up once or twice just to have enough time to look around that page and see which key they want you to use to enter BIOS. It will be stated very clearly on the screen and is often (not always) in the lower left corner.

After you know the key, then you'll be able to press the key at just the right time to enter BIOS.

Design Variations

Each manufacturer also has a different design and arrangement to its BIOS Setup Utility. Therefore, use the following list of BIOS settings only as a rough guide.

General Rule

There are several approaches to Bios settings. Some like to use BIOS settings to make their system run exactly the way they prefer. There is certainly merit to that approach. However, this is an initial configuration of BIOS, so it is wise to take a conservative approach.

For the purpose of this configuration, **only use default settings** when possible. Many BIOS Utilities have a Default Section where you can set all default settings **automatically** without the need to attend to individual settings. It's a good idea to use it.

You can use your mouse or use the keyboard for selections, using the Enter key, Escape key, and arrow directions. BIOS Help is usually at Alt+H.

Standard CMOS Setup

Make sure that:

1. The date and time are correct.
2. The Floppy Disk Drive is set to 1.44MB, 3.5 inches.
3. Video is set to VGA/EGA.
4. In HALT select ON to stop the PC from repeatedly rebooting.
5. Set IDE for Auto-Detection. IDE will either be on the setup menu or on its own menu. (Only some BIOS have this.) **Perform an IDE Auto-Detection now.**

Advanced BIOS Settings

The following can be enabled or disabled. At least for now, we sug-

gest you do the following:

- **The Virus Program** - Enable or disable as you wish.
- **Cache** - Enable; and also, if available, enable ECC Error Checking.
- **Quick POST** - If you leave your computer on most of the time, disable. If you turn your computer off daily, enable.
- **Boot Sequence** - In some versions you may select options. In other versions you have separate settings for “First Boot Device”, “Second Boot Device”, and so on. If your System Boot is on the O/S Installation CD, then for this initial boot-up set CD-ROM as first, hard drive as second, and A: Drive as third. However, if your System Boot is on floppy disk, then set A: Drive as first, hard drive as second, and CD-ROM as third.
- **Swap Floppy Drives** - This is usually disabled. Only enable if you have two floppy drives and you wish to assign the A and B drive letters interchangeably.
- **Fast A20 Gate** - Leave at default.
- **Typematic Rate Settings** - Disable. This deals with the rate by which holding a keyboard character down produces repeated characters on the screen.
- **Boot Numlock** - Enable.
- **CPU Serial Number** - Privacy buffs disable it. This identifies the CPU serial number in Intel CPUs.
- **Video BIOS Shadow** - Disable or default.

Advanced Chipset Settings

You should not need to bother with this section. However, some basic settings are provided for your information. You may enable or disable the following:

- **Chipset Special Features** - (If available) Disable.
- **L2 Cache Size** - (If available) Set to match size of your external cache.
- **DRAM Parity Checking** - Enable only if using parity memory.
- **DRAM Parity/ECC Mode** - Select which one you are using.
- **DRAM Clock Control** - Set to the speed of the system bus,

which should be the default. At a later time, some super-tweaker types may like playing with the settings in this section. Know what you're doing before changing these settings. A wrong setting can cause damage.

- **DRAM Frequency** - Set to the speed of your memory (such as 166).
- **AGP Mode** - Set to "uto." If available. Otherwise, leave at default.
- **AGP Aperture** - Sets the amount of memory space available for graphics. Set to 64 MB, this is normally fine.

There will most likely be many more options available to you. It is best to leave these alone at least for the initial boot-up, and maybe best left alone permanently.

Power Management

This is for sophisticated tweaking, which we are **not** doing now. Your manual will best describe the different options available, if you are interested. But for now, and maybe forever, leave at default (disable) as available.

Integrated Peripherals

Enable the ports you intend to use, disable the ports you intend not to use:

- **IDE Ports** - Enable if you will use both.
 - Device options may be available; if so, set to AUTO when possible.
 - Enable IDE pre-fetch only if your IDE interface supports it, which most likely it does.
 - Enable IDE HDD Block Mode if your hard drive supports it, most new drives do.
- **USB** - Enable, if used.
- **Serial & Parallel Ports** - Enable, if used.

- Set the parallel port mode to ECP, EPP, or both. If you don't know which to pick, leave at default.
- **Motherboard Integrated Hardware** - If not controlled by jumpers, you may enable or disable video, sound, or network hardware as you wish.
- **Expansion Card Hardware** - If you are using one or more expansion cards and your motherboard also has the same options, you need to disable the motherboard options to allow the use of the expansion cards.

PnP/PCI Configuration

This section controls aspects of “Plug-n-Play” and the PCI bus. Most selections should be left at default; but two deserve your attention:

- **PnP OS Installed** - Enable or “Yes”. This allows you to run “Plug-n-Play” programs.
- **Reset Configuration Data** - Usually set to Disabled. However, if a system reconfiguration has previously caused a serious error that rendered the O/S un-bootable, you may wish to enable this option. It will enable you to reset the Extended System Configuration Data (ESCD) when you exit BIOS setup. This allows you to add hardware and software without trouble (in theory).

PC Health

Also known by other names, this section monitors some very basic operational settings, such as voltage levels, fan speed, internal processor temperature. In some versions you can set the temperature at which the computer would automatically shut down.

SoftMenu / Frequency-Voltage Control

This is for use by those with “jumperless” motherboards. This section allows you to control computer settings related to minute voltage settings, CPU multiplier selection, and the system bus speed. Leave all settings at default or AUTO.

This is the section that would also be used by those wishing to overclock their computer system (Not recommended right now).

Defaults

In many BIOS versions, a few clicks will set all default settings automatically without your need to attend to individual settings. Some versions offer “Fail-safe” defaults as well as “Optimized” defaults. If a Default section is available in your BIOS version, feel free to use it.

Passwords

Select change password option to set new password. Now system prompts

Enter New Password :*****

Retype New Password :*****

New password installed, press any key to continue.

To Finish:

1. Click “Save”
2. Make sure your O/S Installation Disk with System Boot is in the CD-ROM drive, or the floppy System Boot Disk is in Drive A:.
3. Exit BIOS Setup Utility. This will automatically reboot your machine.
4. You have now finished BIOS configuration

Summary:

1. CMOS is a menu driven program to configure BIOS.
2. CMOS includes various items through which we can decide the systems behavior.
3. BIOS is powered by a battery which resides on motherboard.
4. Using CMOS we can set the password when system is booting.

Short questions: -

1. What is CMOS setup?

2. Name few BIOS features?
3. What are the features available in ADVANCED BIOS SETTINGS?

Essay Type questions: -

1. How do you set system password and CMOS password?
2. Name few BIOS features and explain briefly?
3. How do you configure BIOS? Name few features of CMOS?

4.1.1 Introduction :

Operating system: It is a software which allows the users to use computers. Without OS a computer is a mere machine, which is incapable of performing any work.

Ex : DOS, Windows 9x, Linux, OS/2 , Solaris etc

In this chapter we will learn how to install DOS and Windows 98 operating system.

DOS is one of the oldest operating system. It forms the basis for next generation of operating systems, like Windows 9x.

4.1.2 Hard Disk Partitions

This procedure explains how to setup a **new hard disk**. Warning - if you are setting up a hard disk which contains data, the following procedure would completely erase your hard disk and the data would be unrecoverable.

Before a new hard disk can be used it needs to be setup. This involves partitioning and formatting the hard disk. Windows 98 or ME boot disk contains the required software to perform this procedure. FDISK.EXE and FORMAT.COM are the files required in your bootable floppy disk.

Start the partition and format procedure by booting your PC using a Windows boot disk. Make sure you set the BIOS so that the boot sequence is set to detect the floppy disk first. If your system has no problems booting you will be presented with a Windows boot disk menu. This gives you the option to start the system with or without CD-ROM support. At this stage you do not need the CD-ROM support, so choose the option to boot without CD-ROM support. You should end up in the MS DOS prompt A: (A drive).

From A: command prompt type **fdisk**. You will be presented with following message:

Your computer has a disk larger than 512 MB. This version of Windows includes improved support for large disks, resulting in more efficient use of disk space on large drives, and allowing disks over 2 GB to be formatted as a single drive.

IMPORTANT: If you enable large disk support and create any new drives on this disk, you will not be able to access the new drive(s) using other operating systems, including some versions of Windows 95 and Windows NT, as well as earlier versions of Windows and MS-DOS. In addition, disk utilities that were not designed explicitly for the FAT32 file system will not be able to work with this disk. If you need to access this disk with other operating systems or older disk utilities, do not enable large drive support.

Do you wish to enable large disk support (Y/N) ? [Y]

Choose “Y” to enable large disk support.

You will now be presented with the FDISK main menu as shown below.

```
Microsoft Windows 98
Fixed Disk Setup Program
(C) Copyright Microsoft Corp. 1983 - 1998

FDISK Options

Current Fixed disk drive: 1

Choose one of the following:

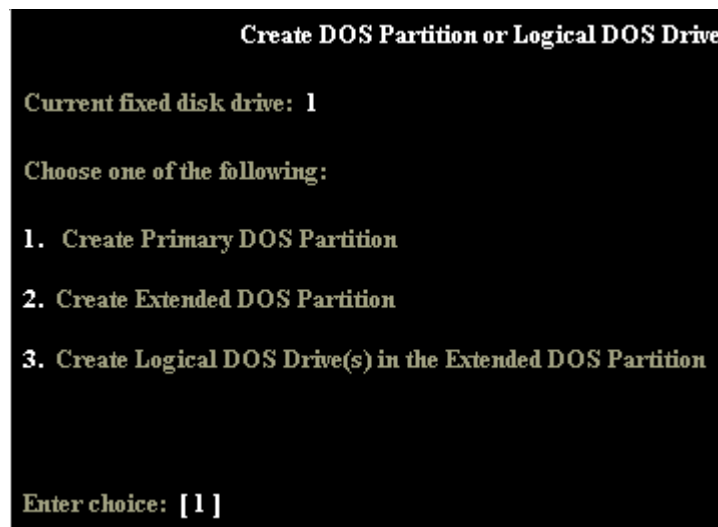
1. Create DOS partition or Logical DOS Drive
2. Set active partition
3. Delete partition or Logical DOS Drive
4. Display partition information
5. Change current fixed disk drive

Enter choice: [ 1 ]

Press Esc to exit FDISK
```

From the menu, choose option 1 - Create DOS partition or Logical DOS drive. Another menu will present the following options.

