EDUSAT LEARNING RESOURCE MATERIAL

ON

MANAGEMENT INFORMATION SYSTEM

(For 3rd Semester CSE & IT)

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MANAGEMENT INFORMATION SYSTEM

Objective :

Management Information System is the basic foundation paper for any hardcore computer engineer. In this subject students will be exposed to the theoretical aspects of different functional units of a digital computer and fundamental idea how different units of a computer system work together to achieve a common goal.

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Learning Resources: Text Books:

Sl no.	Name of Authors	Titles of the Book	Name of the publisher
1.	Dr. A.K.Gupta	Management Information System	S.Chand & Company Ltd
2.	W.S Jawadekar	Management Information System	TMH
3.	Gordon B davis & Margethe H Olson	Management Information Systems	TMH
4.	Girodhar Joshi	Management Information Systems	OXFORD PRESS

Management information system an Over View

A management information system (MIS) provides information that organizations require to manage themselves efficiently and effectively. Management information systems are typically computer systems used for managing. The five primary components of an MIS are:

1. Hardware
2. Software
3. Data (information for decision making),
4. Procedures (design,development and documentation), and
5. People (individuals, groups, or organizations).

Management information systems are distinct from other information systems in that they are used to analyze and facilitate strategic and operational activities.

Academically, the term is commonly used to refer to the study of how individuals, groups, and organizations evaluate, design, implement, manage, and utilize systems to generate information to improve efficiency and effectiveness of decision making, including systems termed decision support systems, expert systems, and executive information systems. Many organizations have an MIS department, alongside departments of accounting, finance, management, and marketing.

Terminology

The terms *Management Information System* (MIS), *information system*, *Enterprise Resource Planning* (ERP), and *information technology management* are often confused. Information systems and MIS are broader categories that include ERP. Information technology management concerns the operation and organization of information technology resources independent of their purpose.

Most management information systems specialize in particular commercial and industrial sectors, aspects of the enterprise, or management substructure.

- *Management information systems*, produce fixed, regularly scheduled reports based on data extracted and summarized from the firm's underlying transaction processing systems to middle and operational level managers to identify and inform structured and semi-structured decision problems.
- *Decision Support Systems (DSS)* are computer program applications used by middle and higher management to compile information from a wide range of sources to support problem solving and decision making. A DSS is used mostly for semi-structured and unstructured decision problems.
- *Executive Information Systems (EIS)* is a reporting tool that provides quick access to summarized reports coming from all company levels and departments such as accounting, human resources and operations.
- *Marketing Information Systems* are Management Information Systems designed specifically for managing the marketing aspects of the business.

- *Office Automation Systems (OAS)* support communication and productivity in the enterprise by automating workflow and eliminating bottlenecks. OAS may be implemented at any and all levels of management.
- *School Information Management Systems* (SIMS) cover school administration, and often including teaching and learning materials.
- *Enterprise Resource Planning* facilitates the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders.

Advantages

The following are some of the benefits that can be attained using MISs.

- Companies are able to identify their strengths and weaknesses due to the presence of revenue reports, employees' performance record etc. Identifying these aspects can help a company improve its business processes and operations.
- Giving an overall picture of the company.
- Acting as a communication and planning tool.
- The availability of customer data and feedback can help the company to align its business processes according to the needs of its customers. The effective management of customer data can help the company to perform direct marketing and promotion activities.
- MIS can help a company gain a competitive advantage. Competitive advantage is a firm's ability to do something better, faster, cheaper, or uniquely, when compared with rival firms in the market.

DEFINITION OF MIS

The Management Information System (MIS) is a concept of the last decade or two. It has been understood and described in a number ways. It is also known as the Information System, the Information and Decision System, the Computer- based information System.

The MIS has more than one definition, some of which are give below.

1. The MIS is defined as a system which provides information support for decision making in the organization.
2. The MIS is defined as an integrated system of man and machine for providing the information to support the operations, the management and the decision making function in the organization.
3. The MIS is defined as a system based on the database of the organization evolved for the purpose of providing information to the people in the organization.
4. The MIS is defined as a Computer – based Information System.

Thought there are a number of definitions, all of them converge on one single point, i.e., the MIS is a system to support the decision making function in the organization. The difference

lies in defining the elements of the MIS. However, in today's world MIS a computerized .business processing system generating information for the people in the organization to meet the information needs decision making to achieve the corporate objective of the organization.

