

[INDEX]

Chapter 1	Software	3
Chapter 2	Data Storage, Retrieval and Data Base Management System	30
Chapter 3	Computer Networks and Networks Security	64
Chapter 4	Internet and Other Technologies	106
Chapter 5	Flowcharts	125
	Conversion System	150
Chapter 6	Decision Table	154
	46 Distinguish Between Related to IT.	155

With Best Wishes

Sushant Jain

Email: sushant_daklia@yahoo.co.in

Thanks to all my students for suggesting me how to improve my teaching style and notes. And Special thanks to Harshwardhan Kaushik, Shrenik Mundada, Ashish Sahni, Anmol Artani, Kamlesh Mendhe, Somnath Sir, Chandu Bhaiya, Arundhati Ma'am & Madhavi Ma'am for their continuous support.

Download Short Notes of Information Technology from the following Link:-
http://www.caclubindia.com/share_files/it-information-technology-new-updated-notes-for-nov-12-exam-51040.asp#.UNgVkJkzTQ8



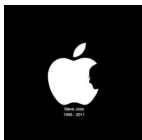
Steve Jobs

CEO of Apple Computer & Pixar Animation



{June 12, 2005} Text of the Commencement address at STANFORD UNIVERSITY

I am honored to be with you today at your commencement from one of the finest universities in the world. **I never graduated from college.** Truth be told, this is the closest I've ever gotten to college graduation. Today I want to tell you three stories from my life. That's it. No big deal. Just Three Stories.



The first story is about connecting the dots.

I dropped out of Reed College after the first 6 months... Because I had dropped out and didn't have to take the normal classes, I decided to take a calligraphy class... Ten years later, when we were designing the first Macintosh computer, it all came back to me. And we designed it all into the Mac. And since Windows just copied the Mac... If I had never dropped out, I would have never dropped in on this calligraphy class, and personal computers might not have the wonderful typography that they do... You can't connect the dots looking forward; you can only connect them looking backwards. So you have to trust that the dots will somehow connect in your future. You have to trust in something — your gut, destiny, life, karma, whatever.



My second story is about love and loss.

I got fired [from Apple]. During the next five years, I started a company named NeXT, another company named Pixar, and fell in love with an amazing woman who would become my wife. Pixar went on to create the world's first computer-animated feature film, Toy Story, and is now the most successful animation studio in the world. Apple bought NeXT, I returned to Apple, and the technology we developed at NeXT is at the heart of Apple's current renaissance. And Laurene and I have a wonderful family together. I'm pretty sure none of this would have happened if I hadn't been fired from Apple. It was awful tasting medicine, but I guess the patient needed it. You've got to find what you love. So keep looking until you find it. Don't settle.



My third story is about death.

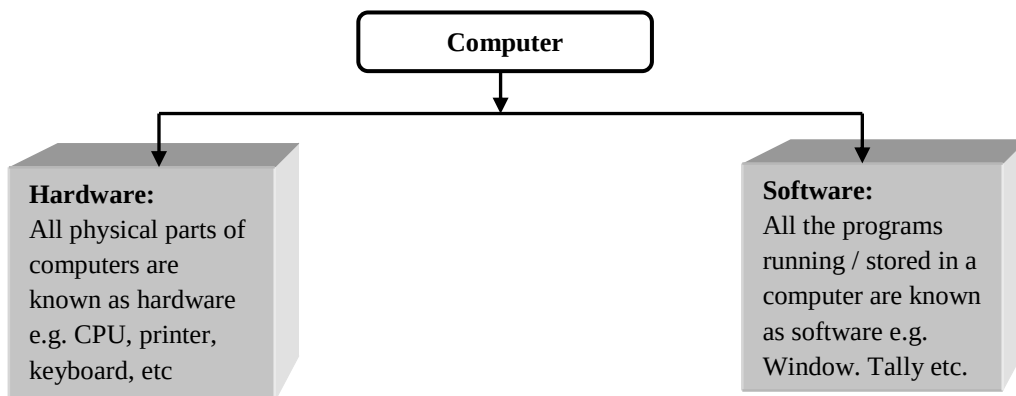
I was diagnosed with cancer. The doctors told me this was almost certainly a type that is incurable. *Later+ I had surgery and I'm fine now. No one wants to die. And yet death is the destination we all share. It is Life's change agent. It clears out the old to make way for the new. Right now the new is you, but someday you will gradually become the old and be cleared away. Your time is limited, so don't waste it living someone else's life. When I was young, there was an amazing publication called The Whole Earth Catalog. On the back cover of their final issue were the words: "Stay Hungry. Stay Foolish". And I have always wished that for myself.

And now, as you graduate to begin anew, I wish that for you.

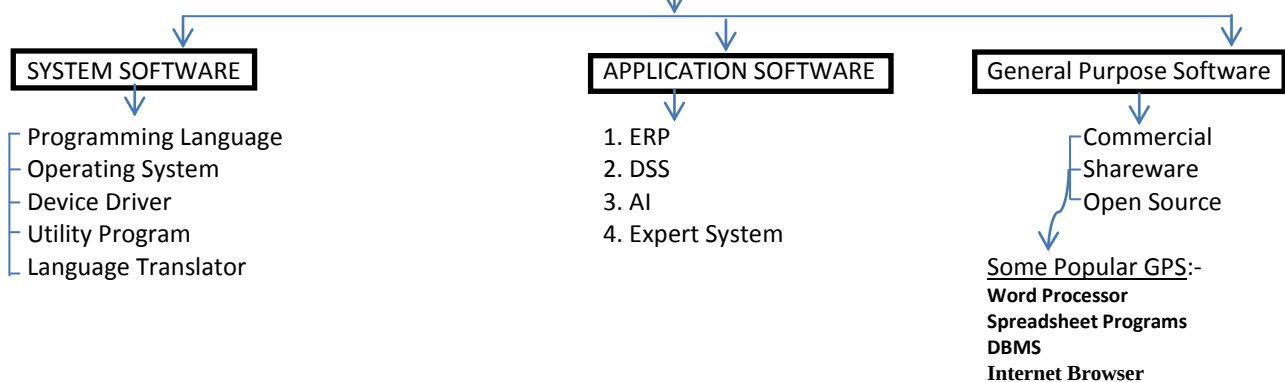
"Stay Hungry. Stay Foolish"





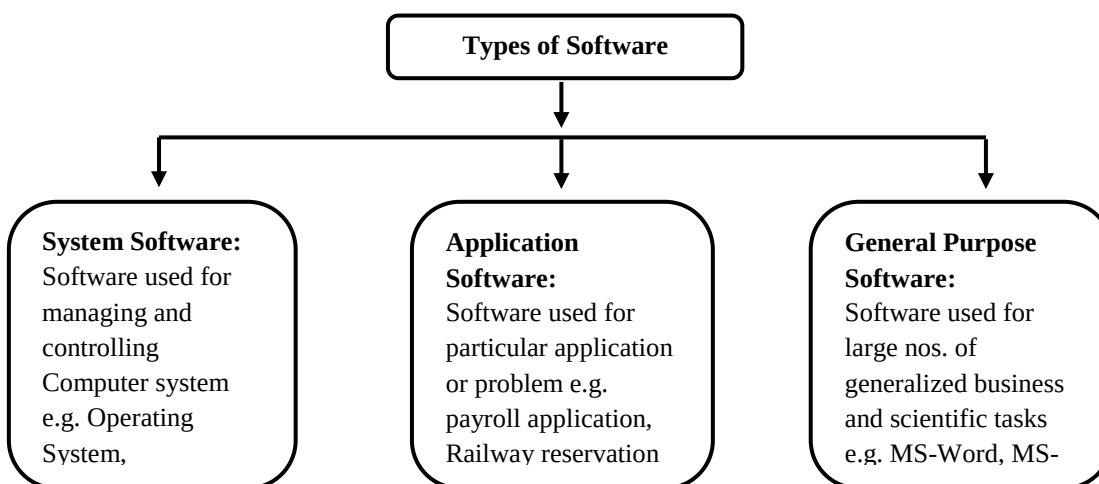
Chapter-1**SOFTWARE**NOV
12**Definition of software:**

Software is a set of instructions of same kind, which is known as program, are combined together to perform specific task.

Software

Types of Software: Broadly, software can be divided into three categories:

- (1) System Software (2) Application Software (3) General Purpose software

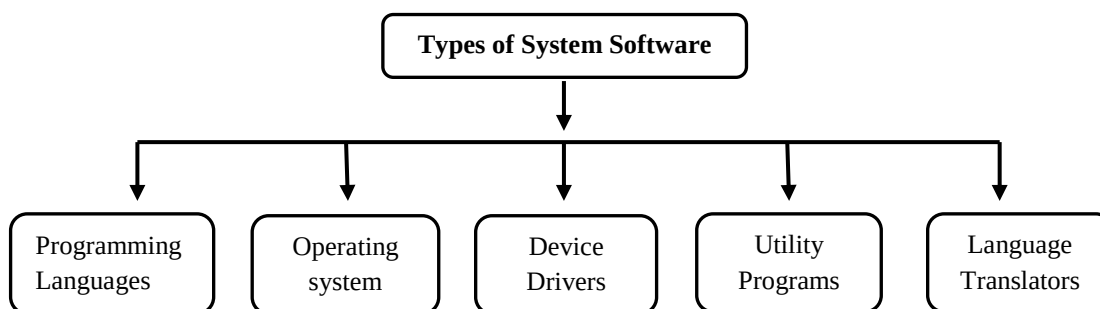


1.0 SYSTEM SOFTWARE

The software that manages and controls the computer system (e.g. hardware, users, application, etc.) and its processing task is known as system software. The system software normally is provided by computer manufactures.

Following are some popular types of system software.

NOV 09,
MAY 04

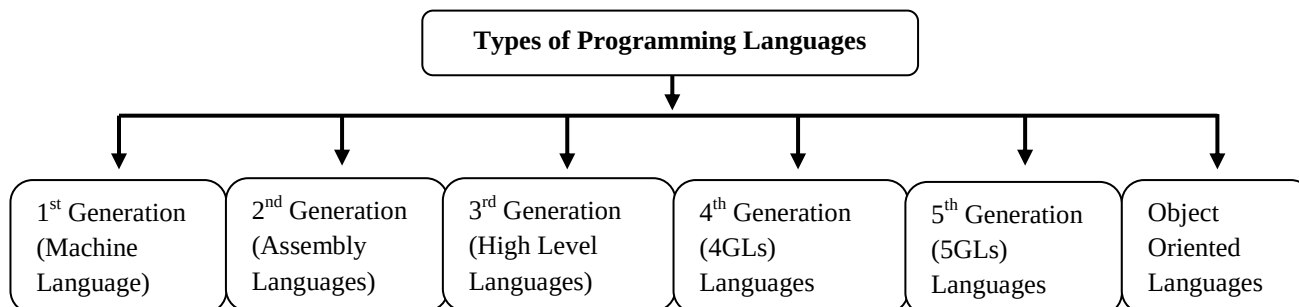


1.1 Programming Languages:

The Programming Languages are used for developing programs or software, which are then used for some data processing applications or any specific tasks.

Over the years, many developments have taken place in the programming languages, and these developments have provided different types of programming languages in the market, which are categories as different types or generations of programming languages.

5



- (i) **Machine Language:** This language is known as 1st Generation Language (1st GL). In the early days of computer, all the programs were written in the machine language. This language is also known as **Low Level Language**. Low Level Languages are system dependent languages i.e. for different system (Computer) there would be different set of instructions. Machine Language is also known as language of computer, i.e. the language which computer can understand without translation.

MAY 12

For writing a program in machine language the programmer must be familiar with specific Machine Language as well as with the details of computer system for which programmer is writing a program. These are the reasons that the machine language is also known as system

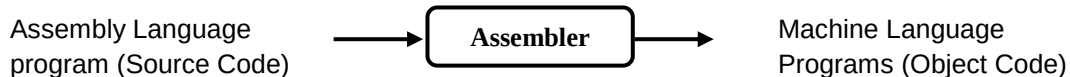
dependent language.

Further, writing programs in machine language is quite difficult because the programmer need to learn the codes in the binary form.

Earlier, the machine language's instructions (statements) were coded only with the binary code (0s and 1s). But, then these codes (binary code) were replaced with the decimal codes which were easy to remember than the binary codes.

- (ii) **2nd Generation Language or Assembly Language:** An assembly language provides improvements over a machine language. That is, it reduces the difficulties for writing programs in a machine language. Instructions in an assembly language are written by using the English language words instead of binary codes (in machine language).

As we know, a computer can understand only a machine language, therefore the programs written in the assembly language need to be translated into the machine language by using a language translator known as assembler.



An assembly language is also known as Symbolic Language because the codes used for operation in a machine language can be represented with the symbols (the English language words) in place of binary or decimal codes.

Example: -

Operation	Operation Code
ADD Z TO THE ACCUMULATOR	ADA Z
STORE RESULT IN X	STA X

Here ADA and STA are codes or symbols but used as statements in the assembly language.

Advantages and Disadvantages of Assembler Language:

Advantages:

1. Provides fast executable programs, because instructions in assembly language programs are one to one related with machine language codes.
2. Programs require less memory space as instructions are written using symbols/codes only.
3. Allow programmers to do bit level programming i.e. very low level programming, which helps to write programs for data transmission between devices.

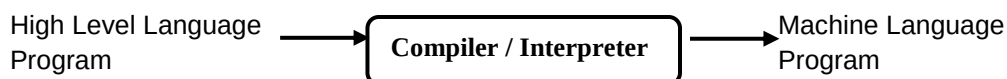
Disadvantages:

1. Provides system dependent programs i.e. programs written for one computer system will not be executed on another system until the internal design is exactly same.

2. Provide lengthy programs even for small task, because the instructions are written in symbolic codes therefore it requires large numbers of symbolic codes (or English words) to perform a small task.
3. Difficult to use for generalized business applications like payroll, inventory management, etc. Therefore, assembly language is mainly used for hardware programming i.e. writing device driver programs, etc.

(iii) **3rd Generation or High Level Languages:** These languages are known as machine **Independent** or system **independent** languages. Because, the programs developed in these languages can be executed in any type of computer systems, without any modifications. As these languages are machine independent, therefore these languages are known as high level languages.

These languages are known as procedural programming languages i.e. the programs in these languages follow the set of steps (procedures) for problem solution. The high level languages' programs are easy to develop because the programs are written like a normal communication in the English language. All the instructions in the high level languages, which are known as statements, are much like the normal English language sentences. Similar to assembly language's programs, the high level language programs also undergo through a process of translation from high level language to the machine language. This process of translation is known as compilation or interpretation of programs; and it requires a language translator known as **compiler or interpreter**.



Some of the most commonly used high level languages are COBOL (For Business Purpose) FORTRAN (For Scientific Application) BASIC, PASCAL, C, etc.

(iv) **4th Generation Languages (4GL):** After the developments of high level languages a need arises to develop the languages which can significantly improve the productivity of programmers for developing programs. This need gave birth to 4GLs and Object Oriented Programming Languages (OOP). In a way, the focus was to develop very high level languages. The 4 GLs help to develop programs in lesser time than the similar programs development with high level languages..

The 4GLs are non-procedural languages, unlike 3GLs (high level languages) which are procedural languages, and allow users to simply specify what the outputs should be without writing the complete procedure to specify the outputs. These Languages are normally task oriented languages because these languages work on the principle of "What to Do" unlike "How to Do" principle of 3GLs languages. In these languages, the users just have to specify the task/function name or problem's outputs only, unlike the entire procedure of function or problem's solutions in the 3GLs. In the 4GLs, a user is not required to go through an entire procedure to solve a problem. For example, in the MS-Excel, we just need to specify IRR function to calculate the **Internal Rate of Return** of a cash flow, not the entire steps of IRR calculations.

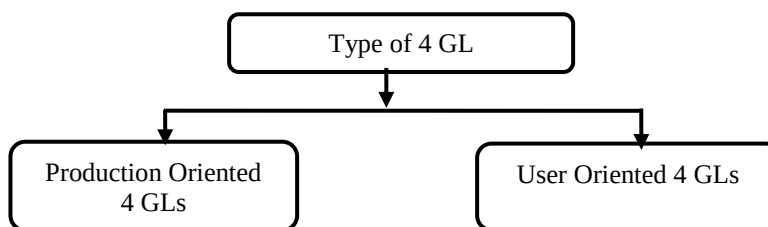
It is very easy to learn 4GLs; and these languages result in significant time reduction for the development of application relative to similar development in the 3GLs. Although there is no general agreement on what exactly 4GLs represent, but in general 4GLs are the application development tools that enhance the productivity of the programmers and end users. These tools

MAY
08,
NOV 08

NOV 01, MAY 08

are called **Fourth Generation Languages**.

There are two types of 4GLs



Production Oriented 4GLs:- The production oriented 4GLs, primarily, are designed for computer professionals. These 4GLs help professional programmers to develop programs without writing entire procedure of problem's solution, thus program developments does not require huge time and efforts. Some popular production oriented 4GLs languages are IDEAL, Natural 2, Rational Rose, etc.

User Oriented 4 GLs:- User oriented 4 GLs are mainly designed for end users (that is users like us, who are normally not the professional programmers). These 4GLs allow users to develop simple data oriented programs without depending upon professional programmers. These 4GLs are normally part of DBMS packages or spreadsheet software. Examples: QBE (Query By Example), SQL (Structured Query Language), and functions or MS-EXCEL.

- (v) **Fifth Generation Languages (5 GLs):-** This generation language does not require writing the program codes like the other generations languages required. In this type of languages, users just specify the problems with conditions or constraints and the programs are developed automatically. The other generation languages require to develop program with algorithms by programmers whereas 5th generation languages require to solve problems without the help of programmers.

NOV 2012

The 5th Generation Languages are mainly used in Artificial Intelligence Applications, fuzzy logics and neural networks. The basic purpose of development of these languages is to develop the ability of thinking and drawing conclusions in computers based on logics or programmed information by using large databases of information. The use of these languages would not require any programming knowledge and users would be able to create products and generate applications with little or no programming or coding. Prolog, OPS5 and Mercury are some of the popular 5th generation languages.

- (vi) **Object Oriented Programming (OOP) and Languages:-** Over the recent past years, the programming approach has changed from procedural programming (using COBOL, BASIC, FORTRAN) to object oriented programming. This is largely due to the features provided by the object oriented programming languages for programming complex tasks in lesser time, and with better quality, than the procedural 3GLs.

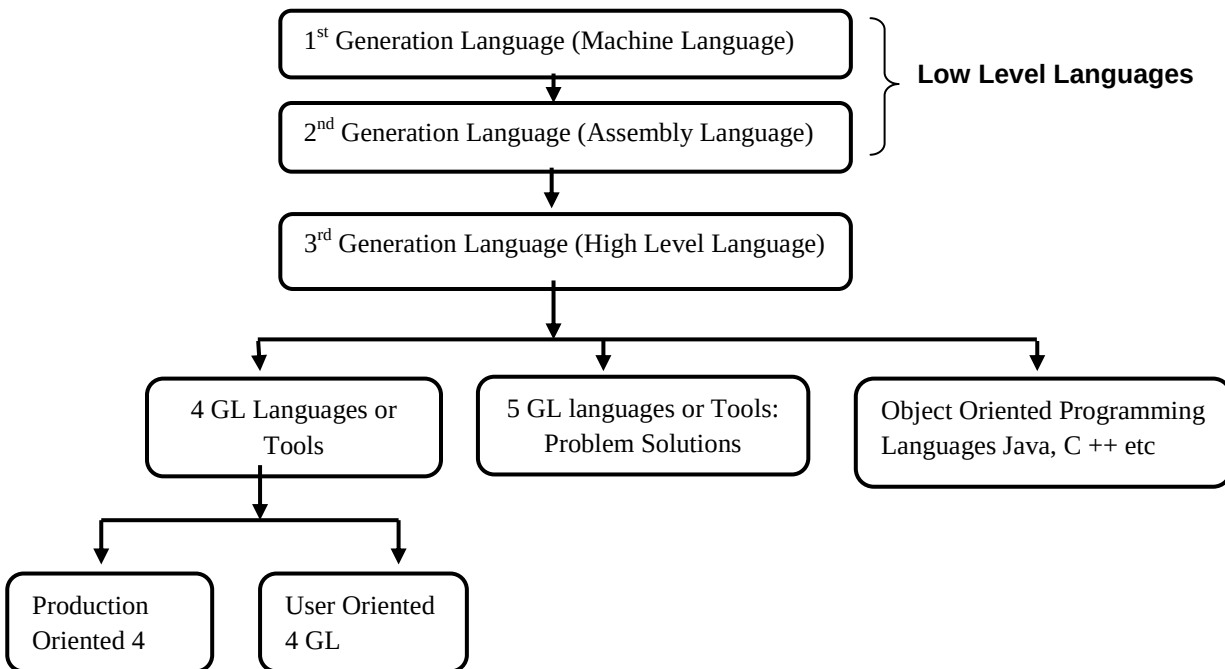
MAY 04, NOV 06, NOV 10

For example, if a user writes a program in the procedural languages then each program is written normally from scratch i.e. line by line from starting point. This tasks a lot of time and also affects the quality of developed programs. Whereas in the OOP languages, once a program is written for

a particular task then this program can be used as an object by any programmer, who wants the similar task in his programs, anywhere without the need of writing that program line-by-line again, as this is required in the procedural programming languages. OOP languages works on the principle of **“Write Once Use Many Times”** which ultimately helps in developing better quality programs in less time.

OOPs help to increase the productivity of programmers and quality of software developed, and reduces the time required to develop the particular software. The programs written in Object Oriented Programming Languages contain fewer errors and programs are more reliable than programs of procedural languages. OOP languages will ultimately create the objects based market to develop any application. The users will buy different types of objects available in the market and link them together to create required application just like in car manufacturing. A car manufacturer buys different components from different suppliers and links these components together to manufacture a car instead of manufacturing every part of car himself.

There are many popular OOP Languages in market like Java, C++, and Delphi.



Types of Programming Language in the hierarchy of development

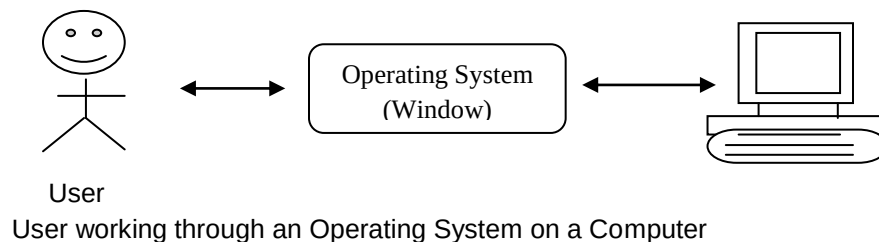
NOV 03, MAY 08, NOV 10

1.2 Operating System (OS):

OS is known as the Executive System, Control System and Monitor System for a computer system

Operation system acts as a mediator between man and machine. Operating System allows the user to work on a computer efficiently and smoothly, by providing an interface to user for working on a computer.

In simple words, if there is no Operating System in a computer then we cannot work on a computer.

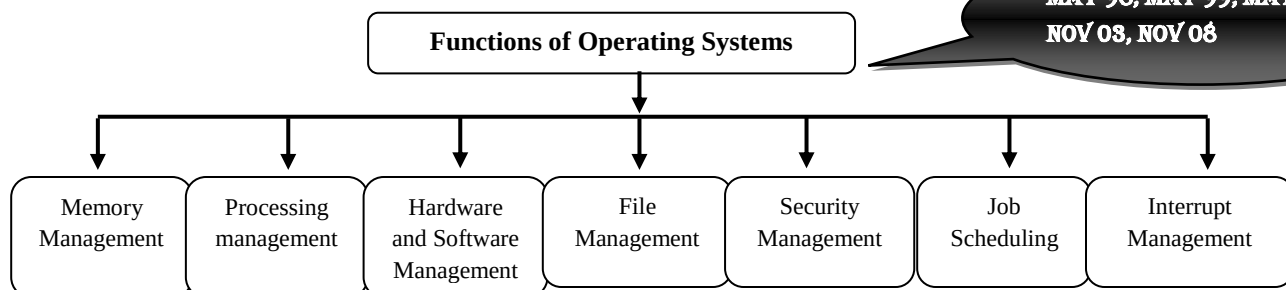


Technically, an operating system may be defined as set of integrated programs, which supervise the operating of CPU and control the input / output functions of the computer system, and help in translation of high level languages' programs into machine language's programs.

Operating system is also based on the concept of modularity i.e. an OS consists of many programs and all these programs can function separately, therefore we call an OS as an integrated system of Specialized programs that are used to manage the resources and overall operation of a computer.

10

MAY 98, MAY 99, MAY 02,
NOV 03, NOV 08



The Main functions of operating system are as follows:

1. **Memory Management:** OS efficiently allocates both primary and auxiliary memory for different tasks, data and programs.
2. **Processing management:** OS efficiently manages different processing task like execution of programs, data transfer between different devices, etc.
3. **Hardware (devices) and Software (applications) Management:** OS does efficient management of all peripherals devices, like printer, hard-disk, scanner, etc., and it also efficiently manages different applications/software efficiently like MS-Office, printer's software, etc.
4. **File Management:** OS protects files from loss and corruption. It also does efficient allocation of space for file storage and allows features like multi-sharing for same file, etc.
5. **Security Management:** OS provides the features for managing the security for both users and data on the computers. The features like id, passwords and security attributes to the files are some common security features provided by an operating system.

6. **Job Scheduling and Accounting:** OS can execute many tasks simultaneously and it maintains track of resources used by multiple jobs/tasks being executed simultaneously. In case of multitasks execution, OS maintains track of tasks to be executed by providing a queue and scheduling these tasks for execution by same CPU
7. **Interaction with Users (User Interface):** The OS like "Window" provides a Graphical User Interface (GUI) to the users which help in a user friendly interaction between a computer and users.
8. **Interrupt Management:** Interrupt is a kind of request from attached devices to CPU for processing and data transfer, etc. An operating system can efficiently manage many interrupts simultaneously without failing to respond to every device request for task executions, whenever requests are communicated to an operating system.

An operating system also constrains many utilities and diagnostic routines which help users for efficient use of a computer

Types of OS

Followings are some popular OS of a computer (personal computer).

- DOS (disc operating system)
- Windows(OS from Microsoft)-Window 3.1, Windows 95/98/Me, Window XP, Window Vista, Window 7
- OS/2 (OS from IBM)
- MAC (OS from Apple Computers)

And some popular networks OS i.e. OS for LAN (Local Area Network) and WAN (Wide Area Network) are:

- Window NT / Window 2000 Advance Server (from Microsoft)
- Novell (From Novell Netware)
- UNIX / LINUX
- VMS

And UNIX is also a popular OS for Mini and Mainframe computer.

DOS (Disk Operating System): MS-DOS from Microsoft was one of the most popular operating system for IBM compatible PC before the wide spread use of Window OS. MS-DOS is 16 bits operating systems. It is a command based operating system i.e. it provides a character based interface to users wherein users can write commands on a command prompt. DOS has gone through many revisions, and finally it was extended to a GUI (Graphical User Interface) based operating system known as Window.

May 2005, Nov 2008

5 Marks

Microsoft Windows: The Windows OS is the most popular operating system from Microsoft Inc. The windows has tremendous amount of user friendly features and capabilities. It is almost a monopolist operating system for Personal Computers (PC). The Windows has gone through several revisions in the

last 10-15 years like Windows 3.1, Windows 95, Windows 98, Windows 2000, Windows Mi, Windows XP, Windows Vista and Windows 7. The key features of the Windows OS are as follows:

- Windows 95/98 and later versions are user friendly 32 bits OS i.e. can handle upto 4 GB of main memory whereas 16 bits MS-DOS could handle maximum 1MB of memory.
- Windows enables multiple programs to be executed simultaneously.
- Windows enables users to work with large files and use file operation like Cut, Copy, Paste, etc very conveniently.
- Windows allows the users to pass information from one application to another application like from Word to Excel.
- Windows help to use a computer system more efficiently and effectively.

All the above features are common to all the Windows OS i.e. for Windows 95, Windows 98, Windows 2000, Windows Mi, Windows XP, Windows Vista and Windows 7. Here are some unique features of popular Windows OS individually.

Windows 95:

- 32 bits OS
- Released in 1995
- First OS from Microsoft to provide internet and network ready applications like browsers, email and network neighborhood etc.

Windows 98

- 32 bits OS
- Released in 1998
- Plug and Play features for new devices i.e. connect the device and Windows will automatically detect from its list of device drivers or will allows user to install device driver and use that device immediately.

MAY 04

Microsoft Windows NT: Windows 95 and 98 are the operating systems used for a PC or single user system. Microsoft also introduced an operating system used for powerful system (server) or for networks known as Windows NT.

- Windows NT is 32 bits operating system used for big size machines or servers; and it is also known as Network Operating System (NOS)
- It is more stable, reliable and multitasking operating system.
- Window NT is multiprogramming, multiprocessing operating system i.e. it can handle many users' programs simultaneously, and it can also work with many processors (CPU) unlike Windows 95 / 98 which is based on a **single processor** (CPU) computer system (PC).
- Windows NT provides enhanced security features than Window 95 / 98
- Window NT portable operating system i.e. it can work with **any type of processor** unlike Window 95 / 98, which can work with processors of PC only (Intel and its clone processors).
- Over the years, Window NT has also been introduced in the market with many versions such as Window 2000 Advance Server, Window 2003 server, etc.

Window 2000:

- This was the OS which was released for both PCs and Servers applications
- Was released in 2000
- It was built on Window NT platform and it provided the enhanced reliability and security features.
- It was succeeded by Windows XP for home use / PCs and Windows 2003 for servers

Windows XP:

- It was released in 2001.
- Available in both 32 bits / 64 bits versions
- It is one of the most popular OS in the Windows series of OS
- The **Name XP** is short name for **Experience**
- It was build on Windows NT architecture

It has many improvements over the previous versions of Windows like

- Fast startup
- Fast users switching i.e. long-in and log-out
- Enhanced security features
- Enhanced graphics capability
- Remote Desktop capability i.e. allow users to connect to any computers anywhere using internet

Windows Vista:

- It was released in 2007
- It has further improvements of features relative to Windows XP, particularly in terms of
 - Enhanced security
 - Better Visual
 - Updated GUI
 - Included large number of multimedia tools like DVD make

However, its criticism due to enhanced system requirements in terms of processor capability and memory, and license problem resulted in its adoption lesser than the other Windows OS mainly in comparison to Windows XP.

Windows 7.0:

- It was released in 2009
- This OS has some further improvements over the previous versions of Windows like multi-touch support and a redesigned user-friendly taskbar.
- This OS has also removed some of the applications of Windows Vista like Windows Mail, Windows Movie Maker etc.

Windows 8.0 (NEW)

- It was released in 2012.
- This OS is touch based operating system supports tablet pc, smart phones, etc.
- Windows 8 supports for USB 3.0 devices.
- Includes faster startup with the help of new "HYBRID BOOT" mode.
- Support for [near field communication](#) to facilitate sharing and communication between devices.
- Desktop basic mode is replaced by Home Screen.

OS/2 (Operating System 2): OS/2 was jointly introduced by Microsoft and IBM for PC's but this OS has certain problems like it demanded considerable computer resources in terms of memory capacity, CPU's processing power, etc. This OS was also not compatible with some of the existing applications; and due to all these problem it is not in much use.

UNIX: It is a multiuser, multitasking and multiprocessing operating system and, primly, used in bigger size machine like mainframe and minicomputers .it was developed by AT&T Bell Labs around 1970.The development of UNIX has given birth to many operating systems that can work on different types and

sizes of computer . For example LINUX and SOLARIS operating system are known as siblings of UNIX operating system. The UNIX is a flexible operating system and can be used for any type of processors unlike MS-DOS which can work only on Intel's processors, or its clones. Also, the UNIX is not to run on a single processor; it can work on single processor system (i.e. PC) as well on many processors system (i.e. mainframe or minicomputer). The UNIX can also interact with devices and networks of different vendors; which help to use this operating system for managing complex networks like banking and telecom.

The UNIX operating system is more popular for mission critical applications than the general purpose applications due to its scalability and security features .It is mainly used for very large, highly secured and multi-users applications like banking and telecom.

Mac OS :-

- Mac OS is a popular GUI OS from Apple Incorporation.
- It is used in Apple's Macintosh lines of computers
- It has a very high quality graphical user interface
- Early versions of this OS were only compatible with Motorola 68000 series of processors but now these are compatible with Intel processors also.
- Mac OS X server is similar to the desktop computer but it run on the Apple's Macintosh line of Server

LINUX :-

- It emerged from the UNIX OS so it is like UNIX OS.
- It is supported by wide range of devices , from PCs to Supercomputers
- It is available under open source license i.e. anyone can read and modify this OS
- Because it is an open source OS, it has been modify to run on large number of electronic devices.
- It is widely adopted OS for servers and at many places it has replaced UNIX OS

There are some other popular OS in the market mainly for midrange to large size computers like **MVS** is very common OS for the **IBM** main frame computers, OS/400 is popular OS for IBM midrange of AS/400 computers, and VMS is an OS used for DEC(Digital Equipment Corporation) midrange and mainframe computers

Multitasking Operating Systems: Multitasking operating systems seems to run one computer into many, not physically but logically. That is on one computer we can execute many applications simultaneously.

These operating system allow many tasks to be executed concurrently. We know that Windows is multitasking OS; and we can execute many applications simultaneously using Windows OS. That is we can work in MS-Word, at a same time, when we are working in MS-Excel. Also, we cab between one application and another without closing any application. Multitasking operating systems increase the productivity of users for use of computers.

1.2.1 Some Advance Concepts Related to Operating System

(1) Interleaving Techniques:

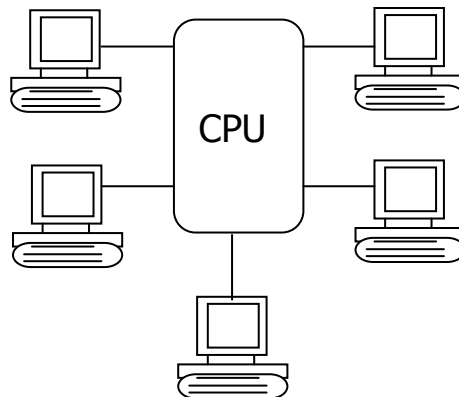
These techniques allow an efficient utilization of resources like CPU processing capability, memory etc. These techniques combine the processing work of many user, many tasks and big tasks (by dividing it into parts) to achieve maximum utilization of resources. The efficient utilization of resources is achieved with the help of operating system capabilities. Some of the common interleaving techniques are multiprogramming, multiprocessing, multitasking, foreground and background processing and virtual memory, etc.

MAY 00, MAY 05

(2) Multiprogramming

- Multiprogramming technique is used in the multi-user environment, it is a technique where many user programs are executed simultaneously by single processor or CPU
- Multiprogramming means when two or more programs are fired (i.e. given to the CPU for processing) or loaded into the internal storage of CPU at the same instant. And from the loaded programs once the portion of one program is executed, and then a portion of another program is executed and so on. Thus multiprogramming refers to concurrent execution of several programs
- The main purpose of multiprogramming is to increase the utilization of a computer and its resources.
- For multiprogramming, a CPU works in a **timesharing mode** for more responding to the requests of many user or I/O devices at the same instant; and thus provides concurrent execution of many instructions/programs.
- Multiprogramming technique is possible due to very high processing speed of a CPU. High processing speed of CPU helps it to allocate its time to every user's programs in a timesharing mode and in such a manner that every user feels that CPU is working for his programs only. In fact the CPU works for each user's programs in the given allocation of time, but as said above this timesharing happens so fast that every user feels that CPU is working for his programs; by in reality the CPU is working for other users also at the same time.

15



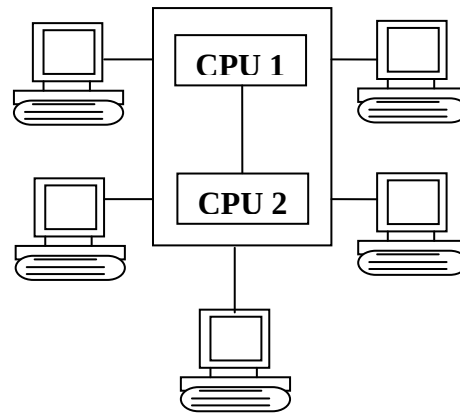
Multiprogramming (many users can execute programs with single CPU)

(3) Multiprocessing:

NOV 08, MAY 08, NOV 10

- Multiprogramming and multiprocessing are not the same concepts.
- Multiprogramming involves concurrent execution of two or more programs by a single CPU, whereas multiprocessing involves two or more processors (CPU) for controlling the different activities or execution of many programs/instructions simultaneously.

- In multi-processing, the instructions are executed simultaneously because different CPUs are available for executing different instruction simultaneously.
- Multiprocessing concept is also known as parallel processing, wherein many processors work in parallel to solve one big task or many tasks simultaneously.
- Multiprocessing is more costly and complex technique to employ than multiprogramming.
- Multiprocessing helps to increase the program execution speed on a computer.

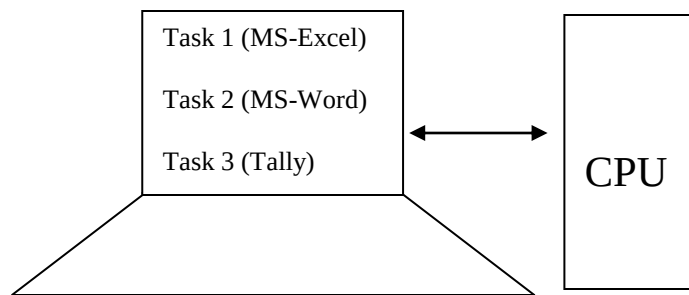


Multiprocessing: (more than one CPU execute many users programs)

4. Multi-tasking:

MAY 2010

- Multitasking refers to ability of a system to execute two or more tasks simultaneously for a single user.
- Multitasking operating system allow a user to execute or switch between many tasks simultaneously.
- In the past, there used to be single user operating systems like DOS, etc. which were able to execute one task at a time. If a user you want to execute another task then first opened task should be switched off to execute another task.
- But the operating systems like Windows, etc are multitasking operating systems; and these operating systems allow users to execute many tasks simultaneously. For example, we can open MS-Word document as well MS-Excel document to work at the same time.
- Multitasking operating systems increase the productivity of users for use of computers, because users can execute many tasks, can compare the many outputs simultaneously; and even can exchange the values from application to another
- Presently, most of the operating systems like windows; LINUX, XENIX, etc are multitasking operating systems.

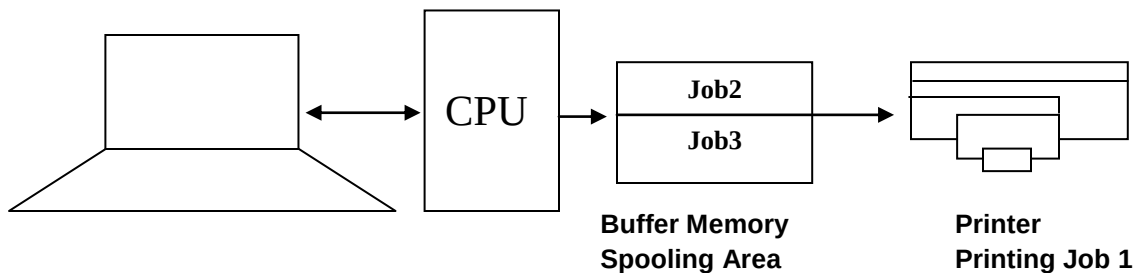


(Multitasking: More than one tasks being executed simultaneously by a single user on a system)

MAY 2003

5. Spooling:

- Spooling is process used to compensate the speed difference between high speed CPU and slow speed Input/output devices.
- Spooling is, primarily, used for printing purpose. You all might have noticed that we can provide many files printout together, although the printer can print one file at a time. But all files get lined up in a queue and get printed one-by-one by printer. In this process, CPU remains free and users can work on other applications. This technique of printing is possible through a capability of operating system known as spooling.
- Actually, when a user provides many documents together for printing to printer then CPU being a high speed component immediacy process all the given documents and provides these documents to printer for printing. But printer being a slow speed device can not print all the jobs at same speed as processed by CPU.
- Here then spooling techniques is used which allows the processed jobs of CPU to be arranged in a separate area in the memory known as spooling area, and CPU remains free for other jobs. And printer as and when become free from printing previous job automatically takes up the next job from spooling area.
- Spooling is possible using buffer memory which is also known as spooling area; and this memory hold the processed jobs by CPU, temporarily. And provides these jobs to printer for printing as and when printer becomes free from printing previous job.



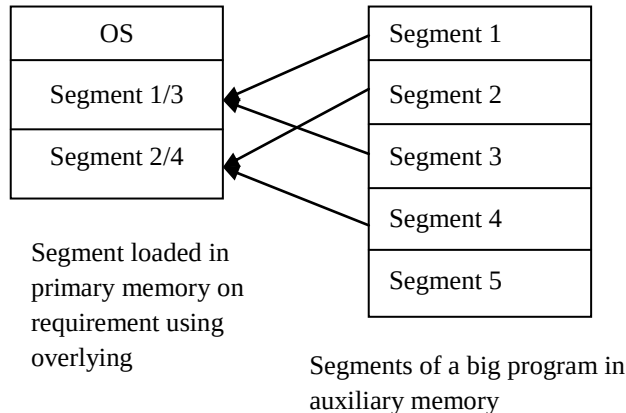
17

MAY 2000

6. Virtual Memory:

- Virtual Memory is not an actual memory; it is a technique employ by operating system to execute big size programs with small size available primary memory.
- We know that to run any program in a computer, first of all that program should be loaded into computer primary memory. Therefore, to run any software one has to take into account the size of primary memory. If a program size is bigger than the available primary memory size then that program should not be executed.
- But, virtual memory technique allows executing such type of big programs also with small size primary memory. This is done by dividing the big size programs into small size segments. Some segments remain onto hard disk, and some segments are loaded into primary memory for execution. The executed segments are replaced by unexecuted segments from hard disk, in this way a continuous exchange of segments take place between primary memory and secondary memory.
- This process of exchange of segments or swapping of segments is done using a technique known as **overlying** i.e. the next required segments are loaded onto the existing executed segments in the primary memory from secondary memory.
- Virtual memory is managed by some special software (operating system) and hardware tricks.

- The virtual means not actual i.e. virtual memory is not the actual memory, but it provides an illusion to a programmer that primary storage for all practical purposes is never ending irrespective of the program size.
- Virtual memory uses some hardware and software features which provide the automatic segmentations of program, and these feature move the segments from secondary storage to primary storage when needed, and keep them into secondary storage when not needed.



7. Foreground and Background Processing:

- Foreground and Background processing technique provides an efficient utilization of CPU processing capability.
- In this technique, the primary memory is partitioned (divided) to hold many jobs for execution. Some jobs are of high priority and some jobs can be of low priority, like programs processing the data will be high priority tasks and will be executed only when CPU is not executing high priority jobs. But when no foreground job is getting processed the CPU automatically switch to background job like doing auto-backup of processed data. And, if foreground job need CPU processing capability then CPU will again switch to the foreground job.
- This technique help in reducing the idleness of CPU time

8. Multitasking:

- This technique is used to execute any application/program efficiently. In this technique, a program execution is performed and controlled in multiple processes and each process is independently executed by a thread. For example, a web application if used as single thread application then it can serve only a single client for the requested tasks. But if it is used as multithread application then it can start a separate thread for each client request and thus can serve may clients simultaneously. This technique helps to achieve the efficient use or resources. Is also helps to increase the responsiveness of application to its clients i.e. application serves all the clients together.

9. Timesharing:

Time-sharing is concurrent or simultaneous sharing of computing resources among many users. Time-sharing is used by means of multiprogramming and multi-tasking. It was considered as major technological invention in 1970 in the history of computer technologies.

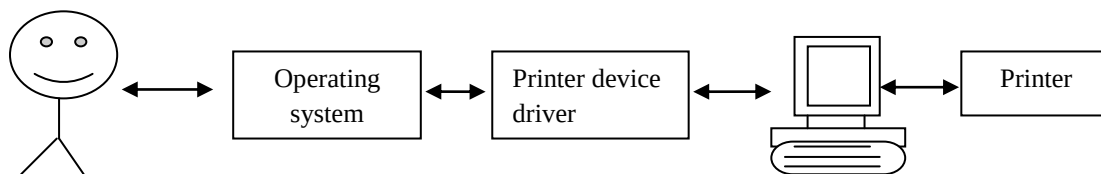
It allows large number of users to interact concurrently with a single computer. It divides or allocates the available time of CPU among many users and that time slot or time slice execute the user task. The time slot is allocated at such as high speed to each user that the user feels like CPU is working for his task only. Time-sharing has dramatically lowered the cost of providing computing capability

and has promoted the interactive use of computers and the development of new interactive applications.

Main advantage of time-sharing technique is the reduction in response time in multiuser mode. It provides immediate response to user's request for execution of any task by immediately allocating a time slot to each user's task.

MAY 2012

1.3 Device Drivers



User giving printing Command

Device drivers are the programs / files that act as an interface between hardware and operating system. Operating system accepts request from users for the operation of any device and then activate the driver data between device and computer system.

The devices which require device drivers programs include: Keyboard,, mouse, Modem, printer, scanner, digital camera, Web Cam, speaker, microphone, CD, DVD etc. Windows OS by default includes device driver programs for all the popular devices and new devices' drivers can be installed when the device is required to be installed with computer.

NOV 01, MAY 11

1.4 Utility Programs

Utility programs are used for executing some specific utilities related to data processing. These programs are also known as service programs. These programs are normally provided by computer manufacturer, or are the part of operating system.

These programs are used for performing tasks that are common in almost all the computers, or are common for all the data processing activities.

Followings are the main functions of utility programs

- Sorting data by using SORT utility program
- Copying the entire content of one diskette to another diskette with the help of **DISKCOPY** program
- To take backup of data stored on one disk (hard disk) to another diskette (floppy disk) with the help of **BACKUP** utility program.

- Copying files from one directory to another, or from one disk to another disk with the help of COPY program
- Formatting new blank disk or diskette to make it usable for storing data using FORMAT utility program
- Deleting one or more files from stored files on diskette or hard disk with the help of DELETE program
- Using WINZIP utility to compress the files to take less space than the actual size of files.

In conclusion, we can say more or less all the data management and files management activities are controlled by utility programs.

A wide variety of utilities are available in the market and some of important utilities are:

- (1) **Sort Utilities:** Sort utilities help in sorting data in ascending or descending order. Sort utilities are mostly the part of electronic spreadsheets and database management software. These utilities help to arrange large number of records in ascending or descending order, as per the specified data value field. Operating system also provides this utility to arrange files and folders in order by name, date or size, etc.
- (2) **Text Editors:** Text editors are programs which help to create and modify the text files. Text editors are used by programmers for writing programs in high level languages. Most of the programming languages provide their own text editors for editing of programs. Text editors are also used for importing and exporting data values from one data source to another. Text files are that types of files which can be opened by any text editor on any computer i.e. text files are used as universal data exchanger files which can be used on any computer system and with any operating system without needing any specific software.
Notepad is the most popular text editor in the market for creating text files and it is provided by Window operating system.

MAY 06, NOV 11, MAY 99, MAY 04

1.5 Language Translators:

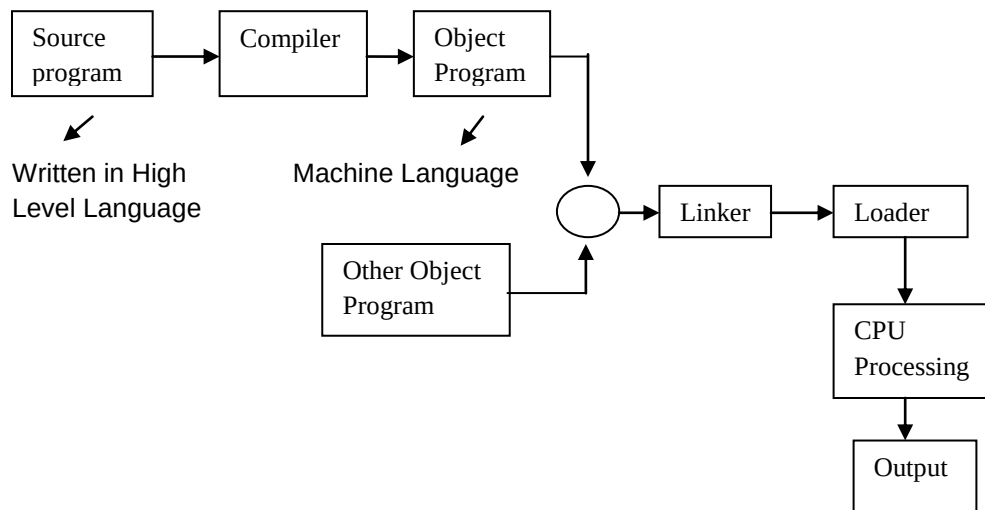
A language translator as its name specifies is used to convert one language program into another language program. The language translator is a general term used for compiler, assembler and interpreter that accepts statements in one language and produces the statements in another language (Machine Language), like assembler is used for converting Assembly language program into machine language.