Name : Installing different operating systems like DOS and Windows



Choose option 1 - Create primary DOS Partition. FDISK verifies the integrity of your drive and will ask you if you want to use the maximum available size of your hard disk to create the primary partition and set it active. To keep things simple we will create one large partition. Choose "Y" to use maximum available space. When the partition has been created successfully you will be notified by the system. Your drive is now known as C: (C drive). Press "Esc" to return to the menu. Press "Esc" again to exit FDISK. You need to restart your system for the changes to take effect. Leave boot disk in the drive.

When the system reboots, choose start without CD-ROM from the boot disk menu. While booting from floppy disk you might get error message like "Invalid media type reading drive C" this is OK for this stage as the hard disk is not formatted.

If you want to create extended DOS partitions, specify the size of the partitions in the bytes for primary partition. And remaining space can be utilized to create logical drives in the extended partition. Like D, E, F etc.

From A: command prompt type **format c:**

You will get a message saying "WARNING, ALL DATA ON NON-REMOVABLE DISK DRIVE C: WILL BE LOST. Proceed with Format (Y/N)?".

Don't worry about the message as you do not have any data in the new hard disk. Choose "Y". The format will proceed and would show you a progress

indicator. The time it takes to format a hard disk depends on the size and speed of the drive. This could be around 5-30 minutes. Once the format is complete you need to reset your system. You are now ready to install an operating system

4.1.3 DOS Installation

1. Run Z:\INSTALL
2. Read Copyright agreement
3. Click on OK
4. Choose the hard drive on which you want to install the program and click on NEXT
5. Choose the directory (Default \BIBLE) and click on NEXT
6. Click on INSTALL DATA FILES TO HARD DRIVE and click on NEXT
7. Click on MS-DOS and click on NEXT
8. Click on each versions you wish to install, ensuring that it is highlighted. Click on the right-hand arrow and repeat procedure for each version you wish to install. Use the scroll bar on the right to view all available versions. Please note that you are restricted to a maximum of nine versions under DOS. When you have completed your choices, click on NEXT
9. Repeat the above procedure with the Notes. You are restricted to eight Notes under DOS. When you have completed your choices, click on NEXT
10. Repeat the procedure for the Topics. When you have completed your choices, click on NEXT

Click on FINISH to complete the installation

4.1.4 Windows 98 Installation

This is what you will need before installing windows 98.

1. Windows 98 CD.
2. Computer with CD-ROM Access.

Configuring your BIOS for the Install:

To find out how to access the BIOS please refer to your motherboard manual or the manufacturer of your computer. (The system bios can usually be entered on

Name : Installing different operating systems like DOS and Windows

boot, usually by pressing the F1, F2, F8, F10 or DEL key. Make sure you save the settings before exiting. If you are unsure or don't want to enter the BIOS then just test the computer by putting the CD-ROM in the drive and rebooting the computer.

This is the recommended way to install windows 98.

Starting The Setup:

1. Insert CD and restart PC.
2. Once the Windows 98 Setup Menu comes up choose option 2 (Boot from CD-ROM)
3. Then the Windows 98 Startup Menu will come up. Select Option 1. (Start Windows 98 Setup from CD-ROM)
4. Now your computer will install some drivers so please wait a few moments.
5. Now a blue setup screen will come up. Press enter.
6. Setup then wants to do some system tests. Just press enter.
7. Scandisk will now run, please wait.
8. After ScanDisk completes Windows will copy a few important files for setup.
9. Now the graphical Windows 98 Setup Screen will come up.
10. Click continue and wait for the setup wizard to complete.
11. Now it will ask you in which directory to install Windows to. The default directory is
just fine so click next.
12. Setup will now prepare the directory, please wait.
13. Setup will now check for installed components and disk space, please wait.
14. Setup will now prompt you what type of install. Choose typical if you have a desktop
computer or portable if it is a laptop.
15. Windows will prompt you to install components, just choose continue.
16. If a network card is detected a network information screen will appear.
Type in the
required information and click next
17. Select your country settings, United States should be chosen by default.
18. Now finally the main part of Setup is here. Setup will start copying files.
This will
take a pretty long time, be patient.

19. Once setup is done copying files Windows will restart automatically.
20. The Windows 98 Startup Menu will appear. Select option 1 (Boot from Hard Disk)
21. The Windows 98 booting screen will appear!
22. Now Windows will prompt you for user information, enter it and click continue.
23. Now the License Agreement. Read and if you agree click on “I accept the Agreement” and click next. If you select “I don’t accept the Agreement” then setup will end.
24. Now input your product key computer. Click next to continue.
25. Next click on Finish.
26. Setup will now finalize the hardware and install settings.
27. Setup will now install plug and play devices.
28. Your computer will restart automatically.
29. The Windows 98 Startup Menu will appear. Select option 1 (Boot from Hard Disk)
30. Windows will start booting for the second time.
31. Setup will continue installing hardware.
32. Now setup will prompt you to enter in your time, date, and time zone. Once selected click on apply and then ok.
33. Windows will continue to setup Windows items.
34. The computer will restart automatically once again.
35. The Windows 98 Startup Menu will appear. Select option 1 (Boot from Hard Disk)
36. Windows will boot for the third time.
37. Windows will update system settings.
38. Now finally you have reached the Windows Desktop!
39. You also may need to install your hardware drivers. If everything is working properly then you shouldn’t worry about them.

Enjoy your new freshly installed Windows

Summary:

1. Operating system is an interface between the user and the computer.
2. There are two types of software's, they are System software which is used to make the system usable for ex : Windows 9X, compilers etc and Application software is used to solve users problems for ex: MS-Word, Spreadsheet, Accounting packages etc.
3. Before an Operating system is installed a hard disk has to be partitioned using FDISK and FORMAT commands.

Short type questions:

1. What is an operating system and give examples?
2. Expand DOS?
3. Define system and application software?
4. Briefly explain the procedure to install DOS?

Long type questions:

1. Briefly explain the procedure to install windows?
2. Briefly explain the procedure to create partitions in hard disk?

1.2.1 Introduction

There are several types of diagnostic software available for PC's. This software some of which is included with the system when purchased, assist user identifying many problems they can occur with a computer component. The types of diagnostic software are as follows.

POST. The power on self-test operates whenever any PC is switched on.

What is tested in POST ?

Whenever you startup your computer it automatically performs a series of checks that check the primary components in the system, such as CPU, ROM, Memory and major peripherals. These tests are brief and are designed to catch hard errors. It detects severe motherboard problems. If the POST encounters the problem that prevents the system from operating properly, it halts the boot process and generate an error message that often identifies the cause of the problem. The POST detected problems are called the fatal errors.

On detecting the problem POST reports the problem in three ways. 1

- 1) Audio codes
- 2) On screen text messages
- 3) Hexa-decimal numeric codes

Manufactured supplied diagnostic software. This manufacturer specific software normally consists of a suit of tests that thoroughly examines a system. In some cases, the diagnostic software is installed on a special partition on the hard drive and can be accessed during a start up. For example IBM, Compaq, Hewlett- Packard, Dell and others make diagnostic software that is designed for their system.

Peripheral diagnostic software: Many hardware devices come with specialized diagnostic software designed to test their particular functions. For example SCSI drives.

Operating system diagnostic software: Operating systems such as windows 9x and windows NT include a wide variety of software designed to identify and monitor the performance of various components in the computer.

Name : Troubleshooting through software

For example we have Windows 9x device manager from the system control panel, you see list of types of devices found in the system. Expanding each type displays the actual hardware installed in the computer. Each entry has a properties dialogue box that enables you to configure the device, view the hardware resources that it is using, and update its driver.

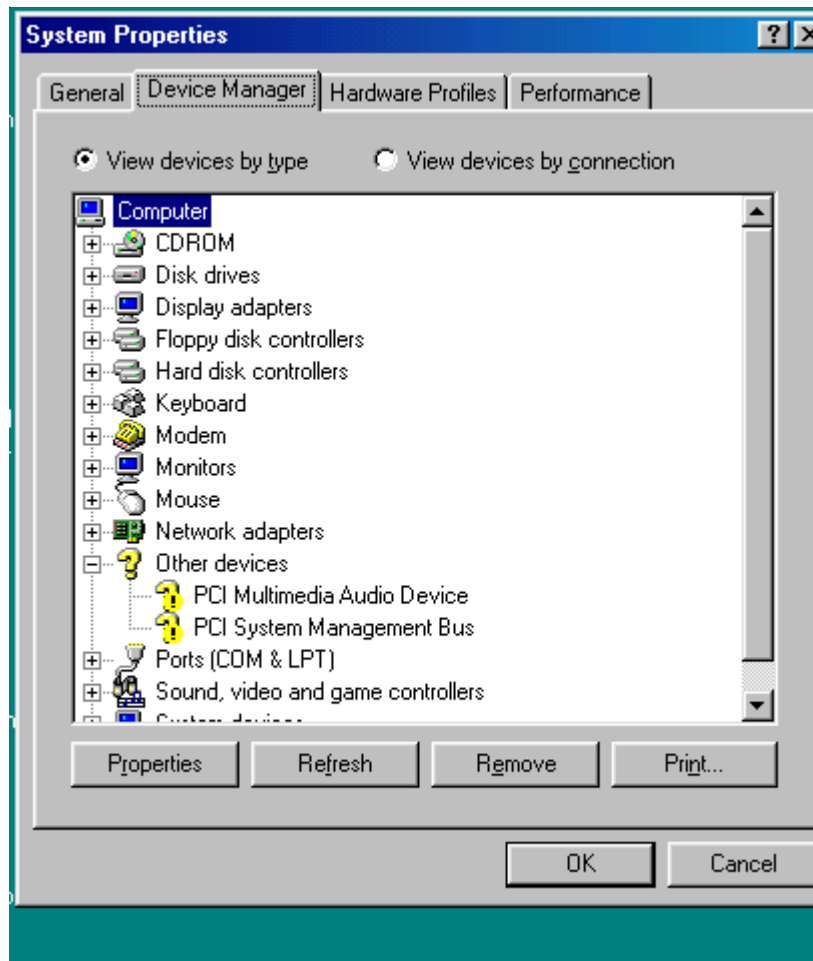


Fig 4.2.1 Device Manager

Windows 9x System/Performance Monitor

The windows 9x system monitor and the windows NT system monitor performs the same function. Both programs track specific elements of a system performance and display them in graphical format.

