SOFTWARE

1. SOFTWARE:

- It is a set of instructions, which is known as program, are combined together to perform special task.
- There are three types of software:
  a. System software
  b. Application software
  c. General purpose software

2. SYSTEM SOFTWARE:

- It comprises of those programs that control and support the computer system and its data processing applications.
- In other words, it is a set of one or more programs designed to control the operation of computer system.
- There are following types of system software:

I. Programming Language:

- Programming languages are used to develop programs or software which is used for data processing or any special tasks.
- Every programming language has its own set of commands or instructions, standard and rules of uses that is known as syntax of programming language.
- If any programmer wants to develop any special programming language then he has to learn the syntax of that programming language.
- Over the years many programming languages have been developed and these programming languages are known as:

a. Machine Language:

- ✓ It is also known as 1st generation language of computers.
- ✓ Machine language means that language which the computer can understand without any translation.
- ✓ In machine language, all the programs were written in the binary codes (0 and 1) only which are difficult to understand for programmers; therefore these codes are replaced with decimal codes which were easy to remember than binary codes.
- ✓ A machine language is a system dependent language; therefore this language is also known as Low level language.

b. Assembly Language:

- ✓ It is known as 2nd generation language of computers.
- ✓ Assembling language was developed to remove the programming difficulties of machine language.

- ✓ In assembly language, all the programs were written in the symbolic language (English language code) in place of binary codes.
- ✓ A computer can understand only a machine language, therefore the programs written in the assembly language need to be translated into a machine language by using a language translator known as **assembler**.
- ✓ An assembly language is also a system dependent language; therefore this language is also known as Low level language.

c. High level language/complier/procedural language:

- ✓ It is also known as 3rd generation language of computers.
- ✓ High level languages are system independent languages because the programs developed in these languages can be executed in any type of computer systems, without any modifications.
- ✓ In high level language, all the programs are written in the simple English language.
- ✓ A computer can understand only a machine language, therefore the programs written in the high level language need to be translated into a machine language by using a **complier or interpreter**.
- ✓ The high level languages are easy to learn.
- ✓ Here are some popular high level languages:
  COBOL (for business purpose)
  BASIC (for general purpose)
  FORTRAN (for science applications) etc.

d. 4th Generation Language:

- ✓ 4th GL are known as very high level language because these languages are easier to use and learn than 3rd GL.
- ✓ The 4th GL are non-procedural language i.e. works on the principle of "what to do" while 3rd GL which are procedural languages i.e. works on the principal of "how to do".
  In the 4th GL, a user is not required to go through an entire procedure to solve a problem.
- ✓ It uses readymade tools/software for programming to save a lot in terms of cost, time & efforts.

- ✓ There are two types of 4th GL:
  i. *Production oriented 4th GL:*
  These 4th GL are designed by computer professionals to develop programs without writing entire procedure of problem's solution.
  Thus, program development does not require huge time & efforts. E.g. IDEAL, Rational Rose, Natural2 etc.

  ii. *User oriented 4th GL:*
  These 4th GL are designed for end users (users like us who are not the professional programmers) to develop simple database programs without depending upon expert programmers.
  E.g. QBE (Query by Example),
  SQL (Structured Query Language), &
  FOCUS etc.

e. Object-Oriented programming & languages:

- ✓ OOP languages are latest development in the programming languages.
- ✓ These languages works on the principle of "write once use many times".
- ✓ In these languages, the programs are written in the form of objects which can be used anywhere as per requirement.
- ✓ OOP languages help to develop better quality programs in less time.
- ✓ E.g. Java, C++, and VB (Visual Basic) etc.

II. Operating System:

- ❖ Operating system acts as a mediator between man and machine (i.e. OS provide an interface to user for working on computer).
- ❖ The operating system may be defined as an integrated system of programs which supervises the operation of the CPU, controls the input/output functions of the computer system and translates the programming languages into the machine languages.
- ❖ OS is also known as an executive of computer because it performs various functions for efficient management of computer system.
- ❖ There are following functions performed by OS:
  a. Memory Management
  b. Processing Management
  c. Hardware & Software Management
  d. Files Management
  e. Security Management
  f. Job Scheduling
  g. User management
  h. Interrupt management (Request management)

Types of OS

a. DOS (Disk Operating System):

- ✓ MS-DOS was one of the most popular operating system made by Microsoft Corporation used in IBM PCs.
- ✓ It was released in 1981 by IBM.
- ✓ There are following features:
  - i. Single tasking OS i.e. it can execute only one task at a time.
  - ii. It is based on character User Interface (CUI) for working on computer.
  - iii. It is 16 bits OS.
  - iv. DOS is a single user OS and it can be used only in personal computer.

b. Microsoft Windows:

- ✓ Windows is the most popular OS from Microsoft Inc. for personal computers.
- ✓ It is based on Graphical User Interface (GUI) for working on computer.
- ✓ Window is a multitasking OS i.e. it helps to execute many task simultaneously.
- ✓ Over the years, many versions of window OS have been released by Microsoft e.g. window 1.0, window 2.0, window 3.0, window 95, window 98, window Mi (Mi=Millennium), window 2000 professional, window XP, window Vista, Window 7.

Window 95

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

Window 98

- 32 bits OS
- Released in 1995
- "Plug and play technology" enables users to connect various peripheral devices with minimum effort.

Window NT

- Windows New technology (NT) is an operating system for servers or networks.
- 32 bits OS
- Multiprogramming (Execute many programs simultaneously) or Multiprocessing (Execute work with many processors).

- It is a portable operating system i.e. it can work with any type of processors.

Window 2000

- This was the OS which was released for both PCs and Servers applications.
- Released in 2000
- It was built on Window NT platform and it provided the enhanced reliability & security features.
- Over the years, Window NT has also been introduced in the market with many versions such as Windows XP for home use/PCs and Window 2003 for servers.

Window XP

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

- It has many improvement over the previous versions of windows like
  - Fast startup,
  - Enhanced security features,
  - Enhanced graphics capability,
  - Remote desktop capability i.e. allows users to connect to any computers anywhere using internet.

Windows Vista

- It was released in 2007.
- It has further improvement features of window XP in terms of
  - Enhanced Security
  - Updated GUI
  - Better Visual
  - Large numbers of multimedia tools like DVD maker etc.
- Vista aims to increase the level of communication between machines on a home network.

Windows 7

- It was released in 2009.
- This OS has some further improvement over the previous versions of windows.
- This OS has also removed some of the applications of window vista like Windows mail, windows movie maker etc.

OS/2

- In 1987, IBM and Microsoft announced a new PC OS called OS/2 (Operating System Two).
- It was not very successful due to following reasons:
  - Slow Speed
  - Unable to support many existing PC Applications.
  - Memory capacity

UNIX

- It is a multiuser, multitasking and multiprocessing OS that are used in bigger size machines like mainframe and minicomputers.
- It was developed by AT&T Bell Labs around 1970.

LINUX

- It has emerged from UNIX OS.
- It can be used in wide range of devices from PC to supercomputers.
- It is available under open source license i.e. anyone can read and modify this OS.

Mac OS

- It is a popular Graphical User Interface developed by Apple Inc.
- Early versions of this OS were only compatible with Motorola 68000 series of processors but now these are compatible with Intel Processors also.

ADVANCE CONCEPTS OF OS

a. Multiprogramming:

- ✓ It is a technique in which many users program are executed by CPU simultaneously.
- ✓ The main purpose of multiprogramming is to increase the utilization of a computer and its resource.

- ✓ In multiprogramming, CPU works in time sharing mode i.e. CPU allocates its processing time to all the users program equally.

b. Multiprocessing:

- ✓ It is a technique in which more than 1 processor or CPU is used to execute many users program simultaneously.
- ✓ It helps to increase the processing speed of computer for executing programs.
- ✓ It is also known as parallel processing because in this technique more than 1 processors works in a parallel to execute programs.

c. Multitasking:

- ✓ It is an ability of a system to execute more than one task simultaneously by a single user.
- ✓ Multitasking helps to increase the productivity of users by executing many tasks simultaneously.
- ✓ In the past, there was used a single user OS like DOS etc. which were able to execute one task at a time. If a user wants to execute another task then first opened task should be switched off to execute another task.
- ✓ But the OS like windows etc. are multitasking OS; and these OS allow users to execute many tasks simultaneously.
  For example: we can open MS-Word documents as well as MS-Excel document to work at the same time.

d. Virtual Memory:

- ✓ Virtual memory means "not an actual memory".
- ✓ It is a technique which helps to execute big size programs with small size available primary memory or RAM.
  In other words, if the program and related data are larger than the capacity of memory, then the programmer has to use the concept of "Virtual Memory".
- ✓ In virtual memory technique, the big sizes of programs are divided into small size of segments and these segments are loaded into primary memory and secondary memory.

e. Spooling:

- ✓ Spooling technique is used to reduce the time gap between high speed CPU and slow speed peripheral devices.
- ✓ Spooling is, primarily, used for printing purpose.

  For Example:

  When a user provides many documents together for printing to printer then CPU being a high speed component immediately process all the given documents and provides these documents to printer for printing. But printer being a slow speed device cannot print all the jobs at same speed as processed by CPU.

  Here the spooling technique is used which allows the processed jobs of CPU to be arranged in a separate area in the memory known as **"spooling area or buffer memory"** and CPU remains free for other jobs. And printer as when become free from printing previous job automatically takes up the next job from spooling area.

f. Foreground and Background Processing:

Foreground Process:

- The process being executed in front of user is known as foreground process.
- Foreground process are called high priority jobs/tasks.

  For Example: Tally program execution, Excel program execution etc.

Background Process:

- The process not executed in front of user is known as background process.
- Background processes are called low priority jobs/tasks.

  For Example: Auto backup of data etc.

In order to reducing the idleness of CPU time, if foreground job is executed then CPU is given the instruction to execute foreground process with high priority like program processing data and if there is no foreground process executed then CPU automatically switch to background job like doing auto backup of processed data.

g. Timesharing:

- ✓ It is used by means of multiprogramming & multitasking.
- ✓ It divides/allocates the available time of CPU among many users.

III. Utility Program:

- ❖ Utility programs are those programs that provide some basic working facilities to users. For Example: Sorting utilities, copy program, delete program, paste program, WinZip program etc.
- ❖ These programs are normally provided by computer manufacturer or operating system.
- ❖ It is also called **"service program"**.
- ❖ There are following types of utilities available in the market:

a. ***Sort Utility Program:***

- ✓ This program is used to arrange the data in ascending or descending order.
- ✓ This program is either provided by operating system to arrange files and folders in ascending/descending order **or** sort utility program are part of electronic spreadsheet (Excel) and database management software (MS-Access).

b. ***Text Editor:***

- ✓ This program is used to create and modify the text files.
- ✓ Text editors are also used for exchange of data from one computer to another.
- ✓ Notepad is the most popular text editor program in the market for creating text files.

c. Spooling Software Program:

- ✓ Spooling technique is used to reduce the time gap between high speed CPU and slow speed peripheral devices.
- ✓ Spooling is, primarily, used for printing purpose.

d. Other utility:

- ✓ Disk **or** File Copy Program
- ✓ Disk Formatting Program (prepare a new/blank disk ready to use)
- ✓ Deletion Program
- ✓ Viewing Program
- ✓ Directory Program (view names, sizes etc. of stored files)

IV. Sub-routine:

- Sub-routines are small programs for routine tasks.
- These programs are written once and called in main program whenever required.
- Sub-routines help programmer to improve their productivity for programming.

V. Diagnostic Routine:

- This programs helps to diagnosis i.e. detect and remove hardware and software problems of a computer.
- These programs are normally provided by Operating System.
- "Control Panel" is a diagnostic program provided by window OS to detect and remove hardware and software problems in a computer.
- Similarly "Norton Antivirus" is a popular diagnostic program for detection and removal of viruses from computer.

VI. Language Translators:

- This program is used to convert one language program into another language program.
- There are mostly three types of language translator used:

a. Compiler:

- ✓ It converts high level language program into machine language program with all program lines together.
- ✓ Most of high level languages like FORTRAN, C, PASCAL and COBOL etc. are complier based languages.
- ✓ Complier is more efficient conversion program than interpreter.
- ✓ It requires high memory space.

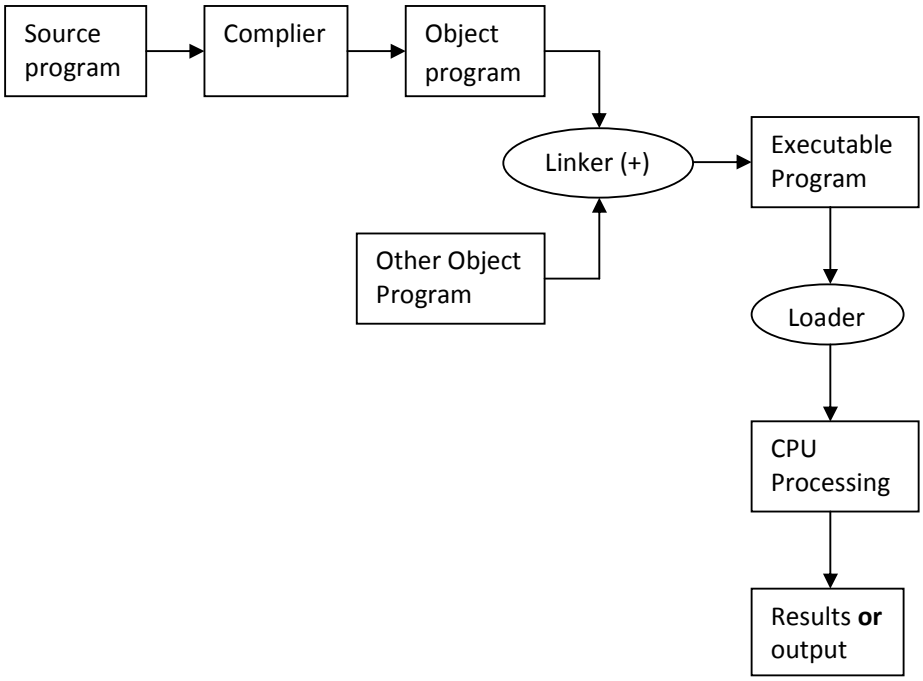
b. Interpreter:

- ✓ It converts high level language program into machine language program with line by line.
- ✓ BASIC is the only popular based interpreter language.
- ✓ Interpreter is less efficient conversion program than complier.
- ✓ It requires less memory space.

c. Assembler:

- ✓ It converts assembly language programs into machine language program.
- ✓ Assembly language is used only with Assembler.
- ✓ Assembler is considered most efficient language translator than interpreter.
- ✓ It requires least memory space.

A PROGRAM EXECUTION STEPS IN A COMPUTER:



Step: 1

- ✓ Complier converts the program written in High Level Language (Source Program) into Machine Language (Object Program).

Step: 2

- ✓ This object program is linked with other object program with the help of linker which provides an "Executable Program".

Step: 3

- ✓ Then, This Executable Program is loaded into CPU (Main memory) with the help of Loader which generate the desired output.

3. SHORT NOTES:

I. User Interface:

- ❖ It is a medium of interaction or communication between the user and the computer.
- ❖ There are two types of interface for PCs:

a. Character User Interface (CUI):

- ✓ In this type of interface, every instruction to computer is given by character based commands which are to be typed through keyboard.
- ✓ It is provided in DOS based Application.
- ✓ It is not more popular interface.

b. Graphical User interface (GUI):

- ✓ In this type of interface, commands are provided in the form of Menu Driven options and user just have to click the required command from given options.
- ✓ It is provided in Window based Application.
- ✓ Almost all the software in the market is based on this type of interface.

II. Virus:

- ❖ Virus is a malicious program or dirty code which may corrupt other programs, data and resources (Memory) in computer.
- ❖ Viruses are originated from portable memories and internet.
- ❖ To detect and remove a virus from computer, anti-virus software can be used like Avast, Quick heal, Norton etc.
- ❖ Norton anti-virus is the most popular software for detecting and removing virus from computer.

III. Device Drivers:

- ❖ Device drivers are the program/files that act as an interface between hardware and operating system.
- ❖ OS accepts request from users for the operation of any device and then activate driver of that device which perform the required operation.
- ❖ Device drivers include keyboard, mouse, modem, printer, scanner, digital camera etc.

IV. Firmware:

- ❖ Firmware is a term used for component in between hardware and software.
- ❖ Firmware is instructions or programs built in some microprocessors or ICs which help to substitute some hardware component in computer.
- ❖ In other words, Firmware's are special programs or instructions stored in CPU so that the most basic operations such as addition, multiplication, move data etc. are carried out. For Example: ROM, BIOS etc.
- ❖ It is provided by the manufacturer.

4. General Purpose Softwares:

- ➢ Software which usually solves common or general problems that are not unique to any user or organization is called General purpose software.
- ➢ This software is in the form of package software and this software is easy to learn.
- ➢ There are three types of general purpose software:

a. Commercial Software:

- ❖ These are the common readymade pre-package licensed software like Tally etc.

b. Shareware:

- ❖ It is a software developed by individuals or small companies that cannot afford to market their software worldwide **or**
  wants to release a demonstration version of their commercial product (Demo Version).
- ❖ This type of software helps to reduce software licensing cost for the organizations because this type of software is available on use basis.

c. 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. For Example: LINUX OS is open source software.

- There are following some popular general purpose software:

a. Word Processor:
   - ❖ A word processor is computer software which is used for documentation purpose.
   - ❖ This software has various features like editing, formatting (bold, italics, underline, indenting, justification, mail-merge & so on).
   - ❖ These are various popular word processing softwares like MS-Word, Word-Pro, Word-Perfect etc.
     MS-Word is the most popular word-processing software.

b. Spreadsheet Program:
   - ❖ Spreadsheet software is used for financial, mathematical and statistical analysis of data.
   - ❖ A spreadsheet contains large numbers of intersected rows and columns in the form of cells.
   - ❖ It has inbuilt functions and formulas.

c. Data Base Management Systems (DBMS):
   - ❖ DBMS is software designed to manage a large collection of records as database.
     For Example: MS-Access, ORACLE etc.

d. Internet Browser:
   - ❖ Internet browser is used for browsing or accessing internet data and applications.
   - ❖ Internet Explorer, Mozilla, Firefox and Netscape are some popular internet browsers.

5. Application Software:

- The software which is designed for any specific purpose like accounting, banking, inventory control etc. is called Application software.
- Usually different organization requires different programs; hence it is difficult to write general standardized programs.
- There are some popular software as follows:

a. Enterprise Resource Planning (ERP):
   - ❖ An ERP system is a fully integrated business management system covering all functional areas of enterprises like production, Finance, Accounting, Marketing and Human Resources.
   - ❖ ERP aims at one database, one application and one user interface for the entire business.
   - ❖ Examples: SAP, ORACLE Applications etc.

b. Decision Support System (DSS):

- ❖ DSS is used for solution of semi-structured and unstructured management problems for improved decision making.
- ❖ This is frequently used by accountants, managers, auditors etc.
- ❖ DSS are normally prepared in Excel spreadsheet.
- ❖ DSS are used for following purposes:
  I. *In Capital Budgeting* for Investment Analysis.
  II. *In Cost Accounting* for Break-even analysis.
  III. *In General Accounting* for Ratio Analysis, Receivable Analysis etc.