In any organization, small or big, a major portion of the time goes in data collection, processing, documenting it to the people. Hence, a major portion of the overheads goes into this kind of unproductive work in the organization. Every individual in an organization is continuously looking for some information which is needed to perform his/her task. Hence, the information is people-oriented and it varies with the nature of the people in the organization.

The difficulty in handling this multiple requirement of the people is due to a couple of reasons. The information is a processed product to fulfill an imprecise need of the people. It takes time to search the data and may require a difficult processing path. It has a time value and unless processed on time and communicated, it has no Value. The scope and the quantum of information is individual-dependent and it is difficult to conceive the information as a well-defined product for the entire organization. Since the people are instrumental in any business transaction, a human error is possible in conducting the same. Since a human error is difficult to control, the difficulty arises in ensuring a hundred per cent quality assurance of information in terms of completeness, accuracy, validity, timeliness and meeting the decision making needs.

In order to get a better grip on the activity of information processing, it is necessary to have a formal system which should take care of the following points:

- Handling of a voluminous data.
- Confirmation of the validity of data and transaction.
- Complex processing of data and multidimensional analysis.
- Quick search and retrieval.
- Mass storage.
- Communication of the information system to the user on time.
- Fulfilling the changing needs of the information. The management information system uses computers and communication technology to deal with these points of supreme importance.

ROLE OF THE MANAGEMENT INFORMATION SYSTEM

The role of the MIS in an organization can be compared to the role of heart in the body. The information is the blood and MIS is the heart. In the body the heart plays the role of supplying pure blood to all the elements of the body including the brain. The heart works faster and supplies more blood when needed. It regulates and controls the incoming impure

blood, processes it and sends it to the destination in the quantity needed. It fulfills the needs of blood supply to human body in normal course and also in crisis.

The MIS plays exactly the same role in the organization. The system ensures that an appropriate data is collected from the various sources, processed, and sent further to all the needy destinations. The system is expected to fulfill the information needs of an individual, a group of individuals, the management functionaries: the managers and the top management. The MIS satisfies the diverse needs through a variety of systems such as Query Systems, Analysis Systems, Modeling Systems and Decision Support Systems the MIS helps in Strategic Planning, Management Control, Operational Control and Transaction Processing.

The MIS helps the clerical personnel in the transaction processing and answers their queries on the data pertaining to the transaction, the status of a particular record and references on a variety of documents. The MIS helps the junior management personnel by providing the operational data for planning, scheduling and control, and helps them further in decision making at the operations level to correct an out of cont rol situation. The MIS helps the middle management in short them planning, target setting and controlling the business functions. It is supported by the use of the management tools of planning and control. The MIS helps the top management in goal setting, strategic planning and evolving the business plans and their implementation.

The MIS plays the role of information generation, communication, problem identification and helps in the process of decision making. The MIS, therefore, plays a vita role in the management, administration and operations of an organization.

Information System for Decision Making

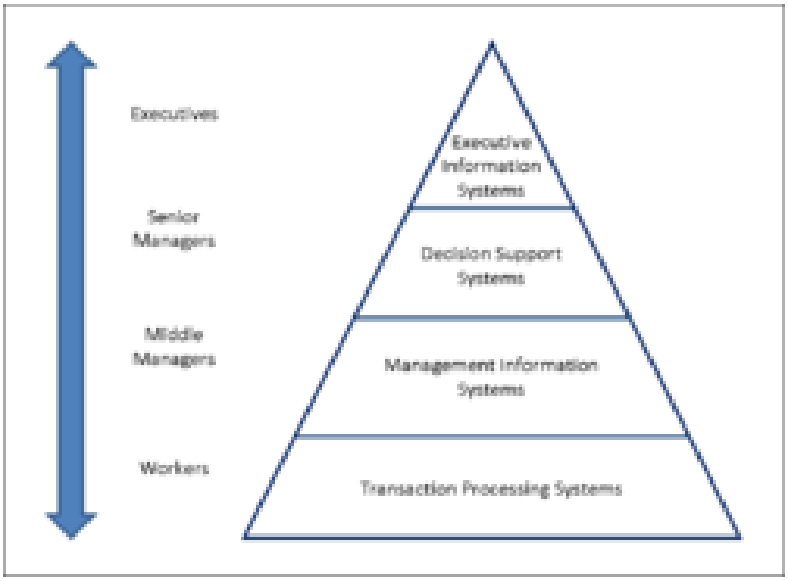
The management process is executed through a variety of decisions taken at each step of planning organizing, staffing, directing, coordinating and control. As discussed in Chapter 1, the MIS aids decision making. If the management is able to spell out the decisions required to taken in these steps are tabulated in the following table.