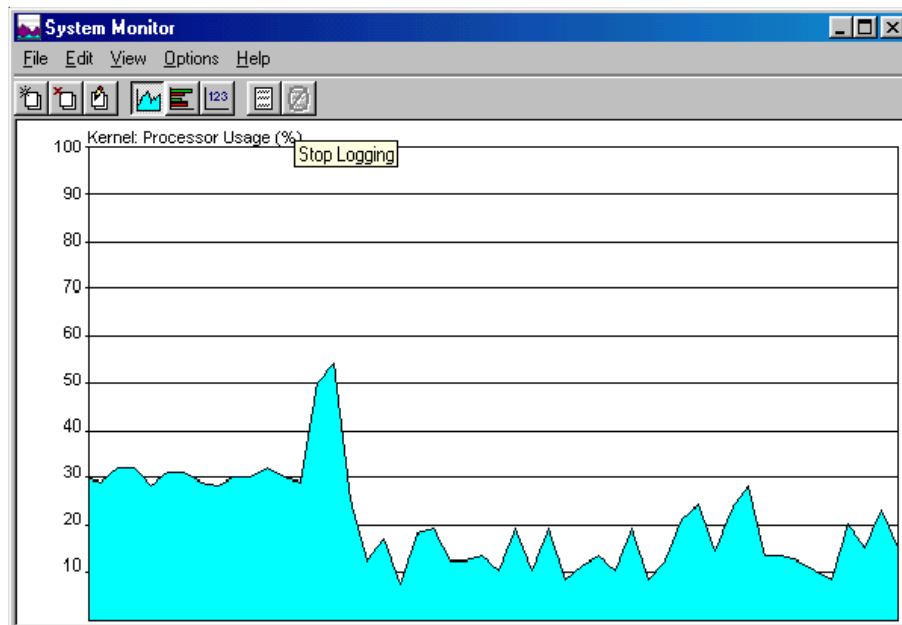


Fig 4.2.2 System Monitor

Windows 9x Resource Meter

This application continuously monitors the windows 9x system, user , GDI(Graphics Device Interface) resources.

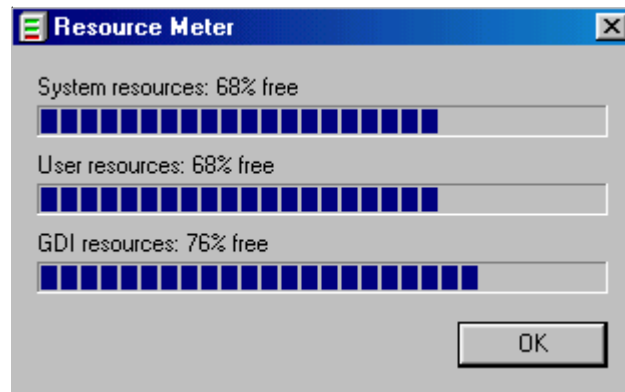


Fig 4.2.3 Resource Meter

System Information and diagnostics

Windows 98 system information program is an excellent addition to the operating system that provides detail information about the computer hardware and software.

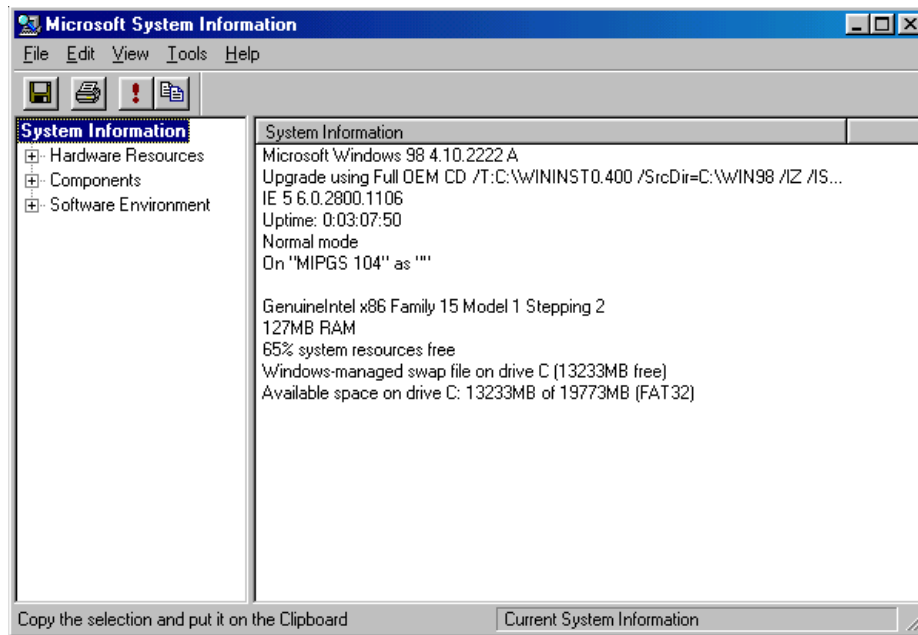


Fig 4.2.4 Microsoft System Information

After market diagnostic software: There are a number of manufacturers making general-purpose diagnostic software for PCs. This type of software is often bundled with other system maintenance and repair utilities to form a general PC software tool kit.

For example

AMIDdiag(AMI) American Megatrends, Inc: is one of the largest manufacturers of PC ROM BIOS software today. The AMI BIOS is found on many PCs, and has numerous features and enhancements which are not found on the simpler ROM version. AMIDdiag is an extensive reporting and diagnostics functions support virtually all hardware found in PCs today.

Checkit Pro. Offers an excellent suite of testing capabilities, including tests of the system CPU; conventional, extended and expanded memory; hard and floppy drives; and video adapter and monitor.

Norton Utilities Diagnostics: This comes with Norton Utilities, which is an essential collection of system data safeguarding, troubleshooting, testing, and

repairing utilities.

There are three other disk utilities available which are Speedisk, Disk Doctor and Calibrate that help in hard drive diagnostics and software level repair.

And there are several other diagnostic tools like Micro-Scope, PC-Technician, QAPLus/FE etc.

Summary :

- 1) Troubleshooting stands for identifying the source of problem.
- 2) Different methods of troubleshooting include POST, Third party general-purpose software's.

Short type questions:

- 1) Expand POST?
- 2) How do POST report errors?
- 3) What is trouble shooting?
- 4) List the various types of Software's available to troubleshoot?
- 5) Give examples of third party softwares to troubleshoot?

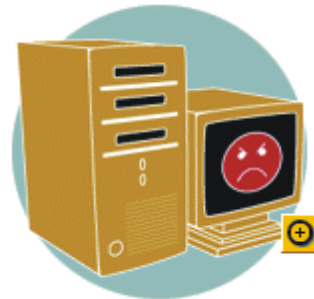
Long type questions:

- 1) Briefly explain Operating system diagnostic software with examples ?

5.1.1 Viruses

They're the common cold for computers; we'll show you how they operate and how to protect your PC.

Virus: A virus is just a computer program. Like any other program, it contains instructions that tell your computer what to do. But unlike an application, a virus usually tells your computer to do something you don't want it to do, and it can usually spread itself to other files on your computer—and other people's computers.



What is a virus?

A virus is a malicious piece of software with the following characteristics. It is:

Hidden : You cannot see it with the normal DIR command.

Self-Replicating : It automatically copies itself, thus infecting other files and disks.

Delayed action : Thus you won't know you've got it until you have been infected for a considerable time, possible with your backups also infected.

They can spread very fast across open networks such as the Internet, causing billions of dollars worth of damage in a short amount of time. These software “pranks” are very serious; they are spreading faster than they are being stopped, and even the least harmful of viruses could be life threatening. For example, in the context of a hospital life-

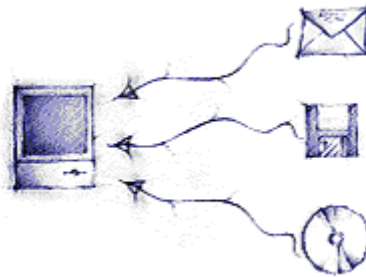
Support system, a virus that “simply” stops a computer and displays a message until a key is pressed, could be fatal. Further, those who create viruses cannot halt their spread, even if they wanted to. It requires a determined effort from computer users to be “virus-aware”, rather than continuing the unawareness that has allowed computer viruses to become such a problem.

Five years ago, very rarely computers used to get infected by virus i.e once in a year, where as the chance you receive a virus today is increased.

5.1.2 Most common entry points :

The first question that you should ask yourself is: How do viruses get into a

computer, or attack it? If you know the answer to this question you can prevent infection by protecting these possible virus entry-points.