The language translators are loaded into a computer memory where they control the translation process. The language translators are available as a part of programming languages.

Three most popular language translators are **compiler, interpreter and assembler**.

Compiler: Compiler translates a high level language program into the machine language. Compiler converts all the statements of a high level language, together. And then execute these converted statements to provide the errors or outputs of statements.

Most of the high level languages like FORTRAN, C, PASCAL and COBOL are compiler based languages. Compiler or Interpreter both are used for converting high level language programs into machine language programs, but whenever execution speed is an important criteria compiler is preferred than interpreter.

Working of Compiler:

- Step- 1: Compiler converts the program written in high level language (Source Program) into machine language (Object Program).
- Step- 2: This Object program is then linked with other object programs with the help of linker, which provides an executable program
- Step- 3: The linked object program is loaded into main memory with the help of a loader, and it is then given to CPU for execution to generate the desired output.

Interpreter: Compiler translates the entire program together into the machine language and then executes the converted program. And the interpreter converts and executes a high level language program, statement-by-statement. Interpreters are normally inefficient and slow in operation in comparison to a compiler. BASIC is the most popular interpreter based language. Interpreter based languages are easy to learn as the error blow up immediately moment it occurs in any statement, because the interpreter convert and execute the program statement-by-statement. Interpreters normally take less memory space than compiler, and frequently BASIC interpreters are inbuilt into the ROM chip of microcomputers.

Assembler: Assemblers are exclusively used to convert assembly language programs into machine language. Assembler working is similar to an interpreter; but assembler convert assembly language program into machine language. Assembly language programs are more efficient than the high level language programs.

MAY 01, MAY 05

Firmware:

Firmware is, frequently, known as in-middle of hardware and software. Firmware is programs or instructions build into some microprocessors. These instructions help to substitute some hardware. For example, previously sound card and LAN card used to come as separate hardware, and now these are built into the motherboard with the help of firmware. Firmware or micro-programs are some special programs or instructions that deal with very basic operations of computer such as additions, multiplications, and move data, make comparisons, etc. These micro-programs are called firmware because these deal with very low level machine operations and thus substitute for additional hardware.

2.0 General Purpose Software/Utilities:

These are normally application software and used mainly for general purpose business, scientific and personal applications. Like spread sheets, databases, Computer Aided Design (CAD) and word processing software are general purpose software.

Most of the general purpose software comes as a package software and these software are easy to learn, and are very useful for presenting the reports in a well formatted manner.

The general purpose software is normally available in three modes:

1. **Commercial:** Available as pre-package licensed software like Tally
2. **Shareware:** Available as shareable on time and fee basis to use through internet like My-SQL DBMS. This type of software helps to reduce software licensing cost for the organizations because this type of software is available on use basis.
3. **Open Source Software:** This type of software is created by generous programmers for public use. These are available free of cost from internet. This type of software are regularly modified and upgraded by programming community e.g. LINUX OS is an open source software.

Some Popular general purpose software / utilities are:

(1) Word Processor:

Word processor software is used for document preparation. This software provides various features which help to prepare a quality documents, efficiently. These features are known as formatting features, editing features etc.

There are various popular word processing software like MS-word, Word-Pro, Word-Perfect, etc. MS-Word is the most popular word-processing software

(2) Spreadsheet Programs

A spreadsheet contains large numbers of intersected rows and columns in the form of cells. Spreadsheet software is used for financial, mathematical and statistical analysis of data. This software provides various in-built functions on financial, mathematical and statistical applications for efficient data analysis of these applications.

There are various popular spreadsheet software like MS-Excel, LOTUS-123. etc. MS-Excel is the most popular spreadsheet software.

(3) DBMS:

Data Base Management Systems: DBMS software features are discussed in detail in the next chapter. DBMS as its name suggests is used for managing database efficiently. Some popular DBMS in market are MS-ACCESS, ORACLE, DB2 and SQL-SERVER

(4) Internet Browser:

As its name suggests, internet browser is used for browsing or accessing internet data and applications. Internet browser is used to access web-sites. Internet Explorer, Mozilla, Firefox and Netscape are some popular internet browsers.

NOV 2009,
MAY 2004

3.0 Application Software

As evident from its name, these programs are written for some specific applications like accounting, payroll, inventory control, etc. these programs usually solve a particular problem or application that is unique to that organization. Usually different organization requires different programs for similar application. Therefore, it is difficult to standardize the application software. Over the years, various popular form of applications software have emerged in the market and these are:

(1) ERP: Enterprise Resource Planning:

A typical definition of ERP is like this, "Software solution that address the enterprise need by tightly integrating all functions of an enterprise".

In simple words, ERP promises one database, one application and one user interface for entire enterprise, where previously disparate systems were ruling manufacturing, personnel, finance and sales functions of an organization.

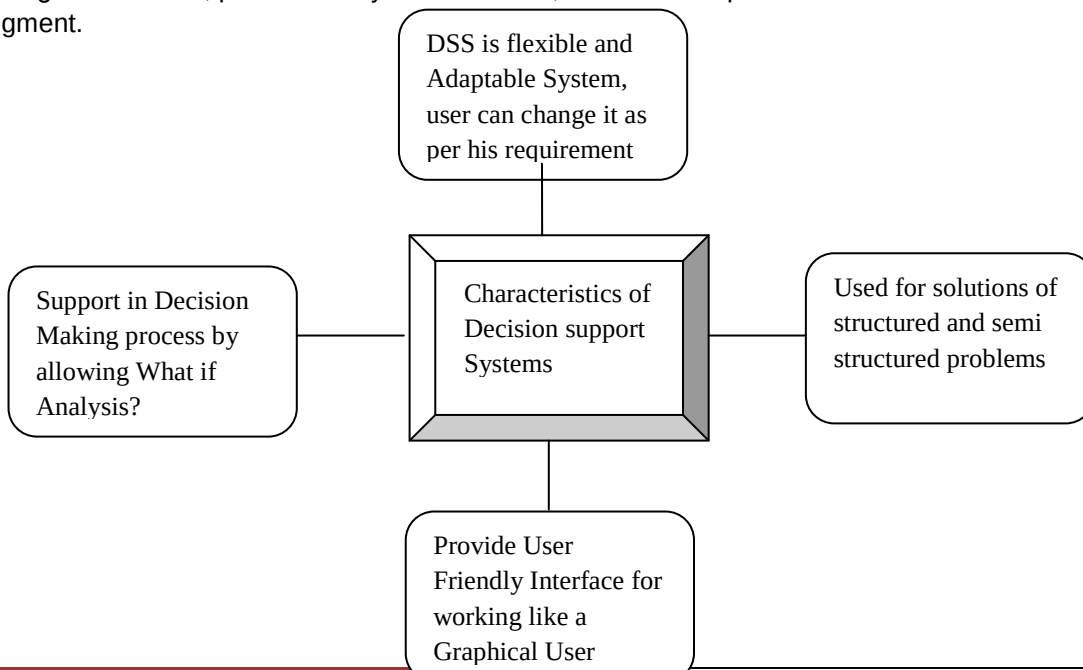
In general, ERP is a software product. But this definition will be doing gross injustice to ERP concept. In the sense that it is not a kind of software that once installed in your company will send your company profits soaring. In fact, ERP is a solution to a company overall business problems. ERP is re-engineering of your current business practices for more efficient and more accurate functioning. It is a mix of software tools enabled with newly designed well-planned business practices.

ERP attempts to integrate five major resources of an organization namely; man, material, money, machine and market. All these are taken care of in the form of HR, Finance, Inventory, Production and Sales, respectively.

MAY 04, MAY 06, NOV 07,
NOV 09, MAY 12

(2) Decision Support System (DSS):

A DSS is an interactive, flexible and adaptable Computer Based Information System specially developed for supporting the solutions of non-structured (Ad-hoc) management problems for improved decision making. It uses data, provides easy user interface, and can incorporate the decision maker's own judgment.



Decision Support System is frequently used by accountants and auditors for solutions of capital budgeting, general budgeting and audit problems. A Decision Support System in general provides following characteristics:

In addition to above, a DSS may use models, is built by an interactive process (often by end users), and support in all activities of decision making, and may include a knowledge component.

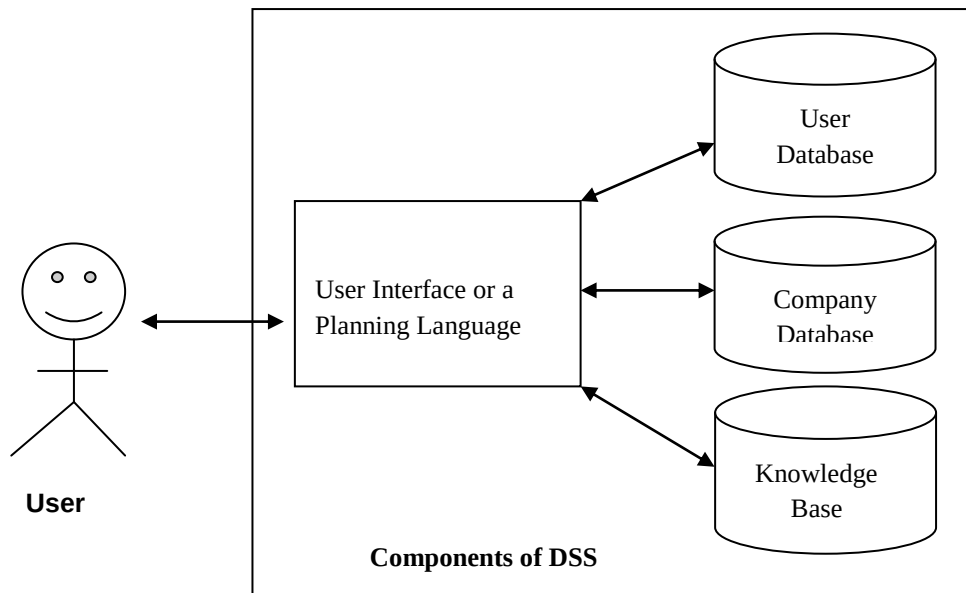
Let us take a practical example of decision support system, suppose TATA group wants to setup an Airline Company, before taking the decision to start an airline company or not, they will prepare a DSS for economic viability of Airline Company. This DSS will have all the basic inputs like cost, capital structure etc. and projected outputs like revenue, cash flow and IRR, NPV, etc. These inputs and outputs will be lined with each other using capital budgeting models, and users can perform what if analysis by changing inputs values like cost, etc, and accordingly outputs values like IRR, NPV will change to arrive at decision.

The features of DSS enable decision makers to make better, more consistent decisions in a timely manner. As stated earlier, the characteristics and capabilities of DSS are provided by its major components, which are described next.

Components of DSS:

DSS is composed of four basic components:

- | | |
|----------------|---|
| (1) User | (2) User Interface or Planning Language |
| (3) Model base | (4) Database |



(1) The user: User is considered to be part of the Decision Support System. The user of decision support system is usually a manager or analyst having knowledge of unstructured or semi-structured problems to solve. DSS had two based broad classes or users:

(a) Managers: These are the users who have basic computer knowledge and want the DSS to be with very user friendly interface.

(b) Staff Specialist (Analysts): These are people who are more details oriented and willing to use complex mathematical and statistical system in their day-to-day work.

- (2) **User Interface System or Planning Language:** A user communicates and commands the DSS through Planning Language. A user can use two types of planning languages:
- (a) **General Purpose Planning Language:** This type of planning language allows the user to perform routine task. For example, retrieving data from database or performing general mathematical, statistical and financial analysis. The syntax, functions and procedures in the MS-Excel are examples of General Purpose Planning Language.
 - (b) **Special Purpose Planning Language:** Some specialized software provides this language for specialized statistical and mathematical analysis. SPSS (Special Purpose Statistical Software) is example of Special Purpose Planning Language.
- (3) **Model Base:** Model Base is known as brain of DSS. It provides the structure of problem to be solved. It provides a frame work of the problem in the form of a model. The model is then used to analyze and solve the problem through data manipulation and calculations. Normally, a model of DSS is custom built, as per the requirement of a problem.

There are some pre-builds models (software package) available that include financial, statistical, management science or other quantitative capabilities for problem solutions. For example, IFPS (Integrated Financial Planning System) and Export Choice is model based system which help in financial analysis of investment problems.

- (4) **Database:** The DSS includes one or more databases. These databases contain data from both internal and external data sources. Internal data comes from within the organization, whereas external data may include industry data, marketing research data, etc. The external data is obtained from other organizations on some payment/fee.

Normally for DSS applications, special database is constructed, as per the task requirement. This database is known as user database wherein user organizes the required data values for DSS.

Uses of DSS in Accounting Applications:

DSS are widely used in accounting applications. DSS are normally prepared using spreadsheets applications like EXCEL or LOTUS 123. DSS are used in following accounting applications.

1. **In Capital Budgeting:** One of the most important uses of DSS is in Capital Budgeting problems for Investment Analysis. A project financial analysis is performed by creating DSS for the project financial feasibility.
2. **In Cost Accounting Problems:** DSS helps in arriving at correct standard cost of product, and also helps in breakeven analysis by using analysis parameter like sale volume, cost and profit margin, etc.
3. **In Budget Variance Analysis:** DSS helps in budget variance analysis. DSS allows to set budgeted value for accounting titles, calculate actual values, help to analyze variance in graphical and tabular form to do an effective budgeting variance and performance analysis.
4. **General Accounting Problems:** DSS also helps in various general accounting problems like ratio analysis, receivable analysis, working capital management, etc.
5. **Security Analysis and Portfolio Management:** Security analyst make use of different DSS models to analyze the securities and forecast their expected earning, price, etc,

There are also some general DSS in the market like Expert Choice, which help user to provide inputs

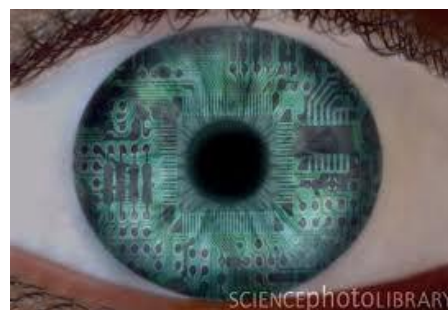
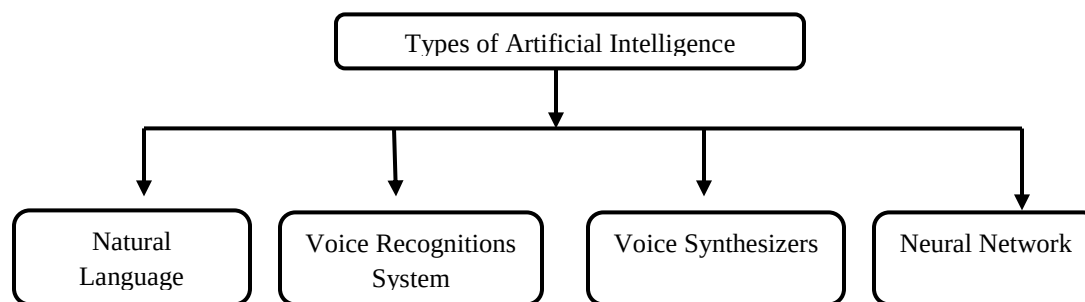
and various alternatives for capital budgeting solutions. These DSS provide the optimum scenarios for investment as per the provided inputs and alternatives.

NOV 2005, NOV 01, MAY 04

(3) Artificial Intelligence (AI):

Artificial Intelligence is an application system or software which replicates or mimics human behavior like human thinking, communication and recognition characteristics etc. There are various types of AI system, which are based on some human intelligence characteristics like

- | | | |
|-------------------------------------|---|---|
| (i) Neural Network | : | Mimic human thinking characteristics |
| (ii) Natural Language Communication | : | Mimic human communication characteristics |
| (iii) Voice Recognition | : | Mimic human natural recognition capability |
| (iv) Voice Synthesizer | : | Mimic human speech construction capability |
| (v) Robotics | : | Mimic human working capability |
| (vi) Expert System | : | Mimic human experts' problem resolving capability |



NOV 02, MAY 04, NOV 05, NOV
07, JUNE 09, NOV 11

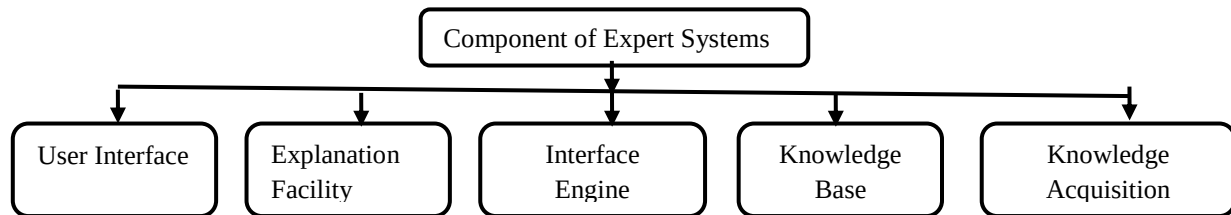
(4) Experts Systems:

Expert system is a computer based information system which provides the advices or solutions of given problems, just like the human experts, Expert system works on the principle of Artificial Intelligence to solve complex and unstructured problems normally in a narrow problem area like audit etc, just like the human experts.

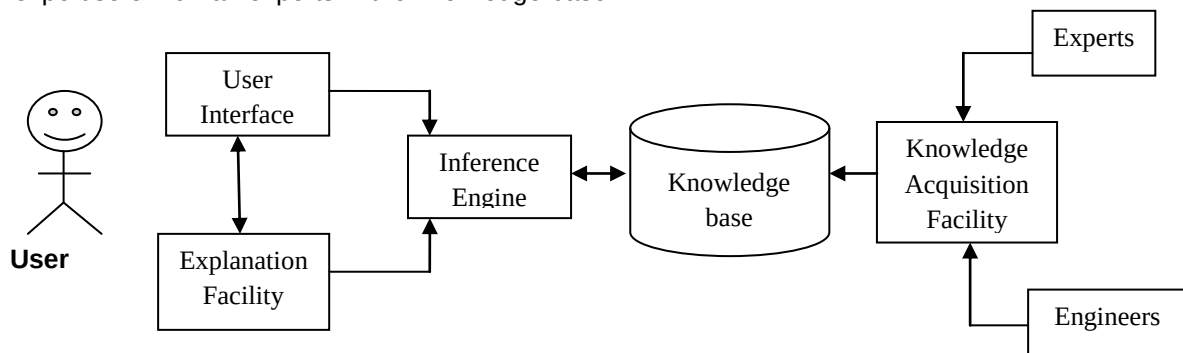
Expert systems are also known as knowledge based systems, because these systems contain the knowledge of experts in an organized and structured manners to solve the problems.

Component of Expert systems:

Following are main components of an Expert System:



- (i) **User Interface:** User Interface allows a user to provide or communicate the problem to expert system for solution.
- (ii) **Inference engine:** Inference engine is the most important component of expert system; it is like a search engine on internet. it contains various rules and logics to arrive at solution for problem provided by users by matching the problem solution from knowledge base.
- (iii) **Explanation Facility:** It is like a reporting system, it provide an explanation of logics to users for solution arrived by expert system.
- (iv) **Knowledge Base:** Knowledge base contains the past knowledge of experts for problem solutions in an organized manner.
- (v) **Knowledge Acquisition Facility:** This component is used for building knowledge base of an expert system. This component is used by programmers/engineers for collecting and organizing knowledge and expertise of human experts in the knowledge base.



Expert System

Characteristics of Expert System:

- Expert System provides problem solution or provides advice like human experts.
- Expert System can be example based, rule based and frame based for providing problem solution or advice

- In example based expert system it searches the appropriate match for present problem or case with previous cases and their solutions from knowledge base. In rule base it uses if then else rules for series of questions from users to draw conclusion for problem solution. In frame base Expert System it divide every data, processes etc into logically linked units called frames to create the most logical solution.
- Expert System provide various level of expertise like
Assistant Level: Provide user attention on problem area
Coleuege Level: Discuss the problem with user at arrive at agreement
True Expert: User accepts the solution without any questions. (Very difficult to develop)

Benefits of Expert Systems:

- Provide low cost solutions or advice
- Provide solutions or advice based on the knowledge of many experts.
- Always available for solutions and advice, there is not time restriction as it happen in the case of human experts
- Help users in better decision making and also improve their productivity

Limitation of Experts system

- Costly and complex system to develop and also it takes a lot of time to develop expert system.
- It is difficult to obtain the knowledge of experts in terms of how they specify a problem and how they make the decisions.
- It is also difficult to develop the program to obtain the knowledge of expert for problem' solutions.

Uses of Expert System:

- Doctors use expert system to diagnose the patient disease by providing symptoms of disease to expert systems
- Indian Revenue Department uses Tax Expert System to investigate tax evasions and frauds on the basis of provided tax returns details.

FUN PAGE: Bill Gates

William Henry "Bill" Gates III (born October 28, 1955) is an American business magnate, investor, philanthropist, author, and former CEO and current chairman of Microsoft, the software company he founded with Paul Allen. He is consistently ranked among the world's wealthiest people and was the wealthiest overall from 1995 to 2009, excluding 2008, when he was ranked third. Bill Gates earns US\$250 every second, that's about US\$20 Million a DAY and US\$7.8 Billion a year. The US national debt is about 5.62 trillion, if Bill Gates were to pay the debt by himself; he will finish it in less than 10 years. He can donate US\$15 to everyone on earth but still be left with US \$5 Million for his pocket money. If Microsoft Windows' users can claim US\$1 for every time their computers hang because of Microsoft Windows, Bill Gates will be bankrupt in 3 days! Bill Gates is 54 this year. If we assume that he will live for another 35 years, he has to spend US\$ 6.78 Million per day to finish all his money before he can go to heaven or hell.



(28-10-1955)

(V.Imp) Question from my Desk for SOFTWARE

- Q.1 Write Short Notes on Expert System & its component?**
- Q.2 Explain the benefits of Expert System.**
- Q.3 What is Decision support system (DSS)? Explain its various components.**
- Q.4 What do you mean by OOP? Explain its advantages?**
- Q.5 Explain the basic functions of an operating system.**
- Q.6 Explain System Software and Application software.**
- Q.7 Short Notes on Graphical User Interface (GUI)**
- Q.8 Short Notes on Firmware**
- Q.9 Explain the significance of utility programs. With examples**
- Q.10 Write Short Notes on Artificial Intelligence?**
- Q.11 Elaborate the various types of General Purpose Software?**
- Q.12 Describe Compilers, Assembler & Interpreter?**

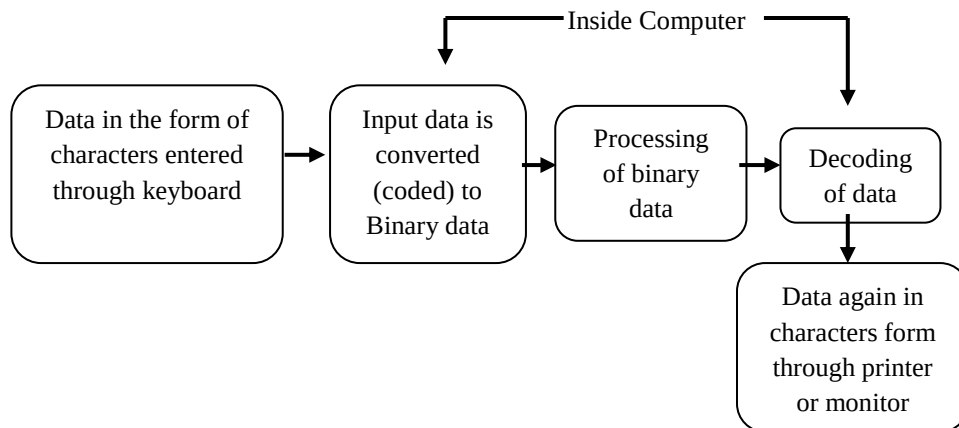


Chapter: 2 Data Storage, Retrieval and Data Base Management Systems

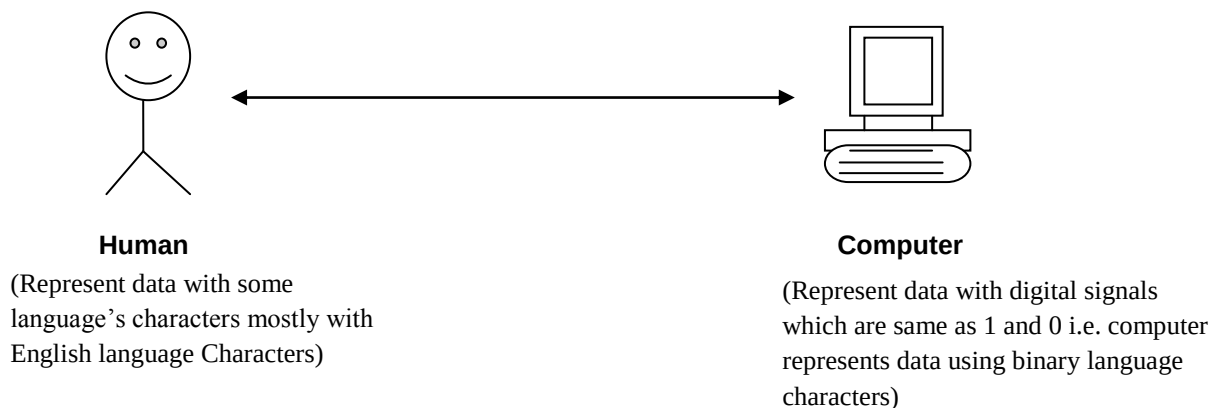
1.0 Data Representation:

In our daily life; we represent data using some language like English, Hindi, etc; by using characters set of that language. For Example, English language data is represented with A to Z, a to z, 0 to 9 and with some special type of characters (+,/,!, . ? “”). It often seems that computer can understand our language, because computers produce information that we can understand. But, in fact, computer cannot understand our language directly.

What computer actually does is; it converts these characters (alphabets or numeric) into electrical signals. These electrical signals are in digital form (in 1 or 0 form), or we can say, computer represent data in binary form (1 or 0); and process the data also in binary form. The processing results are again converted back into characters form on display devices.



Finally, we can conclude that human being represents data with some language characters, and computer represents data internally with electrical signals which are equivalent to 1 and 0. We can say, computers have a language, which has only two characters 1 and 0. This language, in which only two characters are there, is known as Binary Language and each of these two characters is called Bit or Binary Digit.



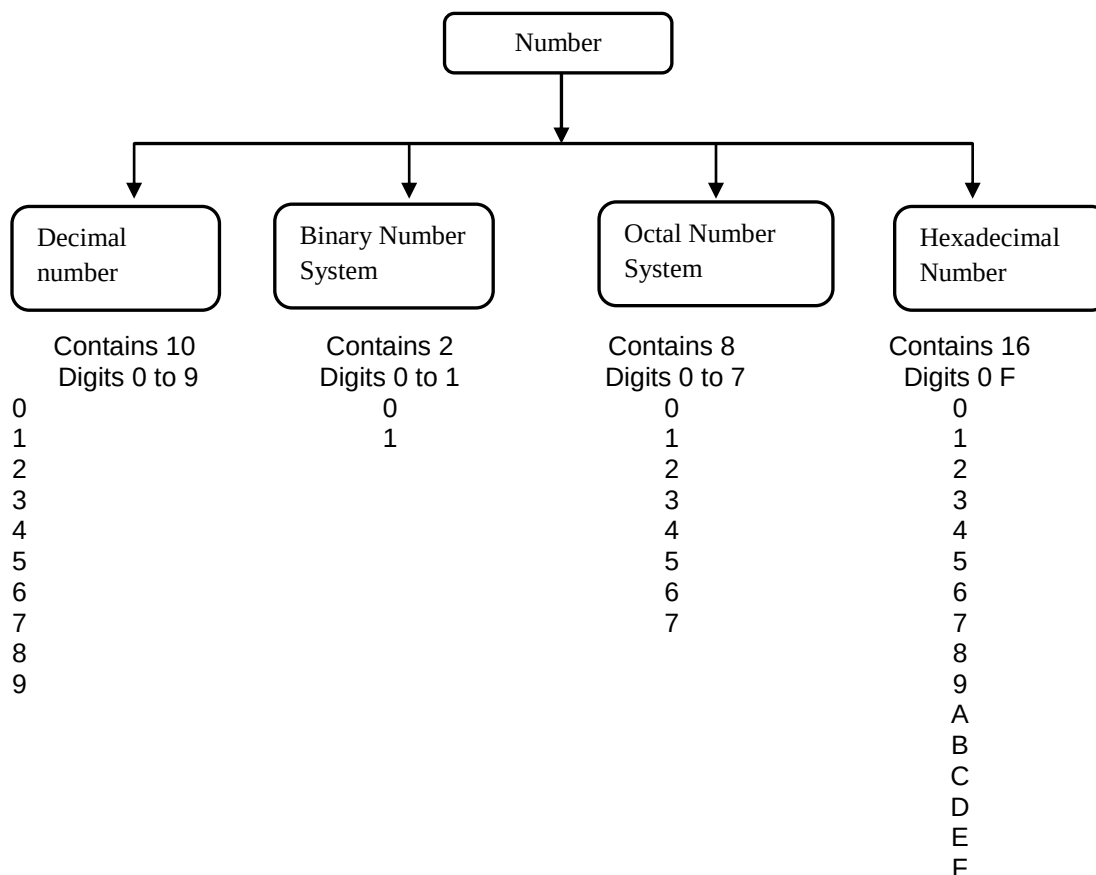
Now it is clear that we have some language to represents our data like English, Hindi, etc; and computer has its own internal language known as binary. But in order to communicate with computer there should be some relationship between our language and computer's internal language. This relationship between our language and computer language is represented by two means.

1. Pure Binary (used for numeric data Only) or Number System
2. Coding System (used for all data types)

MAY 00, NOV 03, MAY 04, NOV
04, MAY 03, NOV 05

(1) Number System

There are four popular number systems used for representing numeric data.



Decimal number system is used for representing numeric data in business applications; you imagine any numeric data, it will be made with digits from 0 to 9. Binary number system is used in the form of digital signals inside the computer.

There are two other popular number systems which are mainly used by system software professional for memory addressing purposes. These number systems are Octal and Hexadecimal number system. The octal number system is base 8 number system i.e. there are total 8 digits (0 to 7) in octal number system to represent any numeric data. Similarly, in Hexadecimal number system there are 16 digits (0 to 9 and A, B, C, D, E, F) to represent numeric data.

We will learn here the conversion from Decimal to Binary and Binary to Decimal number system

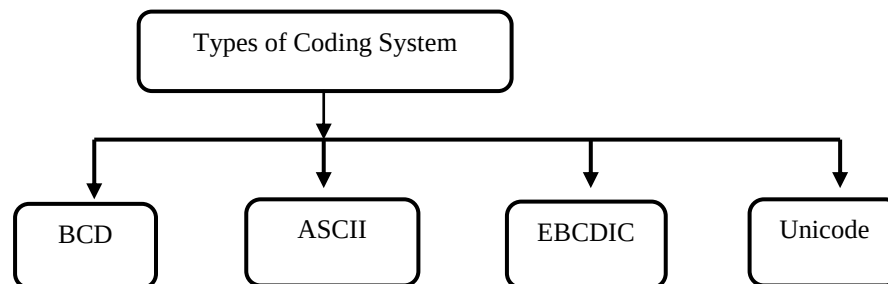
For decimal to binary (or any other number system) conversion, divide whole part of decimal number with the number to which decimal number is to be converted i.e. 2 over here; and multiply the fractional part of decimal number with the number to which decimal number is to be converted

(2) Coding System:

Pure binary number system can be used only for numeric numbers, whereas actual data of business is not only made with numeric characters (0 to 9) but also with alphabetic (A to Z) and some special symbols (like, :, #, etc).

To present these different types of character different types of coding system are used:

1. BCD (Binary Coded Decimal)
2. ASCII (American Standard Code For Information Interchange)
3. EBCDIC (Extended Binary Coded Decimal Interchange Code)
4. Unicode



(1) BCD (Binary Coded Decimal)

We can further divide this coding system in two categories

- (I) BCD for decimal numbers only
- (II) BCD for all types of characters

In BCD, for decimal numbers only, each decimal digit is represented by equivalent four digits binary numbers. And to convert any decimal number into binary number each of the digits of decimal number will be substituted by equivalent four digits binary numbers.

Decimal Digit	Equivalent Binary (8 4 2 1)
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

Example: BCD equivalent of 751 = 0111 0101 0001. Whereas, if we convert 751 decimal number into binary number with pure binary number system then it will provide different value.

BCD for all types of Character: In this codification scheme of 4 bits BCD was extended to cover the alphabets and special symbols by extending above 4 bits coding system into 6 bits coding system by using 6 bits, we can represent $(2)^6 = 64$ different types of codes.

Presently, BCD is a 6 bits coding system where each and every character is represented by 6 bits.

Like 9 = 00 1001

A = 11 0001

MAY 04, MAY 12

(2) ASCII (American Standard Code for Information Interchange):

This is the most popular coding system to represent the data in computer system. ASCII code uses 8 bits to represent every character. But normally only 7 right most bits of these 8 bits are used to represent a character. In this coding system, total $(2)^8 = 256$ different types of code can be made. But, in most system, the right most 7 bits are used to represent the code for a character, therefore, it provides a maximum representation of $(2)^7 = 128$ individual characters. In ASCII system, each character is stored in single byte of memory space in a computer. For example, Anil will take the 4 bytes of memory when stored using ASCII codes.

(3) EBCDIC (Extended Binary Coded Decimal Interchange Code):

ASCII code is mainly used in the personal computer and some of the minicomputers. But there is one more popular coding system used in the mini and mainframe computers known as EBCDIC.

EBCDIC is 8 bits coding system i.e. each and every character is represented by 8 bits. The total number of code which can be made in this coding system are equal to $(2)^8$ i.e. 256.

This coding system is used to handle all types of data (numeric, alphabetic and special symbols.) Each character in EBCDIC is represented by using 8 bits. And these 8 bits are divided into 2 portions, 4 left most bits are known as Zone bits, and the right most 4 bits are known as digit bits or numeric bits

Example code of 1

111	0001
Zone Bits	Digit Bits

In EBCDIC, the value in the zone bits decides the type of character for which it is coded. For example, for numeric character code the value for all the zone bits would be 1.

Unicode:

This is 16 bits coding system. This coding system can cover about $(2)^{16}$ or 65,536 different types of characters for codes. The first 256 codes in the Unicode are similar to 256 codes of ASCII system.

This Unicode was developed in 1991 by a joint research team from Apple Inc and Xerox Inc. This coding system is supported by popular operating systems like Windows and OS/2.

Bit: Bit is known as Binary Digit e.g. 0 or 1.

Byte: As we studied above that to represent characters of our language in computer system we use mostly either ASCII coding system or EBCDIC coding system. Both of these are 8 bits coding system i.e. every character is represented with 8 bits. To save one character in computer memory it takes 8 bits.

These 8 bits are called 1 byte. We can say that the byte is a unit of memory, which is equivalent to one character.

$$1 \text{ Byte} = 8 \text{ Bits} = 1 \text{ Character}$$

But we know, we store large volume of data in computer memory, therefore this is a very small unit of memory. To represent large data size, we use the following memory units.

S. No.	Unit	Symbol	Size in Bytes
1	Kilobyte	Kb	$2^{10} = 1023$
2	Megabyte	Mb	$2^{20} = \text{Approx. } 1 \text{ Million } (> 1 \text{ Million})$
3	Gigabyte	Gb	$2^{30} = \text{Approx. } 1 \text{ Billion } (> 1 \text{ Billion})$
4	Terabyte	Tb	$2^{40} = \text{Approx. } 1000 \text{ Billion } (> 1 \text{ Trillion})$
5	Petabytes	Pb	2^{50}


 NOV 2000

2.0 Concepts Related to Data or Data Fields

Data Type: Each data or data field belongs to a certain type e.g. numeric data type, text data type. In general, following are some data types and their characteristics:

Integer Number:

This data type can hold only whole numbers i.e. number without decimal point e.g. 12345

Single or Double Data type: This data type can also hold numbers only but any type of numbers with large number of significant digits e.g. 345.4589

Logical Data Type: This data type can store only Boolean value i.e. either True or False

Character: Smallest item of the data is known as characters e.g. a, b, c, 1, 2, etc

String: Is non numeric data type e.g. "Anil", "CA Exams"

Variable: Data which can have different values e.g. amount, name

Memo Data Type: Data which can have long string of more than 255 characters

Index Fields: Data field which can be used for sorting and thereafter this help in fast search of data.

Currency Fields: Data fields used for amount only

Data Fields: Data field used for data and time only

Integer Fields: Data field used for integer value without decimal point

Text Fields: Non numeric data fields

3.0 Data Processing:

If you ask someone, what is the most important use of computer in business? I think the reply will be data processing. If you look around in banks, insurance companies, manufacturing companies you will notice that computers are being used for data processing.

So what is Data Processing?

(i) Data: Data represents facts or figures related to certain entities and activities like quantity salary and name. in business, the transactions are known as data like sales, purchase, payment and receipt

Structure of Data: Data is always constructed using some language's characters; like, we mostly construct data using English language characters (A–Z, a-z, 0-9, special symbols (comma, full stop etc). These characters are organized to provide a meaning full value, which is known as data item and these data items are logical arranges to provide a data record and finally data records are arranged in the form of data files.

Data Items {

Receipt No.	<u>101</u>
Date	<u>1/1/2009</u>
Name	<u>Amit Kumar Gupta</u>
Amount	<u>Two Thousands only</u>
Amount	2000/-

Example of Receipt Record

Here Receipt No., Date, Name, Amount are data Items or data fields which together make a receipt record or transaction. Many similar transactions like this provide data files for receipt records book. And to fill these data items we use characters like in above receipt record we have used some alphabetic characters to fill name data item.

(ii) Processing: Processing is an action and here these actions are done on data to convert data into information e.g. calculation, sorting are the processing actions.

Note: We all know to run any business, work is not limited to recording of these transactions, but we have to process these transactions also i.e. we have to create the books of accounts and reports (P & L, Balance Sheet etc) from these transactions. So any data becomes purposeful only when it is processed. Like in accounting, we create various types of transactions (data) e.g. sales, purchase, receipt, payment, journal, debit note, credit note. Ultimately, these transactions are first processed in the form of journal and then ledgers, and finally in the form of reports like P & L, Balance Sheet and Trial Balance, etc. If we will not process these transactions we will not be able to generate reports; and, may be, we will not able to run our business smoothly.

(iii) Data Processing: Data Processing is a process by which data is converted into information.

**Transactions**

Sales
Purchase
Receipt
Payment

Reports

P & L
Trial Balance
Balance Sheet

Note: Organizations are doing this data processing since the existence of business, but yes computer has added extra advantages to this data processing like speed, accuracy, reliability, etc.

(iv) Information: Information is organized and compiled data that has some value to its receiver. Information is data that has been transferred into a meaningful and useful form for specific purposes. Like data arranged in P & L, Balance Sheet, etc is information

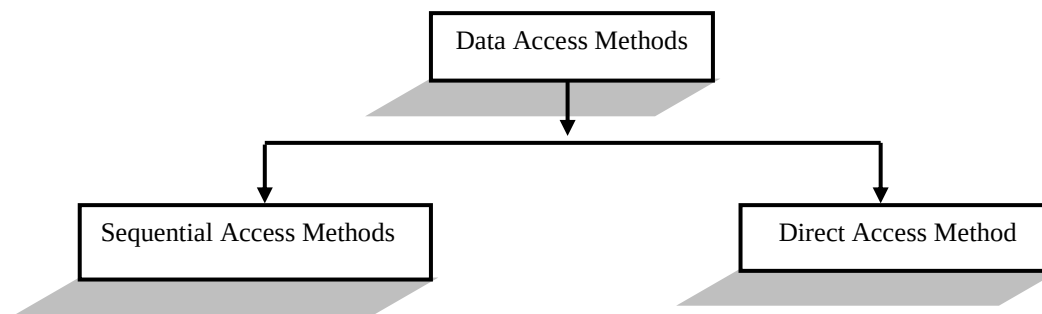
4.0 File Organization

This concept is related to data organization in the files, and their access methods

Data Access and Organization Methods:

Data organization and data access methods are two driving forces for data management.

Organization means arranging data in storage so that it can be accessed conveniently. Access means accessing data from storage.

37

5.0 Data Access Methods:

There are two data access methods for accessing data from storage.

- (1) Sequential Access Methods:** In this method, data is accessed sequentially i.e. one-by-one from storage. This method provides access for records in sequence of their physically arrangement on storage device. Sequential access is a slow access in comparison to direct access, because this method requires scanning of all the records arranged before the desired record. Sequential access method is mainly used in magnetic tape for accessing data.
- (2) Direct Access Method:** Means accessing records in a manner that is independent from their actual physical arrangement on storage device. In direct access, data is accessed directly from its

physical location. Direct access is a fast data accessing method because it does not require the scanning of all the records arranged before the desired record. This method is used in direct access storage devices like hard disk, floppy and CD.

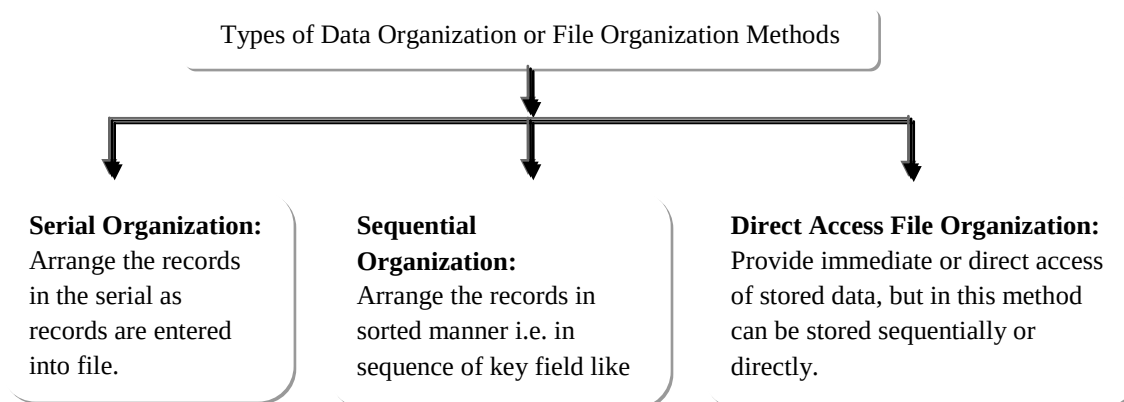
Magnetic Tape uses sequential access method whereas disk type media normally uses direct access method.

NOV 99, NOV 01, MAY 02

6.0 Organization Methods:

We have studied various types of auxiliary storage devices and now we would discuss various types of file organizations used on these devices. The file organization refers to scheme of data storage that allows either sequential access or direct access.

Following are common types of file organization system:



- (1) **Serial File Organization:** This is the simplest file organization scheme. In this records are arranged one after another as they are entered into system in serial without any ascending or descending order. Serial file organization is used to create transaction files in which records are arranged in serial of occurring of transaction in random order of key fields.

Customer No.	Order Amount
102	500
103	700
101	900
107	500
104	1000
105	2500
110	700
111	800
106	700

Data Arranged in Serial File

- (2) **Sequential File Organization:** In sequential file organization the storage of data takes place sequentially and access is also sequential. All the records are placed in sequence, ascending or descending order by their key fields and their access is also in sequence. To locate a record on this type system search start from very first record and it goes to the record required. This type of file organization gives slow performance if the search operation occurs for any particular record. But

these are god file organization at the end of every month for salary calculation all the records are required to be processed. Magnetic tape allows only sequential file organization.

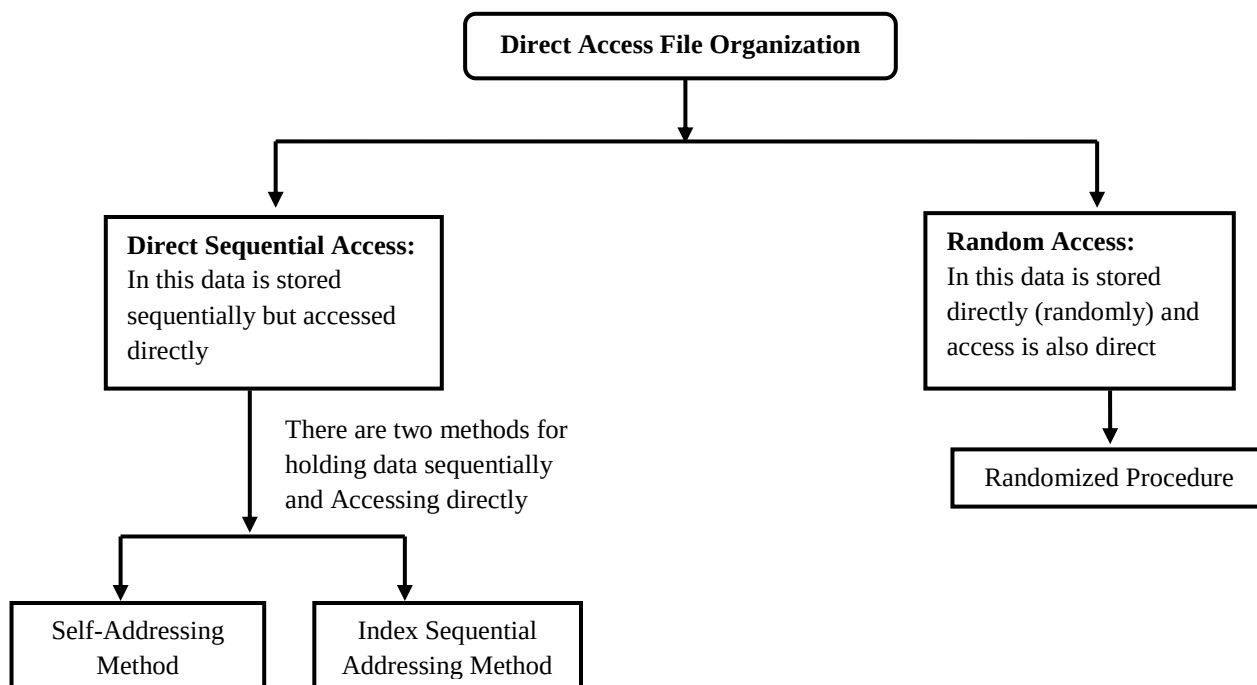
Customer No.	Balance Amount
101	500
102	500
103	700
104	1000
105	2500
106	700
107	500
108	1000
109	2300
110	800
111	900

Data arranged in Sequential file

Sequential file organization is used on magnetic tape for creating master file in which all the master records are arranged in sequence of key fields, this organization is also used in batch processing system for creating transaction file in which sequential transaction file (sorted transaction file) is created before updating maser in batches.

(3) Direct Access File Organization: As its name suggest Direct Access File Organization allows immediate or direct access to any individual records on the file. There are mainly two techniques used for Direct Access File Organization.