Steps in management	Decision
Planning	A selection from various alternatives- strategies, resources, methods, etc.
Organization	A selection of a combination out of several combinations of the goals, people, resources, method, and authority.
Staffing	Providing a proper manpower complement.
Directing	Choosing a method from the various methods of directing the efforts in the organization.

Coordinating	Choice of the tools and the techniques for coordinating the efforts for optimum results.
Controlling	A selection of the exceptional conditions and the decision guidelines.

The objective of the MIS is to provide information for a decision support in the process of management. It should help in such a way that the business goals are achieved in the most efficient manner. Since the decision making is not restricted to a particular level, the MIS is expected to support all the levels of the management in conducting the business operations.

Types of information systems



A four level pyramid model of different types of information systems based on the different levels of hierarchy in an organization

The "classic" view of Information systems found in the textbooks in the 1980s was of a pyramid of systems that reflected the hierarchy of the organization, usually transaction processing systems at the bottom of the pyramid, followed by management information systems, decision support systems, and ending with executive information systems at the top. Although the pyramid model remains useful, since it was first formulated a number of new technologies have been developed and new categories of information systems have emerged.

Computer Hardware & Information System

Introduction: A computer is an automatic m/c mode of electronic mechanical device, that processes data and generate meaningful information with speed and accuracy.

Computer hardware is the physical computer and its peripheral component like I/o device and storage devices.

Basic of data representation: In computer data represented by A to Z symbols, graphs & images. The processed o/p in required in the same form. This form of representation is called external data representation. Computer understands only strings of binary digits (0s & 1s). Combinations of eight bits, referred as byte. Each letter & number represented in a computer by bytes.

Main characteristics of computer is-

1.Speed: The rate at which the computer can process data & information. The speed is measured in MIPS (millions of instruction per second).

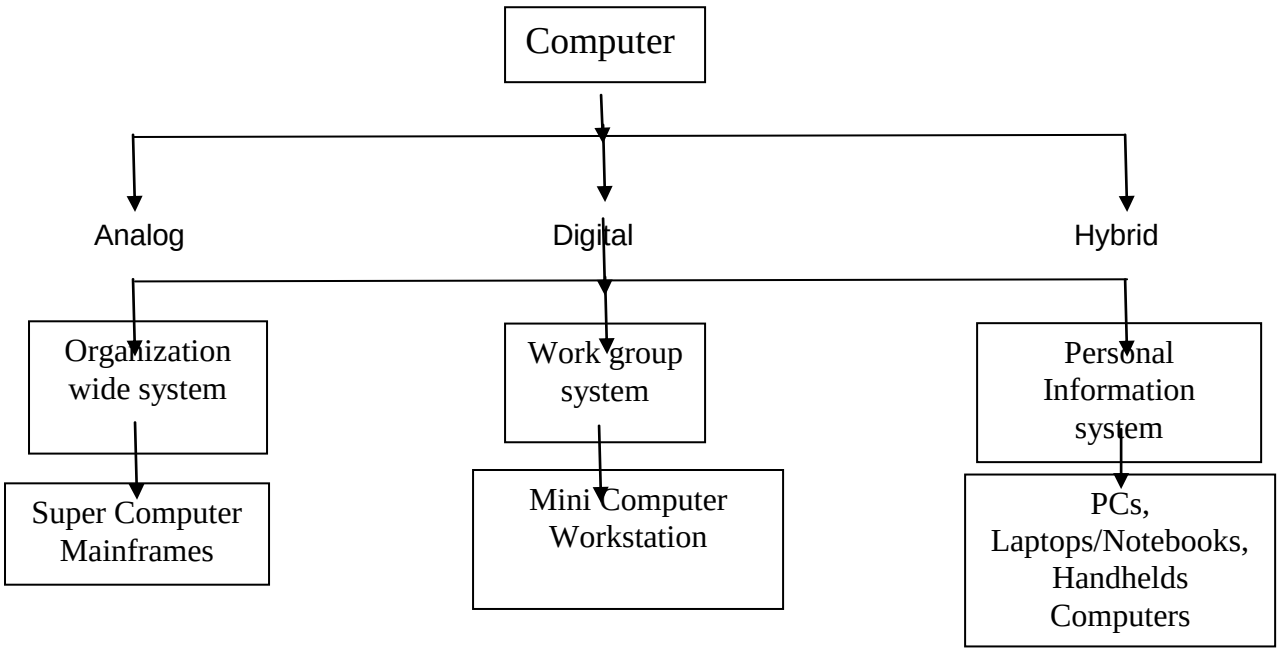
2.Size: The amount of memory required to store the data & instruction.

