LECTURE NOTES

ON

COMPUTER HARDWARE AND MAINTENANCE (5^{TH} SEM,CSE)

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INTRODUCTION

1.1 NEED OF MANAGEMENT IN COMPUTER CENTRES

A management information system (MIS) provides information that organizations need to manage themselves efficiently and effectively. Management information systems are typically computer systems used for managing five primary components: hardware, software, data (information for decision making), procedures (design,development and documentation), people (individuals, groups, or organizations),. Management information systems are distinct from other information systems, in that they are used to analyze and facilitate strategic and operational activities.Academically, the term is commonly used to refer to the study of how individuals, groups, and organizations evaluate, design, implement, manage, and utilize systems to generate information to improve efficiency and effectiveness of decision making, including systems termed decision support systems, expert systems, and executive information systems.

Management of Services on Daily Operations

a) Service Planning: know our customers and their expectation
b) Define service level: Determine what can be done for customers. Computer Center Manager need to understand what is expected by customers and draft out Service Level Agreement for further discussion with customers
c) Make agreement with customers: It's needed to tell customers the truth regarding what computer center can deliver
d) Provide services to customers such as:
   1)Organize staffs to provide agreed services
   2)Prepare people and resources for such services
   3)Assist customers when system is down, i.e. to recover the system within the pre-agreed Period.

Need of Management in Computer Centers:

The computer center, one of the support departments in the college, offer a wide range of services to satisfy the general computational and information processing needs of the educational, research and administrative programs. Services Provided by Computer Center are

- To provide computer-related services to personnel and customers
- To provide advice and consultancy for users
- To provide systems development services to users

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- To provide data entry services for users
- To create and maintain IT standards and procedures
- To provide IT acquisition services to users
- To keep and protect IT and data assets
- To ensure that the organization has adequate/advanced IT progress, which is in line with the organization's vision

1.2 TYPES OF JOB CARRIED OUT IN COMPUTERS IN AN ORGANIZATION :

The various jobs are as follows:

- Providing computing capability, running programs and producing reports, printing documents, providing operations services, make sure that good performance is provided
- Providing Internet services: Set up Internet and Email accounts, managing mailbox, providing disks spaces for Web, providing security and virus warning, etc.
- Providing helps: Help users to solve computer usage problems, help users to develop simple applications, help users to keep their data, help on security
- Providing system development services: Develop system for users
- Providing data entry services: This is to capture data into the systems, during these days, such function seems to be obsolete now. Such services may include storing data in database, data protection by data backup and recovery. Scanning images into the systems is also considered as a part of this function.
- Providing consultancy services: Purchasing devices, installing hardware & software, help users to work more efficiently
- Providing training for users, recently, the use of e-Learning concept of training also implemented.

Hardware jobs:

Computer hardware equals the collection of physical elements that constitute a computer system. Computer hardware refers to the physical parts or components of a computer such as monitor, keyboard, Computer data storage, hard drive disk, mouse, printers, CPU (graphic cards, sound cards, memory, motherboard and chips), etc. all of which are physical objects that you can actually touch. In contrast, software is untouchable. Software exists as ideas, application, concepts, and symbols, but it has no substance. A combination of hardware and software forms a usable computing system.

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Software jobs:-

computer software, or just software, is any set of machine-readable instructions (most often in the form of a computer program) that directs a computer's processor to perform specific operations. The term is used to contrast with computer hardware, the physical objects (processor and related devices) that carry out the instructions. Hardware and software require each other; neither has any value without the other.Firmware is software that has been permanently stored in hardware (specifically in non-volatile memory). It thus has qualities of both software and hardware.

1.3

DUTIES AND RESPONSIBILITIES OF PERSONNEL INVOLVED:

Duties and responsibilities of person in computer centers are as below:

- Computing Service Center (or Computer Center or IT Service Center): Basically, to provide services of all types related to business data processing, business applications, and maintenance services to all departments in the organization.
- Data Processing Center: To process business data (Sales, Deposit/Withdrawal, Airline Ticketing, Student Registration, etc.) and produce summary report or other business documents
- MIS Center: To provide information for managers and executives for making timely and quality decisions (usually continuing the work of data processing.
- Data Center: To provide data for use by all departments (e.g. center to provide criminal records, population records (Khonthai.com), etc.)

-Office Automation and Internet Center:

To provide services to all departments with office automation and communication systems

1.4 HIERARCHY OF POSITION OF DIFFERENT LEVELS:

There are different levels of staff in a computer organization as per their work responsibility are as below:-

Level A - Individual Contributor

- Individuals at this level usually follow standard work routines
- They generally work under close supervision
- They typically have very little decision making ability
- Typically less than three years relevant experience is required at this level.

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Level B - Professionals

- Individuals at this level usually have procedural or systems experience
- They generally work under general supervision
- Their decisions are usually based on established procedures
- Typically 3-5 years relevant experience is required at this level.

Level C - Managers and Senior Technical Professionals

- Individuals at this level must have command of the procedures and systems used.
- They generally work to specific measurable objectives requiring operational planning skill
- with little direct supervision.
- They have considerable latitude for making decisions within their unit
- People skills are important
- Typically 5-7 years relevant experience is required at this level.

Level D - Directors

- Individuals at this level must have a thorough understanding of the theoretical and practical
- application of the principles of their profession.
- They generally work to broad goals for their area of responsibility
- They have significant latitude for making decisions for their operational or functional units
- People skills are essential
- Typically 8-10 years relevant experience is required at this level.

Level E - Vice President

- Individuals at this level are seasoned professionals in their field of expertise
- They give strategic to the units under their control
- They develop and direct short and near term goals for their units
- Their decision making is only to direction from top management
- People skills are essential, including the ability to develop subordinates, are critical.
- More than 10 years relevant experience is required at this level.

However, in computer centres the data processing manager is the head of the department under which you have the computer analyst, programmer, operation manager, etc. The hierarchy of different position levels as below figure:

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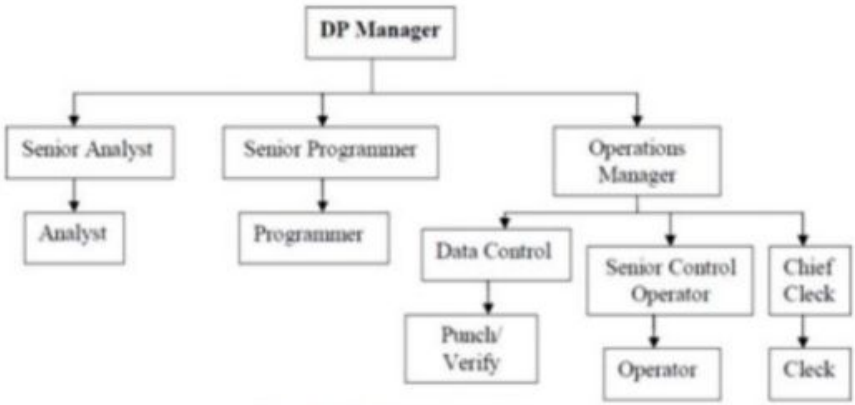

Figure 1 DP Department Structure I

1.5 NEED FOR TRAINING THE STAFFS:-

Training of employees takes place after orientation takes place. Training is the process of enhancing the skills, capabilities and knowledge of employees for doing a particular job. Training process moulds the thinking of employees and leads to quality performance of employees. It is continuous and never ending in nature.

Importance of Training

Training is crucial for organizational development and success. It is fruitful to both employers and employees of an organization. An employee will become more efficient and productive if he is trained well.

Training is given on four basic grounds:

1. New candidates who join an organization are given training. This training familiarize them with the organizational mission, vision, rules and regulations and the working conditions.
2. The existing employees are trained to refresh and enhance their knowledge.
3. If any updations and amendments take place in technology, training is given to cope up with those changes. For instance, purchasing a new equipment, changes in technique of production, computer implement. The employees are trained about use of new equipments and work methods.
4. When promotion and career growth becomes important. Training is given so that employees are prepared to share the responsibilities of the higher level job.

The benefits of training can be summed up as:

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1. **Improves morale of employees-** Training helps the employee to get job security and job satisfaction. The more satisfied the employee is and the greater is his morale, the more he will contribute to organizational success and the lesser will be employee absenteeism and turnover.
2. **Less supervision-** A well trained employee will be well acquainted with the job and will need less of supervision. Thus, there will be less wastage of time and efforts.
3. **Fewer accidents-** Errors are likely to occur if the employees lack knowledge and skills required for doing a particular job. The more trained an employee is, the less are the chances of committing accidents in job and the more proficient the employee becomes.
4. **Chances of promotion-** Employees acquire skills and efficiency during training. They become more eligible for promotion. They become an asset for the organization.
5. **Increased productivity-** Training improves efficiency and productivity of employees. Well trained employees show both quantity and quality performance. There is less wastage of time, money and resources if employees are properly trained.

1.6 THE COMPUTER MAKERS :-

Top Computer Manufacturing Companies of the world include some of the most renowned computer producing brands such as IBM, Apple and Wipro.

These and many others are big names which have successfully curved out a place for themselves in the international market through years of dedication and commitment. These companies have been manufacturing world class computers and their brand itself certifies the quality of their products.

IBM

International Business Machine Corporation which is popularly known as IBM is one of the biggest name among all the Top Computer Manufacturing Companies. The company was founded in the year 1889 and is presently headquartered in New York. The company manufactures and sells computers.

APPLE

Another important name in the competitive sphere of Top Computer Manufacturing Companies is Apple. Apple Inc. is a popular multinational corporation manufacturing computers since 1976. It is headquartered in California. Till 2006, it was known by the name of Apple Computer.

COMPAQ

Compaq is also an important computer manufacturing company which has been doing successful

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business since 1982. It enjoyed the status of being the largest producer of computer systems for many years.

INTEL

Intel Corporation is another important competitor which is the first company to produce x86 series of microprocessor used in personal computers. The company was founded in 1968 and is headquartered in California, with sub-branches almost in every part of the world.

LENOVO

Lenovo group Limited is the third largest computer manufacturing company in the world and the largest in Asia Pacific. The company was established in 1984 and is headquartered in North California, United States.

1.7 MAJOR VENDORS IN COMPUTER HARDWARE AND SOFTWARE:

Roughly half of the companies in the hardware list also produce software, and two-thirds of the companies also offer IT services to their customers. Very large IT companies like HP, IBM, Cisco and Microsoft tend to have an all-round product palette, including hardware, software and services, although each has its specialties and its own accents.

The following company are the at the top level in the field of hardware and software:

Microsoft, SAP, oracle, Lenovo, HP and IBM

As the list shows, the hardware industry is not just a bunch of PC makers. In fact, most of the hardware companies don't make PCs; they only produce certain components. An ordinary PC bought from the store may be composed of a processor from Intel (7th position), a DVD-player from Toshiba (6th position), a hard drive from Seagate (28), a graphics card from Nvidia (66th position), a mainboard from Asus (18) and memory from Kingston (63). All the mentioned companies have specialised in delivering one or more components. A small minority of the companies actually sells full-fledged PCs. The largest PC makers (HP, Dell Acer and Lenovo) all rely heavily on a network of suppliers. Because IBM invented the PC to be an open system, every willing company can start making and selling components that fit in PCs around the world. Hence, margins are often razor-thin in the hardware industry, and competition can be very intense. Eventually, the companies that receive some kind of brand recognition from the public are the ones that succeed in making a profitable living from their produce

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SELECTION OF COMPUTER SYSTEM

2.1 FACTORS AFFECTING SELECTION AND EVALUATION OF COMPUTERS:

Computer based learning (CBL) is increasingly used to enhance the learning experience. Cultural differences and attitudes in learning and teaching are an important consideration for tutors engaged in the choice and provision of CBL materials.Learning resources accessed via computer and web-based learning modes are now commonly used in developed countries and numerous software packages are easily available from a variety of sources.

However, reports suggest that more educational research should be performed to find out how effective computer-based learning (CBL) really is. It has been viewed by some as a fashion based primarily on social influences, in contrast to approaches based on established educational principles, critically evaluated experiences.

Sorting allows information or data to be put into a meaningful order. As efficiency is a major concern of computing, data are sorted in order to gain the efficiency in retrieving or searching tasks. The factors affecting the efficiency of shell, Heap, Bubble, Quick and Merge sorting techniques in terms of running time, memory usage and the number of exchanges were investigated.

Experiment was conducted for the decision variables generated from algorithms implemented in Java programming and factor analysis by principal components of the obtained experimental data was carried out in order to estimate the contribution of each factor to the success selection of computer system.

The factors are affecting the selection of computer system are as below:

a) speed

The speed of the system so that it can give output.

b)reliability

It depends how it is reliable for using

c) durability

It gives how the computer is durable for future generation

d) fault tolerance

It describes how it handle the errors and faults.

e) cost

It gives the computer cost to meet the requirement of the user.

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2.2 DIFFERENT TYPES OF INDUSTRIES AND THEIR COMPUTER REQUIREMENTS

The computer or information technology, or IT industry is the range of businesses involved in designing computer hardware and computer networking infrastructures, developing computer software, manufacturing computer components, and providing information technology (IT) services. The electronic digital computer is the messenger of the Information Age. Just as technologies developed in earlier ages liberated people from physical toil, computers have liberated people from the more tedious kinds of mental toil—and have revolutionized the transfer of information. The banking, insurance, and travel industries, to name a few, are vastly quicker and more responsive than they were a half-century ago.The computer industry employs hundreds of thousands directly, but many millions of people outside the industry use computers as an important tool in their jobs. Besides the growth of software development companies there were also some new businesses that depended on software and fast worldwide communication which grew rapidly during this period.

They were IT enabled services (ITeS) and Business Process Outsourcing (BPO). IT enabled services included tasks such as checking insurance claims, filling income tax returns, medical transcription, remote support on bug fixing of software, call centres etc. The call centres operate 24 x 7 for worldwide customers and require language proficiency mostly in English and some European languages. Business Process Outsourcing (BPO) is primarily performing the back-office work of a number of organizations, the largest segment being banks and insurance companies.

The back-office work was typically accounts receivable, payroll processing, account reconciliation, inventory management, and similar jobs. The only requirement was trainable human resources with good knowledge of English (which was available in reasonable numbers) and identification of overseas clients. BPOs were established not only by Indian companies performing tasks for off-shore clients but also by many British and American companies who shifted their back-office data processing to India as they could get better quality employees and infrastructure at a lower cost. The falling cost of communication immensely helped the expansion of BPOs.

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2.3 SELECTION AND EVALUATION OF APPROPRIATE CONFIGURATION FOR DIFFERENT LEVELS OF INDUSTRIES:

An evaluation and selection methodology has been formulated to meet the specific configuration for different levels of industries as below:

(i) Identification of possible vendors.
(ii). Primary elimination of irrelevant candidates.
(iii). Determination of mandatory requirements.
(iv). Examination of vendors' compliance with mandatory requirements.
(v)Setting quantitative and qualitative criteria
(vi)Writing the RFP to be addressed to selected vendors.
(vii) Receiving, comparing and analyzing bids
(viii). Concluding final list of vendors.
(ix)Performance of hardware and software benchmarks.
(x) Drawing final conclusions and selection of best computer family.

The acquisition procedure consists of five phases:
(i). Preparatory steps: forming an evaluation team.
(ii). Obtaining proposals including:
  (a) Prepare if necessary, request for information,
  (b) prepare request for proposals,
  (c) conduct bidders conference.
(iii). Evaluating proposals
(iv). Financing the acquisition.
(v). Negotiating the contract.

The figure 3 indicates the process system overview. To evaluate vendor proposals, review proposals on the basis of such factors as pricing, fit of proposed equipment to specific needs, future growth potential, vendor qualifications, equipment maintenance, installation, assistance and delivery, etc. Here suggest the direction of rating analysis might take:

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(i). Vendor reputation & qualification

(ii). Differences in hardware implementation.

(iii). s/w architecture.