39



There are so many direct access devices. Magnetic disk (Hard disk), Floppy etc. all are example of direct access devices. The Primary storage in CPU is always of direct access type memory. This type of file organization gives a better performance than the sequential file organization in data transfer rate. As stated above in diagram there are two Direct Access File Organization

1. Direct Sequential Access
2. Random Access

Direct Sequential Access:

There are two direct sequential Access Methods to find out any record directly which has been stored sequentially on media

1. Self-Addressing Method
2. Index Sequential Addressing Method

1. Self-Addressing: In this method storage area (On Floppy Disk or hard disk) is divided into buckets and every bucket can store fixed number of fixed length records. Every bucket would carry an address that may range from suppose 10001 to 26000 to store 160000 records, means every bucket would contain 10 records no. 149892 would be determined like

$$149892/10 = 14989.2$$

Now add 10001 (Starting address of Buckets) to 14989 that would give 24990 and .2 in the 14989.2 is record position in the bucket no. 24990. This process would move the read/write head to on bucket no. 24990 and on 2nd record position in that bucket to access the record no. 149892 from the magnetic disk.

But this method is not very useful because:

- (I) It is used for fixed length records only
- (II) Deleted records from bucket would leave the empty space that makes a lot of memory wastage.

But there is advantage also no memory is required to store the indexes as required in Index Sequential Addressing Method

You can compare Self Addressing Method with manual record keeping system in banks where page no. of ledger book is account no. i.e. no index is maintained for customer ledgers, like account no. 256 will be in third ledger book at page no. 56 if every book is marinating 100 accounts.

Now you again read word **SELF ADDRESS** means logical address account no. itself become the physical address i.e. page no.

2. Indexed Sequential Addressing Method (ISAM): In this type of the file organization sequentially stored data can be accessed directly, that is records in the file are stored sequentially but accessed directly through an index. The index is like we refer a book in the library. Like you first search type of rack with first description and then desired shelf with next nos. in that rack, same way in this file organization when a particular record is to be searched with a record no. then that record no. is processed to find out index. This index contain two value

1. **Cylinder No.** 2. **Track No. on that cylinder**
 Cylinder Index Provide the Cylinder No. Value

Cylinder NO.	Highest Record on that Cylinder
1	125
2	210
3	367
4	489
5	611

Cylinder Index

Note: This cylinder indexing shows that Cylinder no. 1 can keep Record No. 1 to 125 and likewise cylinder no. 2 can keep record no. 125 to 210 and so on.

Track Index for desired Cylinder provides the Track No. Value

Track No.	Highest Record on that Track
1	15
2	40
3	68
4	96
5	125

Track Index for Cylinder No. 1

Track No.	Highest Record on that Track
1	156
2	175
3	187
4	195
5	210

Track Index for Cylinder No. 2

Suppose we want to search record no. 185. First, it will look into Cylinder Index to find the Cylinder No. like record no. 185 will be on Cylinder no. 2. Now from Track Index of Cylinder No. 2 the track no. for record no. 185 will be searched and it will be track no. 3 i.e. 185 record no. will on track no. 3 of cylinder no. 2 In this way read / write head would directly move to Track no. 3 of Cylinder 2 for accessing record no. 185.

This is a very good file organization and mostly used for storing file in sequential manner but accessing directly.

This file organization has many advantages over Self Address Method

- (i) In this we can use variable length records also
- (ii) Empty space for deleted record can be reused i.e. it is not left black.

But it has some disadvantages also

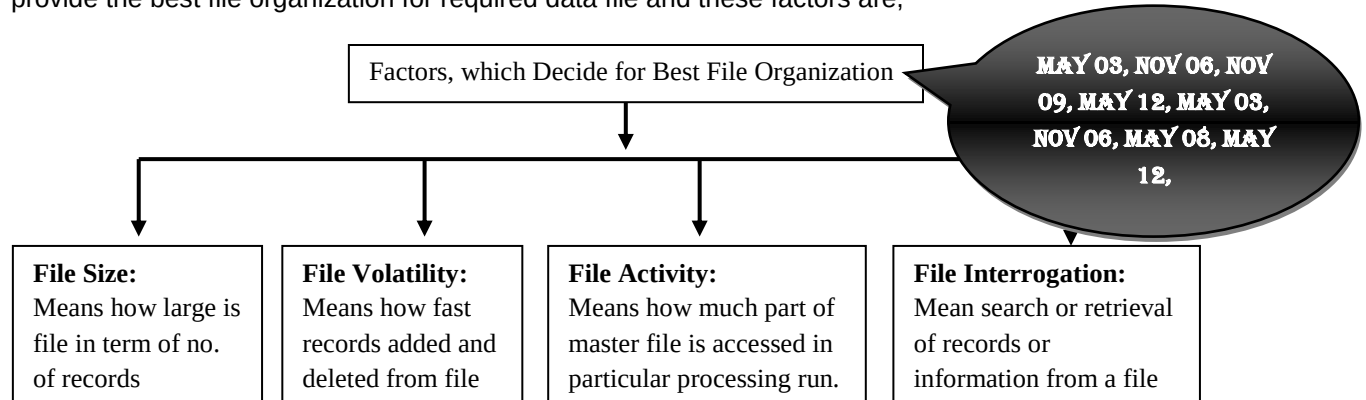
- (i) Indexes maintained in this method also require memory space
- (ii) To utilize the space of deleted records, re-indexing is required which is a time consuming process.

Random Access Method: In this method records are stored randomly (Directly) and records are accessed also directly (randomly). Some Randomize procedure are used to search the desired record directly by converting desired record no. into a physical address that would move read / write head to the physical location where desired record is stored


 MAY 11

7.0 The Best File Organization:

We know there is several file organization like sequential, serial, index sequential addressing, random and direct file organization, now the question arises which file organization to use, which is the best file organization. The best file organization depends upon various factors and analyses of these factors provide the best file organization for required data file and these factors are,

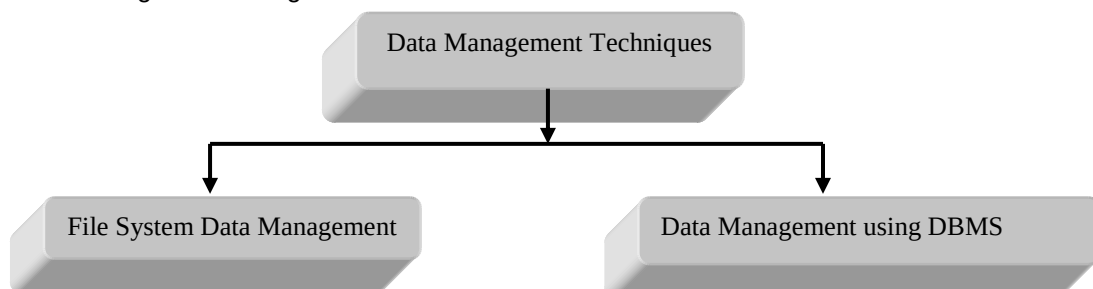


- 1. File Size:** This refers to how large is your file is size (Nos. of records). Larger file with low file activity and low interrogation can have sequential file organization otherwise larger file with high activity and interrogation should have direct sequential file organization.
- 2. File Activity:** This refer to, for processing only individual records are accessed from a file or most of records are accessed from file like in online system only individual records are accessed for processing therefore direct access file organization is required but in payroll file almost all the records are accessed during processing therefore sequential file organization may also suit the requirement.
- 3. File Volatility:** This refer to no. of addition and deletion of records in a file in a given time. Large File with high volatility ISAM method is good choice. Otherwise other direct method can be used for small size high volatile file.
- 4. File interrogation:** This refers to retrieval of information from a file. If retrieval of information is to be fast to support some online information system then there should be direct access file organization otherwise (where a delay in retrieval of information is permitted) sequential file organization can also be considered.

8.0 Data Management Techniques

Data is very crucial resource for an organization and for smooth functioning of organization it is necessary that this data should be managed very efficiently. There are two ways an organization can manage it data.

1. Traditional File System Data Management
2. Data Management Using DBMS.



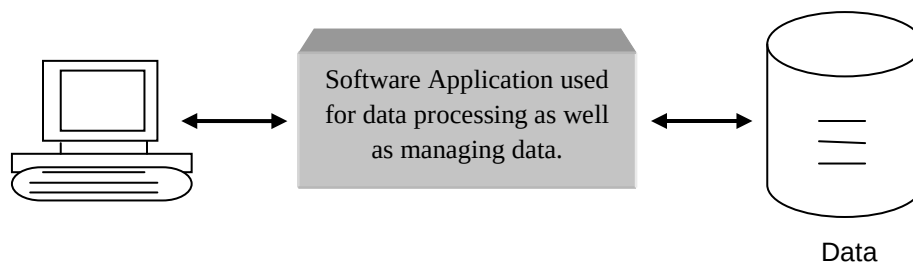
File system data management is an old technique for managing organization data, there are various problems with file system data management, to overcome these problems some specialized software for managing data were invented and these software are known as Data Base Management System.

DBMS: DBMS is software used for creation and management of an efficient database. Database is collection of data in an organized manner. And DBMS contains various programs which help of create database i.e. organize the data and also help to manage this dataset i.e. delete, update, insert new data and search required data etc. from created database efficiently.

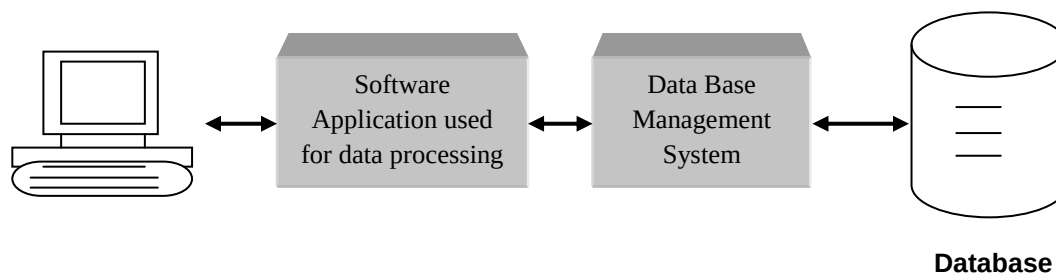
There are various popular DBMS in the market which have evolved over last many years for efficient data management. Example: dBase IV, Paradox from Borland Incorporation, Access, Foxpro, SQL Server from Microsoft, Oracle from Oracle Incorporation etc.

DBMS	Manufacturer	Computer Type
Access	Microsoft	PC, Server, PDA (personal digital assistant)
DB2	IBM Corporation	PC, Midrange Server, Mainframe
Informix	IBM Corporation	PC, Midrange Server, Mainframe
Ingres	Computer Associates	PC, Midrange Server, Mainframe
MySQL	MySQL	PC, Midrange Server
Oracle	Oracle Corporation	PC, Midrange Server, Mainframe
SQL Server	Microsoft	PC, Server, PDA (persons digital Assistant)
Sybase	Sybase Inc	PC, Midrange Server
Visual FoxPro	Microsoft	PC, Server

How DBMS manage a data and how File System manage a data, this can be visualized from the diagrams given below, after understanding this we can better understand the problems of File System Data Management in comparison to data managed by DBMS.



Data Management Using File System



Data Management Using DBMS

As we can visualize from the above two diagrams that in case of File System data is processed and managed by application programs, whereas in case of data management using DBMS specialized software known as DBMS are used to manage data and application programs are only dedicated for processing of data. I hope you can image when there is dedicated software for managing data in place of application software which are processing and managing data as well there will be better data management. In fact the various advantages of DBMS, which were also problems in File System, have led wide acceptability of DBMS software in the organization for managing data. You name any big organization be it banks, railway, insurance companies or FMCG companies everywhere DBMS are being used for managing data.

Now we will look into various problems of File System Data Management and in fact these problem have been reduced in the DBMS manage database, therefore the opposite of these problems are advantages of DBMS managed database.

Employee_Master

EMP_NO	NAME	SALARY
E101	Amit	2300
E102	Sunil	5000
E103	Peter	4000
E104	Salim	3000
E105	Harjeet	2500

Loan_to_Employee

LOAN_NO	AMOUNT	EMP_NO	NAME
L101	2000	E101	Amit
L102	3000	E103	Sunil
L103	2000	E106	Gitesh

Data Dedundancy
(Name is kept in File)

Data Inconsistency
(E103 name is Peter
in file Not Sunil)

View of Data kept in File System

Lack of Data Integrity
(Employee No. E106 does
not exists in the Employee
Master and he is given a
loan)

EMP_NO	NAME	SALARY
E101	Amit	2300
E102	Sunil	5000
E103	Peter	4000
E104	Salim	3000
E105	Harjeeet	2500

LOAN_NO	AMOUNT	EMP_NO
L101	2000	E101
L102	3000	E103
L103	2000	

**View of Data Kept in Database in Linked Tables. Please
not that it does not have the problems of File System**

File System Data Management Problems**((May 07, Nov 08, May 11))**

1. **Data redundancy or Duplication:** In file system data is kept in separate files, which causes the same data to be kept in many files as shown in above figure name is kept in Employee_Master as well as in Loan_to_employee File also i.e. in File System there is data duplication in different files. Data kept in separate file also provide another problem known as Data Inconsistency.
2. **Data Inconsistency:** Means same data having separate value at different locations. We know in file system data is kept in separate files, this also result in an another problem known as data Inconsistency as shown in above diagram name is kept in Employee_Master as well as in Loan_to_Employee also and normally there are separate programs which update these files and sometime this up-dation may provide data inconsistency like E103 name in employee master peter whereas name of same E103 in Loan_to_employee in Sunil.
3. **Lack of Data Integration:** Keeping data in different files also create a problem of data integrity like some such kinds of records are added into the file, which does not have corresponding master record as shown in diagram above Loan_to_Employee contains a record for employee no. E106, which does not exist in Employee_Master
4. **Data Dependence:** File System data is dependent on Application Software programs for creation and management. File system data depends upon the programming languages of application software for its structure and format etc. i.e. COBOL programs create their data files in terms of structure and format which cannot be used by BASIC programs which create their own compatible data files.
5. **Other Problems:** There are various other problems with file system data like Concurrent Data sharing is very difficult, it also difficult to apply controls for data accuracy and completeness etc.

As mentioned earlier the problems of file system data management led to use of another technique for data management known as Data Base Management System.

DBMS Advantages:**((Nov 98, May 99))**

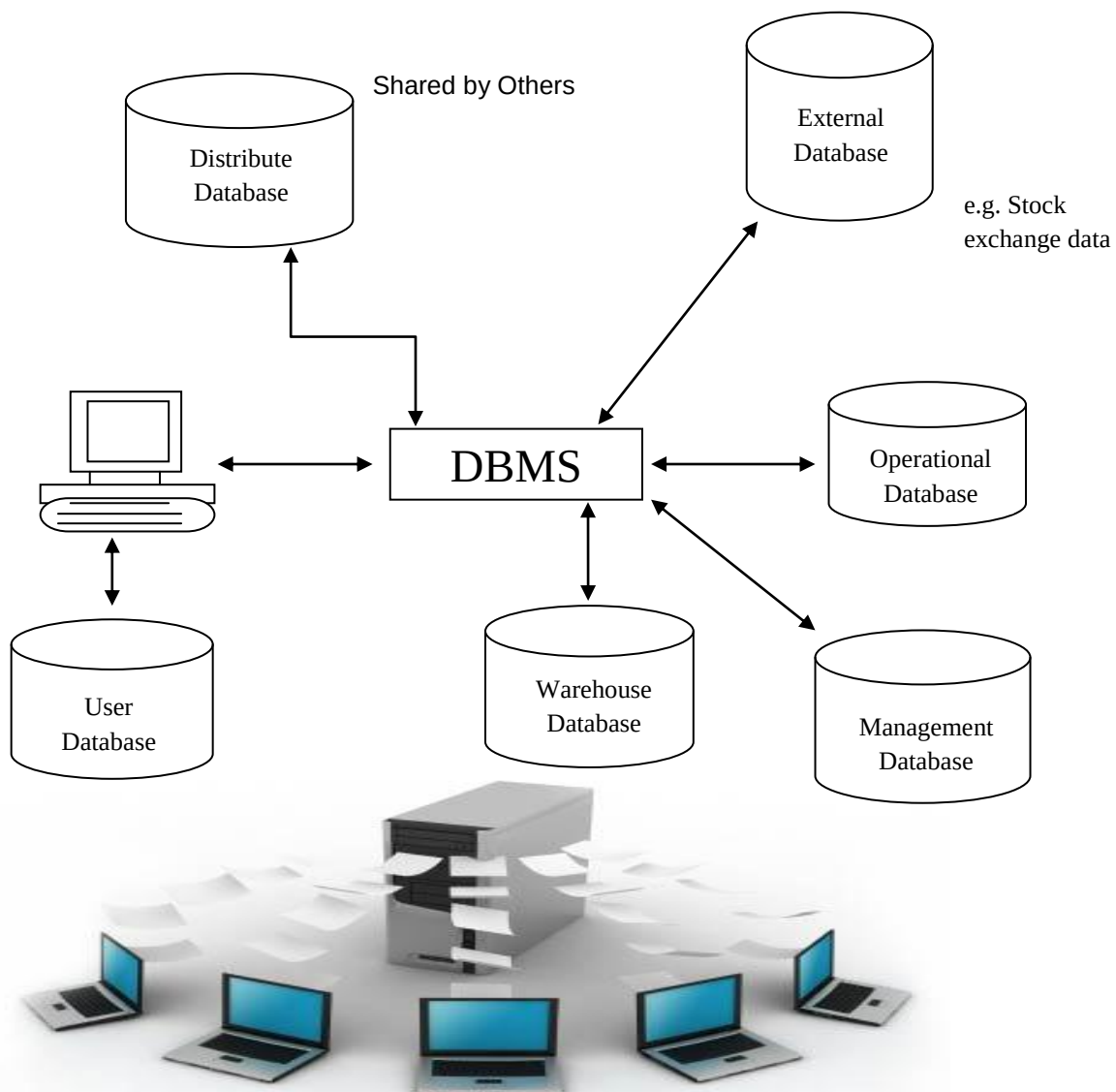
1. **Data Sharing DBMS:** Provides features to share the data of entire organization by various users concurrently or simultaneously ex. Railway Reservation etc.
2. **Reduced Redundancy:** In non-database system (File System), each application or department has its own private files resulting in considerable amount of redundancy of the stored data. Thus storage space is also wasted. By having a centralized database or data in linked tables as shown in view of data managed by DBMS, redundancy can be avoided.
3. **Improved Data Integrity:** DBMS does not allow any transaction data until the master record for such transaction does not exist in master table, this help in maintaining integrity of data, like E106 cannot enter into Loan_to_Employee Table until the same E106 exist in Employee_Master.
4. **Inconsistency can be avoided:** DBMS discourage the duplicity of data, which help in reducing inconsistency in database.
5. **Security:** DBMS provide various security features which can be for providing a secured database like User authentication Access Controls etc.
6. **Better transaction management:** DBMS allow updating multiple database records with single transaction input, this also help in economizing input, this also help in economizing input efforts.
7. **Better Administration and Control:** Data can be easily maintained in terms of up-dating, deleting or adding new data in database.
8. **Data Independence:** Data stored in file system depend upon the programming language in which data files are created. Whereas, data stored with DBMS is independent form type of programming language use in application program.

Disadvantage of Database Systems:**((NOV 98))**

1. **Insufficient Database Expertise:** This is the most serious disadvantage of database technology. Database technology is complex and too few organizations have the necessary expertise to implement and manage data bases properly.
2. **Data Security and Integrity:** Many users have access rights to database and this makes database potentially available to every user and this may cause serious security problems.
3. **Increased Data processing and Maintenance Cost:** If utilities of keeping data in database are not essential then this process may lead to an increased data processing and data maintenance cost.

9.0 Types of Database:**((MAY 06))**

The growth of distributed processing, end user computing and decision support system and executive information system has led to the development of several databases. Followings are some of the important types of databases.



Types of Databases

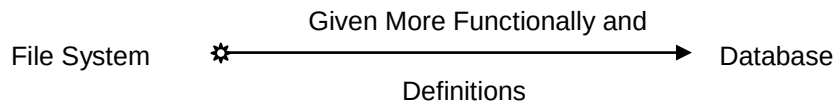
1. **Operational Database:** These databases keep the information needed to support the operation of an organization. These are main day to day working databases like customer database, employee database and inventory database etc.
2. **Management Database:** These databases keep the selected information and data, extracted mainly from operational and external databases. These databases are part of decision support system and executive information system to support the decision making process of management.
3. **Information Warehouse Database:** A data warehouse stores the data of current and previous years. This is usually a data that has been accumulated from operational and external databases over the years. This data helps users in analyses of various trends of business activities over a period for decision making process. These databases are also a kind of central storage data which is available to all the users of an organization.
4. **Distributed Databases:** These are the databases which are local to departments or regional offices etc. these databases include the common operational database as well as the database at user end. These database main aims is to ensure that organization database is distributed but updated concurrently to have any time updated information like in Railway Reservation System.
5. **End user Databases:** These databases consists of various data files of word, excel and database which an end user has generated at his end or these database also consists the copy of common centralized or distributed database at end user work station.
6. **External Databases:** These databases are also known as online databases provided by various organizations either free or at a nominal Fee. The information of these databases helps management in decision making process.
7. **Text Databases:** These are informative databases available normally on a CD-ROM Disk for certain price. These databases are normally in documents form but with features like search, modify etc, example: databases of industries located in and around Mumbai is available in CD.
8. **Images Databases:** Normally databases contain alpha numeric information. But there are databases which contain images for various categories. These databases are also available either on internet or come in CD at some price. These databases are normally used by advertising, publishing, entertainment and web site development agencies.

10.0 DBMS Definition:**((NOV 11))**

DBMS: Database Technology began to replace file system in the mid-1960, As we are aware that initially the data was maintained in file system and smallest items in the file system that has meaning in the real world is a data item (field), for example Last Name, First Name, Address, City Pin Code etc. A Group of related items (Fields) treated as a unit by an application is called record. Like above example is an Address record. File is a collection of records of similar type.

Database Management System have build upon on the above concept and expanded this definition to add some quality features for ease of operation on data (Records) like insert, delete, and update and search any record efficiently. Or we can say in database these data items are maintained in table forms.

Database is collection of data in tabular manner. In Database (Relational Database), a data item is called an attribute (Field), a record is called a row or topples, and a file is called a table.



The motivation of using database rather file was greater availability of data to diverse set of users, integration of data for easier access and update for complex transactions, and less redundancy of data.

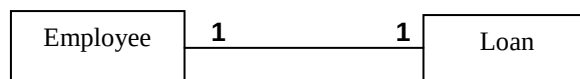
These features required for database are bundled together into a software product known as DBMS (Database Management System).

DBMS is a specific type of software product that is meant to manage database and most of the DBMS are now a days are RDBMS (relational database management systems) which keeps the records in various tables in Related manner.

11.0 Record Relationship in Database:

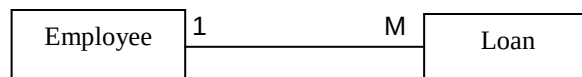
Relationship databases are organized in logical records which are related with each other's. There are several types of relationships that can be represented in database.

1. **One to One relationships:** In this one individual record of one table is related with one individual record of other table.



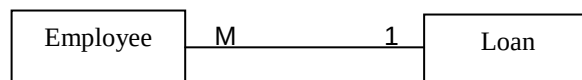
e.g. one Employee can one given one Loan only

2. **One to Many relationships:** In this one individual record in one table is related with many records of other table.



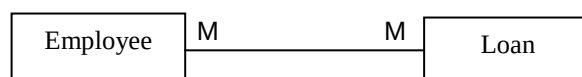
e.g. one Employee can be given many Loans

3. **Many to One relationship:** In this many records in one table is related with one individual record of other table.



e.g. many employees together are given one Loan only

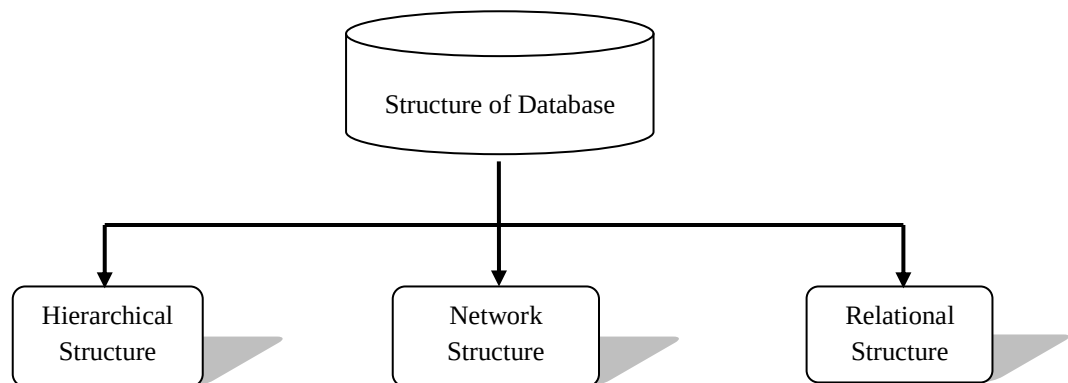
4. **Many to Many Relationship:** In this many record of one table is related with many records of other table.



e.g. One employee can be given many Loans and One loan can belong to Many employee together.

12.0 Structure of a Database:

Three traditional approaches have been implemented commercially to organize records in Database and these are known as structure of database.



(1) Hierarchical Database Structure: In this records are logically organized into a hierarchy of relationships. This structure is like an inverted tree. For example Building, Rooms and Equipments records etc or database structure of management of an organization. **((MAY 05, NOV 07))**

The top record in hierarchy is known as root record and all the records keep parent child relationship in this type of database structure.

Diagram of Hierarchical Structure Here:

Advantages and disadvantages of Hierarchical Structure:

1. **Simplicity:** Since the database is based on hierarchical structure. The relationships between various layers are logically simple.
2. **Data Integrity:** Since the relationship is based on parent / Child theory therefore there is always a link between parent and child which enforce data integrity.
3. **Efficiency:** This database structure is very efficient one when database contain one to many relationships.

Disadvantage:

1. **Implementation complexity:** Although the structure of this database is very simple but it is difficult to implement.
2. **Database Management Problems:** If we make any changes in hierarchical structure then there would be changes in all the application programs which are accessing it.
3. **Implementation limitation:** This structure is mainly based on One to Many relationship. But in real life many of the relationships are not one to many.

(2) Network Database Structure: A network model replaces the hierarchical tree with a graph thus allowing more general connection among nodes. The main difference of Network model and hierarchical model is its ability to handle many to many relationships. In Network Model a relationship is a set. Each set is made of at least two types of records. An Owner Record (Parent in Hierarchical)

and a member record (Child in Hierarchical). The difference is, network model allows a record to appear as member in more than a set thus facilitating many to many relationships.

Some of the advantages of network structure are conceptual simplicity, Data Integrity, Capacity to handle more relationships types and Ease of data Access.

And some of the disadvantages are System complexity (Implementation complexity) and absence of structural independence.

- (3) Relational Database Structure:** Relational structure is most popular database structure. It stores the data in form of table. Relational database are powerful because they require few assumptions on how data would be related and how data would be extracted. Another important feature of relational structure is that single database can be spread across several tables. Relational model uses table to organize data. Each table is equivalent to an application entity like employee and each record (row) is object of application.

Other important advantage of Relational Structure is SQL (Universal RDBMS) operational Language) (Structure Query Language) serves as uniform interface for creating and manipulating database.

Relational type of database system are dominant type of systems for well formatted business databases, RDBMS provide a greater degree of simplicity and data independence than the earlier Hierarchical and Network type of DBMS.

In RDBMS the data is maintained in the linked tables which are linked with the help of keys. There are different types of keys as shown below:

Key: A key is identification for data, and key items in database are used to represent the unique data records like account number, PNR and PAN number.

Primary Key: This attribute to a data field provides uniqueness to data for identification e.g. bank account number is used as primary key

Candidate Key: When many data fields are available to act as primary key then all these data fields are known as candidate key e.g. Account Number and PAN number can be used as primary keys so both are the Candidate Keys i.e. candidate to become the primary key.

Alternate Key: There may be a data field other than primary key which can also provide uniqueness to data e.g. PAN no. in bank account data base.

Secondary Key: It is that candidate key which is not selected as primary key. It is same as alternate key.

Referential Integrity: This refers to linking of two data values i.e. one data value is referred with the help of other and this helps to enforce data integrity or correctness. For example, a loan table will not have a record of loan to an employee or customer until that employee or customer will not have his/her name in the employee master or customer master table.

Referential integrity in the database is ensured by establishing a relationship or linking between tables.

13.0 Other Database Models:

The following are some popular database models.

(1) Distributed Database:

Distributed databases helps to provide the organization services from any location e.g. banking and mobile phone services. In this databases are distributed at various locations of organization but these databases are connected with each other's to provide services from anywhere.

Distributed databases works on two techniques.

1. Replication and
2. Partitioning

In replication techniques same database and resources are maintained at all the locations of organization and these are connected with each other using network i.e. resources are replicated at each location. Like all the bank's branches, regional offices and head office would maintain similar resources. This technique is a very high costly technique normally not used for creating distributed databases.

In partitioning technique each location maintains its own database and resources but at the same time at one common place like head office all the shareable data elements are also maintained. All locations databases are connected with this common database to access the data of other locations to provide services from any location. This is a popular technique of creating distributed databases. Banks etc. uses this technique for creating distributed databases

(2) Object Oriented Database:

The object oriented database model is the latest development in database technology. In this all the elements of database are modeled as objects and these objects can be linked together to create entire database structure.

In this model objects are formed in hierarchical structure using a concept known as inheritance. Object Oriented Database are based on the principle of Object Oriented Programming Languages i.e. write once use many times. The structure once created can be used anywhere. These models provide efficient database. The Object Oriented databases help to increase the productivity of databases designer for design of database and users for use of database.

The object-oriented model is based on collection of objects (Records). And Object contains values in the form of data fields. An object also contains methods that operate on object.

(3) Client Server Database:

These Databases are also known as Database Server i.e. provides data related services. In this one or more database server is used and many clients (Work Stations) interact with these servers to obtain requested data e.g. ATM machine is a client and it always remain connected with bank database server to provide banking services to customers.

There are two popular methods to use Client / Server Databases model

1. Two Tier
2. Three or N tier

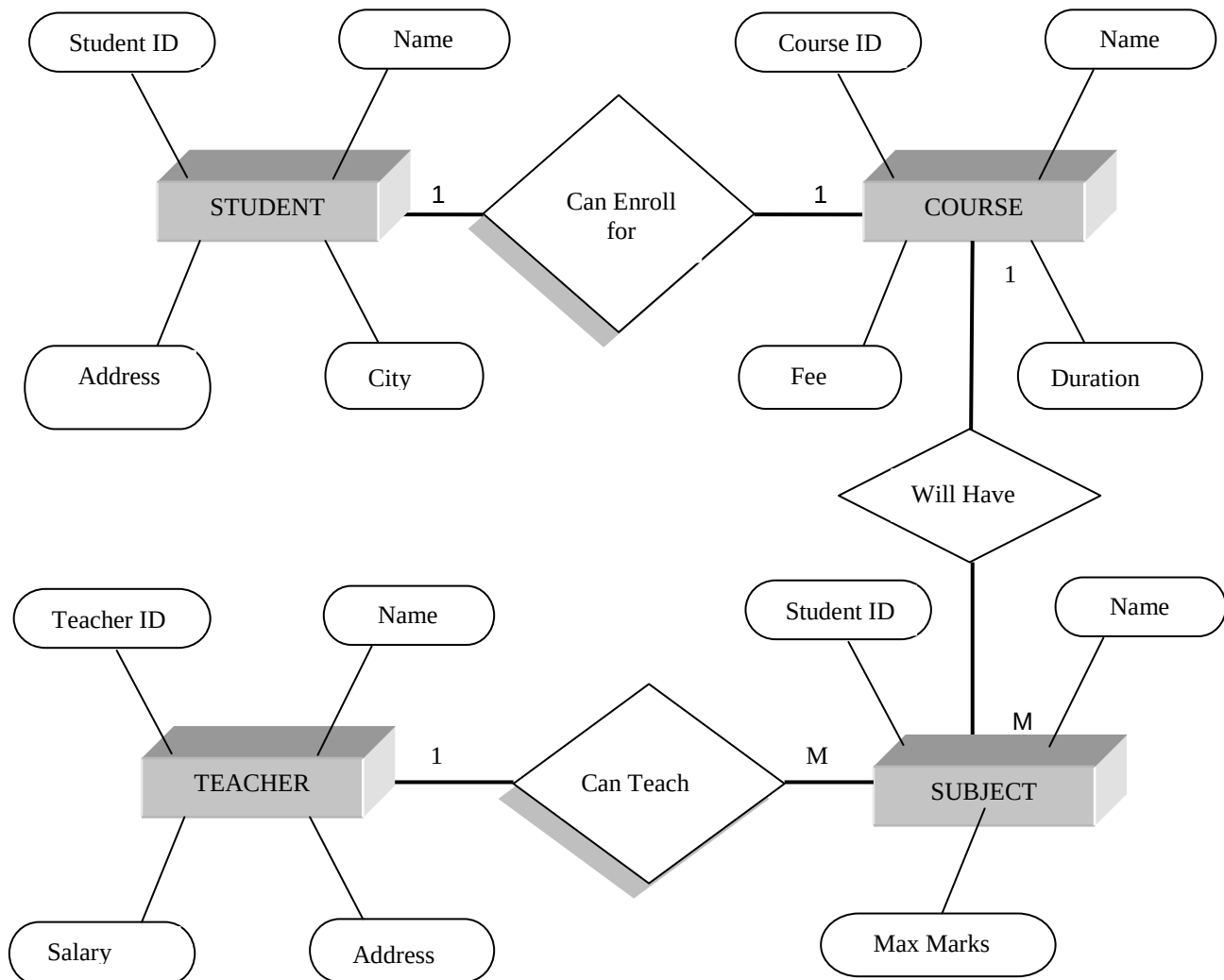
In two tier the client directly interact with database server. And in three tier client interact with database through a intermediate server known as application server.

(4) Knowledge Database:

These databases are collections of knowledge of experts in an organized form. In this type of database the experts historical knowledge for problem solutions are organized to provide help for solutions of future problems. Such databases are part of DSS (Decision Support System), Expert System and EIS (Executive Information System)

Entity Relationship (ER) Model**MAY 12**

E-R model is a specialized graphic model which provides relationship between entities in a database. E-R Model provides a design or conceptual schema of database.

**E-R Diagram**

Here Student, Course, Subject and Teacher are entities (they have attributes like id, name etc) and they have relationship with each other. These entities are converted to tables in the database and attributes become the field of database. So **E-R model is a database design method just like flowchart is program design method.**

14.0 SQL: Structured Query Languages and Natural Language**NOV 04**

It is database language which contains set of commands for creating, updating and accessing data from database. Query languages allow managers and users etc, to ask ad-hoc question to database interactively without the aid of programmers. Some of the important commands of SQL are CREATE, UPDATE, DELETE, SELECT, and INSERT etc.

e.g. `SELECT * FROM EMPLOYEE_MASTER WHERE EMPLOYEE_SALARY>5000`

SQL allows users to retrieve data from database without having detailed information about the structure of the records and without being concerned about the type of DBMS. Knowing query language is very useful for users and managers to access the information as per his choice and requirement without depending upon programmers.

There are two types of commands in SQL (1) Data Manipulation Commands e.g. SELECT UPDATE, DELETE and INSERT. These commands are used for working on data values (2) Data Definitions Commands e.g. CREATE and ALTER etc these commands are used for creating database structure like tables etc.

SQL some time expressed as natural language of DBMS but natural language is also known as language in which users can provides commands without predefined syntax.

Queries:

Select statement is the most useable statement of SQL. This statement provides the required information form database. This query contains many key words like SELECT, FROM, WHERE, ORDERBY, GROUPBY etc.

For example:

Select FirstName, LastName, Address, Loan_Amount From Employee_Master, Loan_Master Where Employee_Salary > 50000 Order by LastName

This SQL statement will provide the employee FirstName, LastName, Address and their Loan Amount from two tables (i.e. Employee_Master and Loan_Master) where salary is greater than 50,000 and output will be sorted by LastName

15.0 Parts of DBMS or Database System:**NOV 04**

In general, a database and DBMS software is called a database system. A database system contains the following four key parts:

- Data
- Hardware
- Software
- Users

1. **Data:** This is most important part of database system because for the management of this part the entire database system is developed. It is a collection of data and data files in an organized form. Data is maintained into integrated form in one or more database which can be accessed or share by many users either directly or through application programs. The data elements are stored in such a

way so as to achieve the data management objectives like speedy access of data, up-dation of data, maintaining data integrity and consistency, and allowing concurrent access of data.

2. **Hardware:** Hardware consists of secondary storage like hard disks, CDs, DVDs etc on which data is marinated. Since data volume can vary a lot depending upon organization to organization, therefore there should be appropriate selection of hardware.
3. **Software:** This part consists of software which helps to access and store the required data. Generally, this part consists of application software along with DBMS which help to access and manage data efficiently.
4. **Users:** a database system consists of different types of users:
 - Application Programmers or System Analysts: These users develop the user friendly application programs for end users so that the end users can work on database.
 - End Users: These users access the data by using application program interface, provided by application programmers. For example, n the banks' branches the banks' employees will be the end users.
 - Database Administrator (DBA): This user is responsible for monitoring the performance, maintenance and security of database.
 - Database Designers: This user is responsible for designing the structure of database i.e. tables and fields etc in which data is maintained.

16.0 Database Components:**NOV 00, MAY 03, NOV 05, MAY 07. MAY 11**

A DBMS consists of a collection of interrelated data and a set of programs to access and manipulate those data. The collection of data, usually referred as the database, contains information about one particular enterprise. The primary aim of DBMS is to provide an environment that is both convenient and efficient to use in retrieving, manipulating and storing database information.

A DBMS is a generalized software system for manipulating databases. DBMS supports a logical view (schema, subschema); physical view (access methods etc.), Data Definition Language (DDL), Data Manipulation Language (DML) and important utilities such as transaction management and concurrency control, data integrity, crash recovery and security.

Some of popular DBMS in the Market are MS-ACCESS, ORACLE, FOXPRO, SQL-SERVER etc.

There are two constituent of any DBMS:

1. DDL (Data Definition Language): This is that part of DBMS which contains the statements for creating and modifying the structure of database like CREATE, ALTER and DROP statement. Suppose we want to create a table for employee to maintain the records of employee than we will use DDL statement CREATE to create employee table.

```
CREATE TABLE EMPLOYEE
```

2. DML (Data Manipulation Language): This helps in manipulation of crated database. Suppose we have created a database for employee name AMIT. We will use the UPDATE statement to change phone no. e.g.

```
UPDATE EMPLOYEE SET PHONENO = 3456789 WHERE NAME = "AMIT"
```

17.0 DBMS Structure

1. **DDL Compiler:** It converts data definitions (DDL statements) statements into tables
2. **Data Manager:** It is a central software component which convert users operations to physical file system
3. **File Manager:** It is responsible for managing data files. It provides the required space to data files on disk. It also searches the required record in the file.
4. **Disk Manager:** It is part of operating system. It manages all inputs and outputs operation of data physically from disk
5. **Query Manager:** It interprets user queries and convert these queries into efficient operation for database.
6. **Data Dictionary:** It maintains information related to structure of database like names of tables, fields in table's etc. data dictionary helps in error free operation of database. This is also known as metadata i.e. it maintains data about data (it contains data about database). It maintains data about database in terms of names of tables, fields and their types in the table, and authority of access on any database etc. The data dictionary in a way maintains the structural information of database.

MAY 03, MAY 05, MAY 07

Data Administrator and Database Administrator

Data Administrator (DA): Data Administrator is a person who, normally help organization to make policies regarding database development and its controls. Data Administrator decide what data will be stored in database, who al will be accessing what part of database etc. This is more an administrative function rather than the technical function.

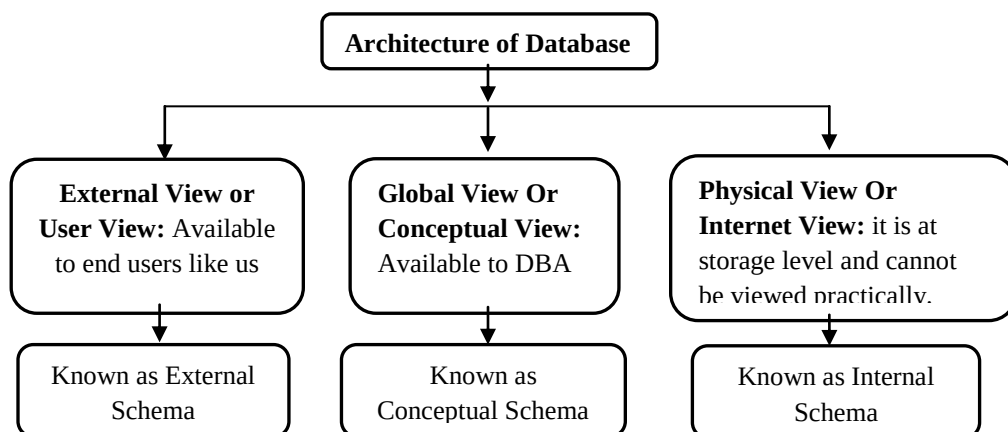
MAY 02, NOV 03, MAY 06

Database Administrator (DBA): DBA is a person who uses the functionalities provided by DBMS to manage the database and its environment. Database Administrator is responsible for implementing policies for data use set by organization for its users by using various functionalities provided by DBMS. DBA uses functionalities of database like DDL, DML, security features, integrity controls Transaction Management etc to provide secured and efficient database.

DBA is a technical professional having an experience in use of DBMS for efficient management of database. DBA is responsible for monitoring the performance, maintenance and security of database.

18.0 Architecture of Database:

A Database follows three level of architecture



- (1) **External View:** It is known as highest level of database abstraction and also known as subschema. It is available to users to view data e.g. users working on banks computers are uses this view of database.
- (2) **Global View:** This view of database is known as logical schema and it is available to Database Administrator. This view provides the tables their relationships etc of database to DBA. By using this view DBA can structure the database:
- (3) **Physical View:** This view is available at storage level i.e. at hard-disk level. This view is practically not available to any type of user and it is also known as schema. At this level data is physically stored in the storage device.

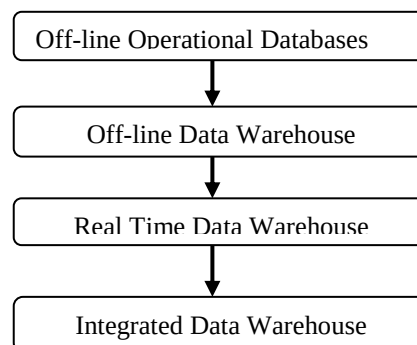
19.0 Data Warehouse:**NOV 11, MAY 08**

A data ware house is computer database that collects and store data in a form to produce correct and timely information with an aim to support data analysis.

Data warehouse; you can imagine are like a well-structured goods store. These databases are developed to handle large volume of information in an intelligent manner, to provide information as well as analysis together. The users of data warehouse are banks, telecom organizations where large volume of data is generated every day.

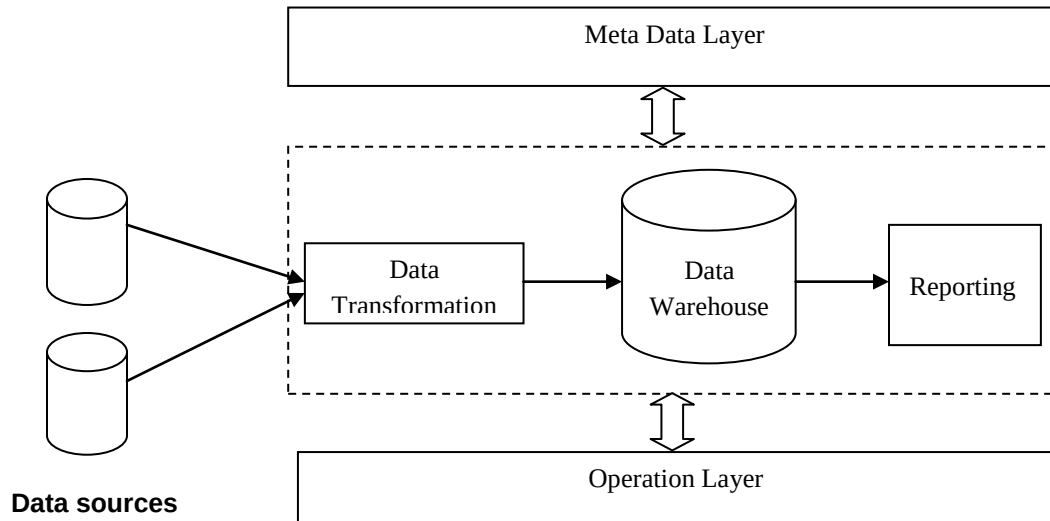
The data warehouse is centralized storage of data collected from different sources. The data warehouse has emerged from various stages of developments over the years and these are

1. **Off-line Operational Database.** This was a simple copy of operational database to an off-line server, to support reporting and analysis without impacting performance of operational databases.
2. **Off-line Data Warehouse:** Data warehouses at this stage were periodically updated from operational databases automatically to support reporting and analysis.
3. **Real Time Data Warehouse:** Data warehouse at this stage are updated on a transaction basis from an operational database and provide reporting and analysis based on always updated information
4. **Integrated Data Warehouse:** This stage is an enhancement of real time data warehouse, in this stage the analysis information of data warehouse is passed back to operational database, which can be used as daily activity of organization for efficient working.

**Development Stages of Data Warehouses**

Components of Data Warehouse:

Following are components of Data Warehouse

**Components of Data Warehouse**

- (1) **Data Sources:** There are sources of data for data warehouse. Data sources provides organizational data collected at various locations in the various format like tables, text files, spreadsheets etc.
- (2) **Data Transformation:** This component clean and standardize the data received from data sources. The standardize data is than stored in the data warehouse repository. We can say this component transform data of data sources available in various format to a standard format
- (3) **Data Warehouse:** Data warehouse is a relational database which maintain the data in standard and organized form to support required analysis and reporting
- (4) **Reporting:** This is one of the most powerful components of data warehouse. This component provides various tools or software which helps to produce different analytical reports, for example:
 - (a) **Business Intelligence Tools:** These are software tools which help to provide intelligent business reports (i.e. reports which help in decision making) in a user-friendly manner.
 - (b) **Executive Information System:** These are software applications that are used to display complex business information for top management in an easy to understand graphical format.
 - (c) **Online Analytical Processing Tools:** OLAP tools divide data into logical multi-dimensional structures and user can select the required dimensions.
 - (d) **Data mining tools:** These are tools which help to provide reports or information by applying mathematical/statistical rules on data and by analyzing data and trends of data warehouse.
- (5) **Operation:** Data warehouse operation contains process of loading, manipulating and extracting data from data warehouse. This also cover security and efficient management of data of data warehouse
- (6) **Metadata:** This component helps users of data warehouse about information held in the data warehouse in terms of type, date and owners of information etc.

Other Optional Components of Data warehouse: The following components also included in the data warehouse:

- (1) Dependent Data Marts:
- (2) Logical Data Marts:
- (3) Operational Data Store:

A Data Mart is a simple from of a data warehouse that is focused on a single subject (or functional area), such as Sales, Finance, or Marketing. There are two types of data marts: dependents and independent (logical). The difference is based on the data source that feed these data marts:

- (1) **Dependent Data Marts:** Dependent data marts draw data from a central data warehouse that has already been created. It is a physical database and receives its information from same hardware (or on a separate hardware) where data warehouse is created. The purpose of this data mart is providing specific information related to a particular department or sub-group in faster manner.
- (2) **Independent Data Marts:** It is a filtered view of main data warehouse and does not exist physically as separate copy in any hard disk. This type of data mart delivers the same benefits as dependent data mart but does not require costly disk space.
- (3) **Operation Data Store:** This is same as operational database. It maintains the current and near-term data. An operational data store may contain information for 30 to 60 days while a data warehouse generally contains years of data. Operational Data Store helps to provide real time reporting if loading time or architecture of warehouse prevents it to provide real time reports.

NOV 11

Different Methods of storing data in the Date Warehouse:

There are mainly two methods of storing data in the data warehouses.

1. **Dimensional:** In this data is stored by facts e.g. sales data can be stored by country, regions, city, products category and product etc this method provides a top to bottom approach of data storage
2. **Normalization:** In this data is stored in third normal form. (I believe here third word is going to raise a curiosity in your mind, but for the time being you can relate it like 3G mobile services) Third normal from is technique of dividing and storing data in related form.