The most common entry-points used by viruses are the following:

- **Removable disk drives**
- **Computer networks**
- **Internet**
 - E-mail
 - Web pages
 - File Transfers (FTP)
 - Downloads
 - Newsgroups

5.1.3 Types of Viruses:

Worms:



Worms are different to other viruses since they do not infect other files. Their sole objective is to propagate or spread to other systems as quickly as possible. They do however make use of replication (propagation) techniques. In fact, their objective is to copy themselves and then infect other systems. Their infections or replications usually take place through e-mails, computer networks and Internet IRC Channels. They could also replicate inside the memory of a PC.

Trojan Horses (or Trojans):



Trojans cannot be considered viruses as such. They take their name from Greek mythology (the famous wooden horse in which Greek soldiers hid so that they could enter the city of Troy undetected and then attack it). Trojans work in a similar way. They seem to be harmless programs which get into a computer through any channel. When that program is executed (they have names or characteristics which trick the user into doing so), they install other programs on the computer which could be harmful.

Logic Bombs:

These activate and damage an infected system only when one or more conditions are met. They are not considered viruses as such, since they do not replicate, but rather depend on the actions taken by the user (the user usually copies and/or executes them unintentionally).

Encrypted:

Rather than a virus category, this is a technique that viruses could use. A virus could belong to another category and be also encrypted (if it uses this technique). The virus encodes or encrypts itself so that antivirus programs cannot easily detect it. In order to perform these activities, the virus de-encrypts itself and, when it is finished, encrypts itself again.

Polymorphic:

These are virus that use a new technique to avoid detection by antivirus programs (they are usually the hardest viruses to find). They change with every infection they carry out. In this way, they create a large number of copies of themselves.

5.1.4 Symptoms of Virus

It may appear that you have a virus in your computer, but you cannot be sure that this is the case until it is detected using an antivirus tool (programs that detect and eliminate viruses). Some actions that can be carried out by a virus are obvious enough to be recognized and could include: messages displayed on-screen, operations slowing down, the properties of some files change, files and/or folders disappear, the computer will not start, the content of the infected disk is lost, etc.

5.1.5 What do virus infect.

The main targets of viruses are files located in storage devices such as hard and floppy disks. They target program files, although other types of files and documents can also be infected. A program is simply a file with an EXE or COM extension, which can be run to perform specific operations.

As we have already mentioned, there are viruses designed to infect files that are not programs. However, these documents contain elements known as macros. Macros are small programs that the user can include in certain types of files.

Other elements prone to virus attack are the storage devices themselves, especially boot sector. By attacking the places in which files are stored, the damage produced by the virus will affect all of the information they contain.

5.1.6 Advent of Antivirus Software

Name : Viruses

Virus experts have recorded more than 40,000 viruses and their variant strains over the years, though only about 200 of those viruses are actively spreading in the wild. While most viruses are just annoying time-wasters, the ones that do deliver a destructive payload are a real threat.

Viruses have been around since the early 1960s, almost since the earliest computers existed, though until the 1980s they were largely laboratory specimens, created by researchers and released in a controlled environment to examine their effect.

When viruses first appeared in the wild in the 1980s, they spread slowly and passed via the “sneaker net”: floppy disks traded by people and shared between computers. But widely available Internet and e-mail access hastened their spread.

Two years ago, the advent of viruses that spread via e-mail (MelissaLoveLetter, for example) significantly increased the odds that the average computer user would confront a virus because they spread so rapidly. E-mail viruses today account for about 81 percent of virus infections and can infect thousands of machines in a matter of minutes.

5.1.7 Virus Detection and Prevention Tips:

1. Do not open any files attached to an email from an unknown, suspicious or untrustworthy source.
2. Do not open any files attached to an email unless you know what it is, even if it appears to come from a dear friend or someone you know. Some viruses can replicate themselves and spread through email. Better be safe than sorry and confirm that they really sent it.
3. Do not open any files attached to an email if the subject line is questionable or unexpected. If the need to do so is there always save the file to your hard drive before doing so.
4. Delete chain emails and junk email. Do not forward or reply to any to them. These types of email are considered spam, which is unsolicited, intrusive mail that clogs up the network.
5. Do not download any files from strangers.

6. Exercise caution when downloading files from the Internet. Ensure that the source is a legitimate and reputable one. Verify that an anti-virus program checks the files on the download site. If you're uncertain, don't download the file at all or download the file to a floppy and test it with your own anti-virus software.

7. Update your anti-virus software regularly. Over 500 viruses are discovered each month, so you'll want to be protected. These updates should be at the least the products virus signature files. You may also need to update the product's scanning engine as well.

8. Back up your files on a regular basis. If a virus destroys your files, at least you can replace them with your back-up copy. You should store your backup copy in a separate location from your work files, one that is preferably not on your computer.

9. When in doubt, always err on the side of caution and do not open, download, or execute any files or email attachments. Not executing is the more important of these caveats. Check with your product vendors for updates which include those for your operating system web browser, and email . One example is the security site section of Microsoft located at <http://www.microsoft.com/security>.

Summary:

1. Virus is a self replicating code which can cause lots of damage.
2. Types of viruses are worms, Trojans, logic bombs, encrypted and polymorphic.
3. Symptoms of viruses are change in file sizes, system slowdown, files disappear, system does not start.
4. Common entry points of viruses are infected floppies, Internet, Compact Disks.
5. Viruses usually infect the storage devices and the files stored on that.

Short type questions:

- 1) What are computer viruses? And why should I worry about them?
- 2) How does a computer get infected with virus?

Long type questions:

- 1) What are the types of Viruses? Explain them in detail?
- 2) What are the symptoms and indications of a virus infection?
- 3) How do you detect and prevent virus?

5.2.1 Introduction:

It's a good idea to make scans with an antivirus program regular part of your preventive maintenance programs. Although both Microsoft and IBM provide antivirus software in MS and PC – DOS respectively, if you run windows 9x or windows NT, you must obtain a third party program to scan your system. There are many antivirus software available for example Norton, e-Scan, AVG, McAfee, Pccillin etc.

No matter which of these programs you use, you should perform a scan for virus programs periodically, especially before making hard disk backups. This will help ensure that you catch any potential virus problems before it spreads and becomes a major catastrophe.

In addition it is important to select an antivirus program from a vendor that provides regular updates. These updates are essential because there are new viruses constantly being introduced.

5.2.2 Before You Start

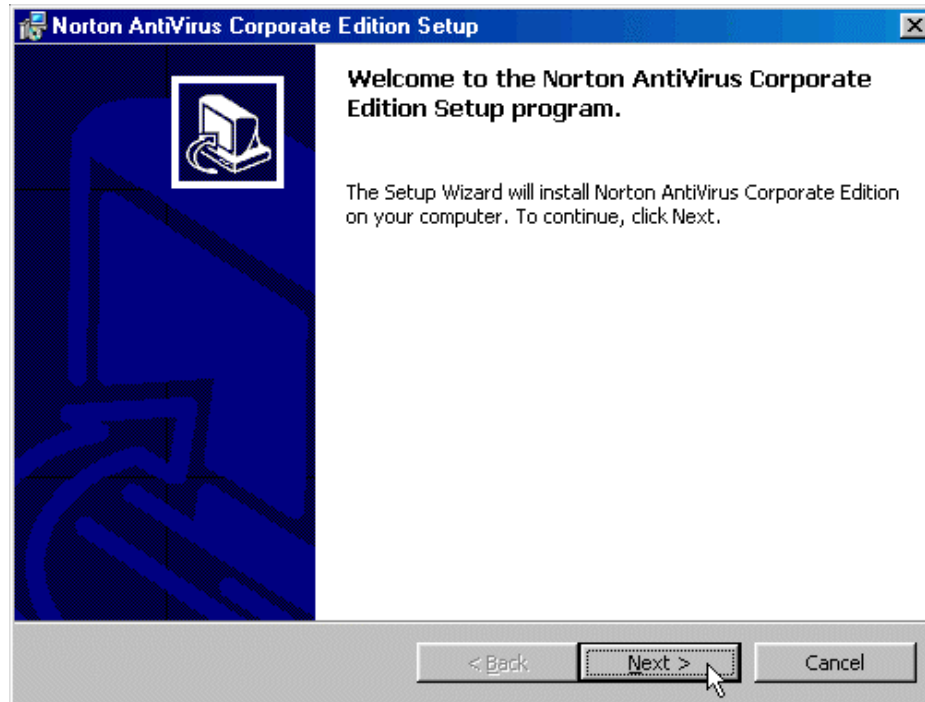
- If any anti-virus program is currently installed on your computer, uninstall it before proceeding, including Norton AntiVirus (click **Start, Settings, ControlPanel, Add/Remove Programs**).
- Print this document for reference during software installation.
- Close this window before you begin the software installation.
- Close all other programs.

5.2.3 Installing and Configuring Norton AntiVirus

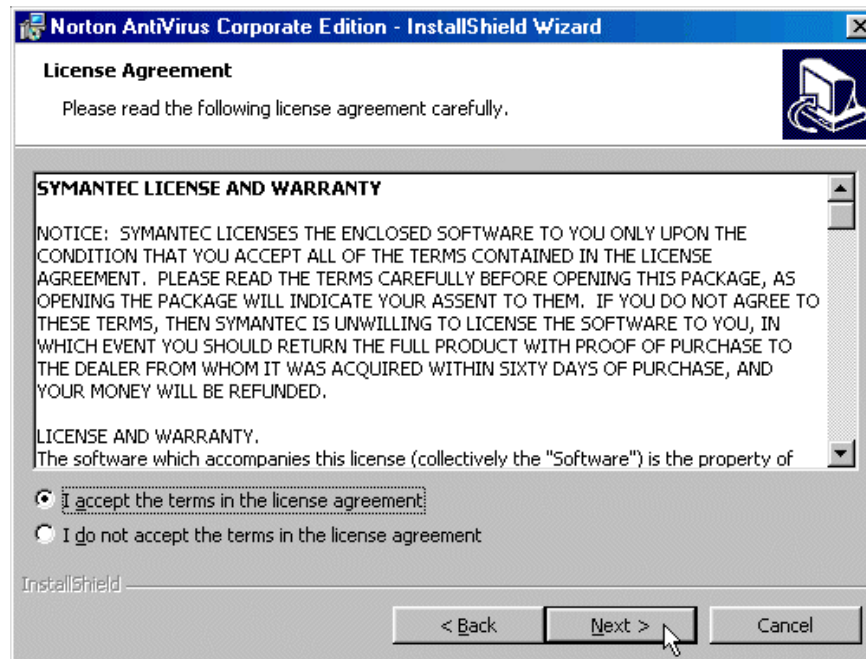
These instructions may not reflect the exact appearance of Windows on your computer due to differences in Windows releases.