(iv).s/w availability

(v) performance

(vi) Future growth potential

(vii) Rick analysis

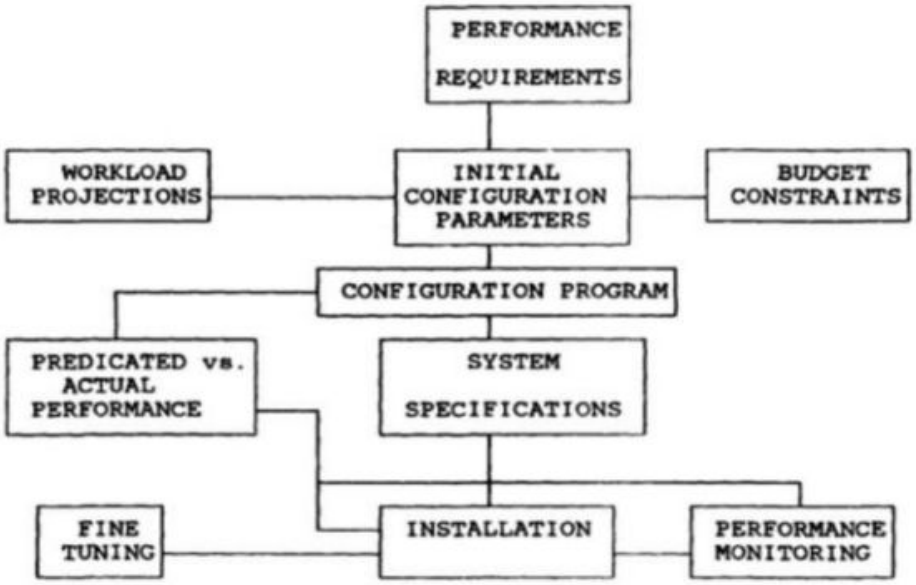

Figure -3 A Process View of System Configuration

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SITE PREPARATION & INSTALLATION

3.1/3.2

PLAN FOR COMPUTER ROOM LAYOUT BASED ON SIZE & LAYOUT FACTORS:

The factors for effective computer room layout are as follows.

Service clearance and floor loading

Each piece of equipment that you plan to install has some minimum amount of space around it that is required to be kept clear so that service might be performed on that equipment, if it become necessary. Beyond keeping a clear area around the equipment, it is advisable that traffic patterns for work flow do not fall in service clearance boundaries. Do not allow the service clearance areas to be used for temporary or permanent storage. Exact clearance dimensions are supplied with the individual product specifications.

Generally, floor loading areas fall inside the service clearance boundaries. Consult individual product planning documentation and your seller for specific information about the equipment that you are planning to install. If you have not yet done so, review floor loading, weight distribution, service clearance, and machine area.

Physical and logical priority

Some types of peripheral equipment might require physical or logical positioning in relation to the processor or other equipment that might dictate where that equipment must be placed on your floor. Consult individual product planning documentation and your seller to determine if equipment that you are planning to install must be specifically placed. Such equipment should be situated in your floor layout diagrams first, before other equipment that does not require precise positioning.

Restrictive cable lengths

As computing power increases, cable lengths might decrease to support improvements in processing speed. Consult product-specific planning documentation and your seller to determine where cable lengths will allow you to place each piece of equipment on your floor. Review cabling and connectivity, especially if you are using Integrated Cluster Bus (ICB) cables.

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Practical work space and safety

Allow enough room around equipment for normal movement of work flow. Consider the placement of equipment in relation to entrances and exits, windows, columns, wall-mounted equipment, such as circuit breaker boxes and electrical outlets, safety equipment, fire extinguishers, storage areas, and furniture. Be especially careful to allow easy access to things like the emergency power-off controls, smoke detectors, sprinkler systems, and under-floor or in-ceiling fire extinguishing systems.

If possible, make plans now to allow for future additional equipment. Plan cable routing and server locations to make it easy for additional units to be added.

Other equipment

In addition to the information technology equipment that you will be installing, allow room for office furniture and equipment, power and air conditioning, storage for operating supplies, and miscellaneous considerations, such as a meeting area, vending machine location, or water fountains.

It is highly recommended that scale drawings of your proposed layout be prepared and reviewed by both your seller and all service providers to ensure that your floor layout is physically capable and practically useful. Following is a chart of standard symbols used to create floor layouts. The diagram is given below:

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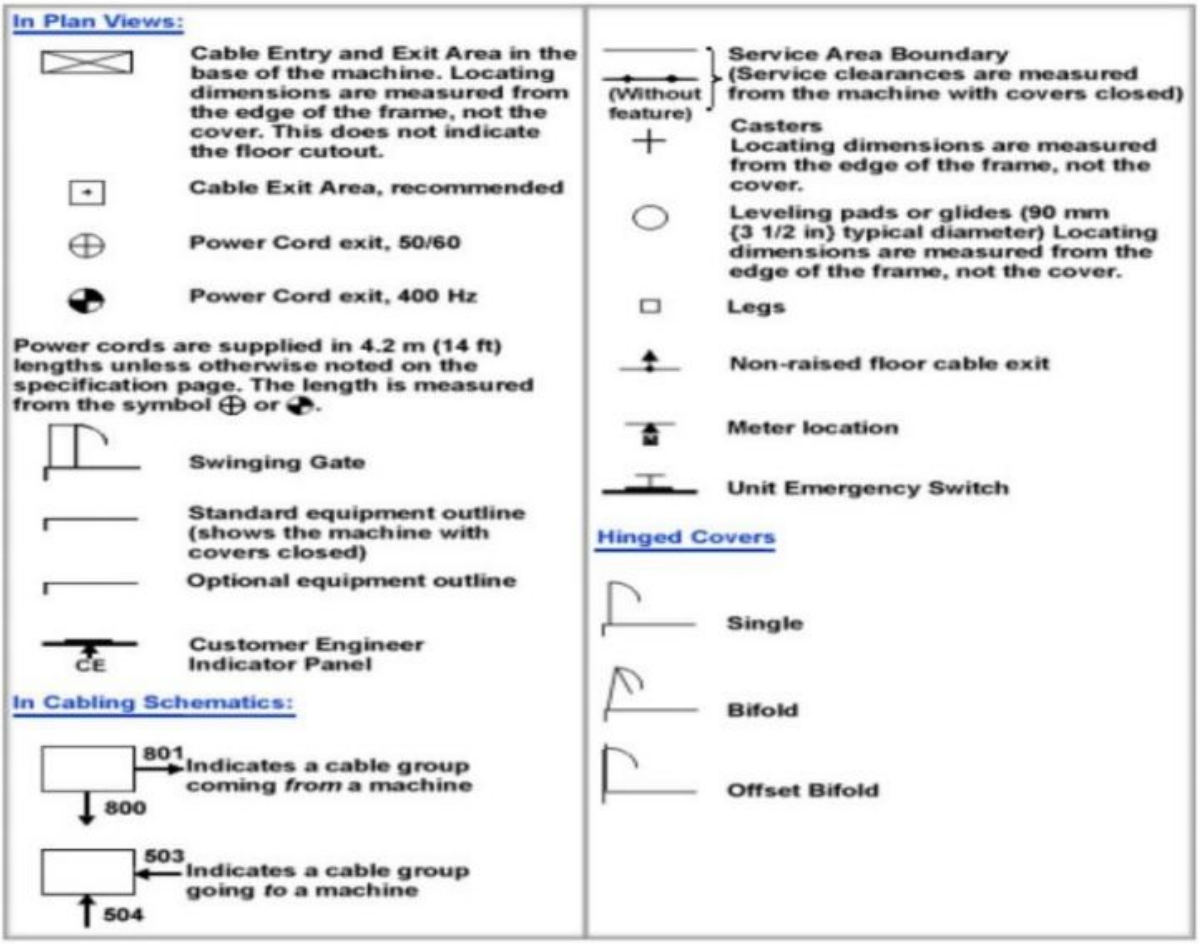
Figure 1. Standard symbols to create floor layouts



Consider the following factors when determining the air conditioning capacity necessary for installation:

- Information technology equipment heat dissipation
- Number of personnel
- Lighting requirements
- Amount of fresh air introduced
- Possible reheating of circulated air
- Heat conduction through outer walls and windows
- Ceiling height
- Area of floors
- Number and placement of door openings

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- Number and height of partitions

Depending on the type of computer centre, certain factors have to be considered when installing computer system. The factors are:

1)Local Support: It is important to discover the level of support available locally from different manufactures of hardware. In most cases, the availability of such support would be a major factor in preferring a particular make of machine, even if initial cost are higher.

2)Hardware Security: Physical security around computer centres and laboratories need to be stepped up because of the activities of looters. Security attention should be given to the computer hardwares because of their small sizes; if the physical security is slack valuable and costly component of the system might be lost.

3)Dust: It is almost always advisable to provide dust cover on computer equipment when not in use, and in some areas special dust filters may be needed to prevent dust penetrating the casing.

4)Heat: Because of the heat been produced by the computer, full air-conditioned office is highly imperative. It is advisable to buy portable air condition unit or install cooling fan in micro itself.

5)Power Supply: Computers cannot function without electricity. Electric generators must be provided at the centre in case of the public power supply failure. In addition, the generator should be supported with power stabilizer and uninterruptible power supply (UPS). Power stabilizer protect the computer the harmful effects of fluctuations while UPS maintain the continuity of power supply in the gap between the switch over public supply to in- house generator or vice – versa.

6)Humidity: An unusually assemble of humidity can also be a problem, leading to corrosion of electric contact; it may be advisable to use non- corrodible plugs and socket or to use a contact less keyboard for example

7) Accessories: It is essential to have a supply of computer accessories and part of a micro and all peripheral equipment's

8)Communication Facilities: These facilities must be provided to provide a link between the main computer centre and its terminals.

9)Space Requirement: From 400sq. ft. to several hundred thousand sq. ft; length-to-

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width ratio should be approximately 2:3; no long, narrow rooms.

10)Floor loading: should be sufficient, preferably with a sound-absorbent and antistatic covering.

11)Workshop: Basic maintenance facilities will be needed. It is not necessary to be an electronic engineer to do routine maintenance such as disc head alignment, to change board in the computer, or to run the diagnostics programs which will at least help to locate a fault

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3.3 NEED OF POWER CONDITIONING EQUIPMENTS:

A power conditioner (also known as a line conditioner or power line conditioner) is a device intended to improve the quality of the power that is delivered to electrical load equipment. While there is no official definition of a power conditioner, the term most often refers to a device that acts in one or more ways to deliver a voltage of the proper level and characteristics to enable load equipment to function properly. In some usages, power conditioner refers to a voltage regulator with at least one other function to improve power quality (e.g. power factor correction, noise suppression, transient impulse protection, etc.).

The terms "power conditioning" and "power conditioner" can be misleading, as the word "power" here refers to the electricity generally rather than the more technical electric power. Conditioners specifically work to smooth the sinusoidal A.C. wave form and maintain a constant voltage over varying loads.

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Types

An AC power conditioner is the typical power conditioner that provides "clean" AC power to sensitive electrical equipment. Usually this is used for home or office applications and has up to 10 or more receptacles or outlets and commonly provides surge protection as well as noise filtering.

'Power line conditioners take in power and modify it based on the requirements of the machinery to which they are connected. Attributes to be conditioned are measured with various devices, such as, Phasor measurement units. Voltage spikes are most common during power storms or other malfunctions in the main power lines. The surge protector stops the flow of electricity from reaching a machine by shutting off the power source.

"Power Conditioning" is the ability to filter the a.c. line signal provided by the power company. "Power Regulation" is the ability to take a signal from the local power company, turn it into a d.c. signal that will run an oscillator, which generates a single frequency sine wave, which is determined by your local area needs, is fed to the input stage of power amplifier, and is then output as what is specified as the ideal voltage present at any standard wall outlet.

Design

A good quality power conditioner is designed with internal filter banks to isolate the individual power outlets or receptacles on the power conditioner. This eliminates interference or "cross-talk" between components. If the application will be a home theater system, the noise suppression rating listed in the technical specifications of the power conditioner will be very important. This rating is expressed in decibels (db).The higher the db rating, the better the noise suppression. Good units start at a rating of about 40-60db for noise filtering.[citation needed] If a device does not state the db rating in its specs it may be better to move on to a different model or manufacturer.

Usages

Power conditioners can vary greatly in specific functionality and size, with both parameters generally determined by the application. Some power conditioners provide only minimal voltage regulation while others provide protection from half a dozen or more power quality problems. Units may be small enough to mount on a printed circuit board or large enough to protect an entire factory. Small power conditioners are rated in volt-amperes (V·A) while larger units are rated in kilovolt-amperes (kV·A).

Constant-voltage transformer:

The CVT is simply a magnetic transformer of a special construction that has a capacitor connected across the secondary winding of the transformer. In an ordinary transformer, the primary and secondary windings are wound near each other so that whenever there is a change of voltage across the primary there is a corresponding change in the secondary voltage

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depending upon the ratio of the turns on the two windings. However, in a CVT the primary and secondary windings are wound separately from each other, as illustrated in figure. To set up field in between the coils, a separate shunt path is provided between the two windings but an air gap is formed in the shunt path. A capacitor is connected across suitable tapings of the secondary winding. Sophisticated computer systems sometimes use diesel engine driven generators for backup in case of mains failure. Where our CVTs are used for power conditioning in the normal mains mode it is desirable to take advantage of the CVT performance when using the generator.

Some generators do not refer the low side of the output to earth. This MUST be tied down to avoid damage to any of our larger catalogue units which have double primary shields. Care must also be taken that the generator neutral is not connected to the CVT output low.

The output from the CVT will be out of phase with the input in cases where the generator supplies other equipment directly some care is needed if a phase sensitive firing circuit is installed.

Unless phasing circuits are fitted all circuits should use 'break before make contactors and enforced supply separation. Some thought needs to be given to the Regulations regarding out of phase supplies in the same area. The reason we use a CVT and not a voltage stabilizer for computer applications is that in the voltage stabilizer relays are present and when these relays operate (switch), the output voltage may be interrupted for a short time. Such a transient may not be desirable for computers which may cause the computer to reboot.

Isolation Circuit:

An isolation circuit is a transformer used to transfer electrical power from a source of alternating current (AC) power to some equipment or device while isolating the powered device from the power source, usually for safety. Isolation transformers provide galvanic isolation and are used to protect against electric shock, to suppress electrical noise in sensitive devices, or to transfer power between two circuits which must not be connected. Isolation transformers block transmission of DC signals from one circuit to the other, but allow AC signals to pass.

Suitably designed isolation transformers block interference caused by ground loops. Isolation transformers with electrostatic shields are used for power supplies for sensitive equipment such as computers or laboratory instruments. whether used to transfer signals or power, is isolating, as the primary and secondary are not connected by conductors but only by induction. However, only transformers whose primary purpose is to isolate circuits are routinely described as isolation transformers. A transformer sold for isolation is often built with special insulation between primary and secondary, and is specified to withstand a high voltage between windings.

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Uninterruptible power supply:

An uninterruptible power supply, also uninterruptible power source, UPS or battery/flywheel backup, is an electrical apparatus that provides emergency power to a load when the input power source, typically mains power, fails. A UPS differs from an auxiliary or emergency power system or standby generator in that it will provide near-instantaneous protection from input power interruptions, by supplying energy stored in batteries or a flywheel. The on-battery runtime of most uninterruptible power sources is relatively short (only a few minutes) but sufficient to start a standby power source or properly shut down the protected equipment.

A UPS is typically used to protect computers, data centers, telecommunication equipment or other electrical equipment where an unexpected power disruption could cause injuries, fatalities, serious business disruption or data loss. UPS units range in size from units designed to protect a single computer without a video monitor (around 200 VA rating) to large units powering entire data centers or buildings.

The primary role of any UPS is to provide short-term power when the input power source fails. However, most UPS units are also capable in varying degrees of correcting common utility power problems:

--Voltage spike or sustained Overvoltage

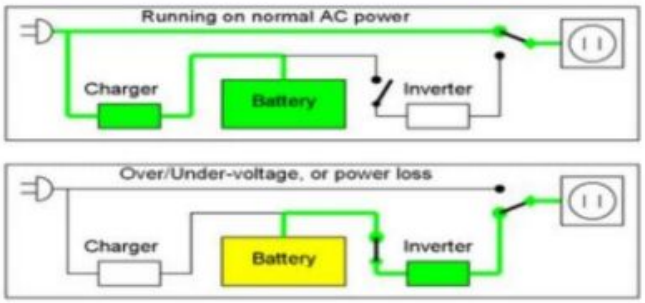
--Momentary or sustained reduction in input voltage.