Types of computer:

Mainly computer are 3types.

1. **Analog Computer:** It works on the principle of measurement.
2. **Digital Computer:** It works on the principle of counting.
3. **Hybrid Computer:** It combines the feature of both analog & digital.

Digital computer further classified into different types based on memory size & processing speed.



Organization wide system: Provide an overall view of an organization super computer and mainframe computer are organization wide system.

Work group system: provide groups of decision makes to process and process and exchange information. Mini Computer are the work group computer.

Personal Information: It is designed to meet the individuals needs.

Personal Computers: Personal Computers are the micro Computer. The size & speed of PCS are smaller than mainframe & mini Computers. PCS has sophisticated application. A pc consist of a system unit, video display unit (VDU), a keyboard & mouse. A system unit having built in fax & modem capabilities.

Laptop & note book: It provides mobile computing technology. These are battery operated & portable. Laptop & note books are equipped with powerful micro processor, graphic capabilities , adequate memory size & more driver input.

Hand held Computers: These are smaller than notebooks. This computers holds more than 1200 records.

Pen based Computers: These computers consisting an electronic writing pad & a light sensitive electronic pen. When the users write on the pad, the writing is converted into digital I/p & stored in a file in the computer.

Mini Computer: This is small, powerful, multiuser system with excellent memory capabilities & processing speed. It is more powerful than a pc. Examples of a mini Computer is IBM AS/400.

Work station: Work stations are faster & sophisticated than Pcs. Some popular workstations are IBM Rs/6000s, Hewlett-Packard's series 700 etc.

Super Computer: These are more powerful, fastest & longest computer available. Super computer have large memories, high processing speed. They are used mainly for large scale scientific calculation. Two main characteristics are-

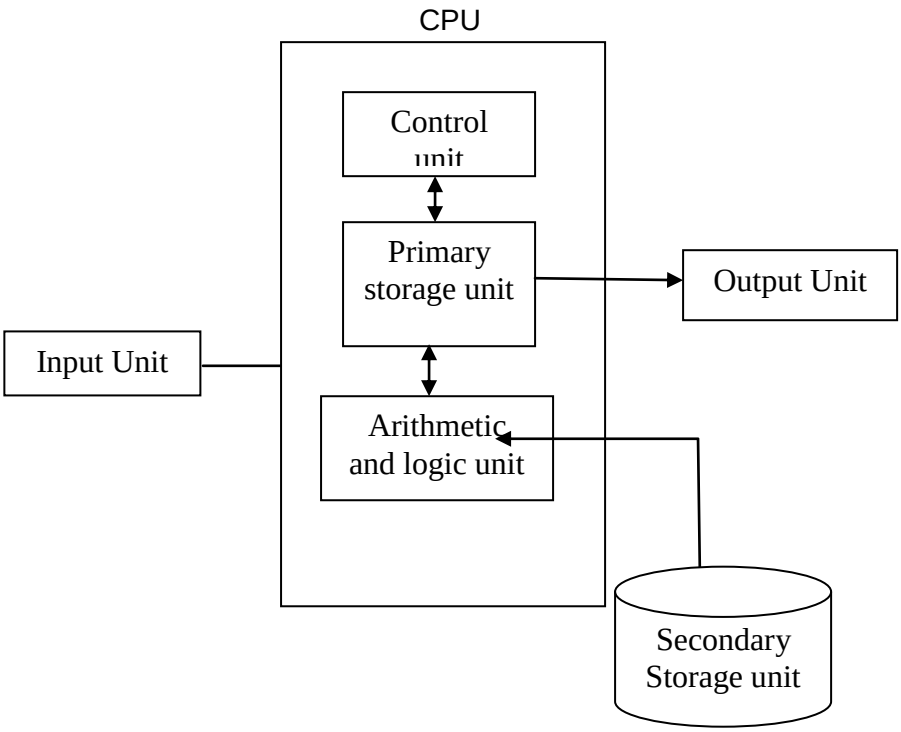
1. Ability to recover automatically from failures.
2. Having multiple processor for multiprocessing. It is very costly and it's software also very costly.

Mainframe Computer:- It is large, general purpose computer with extensive memory and high processing speed. This Computer are suitable for transaction processing, Payroll, airline and railway reservations, weather forecasting etc. It is very expensive to purchase, operate and maintain. It requires costly software and highly trained computer personal.

Basic components of computer system:-

The computer consists of five basic units.