COMPONENTS OF DSS

I. User:

- ✓ The User of DSS is a person who has knowledge of unstructured or semi-structured problems to solve.
- ✓ Normally a user of DSS is a manager or analyst.

II. Planning Language:

- ✓ The Planning Language is a set of interactive commands in a DSS.
- ✓ A user communicates and commands the DSS through Planning Language.
- ✓ A user can use two types of Planning Language:

General Purpose Planning Language:

- This type of planning language allows the user to perform routine task.
  For Example: Retrieving data from database **or** performing statistical analyses.

Special Purpose Planning Language

- This type of planning language allows the user to perform specific tasks like mathematical, financial or structural analysis etc.

III. 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 while External data comes from outside the organization.

IV. Model Base:

- ✓ Model Base is known as brain of DSS because
- ✓ Model Base provides the structure of problem to be solved by the user.

c. Artificial Intelligence:

- ❖ It is an application system or software which replicates or mimics human behavior like human thinking, communication and recognition characters etc.
- ❖ There are various types of AI which are based on Human Intelligence i.e. given below:
  - ✓ **Neural Network** (Mimic Human thinking characteristics)
  - ✓ **Natural Language Communication** (Mimic Human communication characteristics)
  - ✓ **Voice Recognition** (Mimic Human natural recognition capability)
  - ✓ **Voice Synthesizer** (Mimic Human speech construction capability)
  - ✓ **Robotics** (Mimic Human working capability)

d. Expert System:

- ❖ It is a computer based information system which provides the solutions of given problems, just like the human expert.
- ❖ Expert System based on the principle of Artificial Intelligence.
- ❖ It is also called "Knowledge based system" because these systems contain the expert knowledge in structured manner to solve the problems.

COMPONENTS OF EXPERT SYSTEM

I. User Interface:

- ✓ This component helps a user to communicate the problem to expert system.
- ✓ It also display the solutions provided by Expert System.

II. Inference Engine:

- ✓ It 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 which is obtained from knowledge base and user inference.

III. Knowledge Base:

- ✓ It contains the past knowledge of experts for problem solutions in a systematic manner.

IV. Knowledge acquisition Facility:

- ✓ This component is used by Programmers/Engineers for collecting & arranging the expert's knowledge for problem solutions in knowledge base.

V. Explanation Facility:

- ✓ It is like a reporting system.
- ✓ It provides an explanation of logics to users for solution arrived at expert system.

ADVANTAGES OF EXPERT SYSTEM

I. Provide low cost solutions & advice
II. Provide solutions & advice based on the knowledge of many experts
III. Always available for solutions and advice.
IV. Helps users in better decision making

DISADVANTAGES OF EXPERT SYSTEM

I. Costly and complex system to develop (a lot of time to develop an expert system)
II. Difficult to obtain the knowledge of experts
III. Difficult to develop the programs of expert system based on the knowledge of experts.

USES OF EXPERT SYSTEM

I. Doctors use to diagnose the patient disease
II. Indian revenue Department uses Tax expert system to investigate tax evasions and frauds.

DATA STORAGE, RETRIEVAL AND DATA BASE MANAGEMENT SYSTEMS

1. **Write short notes on the following:**

A. DATA:

- Data represents facts or figures related to certain entities and activities like quantity, salary, name etc.
- These data are needed to be organized into useful information.

B. CHARACTER:

- Smallest item of the data is known as character.
- It consists of alphabetic characters, numeric characters or special character.

C. DATA ITEM (FIELD)/Data type:

- A set of characters which are used together to represent a specific data element are called data item.
  E.g. name item consists of alphabetic characters & amount item consists of numbers.
- There are following types of data fields as mentioned below:
  - **a. Text Fields/String:**
    - Non-numeric data fields are called text fields.
  - **b. Currency Fields:**
    - Data fields used for amount only are called currency fields.
  - **c. Integer fields:**
    - Data fields used for integer value without decimal point is called integer fields.
  - **d. Date Fields:**
    - Data field used for date and time only are called date fields.
  - **e. Logical data type:**
    - This type of data can store only Boolean value i.e. either True or False.
  - **f. Memo data type:**
    - The data which can have long string of more than 255 characters are called Memo data type.
  - **g. Variable:**
    - The data which can have different values e.g. amount, name etc. are called variable.
  - **h. Single or Double data type:**
    - This type of data can hold all types of numbers either decimal or without decimal. E.g. 3455.876

D. RECORD:

- It consists of a group of data items related to an object of data processing.
- E.g. A payroll record consists of data fields such as name, age, qualification, sex, wage rate etc.
- In other words, it is a collection of related fields that are treated as a single unit & specified as a row in a database.

E. INFORMATION:

- Information is an organized or classified data and which is useful for users i.e. called information.

For example: A file containing transactions occurred during a year in a company. If the same file is arranged, processed and financial statements are prepared, then it becomes Information. Such statements are very much useful for managers or others.

F. DATA FILE:

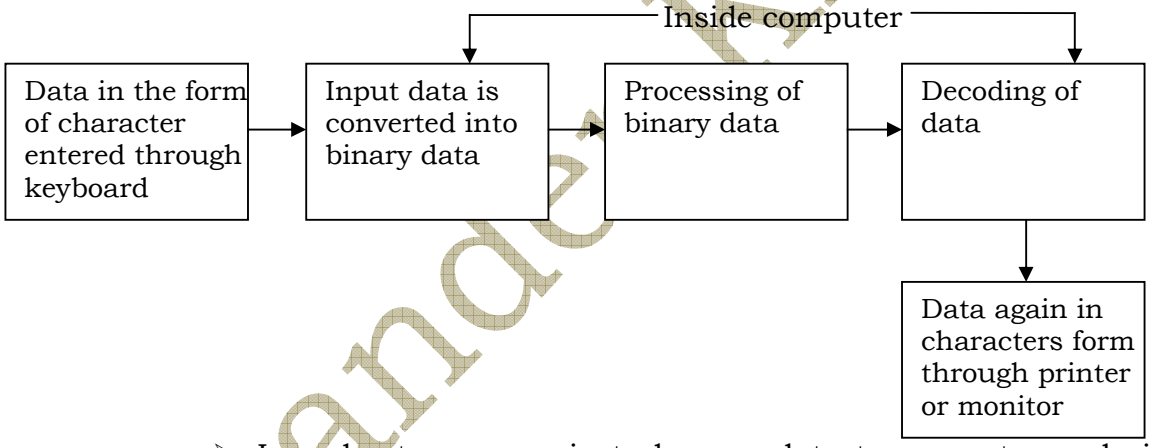
- It is a collection of related records that are treated as a unit.
- It may be a master file for permanent data and to use transaction files containing day to day data of temporary nature.

G. FILE:

- It refers to a collection of data or information in an organized form. For Example: database files, text files, master files etc.

H. DATA REPRESENTATION:

- Computer is an electronic machine and it can represent the data with the help of digital signals only. But these digital signals are replica to binary language character (in 1 or 0).
- Therefore we can say computer represent the 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.



- In order to communicate human data to computer and vice versa; a relationship between human data and computer data is devised with the help of following systems:
  a. Number system
  b. Coding system

I. NUMBER SYSTEM:

- Number system is used to represent numeric data.
- There are 4 popular number systems used for representing numeric data.
  - **a. <u>Decimal Number System:</u>**
    - ❖ It is used for representing numeric data in business applications.
    - ❖ It contains 10 digits (Digits 0 to 9).
  - **b. <u>Binary Number System:</u>**
    - ❖ It is used in the form of digital signals inside the computer.
    - ❖ It contains 2 digits (Digits 0 to 1).

c. Octal Number System:

- ❖ It is used by the system software professionals for memory addressing purpose.
- ❖ It contains 8 digits (Digit 0 to 7).

d. Hexadecimal Number System:

- ❖ It is also used by the system software professionals for memory addressing purpose.
- ❖ It contains 16 digits (Digit 0 to 9 **and** A to F)

J. CODING SYSTEM/PURE BINARY SYSTEM:

- ➢ It is used to represent any type of data like numeric (0 to9), alphabetic (A to Z), and some special character (like :, # etc.).
- ➢ There are 4 types of coding system as follows:

a. Binary Coded Decimal (BCD):

- ❖ There are two categories of BCD in coding system:

(I) BCD for decimal numbers only:

- ✓ This code uses 4 bit code to represent every character.
- ✓ Each decimal digit is represented by equivalent four digit 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	Decimal Digit	Equivalent Binary
0	0000	5	0101
1	0001	6	0110
2	0010	7	0111
3	0011	8	1000
4	0100	9	1001

For Example:

751 = 0111 0101 0001

957 = 1001 0101 0111

(II) BCD for all types of characters:

- ✓ This code uses 6 bit code to represent every character.
- ✓ Presently each and every character is represented by 6 bit code.
- ✓ There are 64 [$(2)^6$ = 64] ways/code of representing digits, alphabets and special symbols.
- ✓ For Example:

  9 = 00 1001

  A = 11 0001

b. ASCII:

- ❖ ASCII stands for "**American Standard Code for Information Interchange**".
- ❖ This is the most popular coding system to represent data in computer system.
- ❖ This code uses 8 bit code to represent every character but normally only 7 bit of these 8 are used.

- There are 256 [$(2)^8$ = 256] ways/code to represent characters but due to 7 bits are used, therefore Maximum 128 ways to represent the characters.
- A letter, digit or special symbol is called a character.
- Here the first 3 bits are zone bits and the remaining 4 bits represent digit values.
- It is mainly used in small computers (like PC and minicomputers), peripherals, instruments and communication devices.

c. EBCDIC:

- EBCDIC stands for "**Extended Binary Coded Decimal Interchange Code**".
- This coding system is an extension of BCD coding system.
- This code uses 8 binary digits to represent every character.
- These 8 bits are divided into 2 parts. First 4 bits are known **zone bits** and remaining 4 bits are known as **digit or numeric bits**.
  For Example:
  1 = 1111 0001
- There are 256 [$(2)^8$ = 256] ways/code to represent characters.
- This coding system is used all types of data (numeric, alphabetic and special symbols).

d. UNICODE:

- This is a 16 bits coding system.
- There are 65,536 or $(2)^{16}$ ways/code to represent characters.
- The first 256 codes in the Unicode are similar to 256 codes of ASCII system.
- The Unicode was developed in 1991 by a joint research team from Apple Inc and Xerox Inc.
- This coding system is supported by popular systems like windows and OS/2.

K. BITS, BYTES

Bits:

- Bit is known as Binary Digit e.g. 0 & 1.

Byte:

- A byte is a grouping of bits that computer operates on as a single unit.
- It consists of 8 bits i.e. every character is represented with 8 bits.
  1 byte = 8 bits = 1 character
- A byte is used to represent a character by the ASCII and EBCDIC coding systems.

S. No.	Name/Unit	Abbreviation /symbol	Size in bytes
1.	Kilobytes	Kb	2^{10} = 1024
2.	Mega bytes	Mb	2^{20} = Approx. 1 Million(>1 Millions)
3.	Giga bytes	Gb	2^{30} = Approx. 1 Billion (> 1 Billions)
4.	Terabytes	Tb	2^{40} = Approx. 1000 billion
5.	Petabytes	Pb	2^{50}

L. DATA CHARACTERISTICS/ KEY

- A key is a set of one or more columns whose combined values are unique among all occurrences in a given table.
  For Example: A/c number, PNR, PAN number.
- There are following types of keys:

Employee No.	Name	City	Mobile No.
E 101			
E 102			
E 103			

a. Primary Key:

- The data fields with the unique value are called Primary key.
  E.g. Employee no. in the above table is selected as Primary Key.

b. Secondary Key:

- The data field which can provide unique value but not selected as Primary key.
  E.g. Mobile no. in the above table is as secondary key.

c. Candidate Key:

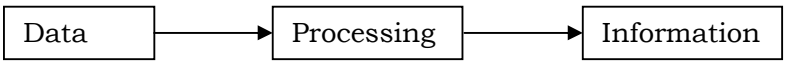
- The data fields which can be selected as primary key are known as candidate key.
  E.g. Employee no. and Mobile no. are candidate keys in the above table.

d. Alternate Key:

- The data fields which are not selected as primary key are known as Alternate key.
  E.g. Mobile no. in the above table is as alternate key.

M. DATA PROCESSING:

- It is a series of actions that converts data (input) into useful information (output).



Transactions
- ✓ **Sales**
- ✓ **Purchase**
- ✓ **Receipt**
- ✓ **Payment**

Reports
- ✓ **P & L**
- ✓ **Trial Balance**
- ✓ **Balance sheet**

STEPS IN DATA PROESSING:

- There are following steps involved in data processing to convert data into information.
  a. Preparation of Source document
  b. Recording Input data
  c. Processing of data
     It includes following operations
     - ***i. Classifying:***
       - ✓ It involves grouping of similar items or transactions.
       - ✓ Data are generally classified according to alphabetic or numeric code.
     - ***ii. Sorting:***
       - ✓ Sorting means arrangement of data or transactions in ascending or descending order.
       - ✓ Sorting may be done on numeric or alphabetic data.
     - ***iii. Calculating:***
       - ✓ It includes adding, subtracting, multiplying or dividing data to produce useful results.
     - ***iv. Summarizing:***
       - ✓ It involves consolidating of data, emphasizing main points.
       - ✓ Generally, it involves finding out totals, calculating percentages etc.
  d. Information (Reporting)
  e. Data Storage

N. DATA MANAGEMENT TECHNIQUE:

- Data management means to manage the data very efficiently because data is very crucial for an organization.
- There are two ways to manage the data :
  a. File System/Traditional File System
  b. Database Management System

File system:

- It is an old technique for managing organization data.
- Here all data is managed in flat files with the help of programs like simple text file.

Database Management System:

- It is software that is used for efficient data management of an organization. For example: Oracle, MS-Access, SQL Server etc.
- Here a specialized software is used to create database and manage database (i.e. delete, update, insert new data, search required data etc.) from created database efficiently.

O. MANAGEMENT PROBLEMS WITH FILE SYSTEM [D, I, I, D, S]:

- Data files can be kept manually or electronically.
- Traditional file system is based on manual paper files.
- There are following management problems with file system:

a. Data Duplication/Redundancy [D]:

- Same data is recorded or stored in several files which provide data redundancy.

b. Low Data Integrity (Orphan Records) [I]:

- The record may exist in transaction file but does not have their corresponding reference in master file.
- Therefore there is a risk of data manipulation by unauthorized people.

c. Data Inconsistency [I]:

- It means same data may have different values in different files because files are not linked with each other.

d. Data Dependence [D]:

- In file system, data remains dependent on a particular program i.e. it can be accessed or stored by using particular program only.

e. Security Problem [S]:

- File system does not provide high security to managed data.

2. FILE/DATA ORGANIZATION METHOD:

- It means to arrange and store the data in files.
- In other words, it refers that how data will be stored in coputer.
- A good file organization provides fast, access and storage of data.
- There are three methods to organize or store data:

a. Serial File Organization:

- This is the simplest file organization scheme.
- In this method, records can be arranged one after another in chronological order.
- In other words, arrange the records in the serial as records are entered into file.
- Serial organization is commonly found in transaction files.

Customer No.	E 101	E 105	E102	E 104	E103
Amount	500	578	700	400	287

E.g. Daybook

b. Sequential File Organization:

- In sequential file organisation, all records are arranged in ascending or descending order, according to a unique value.
  For example: In Payroll master file, records will be arranged in ascending order by employee number.
- This file organization is suitable for master files.
- Records are arranged sequentially on magnetic tape.

Customer No.	E 101	E102	E103	E 104	E 105
Amount	500	700	287	400	578

E.g. Ledger

c. <u>Direct Access File Organization:</u>

- ❖ In this method, any individual records are accessed or stored immediately on the file.
- ❖ There are two types of direct access file organization:

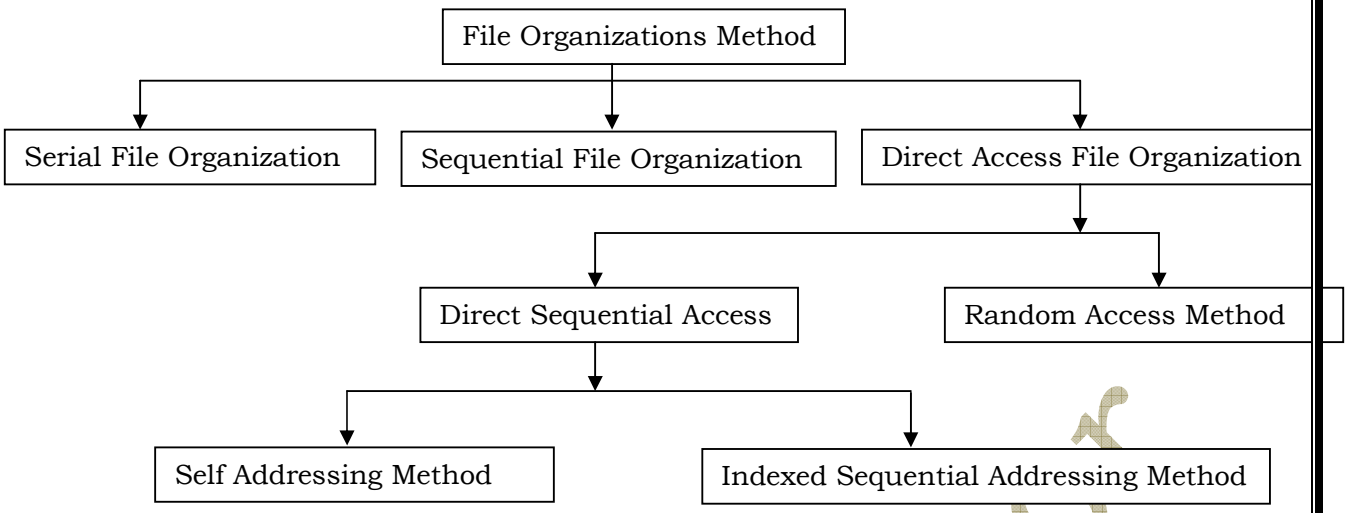
i. Direct Sequential Access method:

- ✓ In this method, data is stored sequentially but accessed directly.
- ✓ There are two types of direct sequential access method:
  (a) Self Addressing Method
  (b) Indexed Sequential Addressing Method

Basis	Self Addressing Method	Indexed Sequential Addressing Method
Meaning	▪ In this method, storage area is divided into buckets and every bucket can store fixed number of fixed length records. ▪ Records are arranged sequentially according to the record key. ▪ In other words, logical address itself becomes the physical address.	▪ In this method, data can be arranged on storage device by using Index table. ▪ In other words, an index table is prepared for the records of logical address and physical address for direct access of data.
Advantage	▪ No need to store index table.	▪ Suitable for variable length records. ▪ Provide fast access and storage of required data. ▪ Any empty space for deleted record can be utilized.
Disadvantage	▪ Records can store only fixed length. ▪ When some records are detected their storage space remains empty.	▪ Expensive hardware and software. ▪ Index table requires an extra space. ▪ It is relatively expensive.

ii. Random Access Method:

- ✓ In this method, records are stored or accessed randomly.
- ✓ Here, a record does not follow any order or unique sequential arrangement.
- ✓ It is the fastest storage and access method because randomize procedure is used to search the desired record directly.
  For example: airline or railway reservation etc.