--Noise, defined as a high frequency transient or oscillation, usually injected into the line by nearby equipment.

--Instability of the mains frequency.

--Harmonic distortion: defined as a departure from the ideal sinusoidal waveform expected on the line.

Diagram:



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3.4

INTERPRETATION OF THE INSTALLATION AND WIRING DIAGRAM:

The first commercial computer to be installed in India was an IBM 1401 at ESSO Standard Eastern Inc., an oil marketing company in Mumbai. Between 1961 and 1964 twelve computers were installed in Research and Development organizations and two in educational institutions. Now-a-days for installation we required various types of tools. For example Here is a list of essential tools:

- Ground bracelet, ground mat, or antistatic gloves to protect against ESD when working inside the computer case
- Flathead screwdriver Phillips-head or crosshead screwdriver
- Torx screwdriver set, particularly size T15
- Tweezers, preferably insulated ones, for picking pieces of paper out of printers or dropped screws out of tight places
- Extractor, a spring-loaded device that looks like a hypodermic needle (When you push down on the top, three wire prongs come out that can be used to pick up a screw that has fallen into a place where hands and fingers can't reach.)
- Software, including recovery CD or DVD for any OS you might work on (you might need several, depending on the OSs you support), antivirus software on bootable CDs orUSB flash drives, and diagnostic software.

Following tools might not be essential, but they are very convenient:

- Cans of compressed air (see Figure 1-39), small portable compressor, or antistatic vacuum cleaner to clean dust from inside a computer case Cleaning solutions and pads such as contact cleaner, monitor wipes, and cleaning solutions for CDs, DVDs, tapes, and drives
- Multimeter to check cables and the power supply output
- Power supply tester
- Needle-nose pliers for removing jumpers and for holding objects (especially those pesky nuts on cable connectors) in place while you screw them in
- Flashlight to see inside the computer case

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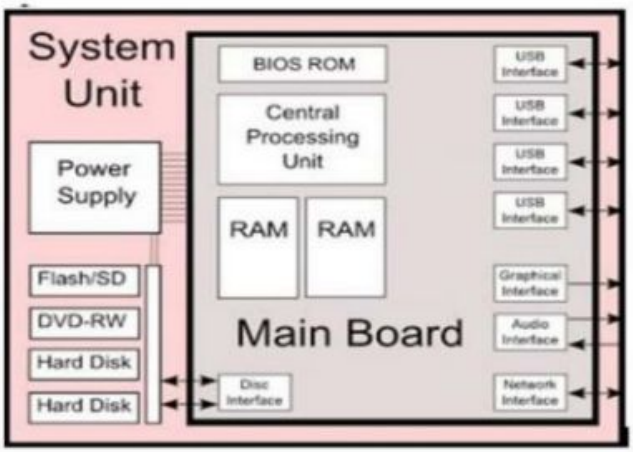
- AC outlet ground tester
- Network cable tester
- Loopback plugs to test ports
- Small cups or bags to help keep screws organized as you work
- Antistatic bags (a type of Faraday cage) to store unused parts
- Chip extractor to remove chips (To pry up the chip, a simple screwdriver is usually more effective, however.)

When building a new system, you can purchase a computer case with the power supply already installed or you can purchase a power supply separate from the case.

1.Unpack the monitor and computer case from the box. Remove any plastic covering or protective tape. Place the monitor and computer case on a desk or work area. Be sure to place your computer case in an area that is well ventilated and has good air flow. This will help to prevent the computer from overheating.
2.Locate the monitor cable.
3.Connect one end of the cable to the monitor port on the back of the computer case and the other end to the monitor.
4.Unpack the keyboard and determine whether it uses a USB (rectangular) connector or a PS/2 (round) connector. If it uses a USB connector, plug it into any of the USB ports on the back of the computer. If it uses a PS/2 connector, plug it into the purple keyboard port on the back of the computer. Do other connections also as required.
5.Locate the two power supply cables that came with your computer. Plug the first power supply cable into the back of the computer case and then into a surge protector. Then, using the other cable, connect the monitor to the surge protector.
6.Finally, plug the surge protector into a wall outlet. You may also need to turn on the surge protector if it has a power switch.

21



3.5

STEPS FOR ACTUAL INSTALLATION AS PER THE MANUFACTURER'S SPECIFIED PROCEDURE:

Computerized systems should be validated at the level appropriate for their intended use and in accordance with quality risk management principles. This applies to systems used in all good (anything) practices (GXP) activities (e.g. good clinical practice (GCP), good laboratory practice (GLP) and good manufacturing practices (GMP)

1. The purpose of validation of a computerized system is to ensure an acceptable degree of documented evidence that establishes confidence in the accuracy, reliability and consistency in performance of the system in accordance with predetermined specifications. The validation data should meet the principles of being attributable, legible, contemporaneous, original and accurate (ALCOA) throughout the data life cycle.
2. Computerized system validation should ensure that all necessary technical and procedural controls are implemented ensuring compliance with good documentation practices for electronic data generated by the system (WHO guidance on good data and record management practices, WHO Technical Report Series
3. System elements that need to be considered in computerized system validation include computer hardware and software, related equipment and network components and operating system environment, procedures and systems documentation including user manuals and people (such as, but not limited to, users, data reviewers, system application administrators, network engineers,

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database administrators and people involved in archiving). Computerized system validation activities should address both system configuration as well as any custom-developed elements.

4. System elements that need to be considered in computerized system validation include computer hardware and software, related equipment and network components and operating system environment, procedures and systems documentation including user manuals and people (such as, but not limited to, users, data reviewers, system application administrators, network engineers, database administrators and people involved in archiving). Computerized system validation activities should address both system configuration as well as any custom-developed elements.
5. Computerized systems should be maintained in the validated state with risk-based controls appropriate to the different stages of the system life cycle. These stages include system planning, specification, programming and configuration, system testing, preparation and verification of standard operating procedures (SOPs) and training programmers, system operation and maintenance including handling of software and hardware updates, monitoring and review, followed by system retirement.
6. Depending on the types of systems or typical applications such as process control systems (distributed control system (DCS), programmable logic controller (PLC), supervisory control and data acquisition (SCADA)), laboratory information management systems (LIMS), laboratory instrument control systems and business systems (enterprise resource planning (ERP), manufacturing resource planning (MRP II)) used by the manufacturer, a document covering (but not limited to) the following information should be available on-site:
   - purpose and scope;
   - roles and responsibilities;
   - validation approach;
   - risk management principles;
   - system acceptance criteria;
   - vendor selection and assessment;
   - computerized system validation steps;
   - configuration management and change control procedures;

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- back-up and recovery;
- error handling and corrective action;
- contingency planning and disaster recovery;
- maintenance and support;
- system requirement;
- validation deliverables and documentation;

7. A typical model for computerized systems validation is the V-model. The lifecycle development model (or V-model for short), is a framework or structure for undertaking the design, execution and commissioning of a design project (see also International Society for Pharmaceutical Engineering (ISPE) Baseline: a risk based approach to compliant GXP computerized systems GAMP). The left-hand edge of the V is where the project is defined and specified in greater detail. The bottom point of the V is the execution step of the project. The right-hand edge of the V is where the commissioning and qualification testing of the installed system is performed

COMPONENTS INSIDE THE COMPUTERS & THEIR INTERCONNECTION

4.1 INTRODUCTION:

Computers store information digitally. All the information stored as numbers, in a binary system. A binary system has only two numbers 0 and 1. (Decimal system has 10 numbers 0 9).

(a)The Central Processing Unit (CPU), also called a processor, is like the brain of the computer. It executes instructions in response to commands. processor's speed is measured in Megahertz (MHZ), or Gigahertz (GHZ) Higher the hertz, the faster the process in of instructions

(b)RAM (Random Access Memory) is also called main memory. RAM is used to store data and instructions that are currently being processed by a computer's CPU. Data is temporarily stored in the RAM till it is saved to the hard disk. The data in RAM is erased when power is switch off. RAM is measured in megabytes (MB) or gigabytes (GB). A bit is the smallest unit of data in computer processing. It represents a digit in the binary system.

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4.2 HARDWARE-BIOS INTERACTION:

The BIOS (Basic Input/Output System and also known as the System BIOS, ROM BIOS or PC BIOS) is a type of firmware used during the booting process (power-on startup) on IBM PC compatible computers. The BIOS firmware is built into personal computers (PCs), and it is the first software they run when powered on. The name itself originates from the Basic Input/Output System used in the CP/M operating system. The fundamental purposes of the BIOS are to initialize and test the system hardware components, and to load a boot loader or an operating system from a mass memory device. The BIOS additionally provides an abstraction layer for the hardware, i.e. a consistent way for application programs and operating systems to interact with the keyboard, display, and other input/output devices. Flash chips are programmed (and re-programmed) in-circuit, while EPROM chips need to be removed from the motherboard for re-programming. BIOS versions are upgraded to take advantage of newer versions of hardware and to correct bugs in previous revisions of BIOS.

The BIOS software has a number of different roles, but its most important role is to load the operating system. When you turn on your computer and the microprocessor try to execute its first instruction, it has to get that instruction from somewhere. It cannot get it from the operating system because the operating system is located on a hard disk, and the microprocessor cannot get to it without some instructions that tell it how.

a) A power-on self-test (POST) for all of the different hardware components in the system to make sure everything is working properly.

b)Activating other BIOS chips on different cards installed in the computer – e.g. SCSI and graphics cards often have their own BIOS chips.

c) Managing a collection of settings for the hard disks, clock, etc.

The BIOS (an acronym for Basic Input/output System and also known as the System BIOS, ROM BIOS or PC BIOS) is a type of firmware used to perform hardware initialization during the booting process (power-on start-up) on IBM PC compatible computers, and to provide runtime services for operating systems and programs. The BIOS firmware is built into personal computers (PCs), and it is the first software they run when powered on. Originally proprietary to the IBM PC, the BIOS has been reverse engineered by companies looking to create compatible systems and the interface of that original system serves as a *de facto* standard. The fundamental purposes of the BIOS in modern PCs are to initialize and test the system hardware components, and to load a boot loader or an operating system

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from a mass memory device. The BIOS additionally provides an abstraction layer for the hardware, i.e., a consistent way for application programs and operating systems to interact with the keyboard display, and other input/output (I/O) devices.

4.3 INTERCONNECTION BETWEEN SUBSYSTEMS OF PC:

Several core components and ancillary subsystems comprise PCs. The core components provide the basic functionality of the PC. Ancillary subsystems enhance the basic functionality to support different applications, such as graphics imaging, multimedia applications, and more. PCs are a package of matched components. The components are matched for speed (somewhat tuned) to provide the best overall performance. It makes little sense to have a super fast Central Processing Unit (CPU) chip and a slow fixed disk drive or slow Random Access Memory (RAM). Such a combination produces a slow system. PCs are as fast as their most used and slowest component.

The PC core components ranked from fastest to slowest are:

- CPU chip—fastest
- RAM
- Display adapter
- Read-Only Memory (ROM)
- Fixed disk drive
- Universal Serial Bus (USB)
- Network adapter
- CD-ROM drive
- CD Rewriteable (CD-RW) drive
- Digital Versatile Disk (DVD) drive
- Floppy disk drive
- Parallel port
- Serial port
- Mouse
- Keyboard

Hardware Components

CPU

The CPU is a computer on a chip. The CPU chip acts as the hands or heart of the computer. There are no brains here because computers are dumb. They only do what they are told. They are the hands that perform the work as directed and the heart that pumps the data to all PC components. Processors are

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classified by their interface to the MBL and by processing horsepower. MLB interfaces are a socket interface or a slot interface. The socket interfaces are Socket 7 (Intel Pentium CPUs) and Socket 8 (Intel PentiumPro CPUs).

ROM

ROM contains the start-up code and the 16-bit BIOS programs for the PC. System ROM is first accessed during the boot process. It performs the initial PC setup, loads the PC's cold boot loader program from the fixed disk Master Boot Record (MBR), and handles the PC's I/O operations under the Disk Operating System (DOS). Most PCs have 64 KB of ROM. The addresses are mapped into the last 64 KB memory page below the memory boundary. Some PCs have more system ROM.

RAM

RAM is the working area of the PC. All data must flow into and out of RAM. It holds both programs and data. When a program is running (executing) and working on data, the program and most often the data reside in RAM. In a Windows environment, RAM is virtualized. The operating system has 4 gigabytes (GB) of virtual memory where components and applications can reside.

Nonvolatile RAM (NVRAM)

There is also NVRAM. This is similar to ROM in that it does not lose its contents when the PC is powered off. NVRAM is SRAM that retains its databits as long as power is supplied to the memory. NVRAM contents are saved when a computer is powered off or its external power is lost, and it is implemented using SRAM with battery power or by using an electrically Erasable Programmable ROM (EPROM).

Firmware

Firmware is PC component driver programs installed in ROM or NVRAM. Firmware was initially used to store hardware setup and BIOS routines because it was easier to update than hardware. In contrast, software stored on disk is the most flexible and easy to change.

Complementary Metal Oxide Semiconductors (CMOS)

CMOS really describes a chip technology that uses low power. This technology was originally employed in the PC AT to store hardware configuration information in a nonvolatile battery-powered memory chip. A three- or six-volt lithium battery powered the CMOS memory chip. Today, CMOS technology is used in chips in almost all PCs to reduce power consumption. "CMOS" as a term is used to identify the PC's nonvolatile parameter storage memory.

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Onboard Controllers

The first onboard controllers were for the keyboard and the serial and parallel ports. Next, systems incorporated bus mouse ports and floppy and fixed disk drive controllers. These ports were initially routed to outside the PC chassis.

Expansion Slots

Expansion slots implement the PC's system bus. The system bus connectors allow other circuit cards to be plugged into them. Because they are card edge connectors, they are called expansion slots. The cards inserted in the edge-style bus connectors are referred to as daughter cards or expansion cards. The daughter card label was used because the cards were inserted into the motherboard.

Power Supply

The PC power supply converts 120/240 volt Alternating Current (AC) into the 5- and 12-volt Direct Current (DC) used by the PC. Power supplies are rated by wattage. They range from 85 watts for the original PC to 300 watts for high-end PC power supplies. A watt is a power measurement that is voltage times the amperage delivered by the supply. Because voltage is the same for all supplies, a higher wattage translates into more current being delivered by the supply.

Sound Cards

All PCs today have the capability to create and record sound. Sound cards installed in the PC provide this capability. Early sound cards were mainly used to produce sounds for Windows activities and to play CDs.

LAN Adapters

Almost all business PCs are LAN connected. Many home PCs are networked as well using Ethernet, home wiring, or wireless LAN technologies. A LAN provides an easy mechanism for sharing disk drives and exchanging data between PCs. After people work with a LAN, they rarely want to go back to operating without the LAN

Modems

Dialup networking using modems provides Internet connectivity for many home PCs. A modem is basically a telephone for a computer. Modems modulate and demodulate digital data, converting it to analog voice-grade (0 Hz to 4,000 Hz) signals that travel across telephone channels.

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Mouse

The mouse is the Windows pointing device of preference for most PCs. It is a rubber ball that rotates sensors on two right-angle axes. In this manner, the mouse movement is translated into vertical and horizontal pointer movement on the PC's display screen.

Keyboard

The keyboard remains the primary input mechanism for the PC. In the not too distant future, direct voice input devices may displace it. This will not be a total replacement, however, for many more years. Many styles of keyboards are available.

Monitor

The monitor or display is our window into the PC. Through it we see the information inside the PC. Displays have different resolutions or levels of visibility. This is expressed in the number of displayable dots (referred to as "pixels" for "picture elements")

4.4 INSIDE THE SYSTEM UNIT:

STUDY OF MOTHERBOARD COMPONENTS:

Definition

A motherboard is one of the most essential parts of a computer system. It holds together many of the crucial components of a computer, including the central processing unit (CPU), memory and connectors for input and output devices. The base of a motherboard consists of a very firm sheet of non-conductive material, typically some sort of rigid plastic. Thin layers of copper or aluminum foil, referred to as traces, are printed onto this sheet. These traces are very narrow and form the circuits between the various components. In addition to circuits, a motherboard contains a number of sockets and slots to connect the other components.