1. I/P unit
2. CPU
3. Secondary Storage.
4. Output Unit.
5. Communication Device.



(Functional Block Diagram of computer)

I/p unit: One can enter into computer through keyboard, a pointing device, data can read optically or magnetically and one can speak to the computer.

Key board device: It is the most popular I/p device. It allow user to I/p data by pressing keys. The keyboard is linked to CPU & video display terminal, for displaying the I/p given to the keyboard.

Pointing device: Mouse is a hand-held, point-and-click device. It has a small ball on its underside. That ball is moving around on flat surface & the corresponding cursors moved on the screen. Mouse has two buttons on upper side. User can press left & right button to execute commands.

Track ball: It is similar to the mouse except that the ball on the top instead of the bottom.

Light pen: Light pen is used to point at the screen. The pen is moved over a special pad, an electronic signal is sent through a thin cable to the computer so that the signal can interpret by the program. It is popular with CAD/CAM system.

Magnetic ink character recognition (MICR):

MICR I/p devices automatically read characters printed along the lower edge of cherubs.

Speech/voice recognition input device: These device recognizes and executes a set of instructions based on voice. In this system speech is first converted into digital pattern and is than compared to a set of pre-recorded patterns. If a match is found, the command is executed.

Central Processing Unit (CPU): CPU consists of ALU, CU & primary storage. ALU performs addition, subtraction & logical operations. The control units access the data & information stored in the computer & transformed them to the ALU.

Primary storage: It is made up of memory cells. Cell consist of several electronic component called semiconductor or chips. Each chip holds several thousand transistors. Each transistor represents a binary state of a bit (on/off, zero/one).

There are four types of primary memory.

1. **Random access memory (RAM):** It is a temporarily storage place. It is volatile in nature. RAM roses its content when the power is turned off or fails.
2. **Read only memory (ROM):** ROM permanently stored, frequently used program & instructions. It is non volatile in nature. There are two variation of ROM.

PROM: Programmable read only memory. It is non-erasable.

EPROM: Erasable Programmable Read only memory. Instruction can be erased & rewriter, using UV ray.

3. **Cache memory:** It is volatile memory. It is the fastest memory. It is interface between RAM & CPU. It is very expensive memory.
4. **Register memory:** It is a volatile memory. It is the smallest memory. It holds the data values, programming instructions & memory address. This memory increases the efficiency of the CPU. Accumulators address registers, instruction registers & general purpose registers are the types of registers which hold various types of data.

Secondary storage unit: It is non volatile in nature. It is reside in the system unit but outside of the CPU. Secondary storage is two types.

1. **Sequential access storage:** Data can be accessed & retrieved only in the order in which it was stored in the system.
2. **Direct access storage:** Data can be access & retrieved in any order.

Secondary storage devices:

Magnetic disk: This is the popular storage medium for computer. It is direct access storage device. They are of two forms.

1. Floppy Disk
2. Hard Disk

The diameter of floppy disk is 5.25 inches & 3.5 inch & storage capacity is maximum 1.44MB.

Hard Disk: Hard disk consists of several patterns. Usually each hard disk has about 11 disks, a r/w mechanism. They have large storage capacity.

CD-ROM (compact disk read only memory): It has excellent storage capacity between (440MB & 1GB). It stores different kinds of data, such as text, pictures, audio, video, animation & graphics.

O/P Unit: O/p unit produce the "information". O/p is produced by various option like displayed, printed & spoken, plotters, computer o/p micro form.

Output Devices:

1. **Displayed o/p devices:** These are various types.

(i) **Video display terminal**- This display uses CRT (cathode ray tube) to shoot a stream of electrons on the computer screen.

(ii) **Flat panel technology**- It consists of liquid crystal display or plasma display.

(iii) **Led**

2. **Printed o/p devices**: Printers produce hard copy. There are three types of printer.

(i) **Line Printer**: This printer prints one line at a time.

(ii) **Character Printer**: This printer prints one character at a time. Character printer in two types.

(iii) **Page printer**: This printer prints one page at a time.

Factors to buy a PC:

Following six factors must be considered while buying a PC:

(a) Processor: The 286, the 386, the 486, & the Pentium;

(b)Clock speed: Varies between 25MHz & 100MHz;

(c)RAM: Speed ratings in the range of 60, 70 & 80 nanoseconds;

(d)Expansion slots & buses: Adding features & capabilities to one's own computer & the type of electrical connection used in an expansion slot.

(e)Monitor: Size, resolution (sharpness), tricolor, interlaced or non-interlaced, radiation levels, & video boards.