3. THE BEST FILE ORGANIZATION:

- Every organization is required to manage data efficiently because an efficient data management helps in fast storage and access of required data.
- Therefore best file organization is depend on the several factors i.e. given below:
  - **a. File Volatility:**
    - ❖ It refers to the frequency of data additions and deletions from the file in a given period of time.
  - **b. File Activity:**
    - ❖ It is the proportion of master file records that are actually used or accessed in a given period of time.
  - **c. File Interrogation:**
    - ❖ It refers to retrieval of information from a file.
  - **d. Data Volume/File Size:**
    - ❖ It means quantum of data to be stored in the file.
- If File size is small and file volatility is high, then Random File organization is the best file organization.
  If File size is large and files volatility is low, then Index Sequentially Access Method (ISAM) is considered as best file organization method.

4. DATABASE:

- Database is an organized collection of related data (i.e. records and file) that provides a base or foundation for procedures such as retrieving information, drawing conclusion and making decisions.
- The DBMS software is used to manage an efficient database.

DBMS Software:

- ❖ It is software that is used for efficient data management of an organization. For example: Oracle, MS-Access, SQL Server etc.
- ❖ Here a specialized software is used to create database and manage database (i.e. delete, update, insert new data, search required data etc.) from created database efficiently.

ADVANTAGES OF DBMS

- There are following advantages of DBMS as given below:
  a. Controlling Redundancy
  b. Restricting unauthorized access
  c. Providing backup and recovery
  d. Reducing Inconsistency
  e. Provide faster accessibility and data sharing
  f. Rapid access to all stored data
  g. Provides various security features

Limitation of DBMS

- There are following disadvantages of DBMS as given below:
  a. Data Security and Integrity
  b. Insufficient database Expertise
  c. Increased Data Processing and Maintenance Cost
  d. Extra storage memory required
  e. Complexity to understand

5. ARCHITECTURE OF DBMS:

- It means the arrangement of database for different users.
- In other words, Database Architecture refers that how the data are viewed or retrieved from the computer file system.

LEVELS OF DATABASE ARCHITECTURE

- There are three levels of database architecture:

a. External View/User View/Sub-Schema:

- ✓ This layer or view is available to end users.
- ✓ It shows that portion of database which is of concern to user in a given situation.
- ✓ It is the highest level of the database abstraction (concept).

E.g. users working on banks computers are use this view of database.

b. Global View/Conceptual View/Logical Schema:

- ✓ This layer or view is available to database Administrator (DBA).
- ✓ It shows complete database with all its records relationship etc.
- ✓ It is the moderate level of the database abstraction.

c. Physical View/Internal View/Physical Schema:

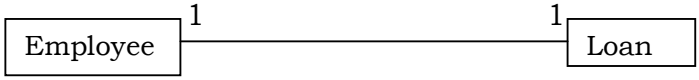
- ✓ This view is not available to any user or DBA.
- ✓ It is at storage level and cannot be viewed practically.
- ✓ It shows an arrangement of data on Hard disk and it is used by system programmers who develop DBMS.
- ✓ It is the lowest level of the database abstraction.

6. RECORD RELATIONSHIP IN DATABASE:

- Relational databases are organized in logical records which are related with each others.
- There are several types of record relationships that can be represented in database:

a. One to One Relationships:

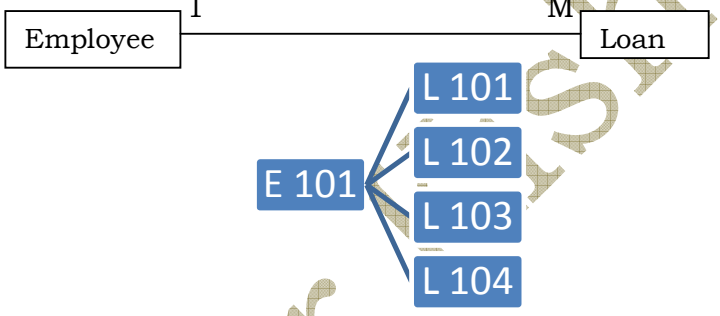
- When one record in a file has only one corresponding record in another file i.e. called one to one relationships.



E.g. one employee can be given one loan only

b. One to Many Relationships:

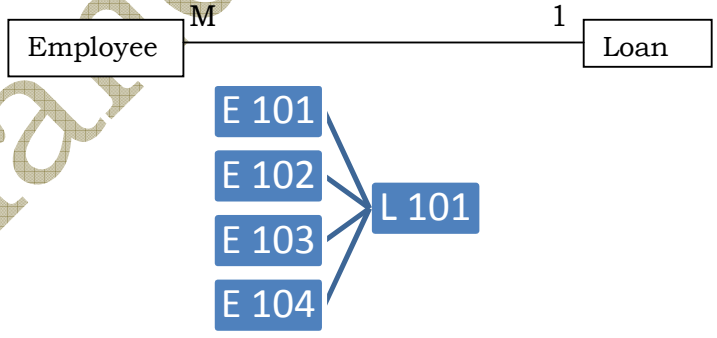
- When one record in a file has many corresponding record in another file i.e. called one to many relationships.



E.g. one employee can be given many loans

c. Many to One Relationships:

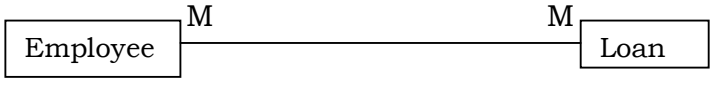
- When many record in a file has only one corresponding record in another file i.e. called many to one relationship.

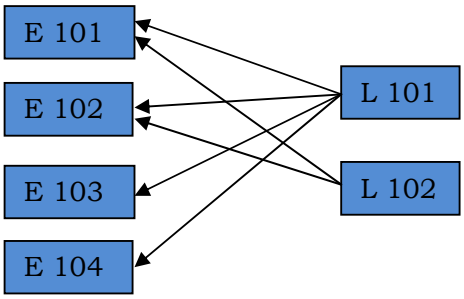


E.g. many employees can be given one loan only

d. Many to Many Relationships:

- When many records of a file has many corresponding record in other file i.e. called many to many relationships.





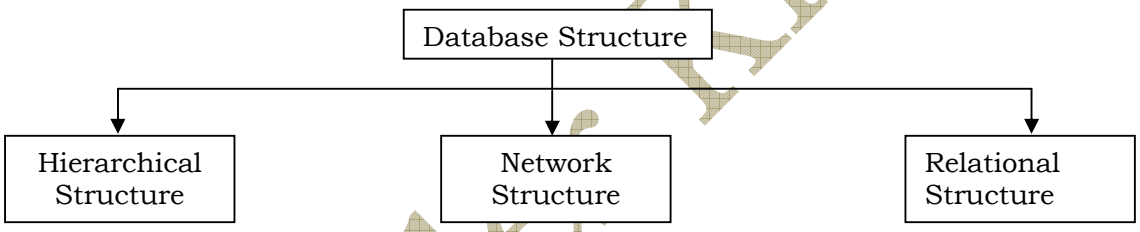
E.g. many employees can be given many loans and one loan can belong to many employees together

7. DATABASE STRUCTURE/DATABASE MODEL:

- Database structure is the definition of data records in which information is stored.
- The data in a database is organized in such a way that it is easy for people to understand.

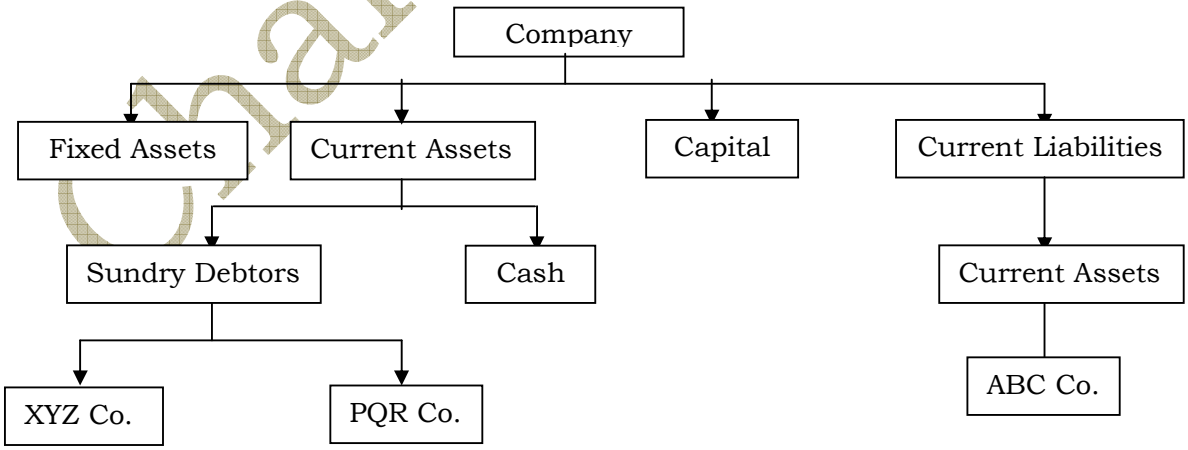
TYPES OF DATABASE STRUCTURE

- The database organization is based on one of 3 approaches for arranging data in a database.
- There are three types of database structure:



a. Hierarchical Structure:

- ✓ This is the oldest database structure.
- ✓ In this structure, records are related with each other in the hierarchical form from top to bottom.

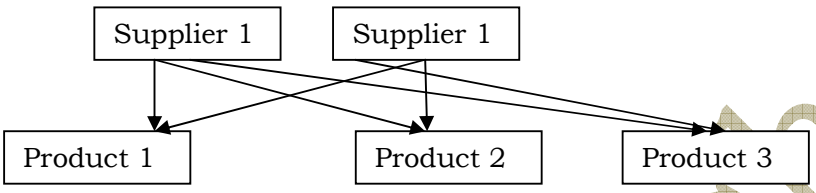


- ✓ This structure provides a record relationship model i.e. all the master records are related with each other.
- ✓ In this structure, all relationships between groups of data are only one to one **or** one to many relationships.

- ✓ This is easy to understand structure but this structure is inflexible i.e. difficult to change.
- ✓ This structure is like an inverted tree. The top record in hierarchical is known as Root record **and** next all keep record are called parent child relationship.

b. Network Database Structure:

- ✓ It is an extension of hierarchical database structure.
- ✓ In this structure, all the records are related with each other in a network form.
- ✓ This structure provides all types of relationship.



- ✓ In this structure, change of record is a difficult task i.e. this structure is also an inflexible structure.

c. Relational Structure:

- ✓ This is a most popular database structure.
- ✓ Almost all the DBMS are based on this structure. E.g. ORACLE, DB2, MS-Access etc.
- ✓ In this structure, all the data is presented in tables.
- ✓ This structure provides a flexible model in which records can be added or deleted without difficulty or changing the structure.
- ✓ This structure also provides all types of relationship.

OTHERS DATABASE MODELS:

a. Distributed Database:

- ❖ This type of database provides common data which can be shared by the many users of the organization from any location.
  For Example: Banking and Mobile Phone services.
- ❖ These databases are generated by local work groups, departments at regional offices, branch offices, manufacturing plants and other work sites.
- ❖ There are two techniques used to create distributed databases:

I. Replication Technique:

- ✓ When similar database is used at all the locations of organization and these are connected with each other using network i.e. called Replication Technique.
- ✓ This technique is very costly.

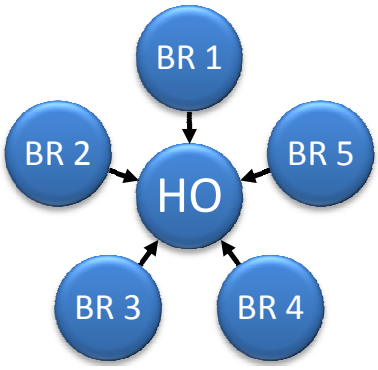


Figure: Replication Technique

II. Partitioning Technique:

- ✓ When common database is maintained at one location which is shared by all the other locations of the organization.
- ✓ This technique is more popular than replication technique.

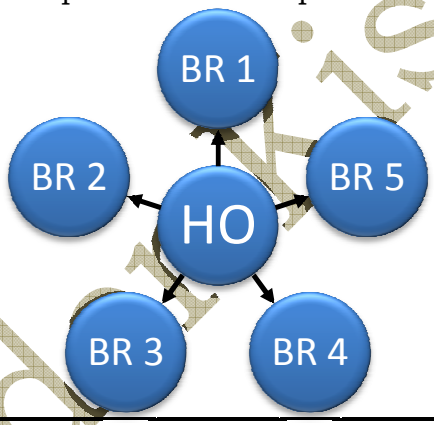


Figure: Partition Technique

b. Object Oriented Database:

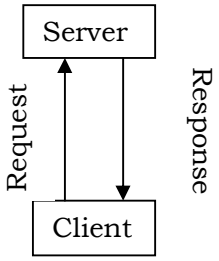
- ❖ This is the latest development in database technology.
- ❖ These databases are based on the principle of object oriented programming language i.e. create once and use many times at anywhere.
- ❖ These databases will increase the productivity of DBA for designing database **and**
- ❖ It will also increase the quality of database in terms of its use and management.

c. Client Server Database:

- ❖ It is a database which is loaded at a server computer to be accessed by client computers, to ask it question or instruct it to perform job.
- ❖ 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 station) interact with these servers to obtain requested data.

For Example:
ATM machine is a client and it always remains connected with bank database server to provide banking services to customers.

- There are two popular methods to use Client/Server databases model:

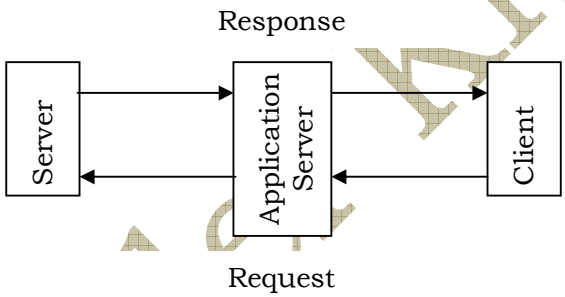


(I) 2-Tier:

- ✓ When client directly interact with database server i.e. called 2-Tier architecture.
- ✓ It has only two levels first client & second server.
- ✓ It is used in small network.

(II)3-Tier:

- ✓ When client interact with database server through an intermediate server/applicaion server i.e. called 3-Tier.
- ✓ It has three levels first client, second application & third database server.
- ✓ It is used in large network.



d. Knowledge Database:

- It is a collection of knowledge of experts in an organized form.
- The knowledge of experts helps in the problems solution.
- Such database are part of DSS (Decision Support System), Expert System and EIS (Executive Information System).

ENTITY RELATIONSHIP MODEL [E-R Model]:

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

8. DATABASE USERS:

- There are following users of database:
  - **a. Naïve or New Users:**
    - They are not aware about the database system.
  - **b. Online Users:**
    - They communicate with database either directly through online terminal or indirectly through user interface or application programs.
    - Usually they acquire at least some skill and experience to communicate with the database.
  - **c. Application Programmers:**
    - They are responsible for developing application programs and user interfaces.
  - **d. Data Base Administrator:**
    - ✓ He can execute centralized control and is responsible for maintaining the database.
    - ✓ He is the most familiar person with the database.

9. COMPONENTS OF DATABASE/DATABASE LANGUAGE:

- There are two types of components/languages of database:
  - **a. <u>Data Definition Language (DDL):</u>**
    - It is a language of DBMS used to define or create the structure of database likes tables, relationship etc.
    - This language accepts, create tables, and alter tables commands of SQL.
    - It is used by Database Administrator.
    - DDL is a link between the logical and physical structure of the database.
    - Here, logical means the way user views data; physical means the way data is physically stored.
  - **b. <u>Data Manipulation Language (DML):</u>**
    - It is also a language of DBMS used for modification on database such as addition of data, deletion of data etc.
    - This language supports, delete, update and select commands of SQL.
    - It is used by users.

10. DBMS STRUCTURE:

- In DBMS Structure, various components or managers are used to manage database efficiently:
- There are following components of DBMS Structure:
  - **a. <u>DDL Complier:</u>**
    - It converts data definition statements into set of tables.
    - Tables contain Meta data (data about data) relating to database.
  - **b. <u>Data Manager:</u>**
    - It is a central software component.
    - It helps in managing records & in Data Processing.
  - **c. <u>File Manager:</u>**
    - This component manages database files.

d. Disk Manager:

- It is a part of operating system.
- It manages all inputs and outputs operation of data physically from disk.

e. Query Manager:

- It interprets user's online query.
- It converts these queries into efficient operations for database.

f. Data Dictionary:

- It maintains information about the structure of database such as table names, field names of tables and field types (Numeric, text) etc.
- Data Dictionary is also known as Meta data (data about data).

11. TYPES OF DATABASES:

- There are following types of databases:

a. Operational Database:

- This database maintains day to day working information of an organization for current year.
- This database maintains data or information about customer, employees, supplier etc.

b. Historical/Information Warehouse Database:

- This database maintains data or information of previous or current years.
- Such type of data helps users in various analyses such as sales analysis etc.

c. Management Database:

- This database maintain that data and information which helps management in the decision making process.
- These databases store data and information extracted from operational and external databases.
- Management databases are also called information database.
- These databases are part of decision support system and executive information system to support the decision making process of management.

d. External Database:

- This database is created by some external organization like banks and stock exchange etc. and
- Organizations download the required information from this type of database for their use.
- These databases are also known as online databases.
- It is provided by various organizations either free or at a nominal fee.

e. Distributed Database:

- This type of database maintains common data which can be shared by the other branches of the organization also.

- These databases are generated by local work groups, departments at regional offices, branch offices, manufacturing plants and other work sites.

f. User Database:

- This type of database maintains data and information created by a particular user **[End User or Manager]** for his reference.
- These databases consists of various data files of word, excel and PDF which is generated by end user for his reference.

12. SHORT NOTES:

A. STRUCTURED QUERY LANGUAGE (SQL):

- It is a database language which contains set of commands for creating, updating and accessing data from database.
- The important commands of SQL are create, update, delete, select, insert etc.
- SQL helps the users to retrieve/access data from database directly without the help of Programmers/Application Programs.
- There are two types of commands used in SQL as follows:

a. Data Definitions Commands:

- These commands are used for creating database structure. E.g. CREATE and ALTER etc.

b. Data Manipulation Language:

- These commands are used for working on data values. E.g. SELECT, UPDATE, DELETE and INSERT etc.

- SQL is known as Natural Language **or** Universal Language.

B. DATA ADMINISTRATOR:

- It is a person who normally helps organization to make policies regarding database development and its controls.
- Data administrator decides that what data will be stored in databases, who are eligible to access such type of data? etc.

C. DATABASE ADMINISTRATOR:

- DBA is a person who is responsible for developing, implementing & maintaining database in an organization.
- There are following functions of database administrator:
  a. To carrying out the policies developed by Data Administrator.
  b. DDL (create and alter the structure of the database)
  c. DML (updating, deleting and changing the records)
  d. Security Features
  e. Set up procedures for identifying & correcting violations of standards & rules.

D. DATA STORAGE/LIBRARY:

- Data library refers to the place, department or a system having a collection of various electronic data files of an organization.
- The Operational Management of any organization must keep a collection of all data in a library for usage as well as security purpose.