Advantages and Concern of Data Warehouse:

Advantage:

1. Helps to access wide variety of data
2. Helps to increase productivity by providing quality reports
3. Combines data from various data sources
4. Helps to increase consistency in data by converting data in a standard form

MAY 2011,
MAY 2008

Concept:

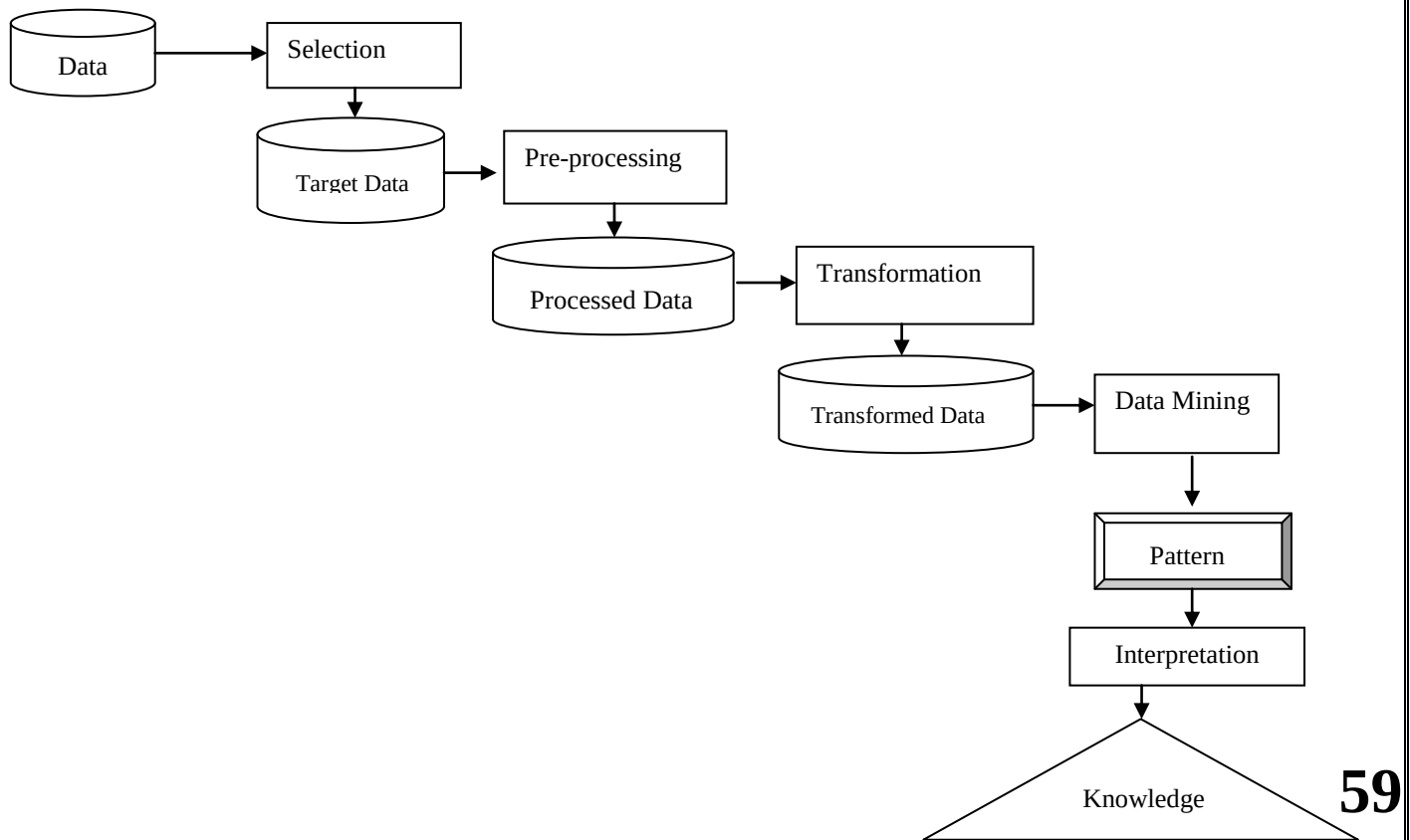
1. Extracting, cleaning and combing data can be time consuming process
2. Require high maintenance
3. Require high technical skill and cost to maintain data
4. Problems of compatibility with system already in place

20.0 Data Mining:

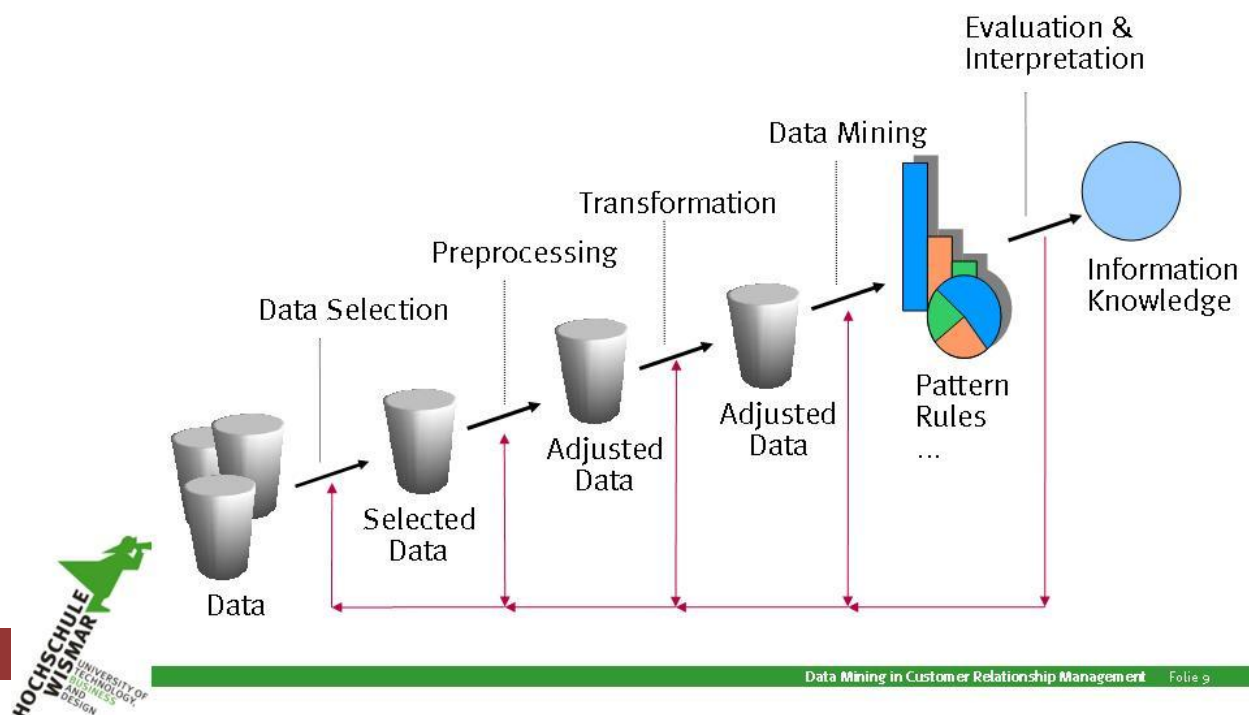
MAY 2010

Data mining is a tool or technique of finding unusual pattern from large volume of data automatically. This technique automatically provides some information, which can be very helpful to management for decision making e.g. finding those customers information, which have interest in sport goods by looking at their purchasing pattern over the years. Data mining can be related to a tool used for finding gold out of coal mines automatically. Data mining tool convert a raw data into knowledge, not in just simple information.

Following stages or processes are used to convert the raw data into knowledge.



Data Mining Model



Data Mining Operation

1. **Selection:** In this target data is selected from large volume of data.
2. **Preprocessing:** In the target data is pre-processed for required data fields or information. The non-required data fields are removed from the target data
3. **Transformation:** In this stage processed data is transformed in a form such that it can be Easily Navigated
4. **Data Mining:** This is the most important stage; in this the data is converted into certain patterns for extraction of knowledge out of it.
5. **Interpretation and Evaluation:** In this stage the data patterns are converted into useful Information known as knowledge based information, which helps in efficient and effective decision making process.

21.0 Documentation and Program Library:**((NOV 02, NOV 04))**

This topic discuss about the importance of documents and programs (software) for organization and accordingly system required to manage these efficiently

Following are some of the important types of documents required in the organization

1. Strategic and operational plans documents
2. Database documents
3. Application and program documents
4. Operational manuals
5. User manuals
6. Standard manuals

If an inefficient system is in place for documents management then this may lead to problems for the organization.

The following are some of the difficulties faced in documents management by the organization.

1. Responsibilities of maintaining documents are distributed to almost all the users therefore a non standard way of maintaining documents emerges, which may create problems in accessing documents when required
2. Documents are stored in a multiple forms and locations therefore some documents are stored repetitively and create problem in management

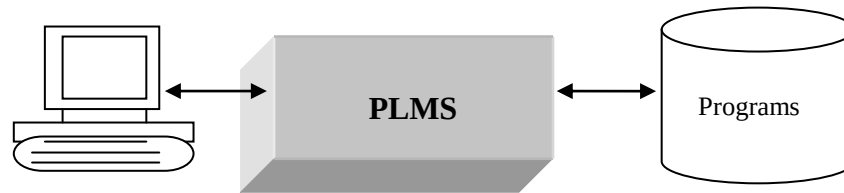
Therefore a document librarian may be employed by organization whose responsibilities are to ensure

1. Documents are stored with proper security
2. Only authorized users can access documents
3. Documents are updated regularly
4. Adequate backup exists for the documents

Various types of software are available in the market, which can help document librarian in this task and these software are known as Program Library Management System (PLMS)

Program Library Management System

The Following are some key functional capabilities of PLMS software



1. **Security:** Provides following facilities for documents security
 - (a) Password
 - (b) Data encryption
 - (c) Automatic backup
2. **Integrity:** Provide following facilities for document integrity
 - (a) Maintain track of all the changes in the previous documents
 - (b) Maintain track of documents deleted and new documents added etc
3. **Reporting Facilities:** Provides different types of reports to management e.g.
 - (a) List of documents
 - (b) Added and deleted documents by data and month etc
4. **User Interface:** Provide a user friendly interface which assist for efficient management of management.

22.0 Backup and Recovery:**MAY 12**

Backup of a database is created for security purpose. In case original database is destroyed than same can be restored with the backup of that database.

The present DBMS software provides backup and recovery utility programs, which helps in auto backup and recovery of database i.e. these utilities programs automatically create the backup of database. And, also in case working database is destroyed due to any disaster than recovery programs automatically recover the destroyed data from backup database.

There is another term known as disaster recovery, which is actually recovering the system like operating system and other programs also before the database recovery.

For database recovery, a system uses the help of log files and these files are known as Transaction log and Mirror Log. Transaction Log records all the changes performed on database. And Mirror Log is a kind of backup of Transaction Log. It provides additional protection in case transaction log is destroyed.

Online Backup, Offline Backup and live Backup: These are the three popular types of backups.

Online Backup: ((May 09))

In Online Backup the database is backed up while system is in use with the help of transactions log i.e. backup can be taken while users are working on system.

Off-Line Backup:

In case of Off-Line Backup the system should not be in use by users and while database is backed up.

Live Backup:

In Live Backup there is no delay in any activity performed by users and its backup on another system. We can say live backup is an advance form of online backup.

Developing Backup and Recovery Strategy:

While implementing a successful backup and recovery system for database following steps should be the part of an efficient strategy

1. **Understand the need for backup and recovery:** First of all, organization should understand the need and importance of backup. Is backup and recovery necessary for survival of your business? Like we all can imagine banks cannot survive without backup and recovery of database,
2. **Management should commit time and resources:** i.e. there should be timely availability of adequate resources like storage media and dedicated computers etc for backup.
3. **Develop procedures for backup and recovery:** There should be pre-defined efficient procedures or rules for backup and recovery, in terms of: timing of backup, documentation and testing or checks etc. Organization should deploy the backup and recovery procedures and should time-to-time monitor their working
4. **Beware of external factors that affect recovery:** Like hardware and software i.e. these should be in proper working conditions.
5. **Regular Testing:** Organization should protect database backup by performing regular health checks

62**FUN PAGE: Mark Zuckerberg**

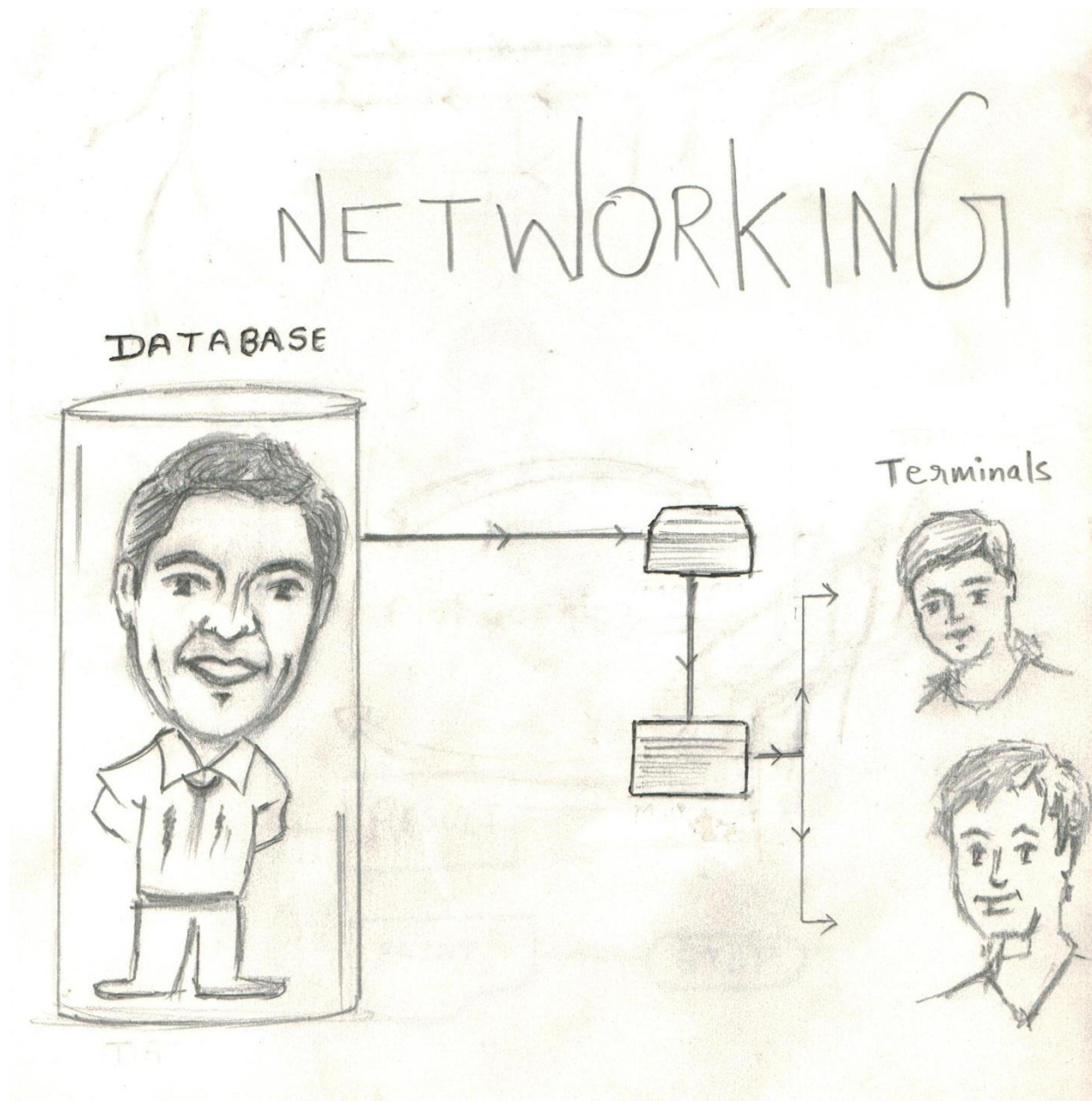
Mark Elliot Zuckerberg is an American computer programmer and Internet entrepreneur. He is best known for co-creating the social networking site Facebook, of which he is chief executive and president. It was co-founded as a private company in 2004 by Zuckerberg and classmates Dustin Moskovitz, Eduardo Saverin and Chris Hughes while they were students at Harvard University. In 2010, Zuckerberg was named Time magazine's Person of the Year. As of 2011, his personal wealth was estimated to be \$17.5 billion. 'Princely', 'Slayer' and 'Zuck'. These all are the various nicknames by which Mark Zuckerberg is often called by. Mark Zuckerberg also has a successful Hollywood film, 'The Social Network' dedicated to him which maps the birth and rise of Facebook. Mark says Money and fame isn't important for him. Mark Zuckerberg rejected a \$1 billion offer to buy Facebook.



(14-5-1984)

(V.IMP) Question from my Desk for DBMS

- Q.1 Describe various factors which determine the best file organization for an application.**
- Q.2 Distinguish between DDL & DML**
- Q.3 Describe the features of various Database structure.**
- Q.4 Explain the management problems that exists in File Processing Systems.**
- Q.5 Describe the various types of file organization methods.**
- Q.6 Short Notes on Program Library Management System.**
- Q.7 Distinguish between DDL and DML.**
- Q.8 Describe the functions performed by a database administrator.**
- Q.9 Discuss the various components of database environment.**
- Q.10 What do you mean by Data Mining. Explain its development Stages.**
- Q.11 Elaborate the various types of Backups.**
- Q.12 Define Data warehouse and explain its component.**



Chapter: 3 Computer Networks & Network Security**1.0 Computer Network:****NOV 2002**

A Computer network is a collection of computers, peripheral devices (I/O Devices) and terminals connected together by a communication system. The set of computers may include large-scale computers, mini computers and microcomputers. The set of I/O devices and terminals may include printers, scanners, terminals and work stations of various kinds, etc.

Before getting into the details on types and working of computer networks, we have to understand why we use the computer networks. Computer Networks are created or we can say networking is done mainly for two reasons.

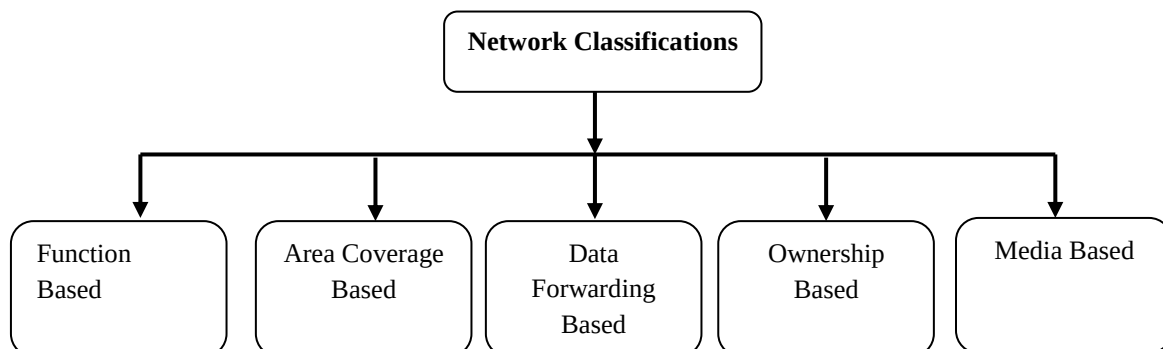
1. **Sharing of Information**
2. **Sharing of Resources**

When we have stand alone computers then every computer will have its own database; and may be this database will have data values which will be common with data values of other computers databases i.e. there will be redundancy of data if every computer still have their own databases. And in some cases, we may have one large size costly laser printer which everyone wants to share.

In case of non-networking, it is very difficult to share information among the databases of various computers and share common costly resources. By connecting all the computers and others devices with each others in networking mode we can share data as well the resources. And, we can also avoid the duplicate entry of common data in various databases which in turn save resources (memory, processing power and manpower efforts); and this also helps to increase the productivity of user. So the primary objective of networks is sharing this can be file sharing, devices sharing, programs (application) sharing, memory sharing, etc.

1.1 Classification of Networks:

Network can be classified in the different categories: Like function based, Area coverage based, data forwarding based, ownership based and media based.



1	Class 1	Function Based Classification
	Data Network	This Network transmits Data
	Voice Network	This network transmits Voice
	Multimedia Network	This Network Transmits Voice, Images and Video
2	Class –II	Area Coverage Based
	LAN	Network with Limited Coverage
	WAN	Network with Unlimited Coverage
	MAN	Network Within a City
3	Class –III	Data Forward Based
	Switched Network	Provide point-to-point data communication i.e. data is switched to required user
	Share Network	Provide broadcasting communication by using a HUB i.e. data can be seen by every user on network
	Hybrid	It is mix of switched and share network
4	Class –IV	Ownership Based
	Public Network	Any user can use these network e.g. Internet
	Private Network	Used by particular organization, not available to outside world user
	Virtual Private Network (VPN)	VPN uses public network but for secured private network access from anywhere i.e. it provides secured private communication from anywhere
	Leased Network	Dedicated leased lines are used to provide network communication
5	Class – V	Media Based Classification
	Wired Network	Network uses physical channels for communication like Cable,
	Wireless Network	Network uses wireless channels for communication

However, are coverage type networks are considered as the most popular network types

(i) Local Area Network (LAN):-

((NOV 02, NOV 05))

LAN is a network which covers a limited area. LAN is most usable network types. A typical LAN consists of many computers and devices connected together within in a limited distance, or within building premises. LAN has become a key medium for any organization to share information and resources within the organization. LAN is easy to construct and take a little amount of extra cost to build up from standalone computers; also, data transmission among users is done at a very high speed and normally on a low cost cable.

LAN provides highest speed of data communication because communication channels are dedicated on one-to-one basis among connected devices and also provides lowest error rate because of short distance communication. Examples of LAN use are Internet Café, School and College network, etc.

(ii) Metropolitan Area Networks (MAN):-

A metropolitan area network (MAN) is somewhat in-between a LAN and WAN. MAN is usually a network that connects computer systems or LANs within a city. MAN mainly uses high speed optical fiber to connect one point with other point in a city. MAN can support data as well as the audio/video signals. Cable television networks are examples of MANs that distribute television signals within a city. MAN communication speed is normally in-between LAN and WAN i.e. higher than WAN but lower than LAN. Similarly, the error rate of MAN is normally higher than LAN but lower than WAN. Examples of MAN are local city network of telephone, television, water supply department, etc.

(iii) Wide Area Networks (WAN):-

WAN covers a large geographic area with various communication facilities such as long distance telephone services, satellite transmission and under-sea cables. The WAN typically involves powerful computers and many different types of communication hardware, and software. Examples of WANs are interstate banking networks and airline reservation systems.

WAN effectively provides a slow speed communication because communication channels used in WAN are ultimately shared among many users for data communication. Error rate of data communication is also the highest in WAN in comparison to LAN and MAN due to large distance involved in data communication. Examples of WANs are banking network, mobile phone network, railway network, etc. Internet is also a WAN.

2.0 Networking Models:**NOV 04**

There are two types of networking models:

- (1) Client Server
- (2) Peer to Peer

Client Server Model:

- ❖ In this architecture, one or more computers are used as dedicated servers i.e. one or more computers are dedicated to provide various services; and these dedicated computers are known as servers. All other computers (workstations) on the network are known as clients.
- ❖ To share any particular application, these clients request the server for that application and server then allows the clients to use requested application
- ❖ Client Server is the most popular and common network model; and it is used to provide a secured and reliable network.
- ❖ Most common type of client server arrangement is a LAN wherein a server is used to provide services to many microcomputers or clients in the networking mode.
- ❖ Some popular users of Client Server architecture are Banks, Railway, Internet, etc.

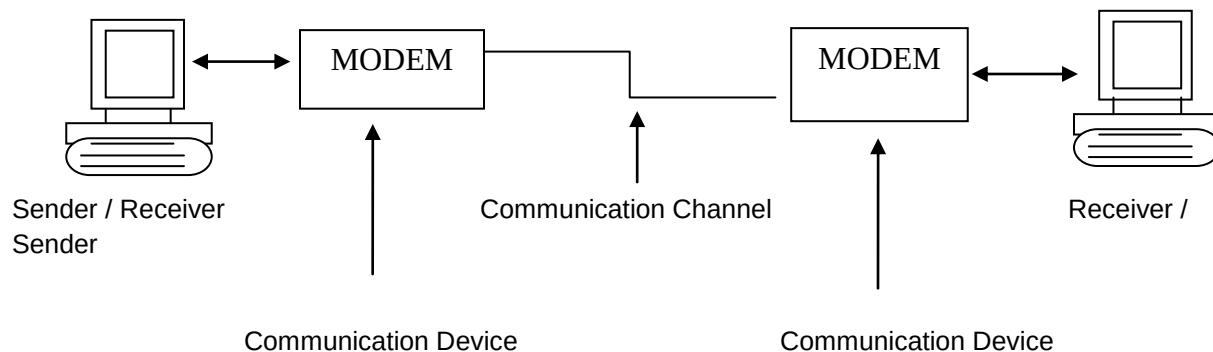
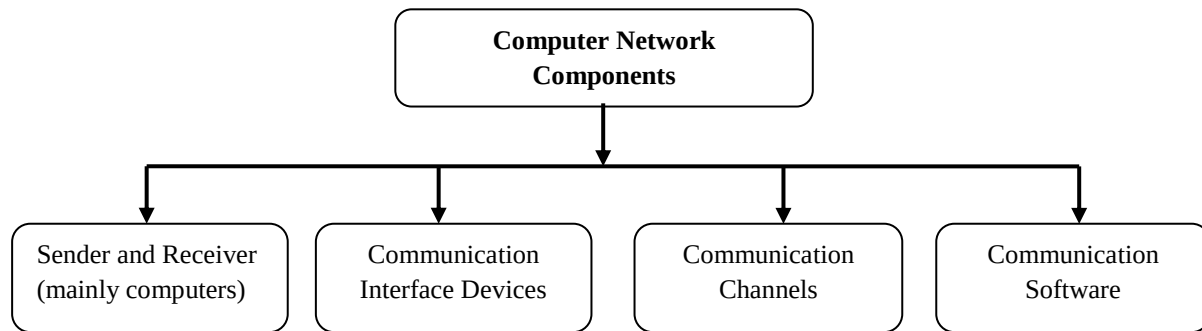
Peer to Peer Model:

- ❖ In this architecture, no dedicated servers are used. All the computers are at equal levels, and therefore termed as peers. Normally, each computer can function both as client and server.
- ❖ This type of arrangement is suitable when limited numbers of users are there and security of data is not a very important criteria.
- ❖ The main advantage of this architecture is simplicity of its design and maintenance.
- ❖ In this architecture, computers are not dependent on a particular computer for data communication and resources sharing
- ❖ This is a low cost and easy to maintain architecture and linking computers in peer to peer network is significantly easier than client server mode.

3.0 Components of a Computer Network:

There are five primary components in any computer network; and these are also known as **DATA COMMUNICATION SYSTEM COMPONENTS**

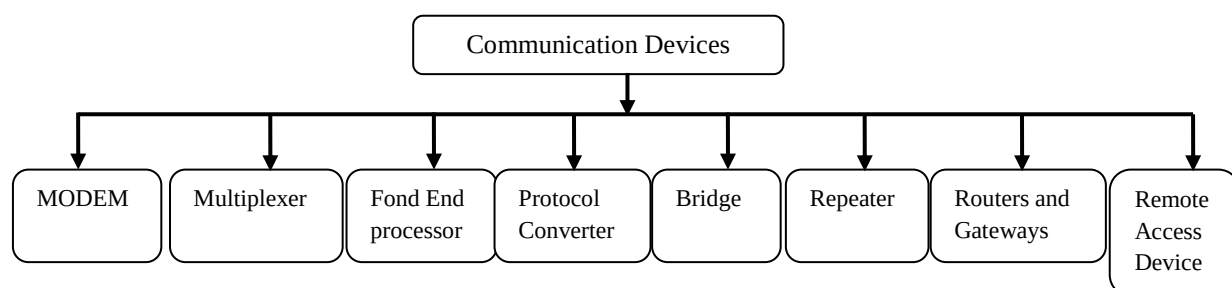
To transfer information among various users, spread geographically, we require following basic components in computer network for data communications.



Computers (Senders and Receivers): These are devices used for sending and receiving the data and information, normally these devices are computers.

Communication Devices:

These are the devices which help in communication of data. Communication devices are mainly used for connecting sender and receiver with communication channels for data communication. Followings are some popular communication devices:

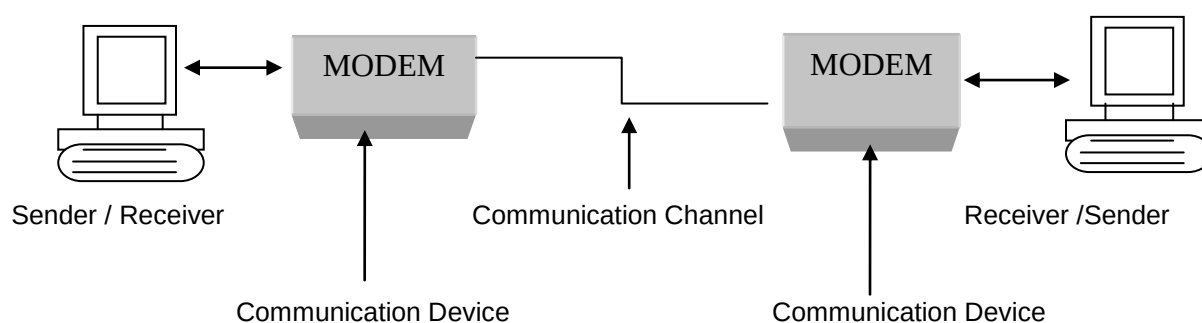


- (1) **MODEM:** MODEM stands for Modulator / Demodulator. MODEM is coding and decoding device i.e. when data is transmitted from one computer to another computer over a distance through a telephone line or other communication channel then MODEM converts the computer digital signals into signals which can be transmitted on telephone line and vice a versa.

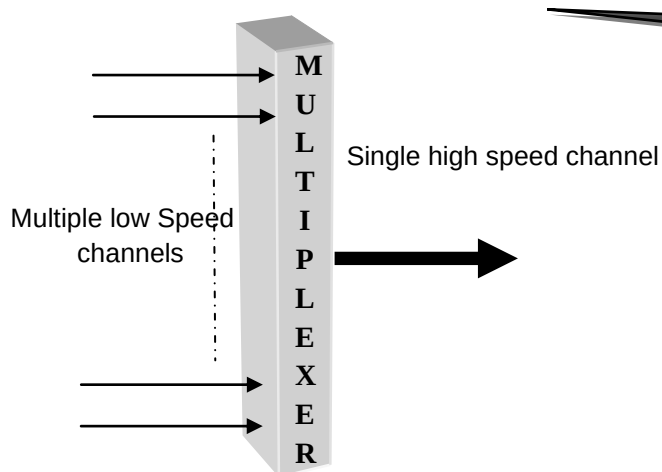
NOV 06, MAY 03

MODEM is mainly used for connecting computers, geographically, distributed over a large distance for data communication. Most important use of MODEM is connecting home computer to internet servers. MODEM is also used for connecting an employee of a company with the company network from a remote location.

MODEM is categorized according to its speed and some other features like analog or digital MODEM, internal or external MODEM. Analog MODEMs can be internal (connected on motherboard in a slot) as well as external type. Speed of a MODEM normally ranges from a few kbps to mbps. Digital MODEMs are known as ISDN MODEMs. These are high speed MODEMs and normally used at places where more large of users are connected through same communication channel. Speed of digital MODEMs is measured in mbps (megabits per second).

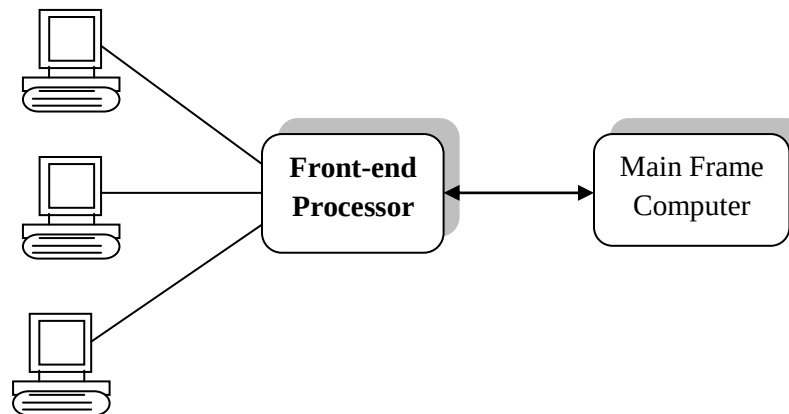


- (2) **Multiplexer:** Multiplexer is a device that enables several devices to share common communication channel. A multiplexer scans multiple devices to collect and transmit data on a single communication line to the appropriate destination. The multiple devices are polled together and periodically asked whether there is any data to transmit. This function may be very complex and in some systems there is a separate computer processor devoted to this activity and that is called a 'front-end-processor'.

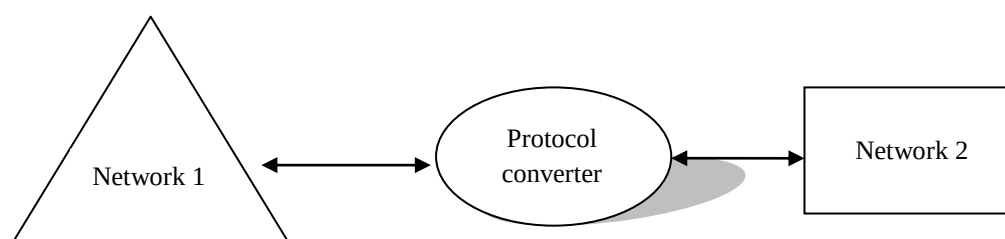


MAY 08, NOV 11

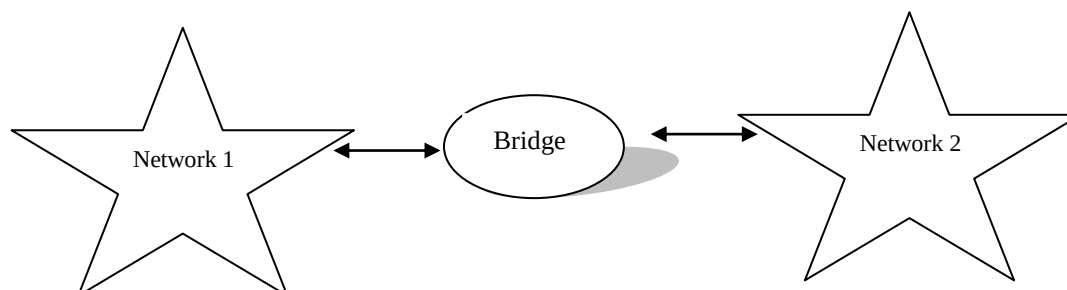
- (3) **Front-end Communication Processor:** These are the programmable devices, which control the functions of a large computer system in a network. This device supports the operation of a mainframe computer by performing functions which otherwise would required to be performed by mainframe itself. These functions include authentication of user by checking his user id and password, coding & decoding of data and control of transmissions lines. Due to use of font-end processor, the mainframe computer dedicates its entire time to its key function i.e. data processing. Finally, front-end processor performs allied functions like user authentication, data encryption, etc in a communication network of large computer based system (e.g. stock exchange network). Front end processor is like a assistant to main frame computer.



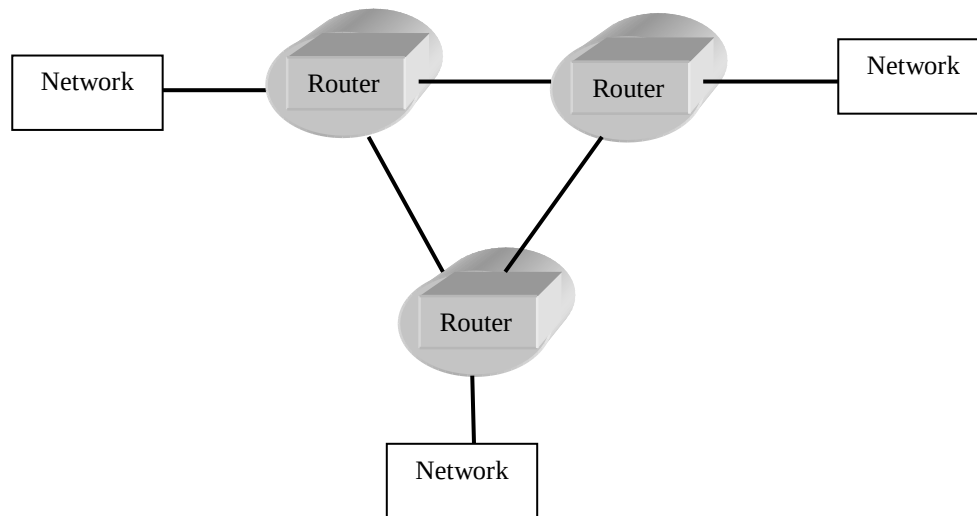
- (4) **Protocol Converters:** A hardware device that changes the protocol of one system to the protocol of another. For example, if you want to connect an IBM data communication network to AT&T data communication network then the protocol converter converts the message formats one network system to another so that these are compatible for communication with each other. It is similar to a person who translates for two persons who do not speak each other language.



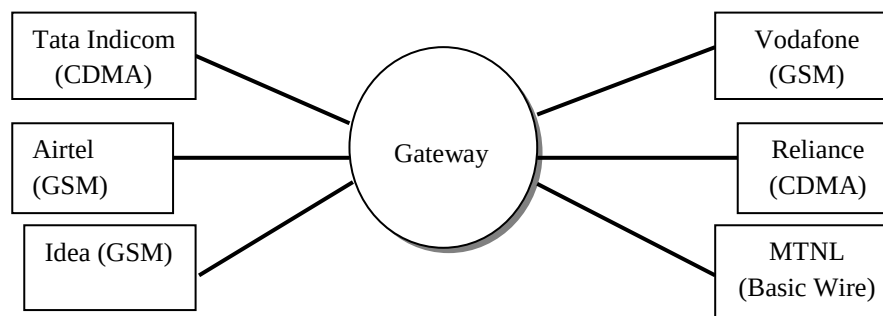
- (5) **Bridge:** A device that connects two networks with each other that are using the same protocols.



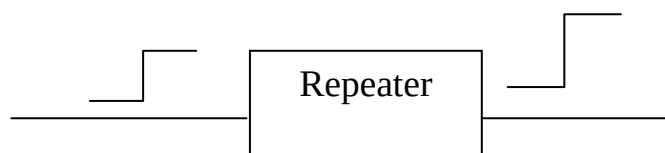
- (6) **Router:** A device that connect two or more networks with each other having same network protocols. This device also helps to select the best rout (shortest and most reliable route) for data communication when there are multiple paths between them.



- (7) **Gateway:** A device that connects two or more dissimilar networks i.e. the networks having different protocols. This device allows networks of different vendors to communicate with each others by translating one vender's protocol into another; gateway is a combination of router and protocol convertor.

NOV 04

- (8) **Repeater:** Repeater is a device, which simply repeats the incoming signal for outgoing communication on channel but with increased strength. Repeater is also known as amplifier, it amplify the incoming signal for long distance communication.

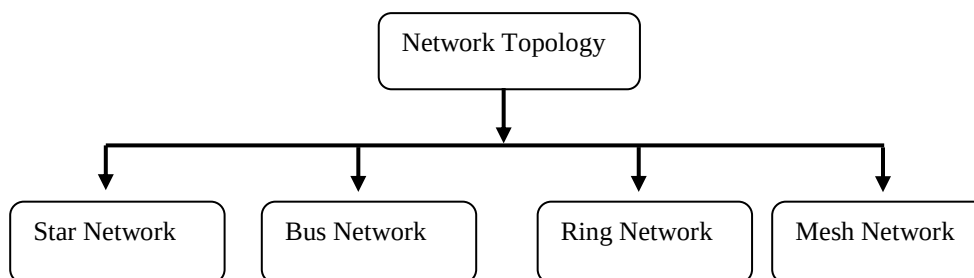
**MAY 05, NOV 07**

- (9) **Remote Access Device:** This device contains a bank of modems i.e. a collection of modems to serve as central point for access of data from various distant or remote locations

4.0 Network Structure or Network Topology:

MAY 00, NOV 04, NOV 01, NOV 08 MAY 06

The geometrical arrangement of computers, devices and communication facilities is known as network structures or network topology. A computer network is comprised of nodes and links. A node is the end point of any branch in a network; it can be a computer, a terminal device, work station or an interconnecting equipment facility. A link is a communication path/channel between two nodes. A network topology provides a mode by which network components can communicate with which each other. Followings are main network topologies.

**(i) Star Network:**

This is the most common network topology. In this all the computers are connected with each others with the help of a centralized system. Processing nodes (computers) is a star network interconnect directly with a central system. Each terminal, small computer or large main frame can communicate only through the central device, and not directly with other in the network. If it is desired to transmit information from one node to another, it can be done only by sending to details to the central node, which in turn transmits that to the desired destination.

A star network is particularly appropriate for organizations that require a distributed data processing system facility. For example, a star network is used in banking, railway and telecom networks to provide distributed (data processing from anywhere) data processing system.

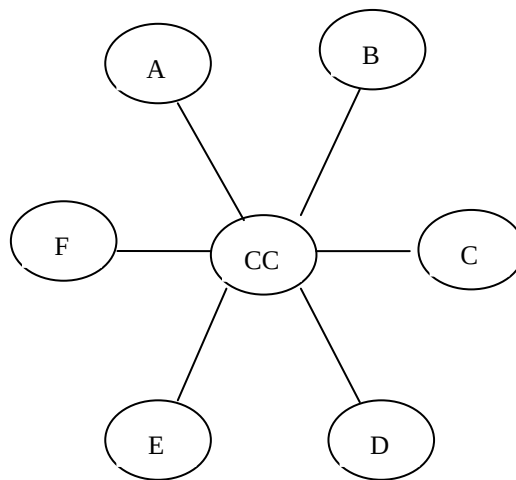
A star network provides following advantage:

1. Reliable and easy to maintain topology, because if a problem occur with any link then only that link system will not function. And maintenance is primarily limited to central system only.
2. Provides point-to-point (direct) communication between connected devices

Disadvantages:

1. If central system is not working then entire network will not work.
2. High cost topology because it involves high communication channels cost. Because every channel terminate up to central system

CC: Central Computer
A to F: Computer System



Star Network

(ii) Bus Network:

This structure was one of the most popular network structures for LANs before the popularity of STAR structure. In this structure, a single cable is laid down in the entire building (or area) and the computers are connected on this cable at different points. End of the cable is terminated with the help of terminators (to avoid the signal loss).

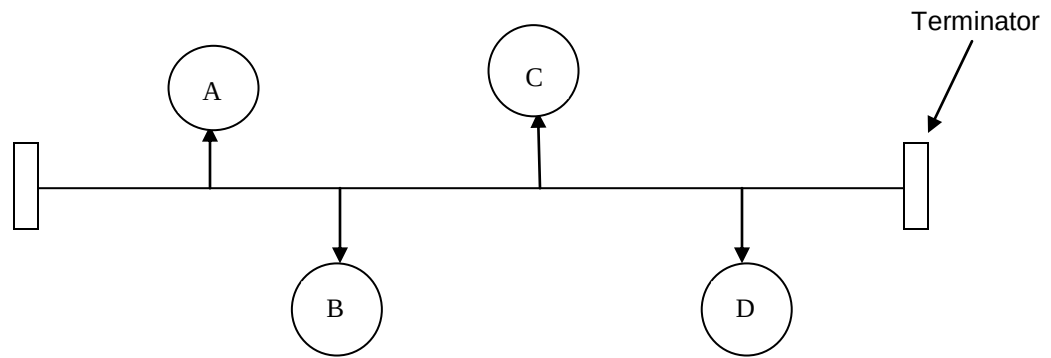
The laying down of a single cable is now replaced with junction boxes known as HUBs. These hubs, externally, provides STAR topology and gives scores of advantages over a single cable run. For example, easy to maintain i.e. if cable becomes faulty at one node it will not affect the working of whole LAN system like it affect in a single cable case.

Bus topology ha following advantages and disadvantages

1. Provides low cost topology
2. Easy to setup topology

Disadvantages:

1. Provide broad cast communication, which is an unreliable communication because many packets collides and does not reach to its destination
2. Difficult to detect the cable fault and one point cable fault may bring down the entire network working.

**Bus Network****(iii) Ring Network:****NOV 09, NOV 12**

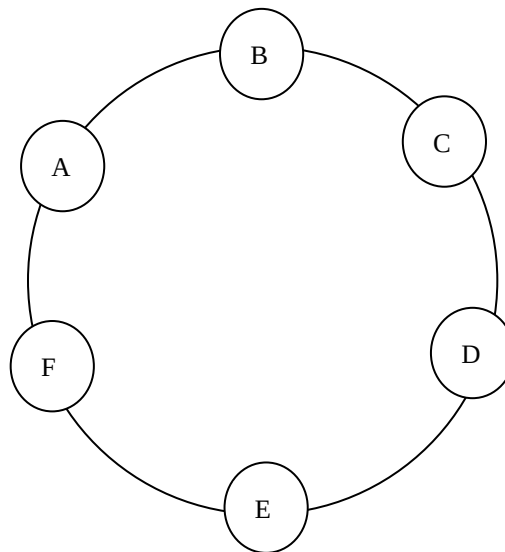
A ring network (also called loop network) is an extension of bus topology; it is like connecting both the ends of bus topology to create a loop. But ring topology provides more reliable communication than bus topology. Because it uses a token ring communication technique wherein a token revolves in the network and only that system can communicate the data that has the token with it; unlike in the bus topology where every system is free to communicate which results in collision of data packets.

Ring topology provides following advantages and disadvantages.

1. Provides reliable data communication
2. Low cost and easy to setup topology

Disadvantages:

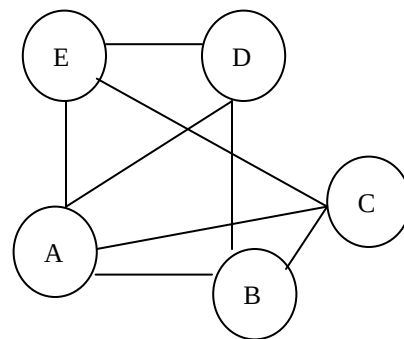
1. Difficult to detect cable fault and one point cable fault may bring down the entire network working.

**Ring Network**

(iv) Mesh Network:

This type of topology is created for highly reliable and security sensitive applications like defense applications and telecom network. In this type of topology, the nodes or computers are connected directly as well as indirectly through different paths. If ne link fails between nodes then alternate links would allow the data communications.

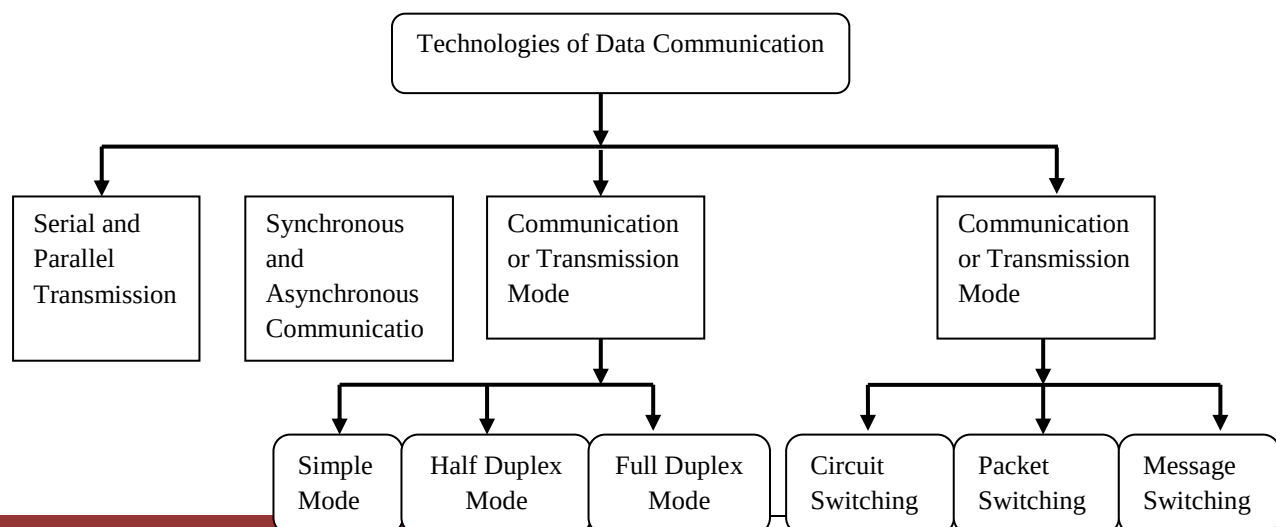
This topology provides highly reliable network but require high implementation cost, and also difficult to maintain than the other topologies.