1. Start the **Norton Anti-Virus** installer.
To continue, click **Next**.

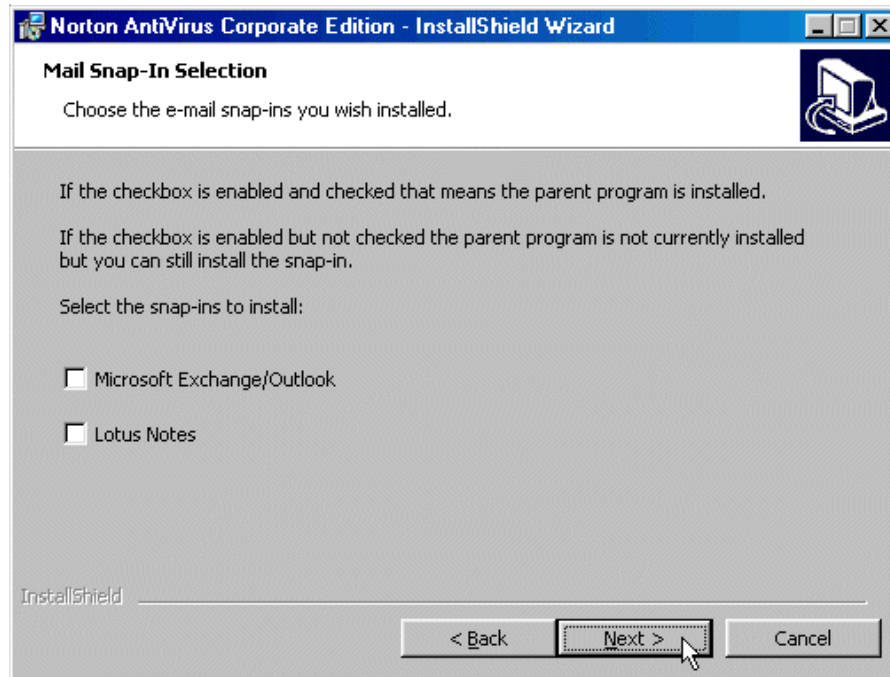
Name : Installation of Norton - Antivirus



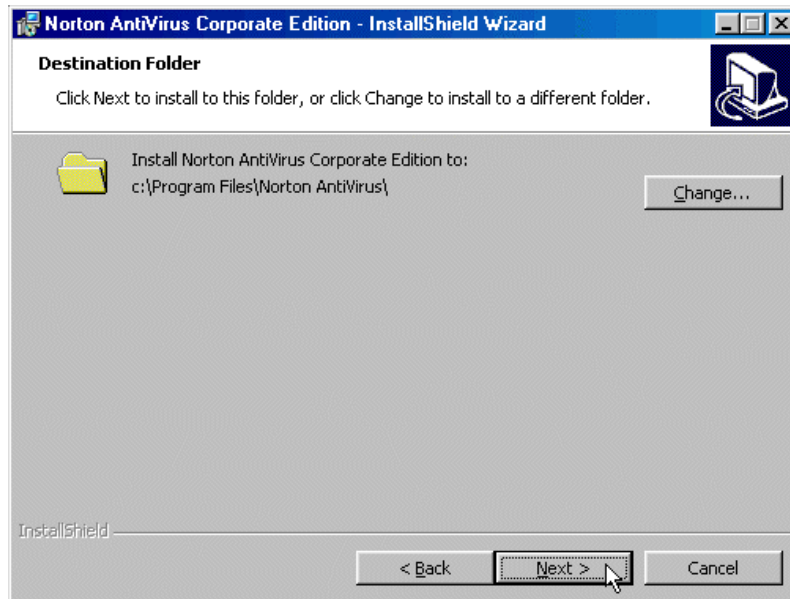
1. To continue, accept the terms of the License Agreement and click **Next**.



Select any snap-ins to install, and click **Next**.

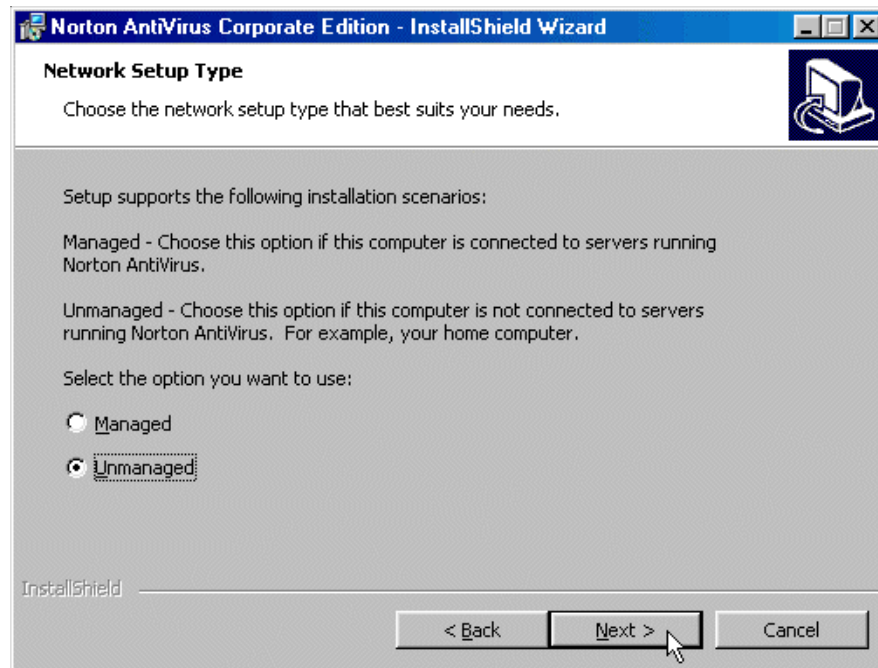


1. The **Destination Folder** is the location on your hard drive where Norton AntiVirus will be installed. Click **Next**.

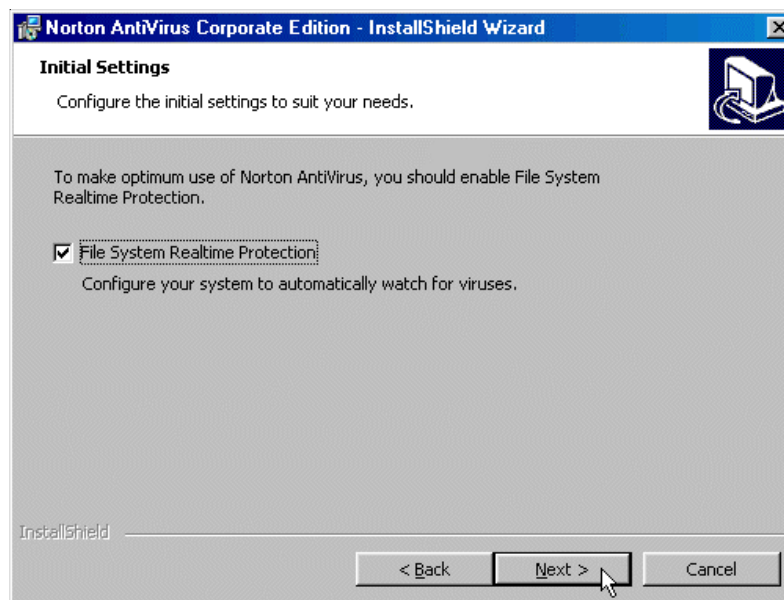


1. In the **Norton Setup Type** window, select **Unmanaged** and click **Next**.

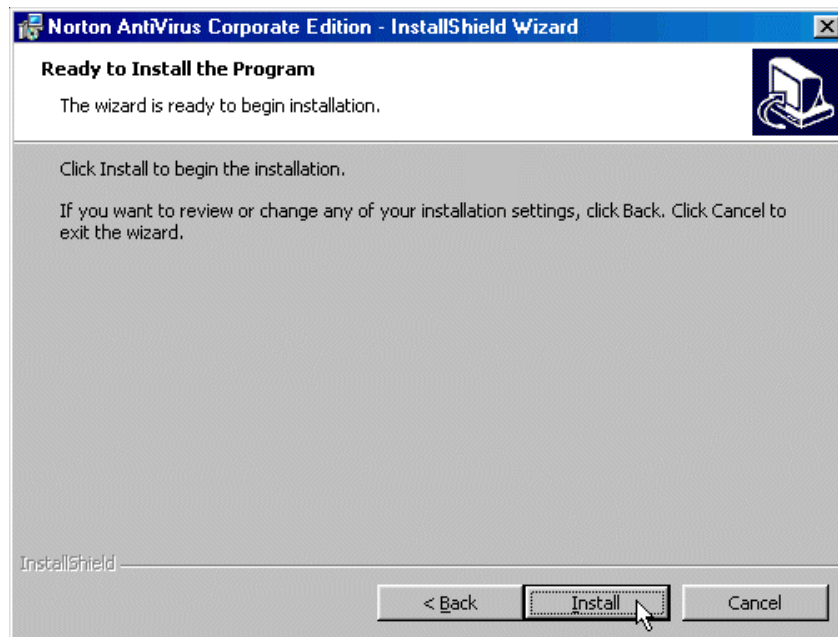
Name : Installation of Norton - Antivirus



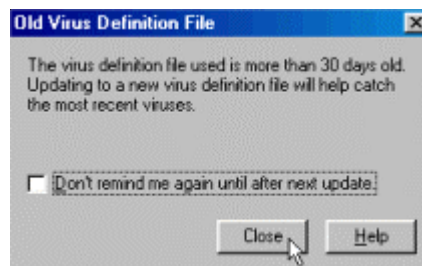
1. In the **Initial Settings** window, put a check-mark in the **File System Realtime Protection** box, and click **Next**.