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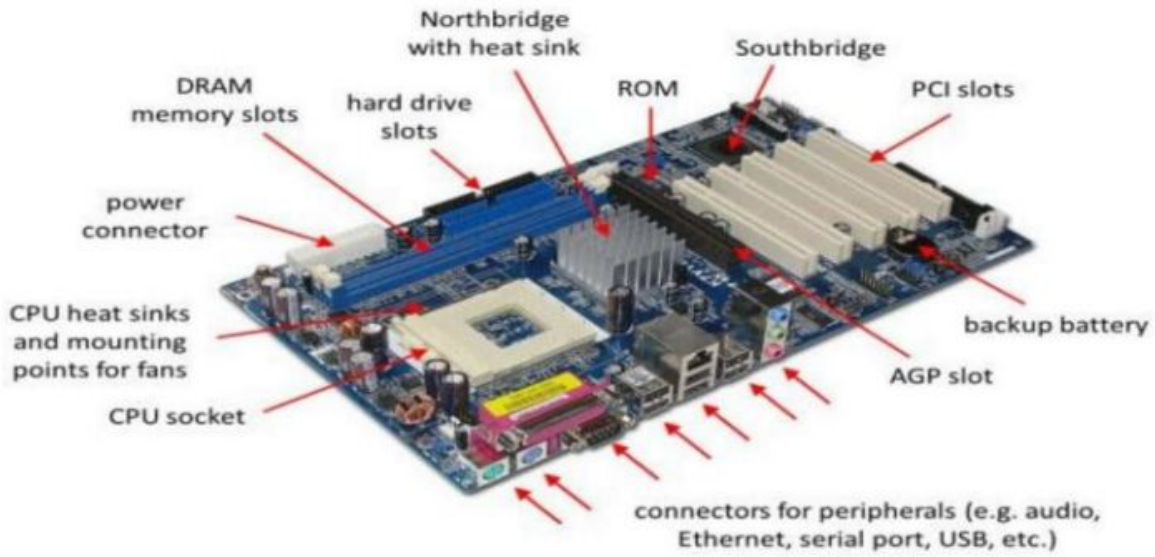

MOTHERBOARD COMPONENTS:-

If you were to open up your computer and take out the motherboard, you would probably get pretty confused about all the different parts. Depending on the make and model of your computer, it might look something like the picture below.

The important constituent components of an ATX Motherboard are given below:

- Mouse & keyboard
- USB
- Parallel port
- CPU Chip
- RAM SLOT
- Floppy controller
- IDE controller
- PCI
- ISA SLOT
- CMOS Battery
- AGP SLOT
- CPU SLOT
- Power supply plug in

1. Mouse & keyboard: Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard.

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2. USB :USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers. a USB connector's distinctive rectangular shape makes it easily recognizable.

3. Parallel port: Most printers use a special connector called a parallel port. Parallel port carry data on more than one wire, as opposed to the serial port, which uses only one wire.

4. CPU Chip : The central processing unit, also called the microprocessor performs all the calculations that take place inside a pc. CPUs come in Variety of shapes and sizes. Modern CPUs generate a lot of heat and thus require a cooling fan or heat sink.

5. RAM slots: Random-Access Memory (RAM) stores programs and data currently being used by the CPU. RAM is measured in units called bytes. RAM has been packaged in many different ways. The most current package is called a 168-pin DIMM (Dual Inline Memory module).

6. Floppy controller: The floppy drive connects to the computer via a 34-pin ribbon cable, which in turn connects to the motherboard. A floppy controller is one that is used to control the floppy drive.

7. IDE controller: Industry standards define two common types of hard drives: EIDE and SCSI. Majority of the PCs use EIDE drives. SCSI drives show up in high end PCs such as network servers or graphical workstation

8. PCI SLOT: Intel introduced the Peripheral component interconnect bus protocol. The PCI bus is used to connect I/O devices (such as NIC or RAID controllers) to the main logic of the computer.

9. ISA SLOT: (Industry Standard Architecture) It is the standard architecture of the Expansion bus. Motherboard may contain some slots to connect ISA compatible cards.

10. CMOS Battery: To provide CMOS with the power when the computer is turned off all motherboards comes with a battery. These batteries mount on the motherboard in one of three ways: the obsolete external battery, the most common onboard battery, and built-in battery.

11. AGP SLOT: If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot, but is slightly shorter and usually brown.

12. CPU SLOT: To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly. So remember if it does not go easily,

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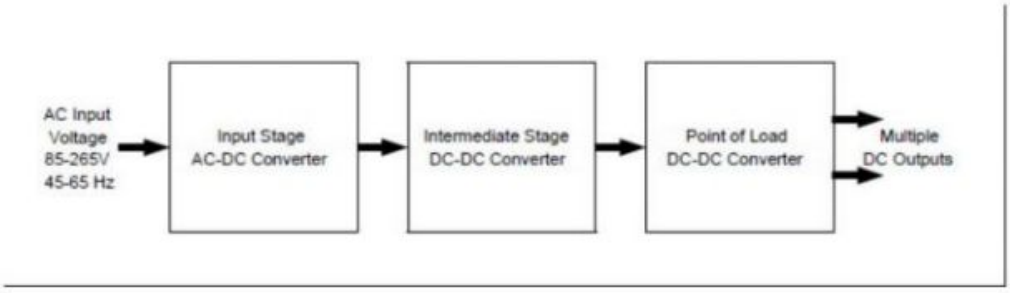
13. Power supply plug in: The Power supply, as its name implies, provides the necessary electrical power to make the pc operate.

FUNCTIONONG OF SMPS:

A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a source, like mains power, to a load, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.

DIAGRAM:



WORKING:

The energy flow in a power supply is controlled by power semiconductors, which can operate in different modes. In legacy systems they worked in linear mode and excessive power dissipated in a series transistor. When a semiconductor operates in switching mode, it can control energy flow with low losses: when a switch is "on", it has low voltage drop and will pass any current imposed on it; when it is "off", it blocks the flow of current. As the result, in such an electronic device the power dissipation which is the product of voltage and current, can be relatively low in both states. That's why switch mode PSUs offer greater efficiency compared with linear ones. Such units are also smaller in size and lighter in weight due to the reduced size of passive components and lower heat generation. The industry trend toward miniaturization, advancements in semiconductor technology, as well as various energy efficiency regulations have made "switcher" the dominant type of PSU across practically the full spectrum of applications. Most PSU manufactured today for AC input applications also include a PFC front end.

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FUNCTIONING OF HDD:

A hard disk drive (HDD), hard disk, hard drive or fixed disk is a data storage device used for storing and retrieving digital information using one or more rigid rapidly rotating disks coated with magnetic material. The platters are paired with magnetic heads arranged on a moving actuator arm, which read and write data to the platter surfaces. Data is accessed in a random-access manner, meaning that individual blocks of data can be stored or retrieved in any order rather than sequentially. An HDD retains its data even when powered off. The hard drive of a computer is a device that stores all the software installed on a computer, as well as all the data files created and used by this software. This includes any documents you have created and downloaded, such as photos and music. The hard drive is a form of permanent storage, rather than temporary memory such as random-access memory (RAM). This means that when you turn off the computer the files remain safely stored on the drive so you can use them again the next time you start your computer.

There are two general types of hard drives: hard disk drives (HDD), which use one or more rotating discs and rely on magnetic storage, and solid-state drives (SDD), which have no moving mechanical parts, but use flash memory like the kind found in USB flash drives. If you have a regular desktop computer, you most likely have a hard disk drive. Solid-state drives are more typical for high-end, expensive laptops.
Hard disk drives are very robust and can be used for many years without problems. However, hard disk drives can fail and one of the most common reasons is a head crash. This occurs when the magnetic head scratches the magnetic film. The platter is usually made of glass or ceramic (modern platter may use titanium). Unlike a floppy disk, the platter cannot be bent or flipped and hence we coin it as "hard disk" or "hard drive". Commonly a hard disk contains 1 to 10 identical platters that are stacked in parallel to form a cylinder. There is usually one Read Write (RW) head designated per platter face, and each head is attached to a single actuator shaft which moves all heads in unison and performs a uniform synchronous motion during reading or writing of data.

TYPES OF HARD DRIVES : SCSI AND IDE

- The primary interface used to connect a HDD to a PC is typically called IDE (Integrated Drive Electronics). IDE refers to the fact that the interface electronics or controller is built into the drive and not a separate board.
- Technically the correct name for the interface is ATA, many persist in using the IDE designation today.
- The primary purpose of the hard disk controller, or interface, is to transmit and recive data to and from the drive.
- ATA is a 16 bit parallel interface, meaning that 16 bits are transmitted simultaneously down the interface.

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- ATA is used to connect not only hard disks, but also CD and DVD drives, high-capacity Super Disk floppy drives and tape drives.

IDE:

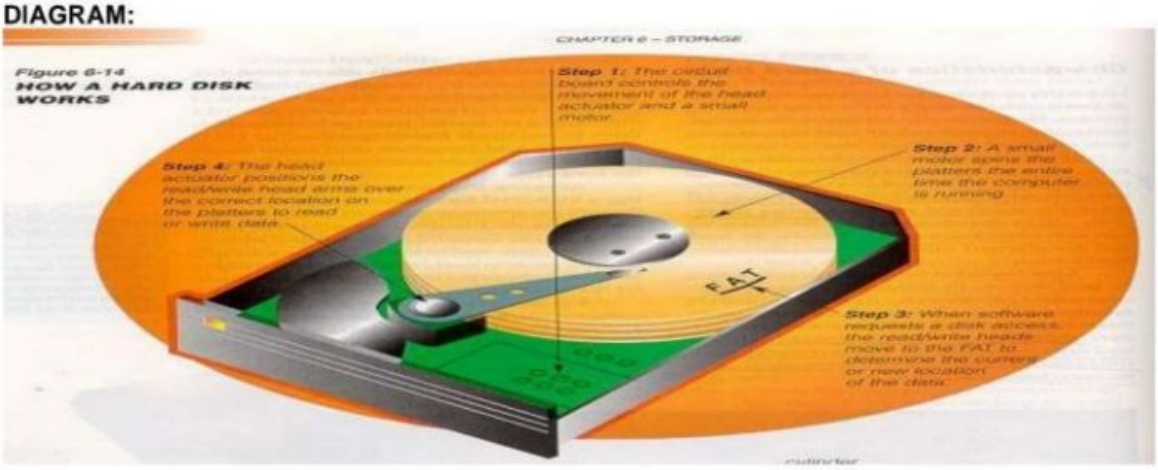
It is originally developed as alternative to more expensive SCSI drives. Modern versions called EIDE drives. Support up to 4 multi gigabyte drives.

- Low level format scans disk for defects and sets aside sectors with defects so they are not used for data.
- IDE drives should *never* be low level formatted by a user or technician. Only high level format necessary.
- IDE supports TWO drives in a system
- one master (boot disk) and one slave
- set master and slave using jumpers
- EIDE supports FOUR drives per system
- 2 drives on each of 2 cables

SCSI:

- Pronounced as Scuzzy
- Small Computer Systems Interface
- For wide range of peripheral devices, including hard disks, tape drives, optical drives.
- 8 devices can connect to a daisy chain
- This chain must be terminated at both ends
- Each device on chain is assigned unique device ID number that is determined by jumpers or
- SCSI bus supports 8 devices
- There are eight SCSI IDs numbered 0 through 7
- ID 7 is always reserved for the SCSI host adapter

DIAGRAM:



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Data is Organized on Disk

- Tracks-
  - circular areas of the disk
  - Length of a track one circumference of disk
  - Over 1000 on a hard disk
  - Data first written to outer most track
- Sectors-
  - Divides tracks sections
  - On a floppy 9 sectors exits
- Cylinders-
  - Logical groupings of the the same track on each disk surface in a disk unit
- Clusters-
  - Groups of sectors used by operating system
  - 64 sectors in one cluster

PARTITIONING AND FORMATTING HDD:

- Disk must be prepared prior to use.
- Hard disk - special process.
- Divided into logical divisions (partitioned).
- Then formatted with file system.
- Partition terms.
- Primary Partition = section of a hard disk.
- Partition table.
- Located in first physical sector.
- Tell where each partition begins/ends.
- Identifies
- Type of file system for each partition.
- If partition is bootable.
- Volume
- Each partition on drive called a Volume.
- Has own volume label.
- Active Partition.
- Can boot only from active partition.
- Hard disk limited to four primary partitions per physical disk.
- Extended partition.
- Only one primary partition can be an extended partition.
- Can contain logical drives (volumes).

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- Dual booting system (system with 2 OSs)
- Create partition for each OS.
- Only one OS active at a time.
- Boot computer from partition where OS is located.
- Each OS formats disks in own way.
- Depending on OS used and file system selected may be able to recognize other drive but no read files on it.
- Precautions in running multiple OS
- W98, WXP and W7, in multiple-boot configuration – compatible.
- Order of installation important.
- Specific information to install multiple OS beyond scope of book.
- File system - organizational scheme of OS.

EXPANSION UNITS:

Computer components send and receive data between different devices by the use of a bus. The design and type of the bus therefore has a crucial effect on how well a computer system will operate. If you have a high speed drive and a fast CPU, but a slow bus, data will be held up and the individual components will not operate at the speed they are capable. Manufacturers have developed standard methods for connecting different devices and for the design of bus technology. This has benefited everyone by allowing the purchase of devices from different manufactures and not having to worry that the devices will talk to each other.

Bits	Bus Type	Description
16 Bit	ISA	Industry Standard Architecture
32 Bit	EISA	Extended Industry Standard
	Micro-Channel	IBM's proprietary architecture
	VESA (VL-Bus)	Video Electronics Standards Association
64 Bit	PCI	Peripheral Component Interconnect

	Bus Type			
Property	ISA	EISA	VESA	PCI
MHz	8.3	8.3	33	33
Bits	16	32	32	32 or 64
Mbps	8.3	33	160	132 or 264
Voltage	5	5	5	3.3 or 5

- ***MHz*** – Think of 33 MHz as miles per hour or speed.
- ***Mbps*** (Mega bytes processed per second, transfer rate) translates how many cars could travel the highway within a time period of one second. A higher Mbps value represents a faster device.

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ISA:

Industry Standard Architecture, ISA was introduced by IBM and headed by Mark Dean. ISA was originally an 8-bit computer bus that was later expanded to a 16-bit bus in 1984. When this bus was originally released it was a proprietary bus, which allowed only IBM to create peripherals and the actual interface. However, in the early 1980's other manufacturers were creating the bus.

EISA:

Extended Industry Standard Architecture, EISA, also known as Extended ISA, is a standard first announced in September of 1988 for IBM and IBM compatible computers to compete with the IBM MCA bus. The EISA bus is found on Intel 80386, 80486 and early Pentium computers and was designed by nine competitors to compete with IBM's MCA bus. These competitors were AST Research, Compaq, Epson, Hewlett Packard, NEC, Olivetti, Tandy, WYSE, and Zenith Data Systems.

VESA:

(Video Electronics Standards Association) Local Bus worked alongside the ISA bus; it acted as a high-speed conduit for memory-mapped I/O and DMA, while the ISA bus handled interrupts and port-mapped I/O. The VESA Local Bus was designed as a stopgap solution to the problem of the ISA bus's limited bandwidth. As such, one requirement to gain industry adoption was that it had to be a minimal burden for manufactures to implement, in terms of board re-design and component costs; otherwise, manufacturers would not have been convinced to change from their own proprietary solutions.

PCI:

Peripheral component interconnect, a local bus standard developed by Intel Corporation. Most modern PCs include a PCI bus in addition to a more general ISA expansion bus. PCI is also used on some versions of the Macintosh computer. PCI is a 64-bit bus, though it is usually implemented as a 32-bit bus. It can run at clock speeds of 33 or 66 MHz. At 32 bits and 33 MHz, it yields a throughput rate of 133 MBps. Although it was developed by Intel, PCI is not tied to any particular family of microprocessors.