- There are four functions for data storage:
  a. Ensuring that removable storage media are ***stored in a secure and clean environment.***
  b. Ensuring that storage media are ***used for authorized purposes only.***
  c. Ensuring that maintenance of ***storage media in a good working condition.***
  d. Ensuring that location of ***storage media at on-site/off-site facilities.***
- For managing a removable storage media efficiently, an ***automated library system*** is needed which records the following:
  a. An identifier of each storage medium i.e. a unique number for every CD.
  b. Location where each storage medium is at present placed.
  c. Identify the person responsible for storage medium.
  d. List of files stored on each medium.
  e. List of authorized persons to access.
  f. Date of purchase and history of use.
  g. Date of expiry when contents of the storage medium can be deleted.

E. <u>DOCUMENTATION LIBRARY/ DOCUMENTS MANAGEMENT:</u>

- Documentation library refers to the place, department or a system having a collection of various documents and papers in an organization.
- There are **<u>following documentation required to support</u>** a system in an organization:
  a. Strategic and operational plans
  b. Application systems and program documentation
  c. System software and utility program documentation
  d. Database documentation
  e. Operational manuals
  f. User manuals
  g. Standards manuals (Internal Control)
- These documents are created by different users at different locations, therefore there may be **<u>following issues raised</u>** in the organization:
  a. Same (duplicate) documents can be created.
  b. Documents are not organized properly.
  c. Documents are not managed, updated and accessed with appropriate security.
- Therefore, a **<u>document librarian</u>** may be employed (engaged) to manage documents in an efficient manner **<u>whose responsibilities</u>** are as follows:
  a. Documents are stored with proper security
  b. Only authorized users can access documents
  c. Documents are updated regularly
  d. Adequate backup exists for the documents.
  e. Not allowing the duplication of documents.

F. PROGRAM LIBRARY:

- Program library refers to the collection of various application programs that are required in an organization.
- To manage documents or programs, an organization can use software known as "**Program Library Management System**" or "**Document Library System**".
- This software provide the following features to manage programs or documents efficiently:

a. **Security:**
- It provides the following features:
  - ✓ ID & Password
  - ✓ Data Encryption
  - ✓ Automatic Backup

b. **Integrity:**
- It provides the following features:
  - ✓ Track all the changes in previous documents
  - ✓ Track of documents deleted and new documents added etc.

c. **User Interface:**
- It provides the following features:
  - ✓ To access and store documents/programs efficiently.

d. **Reporting:**
- It provides the following features:
  - ✓ List of documents
  - ✓ Types of documents
  - ✓ Added and deleted documents by data and month etc.

13. EXPLAIN THE FOLLOWING:

A. BACKUP:

- Backup means maintaining duplicate form of data at some other location.
- It is an additional copy of any file kept for security purpose which can be used if original file is lost or damaged.

TYPES OF BACKUP

- There are three types of backup as given below:

a. Offline Backup:
- ✓ Offline backup is performed when the system is shut-down i.e. called offline back up.
- ✓ In other words, this is performed when users are not working on system.

b. Online Backup:
- ✓ Online backup is performed when the system is in use i.e. called online backup.
- ✓ In other words, this is performed when users are working on system.

c. Live Backup:
- ✓ This is an advance form of online backup.
- ✓ This data backup is taken at the same instant when the data is entered into the working system.

- ✓ It is carried out by using the BACKUP utility with the command option.

TECHNIQUES OF BACKUP

- ❖ There are following backup techniques :
  - a. *Full Backup:*
    - ✓ It means to take a backup of full system.
    - ✓ Copies of all files or records.
  - b. *Differential Backup:*
    - ✓ It means to take a backup of files that have changed since the last backup.
    - ✓ Copies only records changes after last full backup.
  - c. *Incremental Backup:*
    - ✓ It means to take a backup of files that have changed since the last full backup/differential backup.
    - ✓ Copies records changed after last full backup or differential backup or incremental backup.
  - d. *Mirror Backup:*
    - ✓ It means to take a backup of full system with the exception that files are not compressed in zip files and not protected with a password.

COMPONENTS OF DATABASE TO BE BACKUP

- ❖ There are following components included while creating a backup of database:
  - a. *Root File:*
    - ✓ When we create a database, a main database file or root file is created.
    - ✓ This main database file contains database tables, system tables indexes etc.
  - b. *DB Space:*
    - ✓ The database files consist of a database root file, log file, mirror log file and other database files called DB Spaces.
  - c. *Transaction Log:*
    - ✓ Transaction log is a file that records database modifications.
    - ✓ Database modifications consist of inserts, updates, deletes, commits, rollbacks and database schema (design) changes.
    - ✓ A transaction log is not compulsory, but it is recommended.
  - d. *Mirror Log:*
    - ✓ A mirror log is an optional file.
    - ✓ It has a file extension of .mlg.
    - ✓ It is a copy of the transaction log and provides additional security against the transaction log.

B. RECOVERY:

- It is a process of restoring file from the backup files.
- **In other words**, it is a sequence of tasks performed to restore the database either a hardware or media failure.
- Hardware failure is a physical component failure in the machine such as, disk drive, controller card or power supply.
- Media failure is the result of unexpected database error while processing data.

C. DATA WAREHOUSE:

- It is an advance technique to collect data from multiple sources at single location to provide efficient management and useful information for data.
- Data warehouse technique is used in those organizations where large volume of data is generated in different formats at multiple locations.
  E.g. Banks, Mobile co. etc.
- It is centralized storage of data collected from different sources.

STAGES OF DATAWAREHOUSE

- There are following stages of data warehouse:

Stage I	**Offline Operational Database**	✓ This warehouse is created by collecting copy of data from multiple sources.
Stage II	**Offline Data Warehouse**	✓ This data warehouse is updated on a regular time cycle (Usually daily, weekly or monthly) from the operational system.
Stage III	**Real Time Data Warehouse**	✓ This data warehouse is updated on a transaction or event basis from an operational system/database. ✓ It provides reporting and analysis based on always updated information.
Stage IV	**Integrated Data Warehouse**	✓ This data warehouse is used to generate activity or transactions that are passed back into the operational systems for use in the daily activity of the organization.

Advantages & Disadvantages of Data warehouse

Advantages of Data Warehouse	Disadvantages of Data Warehouse
✓ Provide all data at one source (centralized data)	✓ Extracting, cleaning and combining data can be time consuming process.
✓ Increase productivity of user by providing quality reports	✓ Costly because require high maintenance
✓ Increased consistency of data	✓ Training to end-users on how to use it.
✓ Helps to provide useful information based on multiple data sources	✓ Problems of compatibility of different sources.

COMPONENTS OF DATA WAREHOUSE

- There are following components used in the process of data warehouse:

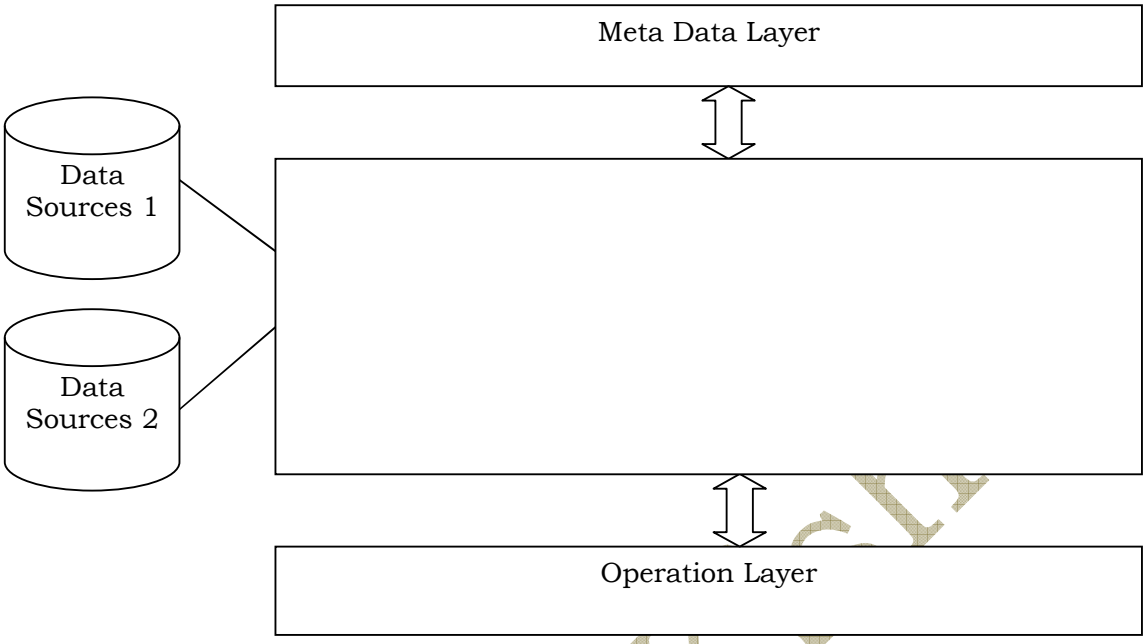


Figure: Components of Data Warehouse

S. No.	Components	Description
1.	**Data Sources**	✓ It refers the sources of data for data warehouse. ✓ It collected data from various locations in the various formats like tables, text files, spreadsheets etc.
2.	**Data Transformation**	✓ This component receives data from various sources and ✓ It cleans and standardizes it **i.e.** it transform data of data sources available in various format to a standard format.
3.	**Data Warehouse**	✓ This maintains the data in standard and organized form to support required analysis and reporting.
4.	**Reporting**	✓ This component is most popular components of data warehouse. ✓ Because it provides useful reports or information from data warehouse.
5.	**Operation**	✓ This component provides rules for data collection into data warehouse. ✓ It contains process of loading, manipulating and extracting data from data warehouse.
6.	**Metadata (data about data)**	✓ This component is used to inform operators and users of the data warehouse about its status and the nature of information held in the data warehouse. ✓ It contains data in terms of type, date and owners of information etc.

D. DATA MART:

- A database which contains selective data from a data warehouse for a specific function or department is called **Data Mart**.

E. DATA MINING:

- Data Mining is a technique of finding unusual pattern from large volume of data automatically.
- In other words, it is extraction of useful data or information from large volume of data just like extraction of gold from a coal mine.
- This technique helps to management in decision making process because it converts a raw data into knowledge, not in just simple information.

STEPS/STAGES OF DATA MINING:

- There are following steps involved in the process of data mining:

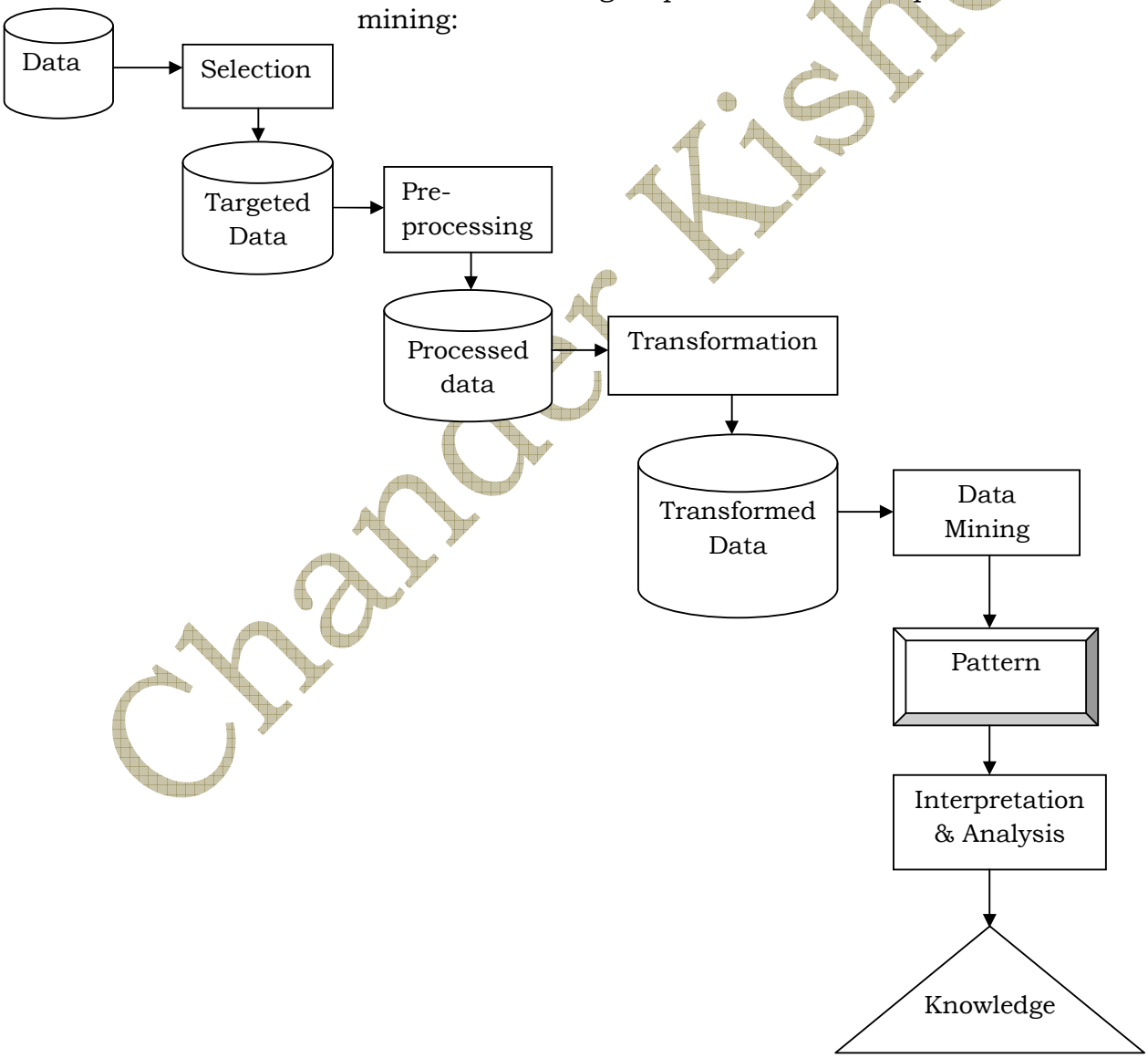


Figure: Data Mining Process

Step 1	**Selection**	✓ In this step, Targeted data is selected from a large volume of data sources. E.g. Customers are not paying bills on time.
Step 2	**Pre-processing**	✓ In this step, targeted data is cleansing i.e. unwanted data are removed from targeted data. ✓ In other words, process the targeted data as per the given rules to provide a processed data, so that useful data is extracted. E.g. Rules such as delayed payment on giving continuous intimation to customers i.e. customer paid his bill but after intimations.
Step 3	**Transformation**	✓ In this step, Processed data is transformed in a form, so that it can be easily navigated (search).
Step 4	**Data Mining**	✓ In this step, Transformed data is converted into certain patterns for extracting knowledge.
Step 5	**Interpretation and Evaluation**	✓ In this step, Pattern data are converted into useful information which helps to management in better decision making process.

COMPUTER NETWORKS AND NETWORK SECURITY

1. COMPUTER NETWORKS:

- It is a collection of computers, peripheral devices and terminals connected with each other for sharing of data and resources.
- In computer networks, computers are connected with each other with the help of communication channels (lines).

PURPOSE OF NETWORKS:

a. Sharing of data
b. Sharing of resources (hardware & software)
c. Distributed Data Processing (Any time anywhere processing)
d. Online data processing (Always updated information)
e. Multi-tasking (Many person doing same job)

COMPONENTS OF COMPUTER NETWORKS:

- To transfer the information among various users, there are following components required in computer networks:
  a. Sender
  b. Interface Devices (Communication devices)
  c. Communication channels
  d. Communication software
  e. Receiver

2. DATA COMMUNICATION:

- Data communication means to transfer of information or data from one device to another located at different places.
- For data communication, devices are linked with each other with the help of communication channels like cable, satellite etc.
- It helps the organization to set up online distributed data processing system.
- For Example: banks, railway, airline, telecom networks etc. are using data communication to provide distributed data processing services.

DATA PROCESSING TECHNIQUES:

- There are three types of data processing techniques:
  a. Centralized Data Processing Techniques:
     - ✓ It is done at one location such as at head office of the organization.
  b. Decentralized Data Processing Techniques:
     - ✓ It has different locations for data processing but these processing locations could not be linked with each other to share data and information.
  c. Distributed Data processing Techniques:
     - ✓ It has also different locations for data processing but these processing locations are linked with each other to share information and resources.
     - ✓ Distributed data processing system is a network of several computers, each of which is linked to a host or central computer known as server.

3. CLASSIFICATION OF COMPUTER NETWORKS:

- There are mainly 4 types of computer networks as follow:

A. Local Area Networks [LAN]:

- It is a network which covers a limited area.
- In this network, computers and devices are connected with each other within a limited distance or within a building or premises. E.g. School, College and internet café etc.
- In LAN, computers are connected with each other with the help of cable i.e. cable is used as communication channel in LAN.

Advantages/Benefits of LAN

- There are following advantages of LAN:
  a. Spread all over small area
  b. Easy to setup network
  c. Transmission speed is very fast (in Mbps)
  d. Easy to control and maintain the network
  e. Inexpensive way of data communication
  f. Relatively Error free

Components of LAN

- There are following components of LAN:

a. File Server and Workstation:

- ✓ One computer normally acts as a File server or server and others act as a workstation.
- ✓ **File Server** is a computer system which is used for managing the files and devices of a network.
- ✓ Server can be dedicated or non-dedicated.

  In dedicated server, all the network management functions are done by server.

  In non-dedicated server, some of the network management functions are transferred to workstations.
- ✓ **Workstations** are attached to the server through Network Interface Card (NIC) and cables.

  PCs load programs and data from server and do the processing on their own. After processing the files are again stored in the server.

  Generally a workstation is defined as:
  LAN Card + PC = Workstation

b. Network Interface Card [NIC]:

- ✓ Every device connected to a LAN needs a communication device known as Network Interface Card.
- ✓ It is also known as LAN Card.

- ✓ This card is normally known as Ethernet card because this card uses Ethernet protocol for data communication.
- ✓ NIC is used to connect a computer with communication channel of Local Area Network.

c. Network Operating System [NOS]:

- ✓ It is used as communication software in Local Area Network.
- ✓ NOS are loaded onto the server hard-disk. The job of this software is to manage and control the working of network.
- ✓ Windows NT is popular network operating system.
- ✓ The NOS helps in file management, security management, applications management, users management, processing management and devices management functions of a network.

d. Wireless:

- ✓ It does not require any physical media or cables for data transmission.
- ✓ Here radio and infrared signals are used.

e. Cables:

- ✓ In LAN, Cables are used as communication channel for connecting computers and devices on network.
- ✓ There are three types of cable which can be used as communication in Local Area Network:

I. *Co-axial Cable (TV cable)/ Coax Cable:*

- This was the most popular type of cable for setting-up a LAN.
- It contains central copper wire as its core that is surrounded by two prospective layers.
- There are two types:
  - Thick Co-axial
  - Thin Co-axial
- Coaxial cables are commonly used to connect computers and terminals in a local area such as an office, floor, building or campus.
- It provides data transmission speed of approximately 10 Mbps.

II. *UTP/ STP Cable (Telephone Wire):*

- This is the most popular type of cable for creating LAN.
- It is most commonly used transmission media to transmit electrical signal.
- It contains pairs of insulated copper wires twisted together.

- There are two types of twisted pair:
  - Shielded twisted pair (8 Wires)
  - Unshielded twisted pair
- Twisted-pair wires or cables are similar to cables used for home and office telephone system.
- It provides data transmission speed of approximately from 10 Mbps to 100 Mbps.