**Mesh Network****Advantages:**

- ❖ Highly Reliable Topology
- ❖ Provide point-to-point communication or direct communication
- ❖ Provide routing of data through alternate path if direct path is busy or not working

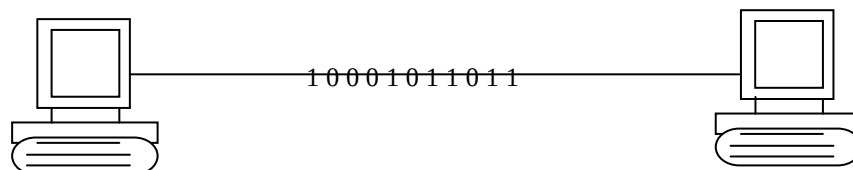
Disadvantages:

- ❖ High implementation and maintenance cost
- ❖ Complex to setup

5.0 Transmission Technologies:**Different Technologies of Data communication or Data Transmission**

(1) Serial versus Parallel Transmission**MAY 06, NOV 12****Serial Transmission:**

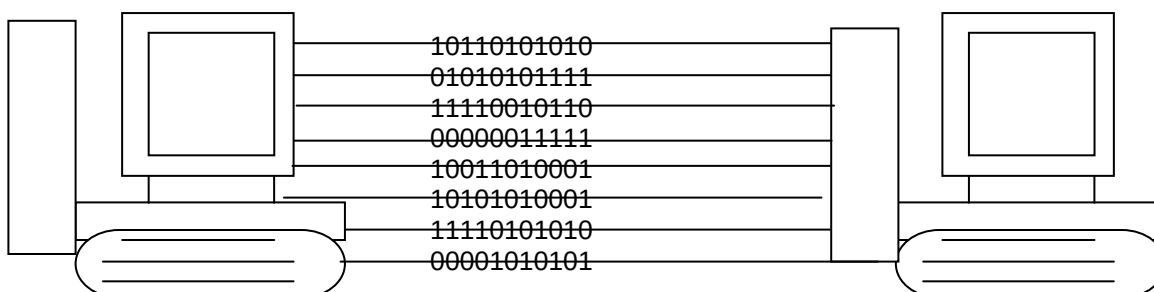
- ❖ In serial transmission, data is communicated bit by bit on a single path or communication channel between connected devices



- ❖ Serial transmission provides slow speed data communication in comparison to parallel transmission wherein multiple bits are transmitted together on multiple channels.
- ❖ But serial transmission provides reliable data communication in comparison to parallel transmission wherein cross talk (noise) in the adjacent bits occurs.
- ❖ Serial transmission is used for long distance data communication because it is easy to maintain a single channel in comparison to multiple channels, and also, it provides error free or noise free data communication as no cross talk occurs in the serial communication.
- ❖ RS-232C is a popular serial transmission port specification used for connecting mouse, modem, etc for serial communication.

Parallel Transmission:

- ❖ In parallel transmission, there are separate or parallel paths corresponding to each bit so that many bits are transmitted simultaneously.



- ❖ Parallel transmission offers faster transfer of data because multiple bits are transmitted together
- ❖ But, it is not practical possible for long distance to use parallel transmission as cross talk can occur in the adjacent parallel transmitted bits
- ❖ Therefore the cable length or channel length remains limited in parallel transmission to minimize the cross talk.
- ❖ LPT port is a popular parallel transmission port specification used for connecting printer, etc for parallel communication

2) Synchronous versus Asynchronous Transmission:**MAY 03, MAY 05, NOV 03, MAY 11**

Another important aspect of data transmission is synchronous and asynchronous transmission. In synchronous transmission, data is transmitted from transmitter in synchronization with a receiver i.e. at

same speed. In this, there is a continuous handshaking between transmitter and receiver for reliable data communication.

Synchronous Transmission: In this transmission, bits are transmitted at fixed rate. The transmitter and receiver both use the same clock signals for synchronization and data communication. This allows data to be send as a multi-word blocks. Synchronous transmission uses a group of synchronization bits, which are placed at the beginning and at the end of each block to maintain synchronization.

Advantage: Transmission is faster as no start/stops bits are required to be recognized in the data blocks as this is required in asynchronous transmission and many data words can be transmitted per second.

Disadvantage: The synchronous device is more expensive to build as it must be smart enough to differentiate between the actual data and the special synchronous bits.

Asynchronous Transmission: Asynchronous transmission is done without any handshaking i.e. transmitter and receiver does not care for the speed of each other or does not use the same clock for data transmission as this happens in synchronous transmission. Therefore for reliability of data transmission, in this transmission, each data word is accompanied by stop (1) and start (0) bits that identify the beginning and ending of the word. When no information is being transmitted (i.e. sender device is idle), the communication line is usually high (in binary 1), i.e. there is a continuous stream of 1.

Advantage: Provide reliable communication because the start an stop bits ensure reliable data transmission between the sender and receiver.

Disadvantage: Inefficient as the extra start and stop bits slow down the data transmission when there is a huge volume of information to be transmitted.

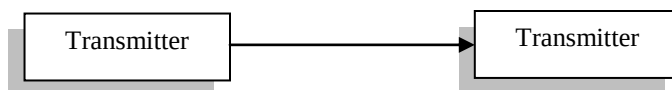
Example: We can relate synchronous communication with voice communication on telephone line and asynchronous communication with SMS communication.

(3) Communication or Transmission Modes:

NOV 98, NOV 06, MAY 02, NOV 11, MAY 07

Transmission modes indicate the direction of data communication on communication channels i.e. one-way or unidirectional and two-way or bidirectional. There are three different types of data communication mode:

- (i) **Simplex:** A simplex transmission made permits data flow in one direction only The devices connected in simplex mode are a send-only (transmitter) and receive-only (receiver) device. Simplex mode is seldom used in computer-to-computer data communication because a return path is generally needed to send acknowledgments or control the error in computer communications.

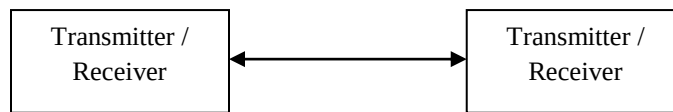


Simplex Mode (One Way Communication)

Example: TV and Radio communications are examples of simplex transmission mode.

- (ii) **Half duplex:** In this mode, data can be transmitted back and forth between the devices but data can be transmitted in one direction only at any given point of time.

This mode also provides the path for acknowledgement from receiver to sender, which helps in error free transmission

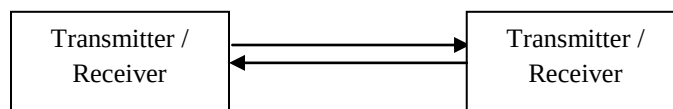


Half Duplex Mode (Two way communication, one at a time)

Example: LAN network, walky-talky communication

(iii) Full duplex: A full duplex connection can simultaneously transmit and receive data between the connected devices. A full duplex mode provides faster data communication, since it avoids the delay that occurs in a half-duplex mode wherein each time the direction of transmission is changed for bidirectional communications.

This mode also provides a path for acknowledgement from receiver to sender, which help in error free transmission



Full Duplex Mode (Two way communication simultaneously)

Example: Telephone line communication

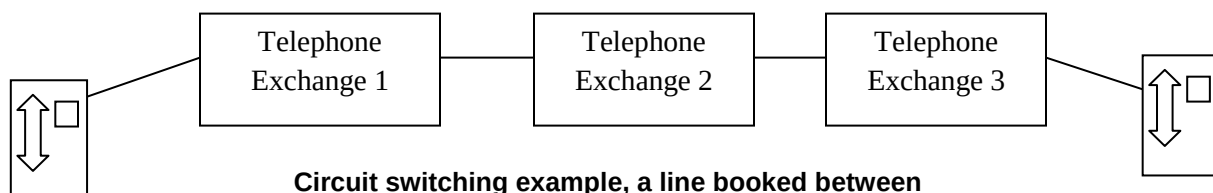
(4) Transmission Techniques:

MAY 04

Transmission techniques are the technologies used for data communication i.e. data is commutated directly, or in the form of packets and messages. There are three popular transmission techniques

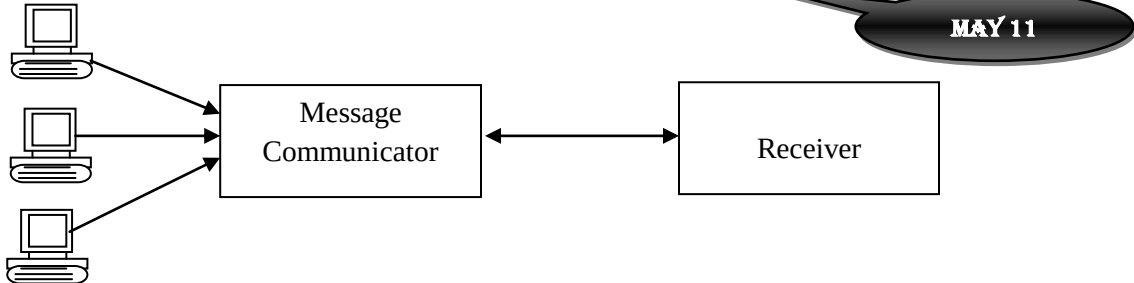
1. Circuit Switching: In this transmission technique, one complete line (channel) is booked for transmission and reception of data between sender and receiver. Example of this technique is voice communication on telephone line.

Circuit switching provides and an inefficient utilization of communication channel capacity, because a complete path is booked between two persons (sender and receiver) for the duration of communication. And other users can not use this booked channel capacity.

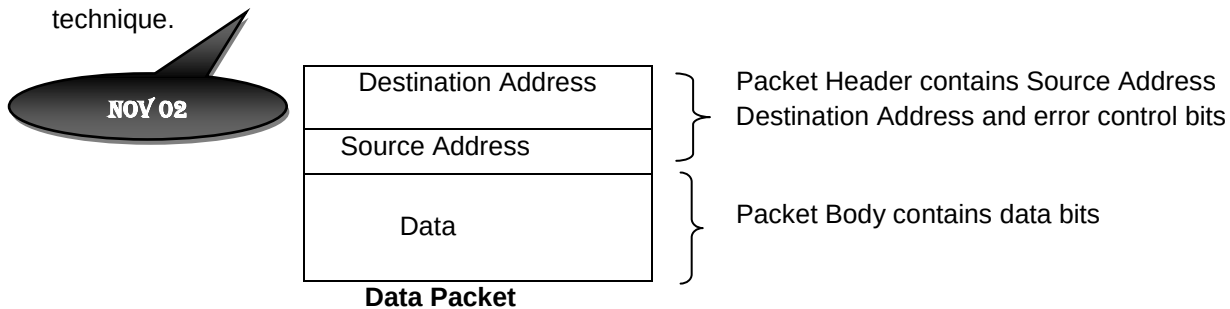


**Circuit switching example, a line booked between
Two telephone users cannot be used by other users**

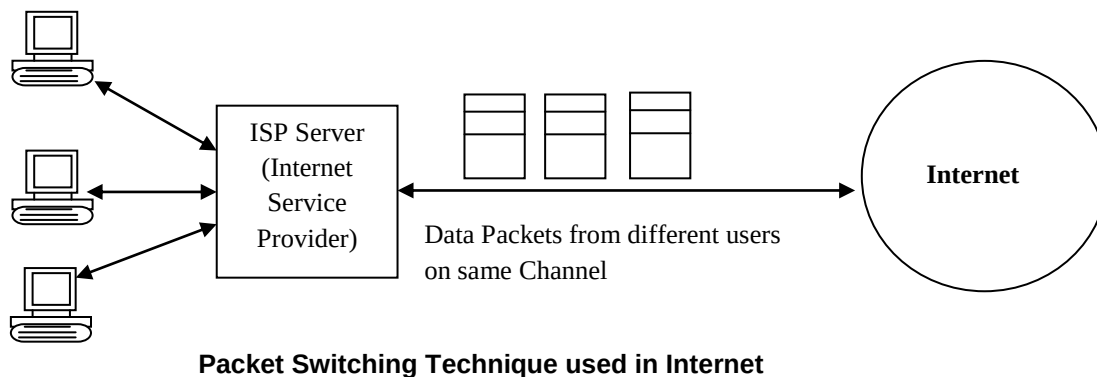
2. Message Switching: In message switching, many data packets are combined together in the form of message, which is then communicated for a common destination. Some organizations which have a high volume of data for transmission to a common destination use a special computer for the purpose of message switching. This special computer receives all the data to be transmitted, converts this data into messages, and when an outgoing communication line is available then forwards these messages to the receiver.



3. Packet Switching: This is one of the most sophisticated and popular transmission techniques. In this technique the message to be transmitted is first broken into small size units known as packets. Then these packets are transmitted on network from source to destination on available routes. Each packet carries the necessary information like its source address, destination address, data and error control bits. This technique provides the maximum utilization of available channel. Internet transmission is based on packet switching and present days popular net telephony also uses the packet switching technique.



A data packet contains two parts known as Header and Body of data packet.



Circuit Switching	Packet Switching
A dedicated path is established between users for data communication	No dedicated path is established for data communication. Large number of users transfer data through common established path
Provide more reliable communication	Provide less reliable communication
High cost of communication	Low cost of communication
Basic Telephony (fixed phone) uses circuit switching	Internet communication uses packet switching

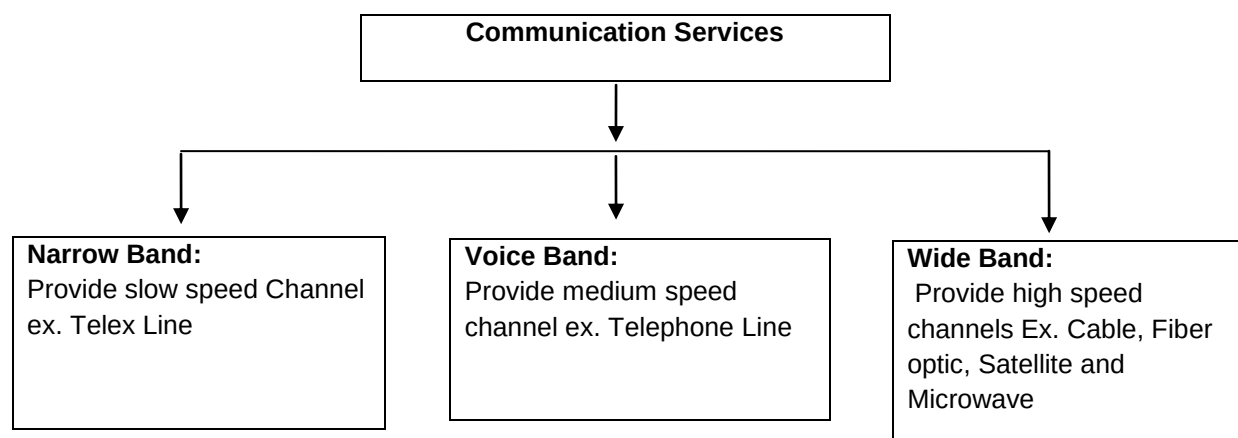
6.0 Communication Channels (Services):

NOV 04, MAY 08, NOV 03

Communication channels are physical medium through which data is transmitted from one device to other like cable, optical fiber, etc. Communication channel connect one device with another for data transmission. There are different types of communication channels which organization uses depending upon their requirement. The type of communication channel selected by organizations depends upon the reliability, security, cost, and most important characteristics **Bandwidth** of channel required by organizations.

Bandwidth: Bandwidth is measurement of channel data carrying capacity i.e. more the bandwidth of channel is there more will be its data carrying capacity. Bandwidth is measured in kbps, mbps and gbps. The communication channels are normally provided by telecom organizations (like BSNL, VSNL, AirTel, Reliance, etc) as a service known as communication services.

Followings are type of Communication Services available in market.



- 1. Narrowband Services:** Narrowband provides slow speed communication channels for data transmission. Usually, this service is used where data volume is relatively low; the transmission rates usually range approx. from 45 to 300 bits per second. Examples of this technique are the telephone companies' typewriters exchange service (TWX) and Telex service.

2. Voice band Services – Voice band services use ordinary telephone lines to send data messages. Transmission rates vary from 300 to 4,800 bits per second, and higher. Telephone line is one of the most popular types of communication channel used for data communication.

3. Wideband Services – Wideband provides the highest speed communication channels. Wideband services provide data transmission rates from several thousands to several million bits per second. These services are mainly used by high-volume data communication users. Such services generally use coaxial cable, microwave communication, space satellites or optical fiber to rapidly transmit data from any part of the world.

Communication services may be either leased or dialed up types. A leased communication channel provides a user the exclusive use of the channel; and this is used when there is round the clock data transmission needs. The dial-up service requires a person to dial the ISP system number for internet connection (and the line may be busy!!) for data communication; this alternative is appropriate when there is periodic need for data transmission.

7.0 Communication Software:

NOV 05, NOV 08, NOV 10, NOV 03

After selecting computers, communication channels, communication mode and communication devices, the last component required for data communication is communication software. Communication software helps in efficient, effective and secured data transmission between senders and receiver, and also helps in management of communication network devices. Communication software normally performs the following functions:

- (1) Access Control:** provides the access of communication devices and resources to authorized users only
- (2) Network Management:** Manages the network and its resources for sharing and exchange of information
- (3) Data and file Transmission:** Transmits the data and files by converting data in the form of packets as per the specified protocol etc.
- (4) Error Detection and Control:** Uses error detection and control techniques for reliable and error free data communication like using packet sequence number.
- (5) Data Security:** Uses data encryption (i.e. data coding, decoding) techniques for secured data transmission

8.0 DATA COMMUNICATION

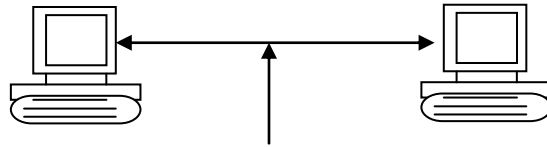
MAY 2000

Data communication means transfer of information or data from one device to another located at different places. The devices can be geographically distributed at very large distance or can be within a building. In today environment of global businesses, an organization may have many offices spread geographically all over the country or world. In such a scenario, the data communication system or networks play a very important role in the management and control of such businesses. Data communication network helps to connect all the offices with each other for immediate transfer of information from one office to another.

Let us define data communication technically.

- Data communication is transfer of information from one device or computer to another device or computer.
- For data communication, devices are linked with each other with the help of communication channels like cable, satellite, etc

- Data communication helps organization to setup online distributed data processing system. For example; banks, railway, airline, telecom networks, etc are using data communication system to provide distributed data processing services.



Communication Channel or link between devices

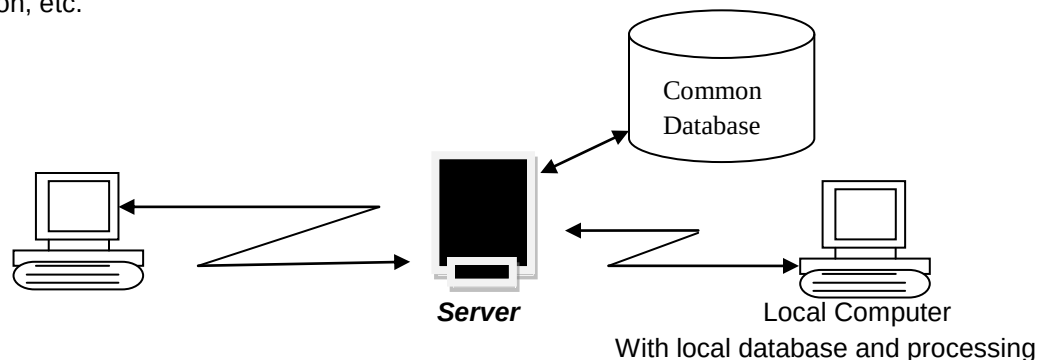
DISTRIBUTED DATA PROCESSING:

NOV 04, MAY 06

There are three types of data processing techniques in terms of locations of data processing facilities.

- (I) Centralized Data Processing
- (II) Decentralized Data Processing and
- (III) Distributed Data Processing

- In centralized data processing, the data processing is done at one location such as at head office of organization; branches normally would not have any local computer processing facilities.
- In decentralized data processing, the different locations would have their own processing facilities but processing locations would not be linked with each other to share data and information.
- Distributed data processing is latest data processing technique, and in this, the processing facilities are distributed at different locations. But these processing locations are linked with each other to share information and resources, and to provide processing from any locations.
- Distributed data processing system is a network of several computers, each of which is linked to a host or central computer known as server. This larger central computer or server maintains the master data base. Each local system is a fully independent computer that maintains its own local database as well a communication link with the master database. These individual local systems are linked to server through a high speed data communication channel. These links allow individual computers to communicate with one another through central server.
- Distributed data processing systems have many advantages. For example, local computers on the network offer immediate response to local needs, and these computers can also access information from other systems on the network as and when required through central server. Online processing system and Real-Time processing system always uses the concept of distributed data processing e.g. banks, railway reservation, etc.



As we know that for distributed data processing the most important thing is communication between various systems connected on network. Therefore, data communication is main technique which makes distributed data processing possible.

9.0 Local Area Network:**MAY 99, MAY 01, MAY 04, MAY 05**

A local area network is primarily a data communication system intended to link computers and associated devices within a restricted geographical area for sharing of information and resources. The key feature of local area network is that the entire network is confined to one place and remains completely under the control of one organization. Implementing a local area network does not prevent the communication with other systems and other network. The communication with other systems and other networks can be achieved by connecting one LAN with other remotely located LAN with the help of special bridging equipments like bridges, routers and gateways.

There are different types of LANs and they are differentiated from each others on the following basis:

- Topology: i.e. whether LAN is using STAR, BUS, RING and MESH topology
- Protocols: i.e. rules used for data communication like peer-to-peer to client/server
- Media: i.e. type of communication channel like co-axial cable, UTP/STP cable, Fiber Optic cable or wireless LAN

Main characteristics of LANs are as follows:

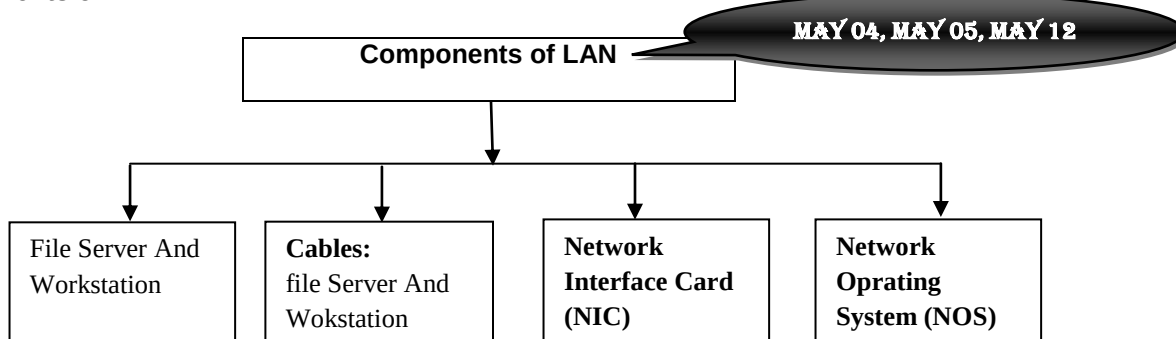
NOV 03, NOV 07, MAY 10

- (a) Inexpensive way of data communication
- (b) Easy to setup network
- (c) High data transmission rate
- (d) Network data transmission speed is independent of speed of attached devices.
- (e) Easy to implement physical connection between devices
- (f) Easy to control and maintain the network

Benefits of LANs:

MAY 09

- (1) LANs allow distributed data processing
- (2) LANs allow the extended use of Personal Computers by connecting them to powerful servers
- (3) Facilities of Electronic Mail and broadcasting among users of LAN for information interchange
- (4) Sharing of data and resources; precious resources like color laser printers, costly applications, etc can be pooled among different users.
- (5) Effective data and devices management, and their utilization
- (6) Effective organization management by providing updated and integrated information.
- (7) Lower data preparation and personnel cost because every data is required to be entered once only, and data is automatically reflected at required places.
- (8) Lower software cost because there is no need to buy the single user license for every user; a low cost multi users license serve every user in the organization.

Components of LAN:

- (1) Computers and Devices (One computer normally acts as a File Server or Server and other acts as a workstation)
- (2) Cables (communication channels)
- (3) Network Interface Card (NIC) (communication devices)
- (4) Network Operating System (communication software)

(1) Server or File Server: Server is a computer which is used for managing the files and devices of a network. Server also helps in handling network communication and servicing the various requests of users for information sharing on a network. Server can be dedicated or non-dedicated; in dedicated server, all the network management functions are done by server and in case of non-dedicated server some of the management functions are transferred to workstations.

Workstation: Workstations are standalone computers which act as nodes in the network and attached to server using network interface card. Workstations are normally personal computers with their own processing power, and because these are connected on network therefore use the extra processing power and capabilities of server that makes them more capable than standalone personal computers.

Generally a workstation is defined as:

LAN Card + PC= Workstation

(2) Cables: Cable is used for connecting computers and devices on network. Cable is communication channel of network on which data communication takes place. The popular types of cables are UTP (unshielded twisted pair) cable, coaxial cable and optical fiber cable.

UTP or STP Cable: This is most popular type of cable for creating LAN. This cable is used with HUB or SWITCH to build a LAN. It is like a telephone receiver cable. It provides speed of transmission normally from 10Mbps to 100 Mbps

Coaxial Cable: This was the most popular type of cable for setting-up a LAN before the popularity of UTP cable. It is like a TV cable and provides data transmission speed of approximately 10 Mbps

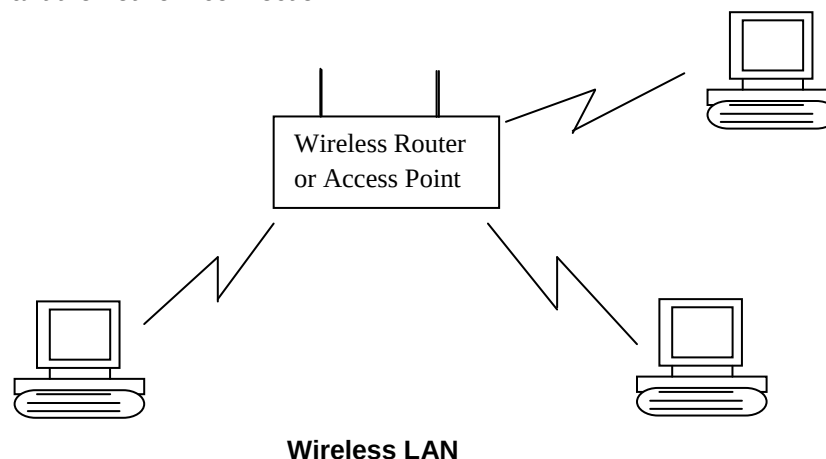
Fiber Optical Cable: This is the latest cable technology and used for building high speed LAN, known as Giga Bits LAN. This type of cable provides the highest data transmission speed.

(3) Network Interface Card: Every device connected to a LAN needs a communication device known as Network Interface Card (NIC). This card is normally known as Ethernet card because this card uses Ethernet protocol for data communication. NIC is used in every PC connected in network mode. NIC uses various rules and regulations i.e. protocol (normally known as Ethernet protocol) for smooth and error free communication of data.

(4) Network Operating Systems (NOS): This is the software which is loaded onto the server hard disk. The job of this software is to manage and control the working of network. It is, in fact, NOS which helps to make a computer as a server on a network. The NOS helps in file management, security management, applications management, users management, processing management and devices management functions of a Network.

Wireless LAN

- Wireless LAN does not require any physical media like cable for data communication
- Wireless signals like radio waves or infrared signals are used for data communication
- Mostly radio waves (similar to one used in Wi-Fi internet connection) are used for data communication
- Wireless LAN provides a flexible network wherein users can use their LAPTOP anywhere in the premises and they stay connected with their network for data communication
- In this type of LAN, one router or access point is used which provides radio waves signals to the devices which want the network connection.



- The access point contains the antenna for providing a wireless connection to the laptop computers and devices.
- In this type of LAN all the devices maintain a wireless network card or Wi-Fi modem for data communication.

Broad Band Network (ISDN)

MAY 2010

- ISDN means Integrated Services Digital Network.
- It is high speed digital communication network.
- It is also known as broad band communication network
- ISDN network helps to transfer the data at high speed
- It helps to transfer both voice and data simultaneously
- Most of the telephone exchanges, mobile phone networks and Internet are part of this ISDN networks.
- It combines different networks together in an integrated form for inter-exchange of data

There are two types of ISDN networks

- Basic Rate
- Primary Rate
 - ❖ Basic Rate Interface consists of two 64 kbps and one 16 kbps with total 144 kbps speed channels. This is suitable for individual users
 - ❖ Primary Rate Interface provides speed in the range of mbps (Mega bits per second) and it is suitable for organizations and users requiring high speed communication.

Advantages of ISDN:

- Allow multiple digital channels and network to work in an integrated form
- Allow to transfer voice and data together on same channels
- It can combine data from difference sources to transfer them to proper destination
- Provide very high speed and error free data communication

Virtual Private Network (VPN)**MAY 2009, NOV 2011****VPN: Virtual Private Network:**

VPN is a network which helps users to connect to their private network (internet) from any location using internet. Virtual means not actual; therefore VPN is not a pre-established network. It is a network, which users established on need basis from anywhere using internet. In VPN, a software known as VPN client or dialer is used which provides access to authorized users for their private network (internet or company LAN/WAN) from any location just like a user get access to its network from its actual place. VPN has become a popular network concept to provide network accessibility to organization's employees from anywhere.

Normally, VPN is built up using following two methods:

- (1) **Remote Access:** In this, a user dials for enterprise network using internet from anywhere.
- (2) **Site to Site:** In this, dedicated locations are set-up by organization for enterprise network access. This type of VPN can be build up based on either intranet or extranet

10.0 Transmission or Communication Protocols:**MAY 12, MAY 98, NOV 03**

Protocols mean rules followed by devices for error free and reliable data communications. In a network, there are many devices connected with each other for exchange of data and information with each other. And in order to have a smooth and correct exchange of information between various connected devices in network, these devices must adhered to some set of rules and these rules are known as protocols.

A protocol normally defines three aspects for data communication:

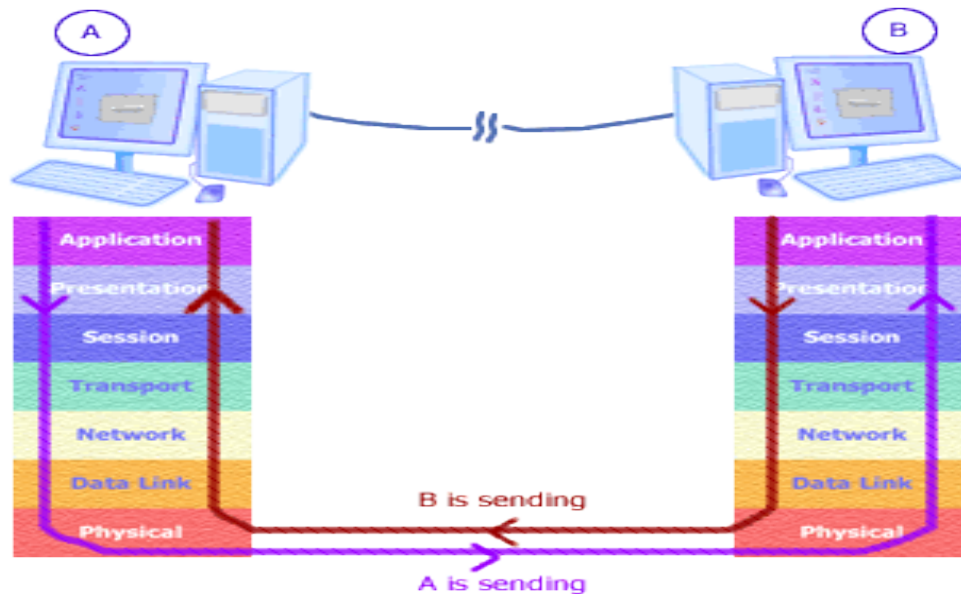
1. Syntax: define the format of data being exchanged, character set used in data, type of error correction used, type of encoding scheme used, etc.
2. Semantics: define order of message used to ensure reliable and error free information transfer.
3. Timing: defines the rate/speed for data transfer.

TCP/IP is the most popular protocol for exchange of information between networks. It is known as protocol of internet for exchange of data. It is also known as PPP (Point Protocol).

A number of different protocols are in use for different applications e.g. X.12 used in EDI, X.75 used for interconnection among different countries.

OSI or Open System Interconnection:**NOV 09, MAY 09**

International Organization for Standardization (ISO) has outlined certain rules to be adopted for communication among different types of hardware or devices. These rules ultimately functions as protocols. ISO has defined following 7 layers controls for data communications.



Physical Layer: Is hardware layer and it specifies rules for connection of hardware devices with communication channels

Data Link Layer: This layer specifies methods for channel access by hardware devices

Network Layer: This layer specifies rules for route selection etc on channels for data packets

Transport Layer: Specifies rules for assembling and error free transfer of data packets on channels

Session Layer: This specifies rules for establishing session or dialogue between devices for communications

Presentation Layer: specifies rules for display of data on screen i.e. it helps to display the application on screen in an appropriate form



Application Layer: Specifies rules for file transfer and files sharing etc e.g. email, webpage etc work on this layer

NOV 10. NOV 07

TCP/IP: Transmission Control Protocol and Internet Protocol: This protocol is used for internet data communication. This protocol has two parts.

1. TCP (Transmission Control Protocol): This part deals with assembling and disassembling of data packets i.e. creating data packets from the files to be transferred etc.
2. IP (Internet Protocol): This part handles forwarding or routing of data packets on internet channels, from source to destination i.e. it handles transfer of data packets on channels

This protocol uses four layer of OSI model, known as:

- Application Layer,
- Transport Layer,
- Network Layer or Internet Layer,
- Data Link Layer

OSI Model	TCP/IP Model
It is a 7 layers model	It is a 4 layers models
It uses Application, Presentation, Session, Transport, Network, Data Link and Physical Layers	It uses Application, Transport, Internet or Network and Data Link Layers for data communication
This model is a base model for all the protocols used for different communication	This model is used for internet data communication
This a reference model and it was devised before any protocol was invented	It is developed after the OSI model was developed

11.0 Client / Server Technology:

NOV 1999

Introduction:

A client / server system is doing for enterprise what the microchip (IC) did for electronics. After the wide spread use of Internet many organization are adopting a form of distributing processing known as client / server computing. Client/Server is shared or distributing computing wherein tasks and computing powers are split between servers and clients (clients also known as workstation). Servers stores and process data common to users across the enterprise, this data can be accessed by client systems.

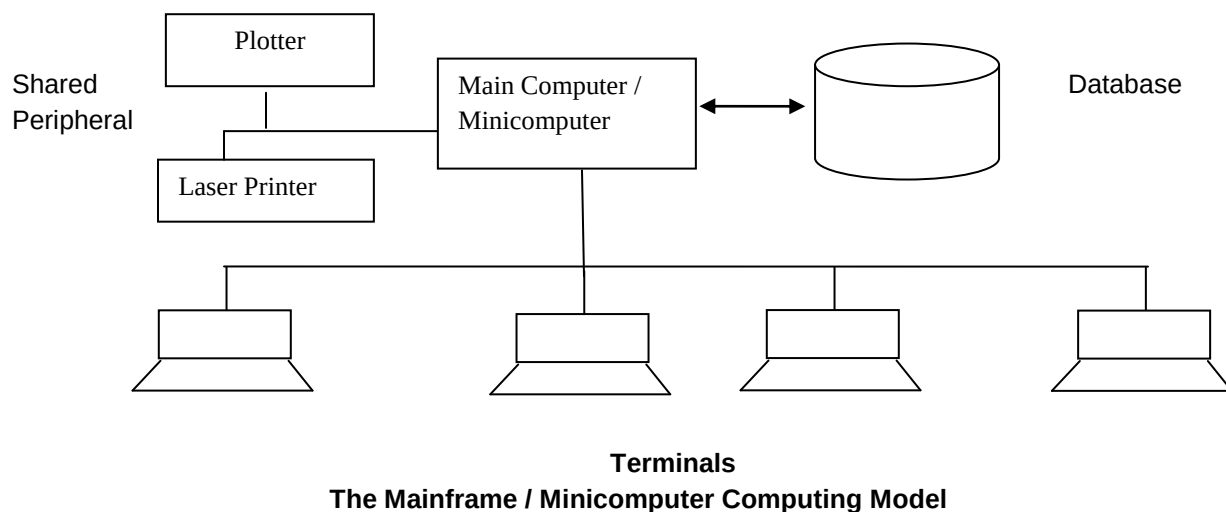
But client/server system or model was not invented in a single day. It slowly evolved over a period of time by taking good aspects of many other computing models. Let us examine corporate computing models from host based (Main Frame) to client/server.

Traditional Business Computing Models and their Limitations**(1) Main Frame Computing Model:**

Main Frame computing model is centralized processing system. In this all the users are connected to a single central host computer through dumb terminals.

Centralized system **allows** users to share expensive hardware resources such as disk drives, printers etc.

But there are other **disadvantages** like all the processing is done at one place, costly hardware, proprietary operating systems, etc.

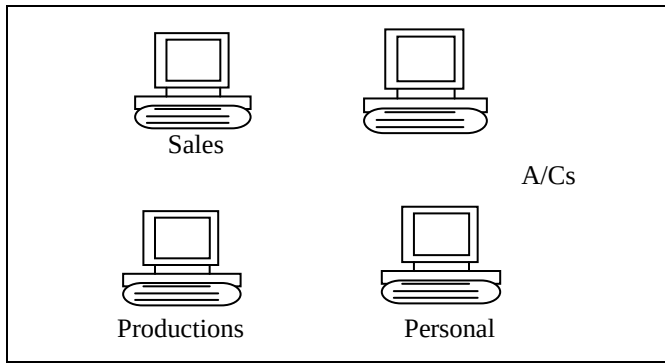
**(2) Personal Computer Computing:**

With the introduction of personal computer and its operating system, personal computers' computing or independent computing workstation quickly becomes very popular. This type of processing was known as decentralized processing,

It allows processing loads on low cost independent personal computers in-place of on a high cost central computer. This type of computing solution was low cost and easy to manage and work, but with host of problems along with these advantages.

Like this computing **does not allow** sharing of data and expensive computer resources (high capacity disk storage etc).

The data sharing problems of independent PC led to the birth of network / File server computing model, which linked PCs together in the form of LAN, so the PCs can share data and expensive resources.



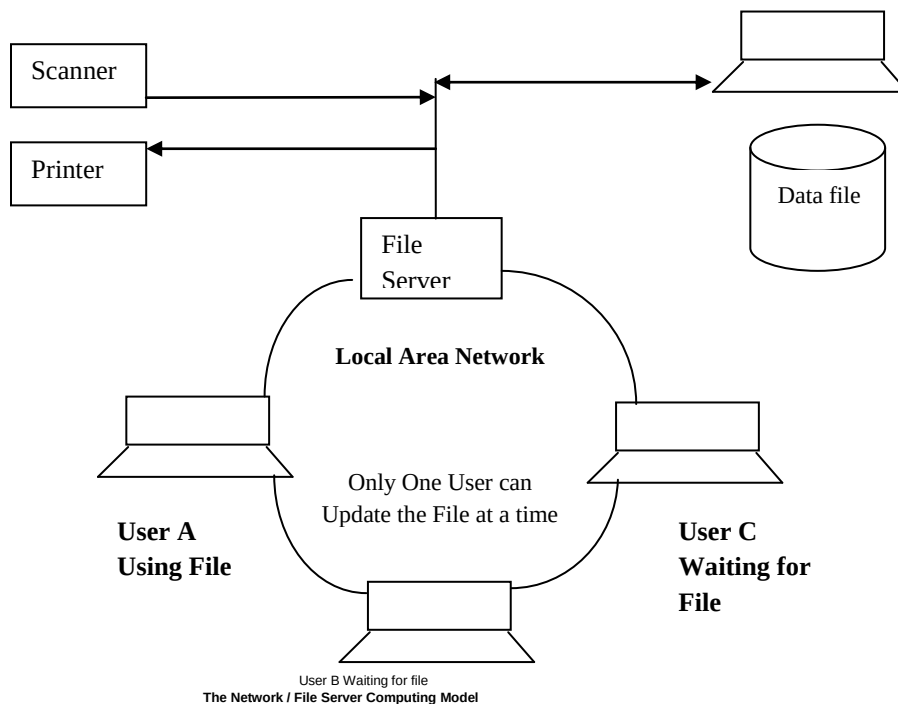
(3) The Network/File Server Computing Model:

The data and resources sharing problems of independent PC and workstations quickly led to the birth of the Network/File server computing mode. A LAN lets a workgroup continue to **obtain the benefits** of easy-to-use PCs but also permits the workgroup to share the data and peripherals resources like a main frame system. Figure below shows a network / file server model. To share data, the LAN users store files on file server. A fileserver is central node that store data files which are accessible to every user in the network. Usually a fileserver is a central point for sharing peripheral resources like printers etc.

In Network / File server computing model, a user who wants to use any data file would request file server for file; and file server would send the requested file to user, if the requested file is not used by any other user. The user will then process the data in the given file and will copy that back to file server. File server itself would not do any processing in file. This type of working design of **fileserver prevents** it from adequately servicing demanding multi users to share data at the same instant which mainframe computing can support.

Conclusion: Network/ File Server computing model provides sharing of data and resources among many users by using a low cost and easy to use PC network. But it does not allow concurrent (simultaneous) sharing of data which makes it slow network system.

This problem of Network / File Server computing model led to emergence of the most popular computing model known as client / server computing model.



(4) Client / server model :

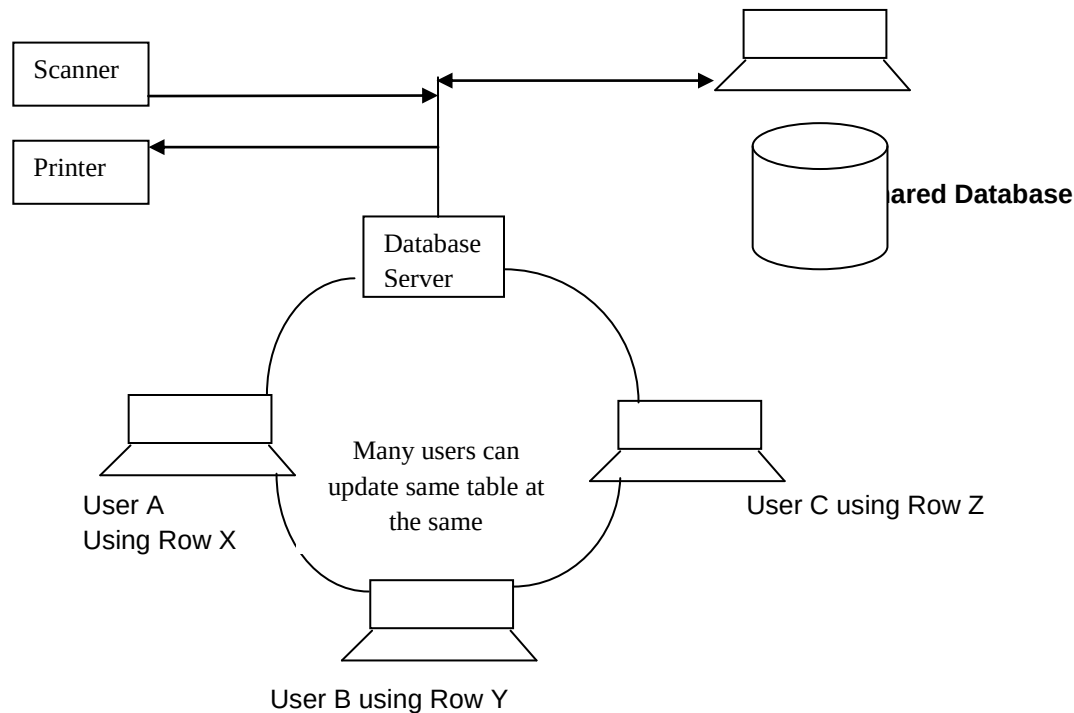
The problems of Network / File Server computing led to development of Client / Server model. The benefits of the network – computing model along with shared data access and high performance characteristics of centralized mainframe computing models.

Client / Server system has mainly three components, a client application, database server and a network.

A client application is that part of this system that users employ to interact with data. Client application main job is to present an interface through which user can interact with server to accomplish his work.

A database server is used for managing common database of information among many concurrent users, controlling database access and other security requirement and enforcing data integrity across all client applications.

The network and communication software are the vehicles that transmit data between the clients and server system both client and server run communication software that allows them to talk to each other.



The Client / Server Computing Model

Benefits of Client Server Computing:

Market research and investment pattern indicates that client / server computing is the most preferable type of business computing. There is no universal agreement on the advantages or benefits offered by client/server computing, but most often projected benefits are:

1. **Adaptability:** We want that the computing applications should meet the need of an ever changing business requirement to easily up or downsize resources to match the requirements. The Client / Server technologies are adaptable and fit in for this type of computing requirement.

2. **Reduced Operating Cost:** The Client / Server computing replaces the expensive large system with less expensive small PC system networked together but offer the benefits of large system as well as small system. This helps in reduced initial cost as well as operating cost.
3. **Platform Independence:** Due to use of PCs, the Client/Server model helps use any computing applications and resources available in the market unlike mainframe computing model which allows the use for proprietary hardware, applications and operating system only.
4. **Better Return on Computing Investment:** Due to freedom from use of proprietary hardware and software one can buy only those components that are available at minimum costs and maximum benefits; this provides better return on completing investment
5. **Improved Performance:** With more processing power distributed through out the organization one can expect to process information more quickly and with a faster response time.
6. **Easier Data Access and Processing:** The rise of Client/Server computing model also coincided with the invention of GUI (Graphical User Interface like Window) based operating system and applications. The major benefits of GUI based applications are easier data access and it reduces staff training costs.
7. **Distributed Operation:** The Client/Server computing model is a distributed processing model; and this model has placed the computing power and data processing capability in the hands of end users which has transformed the clerical workers into knowledge workers. This has resulted in increase of productivity for MIS staff, end users as well the developers.

Characteristics of Client / Server Technology:

NOV 10

Followings are some of the important characteristics of a Client / Server technology

1. Client / Server technology consists of a client process and a server process.
2. Client process and server process can be on same computer or separate computer.
3. Client or server system can be upgraded independently
4. The server can provide service to multiple clients and in some cases client can access multiple servers.
5. Some portion of processing application may reside on a client.
6. A client initiate action for service from server, but server should also be running to provide the services.
7. Client is normally a GUI based (Graphical User Interface based, Windows based) system.
8. Client/Server uses some kind of network facilities.
9. Server which maintain database provides various features for data protection, security and integrity.

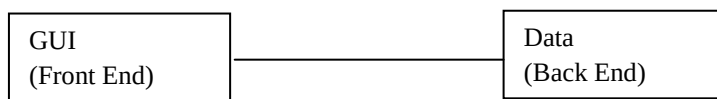
Architecture of Client / Server Application:**Two-tier and three-tier/n-tier**

We know now the benefits of a client/server system. But one need to consider the different types of architectures while developing a client/server application for an enterprise requirement.

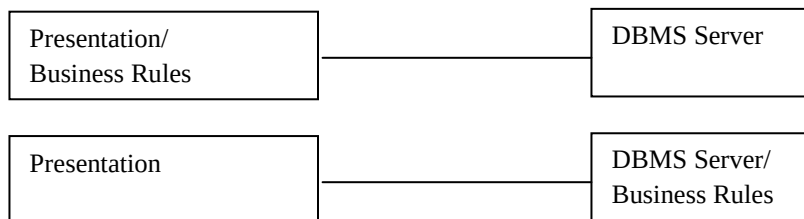
The most common among the client/server architectures are the two-tier and three-tier architectures. A tiered architecture is one in which logical section of an application can be divided into categories or tiers.