POST SEQUENCE:

When power is turned on, POST (Power-On Self-Test) is the diagnostic testing sequence that a computer's basic input/output system (or "starting program") runs to determine if the computer keyboard, random access memory, disk drives, and other hardware are working correctly. If the necessary hardware is detected and found to be operating properly, the computer begins to boot. If the hardware is not detected or is found not to be operating properly, the BIOS issues an error message which may be text on the display screen and/or a series of coded beeps, depending on the nature of the problem. Since POST runs before the computer's video card is activated, it may not be possible to progress to the display

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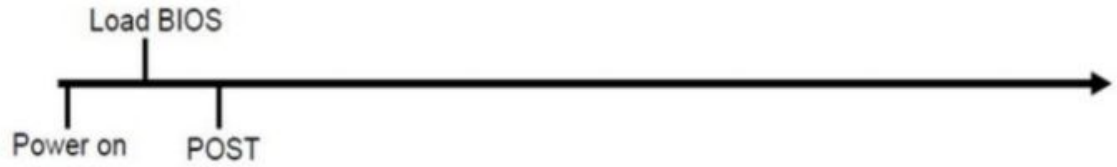
screen. The pattern of beeps may be a variable numbers of short beeps or a mixture of long and short beeps, depending on what type of BIOS is installed.

The patterns of beeps contain messages about the nature of the problem detected. For example, if the keyboard is not detected, a particular pattern of beeps will inform you of that fact. An error found in the POST is usually fatal (that is, it causes current program to stop running) and will halt the boot process, since the hardware checked is absolutely essential for the computer's functions.

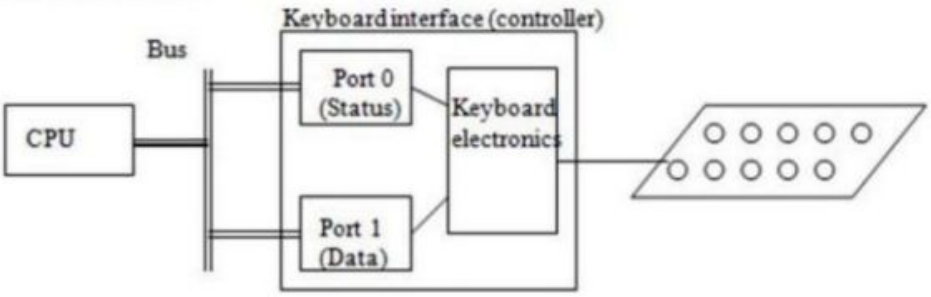


. Problems are indicated through the system speaker
. Consult BIOS/system manual for the meaning of the beep sequences
. Example, repeated long beeps indicate memory problems.

KEYBOARD INTERFACE:

The keyboard uses a special, dedicated interface to talk to the PC. The basic design and operation of this interface is largely unchanged since the days of the old IBM PC/AT of the mid-1980s. Only in the last few years has the availability of the universal serial bus (USB) on newer systems created an alternative way of attaching a keyboard to the PC. The conventional keyboard interface is still used in almost all PCs, however, despite USB's growing popularity. The traditional keyboard interface is in some ways similar to a "stripped-down version" of a regular serial (COM) port. Communication between the keyboard and the PC is accomplished over the lines in the keyboard cable, which connect the internal controller in the keyboard with a matching device on the motherboard, called the keyboard controller.

Keyboard Interface



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The Keyboard Hardware Interface:

The PC interfaces to the keyboard using two separate microcontroller chips. These chips provide user programming registers and a very flexible command set. If you want to program the keyboard beyond simply reading the keystrokes produced by the keyboard (i.e., manipulate the LEDs on the keyboard), you will need to become familiar with the registers and command sets of these microcontrollers.

The Keyboard DOS and BIOS Interface:

Both DOS and BIOS provide facilities to read a key from the system's type ahead buffer. As usual, BIOS' functions provide the most flexibility in terms of getting at the hardware. Furthermore, the BIOS int 16h routine lets you check shift key status, stuff scan/ASCII codes into the type ahead buffer, adjust the auto repeat rate, and more. Given this flexibility, it is difficult to understand why someone would want to talk directly to the keyboard hardware, especially considering the compatibility problems that seem to plague such projects.

4.7 STEPS FOR ASSEMBLING OF A COMPUTER

Step 1: prepare your workspace

1. Take Inventory:

Before you start, take inventory of your parts. Do not begin assembling your computer if you don't have everything you need. Begin the step-by-step process once you have determined you have everything you need.

2. Make Space, Make Time:

Building a PC take space - about a dining room table worth. So make sure you have plenty of working room and a few hours to proceed with minimal interruption. Work on a flat, stable table top surface or bare floor, where you have room to layout all of the items.

3. Prepare Grounding Protection:

Use an inexpensive antistatic wrist strap (they are often priced at less than $6) is the perfect preventive measure if you have no alternative to working on carpet. Remember, a table top or bare floor is always the best place to build your system. Make sure you are wearing your antistatic wrist strap correctly (it does you no good at all if you do not wear it!), and you are ready to proceed. Look Figure 2 for details.

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4. Have the Drivers Ready:

Assuming you have another internet connected PC, download the latest drivers from the vendors' websites for each component you will be installing. Sometimes drivers are updated between the time the component was manufactured and the time you are installing it. It is always best to have the latest. Copy them to a CD for easy access.

Step 2: Install the motherboard

Find the motherboard standoffs (spacers) that should have come with the case. They are screws, usually brass, with large hexagonal heads that are tapped so you can fasten screws into the top. These hold the motherboard up off the case preventing a short-circuit.

Remove the I/O Shield from the back of the case where the ports on the back of the motherboard will fit, and put in the I/O Shield that came with your motherboard. There may be small metal tabs on the inside of this face plate, if so you may have to adjust them to accommodate the ports on the back of the motherboard.

Step 3: Install the Processor

Installing the CPU, and the CPU's heat-sink and fan, are by far the most difficult steps you'll have to complete during your build. Here, more than anywhere else, it will pay to read the instructions carefully, look at the parts, study the diagrams that came with your CPU and/or third party cooling solution, and make sure you thoroughly understand what you are going to do before you try to do it.

Step 4 : Install the cpu heat sink

The two things that go wrong the most often and most expensively (minimum of a killed CPU, sometimes more) in building one's own computer are both related to the CPU and its cooler:

1. Switching the computer on "just to see if it works" before adding any CPU cooling unit. Without cooling, CPUs heat up at extreme rates (a CPU heats up anywhere between ten times and a thousand times as fast as a cooking area on your stove!) By the time you see the first display on the screen, your CPU will already be severely overheating and might be damaged beyond repair.
2. Mounting the CPU cooler improperly. Read the instructions that came with your CPU and cooler very carefully and ensure you are using all components in the correct order and correct place.

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Step 5: Install the memory

Next, you will need to install your RAM (random access memory). Find the RAM slots on your motherboard; they will look something like the picture on your left. To install the RAM modules, first push on the levers (white plastic in the picture) on either side of the DIMM socket, so that they move to the sides. Do not force them, they should move fairly easily.

Put the RAM module in the socket. Line up the notch in the center of the module with the small bump in the center of the RAM socket, making sure to insert it the right way. Push down on the module until both levers move up into the notches on the sides of the module. There should be a small "snap" when the module is fully seated. Although this does require a fair bit of force, do not overdo it or you may break the RAM module.

Step 6: place the mainboard into the case

Now locate the screw holes on your motherboard and find the corresponding holes on the motherboard plate (or tray) in the case. Put a standoff in each of these holes on the tray and position the motherboard so that you can see the holes in the top of the standoffs through the screw holes in the motherboard.

Step 7: Connect the supply

Installing your power supply is pretty straightforward, if it came with your case it was pre-installed and if you took it out earlier to get the motherboard in, now is the time to put it back. Otherwise a few moments of screwdriver work will get the job done. Generally there will be a bracket on the top of the case where the power supply is mounted and a few screws used to fix it in place. Some cases place the Power Supply differently, see the documentation that came with yours.

Some power supplies come with modular cables, so you can plug in only those you'll be using, now is a good time to figure out what you'll need and plug them in.

Step 8 : Install the the graphics card

If you have an AGP video card: Install the video card into the AGP socket. This is always the top expansion slot near the back of the computer. AGP slots are often brown, but can also be strange colours such as fluorescent green. Check the motherboard for levers (or similar devices) that are part of the AGP slot to help hold the card in place. These must be retracted before insertion of the card. Check the motherboard's manual for information on how to use these devices (if your motherboard has one.)

Step 9: Connect the i/o devices

Install the input and output devices like keyboard , mouse and monitor

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Step 10: Install the drives

Most new drives are SATA (Serial ATA) which use simple, small cables for a data connection. The ends of the cables are L shaped, just look carefully at the cable ends and the connector on the drive and match them up. Only one drive can be connected to each SATA port on the motherboard. Some SATA drives have two different power ports - make sure you connect ONLY ONE of these ports to the power supply, connecting both can damage the drive.

Step 11: Install the add-in cards

There will be a set of pins, usually near the front edge of the motherboard to which you will attach the cables sometimes already connected to the the front of the case, or if needed supplied with the motherboard. Most of the time the plugs will be labeled as the pins they will connect to in the motherboard, there they can be difficult to read since the print is very small or you may not be in the right orientation to do so.

Step 12: Turn the computer on

Take a moment to check one more time that everything is as it should be. Make sure you've removed your wrist strap, turn on the monitor, then press the power button, and observe the inside of the open machine. (*Do not touch any part of the inside of the machine while it is powered up – you will NOT die but your computer might.*) The first thing to look for is that the CPU cooler fan spins up, if it does not, cut the power immediately. This fan should start up right away; something is wrong if it doesn't and your CPU is in danger of overheating so stop now and troubleshoot.

Step 13: Install the os

Operating syatem like windows xp and windows 7 are installed

Step 14: update the drivers

In computing, a device driver is a computer program that operates or controls a particular type of device that is attached to a computer. A driver typically communicates with the device through the computer bus or communications subsystem to which the hardware connects. When a calling program invokes a routine in the driver, the driver issues commands to the device. Once the device sends data back to the driver, the driver may invoke routines in the original calling program.

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Step 15: Install a antivirus and install the internet connection

Antivirus software can impair a computer's performance. Inexperienced users may also have problems understanding the prompts and decisions that antivirus software presents them with. An incorrect decision may lead to a security breach. If the antivirus software employs heuristic detection, success depends on achieving the right balance between false positives and false negatives. False positives can be as destructive as false negatives.[1] Finally, antivirus software generally runs at the highly trusted kernel level of the operating system, creating a potential avenue of attack.

Step 16: Install the other software

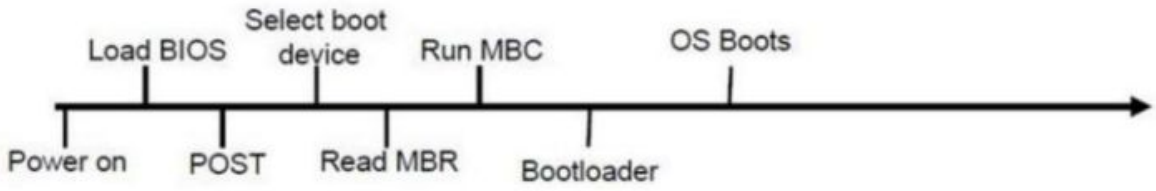
Application software is all the computer software that causes a computer to perform useful tasks (compare with Computer viruses) beyond the running of the computer itself. A specific instance of such software is called a software application, application or app.

The term is used to contrast such software with system software, which manages and integrates a computer's capabilities but does not directly perform tasks that benefit the user. The system software serves the application, which in turn serves the user.

Examples include enterprise software, accounting software, office suites, graphics software and media players. Many application programs deal principally with documents. Applications may be bundled with the computer and its system software or published separately, and can be coded as university projects.

4.8

Software settings of computer after installation (CMOS-setup)



Memory types speed and timing—Adjust the values here to match the memory installed in the system (such as parity, non-parity, SDRAM, EDO, and so on).

Cache adjustments—Some Cyrix CPUs require the user to disable pipelining for proper operation.

Configuration of USB ports—If you upgrade a system to Windows 98 or Windows 2000, you might need to enable the USB ports; systems with older versions of Windows (which didn't support USB) might not have the USB ports enabled. The USB Keyboard Support feature must be enabled if a USB keyboard is installed to allow the keyboard to operate outside of Windows.

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Configuration of the AGP slot—Depending on the specific AGP video card installed (if any), you might need to set the size of the memory aperture used to transfer data between the system and the AGP port and select the AGP mode (1x, 2x, and 4x).

Power Management Configuration- Power management works like this: After a user-defined period of inactivity, devices such as the monitor, the hard drive, or even the CPU will go into different low-power modes:

- **Standby mode**—Shuts off the hard drive and blanks monitor screens that use Display Power Management Signaling. Move the mouse or press a key to "wake up" the system.
- **Suspend mode**—Turns off the CPU clock to save even more power. Systems that fully support suspend mode allow you to choose a special shutdown option that "remembers" what programs and files were open, and can bring the system back to that state when the power is restored.

PnP (Plug-and-Play) Configuration Screen

Plug-and-Play (PnP) configuration allows either the operating system or the system BIOS to select hardware settings for PnP-compatible cards when first installed and to change those settings when new cards are installed.

Security/Passwords

You can enable two types of passwords on many systems: a power-on password that must be entered to allow any use of the system, and a setup password that must be entered to allow access to the BIOS/CMOS setup. If you don't have all the settings recorded (with screen printouts or by writing them down), this can be dangerous to enable. Now install the operating system as below:

(A) Install an operating system:

- Windows: Review Microsoft: Installing and Reinstalling Windows. Using virtualization software,
  install Windows 7 or later in a virtual machine.
- OS X: Review Apple: Installing OS X on an External Volume. Either use virtualization software to install OS X in a virtual machine or follow the instructions to install OS X on an external volume.
- Linux: Review How To Geek: 10 of the Most Popular Linux Distributions Compared and Linux.com: How to Install and Try Linux the Absolutely Easiest and Safest Way. Select a Linux distribution. An Ubuntu/Mint variant is recommended for workstation use, Cent OS is recommended for server use. Using virtualization software, install the Linux distribution in a virtual machine or follow the instructions to try one or more Linux distributions.

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(B) Perform system updates:

- Windows: Review Microsoft: Windows Update. Run Windows Update and install any missing critical updates.
- OS X: Review Apple: Update OS X and App Store Apps on your Mac. Check for software updates and install any missing updates.
- Linux: Review Linux.com Updating Your System. Check for system updates and install any missing updates.
- Chromium OS: Review Google: Update your Chrome book operating system. Check for system updates and install any missing updates.

(C) Add features:

Windows 7: Review Microsoft: Turn Windows Features On or Off. Open the Window dialog box and Configure keyboard, mouse, display, sound, etc..Windows: Review Microsoft: Working with Control Panel. Use Control Panel applets to configure keyboard, mouse, display, sound, and other settings.

(D) Software

We install a standard set of programs as part of the Computer Setup service. To view a list of installed programs, visit the Standard Mac and Standard Windows pages. We can install any software you are licensed for on request.

BASIC MAINTENANCE AND TROUBLESHOOTING PROCEDURES

5.1

. A computer containing accumulated dust and debris may not run properly. Dust and other cruft may accumulate as a result of air cooling. Any filters used to mitigate this need regular service and changes. If the cooling system is not filtered then regular computer cleaning may prevent short circuits and overheating. System maintenance is an umbrella term that encompasses various forms of computer maintenance needed to keep a system running. The three main components of system maintenance are preventive, corrective and online maintenance. Preventive maintenance involves taking measures to help keep the system functioning, whereas corrective maintenance involves the replacement or repair of a system or its components after they have already failed.

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Preventive Maintenance

Preventive maintenance is defined as the proactive maintenance of equipment before a fault or failure occurs. Preventive maintenance involves routine tasks to ensure that your system is running optimally and to avoid problems before they arise. This is similar to routine maintenance performed on a car: In the same way you need to periodically check the oil, lights, engine, and other parts of the car in order for it to run smoothly, the same principle applies to preventive maintenance for a computer.