(f)Upgrade: Combining some parts of an existing PC with some new components, with the result cost may be lower than that of a new system.

Review questions

1. What is the difference between volatile & non-volatile memory?
2. Name two o/p devices that can produce graphics.
3. What is the difference between PC & Workstation?
4. What is the major distinction between a mouse & trackball?
5. What is the difference between RAM & ROM? What are the two types of ROM?

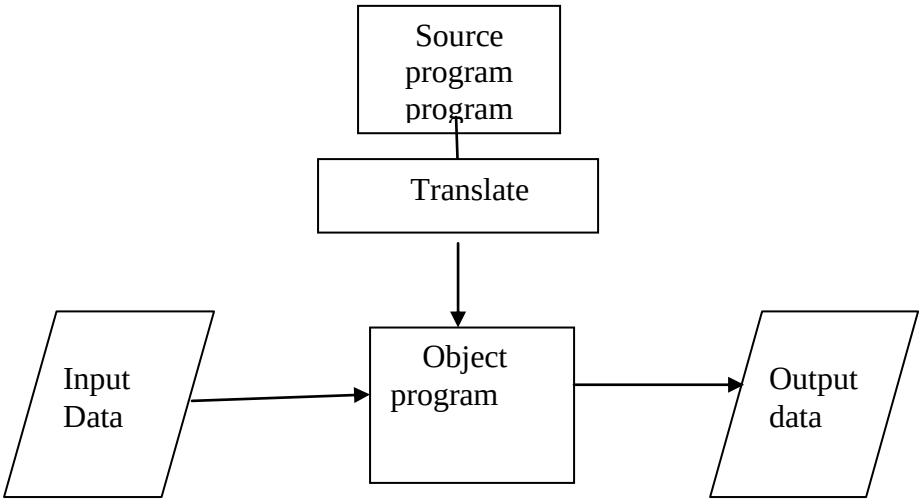
COMPUTER SOFTWARE FOR INFORMATION SYSTEMS

Programming Languages:

A programming language is special types of computer language, with its own syntax & grammar. Two types of programming languages exist: Procedural & non-procedural languages. A language, which explains stepwise sequential is called as procedural language. A non-procedural language focuses on what needs to be done, without specifying exactly how it should be done.

First Generation Language – Machine Language:

A series of zeros & ones that the CPU can interpret & execute. Machine language is important because it is the one language that the computer understands. The program written by the programmer is known as the source program, & the machine language is called the object program. Translates the source program into the object program is called the translator.



Second Generation Language-the Assemblers:

The first translators were called assemblers. An assembly language uses mnemonic names (such as DIV for divide) for the operations that are to performed, symbolic names (such as PAYRATE) for the data that is processed.

Third Generation Language (3 GLs) – the compilers and interpreter:

A third generation language can produce multiple object program instruction from a single source program instruction. Popular third generation languages are COBOL, FORTRAN, PL\I and BASIC. A compiler produces a complete object program is executed.

Fourth Generation Language (4GLs) – the natural languages:

The term natural languages are also used because the syntax of the 4GL can be very similar to our every day speech.

Database Query Language: Database query language that provides a special report from database contents without the need to code a program.

. Modeling Languages: A modeling language is especially designed to make the building of mathematical models easier than when a problem oriented language is used.

. Very high level language: The term very high level language is often used to describe a programming language, such as APL, that offers succinctness and power (but not necessarily user-friendliness) over & above that of conventional languages.

. Graph Generators: A graph generator, also called a graphics package, is used to display or print data in a variety of graphical forms.

.Report writers: A report writer is specifically designed to prepare reports.

.Application Generators: An application generator produces an application program.

Some popular third and fourth-generation programming languages are briefly explained here:

BASIC: BASIC is an acronym for Beginners All purpose symbolic Instruction code. Basic is a procedure oriented, general purpose language that is widely used for commercial & scientific applications.

FORTRAN: FORTRAN is an acronym for Formula translation. FORTRAN is a general purpose, procedure-oriented language.

COBOL: COBOL is an acronym for common business-oriented language. COBOL is the dominant language of the business world & many industries use thousands of lines of code written in COBOL.

PASCAL: PASCAL is widely used for business & scientific applications.

C LANGUAGE: C is a general purpose language. C has become an extremely popular language & is now widely used in system development applications & for commercial uses. C is a concise language that provides a high level of modularity.

Object-Oriented Programming:

Object-oriented programming, also abbreviated as OOP, is also a programming language to enhance the productivity of programmers & reduces software development time.