Two-tier architecture: Two-tier architecture is traditional client/server environment that divides the application into two sections. One is Graphical User Interface (client) and second is database (server).

Generally, these two portions are known as Front End and Back End.



GUI is often referred as presentation layer. In two tiered architecture all the processing parts (business rules) of application are either reside on client (tier1) or server (tier2). For example, if an application has number of business rules (program) related to marketing, finance, etc then those business rules would either reside on client side or server side as shown in figure.



Two-tier Architecture

When business rules reside in a client system then it is known as fat client; and when rules reside on server system then that is known as fat server.

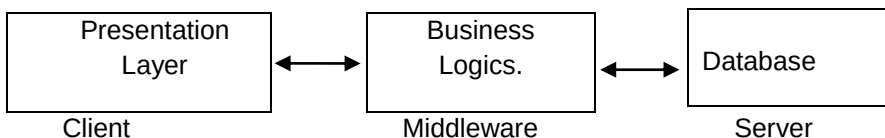
There are both advantages and disadvantages for this kind of architecture. The advantages include; there are only two components, the client and server to deal with, developers of this type of applications have to learn two components only and therefore development time is lesser.

And the disadvantages are; if business rules are written on database server then change of database would require change of business rules also. Similarly, if business rules reside on client system then business rules change would require change of all the clients; and if the clients are geographically distributed at various places then it become very difficult to implement the change. Other major disadvantage is scalability of the application i.e. expanding or contracting the application is not easy in two-tier architecture.

Three-tier architecture: In three-tier architecture, the application components are divided into three logical categories or tiers. In present days, the most widely accepted form of client/server is three-tier architecture. The components of three-tier architecture are:

1. The presentation (GUI) or user services (presenting and receiving data from user)
2. Business rules or business services (validating and processing data according to business rules)
3. Data server or data services (storing and retrieving data from disk)

The manner in which this architecture of client/server model is organized, it provides the maximum long term benefits. In most cases, the presentation and databases are constant in business enterprise, it is business logics/rules which changes because of changing business requirement and growth. Therefore in this type of architecture, if changes are done in business logics then it is done only at one place, presentation and database remains unaffected. The place where the business rules are kept in three-tier architecture is known as **middleware**.



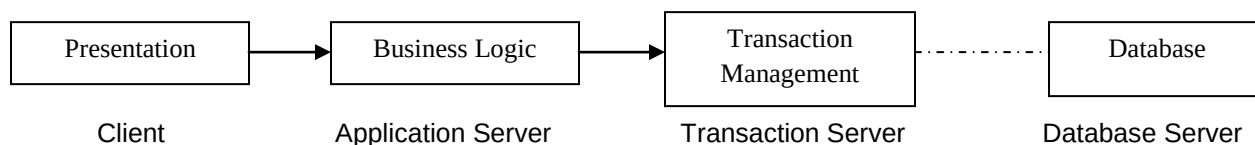
Three-tier Architecture

This is not always advice-able go for three-tier architecture for all the applications, because there are some disadvantages in using this architecture:

1. Setup cost is high in comparison to two-tier architecture
2. It takes more time and resources to put three-tier architecture in place.
3. Administration of three-tier architecture is more complex than two-tier architecture.
4. Also technologies used are newer and the skill available is often scarce, and hence expensive.

But three-tier is the most sought after architecture for enterprise wide solutions where one wants to have distributed computing with online facilities throughout the enterprise like in banks, insurance, telecom, aviation sector, stock exchange, etc.

Multi-tiers Architecture: This is similar to the three-tier network architecture. In fact three-tier architecture is also referred as multi-tier architecture. But in the multi-tier architecture there can be more than three layers for data exchange between client and servers.



Multitier Architecture

Components of Client/Server Technologies:

MAY 2009

Following are the main components of Client/Server technologies.

1. **Client:** Client is a process (normally running on a workstation or PC) running the front end part of applications. It interacts with user through keyboard, display device and pointing devices such as mouse etc. a client refers to the client process that runs on the client machine. The client normally has no data processing capabilities. It simply request data from the server and displays the data provided by server.

There are three types of client processes:

- (i) **Non-Graphical Interface based known as Character Interface Based:** Here the interaction of user with client is in text form using keyboard like in telephone and DOS based computers.
- (ii) **Graphical User Interface:** These are Windows based clients e.g. Window 3.x
- (iii) **Object Oriented User Interface:** These are also Windows based clients but with latest version of Windows like Window95, Window98 and Window XP. Object Oriented User Interface in general also known Graphical User Interface but this type of interfaces has the capability to connect themselves with any type of servers or applications unlike pure GUI which can connect to its own application only. Object Oriented User Interfaces are more flexible and capable than a normal GUI.

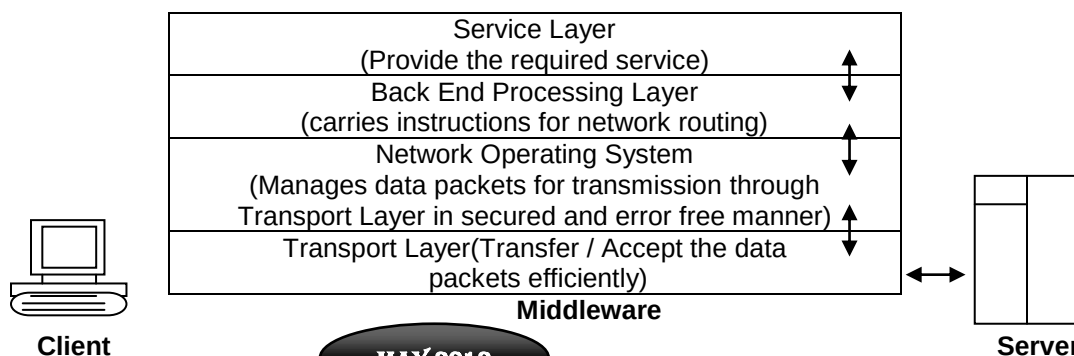
2. **Server:** The server is a process that runs normally the database services and handles the client requests for concurrent and shared data access. It is often referred to as the back-end. Server also refers to the server process that runs on the sever machine. Server receives and processes requests originating from clients. There are different server types like:

Database Server: This manages and provides data services like data access and data storage.

Web Server: This manages and provides web services by maintaining web sites and pages

Mail Server: This manages emails of users in terms of storage, receipt and transfer of emails.

3. **Middleware:** Middleware is term used in three-tier architecture. It is a network system which allows client and server to interact with each others. Middleware allows to implements an efficient distributed network system. In general, a middleware provides services like directory service, queuing, distributed file sharing, etc. A typical middleware provides four layers which execute different type of tasks



Fat Client / Fat Server: Fat client term is used when business rules are kept with presentation services in client machine. Similarly, Fat Server term is used when business rules are kept in server machine with database.

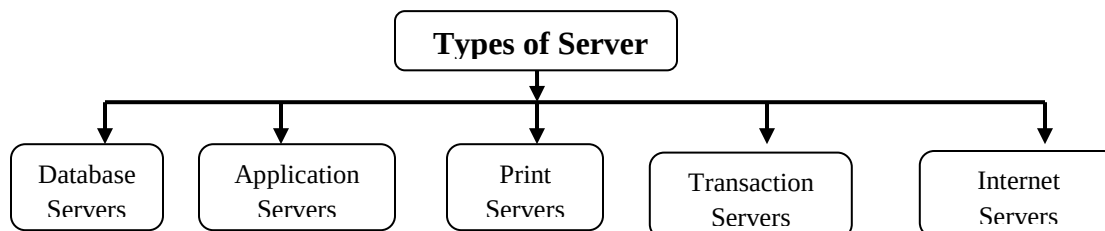
4. **Network:** The network hardware is cabling, the communication cards and devices which link the servers and clients together. The network enables data communication between client and server, and server to server. Normally, in Local Area Network (LAN) environment, two-tier architecture of Client/Server is used; and in VAN (Wide Area Network) environment three-tier architecture of Client/Server is used.

12.0 Types of Services:

NOV 2008

Server is a computer/device, which maintains some specific services to be provided to large numbers. Of users. Following are some broad categories of servers.

95

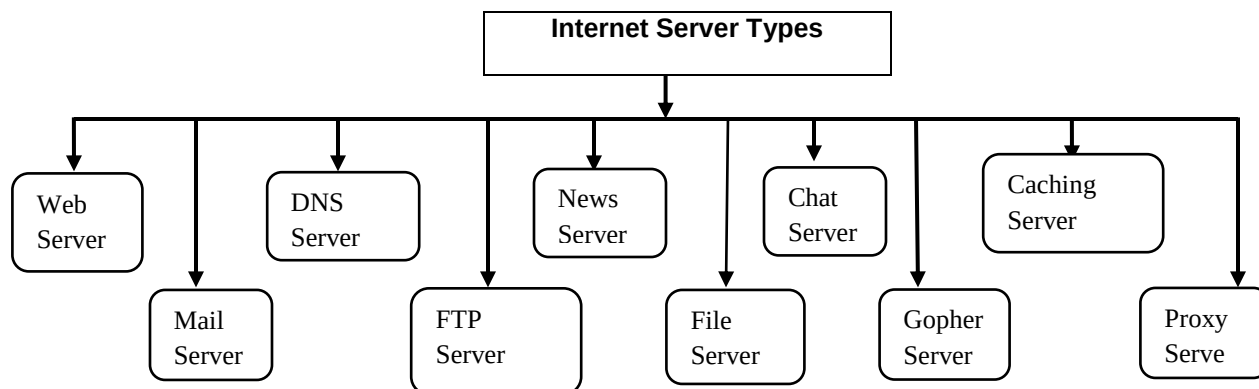


- (1) **Database Servers:** Database server is part of DBMS i.e. DBMS provides database server to provide data related services to large number of users, simultaneously. Some popular DBMS which provide database servers are; ORACLE, SQL Server, DB2, etc.
- (2) **Applications Servers:** Application server is program which maintains business logics for data processing. Application server provides services to large number. Of users known as clients, simultaneously from different locations. Banks' servers are combination of different types of servers and application server is one of the most important server types among those servers.

Application server contains some powerful features for data processing, and normally applications servers are developed using Java language. Some powerful features of applications servers are:

- (1) Component management
- (2) Fault tolerance
- (3) Load balancing
- (4) Transactions management
- (5) Security

- (3) **Print Servers:** As their name suggests, print server provides printing related services. These servers provide shared access of printers to large numbers. Of users connected in the LAN or WAN mode. You might have noticed in internet café you can send the command for printout from any workstation to a single printer connected with any particular computer. This type of services for printing is managed by print server.
- (4) **Transaction Servers:** As their name suggests the job of transaction server is to manage transactions. The Microsoft Transaction Server (MTS) is one of the most popular transaction servers. To understand a transaction sever job, you can imagine the working of ATM, when you start your transaction at ATM machine it is the responsibility of transaction server to maintain track of your transaction right from the beginning to end, until the transaction is over. If transaction breaks in between then transaction server undo the entire previous steps and you have to restart your transaction again. In a way, you can say it does not allow any incomplete transaction on the system
- (5) **Internet Servers:** We all know that internet is collection of millions of servers and there are different types of servers on internet, some popular types of internet servers are:



Here is a brief discussion about Internet Servers:

Web Server: This server maintains web sites in the form of web pages which can be accessed from anywhere through internet e.g. Yahoo web server, Google web server

Mail Server: Provides email services to users e.g. Yahoo mail, Gmail, hotmail etc

DNS Server: known as Domain Name Server; this provides services like converting domain name into IP address.

MAY 2008

NOV 2002

FTP Server: Known as File Transfer Protocol server provides file uploading and downloading services

News Server: Usenet is service provided by news server, in this similar interest groups' users shares their view with each other, post messages and replies.

File Server: A file server, as its name suggests, stored files which can be provided to its user on request

Chat Server: Provide services wherein multiple users communicate with each other simultaneously in a real time manner.

Gopher Server: Gopher is a service in which multiple servers together locate for required images, files etc. It is a kind of search service

Caching Server: Caching server helps in fast access of internet web sites. This server stores the regularly accessed content and which in turn helps in fast access of these contents.

Proxy Server: This server is used for accessing internet by many users using single internet connection. In internet café and organizations having single internet connection, the proxy server is used to provide access of internet sites to many users simultaneously. This server virtually creates that many numbers of connections as the number of users are there, from a single internet connection.

13.0 Data Center:

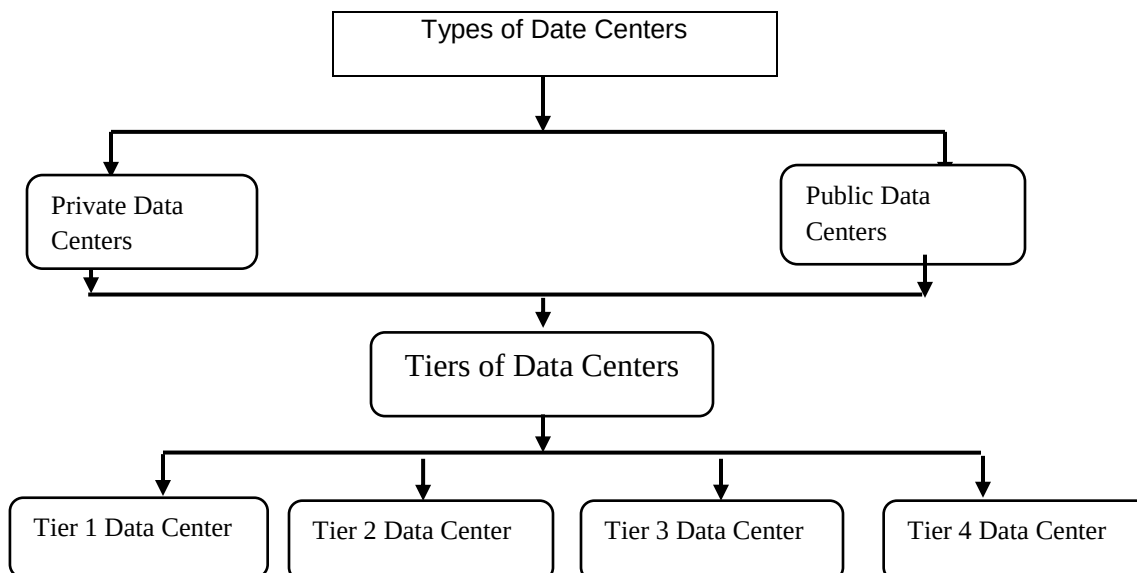
Data center is a centralized repository of data to provide data access and management services for large number of users from any where in the world

Data center can be imagined as place where large number of powerful computers (servers), storage devices, communications devices, communications channels and software are used to provide reliable and efficient data access and storage services, normally, through internet from anywhere. For example, we can think about Google having data center which maintain large volume of data and provide the access of this data to large number of users from anywhere in the world

Types and Tiers of Data Centers

((NOV 06, MAY 06))

97



- (1) **Private Data Center:** Private data centers are implemented by particular organization for data management and access of data to their authorized users. Private data centers are also known as enterprise data center, e.g. banks' data centers.
- (2) **Public Data center:** These data centers provide the data management and access services to large number of organizations. Public data center are normally provide low cost services as setup cost are shared among large number of organizations. However, these data centers are more open to data security risks than private data centers.

Private and Public data centers can be Tier 1, Tier 2, Tier 3 and Tier 4 depending upon the quality of infrastructure and resources they are maintaining

Sr. No	Tier 1 Data Center	Tier 4 Data Center
1.	Maintain and provide basic quality of services	Maintain and provide robust quality of services
2.	Provide inexpensive services.	Services are expensive
3.	These data centers do not maintain highly reliable and secured infrastructure	These data centers maintain highly reliable and secured infrastructure
4.	Low cost and simple to setup	Costly and complex to setup
5.	Used by general enterprise where security and reliability is not very important	Used by Financial and Banking sectors where reliability and security of services is very important

Sectors which use the data centers:

Data centers are now a days are used by almost all types of sectors, but primarily these are used by Banking, Retails, Aviation and Telecom sectors which provide the services to their customers from anywhere and on 24x7 (always available) basis.

Uses of data Centers:

MAY 2010, MAY 2005

- (1) **Database Monitoring:** Help to provide fast and reliable data access services round the clock by continuously monitoring the working and performance of data managed by data centers
- (2) **Web Monitoring:** Provide web hosting (means websites uploading as done by CA institute in a data center for their website) and also the monitoring of websites for round the clock availability; for reliable and efficient access of sites to their users
- (3) **Backup and Restore:** Help to provide automatic backup of managed data and also automatically restore the data destroyed accidentally or interdentally or intentionally, by using the backup data.
- (4) **Intrusion Detection System (IDS):** ID stands for Intrusion Detection; it is an art of detecting inappropriate, incorrect and unauthorized activities on network. This is primarily a security system which helps to provide data access to authorized persons only and protect the data from malicious activities.
- (5) **Storage on Demand:** Help to provide the required storage capacity to organizations to maintain their data volume in online (without lag) manner, which help to provide reliable and robust data management services.

Features of Data Centers:

MAY 2006, NOV 2006, NOV 2011

Following are some of the important features of Data Centers:

- (1) **Size:** Data centers maintain large number of servers, large bandwidth channels and large volume of storage capacity thus data centers are big in size for data management capability
- (2) **Data Security:** Data centers normally employ various techniques and software to provide high security to data.
- (3) **Availability of Data:** Data centers provides round the clock availability of data and services from anywhere
- (4) **Security:** Data centers provides both physical and logical security to data

Physical Security: Physical Security is achieved through

- (1) 24x7 CCTV monitoring (Close Circuit TV)
- (2) Smart Card doors
- (3) Security guards

- (4) Biometric device (fingers print detection etc.)

Logical Security is achieved through:

- (1) Access Management: By using Login-ID and Password
- (2) Perimeter Security: By using Antivirus, etc

- (5) Electrical and Power system:** A data center provides the power for continuous operation and uninterrupted power System (UPS)

Constituents of Data Centers:

NOV 2005

A data center maintain the following equipment's to keep the data center continuous running

- Network servers
- Network equipment's like channels (optical fibers, cables), devices (Modems, Routers etc)
- Network Management Software
- Power backup equipment's like DG (Diesel Generators)
- HVAC (Heat Ventilation and Air-conditioning System) system
- Fire extinguisher system
- Physical security system like CCTV, guards, smart card activated doors
- Raised floors
- Multiple optical fiber connectivity
- Network security software, etc

Challenges Faced by the Data Center Management:

99

Following are some of the challenges faced by management of data centers:

- (i) **Managing Skilled staff:** Data centers maintain high technological resources and managing such resources require highly skilled technical staff. And availability of expert technical staff and managing them is always a big challenge
- (ii) **Maximize uptime performance:** Data center should provide continuous services on 24x7 basis, therefore a decision, on maintaining resources in duplicate (backup) form to maximize uptime, is always extremely difficult.
- (iii) **Technology Selection:** This one is another big challenge for management, as we all know that data centers maintain very high tech resources. Technology of these resources changes quite frequently; therefore to select appropriate technology which can last longer and provide appropriated return is always a big challenge
- (iv) **Resource Balancing:** Data centers are like a retail showrooms. The data centers provide the data management services by providing storage and channel capacity type of resources to their customers, and to maintain these resources in appropriate capacity to fulfill customer's demand is always a big challenge

Disaster Recovery Site:

MAY 2008

Disaster means fire, flood, earthquake, etc which may bring down the data centers from working. Data centers need to be equipped with appropriate disaster recovery systems that minimize the downtime of data centers. Every data center uses different techniques to minimize the downtime i.e. data centers should always be available for services.

Following techniques are used by data centers to minimize the downtime, or from disaster recovery

1. **Cold Site:** This technique maintains the **critical** equipment's and resources in duplicate form at some offsite location. In case of disaster, these duplicate equipment's and resources start providing necessary services to the authorized users. Maintaining cold site is low cost disaster recovery technique but this does not provide 100% downtime elimination.
2. **Warm Site:** This technique is in between the cold site and the hot site technique. It is better than cold site but worse than the hot site technique
3. **Hot Site:** This is considered the most robust disaster recovery technique. In this, all most all the equipment's and resources of a working data center are maintained in duplicate form at some offsite location in a synchronized form with onsite resources. This is the most expensive technique, but this technique provide almost zero downtime

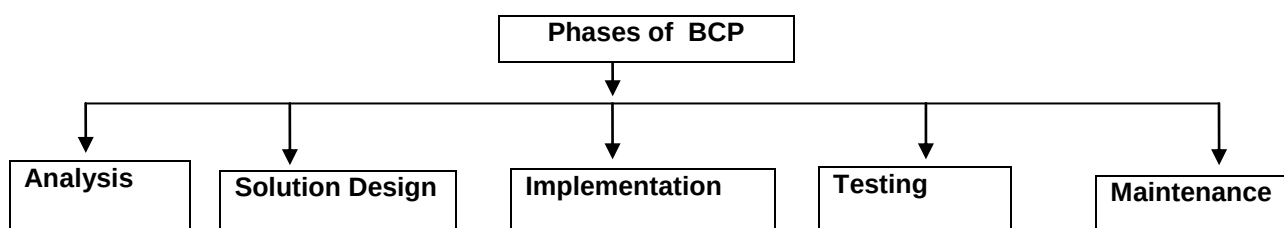
14.0 Business Continuity Planning (BCP)

Organization should always be cautious of disaster because disaster hampers the continuity of a business. It may provide huge losses and disrupts operation of a business. Therefore organization should always go for solutions which may provide the continuous working of business. Some of the common disasters which may affect the continuity of business are fire and equipment's failure etc. The organizations should have pre-planned solutions to overcome from the impacts of these disasters. These solutions are known as Business Continuity Planning (BCP).

BCP is a documented description of actions that organization should take, in case any disaster occurs.

The Following are five important phases of BCP also known as Disaster Recovery Plan

Phases of BCP:



Phase-I: Analysis:

This phase includes analysis of threats and their impact on business. Primarily it includes the following:

(1) Threats Analysis:

In this analysis, various possible threats/disasters like fire, viruses etc are analyzed. The threats are analyzed in terms of their probability of occurrence and controls used to avoid these threats.

(2) Business Impact Analysis (BIA): This is the most important component of BCP development.

This helps to identify and asses the following

- Critical systems or components of business,
- Critical processes and functions of business
- It assess the economic impacts in case of critical system and processes failures
- It also assess resources required to recover with minimum permissible downtime

A report is developed which includes the resources required to support critical functions and processes in the event of disaster.

Phase-II Solution Design:

It explores the available options / plans for recovery from disaster with two aims:

- Business Recovery – Explore the business resources required like human resources, accounting and logistics resources to restart operations
- Technical Recovery – Explore technical/IT resources required e.g. desktop, server, mainframe, and communication system, etc to restart operations

Phase-III Implementation:

Primarily includes

- Implementing the designed plan
- Defining periodic test types, schedules and approaches for test of implemented plan.

Phase-IV Testing:

The implemented plan should be regularly tested to ensure its correct working. Testing is done for checking:

- The completeness of adopted recovery procedures and their workability at the time of disaster
- Competence of personnel
- Resources adequacy

Phase-V Maintenance:

It Includes

- Determine the responsibilities for maintenance
- Identify the events to initiate maintenance e.g. crashing of server
- Determine the rules and schedules for periodic maintenance
- Updating the documents for accepted changes

15.0 Network Security**NOV 2000, NOV 2001**

In the present days' business environment, it is difficult for an organization to conduct business without using computers and networks. Network provides online working environment but networks are also vulnerable to various threats and problems, therefore organization should ensure network security, in order to:

- (1) Safeguards their assets
- (2) Ensure and maintain the data integrity

Network security is broadly classified as:

- (1) Physical Security: To protect physical assets like CD, hard disk, etc
- (2) Logical Security: To protect logical assets like data, programs, etc

Level of Security

And for a robust security of networks, organization normally employs a Security Administrator (SA) who implements the different levels of security for different assets using following steps:

- (i) Prepare a plan for enforcing security

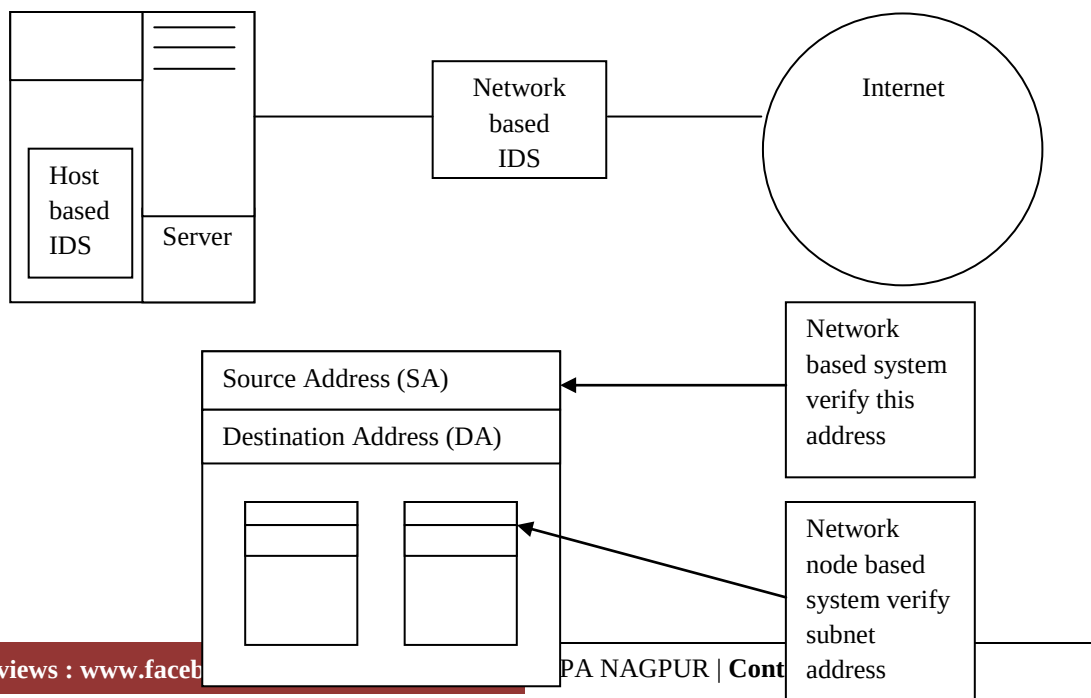
- (ii) Identify the assets which require security
- (iii) Value the assets and accordingly analyze for level of security; more valuable asset require higher level of security.
- (iv) Identify various threats to individual assets
- (v) Identify the probability of threat occurrence
- (vi) Identify the amount of losses or exposure in case of security breach
- (vii) Plan for appropriate controls to avoid threats or security breach
- (viii) Outline or generate reports on level of security provided to individual assets and network systems, etc

Intrusion Detection System (IDS) Components:**MAY 12**

The IDS components or techniques are used for the monitoring of network or detecting any unauthorized activities on the private network. The aim of intrusion detection is to monitor network assets to detect abnormal behavior and misuse. Though there are various measure which helps to prevent unauthorized entry into the system such as id-password, firewall, etc., but the fact is even though with all these security measures are in place there can be some sort of unauthorized activities on enterprise network. Therefore, specific intrusion detection measures are required to detect such unauthorized activities.

There are three popular **Intrusion Detection systems**:

- **Network Based Systems.** In this, a special device is placed in the network system, nearby the server or systems being monitored (device is attached to communications link). This examines the network traffic, and determines whether it falls within acceptable boundaries or increasing significantly due to hackers' attempts to invade the system.
- **Host Based Systems.** This type of system actually installed in the server or system being monitored. This examines the system, and determines whether the activities on the system are in acceptable limit.
- **Network Node Intrusion Detection Systems.** This is an extension of network based system. This type of system analyze the incoming traffic at subnet level instead of data packet level in the network based system i.e. it analyzes the traffic at further micro level to avoid any possible attack at particular user computer (i.e. node) in the organization.



Possible Threats and Vulnerabilities:**MAY 08**

Followings are possible threats and vulnerabilities to network systems:

- (1) Fire
- (2) Water
- (3) Energy Variations like voltage fluctuations
- (4) Pollutions like dust
- (5) Structural damages
- (6) Intrusion (unauthorized access, it can be both physical and logical)
- (7) Viruses and Worms
- (8) Misuse of software and data
- (9) Hacking of data from communications channels

Controls to overcome threats:

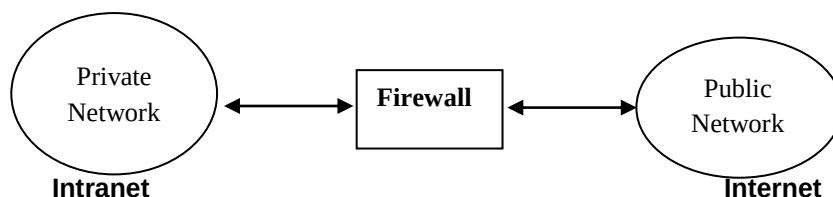
To overcome from these threats organization should use different types of controls, like:

- (1) Preventive Controls: using antivirus, fire-extinguishers, moisture detections, etc
- (2) Detective Controls: executing regularly the antivirus programs, checking files, etc
- (3) Corrective Controls: means regularly cleaning, having a recovery plan from virus infection etc

Techniques of Network Security:**MAY 2008, MAY 2010**

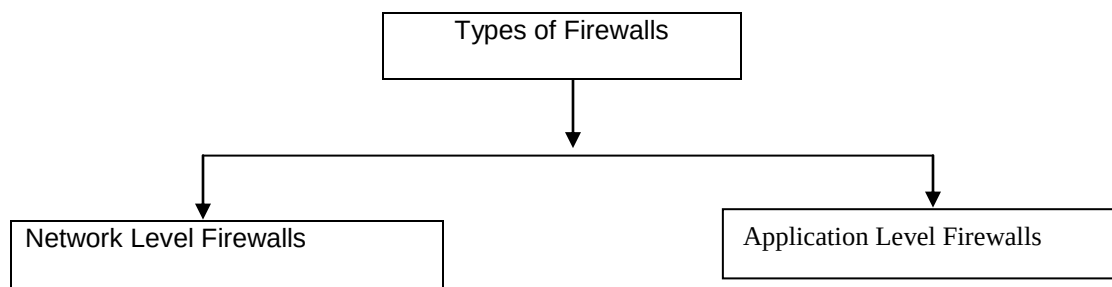
Firewall: Firewall is one of the most popular techniques of network security. Firewall provides logical security to organization data and network.

Firewall is a computerized electronic system (firewalls are mainly specialized software), installed between organization private network and public network to protect organization private network from unauthorized access. Firewall is a control for invasive type of subversive threats.



Firewall is like an insulator which insulates organization private network from invaders coming through public network.

There are mainly two types of firewalls:

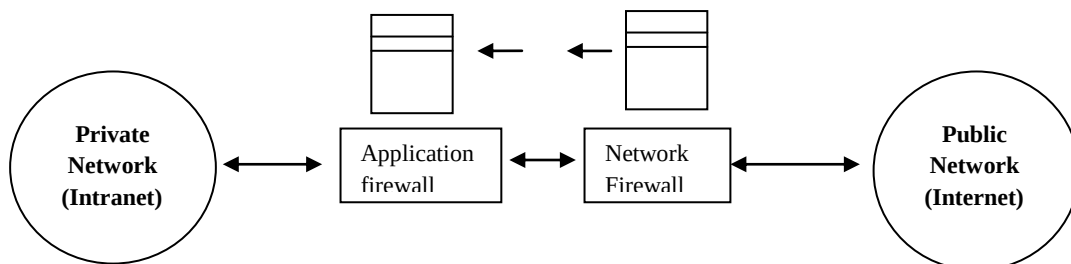


To explain these two types of firewalls I would like to explain it like this: Have you ever gone to a seminar or program of a Minister or any other high dignitary? You must have noticed that before entering into venue you are first checked for invitation card whether you are authorized to attend program or not. Then you are again checked by security guard for any malicious item. Similar to these, there are two types of firewalls; first firewall just check the data packets coming into private network for authorization, and second firewall check the content of data packets to find out any malicious data in the data packets, which may create the problems for data in the private network.

Network Level Firewalls: This firewall check the source address of incoming data packets to find out whether the data packets are authorized to enter in the private network, or not. To do this checking, network firewall maintains the address list of authorized sources from which the data packets are allowed in the private network.

Network firewall rejects the data packets from unauthorized sources.

Application Level Firewall: This firewall provides higher level of network security. As mentioned earlier, this firewall checks the data contents of incoming data packets to find out any unauthorized activities in data packets. This firewall is very complex and expensive to setup.



FUN PAGE: *Steve Jobs*

Apple CEO Steve Jobs, the man behind the first personal computer, died Wednesday at 56 after a long battle with cancer. The innovative genius revolutionized the technical world with the iMac, iTunes, iPod and iPhone. Apple guru Steve Jobs was born in San Francisco and was adopted by Paul and Clara Jobs. The Jobs family later adopted a daughter, Patti. Steve Jobs' biological father, Abdulfattah John Jandali, was of Syrian descent, and his biological mother, Joanne Schieble (later Simpson), was of German ancestry. Jandali is a political science professor and Schieble a language pathologist. Steve never met his biological dad - who had previously expressed a desire to see his genius son.

Jobs' relationship with Bay Area painter Chrisann Brennan yielded his first daughter, Lisa Brennan-Jobs, born in 1978. Steve initially denied he was the father, claiming he was sterile. The Apple CEO later acknowledged Lisa as his daughter, even naming the Lisa computer (the "Apple III") after his first-born.



(24-02-1955 to 05-10-2011)
 Steve Jobs with iPhone 4S

(V.IMP) Question from my Desk for NETWORKING

- Q.1 Describe briefly salient features of Data Centers.**
- Q.2 Explain the Features of LAN & discuss about its various components.**
- Q.3 Briefly explain various functions of Communication Software.**
- Q.4 Discuss various Data transmission modes and techniques.**
- Q.5 Distinguish between on synchronous and Async. Data transmission.**
- Q.6 Distinguish between serial and parallel transmission**
- Q.7 Explain various types of Network topology (structure).**
- Q.8 Describe briefly salient features of Data Centers.**
- Q.9 Describe the functions of Open System Interconnection.**
- Q.10 Describe in brief the various components of Client Server Architecture.**
- Q.11 Explain the features of any 5 Interface devices.**
- Q.12 Write a short Notes on Network Security.**



Chapter: 4 Internet and Other Technologies

1.0 What is Internet?

The internet can be defined as; a very large network of networks wherein connected devices can communicate with each other from any part of the world. Internet integrates several networks to form a large worldwide network. These networks are usually based on the TCP/IP protocols. The term internet, also include resources that can be shared from these networks.

The terms internet and World Wide Web (WWW), which is a service of internet, are many a times used interchangeably. However, these are both different – the web is a body of information, while the internet refers to physical structure of global network. The web is a collection of boundless information that uses the wires of internet to be accessible to users worldwide. TCP/IP (Transmission Control Protocol / Internet Protocol) is standard for internet networking. Internet is neither owned nor governed by any single authority.

The internet history is date back to more than 25 years, when the US defense department set up the Arpanet (Advance Research Project Agency Network) to have a failure proof communication network for defense departments of US. This network architecture was based on following principles:

- (i) Network should be a network of networks rather than network of computers.
- (ii) The network should work on loose connectivity concept i.e. if any computer or smaller network is connected or disconnected it should not affect the working of network.
- (iii) If any part of network is not working, it should automatically route the data from other paths.
- (iv) Network should be adaptable for different number and types of hardware and software.
- (v) Network should allow offline communication also, now this feature provides us a service known as Email.

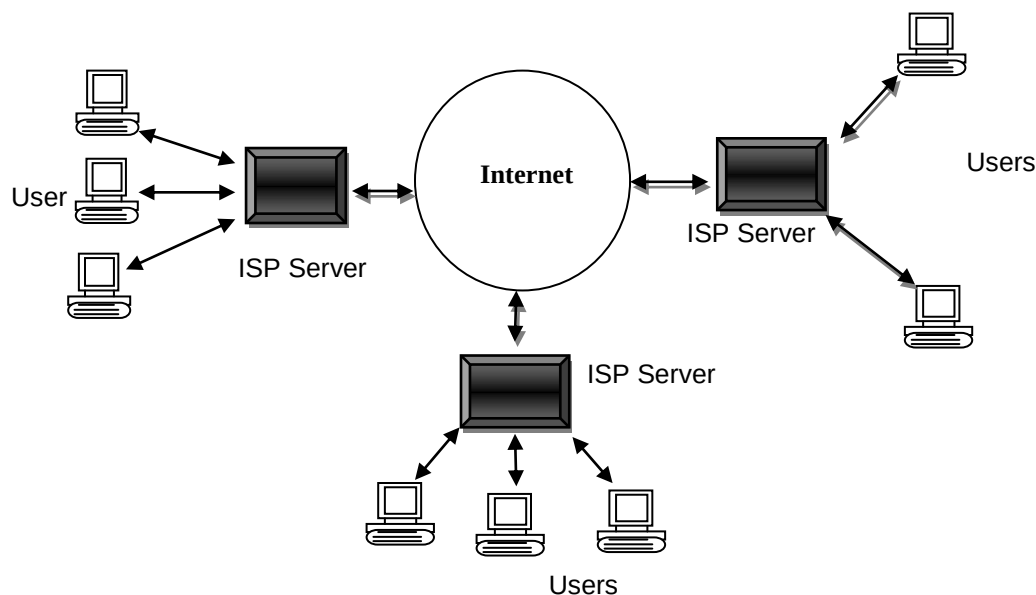
The ARPANET architecture was later adopted by educational institute for exchange of views among research scholars and then it was thrown open to public. Since 1994, the internet has grown by leaps and bounds, driven by cheaper bandwidth (inexpensive accessibility), availability of easy to use browser and increase in content (information)

Internet is most popular and open network in the world; and it provides range of low cost data communication services from anywhere, at any time, to anywhere in the world. Internet now has become an integral part of our daily source of information just like, TV and newsprint.

Following are some popular internet services

- (i) E-Mail: Sending and receiving mail electronically
- (ii) File Transfer: For transferring files from one computer to another
- (iii) WWW (World Wide Web): To retrieve information residing on internet servers in the form of Web Sites.
- (iv) Chat: To exchange views or communicate information in instant manner.

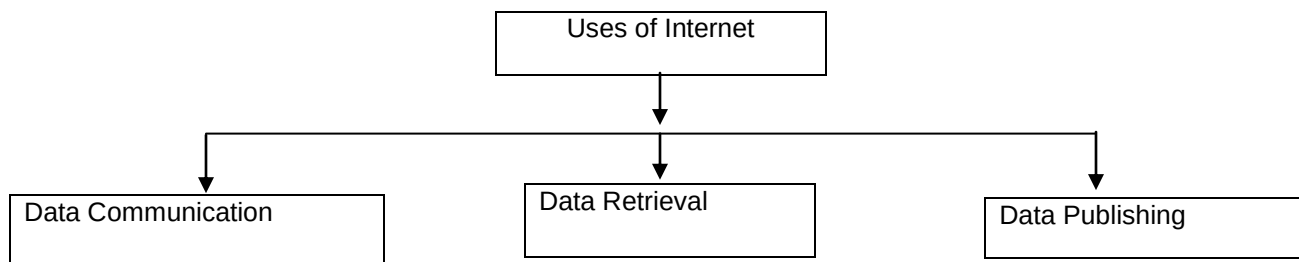
For connecting to internet; we need a computer, a modem, communication software (browser and dialer) and a service provider [Internet Service Provider (ISP)]. A user connects itself to ISP server with the help of dialup telephone line or dedicated telephone line (Now days. And, ISP server is further connected with internet backbone to which other ISPs and users are also connected, which ultimately connect a user with internet and other users.



2.0 Uses of Internet:

There are many uses of internet, but in general all the uses of internet can be classified into three broad categories:

108



1.Data communication 2.Data Retrieval 3.Data Publishing

(1) Data Communication: Internet has become most important medium for inexpensive data communication. Data communication can be one-to-many or peer-to-peer(one-to-one) e.g. online chat. In internet data communication can be offline also, like email or use net. In email, one can send the message to a person irrespective of that person not being present on the net. And in a similar way, in use net, one can post message for many users who are not online. These users get the message whenever they connect to internet.

(2) Data Retrieval: Internet is a source of large information on various subjects and topics. Large number. Of databases are available on internet. Users can retrieve the information from internet of their interest. There are various search engines which help users in easy retrieval of desired information like Google, Alta Vista, etc.

(3) Data Publishing: Data publishing is also one of the main aspects of internet; in fact, it is data publishing by various users and organizations due to which large volume of information is available on internet. Users can publish data either on their own sites or through services provided by various general portals, Usenet sites and general sites. Internet is a low cost medium for publishing or advertising product and services of organization to large number of users around the world.

Some popular categorization for internet sites:

1. **Portal:** Site, which allows user to view information on any subject like www.yahoo.com
2. **Portal:** Site, which allows users to view information and conduct transactions on one particular subject, site like www.automartindia.com is site for auto industry
3. **Usenet sites:** User network/club of particular subject on internet e.g. www.sunijava.com is a Usenet of Java developers
4. **General site:** Site of a particular organization or user for publishing information about product and services of that organization e.g. www.reliance.com is an industry specific site.

Business Uses of Internet:

1. Information on business' products or services can be published in the form of web site at very low cost for large number of users around the world.
2. Provide Global reach for products and services
3. Inexpensive way of sending information and receiving comments and suggestions for new products from large number of customers.
4. Inexpensive medium for communicating with employee located any where in the world through email, bulletin board etc.
*a bulletin board is like a notice board in an office where a message can be posted for large number of private users.
5. Books supply, health services, education and online banking are some of the business applications being extensively happening through internet.
6. Inexpensive way of Customer Relation Management (CRM) for getting suggestions and complains from customers and addressing the same.
7. Inexpensive medium for logistics management [Supply Chain Management, (SCM)] and tracking the locations of transported goods.

Types of Internet Connections:

There are different types of Internet connections:

- (1) **Analog / Dial-up Connection:** Once this was the most popular type of access method. It provides access by dialing ISP number. It is no more popular internet access method due to its slow speed internet access, at less than 56 kbps
- (2) **ISDN Connection:** Integrated Services Digital Network (ISDN) provides communication of voice, data and video over digital telephone lines. Its speed ranges from 64 kbps to 128 kbps
- (3) **B-ISDN Connection:** Broadband ISDN is similar to ISDN but it transfers the data at higher speed.
- (4) **DSL Connection:** Digital Subscriber Line provides an always on connection and it does not require typing up the phone for internet access as done by dial-up line. There are three types of DSL (1) ADSL and (2) SDSL (3) VDSL
- (5) **ADSL Connection:** Asymmetric Digital Subscriber Line supports a data rate of about 1.5 to 9 Mbps for downloading and upto 640 kbps while uploading

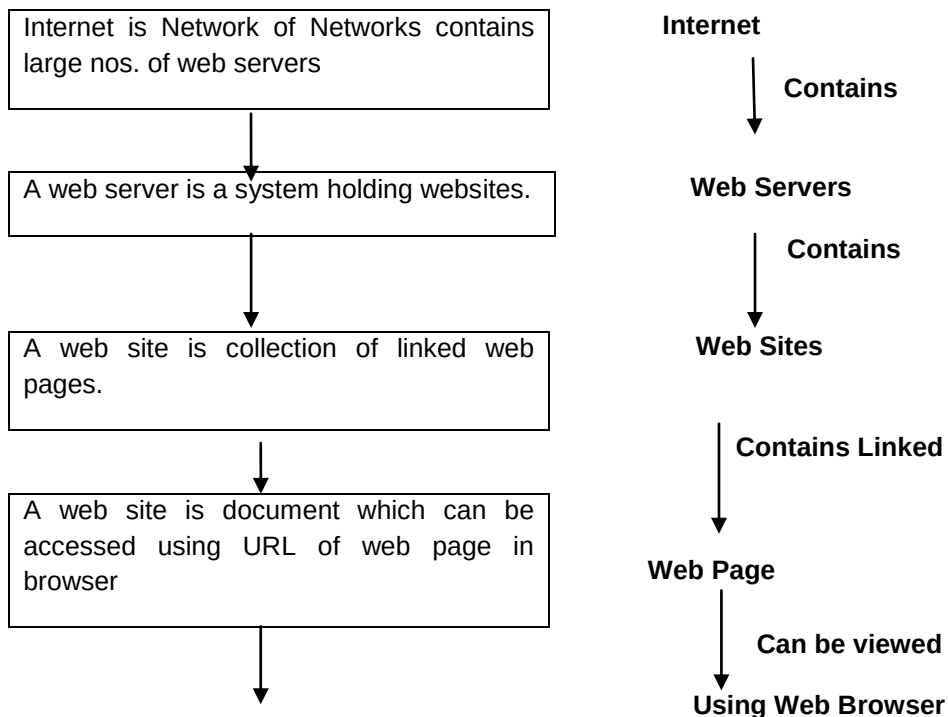
NOV
2011

- (6) **SDSL Connection:** Symmetric Digital Subscriber Line supports same data rate for uploading and downloading therefore it is called symmetric DSL. It supports data rate of about 3 Mbps.
- (7) **VDSL Connection:** Very High Digital Subscriber Line supports faster data rate than DSL
- (8) **Cable Connection:** it uses the TV cable for providing internet connection at very high speed at about upto 20 Mbps
- (9) **Wireless Internet Connection:** it is wireless broadband. It is the newest internet connection service and provides high speed internet connection
- (10) **T-1 lines connection:** This is popular leased line option for internet connection and it is normally used by organization to provide internet access to many users simultaneously.
- (11) **Bonded T-1 connection:** In this two or more T-1 lines are joined together to provide further high speed internet access.
- (12) **T-3 Connection:** This connection provides very high speed internet access. It contains large number of individual channels to provide very high internet access speed to big organizations.
- (13) **Satellite Connection:** It provides the internet connection over satellite to provide internet access from anywhere in the earth.

3.0 World Wide Web (WWW):**MAY 2003**

The World Wide Web (WWW) is perhaps the most important component that moved the internet from scientists and research organizations to people's homes. It offers smooth and easy to use graphical interface to access information available on internet and it is considered as synonymous of internet.

The WWW is distributed file management system with programs to access and send information. The clients to WWW are internet browsers that help to connect to a website server, request a web page and format the received content for display. The fundamental unit of web is web page. The **web page** is a text document developed using HTML that contains links to other web pages, graphics and audio files, and other internet services such as email. Web pages reside on web server and can be accessed with the help of internet browsers.



URL: URL is known as Uniform Resource Locator. It provides an address of particular web page on internet

Example: <http://www.yahoo.com/index.html> is URL of Yahoo site home page (means main page). A URL contains four components

http: Hyper Text Transfer Protocol: It is a protocol used for communication of web pages. Any web page uses rules and regulations governed by this protocol.

www: it is a service used in web browser to access web pages or access internet sites

yahoo.com: It is a server name of yahoo on internet

index.html: It is web page address in yahoo web server

HTML: Web pages are created with the help of HTML (Hyper Text Markup Languages). HTML allows the creator of web pages to specify how the text will be displayed and how a web page would be linked with other web pages. These links are normally known as Hyper Text Link

Most Important facility of internet, Email:

NOV 03, NOV 05

The killer application of Internet is known as Electronic-Mail or email, which allows user to send text and graphic messages to another user located anywhere in the world without any delay, and at almost nil cost. For E-mail, a user either uses some web based mail services like Hotmail, Yahoo, Gmail to open his mail account on their server, or he can be given a mail account by his ISP (Internet Service Provider) on ISP server. The email provided by popular mail servers or ISP is a unique ID like xyz@gmail.com, and can be accessed from anywhere in world. The email services provided by web sites like Hotmail, Gmail and Yahoo are very easy to use and come with numerous user friendly features like:

Address Book: To maintain mail address of nears and dears

Compile a Mail: This provides a user friendly editor which help to create a new mail.

Reply: This option helps to reply to an already received mail by writing the message in received mail itself.

Forward Mail: This option allows forwarding a received mail to other users.

Block Sender: This option helps to block the senders' addresses from which users do not want to receive any mail.

Attachment: This option helps to attach and send files (image, document, spreadsheet, etc) along with the email message to receivers.