1. To continue, click **Install**.

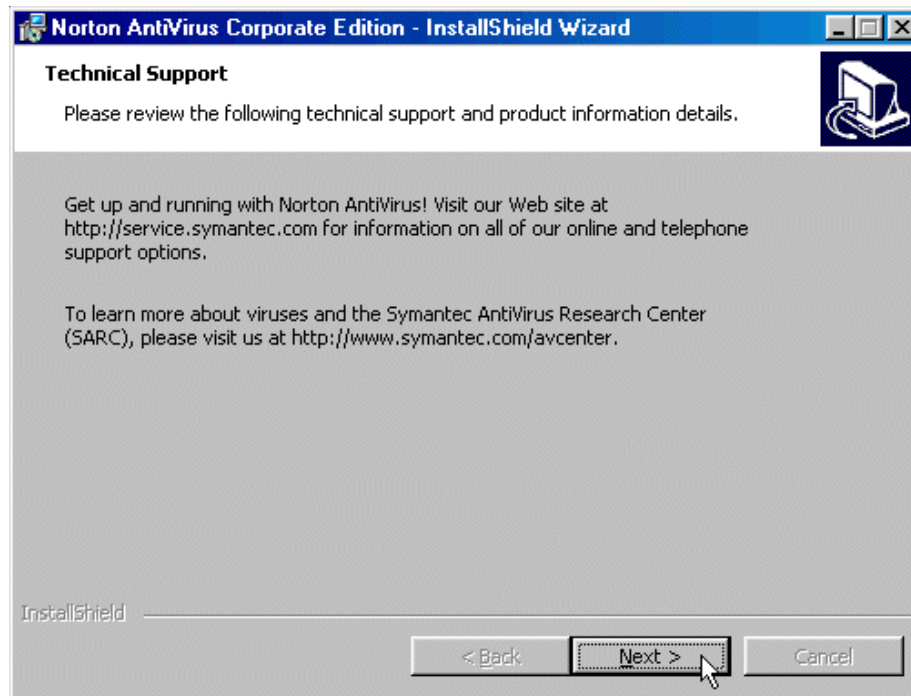


1. If an **Old Virus Definition File** window appears after the file copy and installation processes are through, click **Close**.

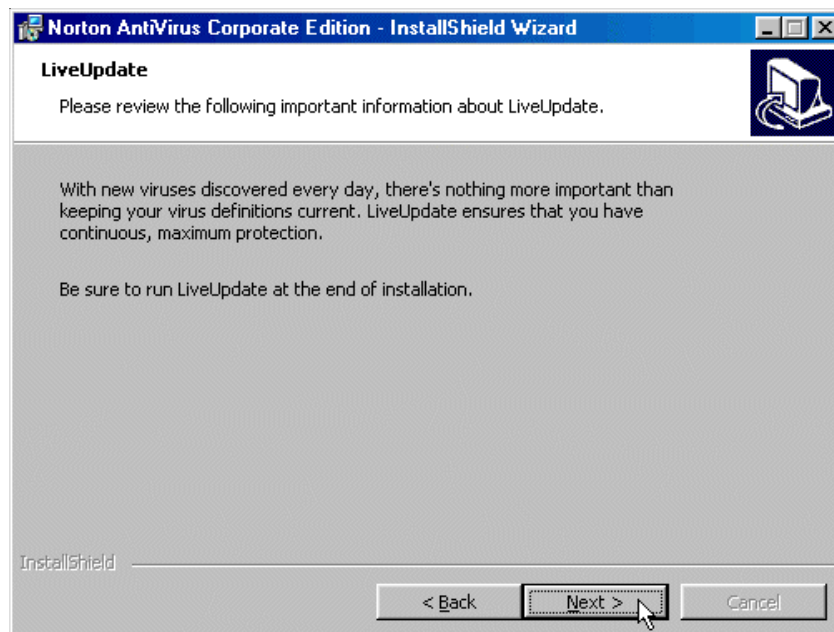


1. Read the **Technical Support** window, then click **Next**.

Name : Installation of Norton - Antivirus



1. Read the **LiveUpdate** window, then click **Next**.



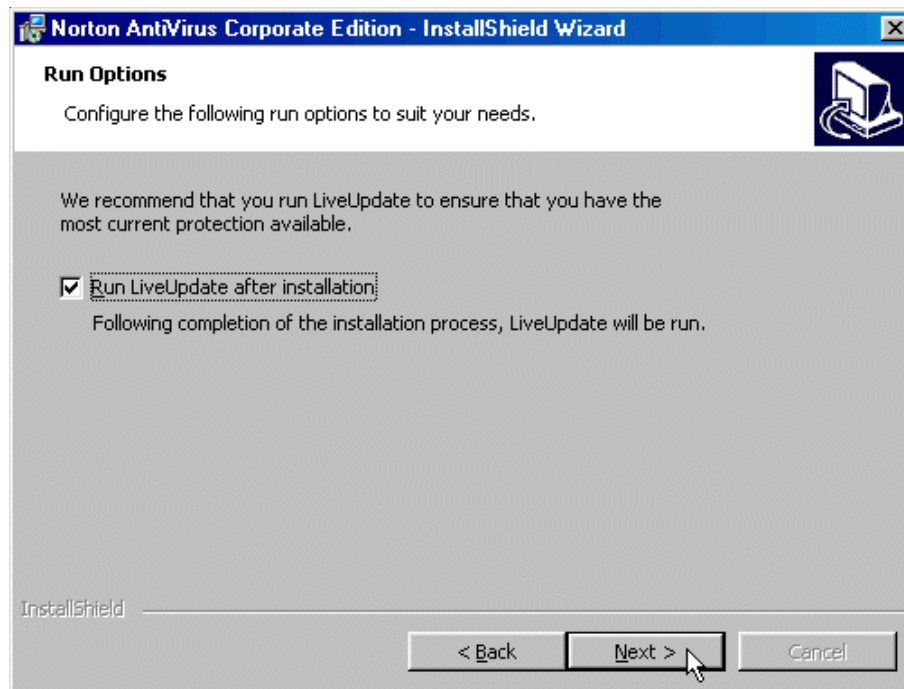
1. In the **Run Options** window, select whether or not to **Run**

LiveUpdate after installation based on the following criteria:

A) If your computer has a permanent or semi-permanent high-speed connection, **check** the box.

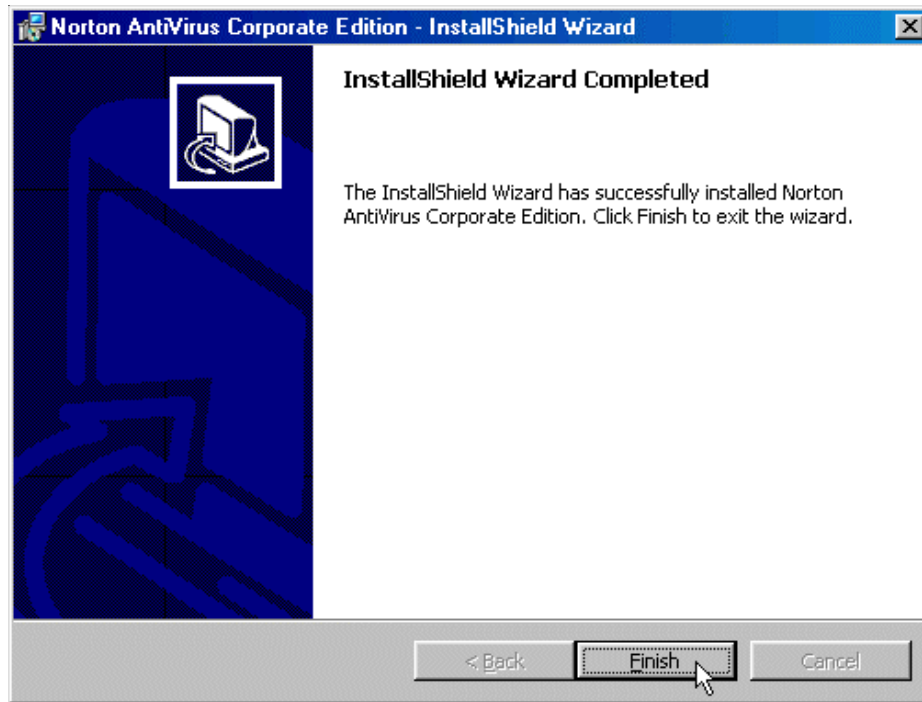
B) If you use modem Dialup Networking to connect to the Internet, **clear** (un-check) the box, so that after your computer restarts in later steps, you can dial into the Internet before running **LiveUpdate** manually.