III. *Fiber Optical Cable:*

- It is a glass or plastic fiber that carries light along its length.
- Here, fibers are used instead of metal wires.
- This is the latest cable technology.
- This is used for building high speed LAN, known as Giga Bits LAN.
- This type of cable provides the highest data transmission speed.

B. Wide Area Network [WAN]:

- WAN is a digital communication system which interconnects different sites, computers and user terminals that are spread over a wide area (a state, a country or even worldwide).
- It covers wide geographic area with various communication facilities such as long distance telephone lines, satellite transmission and even undersea cables.
  E.g. Banking networks, Mobile Phone network, Airline reservation systems, Railway Network etc.
- It is spread over between cities and countries without any distance limitation.
- It provides speed about 1 Mbps.

C. Metropolitan Network [MAN]:

- MAN is a somewhere between a LAN and WAN.
- It 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 (about 10 Mbps & so on).
- MAN communication speed is normally in between LAN and WAN i.e. higher than WAN but lower than LAN.

D. Virtual Private Network [VPN]:

- It is a private network that uses a public network (usually internet) to connect remote sites or users together.
- VPN helps to access organization private network from any location by using internet.

- There are two types of VPN:
  - ***a. Remote Access:***
    - ✓ Employee access the organization network from various remote locations (user to LAN) by using software known as VPN dialer.
    - ✓ Therefore it is also called a virtual private dial-up network (VPDN).

      Working:
      - Generally a company wants to setup a remote access VPN that will be outsourced from third party known as enterprise service provider (ESP).
      - The ESP sets up a Network Access Server (NAS) and provides desktop client software to all the computer of remote users.
      - The user can dial a toll-free number to reach the NAS and use the VPN client software to access the corporate network.
      - They provide secure connections between a company's private network and remote users through a third party service provider.
  - ***b. Site to Site (S2S) VPN:***
    - ✓ An organisation can setup dedicated equipment to access of organization network at different location i.e. called Site to Site VPN.
    - ✓ S2S VPN can be one of the following two types:

      I. Intranet Based:
      - To connect employees only.

      II. Extranet Based:
      - To connect employees with others like suppliers, customer etc.

4. MODELS OF NETWORKING ARCHITECTURE:

- **Networking Architecture** refers to the way in which individual computers (called nodes) on a network interact with other computers on network.
- The scheme of organizing network is called Network Architecture.
- Network models provide technique for sharing of data and resources among its users.
- There are two types of Networking Architecture:

a. **Client-Server Model:**

- This type of network consists of certain machines and devices (called servers) that are fully dedicated to provide various services to the other computers (called clients).
- Server can be either dedicated or non-dedicated.
- In this model, one or more computers are used as dedicated server to maintain shareable information.

- ❖ Client-server model is based on LAN arrangement where microcomputers (clients) are connected to a network server.
- ❖ A program running on client computers can request for specific data from the server and the server program retrieves the requested data from its databases and returns it to the client.
  For Example: Banks, Railway, etc.

b. <u>Peer to Peer:</u>

- ❖ In this architecture, there are no dedicated servers i.e. computers are connected with other.
- ❖ All the computers are equal and therefore termed as "Peers".
- ❖ In this model, all the computers share information directly with each other.
- ❖ This arrangement is suitable when:
  - ✓ There are limited numbers of users (say 10 or less)
  - ✓ Users are located in small area.
  - ✓ Security is not an important issue.
- ❖ In a server based system, if the server fails, the entire network fails. But in a peer to peer network only that particular computer is affected and other systems continue to function as usually.
- ❖ In other words, there is no central server.
- ❖ The architecture is very simple and easy to maintain.
  For Example: internet café, schools and colleges etc.

5. COMMUNICATION DEVICE:

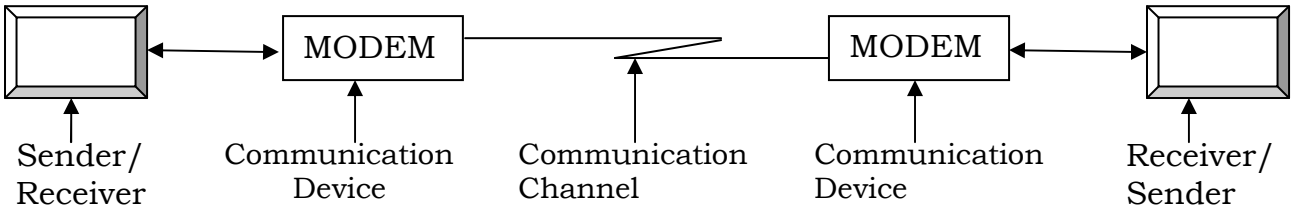
- ➢ It is used to connect sender and receiver with communication channels for data transmission.
- ➢ There are some popular communication devices as follows:

a. **<u>Network Interface Card:</u>**

- ❖ Every device connected to a LAN needs a communication device known as Network Interface Card.
- ❖ It is also known as LAN Card.
- ❖ This card is normally known as Ethernet card because this card uses Ethernet protocol for data communication.
- ❖ NIC is used to connect a computer with communication channel of Local Area Network.

b. **<u>MODEM [Modulator/Demodulator]:</u>**

- ❖ It is an encoding and decoding device used in data transmission.
- ❖ It is a communication device that is used to transmit the computer data through telephone lines because computer data is in digital form while telephone lines are in analog form.



- In other words, it converts digital computer signals into the analog telephone signals are called "**Modulation**" **and** When, it converts analog telephone signal into digital computer signals are called "**Demodulation**".
- There are two types of MODEM:
  - ✓ Internal and
  - ✓ External (Portable MODEM).

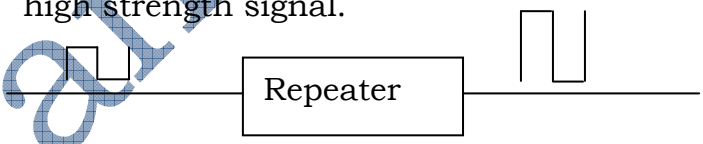
c. **Multiplexer:**

- It is a device that combines many low channels (lines) into a single high bandwidth channel (line) for data transmission.

- Multiplexer can scan each device to collect and transmit data on a single line to the CPU. It can also transmit data from CPU to appropriate terminal linked to the Multiplexer.
  For Example: Telephone lines can carry thousands of our conversations at the same time using multiplexing.

d. **Repeater:**

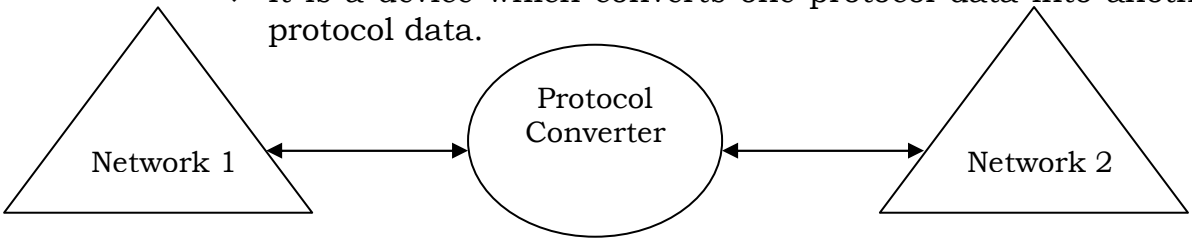
- It is a device that transforms a low strength signal into a high strength signal.



- In other words, it is a device that simple repeats the incoming signal for outgoing communication channel but with increased strength.
- It is also known as *amplifier* **or** *signal booster* which helps for error free transfer of data over a long distance.

e. **Protocol converters:**

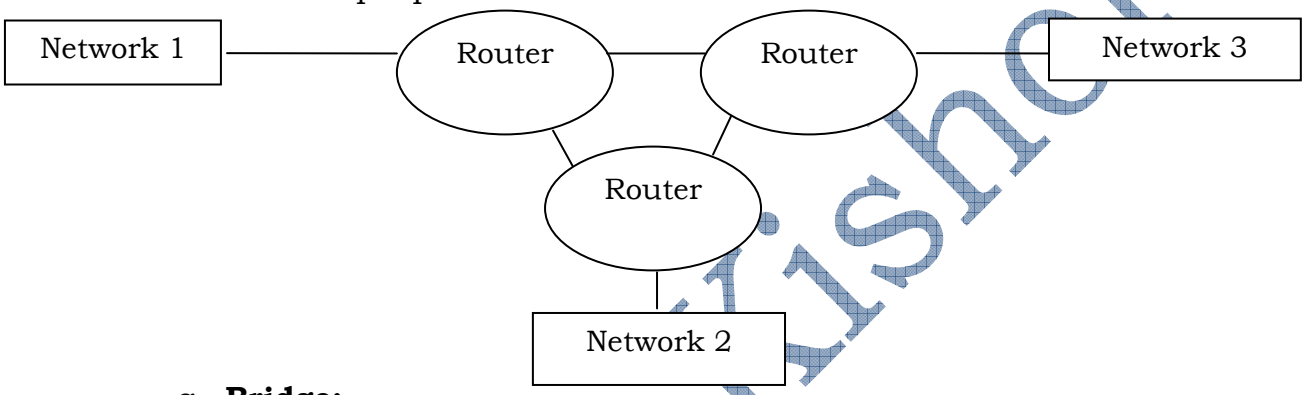
- It is a device which converts one protocol data into another protocol data.



- A Protocol is a set of rules required to initiate and maintain communication between sending and receiving device.
- Protocol conversion can be done by hardware, software or a combination of hardware and software.

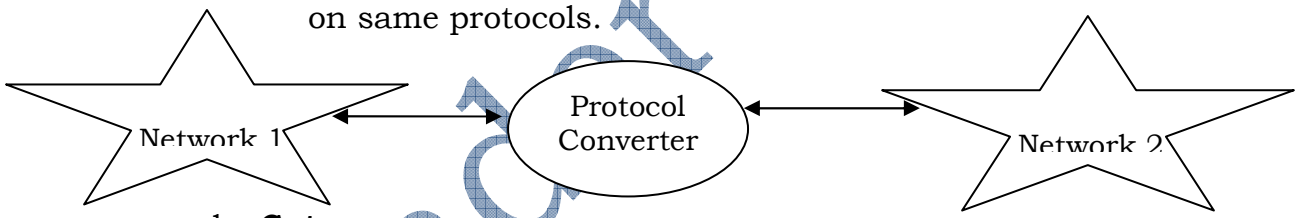
f. **Router:**

- Router is a device that connects more than two networks working on same protocol.
- It also helps to select the best route (shortest and most reliable route) for data communication when there are multiple paths between them.



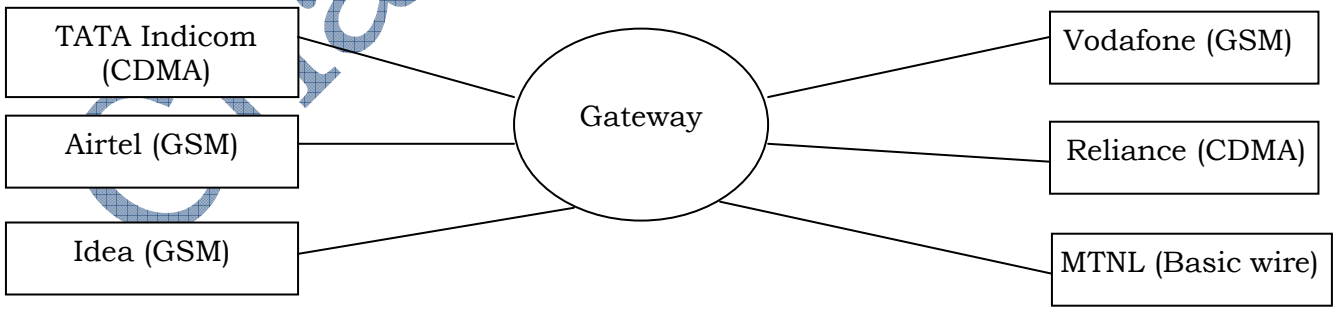
g. **Bridge:**

- It is a device which is used to connect two networks working on same protocols.



h. **Gateway:**

- It is a device which is used to connect multiple networks working on different protocols.
- It is a combination of router and protocol converter.



i. **Switch:**

- It is a hardware device that are used to direct messages across a network.
- Switches create temporary point to point links between two nodes on a network and send all data along that link.

j. **Hub:**
- ❖ A hub is a hardware device that provides a common wiring point in a LAN.
- ❖ Each node is connected to the hub by way of simple twisted pair wires.
- ❖ Then, the hub is connected to the server or the company's WAN or Internet.

k. **Front End Processor:**
- ❖ Front End Processor is known as assistant to server which perform allied task for server.
  For Example: code conversions, editing and verification of data, terminal recognition and control of transmission lines etc.
- ❖ It helps to improve the performance of server for main task like data processing etc.

6. NETWORK STRUCTURE OR TOPOLOGY:

- ➢ It is a geographical arrangement of network devices.
- ➢ A computer network is comprised of nodes and links.
- ➢ A node is the end point of any branch in a computer, a terminal device, workstation or an interconnecting equipment facility.
- ➢ A link is a communication path/channel between two nodes.
- ➢ A computer topology provides a mode by which network components can communicate with each other.
- ➢ There are four types of Network Topology:

a. BUS NETWORK:
- ❖ In this structure, computer & devices are connected with each other with the help of continuous running cable are called "Bus Network".
- ❖ This structure is very popular for LAN.
- ❖ In this structure, a single network cable runs in the building or campus and all nodes are linked with this communication line.
- ❖ There are two ends of the cable terminated with terminators.

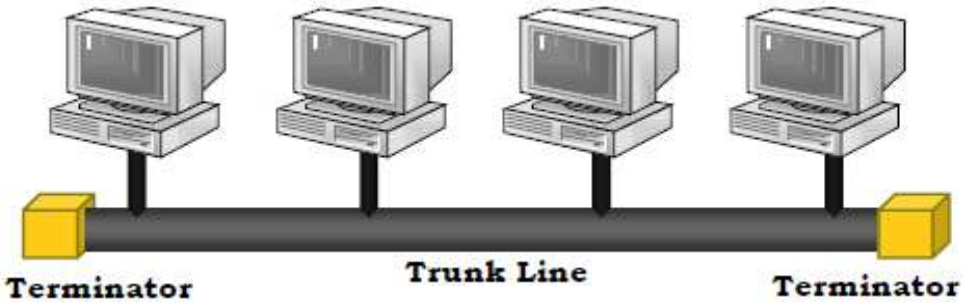


Figure: Bus Topology

ADVANTAGE	DISADVANTAGE
✓ It is simplest way to connect **simplest way to connect multiple clients**.	✓ Difficult to detect the default cable due to which whole network are stopped functioning.
✓ Easy to set up and understand this network.	✓ Heavy traffic can slow down the network.
✓ This network is **highly reliable** in small network.	✓ It is slower than other topology.
✓ It requires **less cable** to connect the computers together.	✓ A repeater is used to quality of signal.
✓ It is low cost topology.	✓ New connections can weak the signals.
✓ It is easy to extend a new network.	

b. STAR TOPOLOGY/NETWORK:

- In this structure, computer & devices are connected with each other in the form of star; hence it is called star topology.
- In this structure, Communication channels are controlled by Centralized System.
- Each terminal/node can communicate with each other only through Central Server.
- If a node wants to transmit information from one node to another, then it can be done by sending the details to the central server and then it sends this information to the desired destination.

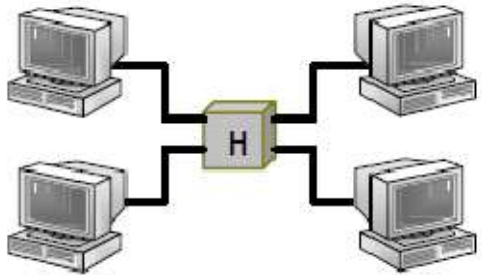


Figure: Star Topology

ADVANTAGE	DISADVANTAGE
✓ It is easy to expend (i.e. add or remove nodes).	✓ If central system is not working, then entire network will not work.
✓ If a node is failure, then no problem with other nodes.	✓ It is costly network in comparison to other topology.
✓ It is easier to detect network problems through a central hub.	✓ The performances of the nodes are depending upon central server/hub.
✓ A new connection does not slow down the communication between networks.	

c. RING TOPOLOGY:

- This is an extension of bus topology.
- In this structure, computers and devices are connected with each other in the form of ring.
- In this structure, a single length of cable is used to connect the both ends of bus topology to create a loop; hence it is also called "loop network".

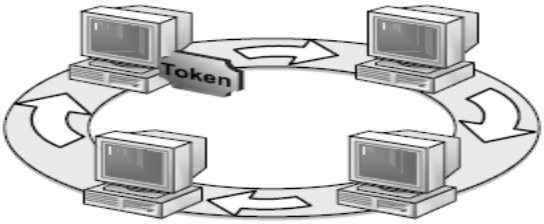


Figure: Ring Topology

- In other words, the network cables passes from one node to another until all nodes are connected in the form of loop or ring.

ADVANTAGE	DISADVANTAGE
✓ It offers high performance for a small number of workstations.	✓ Difficult to detect default cable.
✓ It is easy to expand.	✓ Failure of one computer on the network can affect the whole network.
✓ It performs better than star topology.	✓ Adding or removing computers can disturb the whole network.
✓ It is more reliable since communication between 2 computers is not dependent on a single host computer.	✓ It is expensive and difficult to install in comparison to bus topology.

d. MESH TOPOLOGY:

- In this structure, computers and devices are connected with each other through multiple paths.
- This structure provides a direct (Point-to-Point) communication between connected devices.
- Here every node is connected with every other node in mesh network.
- This concept is applicable to wired and wireless networks.

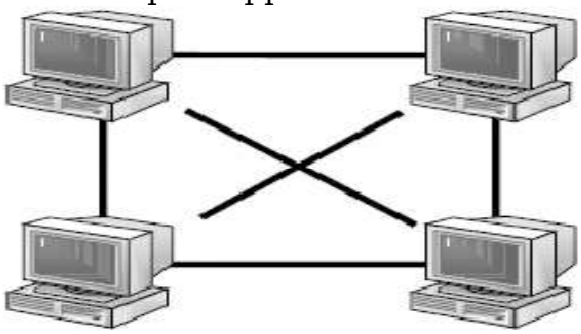


Figure: Mesh Topology

ADVANTAGE	DISADVANTAGE
✓ This is more reliable. If direct link between 2 nodes break down, there exists an alternate path.	✓ The cost of installation and maintenance is very high.
✓ It provides point-to-point (direct) communication.	✓ Adding or removing a node will disturb the entire network.
✓ Networks problems are easier to diagnose (detect).	

7. COMMUNICATION CHANNEL:

- It is a medium through which data is transmitted between link devices (sender and receiver) in a network.
- There are various popular communication channel like Guided Media (Optical Fiber, twisted-pair, co-axial cable) **or** Unguided Media (Wireless Network).