Corrective Maintenance

Corrective maintenance, commonly referred to as "repair," is the correction of a problem after the computer has already broken down. The goal of this form of maintenance is to restore operability to the system by either correcting the problem or replacing the damaged components. Common corrective measures involve removing viruses and malware, uninstalling harmful programs, reformatting, and running a system restore, among others.

On-line Maintenance

Remote administration refers to any method of controlling a computer from a remote location. Software that allows remote administration is becoming increasingly common and is often used when it is difficult or impractical to be physically near a system in order to use it. A remote location may refer to a computer in the next room or one on the other side of the world.

5.2 Type & nature of faults

A fault in a computer system affects the normal operation of the computer, i.e, the computer malfunctions. The symptoms of malfunction are almost unlimited and vary with the nature of the fault. The types of symptoms we often come across are listed below:

- A program has given wrong results.
- A program is looping continuously
- The CPU has lost control
- There is a junk display on the CRT
- The HDD is not working
- Opening more than one window causes the system software to hang.

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Nature of faults: solid and intermittent

Computer faults can be broadly classified into 2 types based on frequency of occurrence of the program:

a)Permanent or Solid fault: When there is a permanent in a computer misbehaves consistently. Any number of times the program is run, the result or symptoms will be same.

b)Intermittent fault: When there is an intermittent fault, the computer's behavior is not consistent. Sometimes it works properly and suddenly it malfunctions. After a certain period of time, it recovers from the fault automatically and again starts functioning properly.

Types of Faults: (Hardware & Software)

A hardware which works now may fail even in the next second. But a software one proven always works. Hence if there is a software fault in a computer, it is because of one the following two reasons:

-The program is not proven. It is a new which is not yet debugged thoroughly.

-The program works only for certain types of data. This is due to the incomplete testing of the software

Software errors may appear to be hardware errors. A hardware problem is classified as a fault in an actual component or in the configuration of that component.

- Electronic problems
- Mechanical problems
- Environmental problems
- Media problems

Each of these types may cause both solid and intermittent problem. They may cause a similar problem. In practice, it is easier to identify the cause of solid problems. An intermittent mechanical problem may give symptoms that may mislead the engineer to conclude it as electronic problem. The symptoms caused by the media problems make one think that they are either hardware or software problems. Hence an intermittent problem needs a very careful and systematic approach.

Fault effects may be permanent or temporary

- Same fault may result in different effects depending on where/when it occurs
- A soft error in the code segment is a permanent error while one in the data segment may be temporary

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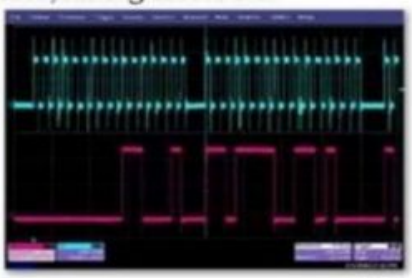
Faults may affect different layers differently

- A permanent fault in the logical level may manifest as a temporary fault at the architectural level if the function unit in which it occurs is often unused.

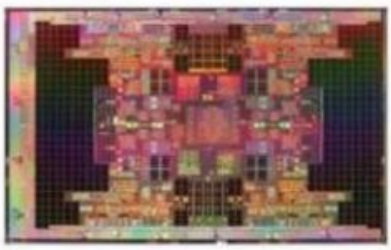
(i) **System Stack: Logical level** – soft error, timing errors etc.



Soft errors

Timing errors

(ii) **System stack: Architectural level** – Design defects, wear out-related defects



Design Defects

Wearout-related defects

(iii) **System Stack: OS/VM level** – kernel error, driver error

Kernel Error

Driver error

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5.3

Diagnostic program and tools:

A diagnostic program is a program written for the express purpose of examining the state, or locating problems with the hardware, or operating system environment that it is running on/in. A diagnostic program is a program written for the express purpose of locating problems with the software, hardware, or any combination thereof in a system, or a network of systems. Preferably, diagnostic programs provide solutions to the user to solve issues.

Examples:

- Diagnostics that are run on-demand when a user needs assistance, typically within the primary operating system of the computer (e.g. Windows)
- "Off-line diagnostics" that are run outside the primary operating system, typically to reduce the masking influence of software on hardware issues
- Background diagnostics that monitor the system for failures and marginal events, and provide statistical data for failure prediction, and root cause analysis of actual failure conditions
- Solutions-oriented diagnostics, that diagnose and resolve user-perceived issues with a computer system.
- In some cases hardware components have specific features to assist a diagnostic program to test it.

Methods of Operation

- Black box, which is testing of a mechanism without knowing how it works, and merely focusing on the accuracy of output data based on a known input.
- White box, which uses knowledge of a mechanisms inner functions to direct testing.
- Operation-oriented, a combination of both black and white box, with one or more black-box operations interleaved with one or more white-box operations. This mode of testing is not preferred; however some complex systems do not have the necessary interfaces to perform one or the other type independently.
- Background monitoring of system indicators, for statistical analysis of trends, and for recording abnormal events
- Background diagnostics, that perform testing of system components during idle-time of a system
- Operation-interleaved diagnostics, that incorporate diagnostics into the normal

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operation of a system component, thus any marginal operating mode is immediately diagnosed

Architectures

- Single-purpose diagnostic, also referred to as "Defined-purpose" diagnostic, such as a program that validates the Windows DirectX configuration
- Multi-purpose diagnostic, a monolithic program that performs multiple tasks that may or may not be suitable for all uses. This would be similar to a hammer that will perform well with nails, less so with screws, and poorly with nuts and bolts.
- Modular diagnostic, which combines sets of single-purpose diagnostics into an environment that is easily tailored for particular requirements.
- Knowledge-Driven diagnostic system (such as a technician or diagnostician) where the knowledge acquired over time is used as a "mental model" of the system's operation and informs the diagnostic system through logical reasoning to one or more possible or likely causes for a situation to exist.

Diagnostic tools

Computer manufactures supply special diagnostic programs. These programs contain test routines to verify the various functions of the computer hardware. Running these programs helps one to decide whether the hardware is faulty or not. In order to verify the presence of intermittent problems, it is necessary to run the diagnostics multiple times. These test programs very often help us to confirm whether a problem in a computer is related to hardware or software. If diagnostic programs run successfully without pointing out any problems, then the chance of a hardware fault is remote. But there are two exceptions to this:

- Intermittent problems may play a hide and seek
- Some problems may be too complex to be detected by simple diagnostic programs.

These faults may occur only when several subsystems work simultaneously.

Unless diagnostic programs simulate the above two situations, then faults may not be caught by the diagnostics programs. The Software routines that test hardware components (memory, keyboard, disks, etc.) diagnostics are often stored in ROM chips and activated on startup. Computer errors can occur due to either hardware or software issues and often requires time consuming trial-and-error troubleshooting to diagnose. The diagnostic tools cover the usual culprits such as memory, hard drives, video cards and software, allowing you to pinpoint the source of your computer troubles. In instances where the tools cannot outright repair the errors, the information provided can be key to determining what has to be replaced. Your desktop computer comes with several sophisticated diagnostic programs.

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5.4 FIRMWARE CONCEPTS:

It can be mainly referred to as being a fixed, rather small program that controls hardware in a system. Firmware is generally responsible for every basic low-level operation without which a device would be completely non-functional. Usually firmware is stored in Flash, ROMs, PROMs, and EPROMs. In most cases, firmware is not supposed to be changed by the user. The POST checks, identifies, and initializes system devices such as the CPU, RAM, interrupt and DMA controllers and other parts of the chipset, video display card, keyboard, hard disk drive, optical disc drive and other basic hardware. A power-on self-test (POST) is a process performed by firmware or software routines immediately after a computer or other digital electronic device is powered on.

The results of the POST may be displayed on a panel that is part of the device, output to an external device, or stored for future retrieval by a diagnostic tool. Since a self-test might detect that the system's usual human-readable display is non-functional, an indicator lamp or a speaker may be provided to show error codes as a sequence of flashes or beeps. In addition to running tests, the POST process may also set the initial state of the device from firmware. Most computer peripherals are themselves special-purpose computers.

- Firmware is programming that's written to a hardware device's nonvolatile memory.
- Firmware, which is added at the time of manufacturing, is used to run user programs on the device and can be thought of as the software that allows hardware to run. Hardware makers use embedded firmware to control the functions of various hardware devices and systems, much like a computer's operating system (OS) controls the function of software applications.
- Firmware may be written into read-only memory (ROM), erasable programmable read-only memory (EPROM) or flash memory. Firmware that is embedded in flash memory chips can be updated easier than firmware written to ROM or EPROM, which makes it more adaptable.

5.5 Fault elimination process

Fault finding is a technique. Some faults can be easily traced out if one proceeds systematically, starting from the symptoms. Some fault show complex symptoms with no clue at all. For such faults there are no defined starting points. In such case, service engineers should try out an appropriate elimination process. The steps of fault elimination procedure are common to any computer. Some of these can be omitted depending on the symptoms.

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(I) Dead System:

A computer is said to be dead when an absolutely essential signal is absent. It is easy to confirm whether a system is dead or alive. The following are some of the symptoms of adead computer:

- DC voltage is absent
- clk signal is absent
- ROM output is inactive
- Microprocessor is faulty or dead
- The ac fuse is blown

(II) Spurious Problems:

Sometimes the computer malfunctions randomly. Logical and systematic trouble shooting may not yield any clue. In such case the engineers should look for symptoms of spurious problem. Some of the hidden symptoms of spurious problems are –

-DC voltage has excessive ripples

-DC voltage is noisy

- clock signal is not stable
- loose contacts of cables and connectors
- there is noise pick up on the next input or on other bus signals.

(III) Security Failures:

In any computer, sometimes there are abnormal symptoms, due to malfunctioning of special hardware meant for error detection. Three types of problems are caused by such security logic:

- When there is no error, the error detection logic (ex. ECC ch..) raises a false alarm.
- When there is an error, the security guard without catching it. The error propagates and creates confusion.
- The error detection hardware malfunctions in generating appropriate coding. For example, the parity generator may generate a wrong parity bit. This goes unnoticed immediately when the parity checker detects an error, the OS wrongly considers it a genuine error.

(IV) Heart Beats:

We have seen some of the symptoms of a dead PC earlier. These are the general symptoms applicable to any computer. In addition, there are some check points which are the heart beats of PCs. By sensing these, the engineer can predict the problem type and determine how to proceed with diagnosis.

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5.6 SYSTEMATIC WAY OF TROUBLE SHOOTING VERSUS ADHOC TROUBLE SHOOTING

. Systematic trouble shooting is a logical approach. It is a scientific and analytical process. The systematic troubleshooting approach can be divided into the following steps:

- Symptom observation
- symptom analysis
- fault diagnosis
- Fault Rectification

a) Symptom observation:

The first step in troubleshooting a system or peripheral is observing all the symptoms caused by the fault in the system. For some problems, especially for problems due to multiple faults, it will be impossible to locate the exact fault or it will take a long time & thus the downtime will be increased. The time spent on symptoms observation in turn will yield proportional return during fault locating. Clean mind and concentration is essential while troubleshooting a problem.

b)Symptom analysis:

A careful analysis of the symptoms will give a clue to the fault location process. When there are multiple symptoms the engineers should try to correlate the various symptoms to identify the problem. If any relationship or clue is found, several steps can be skipped during fault location, thereby reducing the downtime considerably. In cases where there is no interrelation between the symptoms of a problem, the engineer should proceed with the fault location, without wasting time in attempting to establish the relationship. If multiple faults are present, then we may be minted by mixed symptoms. It is difficult to predict the presence of multiple faults.

Two probable clues are as below:

- Symptoms are not consistent but keep changing
- Certain symptoms vanish suddenly

(c) Fault diagnosis:

It is highly sophisticated scientific process. The most important point is the multi-dimensional view to be applied by the hardware engineer while troubleshooting. The main dimensions are as below:

- Architecture:

Certain problems can be visualized properly only when you analyze the problem and the behavior of the computer as a system consisting both hardware and software. Software may be either a system software or an application software. It is not necessary that we should be a programmer. But we should know what the programs do, when they start and stop some activities and when they interact with hardware.

- Organization:

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Different faults may create the same external symptom. The engineer must distinguish the different faults by a deep analysis of the internal machine status. Every computer has certain unique organizational aspects. Before trouble shooting a computer, the engineer should understand the specific detail of organization of the computer. The computer with same architecture need not have the same organization. The hardware organization refers to functional and physical distribution of various subsystems in the computer. It decided by the computer designers based on the status of computer technology during the design state. Hardware engineer should know the organizational aspects including detailed timing relationship and signal sequences. Even if the engineer fortes all the signals in a computer system, he won't be able to locate the fault if he does not know how correlate the various signal conditions.

Engineering Layout:

Faulty cable, loose connection, open wire, track short, etc. To catch these problems, one must thoroughly analyze the physical aspects. The layout documents to a computer are –

- Circuit diagram
- Board layout diagram
- Cable Signals
- Connecter signals list
- Jumper settings

Environment:

Certain problems are caused due to environmental conditions and are listed below:

- High Temperature
- DUST
- Magnetic
- Fields Humidity

(d) Fault Rectification:

Once a problem is diagnosed thoroughly and the fault is traced, the rectification involves skilled mechanical work rather than analytical work. This step involve performing one or more of the actions depending on the result of fault diagnosis:

- Replacing a defective IC or other components
- Replacing a defective PCB
- Cleaning the R/W heads
- Formatting a diskette or hard disk
- Adjustments: mechanical or electrical
- Controlling temperature or improving cooling.

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BASIC NETWORKING DEVICES AND THEIR INTERFACING

6.1 Network Interfacing Card

In the list of networking devices, NIC stands on first place. Without this device, networking cannot be done. This is also known as network adapter card, Ethernet Card and LAN card. NIC allows our PC to communicate with other PCs. Basically it converts data transmission technology. A PC uses parallel data transmission technology to transmit data between its internal parts while the media that connects this PC with other PCs uses serial data transmission technology. A NIC converts parallel data stream into serial data stream and vice versa serial data stream is get converted in parallel data stream.

Usually all modern PCs have integrated NICs in motherboard. NICs are also available separately. For desktop or server system they are available in adapter format which can be plugged into the available slots of motherboard.

Types of NICs:

There are two types of NICs as below:

Media Specific :- Different types of NICs are required to connect with different types of media. For example we cannot connect wired media with wireless NIC card. Just like this, we cannot connect coaxial cable with Ethernet LAN card. We have to use the LAN card that is particularly built for the media type which we have.

Network Design Specific :- A specific network design needs a specific LAN card. For example FDDI, Token Ring and Ethernet have their own distinctive type of NICs card. They cannot use other's NIC card.

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Collision:

Collision is the effect of two devices sending transmissions simultaneously in Ethernet. When they meet on the physical media, the signals from each device collide and damaged. Collision domain is the group of devices that share same collision effects over the Ethernet network. It is a mechanism of removing collision from network.

The more devices you place on a segment, the more likely you are going to experience the llisions. More devices means more random time interval, creating even more collisions, gradually slowing down a device's access when trying to transmit the data.

6.2 Network Interconnecting Devices

. Hub

.Switch

. Router

Hub:

Hub is a device works on the physical layer of OSI Models which create single broadcast domain & single collision domain. It is a layer 1 device. Hub use the method of Broadcast data transmission.

Characteristics of HUB:-

1) Hub creates single Broadcast Domain.
2) Hub creates single Collision Domain.

HUB is used to connect multiple computers in a single workgroup LAN network.

Typically HUBs are available with 4,8,12,24,48 ports.

Based on port type,there are two types of HUB:-

Ethernet HUB :- In this type of HUB all ports have RJ-45 connectors.

Combo HUB :- In this type of HUB ports have several different types of connectors such RJ-45, BNC, and AUI. HUBs generally have LED (light-emitting diode) indicator lights on each port to indicate the status of link, collisions, and other information.

There are two types of HUB:

Passive HUB :- It forwards the data signal from all ports except the port on which signal arrived.It doesn't interfere in data signal.