2. Click **Next**.

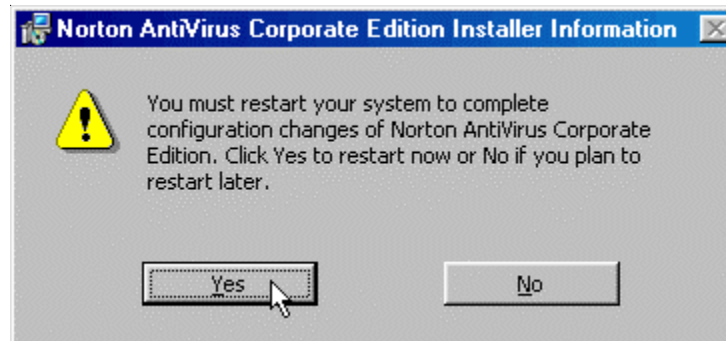


1. Click **Finish** to continue.

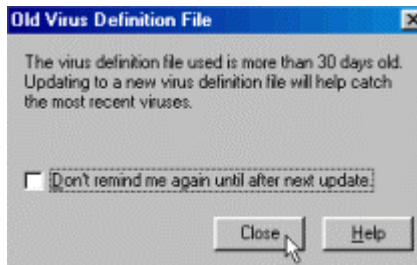
Name : Installation of Norton - Antivirus



We recommend that you restart your computer at this stage of the process; click **Yes**.



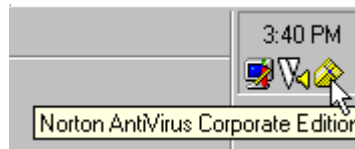
16. If you see an **Old Virus Definition File** dialog box after restarting, click **Close**.



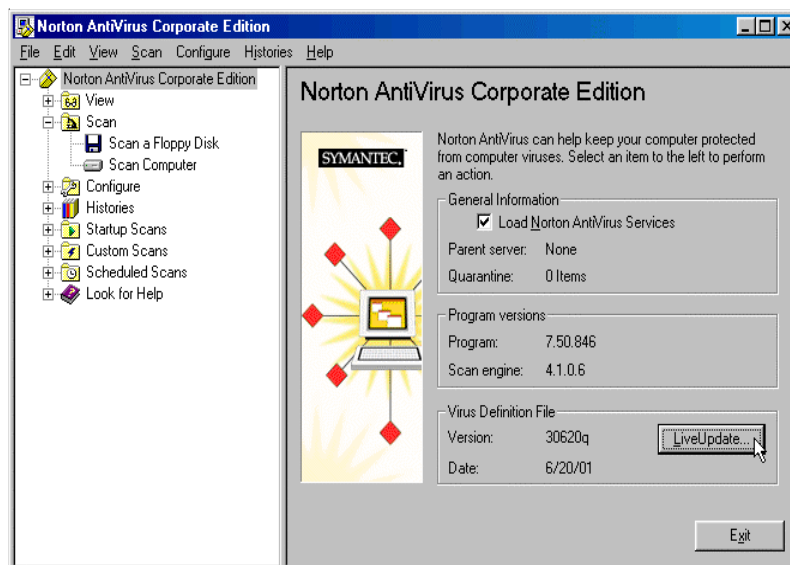
Updating Virus Definitions with LiveUpdate

17. If your computer is already connected to the Internet, and **Virus Protection Update** has started already, skip to step #20.

18. Make sure your computer is connected to the Internet, and then double-click the **Norton AntiVirus Corporate Edition** yellow shield icon in the Windows System Tray located at the bottom right of the Windows Desktop, near the clock.



19. In the **Norton AntiVirus Corporate Edition** window that appears, click the **LiveUpdate** button.



20. In the **LiveUpdate** window that appears, select **Internet** and click **Next**.

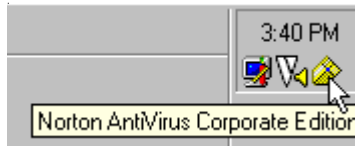


21. When the LiveUpdate process is through, click **Finish** in the **LiveUpdate** window that appears.

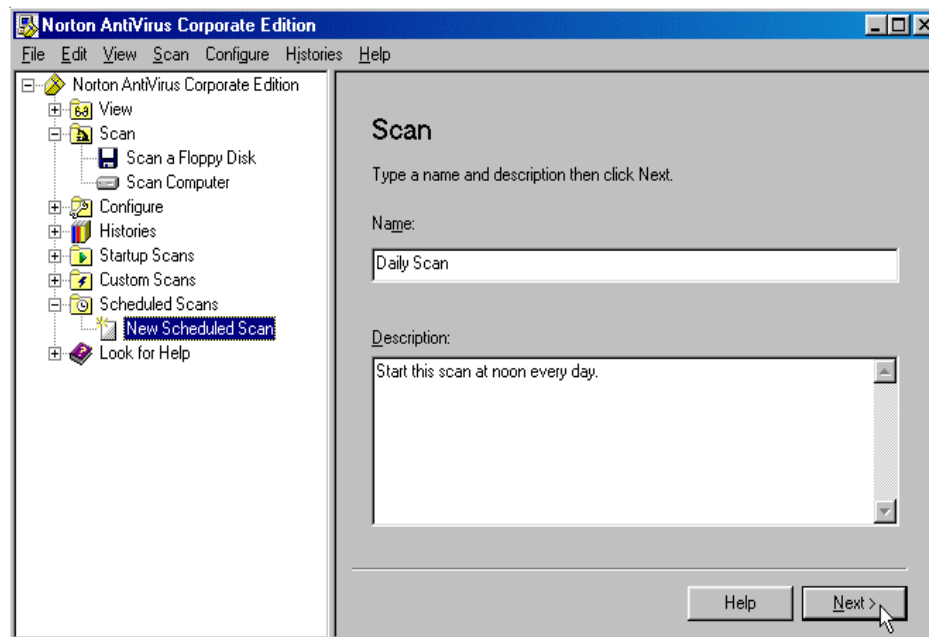


Scheduling Automatic Virus Scans

22. Double-click the **Norton AntiVirus Corporate Edition** yellow shield icon in the Windows System Tray located at the bottom right of the Windows Desktop, near the clock.

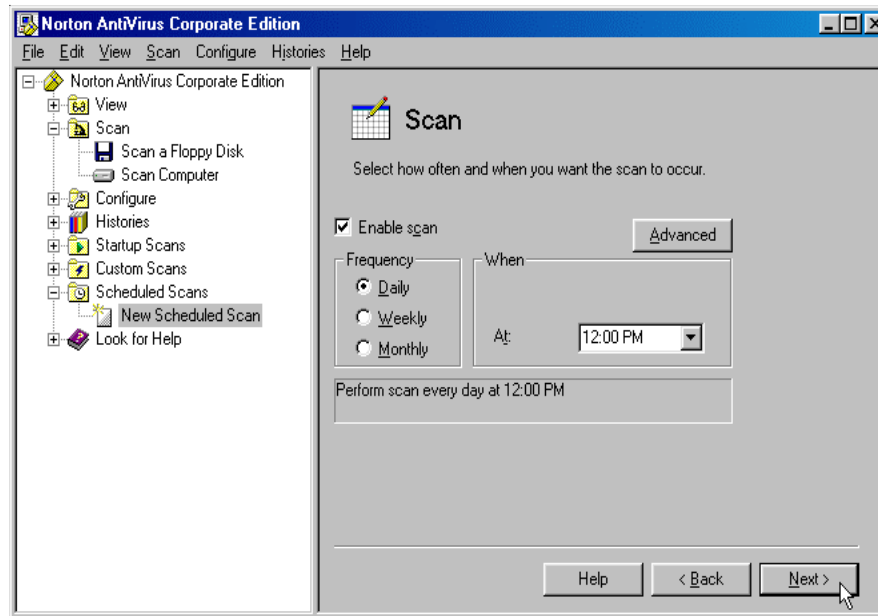


23. In the **Norton AntiVirus Corporate Edition** window that appears, under the item **Scheduled Scans**, click the item **New Scheduled Scan**, fill in the **Name** and **Description** fields as desired, and click **Next**.

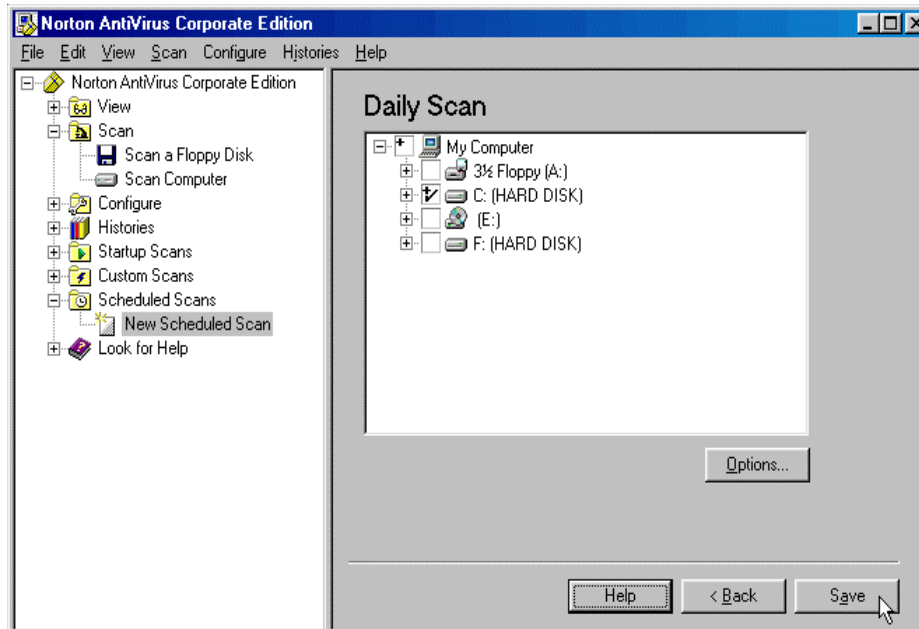


24. Set the scan to run at a time when you expect your computer to be powered on, such as at lunch time, and click **Next**.