CHARACTERISTIC OF COMMUNICATION CHANNEL

a. **Bandwidth:**
   - Every communication channel has certain data carrying capacity known as "**bandwidth of communication channel**".
   - In other words, **Bandwidth** refers to channels of data carrying capacity.
   - It is measured in Kbps, Mbps & Gbps.

b. **Reliability (**Consistency**)**

c. **Transmission Rate:**
   - It is the data transmission capacity of a telecommunication channel.
   - It depends on the bandwidth.
   - The greater the bandwidth higher will be the transmission rate.

d. **Security**

e. **Cost**

8. COMMUNICATION SERVICES:

- When communication channels are provided by telecom organizations (like BSNL, VSNL, Airtel, Reliance etc.) as a service known as "**communication services**".
- There are following types of communication services:

a. Narrow Band:
   - It provides slow speed communication channels for data transmission.
   - Usually, this service is used where data volume is relatively low.
   - The data transmission rates usually range approx. from 45 to 300 bits per second.

For Example: Typewriters Exchange Service (TWX), Telex service.

b. Voice Band Services:

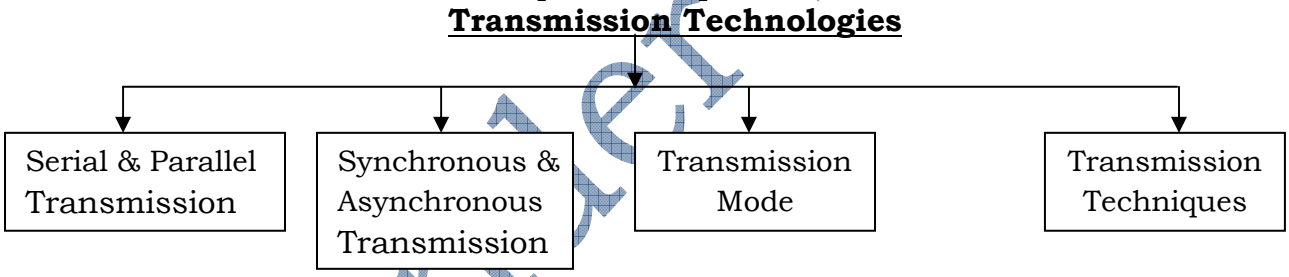
- ❖ It uses ordinary telephone lines to send data messages.
- ❖ The data transmission rates vary from 300 to 4800 bits per second and higher.
  For Example: Telephone lines

c. Wide Band Services:

- ❖ It is the most popular type of communication service.
- ❖ It provides the highest speed communication channels for data transmission.
- ❖ The data transmission rates from several thousands to several million bits per second.
- ❖ It provides speed in Mbps to Gbps.
  For Example: Satellite Channel, optical fiber, co-axial cable, micro-wave etc.

9. TRANSMISSION TECHNOLOGIES:

- ➢ It provides various options for transmission of data between sender and receiver.
- ➢ There are following some popular transmission technologies which can be selected as per the requirement of data transmission:



- ➢ Transmission technologies has been explained as follows:

a. SERIAL & PARALLEL TRANSMISSION:

- ❖ These have been explained as follows:

Basis	Serial Transmission	Parallel Transmission
Meaning	✓ When data is transmitted bit by bit on single communication channel between connected devices i.e. called Serial Transmission.	✓ When data is transmitted by using multiple bits together on multiple communication channel between connected devices i.e. called Parallel Transmission.
Diagram & Path	C 1 — 10101010111 — C 2 ✓ The bits of each byte are sent along a single path one after the other.	C 1 — 10101010111 / 00101010101 — C 2 ✓ There are separate parallel paths corresponding to each

		bit of byte.

Speed	✓ The rate of data transmission is very slow.	✓ The rate of data transmission is very high.
Data transmission	✓ Bits in a byte are transmitted one by one.	✓ All character bits are transmitted in parallel, at a time.
Where it is used?	✓ It is used where low volume of data transmitted.	✓ It is used where high volume of data transmitted.
Distance	✓ It is used for long distance communication.	✓ It is used for short distance communication.

b. SYNCHRONOUS & ASYNCHRONOUS TRANSMISSION:

- These have been explained as follows:

S. No.	Synchronous Transmission	Asynchronous Transmission
1.	When sender and receiver communicate the data at same speed i.e. known as "synchronous transmission".	When sender and receiver do not communicate the data at same speed i.e. known as "asynchronous transmission".
2.	It does not use starts and stop bits for sending data segment.	It uses start (0) and stop (1) bits to identify the beginning and ending of the word.
3.	Data transmission rate is fast.	Data transmission rate is slow.
4.	It provides 64 to 128 Kbps speed.	It provides 38.4 Kbps speed.
5.	It is expensive.	It is less expensive.
6.	It is more efficient.	It is less efficient.

c. TRANSMISSION MODE:

- It indicates the direction of data communication on communication channels.
- There are three different types of data communication modes as follow:

i. **Simplex Mode:**

- ✓ Data is transmitted in one direction only.
- ✓ The devices connected in simplex mode can send only (transmitter) and receive only (receiver).
  For Example: TV and Radio.

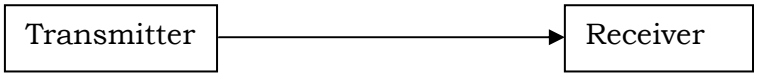


Figure: Simplex Mode (One way communication)

ii. **Half Duplex Mode:**

- ✓ Data can be transmitted in both directions but only one side at a time.
- ✓ The devices connected in half duplex can send and receive data but only one activity at a time.
  For Example: Walky Talky, LAN Network.

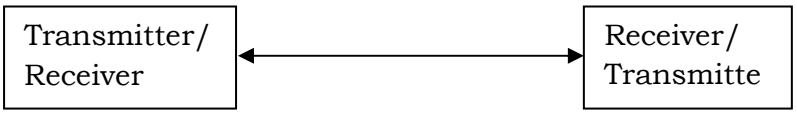


Figure: Half Duplex Mode (Two way communication, one at a time)

iii. **Full Duplex Mode:**

- ✓ Data can be transmitted in both directions simultaneously.
- ✓ The devices connected in full duplex can send and receive data simultaneously.
- ✓ It uses two separate circuits for communication i.e. one for sending data and other for receiving data.
  For Example: Telephone line connection.

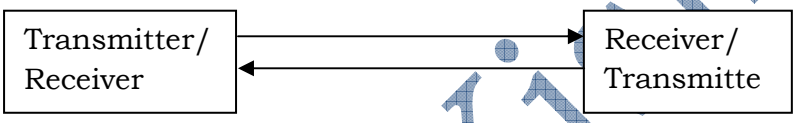


Figure: Full Duplex Mode (Two way communication simultaneously)

d. <u>TRANSMISSION TECHNIQUES:</u>

- ❖ It is used for data communication i.e. data is commutated directly or in the form of packets and messages.
- ❖ There are three popular transmission techniques:

i. **Circuit Switching:**

- ✓ A permanent path is established between sender and receiver for duration of data communication i.e. called "circuit switching".
- ✓ Here a special circuit is used for the duration of the call/transmission to transmit data.
- ✓ Once a circuit is established between two stations, it is exclusively used by the two parties and the dedicated link becomes unavailable to others till the call is terminated by either party.
- ✓ This will be the experience of every person using the telephone. When we make a call and either we get our destination party or encounter a busy signal.
  For example: Circuit Switching is used for voice communication on telephone.

ii. **Packet Switching:**

- ✓ It is the latest technique of data communication.
- ✓ In this technique, firstly message is broken into small parts (i.e. known as packets) and then these packets are transmitted on network from source to destination on available routes.

- ✓ Each packet contains source and destination address, data and error control bits.
- ✓ This technique provides an efficient utilization of communication channel because on the same channel many users' data packets can be transmitted simultaneously.
  For Example: internet communication is based on packet switching techniques.

iii. **Message Switching:**

- ✓ It is an extension of packet switching.
- ✓ Here a special kind of computer used for sending and receiving message at a high speed.
- ✓ This special computer receives all the data to be transmitted, converts this data into messages (combined many data packets) and then forwards this messages to the receiver; when line is available.
- ✓ For Example: telegrams, Electronic mail, transaction queries and responses etc.
- ✓ This technique provides more efficient utilization of communication channel.

10. COMMUNICATION SOFTWARE:

- ➢ It is special system software which manages the flow of data across a network.
- ➢ In other words, it helps in efficient, effective and secured data transmission between sender and receiver.
- ➢ There are following functions of communication software:

a. Data and file transmission:
   It transmits the data and files among the various devices.

b. Access Control:
   It provides the access of communication devices and resources to authorized users only.
   It establishes parameters such as speed, mode and direction of transmission.

c. Data Security:
   It protect data during transmission from unauthorized access like uses data encryption (data coding, decoding) etc.

d. Network Management:
   It manages the network and its resources for sharing and exchange of information.

e. Error detection and control:
   It ensures that sent data is received without errors.

11. BROAD BAND NETWORKS OR ISDN:

- **ISDN** stands for Integrated Services Digital Network.
- ISDN network helps to transfer the data at high speed.
- It is a system of digital telephone communication which allows both voice and data to be transferred simultaneously.
- Telephone Exchanges, Mobile phone networks and Internet are part of this ISDN networks.

TYPES OF CHANNELS:

- There are two types of Broad Band Channels:

a. Bearer Channels (B Channels):

- ✓ Data and voice are carried by these channels having a bandwidth of 64 kilobits per second.

b. Delta Channels (D Channels):

- ✓ Signals are carried by these channels at 16 Kbps or 64 Kbps.

TYPES OF ISDN SERVICES

- There are two types of ISDN services:

a. Basic Rate Interface (BRI):

- ✓ It consists of two 64 kbps (B channels) and one 16 kbps (D channel) to form a total of 144 kbps.
- ✓ It is suitable for individual users.

b. Primary Rate Interface (PRI):

- ✓ It consists of 23kbps (B channels) and one 64 kbps (D channel) to form a total of 1536 kbps.
- ✓ It provides in the range of kbps.
- ✓ It is suitable for users with higher capacity requirements.

ADVANTAGES OF ISDN SERVICES:

- There are following advantages of ISDN Service:
  a. Full Duplex
  b. Multiple lines can be operated.
  c. Voice and data can be transferred.
  d. No Interface or Noise problems
  e. Caller ID facility.

12. TRANSMISSION PROTOCOLS:

- It is a set of rules to be followed for transmission of data between two devices.
- Protocols are implemented with the help of communication software.
- Normally a protocol defines three aspects for data communication:
  a. **Syntax:**
    - ✓ It means format of data being exchanged, character set used, type of error correction used, type of encoding scheme used etc.

b. **Semantics:**
   - ✓ It means order or format of message used to ensure reliable and error free information transfer.

c. **Timing:**
   - ✓ It means the rate/speed for data transfer.

- ➢ There are various popular transmission protocols like
  TCP/IP is the standard for internet.
  POP3 is used for e-mail.
  Ethernet is used for networking.

13. OPEN SYSTEM INTERCONNECTION (OSI):

- ➢ OSI is a description of layers which is outlined by International Organization for Standardization (ISO).
- ➢ Open System Interconnection (OSI) has defined certain layer to be used for data communication between devices known as OSI layers.

S. No.	Layers	Descriptions
1.	**Physical Layer**	❖ It is a hardware layer. ❖ It specifies rules for connection of hardware devices with communication channels.
2.	**Data Link Layer**	❖ It is also a hardware layer. ❖ It specifies the channel access control.
3.	**Network Layer**	❖ This layer specifies rules for route selection etc. on channels for data packets.
4.	**Transport Layer**	❖ It specifies rules for assembling and error free transfer of data packets on channels.
5.	**Session Layer**	❖ It specifies the rules to establish maintain and terminates the session between users. ❖ Identification and authentication are undertaken at this layer level.
6.	**Presentation Layer**	❖ It specifies the rules for display of data on screen. ❖ In other words, it helps to display the applications on screen in an appropriate form.
7.	**Application Layer**	❖ It specifies the rules for file transfer and files sharing etc. ❖ For Example: E-mail, webpage etc. work on this layer.

- ➢ **For remembering the OSI layers**
  Please **D**o **N**ot **T**hrow **S**ausage **P**izza **A**way
  OR
  All **P**eople **S**eem **T**o **N**eed **D**ata **P**rocessing
- ➢ **A PROTOCOL STOCK** is a combination of a set of protocols defined in different layers where each layer is handled by different protocol.

14. NETWORK PROTOCOL:

- Networks Protocols are sets of rules for communicating timings, sequencing, formatting and error checking for data transmission.
- These rules are embedded (set in) into the software which reside either in computer memory or transmission device.

PROCESS OF PROTOCOLS/STEPS IN TRANSMISSION OF DATA

At the sending computer, protocols	**At the receiving computer, protocols**
✓ Breaks the data into packets	✓ Receives data packets from NIC
✓ Add destination address to the packets	✓ Removes the address
✓ Prepare data for transmission through Network Interface Card.	✓ Copies data from packet & re-assembling packet in a buffer memory.
	✓ Pass the reassembled data to the application (Browser).

- **In short,** The TCP protocol breaks it up into small packets. A header is given to each packet, which consists of destination address and then such packets are sent to users over the Internet. The IP protocol guides the packets so that they arrive at proper destination. Once the destination is reached, the TCP protocol reassembles the packets into the original message.

15. TCP/IP:

- The protocols used in the internet are called TCP/IP.
- TCP/IP stands for transmission control protocol/Internet Protocol.
- This protocol has two parts:
  a. TCP:
     - ❖ It sends & receives the data into packets.
     - ❖ It deals with assembling & disassembling of data packets.
  b. IP Address:
     - ❖ It manages the source & destination address of devices called IP address.
     - ❖ It handles to transfer of data packets on channels.
- It has **four layers** to perform & complete transmission:
  a. Application Layer:
     - ❖ It directly provides services to the users such as E-mail.
  b. Transport Layer:
     - ❖ It provides end-to-end communication between applications and verifies correct packet arrival.
     - ❖ It is used to send or receive physical movement of data.
  c. Network/Internet Layer:
     - ❖ It is used to provide packet routing for error checking, addressing and integrity.

d. Network Interface Layer/Data link layer:
   - ❖ It is used to handle the physical hardware networking devices & their drivers.

16. TRADITIONAL COMPUTING MODELS:

- ➢ There are three technologies that came before client-server Architecture is called Traditional Computing Models.
- ➢ The limitation of these models gave rise to client-server architecture.
- ➢ Over the year many business computing models have been invented for data processing such as:

a. Mainframe Architecture:
- ❖ In this model, a mainframe computer is used for data processing.
- ❖ This is the oldest computing model in which data processing is done in central host computer & users have to interact with clients/terminals like H.O.
- ❖ Here data are stored in centralized computer.
- ❖ These are the limitations:
  High cost, Suitable only for large organization, Dependence, No GUI support.

b. PERSONAL COMPUTERS AND WORKSTATIONS (PC COMPUTING MODEL):
- ❖ In this model, Personal computers are used for data processing.
- ❖ This model provides de-centralized data processing i.e. data processing is done at various locations.
- ❖ But this model does not provide the sharing of data among its users.

c. FILE SHARING ARCHITECTURE/FILE OR SERVER NETWORK COMPUTING MODEL:
- ❖ This model is the extension of PC computing model.
- ❖ In this model, all the computers are connected with each other in a network form to share the data and resources.
- ❖ The shareable data or common data used to maintain at one computer known as file server.
- ❖ This model provides sharing of data but this data does not provide concurrent sharing of data among its users.
- ❖ These are the limitations:
  Not a real multi-user environment, low speed, security problems.

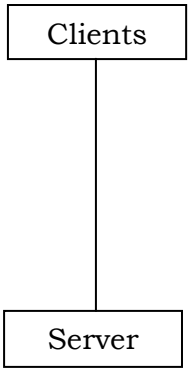
17. CLIENT-SERVER ARCHITECTURE:

- This is the extension of File sharing architecture to provide con-current sharing of data among its users.
- In this architecture, large number of computers is divided into servers and clients.
- Here servers that give service & clients that take service.
  Servers accept requests for information from clients and return the result to the clients.

Benefits & Characteristic of Client-Server Architecture

a. Flexible Model
b. Platform Independence
c. Multi-tasking
d. Improved performance of users
e. Low cost operation
f. Distributed data processing
g. Con-current sharing of data

TYPES OF CLIENT-SERVER ARCHITECTURE:



❖ There are two types of client-server architecture:

a. 2-Tier Architecture:

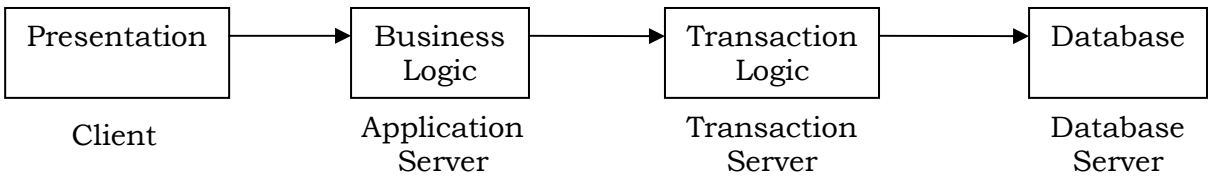
- ✓ In this architecture, there are two components in 2 Tier.
- ✓ One is Client i.e. also called graphical user interface & second is server (database).
- ✓ Generally, these two portions are also known as Front End (Client) and Back End (Server).
- ✓ In this architecture, presentation processing is maintained on client & database on server.
- ✓ It is traditional method.

b. 3-Tier Architecture:

- ✓ In this architecture, there are three components in 3 Tier.
- ✓ One is Client, second is Application software and third is Server.
- ✓ In this architecture, Presentation on client, processing on middleware and database on server.
- ✓ This is the most popular.

c. Multi-Tier Architecture (N-Tier Architecture):

- ✓ In this architecture, there can be more than three layers for data exchange between client and servers.



COMPONENTS OF CLIENT-SERVER ARCHITECTURE

- There are following types of Client server architecture:

a. Client:

- ✓ It is the personal computers taking the services offered by the servers called clients.
- ✓ Normally, the client has no data processing capability.
- ✓ It simply request data from the server and displays the data provided by server.
- ✓ There are three types of clients:
  - i. Non-graphical User Interface clients
  - ii. Graphical user interface
  - iii. Object-Oriented user interface

b. Servers:

- ✓ It refers to the system that provides required data to the clients.
- ✓ Servers receive request from the clients and provides required data to the clients.
- ✓ There are various types of servers as follows:

A. *Database servers:*

- This server is used to provide database services.
- This server maintain database and provide its access to its authorize users only.
- It is a part of DBMS.

B. *Application Servers:*

- Application server is a program which maintains business logics for data processing.
- Application server provides services to large number of users known as clients, simultaneously from different locations.
- It contains some powerful features for data processing and normally application servers are developed by using Java Language.

C. Print Servers:

- Print server provides printing related services.
- This server helps to use a common printer in a network by large number of users simultaneously.

D. Transaction Servers:

- Transaction server is used to manage the transactions.
- This server is used to maintain the track of a transaction till the transaction is completed.
- To understand the transaction server, when you start your transaction at ATM machine. It is the responsibility of transaction server to maintain

the track of your transaction right from the beginning to end, until the transaction is completed.

If transaction breaks in between then transaction server, then entire previous steps has finished and you have to restart your transaction again.

In such way, you can say that it does not allow any incomplete transaction on the system.

E. Internet Servers:

- Internet is a hub of servers which provide different type of services.
- There are following types of internet servers:

i. File server:

This server maintains files on internet for sharing purpose.

ii. Web-server:

This server maintains web sites in the form of web pages which can be accessed from anywhere through internet.

iii. Mail server:

It provides e-mail services to users e.g. Yahoo mail, Gmail, hotmail etc.

iv. Chat server:

It provides chat services to the multiple users simultaneously.

v. DNS Server:

DNS stands for Domain Name Service.