FTP:

NOV 2002

File Transfer Protocol: It is a service used for sending and receiving files from local computer to a computer (server) on internet, or receiving files from a computer (server) on internet to local computer.

There are various software which provide FTP services like Microsoft Web Publisher, Cute FTP, etc.

Web Casting:

MAY 04, NOV 06, NOV 10

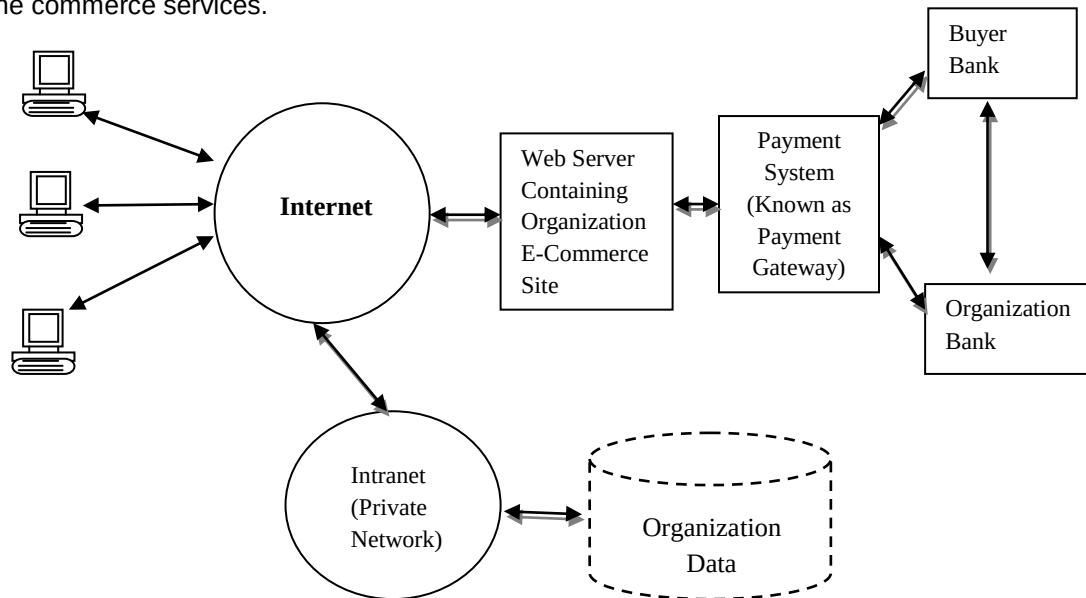
When we communicate data through internet then normally there is one-to-one communication between web server and user, who is requesting the data from web server. But there is one more type of data communication in which data is communicated to many users automatically without even request of that data from users. And this type of communication on internet is known as Web casting.

Web casting is like radio broadcasting, wherein data from one website is delivered to many users, who are connected to website, continuously without even any request (clicking on link) from users. Web casting is used for presenting live events on internet like matches, fashion show, seminars, etc.

Normal internet communications like www is based to pull technology i.e. user is required to pull the required information from web server, but the web casting is based on push technology in which web server keeps on pushing or sending the information to its users without even request from them for data.

4.0 E-Commerce:**NOV 2002**

- Electronic commerce is the process of doing business electronically (On line).
- Online commerce started with the invention of Electronic Data Interchange (EDI), a form of electronic commerce, which deals with the electronic transmission of preformatted business transaction documents (e.g. purchase order, export documents etc).
- E-Commerce is a collection of technologies, processes and business strategies that allows the instant exchange of information (transactions) within and between organizations.
- E-commerce is not a single technology but a combination of sophisticated technologies and business services integrated to provide instant transaction and response to consumer. For example, e-commerce is collection of Internet, Intranet, www, email, fax, EDI, etc to provide online commerce services.



You can visualize from above diagram that E-Commerce is collection of various Technologies

- E-Commerce is business anywhere around the world and at any time.
- E-Commerce has become very popular concept after the invention of internet. EDI which is also a kind of e-commerce was limited to only big organizations which were having their own private network for exchange of information. But internet has made e-commerce possible for even a very small organization.
- E-Commerce with internet has many benefits like
 - Lower cost of operation (Paper cost, manpower cost, Inventory cost etc)
 - Better interaction with consumer,
 - Business at anytime,
 - Personal solution to customer as per customer requirement,
 - Instant transaction for business,
 - Instant response and status of delivery for customer and worldwide reach etc.

- Provide updated information
- Paper less transaction
- Services can be setup any where
- Availability of business services all around the world.
- Online inventory management
- Creation of new markets without incurring large cost
- Reduced advertising cost

But there are some problems areas of E-commerce, like:

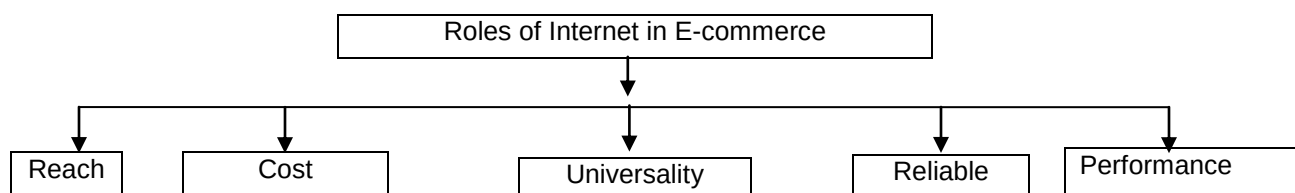
- Security problems for data and payments
- False claim of organization to customer
- Virtual presence of goods on net do not assure that actual goods would also be same
- Payment modes are risky (like payment through credit card etc).

Overall, the e-commerce is a successful concept for business/services, like education, health services, logistics (transport) services, stock market and CRM (Customer Relationship Management) call centers, etc.

Role of Internet in E-Commerce popularity:

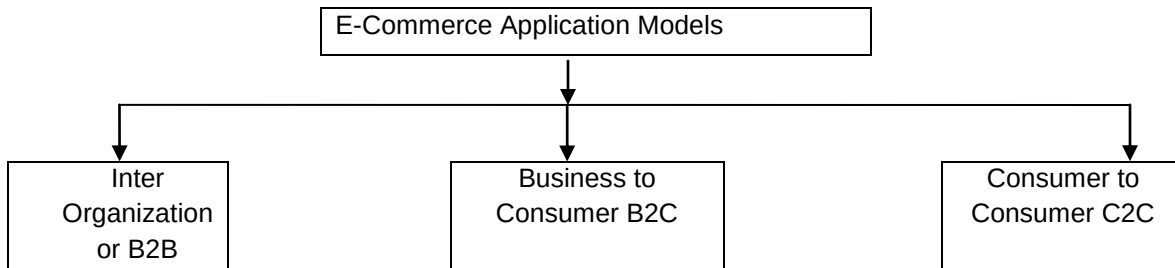
E-commerce which is an extension of EDI has gain immense popularity or acceptance due to low cost and always available internet. Following are some of the key roles which internet has played for e-commerce.

1. **Reach:** Internet is available everywhere, this has made the e-commerce applications reach also everywhere, be it a small town or big city.
2. **Cost:** Cost of data communication and setting an e-commerce site is surprisingly low due to low cost internet services.
3. **Momentum or Growth:** Internet is a very popular network for data communication and every day 1000s of users get connected to internet which ultimately provide fast growth to e-commerce activities.
4. **Universality:** Internet is a global network and is available from any part of the world, therefore business can communicate with another business operating from any where. It has provided a universal access to organization for setting e-commerce activities and communicating with other businesses.
5. **Reliable:** Internet is very reliable network in terms of its working; internet is an extension of ARPAnet which was highly robust and reliable. In spite of different type of devices and applications working on internet at the same time internet have nil downtime or nil non-availability problems.
6. **Performance:** Internet can handle any type of data like audio, video, images and text data. It provides a high performance in terms of handling different type of data and services thus it also improves the performance of e-commerce activities to handle various types of data.



E-Commerce Models (applications):

Following are three distinct general classes of e-commerce applications.



1. **Inter-Organizational (Business to Business (B2B)).** This model serves limited numbers of customers, not too many persons know the existence of such applications. In this model, transactions occur electronically between one business and another, normally between businesses of same area. For example, Intel is selling its chips to computer manufacturer online using B2B website. Inter-organizational applications normally help in followings:

***Supplier Management:** Help organizations to remain in touch with their suppliers for placed order thus B2B applications provide updated and continuous information on status of their order.

***Inventory Management:** Help in online inventory management i.e. help to maintain updated information on stock in store and transient.

***Distribution Management (warehouse management):** Organization can manage their distribution Channels efficiently.

***Customer Management:** Also help in better management of customers by providing them online access of services.

2. **Business to Consumer (B2C):** These are the most common and popular types of E-Commerce applications. In these e-commerce applications, individual transactions' values (amount) are lower but transactions volumes (number of transactions) are significantly higher than B2B applications. These applications include online books store, virtual departmental store and net banking, etc. e.g. www.amazon.com is the most popular online book store and it belongs to this category of applications.

There are two types of B2C E-commerce sites

1. Social Sites
2. Transactional sites

The social sites are informative site only these sites provide information on products and services offered by various business organizations to its customers.

Example: www.tisco.com

The transactional sites are those e-commerce site which allow conducting transactions of sales and purchase. Example www.amazon.com

3. **Consumer to Consumer (C2C):** This type of e-commerce applications facilitates consumers to interact directly with each other for transactions. For example, e-bay.com is the most popular C2C e-commerce applications. C2C e-commerce applications are sometime also known as auction sites.

Intra-Organizational Applications: These applications provide use of internet within the organization for various business activities. Normally, following are the type of intra-organizational applications:

- **Workgroup Communications:** a group of persons located remotely but working on same task or project can be managed efficiently using such e-commerce applications.
- **Collaborative Working:** This is making a decision or arriving at a solution of any problem by number of persons located remotely.
- **Sales Force Productivity Improvements:** These applications help organizations like pharmaceutical organizations, consumer goods originations to improve the productivity of their sales force by always remaining in touch with them and by using online reporting.

The popular term used for use of internet and its technologies within the organization for business activities is known as **Intranet**

Intranet:

NOV 00, NOV 07

Intranet is a private network available to organization employee from anywhere in the world using internet. The intranet is a type of information system that connects people, department, and offices which are widely dispersed within an organization. Intranet is a private network of an organization which uses internet technology for communication, like web browser, web server, etc. With an intranet, access to organization database (Network) can be made available to organization employees and offices remotely through internet connectivity. The objective of intranet is to provide connectivity to offices and to employees from anywhere in the world at a least cost for a better a management and coordination. Intranet facilitates a group and collaborative working between employees of organization located at different places. This help to provide the latest and up-to-date information for decision making (Collective) and reduce the documentation and communication (STD, ISD, FAX cost etc) cost.

Benefits of intranet are same as benefits of intra organization e-commerce activities:

- Collaborative and group working
- Low cost access to information from anywhere
- Sharing of resources, data and skill from anywhere
- Reduced documents and working cost
- Availability of updated information

Extranet:

NOV 2005

Extranet is an extension of intranet which makes organization intranet to be accessible to outside world also, like to the customers and business associates. In case of extranet, the part of intranet made available to customers or business associates for specific business applications. Extranet is also known as virtual corporation established by providing connection of specific parts of intranet to business partners (material suppliers, financial partners, buyers etc) for effective e-commerce.

The combination of intranet and extranet help organizations to achieve the concept of virtual organization i.e. entire working of organization can be in electronic form. Extranet help organizations to achieve supplier management, customer management and distribution management of goods and services in an efficient manner.

5.0 CRM: Customer Relationship Management

NOV 2012, MAY 11

CRM includes the methodologies, technologies and capabilities to manage a good relationship with customers.

The purpose of CRM is to enable organization to manage their customers in the best possible manner by using some real time systems and software. CRM is not only software and system but also a philosophy and culture of organization to serve their customers in the best possible manner.

To be an effective CRM it should be

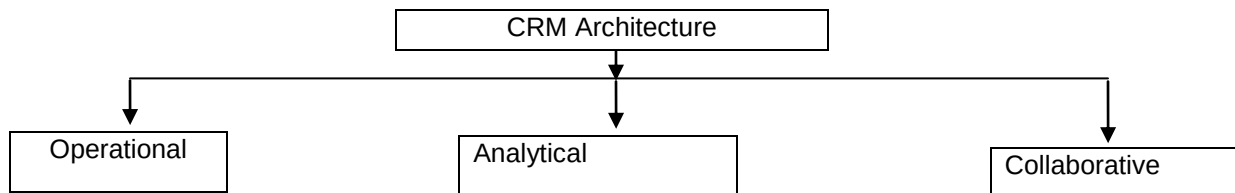
- (i) Integrated with sales, marketing and customer services
- (ii) Identify customer success factors
- (iii) Create customer based culture
- (iv) Adopt customer based measures
- (v) Develop process to serve customers
- (vi) Recommend set of questions to serve customers

You might have seen mobile companies and banking organizations providing toll free numbers to serve their customers for solutions of their problems. To provide such facilities for customer services is an example of CRM.

Architecture of CRM:

The CRM architecture means technologies or components used in CRM

CRM is based on following architectural components



- (1) Operational CRM:** Operational CRM support the front office business activities like sales, customer contact, etc. when we go to any mobile company office for any sales or complain solution, it is the part of operational CRM e.g. Reliance Web World etc

Operational CRM provides various benefits, like:

- (i) Deliver personalized services
- (ii) Enable customer to view organization and its services by directly interacting with organization's employees
- (iii) Sales and service persons of organization can access complete history of customer to provide better services

Operational CRM mainly cover the following three areas

- (i) Sales Force Automation
- (ii) Customer Service and Support
- (iii) Enterprise Marketing Automation

- (2) Analytical CRM:** Analytical CRM support mainly the back office business activities like provide details about percentage of customers company able of retain, percentage of customers who had regularly lodged the complains, etc.

Analytical CRM is very important; as it helps in various effective decision making process to retain and increase the number of customers, by proving the focus on problem areas

Analytical CRM primarily involves the data collection, analysis and reporting

(3) Collaborative CRM: This CRM help to interact with customers through all possible channels like Web, Phone, Fax, Letter, Email, etc. It brings customers and organization service provider in proximity to each other:

Collaborative CRM provides various benefits, like:

- (i) Enable customer interaction across all possible channels
- (ii) Enable web collaboration to reduce customer service cost, here I would like to mention that internet is considered the most inexpensive way of communication
- (iii) Help to integrate the multi-channel interaction with company call centers
- (iv) Help to integrate the customer view at transaction level

Purpose of CRM or Customer Relationship Management:

We can imagine now that CRM is primarily a technique of managing interaction between customers and business. CRM provide customer services through all possible methods. We can broadly put together the followings as purpose of CRM

- (i) Provide product information, use and technical assistance to customer
- (ii) Acquire and retain good customers
- (iii) Increase the importance of customer for organization
- (iv) Identify each individual customer to define quality and provide customized services
- (v) Provide mechanism of all possible contacts between organization and customers
- (vi) Help to identify problem areas quickly
- (vii) Provide a user friendly mechanism to register customer complaints
- (viii) Provide a fast mechanics to handle customer complaints and solutions
- (ix) Help to track customers preferences interest etc with the help of internet cookies etc
- (x) Help to provide services in faster and best possible manner

6.0 Supply Chain Management (SCM):

NOV 2007, MAY 2011, NOV 2012

Supply chain represents a link of entities involved for the movement and management of materials/goods. It includes a link from origination of raw materials, from supplier, to distribution of finished goods to customers. Managing supply chain is a very important aspect for organization to satisfy their customers' needs efficiently

Supply Chain Management (SCM) includes the movement and management of storage of raw materials inventory, work in progress inventory, finish goods inventory and distribution of finish goods to customers.

Following are the advantages or opportunities provided by SCM, if implemented properly.

Advantages or Opportunities provided by SCM:

Fulfillment: Ensures right quantity is always available of raw materials for production, and finish goods for sale

1. **Logistics:** Ensure transport costs as low as possible with safe and timely delivery
2. **Production:** Helps to provide smooth production by ensuring availability of required materials and parts
3. **Revenue & Profit:** Ensures no loss of sale or profit by providing availability of required finish goods
4. **Costs:** Control the costs of production, transportation costs, etc by employing methods to manage inventory at acceptable levels.
5. **Cooperation:** Ensure a greater degree of cooperation among organizations, and its buyers and suppliers, which ensure high level of reliability and quality in relationships.

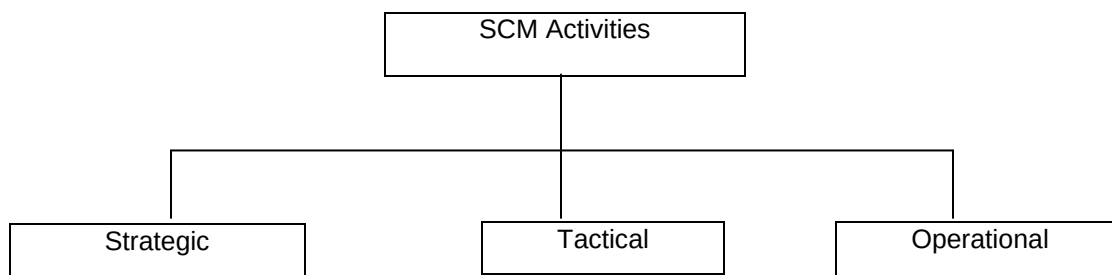
Problems Areas of SCM:

SCM is highly integrated process and need very effective and integrated distributions networks, some of the problems in managing SCM may be:

1. **Distribution Network Configuration:** Setting up appropriate numbers and locations of suppliers, production facilities and warehouses is a big challenge.
2. **Distribution Strategy:** Establishing a strategy to ensure smooth flow of materials and goods is another big task
3. **Information Sharing:** Among various locations and setup is another issues for establishing successful SCM
4. **Inventory Management:** Deciding on appropriate quantity of materials and goods to be maintained is another big stress area in SCM

SCM Activities:

All the SCM activities can be group together into:

**Strategic Activities:**

- (i) Planning numbers, locations and size of distribution network
- (ii) Deciding on partnership with suppliers and buyers
- (iii) Information technology infrastructure setup
- (iv) Make or buy decisions
- (v) Product design coordination

Tactical Activities:

- (i) Production decisions regarding contracting and scheduling
- (ii) Inventory decisions regarding quantity
- (iii) Transportation planning for goods
- (iv) Payments terms structuring
- (v) Sourcing decisions of materials

Operational Activities:

- (i) Daily production and distribution planning
- (ii) Production scheduling of each manufacturing facility resources minute-by-minute
- (iii) Planning to meet demand
- (iv) Daily inventory control
- (v) Logistics control
- (vi) Performance tracking of all activities

The Bullwhip Effect:**MAY 2008**

This effect is related with forecasted error. We all know we maintain inventory to manage uncertainty in demand, accordingly inventory is managed based on possible forecasted demand. And as per Whiplash, there is always a chance of error in the forecasted demand, and this error effect keep on increasing when we go farther from consumer to supplier. Effectively, multiplied effect ends up providing excess or shortage of inventory quantity.

This increasing error in the forecasted demand as we go farther from consumers and resulting excess or shortages of inventory known as bull-whip effect.

Alternative to this forecast driven supply chain is demand driven supply chain, which reacts to actual customer orders. The net result is near perfect visibility of customer demand and inventory movement. But it is not easy to implement this alternative because this method requires significant investment in Information Technology, and requires a culture with focus on customer demand.

8.0 Electronic Fund Transfer: (EFT):**NOV 2011, MAY 2009**

EFT represents the transfer of funds into a person's bank account, electronically. EFT is faster and safer money transfers method; and money is transferred immediately into an account by using online banking solutions in place of cheques and drafts which take time for money transfer.

EFT moves money into an account without using any paper movement

Some example of EFT systems in operation are:

Automated Teller Machines (ATMs): Now widely used everywhere by banks. Consumers can do banking without the assistance of a teller. Consumers can get cash, deposit cash, transfer funds, pay bills using ATM.

Point of Sale (POS) Transactions: This allows use of Credit or Debit card to allow transfer of funds from consumer's bank account to merchant account, directly.

Preauthorized Transfer: This provides automatic depositing or withdrawal of funds from an individual account, when an account holder authorizes the bank to do so. Normally, this is used by consumers to

authorize their banks to allow withdrawal of funds from their account for payment of bills, insurance premium, etc.

Telephone Transfer: Consumers can transfer the funds to another account for payment of bills by providing telephonic instructions.

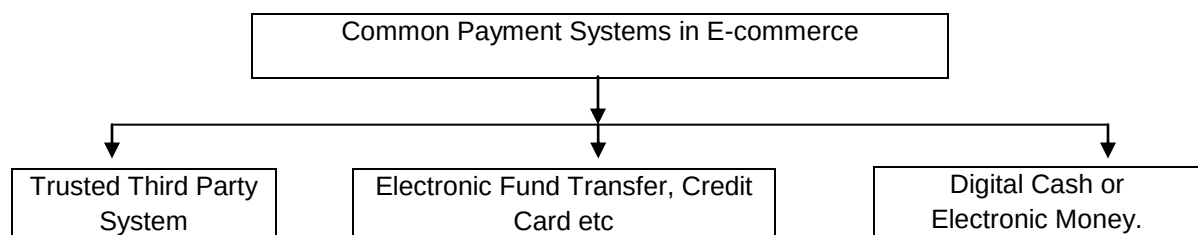
Types of Electronic Payments: As discussed above, EFT is becoming part of our daily routine tasks, and here are some electronic payment systems or technologies used for electronic payments

- 1 Credit Cards
- 2 Transaction using third party verifications
- 3 Secured Electronic Transactions
- 4 Joint Electronic Transactions
- 5 Electronic Cheques
- 6 Smart Cards
- 7 Electronic Purses

Payment System in E-Commerce:

NOV 2004

There are various payment systems, proposed or already in existence for e-commerce activities. Some of the popular payments mechanisms are:



1. **Trusted Third Party System:** In this, a third party like exchange maintains details of buyer and supplier accounts. After the execution of any transaction and on receipt of transaction details, the exchange transfers the funds from buyer account to supplier account as a settlement. Such type of third party system is also known as clearing house or settlement house.
2. **Electronic Fund Transfer, Credit/Debit Card:** This is the most popular online payment method. In this method, the payment is immediately credited to supplier's bank account from buyer's bank account. But this payment mechanism has some inherent security risks. It is possible that during the transfer of credit card details some can hack the details, and misuse the details for paying his own bills. To avoid these problems, credit card details are transmitted in encrypted (coded) form.
3. **Digital Cash or Electronic money:** This is also an online payment mechanism, in which money is exchanged in coded form between supplier and buyer. In this method, a buyer buys some digital cash in-exchange of physical cash (digital cash is numbers for various denomination of currency), and exchange this digital cash with supplier through online transactions. But this is not very popular method of payment for e-commerce activities.

9.0 Risk and Security Considerations in E-Commerce

Internet use in businesses is continuously expanding. But internet has some inherent risks and security concerns which every organization should take into consideration, and should establish security for the protection of business data and e-commerce infrastructure. Some of the concerns which organizations have for e-commerce services are:

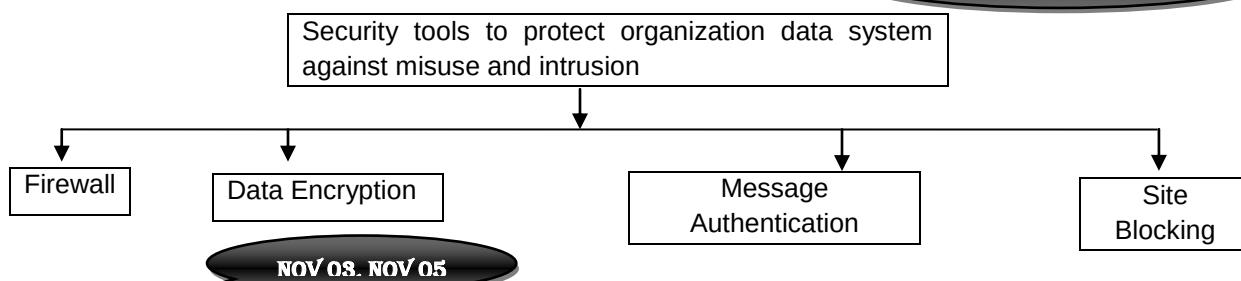
1. Hacking of important data and information
2. Reliability of services
3. Scalability of services, i.e. how much services can be expanded.
4. Will it be easy for users to use such services?
5. Payment methods for e-commerce.
6. Protection of data and information from viruses.

There are some general management concerns also for use of internet and ecommerce services like:

- (i) **Loss of paper based audit trails:** As transactions are kept in electronic form therefore management remain concerned about the loss of paper based audit trail as it is difficult to create audit trail for electronic transactions.
- (ii) **Business Continuity risk:** A total dependence on electronic business exposes organizations to failure of electronic system or business continuity.
- (iii) **Risk of legal liabilities:** There are always legal risks in terms inadvertently disclosure of data (customers and suppliers data) to third parties.
- (iv) **Safe retention and easy retrieval of data in storage devices:** There is some mandatory requirement for retaining data in electronic form as per the specific format.
- (v) **Exposure of data to third parties etc:** There is always a risk of exposure of data to third parties like to vendors and customers, because in e-commerce applications the organizations need to share data with third parties.

In spite of varied concerns, the internet is the most promising infrastructure for anywhere, anytime electronic communication between businesses and its partners.

Security tools- These are the tools which can be employed to address security concerns for data and information on internet. And these can protect information and organization's system from misuse, intrusion and viruses.



1. **Firewall:** We have already discussed firewall in the last chapter. As mentioned there, firewall controls the flow of traffic between internet and business's internal network (intranet). Firewall helps to protect organization data and internal resources from unwanted intrusion.
2. **Encryption:** This helps to transmit data between authorized users in coded or encrypted form, which helps to avoid misuse of hacked data by hackers.
3. **Message Authentication:** This technique ensures that message is from, who really claim it; and also is not tempered in between.

4. **Site Blocking:** This software helps in blocking site that are deemed inappropriate by management for visit

Legal Issues Related to Electronic Transaction:

Although people are aware of advantages which an electronic form of business provides, but people are reluctant to conduct business or conclude transactions in electronic form due to lack of a proper legal frame work. Some of the legal issues, which arise in mind of business associates, are:

1. Are electronic transactions enforceable in the court?
2. Can these be proved easily in the court?
3. To what extent network service provider is liable if message is lost in the network.
4. Tax liabilities and location of sale.
5. Jurisdiction of disputes

Although governments in different countries have framed laws for legalities of electronic transactions but still security has a lot of issues to be addressed to make it a popular medium for conducting business.

10.0 Other Technologies**Mobile Commerce:****MAY 2011**

This is an extended form of e-commerce. In this technique, business services are provided through internet enabled mobile phones and Personal Digital Assistance (PDA).

M-commerce is buying and selling of goods and services through wireless handheld devices such as mobile phone and PDA. The m-commerce is known as next generation business tool, as more and more users are using mobile phones; and it will enable users to access the internet for business activities without the need to plug in the computers

The technology behind m-commerce is WAP (Wireless Application Protocol). In order to make m-commerce more popular, the mobile manufacturers are already providing inbuilt facilities of internet access, email, Bluetooth, etc.

There are expectations, and already this is happening, that m-commerce will be increasingly used for:

1. Financial Services like banking, stock trading
2. Telecom services like bill payment and account review etc
3. Retail services like for online order of goods
4. Information services like receiving news, sports alerts

Bluetooth**MAY 07, MAY 12**

Bluetooth is a latest technology which enables mobile phones, computers and PDAs to communicate with each other in a short range or distance with wireless facility i.e. without connecting with each other by using wires or cables

Bluetooth enables its users to coordinate data exchange between mobile phones, computers and printers for sending, receiving and printing information without the need of connecting to each other.

Bluetooth requires a low cost trans-receiver chip in each device, this chip enables to transmit and receive the data in certain predefined frequency band of 2.45 GHz. In addition to data exchange, the Bluetooth also enable to sue voice channels. Bluetooth connection can be point-to-point and multipoint, but normally works in the short range.

This technology got this name in honor of Herald Bluetooth, the king of Denmark in the 10th century.

Wi-Fi (Wireless Fidelity):

MAY 10, MAY 12

Wi-Fi is a technology used for mobile computing devices such as laptops and mobile phones. Wi-Fi helps to remain connected with internet and LAN even when the person is on move/travel from location to another. Wi-Fi primarily helps to provide a wireless network.

A person with Wi-Fi connection and device such as computer, telephone or PDA can access the internet when that person is in proximity to Wi-Fi access point, and these access points are known as hotspot. These access points are installed by Wi-Fi service providers at different locations like Railway Station, Airport, etc just like mobile phone operators install the towers.

Wi-Fi also provides the connectivity in Peer-to-Peer mode, which enables devices to connect directly with each other.

Wi-Fi Certification: Initially there were not the set standards for Wi-Fi products or devices, which were used in computer for connecting to internet. This resulted in different service providers having different devices and there were problems of connecting to each other networks. So a need arise to use a device or card in the computers like modem card which should enable to connect to nay Wi-Fi service provider network; and this need gave the birth to Wi-Fi certified devices. Therefore, when you buy a Wi-Fi certified device for your computer, it ensures that you can connect your computer with any Wi-Fi service provider network without worrying about which service provider is providing the services

123

FUN PAGE: Google

Google is a mathematical term 1 followed by one hundred zeroes. The term was coined by Milton Sirotta, nephew of American mathematician Edward Kasne. Google started in January, 1996 as a research project at Stanford University, by Ph.D. candidates Larry Page and Sergey Brin when they were 24 years old and 23 years old respectively. Google receives daily search requests from all over the world, including Antarctica. The infamous "I'm feeling lucky" button is nearly never used. However, in trials it was found that removing it would somehow reduce the Google experience. Users wanted it kept. It was a comfort button. Due to the sparseness of the homepage, in early user tests they noted people just sitting looking at the screen. After a minute of nothingness, the tester intervened and asked 'Whats up?' to which they replied "We are waiting for the rest of it". To solve that particular problem the Google Copyright message was inserted to act as a crude end of page marker. Google has the largest network of translators in the world. Employees are encouraged to use 20% of their time working on their own projects. Google News & Google+ are both examples of projects that grew from this working model.

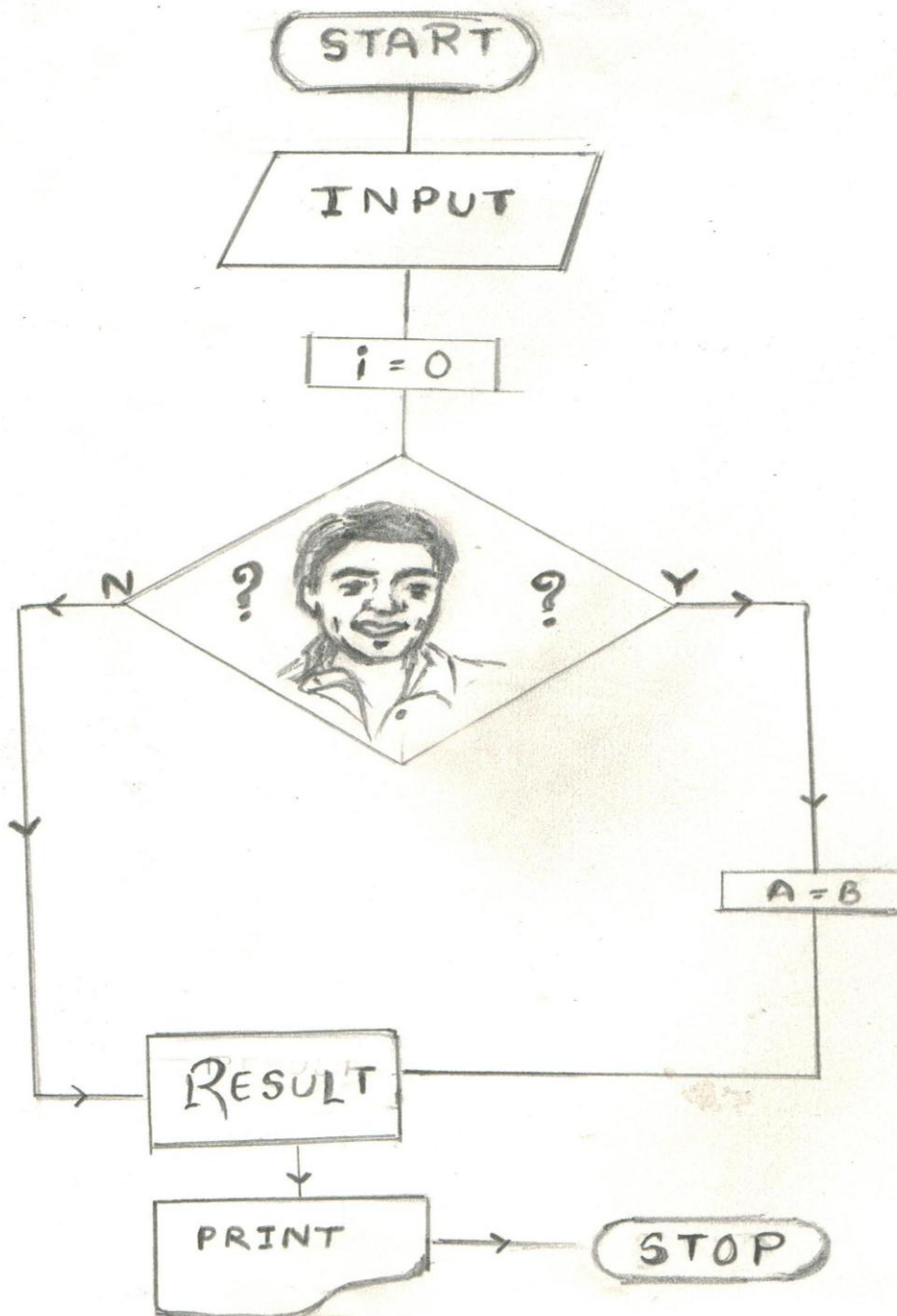


Founded on: 4-9-1998
Founders: Sergey Brin & Larry Page

(V.IMP) Question from my Desk for INTERNET

- Q.1 Explain any five features offered by E-mail software**
- Q.2 “SCM should focus on certain problems”. Discuss these problem in detail?**
- Q.3 Describe Wi-Fi & Bluetooth.**
- Q.4 Write short notes on Intranet and Extranet.**
- Q.5 Write short notes on web casting.**
- Q.6 Describe briefly: - Electronic Fund Transfer (EFT) & its types.**
- Q.7 How does CRM improve customer relationship?**
- Q.8 Describe HTML, URL, WWW, Domain name, Surfing**
- Q.9 Describe the features of E-commerce and M-commerce.**
- Q.10 What do you mean by Voice-messaging & Tele-conferencing.**
- Q.11 What are the types of E-payment (Any 4).**
- Q.12 What do you mean by SCM.**

FlowChart



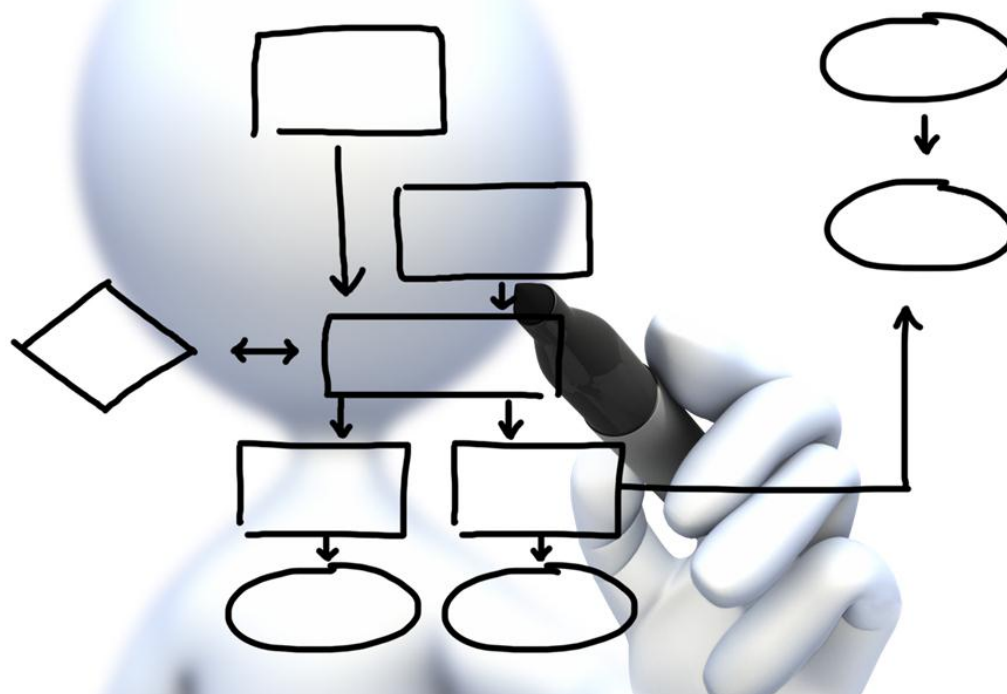
125

Chapter: 5

FLOWCHARTS

(MAY, NOV)

FLOWCHART



126

COMPUTER= 		Hardware + Software All physical Items System Software Appl. Software
		System Software like programming Language & OS(Windows, etc.) are used for developing application Software and Managing Computer System
So, Computer which is actually an electronic machine (Dumb) becomes intelligent because of software only. Software is a collection of program to carry out particular task.		
In IT Industry, developing software is known as software development & this process of software development requires lot of planning and thinking. Thus software development or Programming process broadly may be divided into six phases .		
SIX PHASES	Program Analysis:	This is a stage in which a detailed analysis for the application, which is to be developed, is done in-term of Input required, Output and Processing of data.
	Program Designing:	Determines the function to be performed using flow chart. (Drawing Flowchart and assigning the steps of Coding)
	Program Coding:	Converting the logic of the program outlined in the flowchart into actual program code (by Programmer) which can be executed on computers. By using programming languages like COBOL, BASIC, C, C++, Visual Basic, etc.
	Program Debugging:	During the process of compilation there can be many errors (run-time or object code error), which should be removed. Debugging means removing errors.

	Program Documentation:	Includes Program specification, Program descriptions, Test data, Operational manual and finally, Maintenance documentation.
	Program Maintenance:	Modification, Re-writing and restructuring of program, based on requirements of business data processing application subjected to the continued changes in near future.

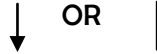
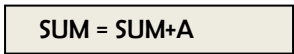
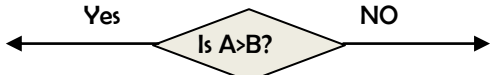
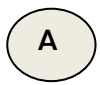
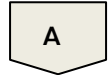
Flow Chart:	A diagram that shows sequence of steps to solve a particular problem. It is a logical flow of step which shows sequence of operations of a program by using symbols and interconnecting lines.	
Advantages:	◆ Easy communication of logics of the problem ◆ Serves as document for solving of problem ◆ Help to debug the program error	◆ Provide effective analysis of given problem ◆ Help in efficient programming or coding ◆ Help to make changes in the existing Program
Limitations:	◆ Not easy to make flow chart for complex Logics. ◆ It is difficult to make alteration or modification because that may require complete redrawing of flowchart. ◆ There is not scientific testing method to check the correctness of flowchart.	

Some Key points to be considered while creating a Flowchart:

1. First read the problem carefully and determines the **output** of problem like discount, rate etc.
2. After determining the output, find out the inputs of the problems.
3. Make sure all the Condition/Rules mentioned in the problem are covered in your Flowchart.
4. Make sure CAWL (clear all working Location) is properly used or not to clear the earlier memory.
5. To count the transaction like number of employees or number of students, etc there can be two or more types of counter

SYMBOLS of FLOWCHART

The following Symbols are used for creating a Flowchart:-

Start/end	
Instruction flow line	
Input/output	
Process	
Decision	
On-page connector	
Off-page connector	
Print	

Question 1

An insurance company follows the following rules:

- (i) If a person's health is good and age is between 20 and 40 years and lives in a city and sex is male, then the premium is Rs.20 per thousand and he will be insured for maximum amount of Rs.10.0 lakhs.*
- (ii) If a person satisfies all the above conditions, except that sex is female, then the premium is Rs.15 per thousand and maximum insured sum will be Rs.15.0 lakhs.*
- (iii) If a person's health is poor and age is between 20 and 40 years, but lives in a village. For a male sex, premium is Rs.50 per thousand and maximum insured sum is Rs.1.0 lakh only.*
- (iv) In all other cases, the person is not to be insured.*

Draw a flow chart to find the eligibility of a person to be insured, premium rate and maximum amount of Insurance.

(PE – II Nov. 2002)

Question 2

An electricity distribution company has three categories of consumers namely-

(i) Domestic (ii) Commercial (iii) Industry

The charges of electricity per unit consumed by these consumers are Rs.3, Rs.4 and Rs.5 respectively. The computer database of the company has following information:

· Consumer's name · Category · Units consumed · Bill date · Date of payment.

The company processes bills according to the following criterion.

If the consumer is domestic and pays his bill within 10 days of the bill date, 5% discount is given. If he pays the bill within 15 days, no discount is given. If he makes the payment after 15 days of the bill date, 10% surcharge is levied. For the non-domestic consumers (commercial or industry), corresponding percentage be 10%, 0% and 15% respectively. Draw a flowchart to calculate the bill amount, discount, surcharge and net amount of the bill

for each type of consumer and print it.

(PE – II May 2003)

Question 3

A bank accepts fixed deposit for a year or more and the policy on interest rate is as follows:

- (i) If a deposit is less than Rs.10,000 and for two or more years, the interest rate is 5% compounded annually.*
- (ii) If a deposit is Rs.10,000 or more, but less than Rs.50,000 and for two or more years, the Interest rate is 7% compounded annually.*
- (iii) If the deposit is Rs.50,000 or more and is for one year or more the interest rate is 8% compounded annually.*
- (iv) On all deposits for five years or more interest rate is 10% compounded annually.*
- (v) On all other deposits not covered by the above conditions, the interest rate is 3%.*
- (vi) If the customer is holder of any type of account for last five years, an additional 1% interest is allowed.*

Draw a flow chart to obtain the money in customer's account and interest credited at the time of withdrawal.

(PE – II Nov. 2003)

Question 4

Draw a flow chart to compute and print Income-tax, Education cess on the income of a person, where income is to be read from terminal and tax is to be calculated as per the following rates:

<u>Slab Rate</u>	<u>(Rs.)</u>
(i) 1 to 2,00,000	No tax
(ii) 2,00,001 to 5,00,000	@ 10% of amount above 2,00,000
(iii) 5,00,001 to 10,00,000	Rs. 30,000 + 20% of amount above 5,00,000
(iv) 10,00,001 onwards	Rs. 1,30,000 + 30% of amt above 10,00,000
Education cess 3% on the total tax	

Question 5

A company ABC Ltd. is engaged in selling consumer goods to different categories of customers. In order to increase its sales, different types of discounts are offered to customers. The policy of discount is as given below:

- (i) On cooking range, a discount of 12 percent is allowed to dealers and 9 percent to retailers irrespective of the value of the order.*
- (ii) A discount of 12 percent is allowed on washing machine irrespective of the category of customer and the value of the order.*
- (iii) On decorative products, dealers are allowed a discount of 20 percent provided that the value of the order is Rs. 10,000 and above. Retailers are allowed a discount of 10 percent irrespective of the value of the order.*

Draw a flow chart to calculate the discount for the above policy.

(PE – II May 2004)

Question 6

A bicycle shop in a city hires bicycles by the day at different rates for different models as given below:

<u>Model No.</u>	<u>Hire Rate per day</u>
Model No. 1	Rs. 10
Model No. 2	Rs. 9
Model No. 3	Rs. 8
Model No. 4	Rs. 7

In order to attract customers, the shopkeeper gives a discount of 15 percent to all those customers, who hire a bicycle for more than one-week period. Further to attract women customer, he gives additional discount of 10 percent irrespective of hire period. For every bicycle hired a security deposit of Rs. 25 must be paid.

Draw a flow chart to print out the details of each customer such as name of customer, bicycle model number, number of days a bicycle is hired for, hire charges, discount and total charges including deposits.

(PE – II Nov. 2004)

Question 7

An electric supply company charges the following rates for its domestic consumers:

<u>No. of units consumed</u>	<u>Charges/unit</u>	<u>(Rs.)</u>
<i>For the first 200 units</i>		<i>1.60</i>
<i>For the next 300 units</i>		<i>2.10</i>
<i>Over 500 units</i>		<i>3.90</i>

Surcharge @ 20% of the bill is to be added to the charges.

Draw a Flow chart for the above, which will read the consumer number and the number of units consumed and print out the total charges with the consumer number and the units consumed.

(PE II Nov 2006)

Question 8

A bank has 500 employees. The salary paid to each employee is sum of his basic pay, Dearness Allowance and House rent allowance. For the purpose of computing house rent allowance bank has classified his employees into three classes A, B and C. The house rent allowance for each class is computed at the rate of 30 percent, 20 percent and 10 percent of the basic pay respectively. The dearness allowance is computed at a flat rate of 60 percent of the basic pay.

Draw a flow chart to determine the percentage of employee falling in the each of the following salary slabs:

- (i) Above Rs. 30,000*
- (ii) Rs. 15,001 to Rs. 30,000*
- (iii) Rs. 8,001 to Rs. 15,000*
- (iv) Less than or equal to Rs. 8,000.*

(PE II May 2005)

Question 9

A water distribution company has two categories of consumers (Domestic and Commercial). The charges of water per unit consumed by these consumers are Rs. 5.00 and Rs. 8.00 respectively. The computer database of the company has the following information:

- Consumer's name
- Category
- Units consumed
- Bill's date
- Date of payment.

The company processes bills according to the following criterion:

If the consumer is domestic and pays his bill within 10 days of the bill date, 7% discount is given. If he pays the bill within 15 days, no discount is given. If he makes the payment after 15 days of the bill date, 10% surcharge is levied. For commercial consumers, corresponding percentage be 15%, 0% and 15% respectively.

Draw a Flow chart to calculate the bill amount, discount, surcharge and net amount of the bill for each type of consumer and print it.
(PE II Nov 2005)

Question 10

Draw a Flowchart to add two Numbers?

Question 11

Draw a flowchart to add five Numbers?

Question 12

Draw a flowchart to Compute SIMPLE INTEREST?

Question 13

Draw a flow chart to Compute Compound Interest? (for “n” times)

138

Question 14

Draw a Flowchart to Find and Print the Sum of First 65 ODD Numbers?

Question 15

Draw a Flowchart to add sum of square of first 20 odd nos.

Question 16

Prepare the flowchart for finding the sum of the following given series:

$$8 \times 5 + 10 \times 8 + 12 \times 11 + 14 \times 14 + \dots\dots\dots$$

Add the terms from the above series till the sum value will not exceed 5000. Print the sum and number of terms taken from the series.

Question 17

Draw a flowchart for calculating Factorial of a Number?

Question 18

Draw a Flowchart to add Following Series 2,5,10,17,26.....10 nos.