A significant benefit of OOP is code reusability that is the same piece of code can be used for different applications. OOP software is easier to update because some aspects of an object have often to be modified.

Visual Programming: Microsoft Company has developed visual BASIC, designed to allow users to integrate Microsoft windows applications. Visual BASIC serves as a common macro language for access, power point, word & excel.

CLASSIFICATION OF SOFTWARE: Two types of computer software are available: System software & Application software.

System software:

There are 3 basic types of system s/w:

(a) System control s/w.

(b)System support s/w.

(c) System development s/w.

System control s/w: This s/w helps to monitor, control, coordinate, & manage the resources and functions of a computer system. System control s/w can be classified into two categories: (1) Operating system and its functions and (2) Operating system environments.

1. **Operating system & its functions:** The operating system manages the computer's, processes, functioning as an interface between the users, the s/w that processes the firm's data, & the h/w. Other six basic functions, that an operating system can perform are:

. Schedule jobs

. Manage hardware & software resources

. Maintain system security

. Enable multiple user resource sharing

. Handle interrupts

. Maintain usage records

2. **Operating system environment:** There are two types of operating system environment. (a) Multiprogramming (b) Multiprocessing.

System support software: Programs which support the smooth execution of various programs & operations of a computer are called system support software. It includes utility programs. Programming services s/w, database management systems, security software, & system documentation.

System development software: It helps design & build better systems, e.g. , a collection of programs that assist developers in developing an information, also called as Computer-aided software engineering (CASE).

Application software:

There are two types of application software:

1. General-purpose software
2. Dedicated software

General Purpose Software: It is designed for general application such as payroll, inventory management, and accounting.

Dedicated Software: It includes specialized or customized applications designed for specific purposes. For examples, logistic software helps firms handle the flow of goods & services from one location to another in order to cut costs, minimize inventory, & reduce the time it takes for goods, services, or information to reach their destinations.

Types of General purpose Application Software:

Types of Application Software	Description

Word Processing	Computerization of the creation & Management of documents.Allows easy correction & Manipulation of text.
Desktop Publishing	Produces documents such as Memos & pamphlets. Has many of the features of word processing along with more sophisticated text & graphics capabilities.
Spread sheets	Electronic calculators used for extensive number crunching, such as financial analysis, budget preparation, & other numerical analysis. Also used for "What-if" analyses.
Computer Graphics	Provides for the creation & of Management sophisticated graphics, charts, figures. Often comes with extensive colour capabilities & clip art.
Accounting S/w	Automates accounting function Such as general ledger, accounts Payable, & accounts receivable. Often can be interfaced with other Financial systems, such as payroll, budgeting & so on.
Imaging	Scans text & graphics from paper documents & converts them into digital images.

ROLE OF SOFTWARE IN PROBLEM SOLVING:

Software can play either a direct or an indirect role in problem solving. System software always plays an indirect role. Application software can play either a direct or an indirect role. Must general business & industry specific packages are designed to play an indirect role. Some industry specific packages so beyond data processing, providing components that directly contribute to problem solving. Electronic spreadsheet, project management, forecasting, & statistical analysis packages provides direct support.

Criteria for investment means the standards that an organization uses to make computer related investment decisions.

Review Questions

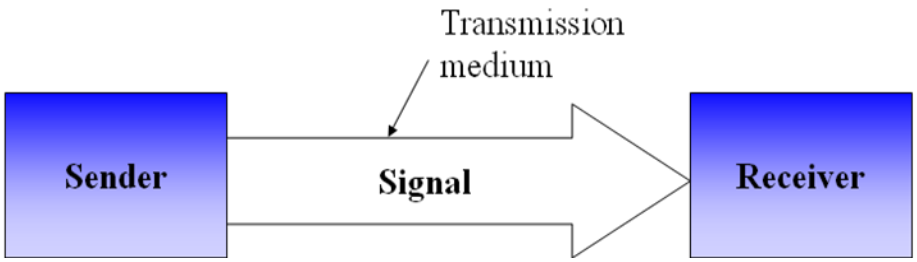
1. Define a 'program' and explain the need of hardware & software to build an information system.

2. What are procedural & non-procedural languages?
3. Explain some popular third- & fourth-generation programming languages?
4. Explain in brief OOP & visual programming, and their significant characteristics.
5. What are the important operating systems & their characteristics?