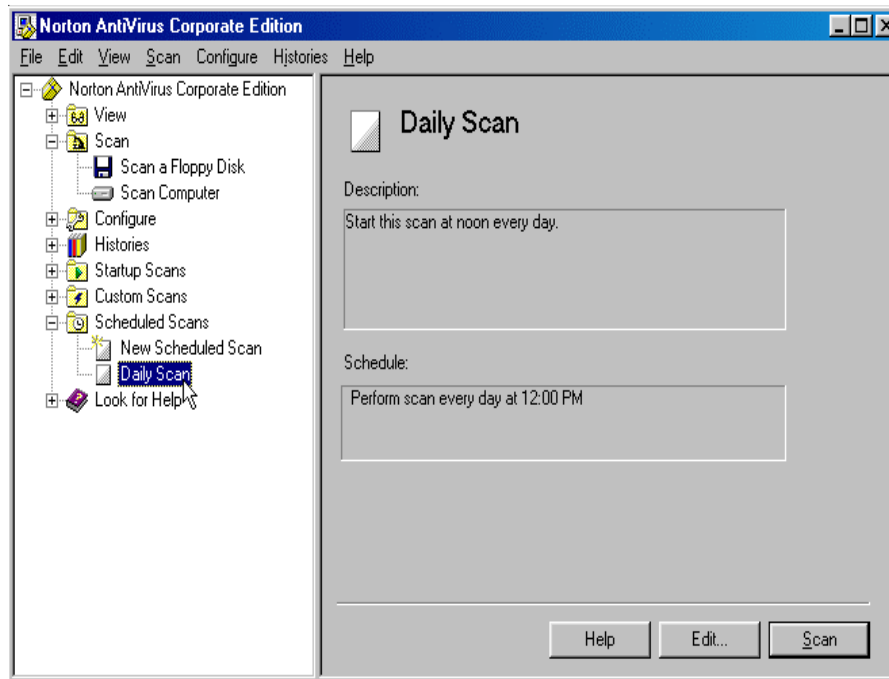
Name : Installation of Norton - Antivirus



25. Designate the drive(s) you wish to scan by clicking the necessary checkboxes, and click **Save**.



- 26 The **Daily Scan** job which was created now appears under the **Scheduled Scans** folder on the left side of the window.

**Summary :**

- 1) Antivirus software is used to scan the Computer for viruses.
- 2) Frequently used antivirus software are McAfee, Norton, AVG etc.

Short type questions:

- 1) Define Antivirus software?
- 2) Name few antivirus softwares available?
- 3) Can Antivirus software be infected? Why?

Long type questions :

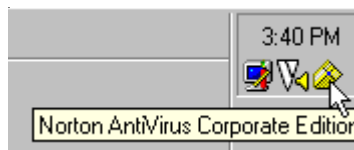
- 1) Briefly explain the installation of Norton Antivirus?

5.3.1 Automatic Updates of Patches:

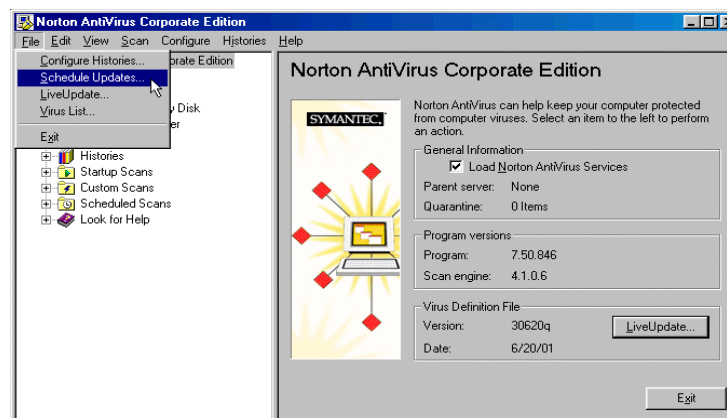
Many of the newer versions of antivirus programs have an automatic update feature. To use this feature, just connect to the Internet, start the antivirus program, and click on the Update button. The Update process is completely automated. Some programs allow you to choose to update automatically without having to even click a button. These programs will automatically update when you connect to the Internet.

Even if your program is set to automatically update, you should always check to make sure that the update is actually occurring. At least once a week, you should open your antivirus program and check to make sure that a very recent date is listed for the time of the last update. Also, when virus activity is extremely high, you may want to manually update in addition to the automatic update.

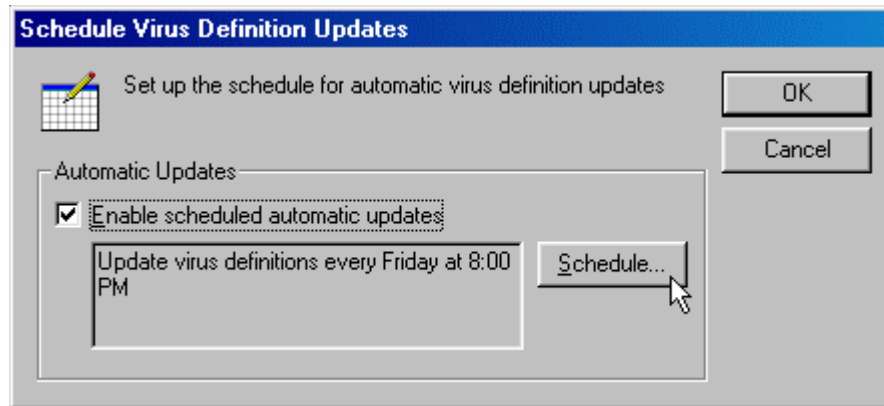
1. Double-click the **Norton AntiVirus Corporate Edition** yellow shield icon in the Windows System Tray located at the bottom right of the Windows Desktop, near the clock.



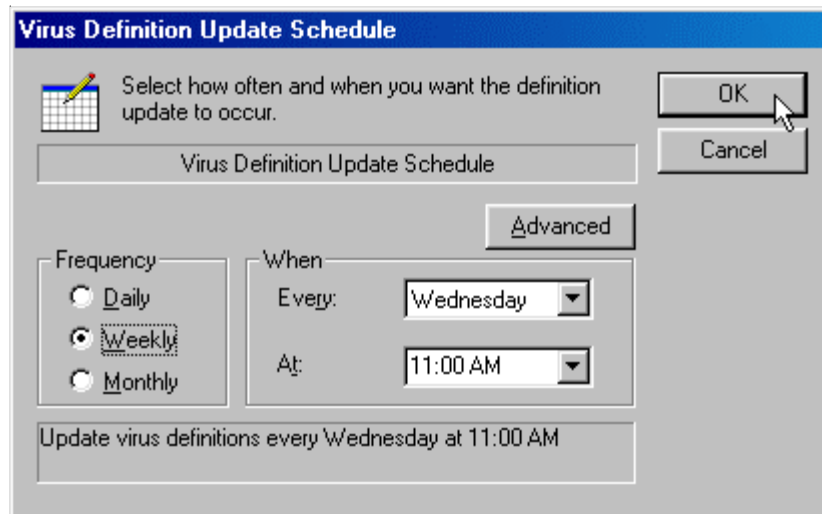
2. In the **Norton AntiVirus** window, click **File** and **Schedule Updates...**



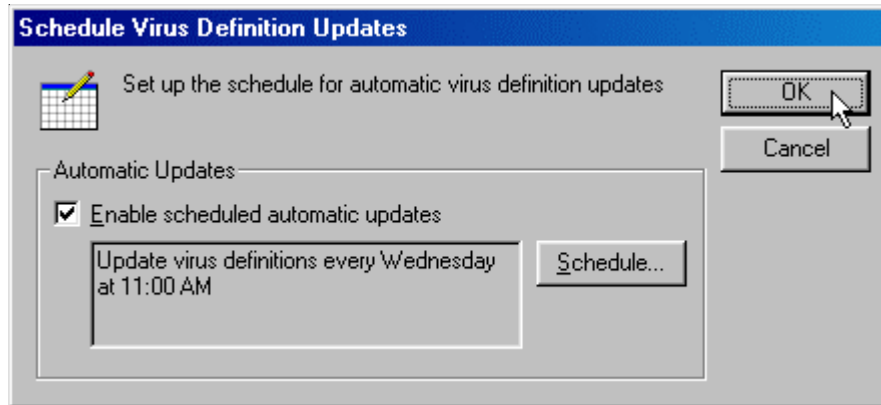
3. In the **Schedule Virus Definition Updates** window, click the **Schedule** button.



4. In the **When** section of the window, select a day and time you would normally expect your computer to be powered on (up and running, already connected to the Internet), and click **OK**.



5. In the **Schedule Virus Definition Updates** window that reappears, click **OK** to save your changes.



6. Exit the **Norton AntiVirus** program.

5.3.2 Manually Downloading

If you do not have an automatic update feature or if that feature doesn't work properly (it has been known to happen!), you will have to go to the manufacturer's Web site to manually download the virus updates. Norton Antivirus users will go to www.symantec.com. McAfee VirusScan users can surf over to www.mcafee.com. Find the latest update for the operating system that you are using and download it to your computer. If you have the choice of opening or saving the file, choose Open and the file will automatically install. If you have chosen to Save the file, you will have to complete the installation by finding the file and double-clicking on it.

5.3.3 Scan for Viruses

1. Click on *start button* and go to *programs* or click on desktop *icon of Norton antivirus* or click on the *Norton antivirus icon on status bar*.
2. Click on the options available for your use. Ex: 1) If you want to scan floppy, click on floppy option. 2) If you want to scan C drive, select and click on it.
3. It scans and reports if any infected files are present with several options.
4. They are 1) Clean the virus. 2) If it cannot clean it will ask for "Quarantine or delete" the file.
5. This is the time when you have to download the patches from the vendor's site and install. And now again scan the system to clean the virus, which could not get cleaned in the previous attempt.

6. If this is not helpful to clean the virus. It is better to report to the vendor.

Summary:

1. Patches can be updated either manually or automatically.
2. Schedule scan for viruses must be adopted to protect your PC from getting infected.

Short type questions:

1. Give the procedure for manual download of patches?
2. Give the procedure for automatic download of patches?

Long type questions:

1. What is the procedure to remove virus from a computer?