This server converts the domain name into the IP address.

vi. FTP Server:

FTP stands for File transfer protocol.

This server provides file uploading and downloading services on internet.

vii. News Server:

It connects several news groups to provide news to its users.

This server also helps to the user to share their views with each other on particular subject.

viii. Gopher Server:

This server provides fast access/search of required files, data and images from several web servers.

ix. Caching Server:

This server helps in fast access of internet web sites. This server stored the regularly accessed content.

In other words, it makes a copy of requested information, so that frequently requested items can be accessed directly instead of from the original internet source.

x. Proxy server:

A proxy server is designed to restrict access to information on the Internet.

If we don't want our users to access certain material then a proxy server can be used to refuse the access to such material.

A proxy server operates on a list of rules given to it by a System Administrator.

c. Middleware:

- ✓ It is the software that sits in the middle to allow clients and servers to interact and communicate with each other.
- ✓ This component is used in 3-Tier Architecture of client-server technology.
- ✓ It provides services like file sharing, printing and other services.
- ✓ This component is maintaining the processing part of application.

d. Fat Client/Fat Server:

- ✓ Fat-Client & Fat-server are the terms used to describe the type of clients/server systems in which processing takes place.
- ✓ Fat-client is used in 2-Tier architecture when presentation and processing are maintained together on clients.
- ✓ Fat-server is used in 3-Tier architecture when processing and database are maintained together on server.

e. Network Components:

- ✓ It transmits the data between the clients and server system.
- ✓ Various networks devices like communication devices, communication channels and communication software are used in client-server architecture to connect client and server with each other.

18. Data Center:

- Data center is centralized repository (warehouse) of data and information to provide data access, storage and distribution services to its users.
- In simple words, it is a place where large number of servers are established to maintain with large volume of data to provide the access of this data to its users from anywhere in the world.
  For Example: Google having data center which maintain large volume of data and provide the services to access this data to large numbers of users from anywhere in the world.
- There are **two types** of data center:

S. NO.	PRIVATE DATA CENTER	PUBLIC DATA CENTER
1.	❖ Private data center is owned by the organization itself. For Example: Banks data centers etc.	❖ Public data center is owned by outsiders, hence to be hired. Example: VSNL, Airtel, Reliance etc.
2.	❖ This is costly to maintain.	❖ This provides low cost to maintain.
3.	❖ This type of data center is used when security is a big concern.	❖ This type of data center is used when security is not a big concern.
4.	❖ This is also known as enterprise data center.	❖ This is also known as internet data center.

TIERS OF DATA CENTER

❖ There are four types of tier in data center:

Tiers in data center	Description
Tier 1	❖ It is the most basic and inexpensive data center. ❖ It does not have redundant (Extra) power and cooling infrastructure. ❖ It can tolerate upto 28.8 hours of downtime per year. ❖ It can be easily setup. ❖ It is used by enterprise data centers.
Tier 2	❖ It is better than Tier 1 data center. ❖ It has redundant (Extra) power and cooling infrastructure. ❖ It is used by enterprise data centers.
Tier 3	❖ It is little less than Tier 4 data center. ❖ It may have some arrangement for redundant (Extra) power and cooling infrastructure.

Tier 4	❖ It is the most robust (high speed channel, large volume etc.) quality and costly data center. ❖ It has arrangement for redundant (Extra) power and cooling infrastructure. ❖ It can tolerate upto 0.4 hours of downtime per year. ❖ There is complex to set up. ❖ It is used by Financial and banking sectors where reliability and security is very important.

Services provided by Data center/Uses of Data center:

- There are following services provided by data center:
  a. Database Monitoring
  b. Web Monitoring
  c. Storage on demand (to maintain data online)
  d. Auto backup and recovery
  e. Intrusion Detection System (it is a software which helps to detect inappropriate, incorrect and unauthorized activities on network).

Features of data center:

- There are following features of data center:
  - ✓ Large size because it maintains large number of servers, bandwidths and large number of communication channels.
  - ✓ Data security
  - ✓ Availability of data: it provides round the clock (24*7) availability of data and services.
  - ✓ Security: there are two types of security provided by data center: (i.) Logical security with the help of login ID, Password, antivirus etc. (ii.) Physical Security with the help of smart card doors, security cards, CCTV monitoring, security guards etc.
  - ✓ Power backup provisions

Components or Constituents of data center:

- There are following components of data center:
  a. Network servers
  b. Networks equipment like channels (Optical, Fibers, cables etc.) and devices (MODEM, Routers etc.)
  c. Network Management Software
  d. HVAC (Heat Ventilation and Air Conditioning) System
  e. Fire Extinguisher System
  f. Physical Security like CCTV, guards, Smart Card doors etc.
  g. Network Security software

Challenges Faced By the Data Center Management

- There are following main challenges faced by the management regarding data center:
  a. Maintaining a skilled staff
  b. High infrastructure needed for daily data center operations.
  c. Maximizing uptime and performance
  d. Technology selection
  e. Resource balancing
  f. Security

Disaster Recovery Site:

- Disaster means fire, flood, earthquake and act of terror etc. which may bring down the data centers from working. Therefore organizations or data center should create disaster recovery site which can help them to recover the data from disaster immediately.
- There are following types of disaster recovery sites:
  a. Cold Site:
    - ✓ It maintains only essential components and services of working data center at some other location in duplicate form.
    - ✓ This site is low cost to set up and maintain but it does not provide 100% downtime elimination.

  b. 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.

  c. Hot Site:
    - ✓ This site maintains all the components and services of working data center in duplicate form and in a synchronized manner at some other location.
    - ✓ This site is very costly to set up and maintain but it provides NIL downtime

19. BUSINESS CONTINUITY PLANNING:

- It is a documented description of actions that an organization should take in case any disaster occurs.
- In simple words, an organization should plan for their continuity of their business to deal with any problems or disasters.
- It helps an organization to resume business operations after a disaster immediately.

PHASES OF BCP:

- There are six phases of Business Continuity Plan:

Phases	Description
I.	Risk Analysis (threats)
II.	Define & determine resources, operations and activities
III.	It involves identification of most appropriate recovery solutions (Control)
IV.	Prepare Plan & Team
V.	Testing of BCP in various phases like pre-test, post-test, review test etc.
VI.	Maintenance of BCP (Scheduled training, maintain records of test, review, update etc.)

20. NETWORK SECURITY:

- It consists of provisions made in computer network which is adopted by the administrator to protect the network from unauthorized access.
- The basic objective of network security are:
  a. To safeguard their assets
  b. To ensure and maintain the data integrity.

TYPES OF NETWORK SECURITY

- There are two types of network security for protection of data and devices:
  a. **Physical Security:**
     - ✓ To protect the physical assets of an organization like smart card doors, security cards, CCTV monitoring, security guards etc.

  b. **Logical Security:**
     - ✓ To protect or control the malicious and non-malicious threats due to unauthorized remote access like login ID, Password, antivirus etc.

THREATS AND VULNERABILITIES TO NETWORK SYSTEM:

- There are following threats founds to network system:
  a. Fire
  b. Water
  c. Pollutions like dust
  d. Energy variations like voltage fluctuations, circuit breakage etc.
  e. Viruses
  f. Hacking of data
  g. Viruses
  h. Intrusion (unauthorized access, it can be both logical and physical)

i. Misuse/Abuse of software.

TO DEVELOP A LEVEL OF SECURITY/SECURITY PROGRAM:

- Level of security means to provide the protection to asset as per the value of asset.
- A plan is prepared by security administrator covering, several control to safeguard assets, date etc. of an organization.
- There are following **eight steps** involved while preparing security programs:

Step	Name	Description
1.	Preparing project plan for security	✓ The components of project plan are as follows: - Outlining the objectives of the review - Determining the scope of the review and tasks to be accomplished, - Assigning tasks to the project team - Preparing resources budget and - Fixing a target/schedule for task completion.
2.	Assets Identification	✓ Identify the assets which require security like personnel, hardware facilities, documentation, application & system software etc.
3.	Assets Valuation	✓ Value of assets and accordingly analyze for the level of security; more valuable asset require higher level of security.
4.	Threats identification	✓ To identify the various threats to individual assets. - The source of a threat can be external or internal and the nature of a threat can be non-deliberate (accidental) or deliberate. **Examples:** a. Non-deliberate external threat-act of God. b. Non-deliberate internal threat– pollution. c. Deliberate external threat– hackers d. Deliberate internal threat- employees.
5.	Threats probability of occurrence assessment	✓ To identify the probability of threats occurrence.
6.	Exposure Analysis	✓ To identify the amount of data losses or exposure if threat is successful.
7.	Controls Adjustment	✓ It involves deciding about the changes to make in security controls considering their availability, efficiency, costs & benefits.

8.	Report Generation	✓ Report generation includes - Documenting the findings of the review - Recommending new asset safeguarding techniques - Recommending the existing assets safeguarding mechanisms that should be eliminated / rectified, and - Recommending the levels of security to be followed for individual end users and systems.

21. WRITE SHORT NOTES ON THE FOLLOWING :

A. <u>VIRUS:</u>

- Virus is a malicious program or dirty code which may corrupt other programs, data and resources (Memory) in computer.
- Viruses are originated from portable memories and internet.
- To detect and remove a virus from computer, anti-virus software can be used like Avast, Quick heal, Norton etc.
- Norton anti-virus is the most popular software for detecting and removing virus from computer.
- There are following controls to safeguards against the viruses:
  - **a. Preventive Control** like
    - Using only clean and licensed copies of software
    - Downloading files or software only from reliable websites,
    - Checking new files/software with software with anti-virus software before installation.
  - **b. Detective Control** like
    - Regularly running anti-virus software.
    - Date/time comparisons to detect any unauthorized modifications.
    - File size comparison to observe whether the size of programs has changed.
  - **c. Corrective Control** like
    - Maintaining a clean backup
    - Having a recovery plan from virus infections
    - Regularly running-antivirus software (which is useful for both detection & removal of virus).

B. <u>HACKING:</u>

- It refers to any unauthorized entry in a system by circumventing (i.e. avoiding) the access controls.
- Some hackers may just trespass and read the files without making any changes to them.
- Some hackers may cause destruction by deleting critical files, disrupting / suspending operations, stealing sensitive data or programs.

- It can be avoided or managed through:
  a. Strong (robust) logical access controls
  b. Strict cyber laws & their implementation.
  c. Strong backup and recovery plan.

C. FIREWALL:

- It is the most popular techniques of network security.
- It helps to protect private network from un-authorized users and malicious data packets of public network.
- In simple words, it is a computerized electronic system that is installed on computer/networks to protect from unauthorized entry [Intrusion].
- Firewall is always installed in between public network and private network to protect private network.
- Data packets are checked by network firewall, firstly and then application firewall.
- There are two types of Firewall:

a. Network Firewall:

- This firewall is used to check the incoming data packets from public network to find out whether the data packets are authorized to enter in the private network or not.
- Network firewall rejects the data packets from unauthorized sources.

b. Application Firewall:

- This firewall provides higher level of network security.
- As mentioned earlier, this firewall checks the data contents of incoming data packets from public network to find out any authorized activities in data packets.

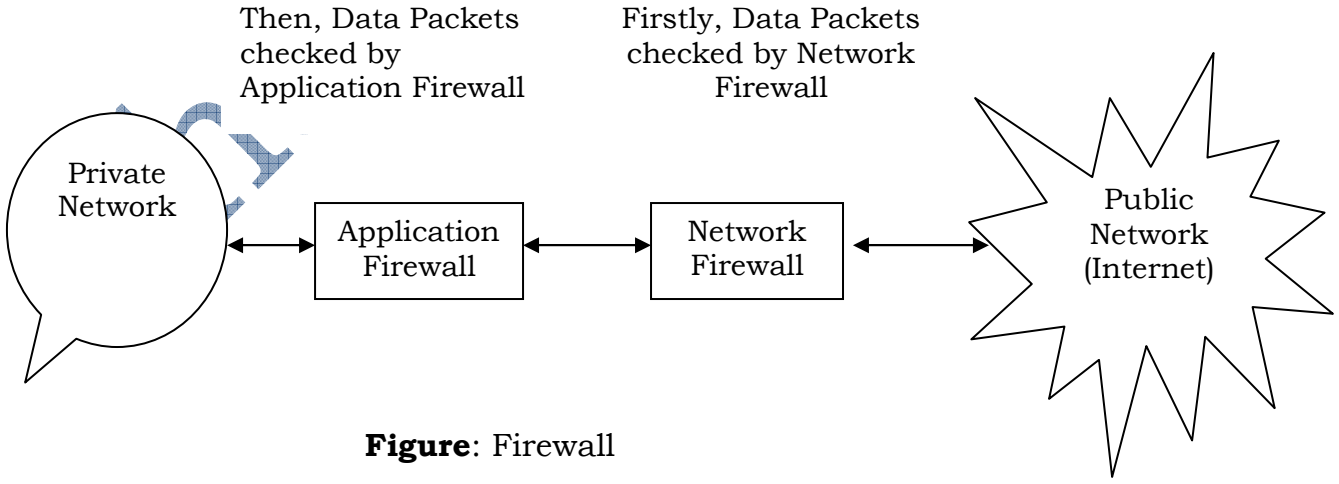


Figure: Firewall

INTERNET AND OTHER TECHNOLOGIES

A. Describe briefly, the following terms:

a) Internet:

- It is very difficult to define the term 'Internet'. Internet is a very large network of networks where connected devices can communicate with each other from any part of the world.
- It is a global network available all over the world.
- These networks are usually based on the TCP/IP protocols.
- Now it has become an integral part of our daily source of information just like as TV and newspaper.
- These are the following popular internet services:
  - ***a. E-mail:***
    Sending and receiving mail electronically.
  - ***b. File Transfer:***
    For transferring files from one computer to another.
  - ***c. World wide web (WWW):***
    To retrieve information residing on internet servers in the form of websites.
  - ***d. Chat:***
    To exchange views or communicate information in instant manner.
- For connecting to internet; we need a computer, modem, communication software (browser and dialer) and internet service provider (ISP).
  A user connects itself to ISP server with the help of dialup telephone line or dedicated telephone line and then ISP server is further connected with internet backbone.

The main features of internet are given below:

1. ***No central server:***
   There is only a web of connections between thousands of independent systems connected to each other through telephone lines.
2. ***Network of networks:***
   The internet is not a single network. It is a vast, global network of networks. No single person, group or organisation runs the Internet. These networks communicate with each other on the basis of certain protocols such as TCP/IP. There are tens of thousands of such networks.
3. ***Public Access:***
   Information of business and services is placed at common location. It provides immediate feedback from consumers or business partners.
4. ***Global reach***
5. ***Multimedia support***
6. ***Business use***
7. ***Information can be published or accessed internationally.***

USES OF INTERNET ARE GIVEN BELOW:

1. ***Data communication:***
   Internet helps to provide low cost data communication from anywhere in the world through various services. For e.g. e-mail, chat, bulletin boards, file transfer etc.
2. ***Data retrieval or access:***
   Internet is a hub of information on various subjects.
   Internet provides required information to the users with the help of www service. There are also various search engines which help in efficient access of required information. For e.g. Google, AltaVista, Yahoo, MSN etc.
3. ***Data publishing:***
   Internet is a low cost medium for advertising products and services of organizations.
   The information about products and services of organizations can be published on internet in the form of website which can be accessed from anywhere of the world.

TYPES OF INTERNET CONNECTIONS:

1. ***Analog/Dial-up connection:***
   It provides access by dialing ISP number. It is no more popular internet access method due to its slow speed internet access (less than 56 kbps).
2. ***ISDN connection:***
   ISDN stands for Integrated Services Digital Network. It provides communication of voice, data, and video over digital telephone lines. It speed ranges from 64 kbps to 128 kbps.
3. ***B-ISDN connection:***
   B-ISDN stands for broadband integrated services digital network. It is similar to ISDN but it transfers the data at higher speed.
4. ***DSL connection:***
   DSL stands for Digital Subscriber Line. It provides an always connection by dial-up line for internet access. It does not require tying up the phone for internet access.
   There are 3 types of DSL connection:-
   i. **ADSL connection:**
      ADSL sands for Asymmetric Digital Subscriber Line.
      It supports same data rate of about 1.5 to 9 Mbps for downloading and upto 640 kbps while uploading.
   ii. **SDSL connection:**
      SDSL stands for Symmetric Digital Subscriber Line.
      It supports same data rate (about 3 Mbps) for uploading and downloading therefore it is called Symmetric DSL.
   iii. **VDSL connection:**
      VDSL stands for Very High Digital Subscriber Line.
      It supports faster data rate than DSL.

iv. **Cable connection:**
It uses the TV cable for providing internet connection at very high speed at about upto 20 Mbps.

5. ***Wireless internet connection:***
It is wireless broadband. It is the newest internet connection service and provides high speed internet connection.

6. ***T-1 lines connection:***
This is popular leased line option for internet connection.
It is normally used by organisation to provide internet access to many users simultaneously.

7. ***Bonded T-1 connection:***
There are two or more T-1 lines are joined together to provide further high speed internet access.

8. ***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.

9. ***Satellite connection:***
It provides the internet connection over satellite to provide internet access from anywhere in the earth.

b) Internet service provider:
ISP is an agency that provides internet access to its clients (i.e. individual user or companies) for a payment through any medium like telephone or wireless.
In India, popular ISP's are MTNL, BSNL, TATA, AIRTEL etc.

c) Webpage:
It is a collection of several pages of information containing text audio, video, pictures etc. that are registered under one domain name such as ICAI.org which can be accessed from anywhere in the world by internet.
Such pages are stored on special computers i.e. called web-servers/ websites.

d) Uniform Resource Locators (URL):
It is used to address and access a specific information or websites/web pages through internet by using a standard format.
The format of URL is protocol / internet address /web page address.
e.g. http://www. icai.org /admission.html

e) Hyper Text Markup Language [HTML]:
It is a language by which webpage's are written.

f) Browsing:
The process of linking or connecting to internet and opening and viewing websites is called browsing/surfing.

g) Web browser:

Special software is required to access and view the websites over the internet is called web browser. E.g. Internet Explorer, chrome, Mozilla firebox etc.

h) Hyper Text Transfer Protocol [HTTP]:

It is a protocol followed by content or information that can be displayed itself in the web server.

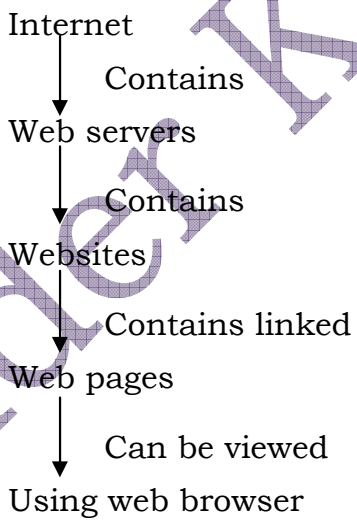
i) Hyper Text Markup Languages (HTML):

Web pages are created with the help of HTML. It 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.

j) World Wide Web (WWW):

WWW is a link of internet sites. It is the most popular internet service. This service help to access the required information located in different servers in the form of web pages.