Active HUB :- It also forwards the data signal from all ports except the port on which signal

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arrived. But before forwarding, it improves quality of data signal by amplifying it. Due to this added features active HUB is also known as repeaters.

Switch:

Switch is a device works on the Data Link Layer of OSI Models which create single broadcast & multiple collision domains. It is a layer 2 device & works on MAC address. Switch use the method of Unicast data transmission. Switch maintain a table which called MAC Address Table. In this table switch store Mac Address & Port no. of all the hosts attached on this network.

Characteristics of SWITCH:-

3) Switch create single Broadcast Domain.
4) Switch create multiple Broadcast Domain.

Switch is also used to connect multiple computers together in a LAN segment. Switches available with 4,8,12,24,48,64 ports. Each switch port has a separate collision domain. Switch works at layer two in OSI Layer model.

Router:

Router is a device works on the Network Layer of OSI Models which creates no Broadcast Domain & Collision Domain. Router prevent Broadcast. It is a Layer 3 device works on IP Address. Router has mainly 2 types of interface. Ethernet or LAN interface & Serial or WAN interface. Router maintain a table called Routing Table. It holds the Information of IP Addresses, interface & HOP of all the hosts connected to this network.HOP means jump.

Basically routers are used :-

- To connect different network segments.
- To connect different network protocols such as IP and IPX.
- To connect several smaller networks into a large network (known as internetwork)
- To break a large network in smaller networks (Known as subnet usually created to improve the performance or manageability)

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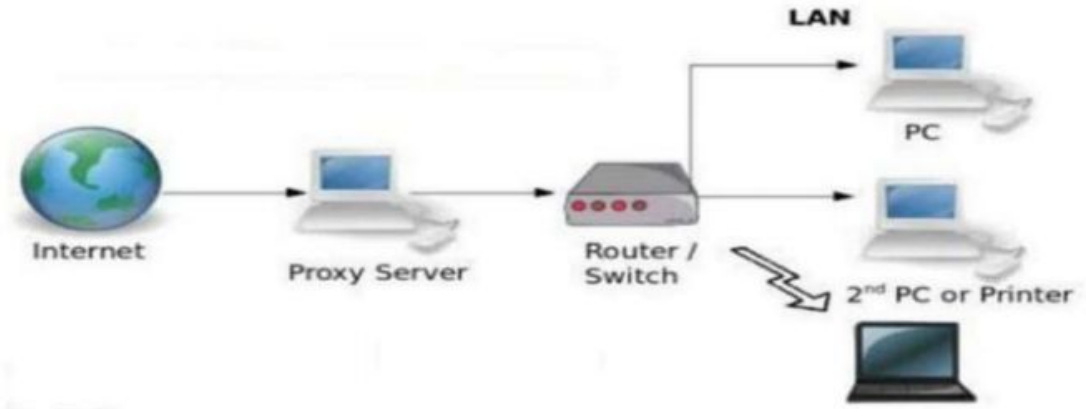

6.3 Types of Network Cable

In networks using cable-based media, there are three basic choices:

-Twisted pair

-Coaxial

-Fiber-optic

Twisted pair and coaxial cables both use copper wire to conduct the signals electronically; fiber-optic cable uses a glass or plastic conductor and transmits the signals as light.

(A)Twisted Pair Cable

Two main types of twisted-pair cabling are in use today:

a)Unshielded Twisted Pair (UTP)

b) Shielded Twisted Pair (STP) .

UTP is significantly more common than STP and is used for most networks. Shielded twisted pair is used in environments in which greater resistance to EMI and attenuation is required. The greater resistance comes at a price, however. The additional shielding, plus the need to ground that shield (which requires special connectors), can significantly add to the cost of a cable installation of STP. STP provides the extra shielding by using an insulating material that is wrapped around the wires within the cable. This extra protection increases the distances that data signals can travel over STP but also increases the cost of the cabling.

(B) Coaxial Cable

Coaxial cable, or coax as it is commonly called, has been around for a long time. Coax found success in both TV signal transmission and network implementations. Coaxial

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cable is constructed in this way to add resistance to attenuation (the loss of signal strength as the signal travels over distance), crosstalk (the degradation of a signal, caused by signals from other cables running close to it), and EMI. Two types of coax are used in networking: thin coax, also known as thin net, and thick coax, also known as thick net. Neither is particularly popular anymore, but you are most likely to encounter thin coax. Thick coax was used primarily for backbone cable. It could be run through plenum spaces because it offered significant resistance to EMI and crosstalk and could run in lengths up to 500 meters. Thick coax offers speeds up to 10Mbps, far too slow for today's network environments

(C) Fiber optic Cable

In many ways, fiber-optic media addresses the short comings of copper-based media. Because fiber-based media use light transmissions instead of electronic pulses, threats such as EMI, crosstalk, and attenuation become nonissues. Fiber is well suited for the transfer of data, video, and voice transmissions. In addition, fiber-optic is the most secure of all cable media. Anyone trying to access data signals on a fiber-optic cable must physically tap into the medium. Given the composition of the cable, this is a particularly difficult task.

Two types of fiber-optic cable are available:

.Multimode fiber : Many beams of light travel through the cable, bouncing off the cable walls. This strategy actually weakens the signal, reducing the length and speed at which the data signal can travel.

Single-mode fiber: It uses a single direct beam of light, thus allowing for greater distances and increased transfer speeds.

NETWORK CABLE

STRAIGHT CABLE:-

END 1	**END 2**
1) BLUE	1) BLUE
2) GREEN	2) GREEN
3) BROWN	3) BROWN
4) ORANGE	4) ORANGE
5) BLUE on WHITE	5) BLUE on WHITE
6) GREEN on WHITE	6) GREEN on WHITE
7) BROWN on WHITE	7) BROWN on WHITE
8) ORANGE on WHITE	8) ORANGE on WHITE

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Straight cable is used to connect pc to hub, pc to switch, router to hub through Ethernet & router to switch through Ethernet.

CROSS CABLE:-

END 1	END 2
1) ORANGE	1) GREEN
2) BLUE	2) BROWN
3) GREEN	3) ORANGE
4) ORANGE on WHITE	4) ORANGE on WHITE
5) BLUE on WHITE	5) BLUE on WHITE
6) BROWN	6) BLUE
7) GREEN on WHITE	7) GREEN on WHITE
8) BROWN on WHITE	8) BROWN on WHITE

It is used for to connect pc to pc, hub to hub, switch to switch, switch to hub, router to router through Ethernet.

ROLE OVER CABLE:-

END 1	END 2
1) ORANGE	1) BROWN on WHITE
2) BLUE	2) GREEN on WHITE
3) GREEN	3) BLUE on WHITE
4) BROWN	4) ORANGE on WHITE
5) ORANGE on WHITE	5) BROWN
6) BLUE on WHITE	6) GREEN
7) GREEN on WHITE	7) BLUE
8) BROWN on WHITE	8) ORANGE

It is used for to connect a router through console port to a pc through serial port.

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6.4 Types of Network Connector

A variety of connectors are used with the associated network media. Media connectors attract the media and allow the physical connection into computing device. Many of the fiber and the copper networks are used for sending data from the one place of the world to the corner of it. There are so many connections are out there which are most commonly found in the modern era. These connectors have some specific cables as well. The cables that we use at the homes are important since they might be the base of the connection that is being used. When the house is being build, and the networking is being selected from the scratch, it is very vital to know that the cables selected are of the right type so that no difficulty can be seen in the future. Here are some connectors and the cables which have some specific characteristics;

(I) BNC connectors are associated with coaxial media and 10Base2 networks. BNC connectors are not common as they once were, but they still are used on some network cards and older hubs. Common BNC connectors include a barrel connector, T-connector and terminator.

(II) When one starts working with the fiber, he would notice that it contains many types. There are various kinds of the connectors which are connected at the end of the cables. They are mentioned as Connectors: SC, ST and LC: The ST uses a half-twist bayonet type of lock. The SC uses a push-pull connector similar to common audio and video pulgs and sockets. The LC connectors have a flange on top, similar to an RJ-45 connector, that aids secure. MT-RJ is a popular connector for two fibers in a very small factor.

(III) It is pretty obvious that if one decides to do all the cabling himself, he would have a different way of doing it than others. Hence one can face many problems while doing so. Due to that reasons, there are some standards which have been created and linked to the devices so everyone follows the same. Some of them are associated to the twisted pair cabling.

(IV) F-type connectors are screw-on connections used to attach coaxial cable to devices. This includes RG-59 and RG-6 cables. F-type connectors are commonly associated with connecting Internet modems to cable or satellite Internet service provider's (ISPs') equipment.

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- RJ-11 connectors are used with standard phone lines and are similar in appearance to RJ-45 connectors used in networking. However, RJ-11 connectors are smaller.
- RJ-45 connectors are used with UTP cabling.
- F-type connectors are used to connect coaxial cable to devices such as Internet modems.
- Fiber-optic cabling uses a variety of connectors, but SC and ST are more commonly used than others.
- SC and ST connectors are associated with fiber cabling. ST connectors offer a twist-type attachment, whereas SCs have a push-on connector.
- LC and MT-RJ are other types of fiber-optic connectors.
- UTP cabling is the most common type used on today's networks. For greater speeds, distances, and resistance to interference, fiber-optic cable provides an increasingly affordable alternative.

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Straight Versus Crossover Cable

Two types of cables are used to connect devices to hubs and switches: crossover cables and straight-through cables. The difference between the two types is that in a crossover cable, two of the wires are crossed; in a straight-through cable, all the wires run straight through.

Vertical Cable

Vertical cable, or backbone cable, refers to the media used to connect telecommunications rooms, server rooms, and remote locations and offices. Vertical cable may be used to connect locations outside the local LAN that require high-speed connections. Therefore, vertical cable is often fiber-optic cable or high-speed UTP cable. Figure 2.16 shows the relationship between horizontal cable and vertical cable.

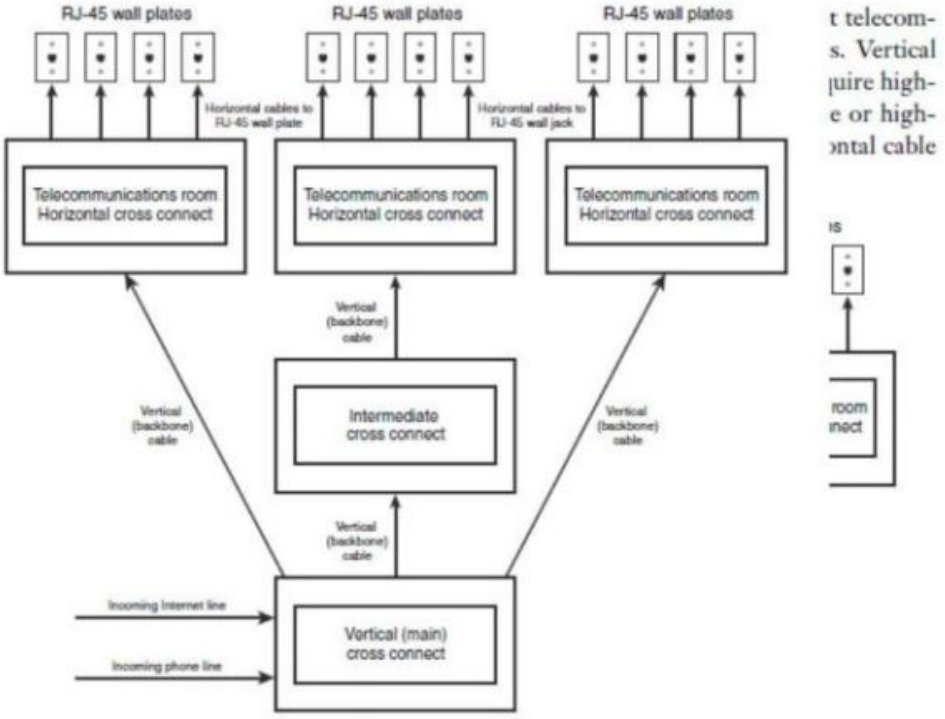

FIGURE 2.16 Vertical and horizontal cabling.

FIGURE 2.16 Vertical and horizontal cabling.

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Hard disk : A hard disk drive, hard disk, hard drive or fixed disk is an electro-mechanical data storage device that uses magnetic storage to store and retrieve digital data using one or more rigid rapidly rotating platters coated with magnetic material.

Best external hard drives at a glance

→ Western Digital My passport ultra 4TB
→ Samsung T5 SSD.
→ Buffalo Ministation Thunderbolt.

Hard disk (hard drive) construction

→ Hard disks are rigid platters, composed of a substrate and magnetic medium. The substrate- the platter's base material - must be non-magnetic and capable of being machined to a smooth finish
→ It is made either of aluminium alloy or a mixture of glass and ceramic.
→ One or more platters are mounted on a common spindle. A platter has two magnetic surfaces, top and bottom.
→ It consists of a spindle motor to drive the above mentioned stack of platters about its axis at a speed ranging from 3600 rpm to 10000 rpm.
→ A set of magnetic heads made up of thin magnetic film are also mounted on a common shaft which perform the operation of accessing the information from the platters.
→ Information is recorded on both the sides of the disk, such that magnetized spot on platter is used for storing 1 and a non-magnetized spot is used for storing 0.
→ Information is recorded on the circular tracks and the track is divided into sectors.

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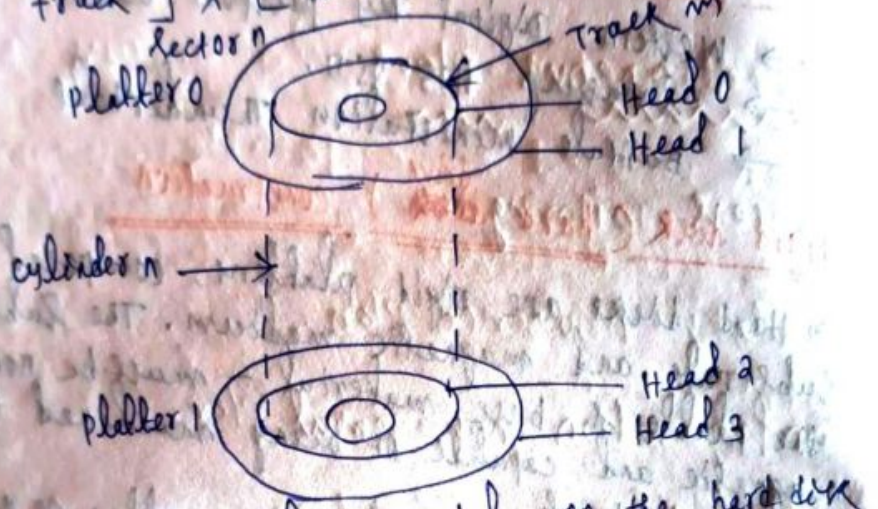
→ The capacity of the hard disk depends upon the total number of usable surface, bytes stored per sector, sectors per track, tracks per surface.

→ The capacity of HDD can be calculated by the equation given below:

capacity of HD = [no. of usable surface] [bytes stored per sec] x [sectors per track] x [track per surface]



(Organization of data on the hard disk drive)

File System In computing, a file system controls how data is stored and retrieved.

→ Without a file system, data placed in a storage medium would be one large body of data with no way to tell where one piece of data stops and the next begins.

→ There are many types of file systems. Each has different structure and logic, properties of speed, flexibility, security, size and more.

Formatting and partitioning of Hard drive

→ If we are installing a new hard drive, or need to wipe our drive clean for that formatting is necessary.

→ Formatting will check the drive for errors and prepare it for use. If a drive has data on it, formatting the drive will

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remove all the pointers to the files.
→ Formatting doesn't securely erase the contents of a hard drive.
→ clean formatting can take hours to complete, but it is a good option when we have a new or inherited drive that is not properly formatted, a drive overrun by malware or other s/w problems, or a drive in need of a fresh start before a windows installation.
→ Before formatting we should back up important files on the disk.

* To partition and format the drive, we can use window's built-in-tool called disk Management.
* you can repartition and format your hard drives in windows using the disk Management tools.