Question 19

Draw a flowchart for following Series $1A+2A^2+3A^3+4A^4+.....N$ Terms

Question 20

A bicycle shop in a city hires bicycles by the day at different rates for different models as given below:

Model No.	Hire rate per day
MTB	Rs 14.00
Atlas	Rs 12.00
Hero	Rs 10.00

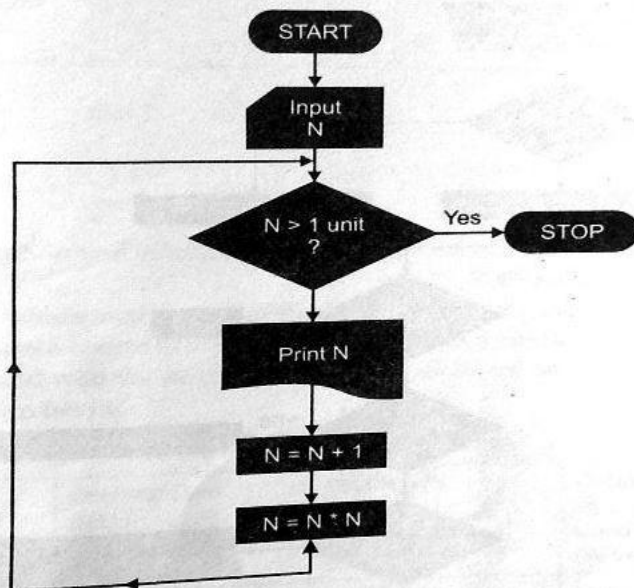
In order to attract customers, the shopkeeper gives a discount on the number of days a bicycle is hired for. The policy of discount is as given below:

No. of days	Discount Rate
1-5	0%
6-10	5%
11 and over	10%

For every bicycle hired a deposit of Rs. 30 must be paid. Develop a Flowchart to print all detail & Charges

Question 21**New Category Questions: (IMP)**

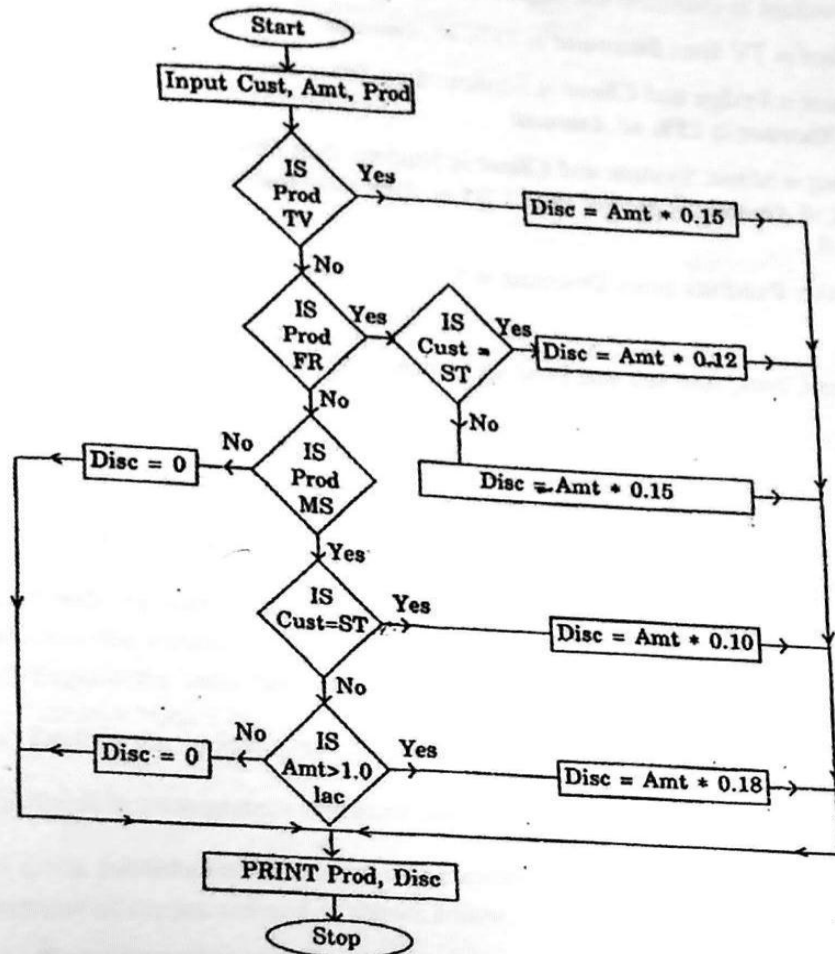
- (a) Write the output sequence (at least first five numbers) for the given flowchart, if $N = 0$ is selected as the value of N as input.
- (b) If the statement " $N = N * N$ " in the computation box of the flowchart is modified as " $N = N * (N - 1)$ ". Write the output sequence (at least first five numbers) for the flowchart with $N = 0$ as the input value for N .
- 2009 November



Question 22

4. Frame the problem for which the given Flowchart 'has been drawn. See the Abbreviations defined below:

10



Cust: Client, **Prod:** Product **Amt** Amount **Disc:** Discount, **TV:** Television **FR :** Fridge,
MS : Music System, **ST :** Student

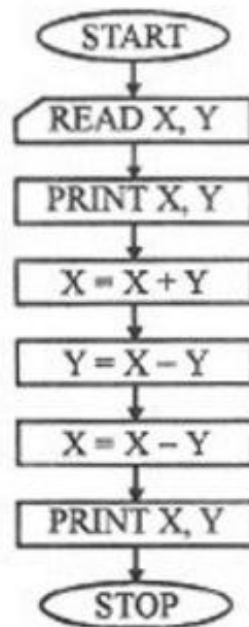
147

Question 23

- (a) Print the output displayed for using the given two sets of data :

	X	Y
1 st Set :	15	20
2 nd Set :	35	30

- (b) What interpretation do you make from the instructions given in the flow chart ?
- (c) Comment about the storage of the variables used in the instructions of the flow chart.



Question 24

Draw a flowchart to print the square of odd numbers between 10 to 50 and also print the sum of their square. (NOV 12)

CONVERSION SYSTEM

1. Decimal to Binary

Eg:- $(75.3125)_{10} \longrightarrow (\quad)_2$

Ans:-

2. Decimal to Octal

Eg:- $(75.3125)_{10} \longrightarrow (\quad)_8$

Ans:-

150

3. Decimal to HexadecimalEg:- $(75.3125)_{10} \longrightarrow (\quad)_{16}$ **Ans:-****151****4. Binary to Decimal** (same for “O-D” & “H-D” just replace 2 by 8 & 16)Eg:- $(111101.101)_2 \longrightarrow (\quad)_{10}$ **Ans:-**Eg:- $(111101.101)_2 \longrightarrow (\quad)_8$ **Ans:-**

5. Binary to Octal

	4	2	1
1 -	0	0	1
2 -	0	1	0
3 -	0	1	1
4 -	1	0	1
5 -	1	0	1
6 -	1	1	0
7 -	1	1	1

Q. $(754)_8$ ----- ()₂

Ans:-

Q. $(4712)_8$ ----- ()₂

Ans:-

6. Binary to Hexadecimal

	8	4	2	1
1 -	0	0	0	1
2 -	0	0	1	0
7 -	0	1	1	1
8 -	1	0	0	0
A -	1	0	1	0
D -	1	1	0	1
F -	1	1	1	1

Q. $(A954)_{16}$ ----- ()₂

Ans:-

Q. $(4DE2)_{16}$ ----- ()₂

Ans:-

Imp Q

1. $(A954)_{16}$ ----- ()₈ (Hint:- First convert it into Binary)

2. $(4723)_8$ ----- ()₁₆ (Hint:- First convert it into Binary)

6. DECISION TABLE

Sometimes it is very difficult to prepare a flowchart based on many decision blocks or conditions as such flowchart becomes very complex to draw. We may represent such kind of problem solutions in a table form and such tables are known as decision tables.

Decision Table:	A precise yet compact way to model complicated logic which defines the possible contingencies that may be considered within the program and the appropriate course of action for each contingency.		
Four parts of Decision Table:	◆ Condition stub	◆ Condition entries	
	◆ Action stub	◆ Action entries	
	<i>Condition being tested</i>	<i>Condition statements</i>	<i>Condition entries</i>
	<i>Possible action to take</i>	<i>Action statements</i>	<i>Action entries</i>
Steps to create a Decision Table	1. Finding all conditions from the problem (normally inputs with analysis) 2. Findings of action from the problem (normally outputs) 3. Finding Rules ---- Rules = 2^(No. of Conditions) 4. Filling the Condition Entries: with the help of Y or N 5. Filling the Action Entries: with the help of X or ✓ 6. The Next step is to remove Redundancy.		
Types of Decision Table	Limited Entry Tables:	The condition and action statements are complete. The condition and action entries merely define whether or not a condition exists or an action should be taken. Y : Condition exists N : Condition does not exist – : Condition/Action does not apply X : Execute the action statement	
	Extended Entry Table:	Condition and action statements are not complete, but are completed by the condition and action entries. Condition and action entries not necessarily be defined as Y, W and X.	
	Mixed Entry Table:	It combines both the limited and extended entry forms.	
Advantages	1. It is easier to construct a decision table than flowchart 2. It gives better representation of any problems solutions 3. It is possible to convert a decision table directly into a computer program with the help of specialized software. 4. Decision Table uses a standardized Format 5. Table solution is like a show cause and effect relationships 6. To understand table no prior knowledge of computer is Required		
Disadvantages	1. Decision Table cannot represent the clear sequencing of a problem as represented by Flowchart 2. Decision table are used for problem which involves logic sequencing. It is difficult to construct table for a problem involving arithmetic cal^u 3. For a simple Logical problem, flow charts serve the better purpose than decision table.		

7. Differences in Information Technology (46 diff.)

1. Data Vs. Information. (chapter: DBMS)

No.	Distinction	Data	Information
1.	Meaning	It is the smallest raw fact of life. It is the plural form of the word datum.	It is the processed data.
2.	Input/output	It is the input for processing.	It is the output of processing.
3.	Usefulness to the user.	It is not directly useful to the user.	It is directly useful to the user because of its presentation, format and design.
4.	How is it collected?	It is generally collected in vouchers or source documents from which they are entered into computer.	It is always presented in a well designed format, either on paper or on computer terminal.
5.	From where it is collected?	Data used for a single application is collected from several departments.	Information in the form of report is distributed to more than one department or business function.
6.	Volume	Data for business applications is generally voluminous.	Information is the way of summarizing data so that it has some use and value to the user. Summarization brings down the volume of information.
7.	Nature	Data should be accurate but need not be relevant, timely or concise.	Information must be relevant, accurate, timely, concise and complete and apply to the current situation.

2. Bit Vs. Byte

(chapter: DBMS)

No.	BIT	BYTE
1.	It is the smallest unit of storage measurement.	It is a collection of 8 bits.
2.	A bit can represent either '0' or '1'.	It can represent an alphabet, number or

		some special symbol.
3.	It is represented in the form of ON or OFF in the memory.	It is used to represent several combinations of bits that indicate a character.
4.	It is used to represent small amount of memory.	It is used to represent large amount of memory.

3. Data Processing Vs. Data Processing System.

(chapter: DBMS)

No.	Data Processing	Data Processing System
1.	Data Processing is the restructuring, manipulating or recording of data by people or machines to increase their usefulness and value for some particular purpose.	Data Processing System is a system that accepts data as input, processes it into information and gives output.
2.	It refers to some operations, which are required to process data and to produce information. For example, classifying, sorting, summarizing etc.	It refers to some system which performs those functions.
3.	Processing involves some steps but does not include any components	The components in manual data processing system would be men. They will use simple tools such as paper, pencils and filing cabinets. Mechanical data processing systems utilise such mechanical devices as typewriters, calculating machines and book keeping machines. Automatic data processing implies the use of machines for data processing. It could be performed either by unit record method or electro mechanically by computer.
4.	The main objective of data processing is to increase the usefulness the data.	The system is designed to achieve the objectives of data processing.

4. Master File Vs. Transaction File.

(chapter: DBMS)

No.	Master File	Transaction File
1.	Master file contains relatively permanently records for identification and summarizing statistical information.	These are created from source documents used for recording events or transactions.

2.	It contains current or nearly current data, which is updated regularly.	These files generally contain information used for updating master files.
3.	It rarely contains detailed transaction data.	It contains detailed data.
4.	The product file, customer file and employee file are examples of master files.	Examples of transactional files are purchase orders, job cards, invoices etc.
5.	These are usually maintained on direct access storage devices.	These can be maintained on sequential as well as direct access storage devices.

5. Workstation Vs. Microcomputer.

(chapter: Networking)

No.	Workstation	Microcomputer
1.	Workstations are powerful desktop computers designed to meet the needs of engineers, architects and other professionals who need good graphic displays.	It is a full-fledged computer system which uses a microprocessor as its CPU.
2.	It looks like a personal computer and is used by a single user. Its CPU uses Reduced Instruction Set Computing (RISC), which results in faster processing of instructions	It uses a microprocessor as its CPU. It is also a single user computer.
3.	Workstations generally run on Unix Operating System or a variation of it.	Microcomputers run on Dos, Unix, OS/2, MS Windows NT, etc. Microcomputers enable the users to switch between tasks known as Multitasking, which is a great time saver.
4.	Workstations are commonly used for Computer-Aided Design (CAD) and are used as servers for Local Area network (LAN)	It is multi purposeful. If the required software is available, it can be used for any application.
5.	Relatively fast in processing.	Relatively slow in processing.

6. Special purpose computers Vs. General Purpose computers.

(chapter: Software)

No.	Special purpose computer	General purpose computer
1.	A special purpose computer is designed to	General purpose computers can be used for

	perform a special task.	business, scientific and other applications.
2.	The instructions are in-built in the computer circuitry by the manufacturers.	It can be programmed by the user for different purposes.
3.	These are also called dedicated computers.	These are also called versatile machines.
4.	More efficient machines.	Less efficient than special purpose computers.
5.	Programs in the machine cannot be changed or upgraded.	As and when necessary, programs can be amended or dropped.
6.	Costly.	Comparatively cheap.

7. Hardware Vs. Software.

(chapter: Software)

No.	Distinction	Hardware (HW)	Software (SW)
1.	Meaning	Refers to components that constitutes computer system.	Refers to means of controlling the computer equipment.
2.	Visibility	It refers to physical, visible components of a computer.	If refers to invisible components of a computer.
3.	Components	It is made up of input devices, output devices, C.P.U., storage devices, communication devices etc.	Software is made up of data and instructions.
4.	Producers	Hardware is produced by Hardware manufacturers. Eg. IBM, INTEL, HCL, WIPRO, HP, SONY, AMKETTEE.	System Software like WINDOWS are manufactured by big software companies like MICROSOFT. Some readymade application Software like "TALLY, Ex etc. are manufactured by Software companies like TCS, Infosys etc. Other application Software may be prepared by individual programmers and end users.
5.	Modularity	Most of the Hardware devices are purchased initially but few of them can be added later on.	Most of the Software can be purchased initially along with Hardware. But application software is procured in stages, depending on requirements.
6.	Changes/	Hardware once procured does	System Software once procured do not go

	Alteration	not go through frequent changes except for new additions or releases or updation.	through frequent changes, except for updation. Application software goes through frequent changes whenever policies and procedures are changed.
7.	Virus	Do not get affected by computer virus.	Only Software gets affected by computer virus.

8. Direct Data Entry Vs. Remote Data Entry.

(chapter: DBMS)

No.	Direct Data Entry	Remote Data Entry
1.	Under this method data is entered directly into the computer using machine-readable source documents or through use of on-line terminals.	Data is entered and grouped in blocks for transmission to computer from a terminal, which is located at remote site.
2.	DDE devices have the capability of scanning source documents magnetically or optically. For e.g. MICR, OCR, OMR etc.	These terminals have capability of receiving back information from computer and printing.
3.	These terminals are connected to keyboard or other input devices for direct data entry.	These terminals are connected either directly or through communication lines with the computer.

Note: Remote job entry can also be done using Direct Data Entry devices.**9. Dumb Terminal Vs. Intelligent Terminal.**

(chapter: Network, DBMS)

No.	DUMB TERMINAL	INTELLIGENT TERMINAL
1.	A dumb terminal is an input / output device that provides for data entry and information exit when connected to a computer.	An intelligent terminal is an Input/Output device that is user-programmable.
2.	It has no such additional capabilities.	An intelligent terminal is user programmable. It contains not only a storage area but also a microprocessor.
3.	It is totally dependent on the computer to which it is connected.	The terminal can be programmed to communicate with and instruct the user who is entering data.
4.	Dumb terminals do not have	It can also do some processing of data

	microprocessors. Therefore, they are simple input devices that can display output from the CPU to which they are connected.	internally such as sorting, summarizing, checking both input and computed values for reasonableness and so on. Thus it does not rely on minicomputer or mainframe computer for processing. This feature can reduce the load on the central CPU.
5.	They immediately transmit each keyed data character to the main processor. When a keying error occurs, the operator may need to backspace to the error and then re-key all later characters.	Intelligent terminals can be used on a stand-alone basis or can be part of a distributed network of terminals.
6.	Cost is very low.	Cost is very high.

10. Application Program Vs. Utility Programs.

(chapter: Software)

No.	Application Program	Utility Program
1.	Application programs are written for the purpose of solving specific business / scientific problems.	Utility programs are available for the purpose of supporting the data processing activity.
2.	It is developed using programming language.	It is used in developing application software.
3.	It is used in carrying out the data processing jobs.	It acts as a tool in carrying out the data processing job.
4.	It gives some general solutions for related problems.	It gives specific solutions for specific problems.
5.	Professional programmers write application programs.	Software manufacturers supply the utility programs.

11. Interpreter Vs. Compiler. / Interpretation Vs. Compilation. (chapter: Software)

No.	Distinction	Interpretation	Compilation
1.	Meaning	It is a type of translation in which one line is translated at a time.	It is a type of translation where the entire source programme is translated at a time.

2.	Interpreter/ Compiler	The translation software which translates only one line at a time is called Interpreter.	The translation software which translates the entire source programme at a time is called compiler.
3.	Storage	In interpretation every line of source programme is read and translated. The object code is created and immediately executed. When the next line is read & translated, the object code created earlier is not stored.	The entire programme is read and translated at a time. The object programme is generated and stored in the secondary storage device. Using this object programme, the programme gets executed subsequently without compilation.
4.	Translation & Execution	In interpretation, programme translation and execution always happens together line by line.	Programme translation and execution need not happen together.
5.	Number of Translations	Translation has to be done every time the programme is executed.	Translation is one time activity. Future programme executions may be done with the object programme without having repeated translation.
6.	Speed	Programme execution is slow.	Programme execution is fast.
7.	Users/Preference	Interpreters are preferred by new learners. (Or) In case the data to be translated is less.	These are preferred by professionals, for business data processing applications at large centers.
8.	Future executions.	Source programme has to be permanently present for all future programme executions.	Source programme need not be present at all times. Future executions may be done only with object programme.
9.	Error detection	Syntax Errors are detected, displayed and corrected line by line.	All syntax errors can be detected, displayed and corrected together.
10.	Security to applications	Gives less security to applications because easily correctable source programmes are permanently stored for all future programme executions.	Gives more security to applications.

12. Multiprogramming Vs. Multitasking.

(chapter: Software)

No.	Multi Programming	Multitasking
1.	Multiprogramming is a technique used to execute number of programs simultaneously by a single processor.	It is the logical extension of multiprogramming and refers to the operating systems ability to execute two or more of a single user's tasks concurrently.
2.	In multiprogramming, number of processes resides in main memory at a time.	The CPU switching between them executes multiple jobs. The CPU scheduler selects a job from the ready queue and switches the CPU to that job. When time slot expires, the CPU switches from this job to another job.
3.	The operating system picks and begins to execute one of the jobs in the main memory.	Here, different processes share the CPU time. The main advantage of multitasking is efficient CPU utilization.
4.	The purpose of multiprogramming is to increase the utilization of the computer system as a whole.	It provides single user with multiprogramming capabilities.

162

13. Multiprogramming Vs. Time Sharing System.

(chapter: Software)

No.	Multiprogramming	Time sharing system
1.	Multiprogramming is a processing mode in which several partially completed tasks are processed concurrently.	Time Sharing is a processing system with number of independent, relatively low speed, on line, simultaneously usable stations which are geographically remote from the computer and from each other.
2.	At any time, only one task or job is actually being executed, but within a larger time span of several minutes, the computer is processing several jobs or programs, alternating between actually executing, and performing input/output activities.	Each station provides direct access to the central processor for obtaining instant responses to the questions asked or statements made in an interactive conventional mode.
3.	When one job needs to do input/output another can begin execution. Thus two or more independent programs are executed in the same time span by interleaving their	The speed of the system and the use of multiprogramming allows the central processor to switch from one using station to another and to do a part of each job in the

	execution.	allocated "time slice" until the work is completed.
5.	The advantage of multiprogramming is that overall performance of the system can be enhanced. The speed of the CPU can be used to avoid the delays in waiting for input or output operations.	The response is so fast that the user has the illusion that no one else is using the computer, which creates an impression of having a computer for one's sole use.

14. Multiprogramming Vs. Multiprocessing.

(chapter: Software)

Multi programming is the term used to describe a processing approach in which 2 or more independent CPU's are linked together in a coordinated system. On the other hand, multiprogramming refers to the processing mode in which interleaved execution of 2 or more different and independent programs is carried out by the same computer.

Multiprogramming is not defined as the execution of instructions from several programs at the same instant in time. Rather, it means that there are number of programs available to the CPU and that a portion of one is executed, then a portion of another and so on. On the other hand, in multiprocessing, instructions from different and independent programs can be processed at the same instant time by different CPU's. Or, the CPUs may simultaneously execute different instructions from the same program.

15. Syntax errors Vs. Logical errors.

(chapter: Software, Flowchart)

No.	Distinction	Syntax Error	Logical Error
1.	Meaning	These are programme errors which occur on account of wrong usage of computer language and its rules or syntax.	These are content errors that can be detected from the output of a computer programme. Here the output is different from what is expected either in value or in design or in format.
2.	Where they can Present	These can only be present in object programme since compiler will not convert it into object programme until it is syntax error free.	They may be present both in source programme as well as object programme.
3.	How identified	Can be identified by compilation Software during compilation	Cannot be identified by compiler during compilation.
4.	Both are errors that occur in computer system.		

16. System Software Vs. Application Software.

(chapter: Software)

No.	Distinction	System SW	Application SW
1.	Meaning	It is an important type of SW which is essential for computer system to be used by the user. Used to improve the performance and maximum utilization of system resources.	It is an important type of software which are created to achieve the end users or applications of the computer system. Used to improve the speed and quality of business activity.
2.	Examples	Operating system, Computer languages, Compilation SW, Utility programmes, Library functions, Diagnostic SW etc.	Software for stores accounting, Financial accounting, Invoicing SW, Payroll programmes etc.
3.	Who produce?	May be prepared by large SW companies like MICROSOFT. Some may also be written by system programmers.	Application SW in the form of readymade application packages may be produced by SW companies. Tailor made application SW may also be written by programmers or end-users.
4.	How prepared?	Prepared using any low level language.	May be prepared using any higher computer language or specification SW like DBMS.
5.	When procured?	It is generally procured along with HW at the time of initial purchase. But few modules may be added later also.	Generally prepared in stages one after another based on user priorities.
6.	Updations	Once prepared doesn't change frequently except for new additions or versions.	Goes through more frequent changes whenever policies and procedures relating to the applications are changed or when application programmes need to be improved for better performance.
7.	Knowledge of Hardware	Detailed knowledge of hardware is required.	This requires detailed knowledge of organization.
8.	HW Independence	System software varies from computer to computer.	Application software varies from organization to organization.

17. Compiler Vs. Assembler.

(chapter: Software)

No.	Compiler	Interpreter
1.	Compiler is a standard program supplied by the manufacturer.	Assembler is also a standard program supplied by the manufacturer.
2.	It converts the high level language program into machine code.	It converts an assembly language program into machine code.
3.	Compiler will be loaded into the computer first and then source program will be input.	Assembler is available within the memory and accepts symbols and mnemonic codes.
4.	Compiler generates an object code of the source program as a result.	It generates machine codes as a result.
5.	Compilers scan the whole program at a time.	It scans the program line after line.
6.	Compiler generates one to many instruction relationship i.e. for one high level language instruction it may generate multiple machine language instructions.	Assembler converts on one to one basis i.e. for every instruction in source code it generates an equivalent machine code instruction.

165

18. Third Generation Languages (3 GL's) Vs. Fourth generation Languages (4 GL's).

(chapter: Software)

No.	Third Generation Languages	Fourth generation Languages
1.	These languages are intended for use by professional programmers.	These languages are used by non-programming end-users as well as professional programmers.
2.	These languages require to specify how to perform a particular task.	It is just sufficient to specify the task required to be performed.
3.	Requires that all alternatives should be specified.	Some default alternatives are built in. User need not specify these alternatives.
4.	To solve a particular problem, it requires	To solve a particular problem it requires less

	large number of procedural instructions.	number of instructions.
5.	Program code is difficult to read, understand and maintain.	Code is easy to understand and maintain because of English like commands.
6.	Difficult to learn.	Easy to learn.
7.	Difficult to locate errors and debug.	It is easy to locate and debug errors.
8.	E.g. FORTRAN, COBOL, PASCAL, BASIC, C, etc.	E.g. Visual Basic, Java, C++ etc.

19. High Level Language Vs. Low Level Language.

(chapter: Software)

No.	Distinction	High Level Language	Low Level Language
1.	Hardware independence	It is a computer language which is hardware independent i.e. it can be used in all computers irrespective of their types, sizes and manufacturers.	It refers to hardware dependent computer language. The language differs from one model to another model of the computer.
2.	English like language	These are highly English like languages.	These are not English like languages.
3.	Learning	They can be learned faster with minimum effort and learning is a one time activity.	These can be learned with more effort and time and learning has to be repeated whenever hardware changes.
4.	Coded languages	These are not coded languages.	These are coded languages which use special codes close to the machine language and are called mnemonic codes.
5.	Where used	Used for developing all types of general applications.	Used only for the following specialised requirements. a. To programme and control internal devices of computer. b. To connect or link computers with other equipment. c. In special purpose computers like ATM.

6.	Execution	Slow	Fast
7.	Who uses?	These are used by all software development professionals or application programmers.	These are used only by specialized system programmers.

20. Self (Direct) Addressing Method Vs. Indexed Sequential File organisation.

(chapter: DBMS)

No.	Self (Direct) Addressing Method	Indexed Sequential File organisation
1.	In this method a record key is used as its relative address. Therefore, we can compute the record's address directly from the record key and the physical address of the first record in the file.	The indexed sequential file organization or indexed sequential access method (ISAM), is a hybrid between sequential and direct access file organisations. The records within the file are stored sequentially but direct access to individual records is possible through an index.
2.	To access a particular record some calculations are required to be performed.	To access a particular record it is not required to do any calculations.
3.	It does not use any indexes.	It uses cylinder and track indexes for locating records.
4.	There is no simple relationship between the keys of adjacent records.	There exists some simple relation between the keys of two adjacent records.
5.	Insertions and deletions can be easily made.	Insertions and deletions take more time because every time it is required to update the index.

21. Fixed Word Length Vs. Variable Word Length.

(chapter: DBMS)

No.	Fixed Word Length	Variable Word Length
1.	In this system all words will have same length.	In this system words will vary in number of bytes.
2.	In fixed word length system every storage location is identified by a specific address.	In this system each set of bytes will have one unique address.
3.	Machines operating with fixed word length	The calculating speed of variable word length

	have faster calculating capabilities.	machines is low.
4.	Fixed word length system maintains memory with less efficiency i.e. lot of memory will be wasted.	Variable word length machines utilises the systems memory with higher efficiency.
5.	Access time (time required to access a particular data) is low.	Access time is high.

22. Sequential File Organization Vs. Direct access File Organization. (chapter: DBMS)

No.	Sequential File Organization	Direct File Organization
1.	Data are arranged / stored in sequence either in ascending or descending order of the record key.	Data are arranged / stored without any sequence or in any specific order.
2.	Only sequential access is possible.	Accessing can be either sequential or direct.
3.	This type of organization is efficient only when there is no need for accessing records in between.	This method is suitable for accessing records in between process runs.
4.	It is suitable for batch processing system.	It is suitable for online and real-time systems.
5.	Identifying individual records is time consuming.	Identifying individual records requires no time.
6.	Does not require any calculation or index for storing and accessing records.	Requires either calculation or index for storing and accessing records.

23. Sequential File Organization Vs. Indexed Sequential Organization. (chapter: DBMS)

No.	Sequential File Organization	Indexed Sequential Organization
1.	In sequential file organization, records are written in the same sequence in which they are collected, but they are organized into certain order.	Indexed Sequential Organization is a combination of sequential and direct access file organization.
2.	Ordering of records within the file is according to a specific data field, which is known as key	Here files are recorded serially in a logical sequence; indexing or reference techniques are

	field.	used so that access can be done on a random basis as well as sequentially.
3.	Records appear in sequential file one after another, in key sequence.	Records are updated in place, without the need to create entirely new files during processing.
4.	Sequential files can be read and processed only in the order in which they are recorded.	This method of file organization is used for applications that might require both sequential and random access references.
5.	Sequential organization can be used on all storage media.	It can done only on direct access storage devices.

24. Sequential File Organization Vs. Random File Organization. (chapter: DBMS)

No.	Sequential File Organization	Random File Organization
1.	In a Sequential File Organization, records are written in the sequence of their occurrence.	In Random File Organization Method, record can be written randomly.
2.	Ordering of records within the file is according to a specific sequence.	Ordering of records in random file does not include any specific sequence.
3.	Sequential files can be read and processed in the order in which they are recorded.	Records can be processed or read and written in many locations throughout the stored file.
4.	To process a required record in sequential file it is necessary to read all the records preceding to the required record.	To process or access the required record in random file prior records need not be examined first.
5.	Sequential files can be created on all storage media.	Random file can be created only on direct access storage media.
6.	Sequential file is not suitable for instant inquiry or updating.	Random file is suitable for instant inquiry or updating.

25. Batch System Vs. Real-Time System (or) Batch processing Vs. Real Time processing.
 (chapter: DBMS)

Aspect	Batch System	Real-time System
Time Lag	There is a time lag between the point at which economic event occurs and point at which it is reflected.	No time lag. Transactions are processed the moment the economic event occurs.
Resources	- Less organizational resources needed. Shorter development period and easier to maintain programs. - No idle time. Computer used only when program is run.	- Cost is more for designing the user-interfaces. Pop-up menus, online tutorials, special help menu require additional programming. - Dedicated computer system needed. Therefore, sometime remains idle.
Data Input	Data collected is accumulated over a definite period of time and then processed in batches.	Data can be input at any time and it is processed immediately.
Efficiency Vs. Effectiveness	Processing more transactions at lower unit cost makes it efficient. If process time is not important batch system can be used.	Individual transaction is processed effectively. Very much useful when the system requires latest information at any point of time.
Application	This method of processing is suited in the applications of payroll processing, customer billing etc.	This method is very much suited in the areas of airline reservation, inventory management, railway reservation, sales order processing, etc.
Storage	It is sufficient to store data on sequential access storage devices like magnetic tape, tape cartridges, etc.	Data must be stored on direct access storage devices like magnetic disc, floppies, CD's, etc.
Delay	Some amount of delay is inevitable.	Even minute delay is not acceptable.

170

26. On line System Vs. Real Time System. (chapter: DBMS)

The term on-line processing and real time processing are used interchangeably but there is a basic difference between the 2. On line processing refers to processing of individual transactions as they occur from their point of origin. This processing mode utilises direct access devices such as magnetic disk and number of terminals connected to and controlled by a central processor. It provides multi access to information files by terminal users and also enables them to update files with transaction data. Aside from transaction processing and file

updating, inquiries are also handled by the online processing system. It also ensures that the records are in updated status at any time.

The term real time processing, on the other hand, refers to the technique of updating files with transaction data immediately after the event to which it related occurs. Real time processing is basically, on line processing with one specialty in inquiry processing. On line updating in real time usually leads to transactions as a by-product. The response of the system for the inquiry itself is used to control the activity. It would normally differ from one activity to another activity. The response of a real time system is one type of feedback control system. An on-line production data collection system that simply accepts input and utilised it for payroll and costing purposes can't be treated real time, but if, on the other hand, the system is designed to provide immediate information to monitor the production process, it is real time processing.

27. Computer Network Vs. Distributed System. (chapter: Networking)

A computer network is a collection of computers and terminal devices connected together by a communication system. The computer may include large-scale computers, mini computers, terminals, workstations and miscellaneous devices. 2 computers are said to be inter connected if they are capable of exchanging information. The connection need not be via a copper wire; but lasers, u-waves and earth satellites can also be used. Computer networks increase the reliability of computer resources and facilitate overall system development. They also satisfy the prime objective of resource sharing which includes device sharing, file sharing, program sharing and program segmentation.

A distributed system is one in which the computing functions are dispersed among several physical computing elements. Computer systems are arranged in a computer network, with each system connected to one or more other systems. A distributed system is both a technological and organisational concept. Its premise is that information processing can be more effective if computer hardware, data, software and in some cases, personnel are moved physically closer to the people who use these resources. In distributed system, users have greater control over their computing environment.

Network may or may not be distributed system, depending on how it is used.

28. Local Area Network (LAN) Vs. Wide Area Network (WAN) (chapter: Networking)

No.	<i>Difference</i>	<i>Local Area Network</i>	<i>Wide Area Network</i>
1.	Spread/ Coverage	A LAN is restricted to a limited geographical coverage of few	WAN spreads over greater distance and may operate nationwide or

		kilometres.	even worldwide
2.	Data transmission errors.	Fewer data transmission errors occur in case of LAN because the distance covered is less.	When compared to LAN, error rate is more because the distance covered is more.
3.	Data transmission speed.	Data transmission speed is much higher in LAN than in WAN. Typical transmission speeds in LAN'S are 0.1 to 10 MBPS.	In a WAN the data transmission speed ranges from 180 to 9600 Bits per second
4.	How nodes are connected?	In a LAN, computers, terminals and peripheral devices are usually connected with wires and coaxial cables.	But in WAN there may not be direct physical connection between various computers.
5.	Cost of transmission.	The cost to transmit data in a LAN is negligible since the transmission medium is usually owned by the user organisation.	Cost will be high because the transmission medium used is leased lines or public systems such as telephone lines, microwaves and satellite links.
6.	Communication Mode	Communication may take place just by a way of direct cabling.	Communication takes place by way of telecommunication cables, satellites or microwaves.
7.	Security	Security is not that much important because the network runs within the organisation.	Security is very important because the network has to run outside organisation also.

29. Serial Transmission Vs. Parallel Transmission.

(chapter: Networking)

Serial Transmission: Serial Transmission is the most commonly used method of communication. In serial transmission bits of each byte are transmitted one after the other along a single path. Then the receiver assembles the incoming bit stream into characters. In serial transmission, the bits of each byte are sent along a single path one after another. An example is the serial port (RS-232), used for Mouse or MODEM. Serial transmission can occur in any of the two ways - Asynchronous & Synchronous transmission.

Advantages:

- ▶ It is a cheap mode of transferring data.
- ▶ It is suitable to transmit data over long distances.

Disadvantage:

This method is not efficient (i.e. slow) because it transfers data in series.

Parallel Transmission:

- ▶ In parallel transmission all bits of each byte are transmitted simultaneously i.e. each bit will have a unique channel dedicated to it. For ASCII character we need eight channels. All bits are transmitted together and arrive at the destination together.
- ▶ Example – Parallel port being used for printers.

Advantages:

Data can be transmitted at a very high speed.

Disadvantage:

- ▶ Not suitable for transferring data over long distances. As it uses parallel paths, cross talk may occur. To minimize cross talk, cable length should be limited.
- ▶ It is costly. (Because there should be separate channel for each bit)

30. Difference between Serial transmission and parallel transmission. (chapter: Networking)

No.	Serial transmission	Parallel transmission
1.	The bits of each byte are sent along a single path one after the other.	In parallel transmission, there are separate parallel paths corresponding to each bit of byte.
2.	Bits in a byte are transmitted one by one.	All character bits are transmitted in parallel, at a time.
3.	It is used to transfer data over long distances.	It is used to transfer data to limited distances.
4.	The rate of data transmission is very slow.	The rate of data transmission is very high.
5.	It is used where less volume of data is to be transmitted.	It is used where more volume of data is to be transmitted.
6.	It is economical.	It is costly.

31. Synchronous Transmission Vs. Asynchronous Transmission. (chapter: Networking)

No.	Synchronous	Asynchronous
1.	In this transmission bits are transmitted at fixed rate.	In this transmission takes place in form of words accompanied by stop and stop bits.
2.	This allows characters to be sent down the line without start-stop bits.	Transfers the data with start-stop bits.
3.	It allows data to be sent as a multi-word blocks.	Data transfer takes place in the form of words.
4.	Uses a group of synchronization bits.	No special synchronization bits to synchronize the equipment.
5.	Rate of transferring data is faster.	The transfer rate is slow.

32. Star Network Vs. Ring Network. (chapter: Networking)

No.	Star Network	Ring Network
1.	It is a type of network topology in which all nodes are connected to a central computer/hub through dedicated cables.	It is a type of network topology in which all nodes are connected in the form of a circular chain.
2.	The communication takes place between the nodes through the hub/computer only i.e. all communication between terminals must pass through hub/computer.	The communication takes place by each node to receive and check for the message i.e. every node receives message and passes it to the next node.
3.	A broken connection between hub/central computer and node does not affect the rest of the network.	A broken connection between nodes leads to failure of entire network.
4.	Failure in the hub/central computer affects all nodes connected to that hub.	Failure in one node does not affect the entire system.
5.	The signal becomes weak when it has to travel long distances. To avoid it, repeaters are required to be used.	Repeaters are not needed. Every computer acts as a repeater.
6.	It is very easy to add/remove a node from the network.	It is difficult to add/remove a node from the system.

33. Internet Vs. Intranet.

(chapter: Internet)

No.	Internet	Intranet
1.	The Internet is a global network of computer networks that are formed by various educational, commercial, Government, non-profit and military organizations.	On the other hand intranet is a type of information system that facilitates communication within the organization, among widely dispersed departments, divisions and regional locations. Intranet connects people together with Internet technology using web browsers, Web Servers and Data warehouses in a single view.
2.	This is not being developed and controlled by a single person or organization.	It is developed and controlled by private individuals and organizations.
3.	Internet is a public network. So, anybody can log into the network and perform any action at his choice.	It is a private network and access to private individuals is restricted by user names and passwords.
4.	Thousands of databases exist which can be accessed and used by private individuals.	Only authorized persons are allowed to access the data available in organization's databases.
5.	An internet can be defined as a network of networks.	An intranet can be a LAN or WAN that belongs exclusively to a corporation.
6.	Any node can transmit a message to any other node, along with communication channels, via the intermediate nodes. Internet uses are many; some of them are given below: Communication, Data Retrieval, Data publishing, etc.	Several applications of Intranet include: (a) Supplier management (b) Inventory management (c) Distribution management (d) Channel management
7.	Acts as an information service to retrieve the information worldwide.	Acts as an information service to retrieve and share files within the organisation.

34. Firewall Vs. Encryption.

(chapter: Networking)

No.	Firewall	Encryption
1.	They control the flow of traffic between the Internet and the firm's internal LANs and systems. They are setup to implement the	This allows information to transit the Internet while being protected from interception. There are two basic approaches

	security policies desired by the organization.	to encryption: Hardware encryption and Software encryption.
2.	It is software oriented.	It is both hardware and software oriented.
3.	Controls the flow of traffic between the Internet and the firms internal LANS and systems.	It protects the information transmitted through Internet from eavesdroppers.
4.	It is defined based on specific security policies of the organization.	It is a generalized policy with reference to information transmission.
5.	It is an effective means of protecting the firm's internal resources from unwanted intrusion.	Restricts the tampering of information from interception while in transmission.
6.	May be established for the entire LAN or for a specific application.	It will be application specific.

35. Data Administrator (DA) Vs. Data Base Administrator (DBA) (chapter: DBMS)

176

No.	Data Administrator (DA)	Data Base Administrator (DBA)
1.	A Data Administrator logically defines data and also advises the users on data collection procedures.	Data Base Administrators physically define the data and prepare programs to create data.
2.	They answer and educate the end users and determine their requirements.	They answer and educate the programmers and define the programming requirement.
3.	They develop standards for data definition.	They implement the standards for data definition.

36. Data Definition Language Vs. Data Manipulation Language. (chapter: DBMS)

No.	Data Definition Language	Data Manipulation Language
1.	Data definition language is the link between the logical and physical structures of the databases.	It provides techniques for processing the database.

2.	It is used to define the physical characteristics of each record.	It is used to perform operation on data such as retrieval, sorting and display.
3.	It provides for physical and logical data independence.	It provides for independence of programming languages.
4.	It describes the schema and sub-schemas.	It enables the user and application programs to process data on a symbolic logical basis rather than on physical location basis.
5.	It takes care as to how the data is maintained in physical storage.	It separates the user from physical storage.

37. Database Vs. Database Management System (DBMS)

(chapter: DBMS)

No.	Data Base	Data Base Management System
1.	Database is a collection of related data necessary to manage an organization and excludes temporary data like input documents, reports and intermediate results obtained during processing.	DBMS is a set of procedures which manage the databases and provide access to the database in the form required by an application program.
2.	It models the data resource of an organization using the relationships between different data items, which is independent of any application program.	It ensures that the necessary data in the required form is available for different applications of different users of an organization.
3.	When data is stored in a database it becomes independent of other programs. So, it can be processed, retrieved very easily.	Database management system (DBMS) provides flexibility in storage and retrieval of data and production of information.
4.	Database represents data belonging to the entire organization.	It represents software which manages such database.
5.	Data can be arranged in any of the following ways – Hierarchical, Relational or Network databases.	Such data can be maintained by ordinary database management systems or relational database management systems.

38. Logical Record Vs. Physical Record.

(chapter: DBMS)

No.	Logical Record	Physical Record
1.	A logical record contains all the data related to a single item. It may be a payroll record for an employee, or a record of all of the charges made by a customer in a departmental store.	A physical record refers to the actual portion of a medium on which data is stored. It may be group of pulses recorded on a magnetic tape or disk, or a series of holes punched into paper tape.
2.	A logical record is independent of its physical environment.	Portions of the same logical record may be located in different physical records or several logical records or parts of logical records may be located in one physical record.
3.	It refers how data is presented to the user.	It refers how data is actually stored in the computer.

39. Structured Query Language (SQL) Vs. Query By Example (QBE).

(chapter: DBMS)

No.	Structured query Language (SQL)	Query By Example (QBE)
1.	SQL is a query language for finding out the required data from the RDBMS by asking some standard questions.	QBE is a query language where queries are framed through examples.
2.	It is usually a Character oriented interface.	It is Graphic oriented interface.
3.	The users request data by issuing instructions that are close to English.	The users can request data by typing values or expressions into the fields of a form or grid.
4.	It contains the statements that describe the data contained in the database.	It uses grid like structures to receive the criteria data.
5.	It requires the internal structure of the data tables.	It displays a list of tables in the form of a window grid or dialog boxes and allows selecting interactively.

40. Auditing Around the Computer Vs. Auditing Through the Computer. (General)

Particulars	Auditing around the Computer	Auditing through the Computer
-------------	------------------------------	-------------------------------

	(Black Box Approach)	(White Box Approach)
Recognition of Computers	Under this approach computers are treated as mechanical book keeping aids.	Computers are used as “live” and dynamic devices, which add value to the process of auditing. They are the target of auditing.
Focus of Audit & Means of Audit Assurance	The focus of audit is to take voluminous reports and outputs, and compare “input vouchers” with “system outputs” to obtain audit assurance.	The focus of audit is to peruse the accounting system and software used-to ensure that they provide audit assurance on the various aspects of control.
Use of Computers	Computers are only considered as systems, which provide legible printouts of the accounting transactions. Auditors traced transactions to the “black box” and picked up the trail on the other side by examining printouts.	Computers are used to check calculations, to compare the contents of two files, to examine files for missing amounts, and to analyse accounting data by finding ratios etc.
Use of CAAT's	No regard is paid to the transformation of data that takes place inside the computer.	CAAT's and audit software tools are used to analyse transformation of data.

41. System Flowchart Vs. Program Flowchart.

(chapter: Flowchart)

No.	System Flowchart	Program Flowchart
1.	It is designed to present an overview of the data flow through all parts of a data processing system.	It is designed to present the logic involved in the problem.
2.	It represents the flow of documents, the operations or activities to be performed and the persons or workstations involved.	It represents the flow of data in the processing of the problem logic.
3.	It represents how input data is prepared and the medium or device used.	It represents the input required and output generated by the program.
4.	It indicates the intermediary and final output prepared and the medium and devices used for their storage.	Represents actual processing of data to convert into information.

5.	It includes the sequence of operations involved.	It includes the sequence of operations in solving a specific problem.
----	--	---

42. Centralized Processing Vs. Distributed Processing.

(chapter: DBMS, Networking)

No.	Centralized Processing	Distributed Processing
1.	It refers to an environment consisting of a large mainframe computer system that supports multiple users and multiple application programs.	Distributed processing seeks to spread the computing needs across the organization. There may be one large central computer with a series of small computers or mini or microcomputers or there may be number of computers of equal size scattered geographically.
2.	Users can access computer resources via hundreds of remote communication devices including on line terminals used to input data and printers to obtain reports.	In distributed processing the individual computers are tied together through a high-speed data communication network.
3.	Highly skilled, technically trained specialists are required to operate the system.	People with functional knowledge can also manage the system.
4.	This mode of processing is comparatively cheap. It also offers better control and protection of data.	This mode of processing incurs more expense with limited security, controls and protection of data.
5.	Can work effectively in small organisations.	Suitable even for big organisations.
6.	Generally, a dumb terminal will be allotted to each employee.	Generally, an intelligent terminal will be allotted to each employee.
7.	If the central computer fails, the entire network stops performing.	Even if the central computer fails, the network continues to function.

180

43. File Access Method Vs. File Organization Method.

(chapter: DBMS)

No.	File Access Method	File Organization Method
1.	Access refers to reading of data from the file.	Organization refers to the physical arrangement of data on the files.

2.	There are two ways of accessing the data i.e. sequential and direct.	There are five ways of organizing the data.
3.	Sequential access refers to reading the data sequentially.	Serial and sequential access allows storing data in a particular order.
4.	Direct access refers to reading data without any order.	Self-addressing, ISAM, random methods allows to store data without any order.
5.	Direct access is possible only on direct access storage devices like magnetic disk or compact disk.	Depending upon the organization requirement, one of the media will be selected.

44. Loader Vs. Linker.

(chapter: Software)

Both loader and linker are system software. However, a loader is a component of the operating system that locates a given program which can be an application program or even a part of the operating system from the offline storage such as a hard disk, and then loads it into the random access memory.

On the other hand, a linker is used to perform the linking process. Any program written in high level or assembly language has to be translated into machine language (object program) before it can be run on a computer. Usually, a program is split into number of small modules. These modules are compiled or assembled individually. This results in number of object programs or modules. All these individual object modules are to be combined or linked to create one single object module before executing the program on the computer. This process of linking is done by Linker.

A linker enables a computer system to access modules, subroutines, overlays and other segments of an application program that are stored on the disk. The linker finds the required program segment and supervises the transfer of computer control to the segment to be executed. The linker also enables the program to access standard subroutines stored for the convenience of users.

No.	Loader	Linker
1.	It is system software provided as an additional component of operating system.	It is system software provided as a component of language translators.
2.	It is used to load operating system components or application from secondary memory to main memory.	It is used to look the modules of an application and to load them to main memory.
3.	It is used in loading individual components	To link and load the components of

	of operating system or application.	applications.
4.	It controls and supervises the transfer of operating system components.	It controls and supervises the transfer of program modules.

45. Parity Check Vs. Echo Check.

(chapter: DBMS)

No.	Parity Check	Echo Check
1.	Parity check is among the most effective hardware controls that provide a check on the integrity of data representation system.	Echo check is a hardware check applied to check the mechanism of the input/output devices.
2.	Parity checks provide timely detection of errors of loss/gain in a bit as a result of dirt, magnetic storm etc.	It verifies whether a device has been activated to carry out an operation, which it has been instructed to perform.
3.	It is an extra bit that is added to the code for each character in order to make the number of 1 bit odd (or even).	The echo check verifies that the equipment was activated rather than testing the actual results obtained.

4.	The oddness (or evenness) of the bits is checked to detect loss of bits during transmission of data.	Example: When the data channel is ready to transmit data to the printer, it transmits a signal that activates the printer. If the printer is ready, it sends an echo signal to the data channel. If the printer does not send the echo signal, the data channel postpones transmission and signals the operator that the printer needs attention.
-----------	--	--

46. Virus Vs. Worms.

(chapter: Internet)

No.	Virus (May 1999, Nov 2001)	Worms
1.	Viruses are self-replicating program code that are inserted into other executable code.	Worms are destructive programs that may destroy data or utilize computer and communication resources by duplicating themselves.
2.	They may lie dormant for some time before getting triggered by certain events or occurrences, such as a date or on being copied at a pre-specified number of times.	Worms run independently and travel from machine to machine across network connections.
3.	They are not capable of self-actuating.	They are self-actuating and self-sustaining.

183

ALL THE BEST

“If the facts don’t fit the theory, change the facts”

By:- Albert Einstein