WWW helps to connect to a website server, request a web page and received the content for display.



k) E-mail:

- It is the most popular internet service.
- E-mail helps to send or receive messages from one user to another from anywhere in the world electronically.
- It is a low cost data communication.
- It is provided by popular websites such as Gmail, Hotmail, Yahoo, Rediff etc.
- There are the following main features of E-mail :
  a. Compose/Compile new message
  b. Reply to mail received
  c. Forwarding of mails received to others
  d. Maintaining address book of E-mail address for friends, relatives, customers etc.
  e. Attachments
  f. Block sender

B. Write short notes on the following:

a. File Transfer Protocol Service:

- It is a popular service used for sending and receiving files from a local computer to web-server **or** from a web-server to a local computer.
- This service is used for publishing web pages on internet.
- There are various software that provide FTP services like Microsoft web publisher, cute FTP etc.

b. Push/Pull Technology:

1. Push Technology/Webcasting:

It allows users to passively receive broadcast information rather than actively search the web for information just like we receive a lot of messages over our mobile phone without asking them.

In other words, Webcasting is based on push technology in which data is transmitted to many users automatically without requesting for it i.e. called Push technology.

Examples: broadcasting in Radio, tele-casting in T.V. or live events on internet such as sports match, fashion events, cricket match etc.

2. Pull technology:

Normally all the services of internet are based on pull technology that mean user can pull the required information from a web-server.

In other words, when users receive a piece of information after asking for it, it is called pull technology.

Examples: a user searches particular information through a search engine and receives a list of links through several websites.

Basis	Push Technology	Pull Technology
Meaning	Send (Without asking)	Ask & get
Example	Bulk SMS etc.	Search on Google etc.
Speed	Very fast (One to many)	Slow (one to one)
Efforts by	Sender	Receiver

c. Intranet & Extranet

1. Intranet:

- Intranet is a private network that helps an organisation employee to access organisation network (database) from anywhere in the world by using internet.
- Intranet provides services to its organisation employees.
  E.g. Banks, private network available to its employee only.
- There are following features/benefits of using Intranet:
  a. Reduced administrative costs – printing, paper, software distribution, mailing, order processing, and telephone.
  b. Easily access of an organisation network (database)
  c. Easier access to customers and partners.

d. Low cost to access information from anywhere
e. Collaborative and group working
f. Availability of updated information
g. Easily communication among departments hence better Co-ordination

2. Extranet:

- ❖ It is an extension of intranet that provides to access information to outside companies or individual also, whether who is not a part of the intranet.
- ❖ Extranet provides services to its customer and business associates such as buyer, partner and supplier.
  E.g. Banks that portion of networks which is available to banks associates.

Extranet = Intranet + Access to related parties (user id & password)

- ❖ It provides privacy & secrecy to organisation by way of encryption, password, access rights etc.

d. E-commerce:

- ❖ It is a process of doing various business activity and related processes electronically (online) by way of computers & internet.
- ❖ In e-commerce, the transactions happen without the movement of any paper i.e. it happen with exchange of binary signals.
- ❖ It is not a single technologies or service. It is a collection of various technologies like www, e-mail, telephone, fax machine, EFT etc.

Benefits/Role/Advantage of E-commerce

a. Creation of new markets
b. Immediate processing of transactions
c. Immediate payment
d. Updated information about goods & services etc.
e. Reduced advertising costs
f. Business activity all over the world
g. Reduced delivery cost or cost to suppliers or buyers.
h. Better customer service
i. Global Reach

Limitation of E-commerce

a. Security
b. problems for data and payments
c. False claim from supplier
d. Payments modes are risky (like payment through credit card etc.)
e. Presence of goods on net does not assure that actual goods would be same.

Types/Models of E-commerce

a. **B2B:**

In this type of model transactions one business organisation transact with another business organisation. Normally, it is done between businesses of same area.

These applications provide high value (Amount) and low volume (Number of transaction) transactions.

It involves exchange of goods/services/information among various organizations.

For Example: Maruti Suzuki and its distributors, Intel and its distributors etc.

b. **B2C:**

This is the most common and popular types of e-commerce applications. In this model a customer or consumer directly interact with business organizations.

These applications provide high volume (Number of transaction) and low value (Amount) transactions.

It involves exchanges of goods/services/information from a business to customers.

There are two types of **B2C e-commerce:**

I. *Direct Sellers*:

That companies provide products or services directly to customers are called direct sellers such as:

E-tailers (who buy from manufacturers & sell to customers),

Manufacturers (who sell directly to customer by using internet.

II. *Online intermediaries*:

Those companies that provide transactions on-line between buyers and sellers for a commission are called online intermediaries such as:

Brokers (who connect buyer or seller online)

Intermediaries (who provide information to buyer about seller and their offer).

There are two types of **B2C e-commerce sites**:

- Social sites:

  Such e-commerce sites provide information only to customers about goods & services. E.g. www.infosys.com, www.tisco.com etc.

- Transactional sites:

  Such e-commerce sites help to customer to transact with business for goods and services. E.g. www.amazon.com

  A customer is directly interacting with business organisation.

c. **C2C:**

In this model one customer directly interact with another customer.

E.g. www.ebay.com . Such e-commerce sites are also known as auction sites where one customer can auction the goods and services for another customer.

This type of E-commerce is a low volume business (number of transaction) that is suitable for services like selling old cars, matrimonial services etc.

e. Customer Relationship Management (CRM):

- CRM is an important concept to maintain a good relationship with customer.
- It is a system which enables business organisation to manage their customer relationship with the help of improved processes and procedures by using new technology.

To be an effective/good CRM

1. Identify customer both present and potential
2. Identify their needs
3. Identify their behavior
4. Identify their trends of buying
5. Create a customer based culture
6. Developing an efficient business process to serve customers
7. Recommended how to help a customer having a problem.

Purpose of CRM

CRM is a technique of managing interaction between customers and business. CRM provides customer services through all possible methods. There are following purpose of CRM:

a. Provide product information, use & technical assistance (help) to customers,
b. Helps to acquire and retain new customers,
c. Helps to increase the brand image of organisation,
d. Help to identify problem areas quickly,
e. Provide a user friendly mechanism to register customer complaints,
f. Customers are given the required services and their complains are resolved on time,
g. Helps to provide better services and best possible manner.

Architecture of CRM

1. *Operational CRM*:

In this method, an organisation provides front end services to their customer by opening service offices at various parts of city & country etc.

Through such method customers can directly interact with organization executives to avail services and to resolve complains. E.g. Reliance web world etc.

Operational CRM covers the following **three general areas of business**:

a. Sales force automation: to manage the work of sales staff.
b. Customer service and support: in much easier & efficient way.
c. Enterprise marketing automation: to manage in-house marketing operations.

2. *Analytical CRM*:

This method is known as backroom operation. In this method, organisation analyses the customer quality of services on various parameters such as no. of complaints lodged by customers & no. of complaints resolved in last month.
It involves the data collection, analysis & reporting.

It helps in designing campaigns like:

a. *Acquisition*: making new customers.
b. *Retention*: retaining customers who leave due to maturity or attrition.
c. *Information*: providing timely and regular information to customers.
d. *Modification*: alteration nature of customer's relationship.

3. *Collaborative CRM*:

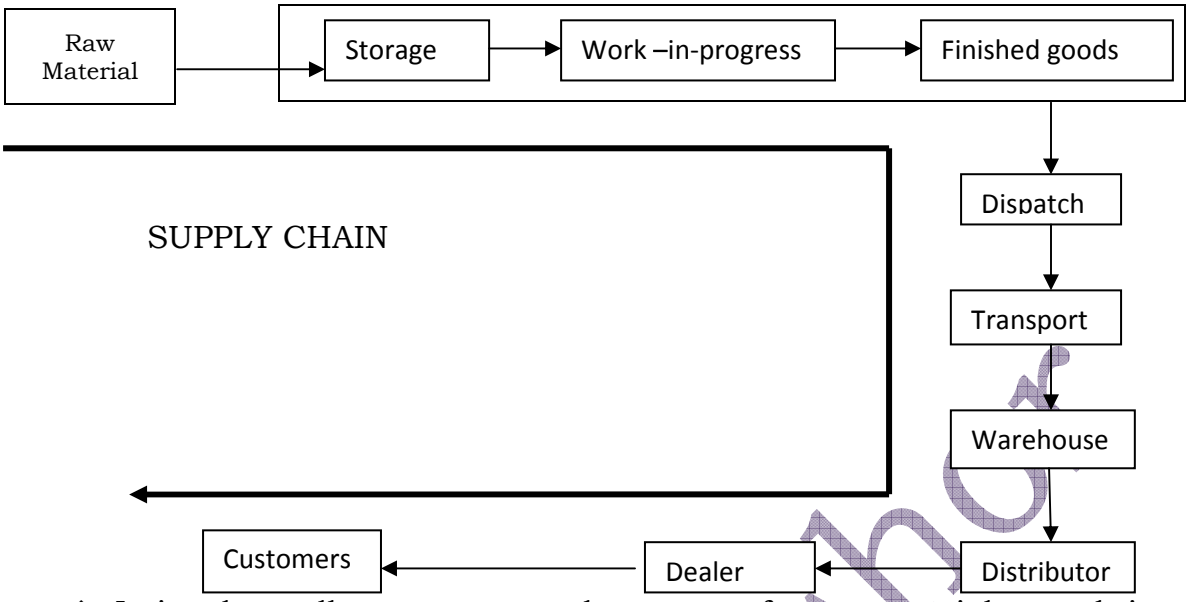
Under this method, it helps to interact with customers through all possible channels such as internet, phone, fax, e-mail, letter etc.
It is a solution that brings people, processes and data together so companies can better serve and retain their customers.

Collaborative CRM provides the following benefits:

a. Enables efficient customer interaction,
b. Reduces customer service costs
c. Integrates call centers enabling personal customer interaction.
d. Provide all details of the customers while interaction.

f. <u>Supply Chain Management:</u>

- SCM refers to the management of all activities starting from procuring raw materials & ending with providing delivery & services to customers to provide best satisfaction to customer.
- Supply Chain Management (SCM) is the process of planning, implementing and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible.



- It involves all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of consumption.

Advantage/Opportunities of SCM

a. Fulfillment:
Ensure that right quantity is always available of raw materials for production and finish goods for sale at right time by efficient communication.

b. Logistics:
Ensure that transport costs as low as possible with safe and timely deliver.

c. Production:
Helps to provide smooth production by ensuring availability of required materials and parts.

d. Revenue/Profit:
No loss of sales order because of sufficient stocks.

e. Costs:
Keeping the cost of purchases at acceptable levels i.e. minimum purchasing cost.

f. Co-operation:
Among supply chain partners to ensure mutual success.

Problems areas of SCM

a. Distribution Network Configuration:
Setting up appropriate number and locations of suppliers, production facilities, distribution centers, warehouse and customers is a big challenge.

b. Distribution strategy:
Establishing a strategy to ensure smooth flow of materials and goods is another big task.

c. Information sharing:
Information sharing among various locations is another issues for establishing successful SCM.

d. Inventory management:
Deciding an 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 into three activities.

a. *Strategic SCM*:
This is planned by top executives for long term. E.g.

1. Planning numbers, locations and size of warehouse and distribution network.
2. Deciding on partnership with suppliers and buyers.
3. Set up information technology infrastructure to support supply chain operations.
4. Make or buy decisions
5. Product design co-ordination

b. *Tactical SCM*:
This is a planned for sourcing of raw materials, production of goods and their distribution etc, in short term such as monthly basis.

1. Production decisions
2. Inventory decisions
3. Transportation decisions
4. Payment terms structuring
5. Comparison of all operations with competitors and implementation of best practices.

c. *Operational SCM*:
This supply management planned for day-to-day operation to provide smooth movement of goods in the chain.

1. Daily purchasing, production and distribution planning.
2. Planning to meet demand
3. Daily inventory control
4. Logistics control
5. Performance tracking of all activities

C. Write short notes on the following:

a. Bullwhip effect in Supply Chain Management. (5 Marks)

- In a supply chain many entities are involved from customer to supplier. An organization normally source the raw materials from supplier based on expected customer demands.
- Bullwhip effect which was described by whiplash that indicates a continuous error in the forecasted demand at various points in the chain can provide large impact on the organisation planning.
- It indicates a continuous error in the forecasted demand as we go farther from consumer to supplier and resulting excess or shortages of inventory known as bullwhip effect.
- It can provide high losses to the organizations and to overcome this effect. Organizations should have dynamic demand forecasting system.
- The following factors contribute to the Bullwhip Effect:
  a. Forecast Errors
  b. Lead Time Variability (change)
  c. Price Fluctuations
  d. Batch Ordering
  e. Change in method of buying, producing, selling etc.

Measures of Bullwhip Effect:

  f. Vendor Managed Inventory (VMI)
  g. Just In Time purchasing (JIT)
  h. Strategic Partnership with vendors, buyers etc. (SP)

b. Electronic Data Interchange (EDI):

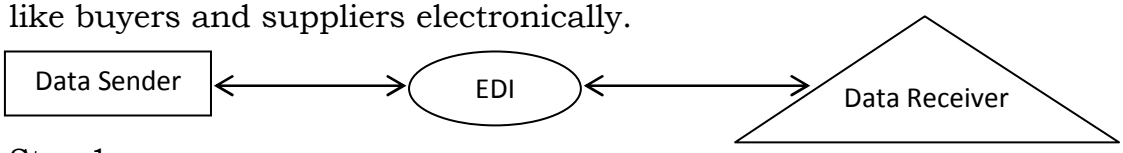
- It is a protocol or rules and regulations which help to exchange one form of data into another electronically.
- EDI refers to the exchange of data & information between two or more individuals/organizations in a standard format by using computer.
  Any business documents like purchase order, invoice, quotation, delivery challan etc. can be send electronically by converting it into a standard format by using computer hardware & software.

Advantages of EDI

1. Issue and receive order faster
2. Reduction in paper documents
3. Provide quotation/information to customer quickly
4. Always updated information which helps in better decision making.
5. Low cost transaction
6. Sales more easily
7. Immediate payment

How EDI works?

EDI allows transmission of documents between trading partners like buyers and suppliers electronically.



Step 1:

Sender prepares the data as per his database format in his system.

Step 2:

Senders provide this data to EDI for transmission with receiver profile.

Step 3:

EDI converts this data into a receiver's database format.

Step 4:

EDI transmits this data into the receiver database.

Step 5:

Receiver can view/use the received data as per his convenience.

c. <u>Electronic Fund Transfer (EFT):</u>

- EFT is a system of sending or receiving money by way of electronic.
- 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.
- The different EFT systems in operation are as follows:

1. ***Automated Teller Machines (ATMs):***
   This allows the consumer to do their banking without assistance of a human teller. These machines are used with a debit or EFT card and a code, which is often called a Personal Identification Number or "PIN."
2. ***Point-of-Sale (POS) Transactions:***
   Some debit or credit cards allow transfer of funds electronically from the consumer's account to the merchant's account while shopping.
3. ***Telephone Transfers:***
   Consumer can transfer funds from one account to another account by telephonic instructions.
4. ***Preauthorized Transfers:***
   The account holder authorizes the bank or a third party to withdraw or deposit the funds from or into his account. 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.

d. <u>Payment system in E-commerce:</u>

- There are 3 popular systems in e-commerce applications:

1. ***Electronic payment system:***
   This is the most popular payment system in e-commerce application. In this payment system debit card, credit card and EFT are used for payment for purchased goods & services.
   In this payment system security of payment and user credentials always remains a big concern.

2. ***Payment through clearing cheque:***
   This payment is used only in trusted party in B2B applications.
   In this method a clearing exchange acts as settlement house which debit or credit money in the buyer –supplier account as per the given information of goods & services.
   E.g. inter banking transactions, stock exchange settlement between broker accounts.

3. ***Digital Cash or Electronic Money:***
   This payment system is like use of traveller's cheque for purchasing of goods & services on internet.
   This is also an online payment mechanism, in which money is exchanged in coded form between supplier and buyer.
   In this system user is given digital cash in exchange of physical cash, which he can use for online buying of goods & services.
   This is not a popular method of payment due to complexities involved in the exchange of cash.

e. <u>Internet risk & security:</u>

- Internet use in businesses is continuously increasing but internet has some inherent risk. Every organisation in concerned for the security of internet.
  Therefore every organisation should establish security for the protection of business data and e-commerce activities.
- There are following risk for business organisation setting-up E-commerce application:

1. Payment security
2. Hacking of important data and information
3. Reliability of services:
   E-commerce services are reliable in terms of always available or not.
4. Protection of data and information from viruses.
5. Loss of paper based audit trail:
   E-commerce services 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.

6. Business continuity:
   A total dependence on electronic business exposes organizations to failure of electronic system or business continuity.
7. Safe retention and easy retrieval of data in storage devices:
   There is some mandatory requirement for retaining data in electronic form as per specific format.

f. Legal issues for e-commerce:

- There are the following legal issues regarding e-commerce:

1. **Taxation issue:**
   If law is not clear, then it is difficult to determine tax liabilities and jurisdiction area in case of e-commerce transaction.
2. **No Papertrail:**
   Paper document are prime evidence in manual system which are missing in e-commerce.
3. **Fraud detection:**
   It is very difficult to detect global fraud & fix punishment for the fraudster.

g. Security Tools in E-commerce application:

- The tools which can protect data and information of organization from misuse, intrusion and viruses are called "security tools".
- There are following security tools in e-commerce application to protect private network data:

1. **Firewall:**
   It is the most popular techniques of network security.
   It is a computerized electronic system that is installed on computer/networks to protect from unauthorized entry [Intrusion].
2. **Data Encryption:**
   This technique helps to transfer data between authorized users and private network in a coded form (encrypted form) which helps to avoid mis-use of such data, if it is hacked by the hackers.
3. **Message Authentication:**
   It means to make sure that the information received has been sent by authentic sender only like Digital Signature.
4. **Site Blocking:**
   It means to prohibit access certain websites by an organization.
   This help to avoid downloading of unwanted content such as viruses etc. to private network to public network.

D. Write short notes on the following:

a. Bluetooth (5 Marks) (PCC-May 2007)

- It is popular technique for data exchange between the devices without using of any wire or cable.
- It provides the wireless exchange of data such as music and video files etc.
- It transmits the data within small range of 10 m.
- It requires a low cost transceiver chip in each device that enables to transmit and receive the data in certain predefined frequency.
- The transceiver transmits and receives in a frequency band of 2.45 GHz.

b. Wi-Fi:

- Wi-Fi stands for "Wireless Fidelity".
- This technology is used to create a wireless local area network (WLAN) of computers and devices.
- A building or campus can be converted into a Wi-Fi zone by installing Wi-Fi devices.
- The Wi-Fi zones covered by one or several access point are called Hotspot.
- It is a popular technique for connecting a large number of computers to the internet by providing a wireless LAN in the organization, cybercafé, building or even a public place like Airport, Railway, Public Park etc.
- In this technique, laptop/computers with Wi-Fi modem and services from Wi-Fi ISP are used to remains connected with internet at everywhere particularly public places such as railway station, Airports, Markets etc.

c. M-commerce:

- This is an extension of e-commerce.
- M-commerce is buying and selling of goods & services through wireless hand-held devices such as mobile phone and PDA (Personal Digital Assistants).
- It is based on a protocol known as WAP (Wireless Application Protocol). This protocol helps to convert normal e-commerce site content into a form that can be displayed on mobile phone.
- This is known as next generation e-commerce.