Steps (To create and format a new partition (volume))

1. First go to start → control panel → System and Security > Administrative tools and then double click computer Management.
2. on the left pane, under Storage, select disk Management.
3. Right-click an unallocated region on your hard disk, and then select New Simple volume.
4. on the new Simple volume wizard, select next.
5. Enter the size of the volume you want to create in Gigabytes (GB) or accept the maximum default size, then select next.
6. Accept the default drive letter or choose a different drive letter to identify the partition and then select next.
7. on the format partition dialog box, do one of the following:

* if you don't want to format the volume right

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now, select do not format this volume, and then select next.

* To format the volume with the default setting, select next.

9. Review your choices, and then select finish.

To format an existing partition (volume)

1. Open computer management by selection start button. Then select control panel > System and security > Administrative tools, and then double click computer management.
2. In the left pane, under storage, select disk management.
3. Right click the volume that you want to format and then select format.
4. To format the volume with the default setting in the format dialog box, select OK, and then select OK again.

* You can not format a disk or partition that is currently in use, including the partition that contains windows.
* The quick format option will create a new file table, but will not fully overwrite or erase the volume. A quick format is much faster than a normal format, which fully erases any existing data on the volume.

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Removable Storage and Special devices and their working Principle:

CD (compact disc)

→ CD-ROM is an optical disc that contains audio or software data whose memory is read-only.
→ A CD-ROM drive or optical drive is the device used to read them.
→ CD-ROM drives have speeds ranging from 1x to 72x, meaning it reads the CD roughly 72 times faster than 1x version.
→ These drives are capable of playing audio CDs and reading data CDs, including CD-R and CD-RW discs.

DVD (Digital versatile disc)

→ A DVD is a type of optical media used for storing digital data. It is having the same size as CD but has a larger storage capacity.
→ A standard video DVD can store 4.7GB of data which is enough to hold over 2 hours of video in 720p resolution.
→ DVDs are also used to distribute S/w programs.
→ DVD media comes in several formats including DVD+R (recordable DVD), DVD-R, DVD+RW (re-writable DVD), DVD-RW, DVD-RAM, DVD-ROM.
→ DVDs are widely used for storing and viewing videos and S/w programs.
→ Once a DVD-R has been written to, it cannot be written to again.

External Drives

An external drive is just a hard drive (HDD) or solid state drive (SSD) that is connected to a computer on the outside rather than on the inside.
→ Some external drives draw power over their

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data cable, which of course comes from the comput itself, while others may require an AC wall connection to derive power on their own.

→ External hard drives are portable, easy use and can provide a large amount of storage whenever you need it.

→ you can store the actual device any place you like, and carry a large number of files with you wherever you go.

→ Another advantage of owning an external dr is that you can move them from computer to computer, making them great for sharing large files.

USB flash drive:

→ A USB flash drive - also known as a USB stick USB thumb drive or pen drive - is a plug - and - play portable storage device that uses flash memory and is lightweight enough to attach to a key chain.

→ A USB flash drive can be used in place of compact disc, when a user plugs the flash memory device into the USB port, the com operating system (OS) recognize the device as a removable drive and assigns it a drive letter.

→ A USB flash drive can store important files or data backups, carry favorite settings or applica run diagnostics to troubleshoot computer problems or launch an OS from a bootable US

→ The USB drive support MS Windows, Linux, Mac etc.

SSD (Solid state drive):

→ SSDs work differently than a traditional hard drive as there are no moving parts. Whereas HDDs use spinning disk platters to access information, SSDs store data on flash mem chips, much like smartphones, USB drive et

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→ Since the drive doesn't have to wait for any platter to spin to where your data is located, all memory chips are accessible at the same time.
→ This makes it much easier for users to access their information at high speed.
→ SSDs are becoming far more common in everything from high-end gaming PCs to entry-level laptops. They have embedded flash memory.
→ SSDs are more durable and reliable. There are no moving parts to damage and no drive motor to break. SSDs can write or read data at incredible speeds compared to HDD.

Mouse Interfacing :

→ The mouse interface works in two ways, one is with wire and other is wirelessly.
→ To transmit their input, typical cabled mice use a thin electrical cord terminating in a standard connector, such as RS-232C, PS/2 or USB.
→ cordless mice instead transmit data via infrared radiation or radio (including bluetooth), although many such cordless interfaces are themselves connected through the wired serial buses.
→ While the electrical interface and the format of the data transmitted by commonly available mice is currently standardized on USB, in the past it varied between different manufacturers.
→ With the arrival of the IBM PS/2 personal-computer series in 1987, IBM introduced the PS/2 interface for mice and keyboards, which other manufacturers rapidly adopted. The most visible change was the use of a round 6-pin connector than the former 5-pin connector.
→ In default mode (called stream mode) a PS/2 mouse communicates motion, and the state of each button, by means 3-byte packets.

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Keyboard Types

USB Keyboard: A USB keyboard is a simple plug and play keyboard with a wire that connects the keyboard to your computer and at the end the cable is a USB plug that goes directly into one of your computer's USB ports.

→ Most of the keyboards used now a-days are USB type.

→ As we type, the processor in the keyboard analyzes the key matrix and determines what characters to send to the computer.

→ It maintains these characters in its memory and then sends the data.

Wireless Keyboard:

→ A wireless keyboard is a computer keyboard that allows the user to communicate with computer, tablets or laptops with the help of radio frequency, such as WiFi and bluetooth or wireless infrared (IR) technology.

→ It is common for wireless keyboards available these days to be accompanied by wireless mouse.

→ Wireless keyboards based on infrared technology use light waves to transmit signals to other infrared-enabled devices. The radio receiver plugs into a keyboard port or USB port. Once the receiver and transmitter are plugged the computer recognizes the keyboard and mouse as if they were connected via a cable.

Types of Keys:

Usually there are 104 keys in keyboard. They are of the following types:

1. **Alphabet Keys**: 26 Alphabet keys (A–Z) or (a–z) not in order.

2. **Numeric Keys**: Used to type numbers. These are present above the top row of the

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alphabet keys and also present on the right side bottom of the keyboard.

3. Special keys: Special keys such as space bar, caps lock, back space, shift, enter, symbol keys and tab key etc.

4. Function keys: 12 function keys are present to perform specific tasks. F1 to F12. These keys have different functions for different programs

5. Navigation keys: Every keyboard has some special navigation keys such as cursor control keys (Arrow keys), Home, End, Ctrl, Alt, Page up, page down, delete, Insert etc.

Keyboard Matrix:

A keyboard matrix circuit is a design used in most electronic musical keyboards and computer keyboards in which the key switches are connected by a grid of wires, similar to a diode matrix.

→ For example, 16 wires arranged in 8 rows and 8 columns can connect 64 keys. By scanning these crossings, a keyboard controller can determine which keys are currently pressed.

→ Without a matrix circuit, a 64-key keyboard for a synthesizer would require 64 wires to connect - a thick bundle of wiring.

→ With a matrix circuit, any of 61 notes can be determined with only 16 wires. This is drawn schematically as a matrix of 8 columns and 8 rows of wires, with a switch at every intersection.

Key Bouncing: Key bounce also known as chattering occurs in mechanical switches and can cause one switch press to be detected as multiple presses.

→ Mechanical switches are used as keys in most of the keyboards. When a key is pressed the contact bounce back and forth and settle down only after a small time delay (20ms). Even though a key is actuated once, it will appear as actuated several times.

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PRINTERS :

A printer is an output device that prints paper documents. This includes text documents, images, or a combination of both. The two most common types of printers are inkjet and laser printers. Inkjet printers are commonly used by consumers, while laser printers are typical choice for business.

Types of printer :

→ Laser printers
→ Solid Ink printers
→ LED printers
→ Home inkjet printers
→ Multifunction printers
→ Dot Matrix printers
→ 3D printers

TROUBLE SHOOTING IN PRINTERS

When your printer, for whatever reason, stops printing, you quickly realize just how essential it is to your business. The basic troubleshooting techniques are given below :

1. unplug and restart your printer.
2. check cables or wireless connection.
3. Uninstall and reinstall your printer.
4. Install the latest driver for your printer.
5. Run the printing troubleshooter.
6. clear and reset the print spooler.
7. Fix printer problems after updating windows
8. change a printer status to "online".

The print spooler helps your windows computer interact with the printer, and orders the print job in your queue.

SCANNER :

An image scanner — or just scanner is a device that optically scans images, printed text, handwriting or an object and converts to a digital image.

→ Scanners operate by shining light at the obj-

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or document being digitized and directing the reflected light onto a photosensitive element.

→ In most scanners, the sensing medium is an electronic, light-sensing integrated circuit known as a charged coupled device (CCD).

Types of SCANNER

The four common scanner types are:

→ Flatbed scanners
→ Sheet-fed scanners
→ Handheld scanners
→ Drum scanners.

TROUBLESHOOTING IN SCANNER

→ Verify that the scanner works by scanning in another application.
→ Install the latest scanner driver.
→ Restart your computer with startup items disabled.
→ Rescan the image using a different color mode.
→ Specify the image size in the preview panel of the scanner software.
→ Log in with a new Account.
→ Scan the image into another application as a TIFF file, and then convert the TIFF file to a PDF file.

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DISPLAY, POWER SUPPLY AND BIOS

DISPLAY A display is a computer output surface and projecting mechanism that shows text and often graphic images to the computer user, using a cathode ray tube (CRT), liquid crystal display (LCD), light-emitting diode, gas plasma, or other image projection technology.

Graphic card : A graphic card is a piece of computer hardware that produces the image we see on a monitor.

→ The graphic card is responsible for rendering an image to our monitor, it does this by converting data into a signal our monitor can understand.

→ The graphics card decides how to use the pixels on the screen to create the image. It then sends that information to the monitor through a cable.

→ Video cards come in three different connector types: PCI, AGP and PCI express. The slots all look different and are easily identifiable from each other.

→ peripheral component interconnect (PCI) is a local computer bus for attaching hardware devices in a computer and is part of the PCI local bus standard.

→ PCI is a parallel connection, and devices connected to the PCI bus appear to be a bus master to connect directly to its own bus.

PCI express is a high-speed serial connection. With PCI Express, a maximum of 32 end-point devices can be connected.

→ The Accelerated graphics port was designed as a high-speed point-to-point channel for attaching a video card to a computer system, primarily to assist in the acceleration of 3D computer graphics.

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LCD (Liquid-crystal display)

→ It is a flat-panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystals combined with polarizers.

→ Liquid crystals do not emit light directly. Instead using a backlight or reflector to produce images in color or monochrome.

→ LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, as in a digital clock.

→ They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements.

→ LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement.

→ LCDs are used in a wide range of applications including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays etc.

→ LCD screens have replaced heavy, bulky (CRT) displays in nearly all applications.

PLASMA (Plasma display panel) (PDP)

→ A plasma display panel (PDP) is a type of flat panel display that uses small cells containing plasma: ionized gas that responds to electric fields.

→ plasma TVs were the first flat panel displays to be released to the public.

→ plasma displays were commonly used in large televisions. Since then, they have lost nearly all market share due to LCDs which are of low costs.

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→ plasma is created by energizing a gas, increasing the number of electrons within the gas.
→ plasma is highly conductive in the presence of an electromagnetic field.
→ The structure of PDPs consist of multiple layers of various materials. The inner most layer consists of a series of 3 cell compartments which make up a single pixel of the projected image.
→ Each cell contains a gas mixture of noble gases usually neon with 10–15% xenon, and is responsible for producing one of the three primary colors, red, blue, green.
→ The outer most part of the plasma display are the glass layers.
→ The way plasma displays works is quite similar to the florescent light bulb works.
→ The plasma itself does not provide the light energy itself, rather it produces ultraviolet, UV, light that excites the phosphors that are coated on to each cell.
→ The color that is produced (either red, green, or blue) is dependent on the phosphor.

TFT display : (Thin-film-transistor)

→ A thin-film-transistor liquid-crystal display is a variant of a LCD display that uses thin-film-transistor technology to improve image qualities such as addressability and contrast.
→ TFT LCDs are used in appliances including television sets, computer monitors, mobile phones, handheld devices, PDAs, video game systems.
→ The addition of the thin-film transistor in LCD designs vastly improved the use of LCD's in all market areas.

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LED Displays (Light-emitting-diode display)

→ LED Display is a screen display technology that uses a panel of LEDs as the light source.

→ Currently, a large number of electronic devices both small and large, use LED display as a screen and as an interaction medium between the user and the system.

→ Electronic devices such as mobile phones, TVs, tablets, computer monitors, laptops screen, etc, use a LED display to display their output.

→ The biggest advantage of the LED display is its efficient and low energy consumption, which is especially needed for handhelds and chargeable devices such as mobile phones and tablets.

→ An LED display consists of a number of LED panels that in turn, consists of several LEDs.

→ LEDs produce more brilliance and greater light intensity.

→ A LED is an electric component that emits light when the electric current flows through it. It is a light source based on semiconductors. When current passes through the LED, the electrons recombine with holes emitting light in the process.

→ LED display is a flat panel display that uses an array of LEDs as pixels for a video display.

→ LED displays can offer higher contrast ratios than a projector and are thus an alternative to traditional projection screens, and they can be used for large, uninterrupted video walls.

→ MicroLED displays are LED displays with smaller LEDs, which poses significant development changes.

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POST (Power on Self Test)

→ POST stands for power on self test. POST is a series of system checks run by computers and other electronic devices when they are turned on.

→ The results of the test may be displayed on a screen, output through flashing LEDs, or simply recorded internally.

→ On computer systems, the POST operation runs at the begining of the boot sequence. If all test pass, the rest of the startup process continue automatically

→ Both Macs and windows PCs run a POST each time the computer is booted up and restarted.

→ The scan checks the hardware and makes sure the processor, RAM and storage devices are all functioning correctly.

→ If an error is encountered during the POST, the startup process may pause or halt completely and the error may be displayed on the monitor.

→ On the PC, POST errors are often displayed on the BIOS information screen.

→ They may be output as cryptic codes such as "08" for bad memory, or as a system message, such as "system RAM failed at offset". On Macs, POST errors are often indicated by a simple graphic, such as a broken folder icon that indicates no bootable device was found.

→ If your computer won't start up because of a POST error, you can use a different device to look up the meaning and cause of the error, possibly from the manufacturer's website. Then you can take the appropriate action, such as removing a memory module or reseating the video card, then you can restart your computer again.

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BIOS (Basic Input/output System)

→ BIOS is the program a computer's microprocessor uses to start the computer system after it is powered on. It also manages data flow between the computer's OS and attached devices, such as the hard disk, video adapter, keyboard, mouse and printer.

USES OF BIOS :

→ The main use of BIOS is to act as a middleman between OSes and the hardware they run on.

→ BIOS is theoritically always the intermediary between the microprocessor and I/O device control information and data flow.

BIOS working principle :

→ BIOS comes included with computer, as firmware on a chip on the motherboard.

→ In contrast, an OS like windows or iOS can either be pre-installed by the manufacturer or vendor or installed by the user.

→ BIOS is a program that is made accessible to the microprocessor on an erasable programmable read-only memory (EPROM) chip.

→ When the users turn on their computer, the microprocessor passes control to the BIOS program which is always located at the same place on EPROM.

→ When BIOS boots up a computer, it first determines whether all of the necessary attachments are in place and operational.

→ Any piece of hardware containing files the computer needs to start is called boot device

→ After testing and ensuring boot devices are functioning, BIOS loads the OS -- or key parts of it -- into the computer's RAM from a hard disk or diskette drive (the boot device

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Functions of BIOS :

Four main functions of BIOS are given below:

1. POST : This tests the hardware of the computer before loading the OS.
2. Bootstrap loader : This locates the OS.
3. Software/drivers : This locates the software and drivers that interface with the OS once running.
4. complementary metal-oxide semiconductor (CMOS) set up. :— This is a configuration program that enable users to alter hardware and system settings. CMOS is the name of BIOS's non volatile memory.

Accessing BIOS :

→ Reset or power off the computer.
→ When the computer turns back on, look for a message that says "entering setup". Accompanying that message will be a key that the user should press to enter system configuration. Like "press [key] to enter BIOS setup". Some keys often used as prompts are del, Tab, Esc and any of the function keys (F1 – F12).
→ Upon seeing the prompt, quickly press the key specified.

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