DATA COMMUNICATION SYSTEM

COMMUNICATION

- The message (data and information) is communicated via the signal
- The transmission medium "carries" the signal



Comminication is the transmission of data from one computer to another, or from one device to another. A communications device, therefore, is any machine that assists data transmission. For example, modems, cables, and ports are all communications devices. Communications software refers to programs that make it possible to transmit data

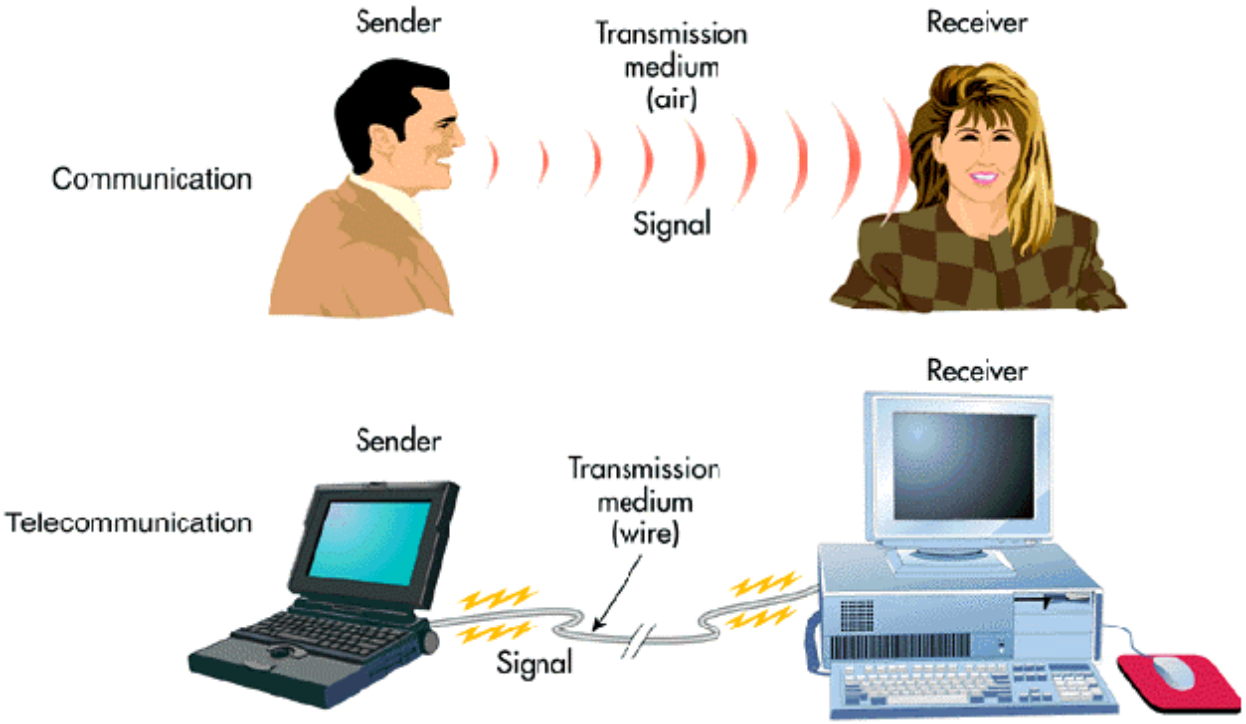
TELECOMMUNICATION

- **Telecommunications**
  - The electronic transmission of signals for communications, including such means as:
    - Telephone
    - Radio
    - Television
- **Telecommunication medium**

• Anything that carries an electronic signal and interfaces between a sending device and a receiving device

COMMUNICATIONS AND TELECOMMUNICATIONS

In human speech, the sender transmits a signal through the transmission medium of the air. In telecommunications, the sender transmits a signal through the transmission medium of a cable.



Data communications

A specialized subset of telecommunications that refers to the electronic collection, processing, and distribution of data -- typically between computer system hardware devices

Elements of a Telecommunications System

In its most fundamental form, a telecommunication system includes a transmitter to take information and convert it to a signal, a transmission medium to carry the signal and a receiver to take the signal and convert it back into usable information. This applies to any communication system, whether it uses computers or not.

There are six basic components to a telecommunications network.

1. Input and output devices, also referred to as 'terminals'

These provide the starting and stopping points of all communication. A telephone is an example of a terminal. In computer networks, these devices are commonly referred to as 'nodes' and consist of computer and peripheral devices.

2. Telecommunication channels and media, which transmit and receive data

This includes various types of cables and wireless radio frequencies.

3. Telecommunication processors, which provide a number of control and support functions

For example, in many systems, data needs to be converted from analog to digital and back.

4. Control software, which is responsible for controlling the functionality and activities of the network

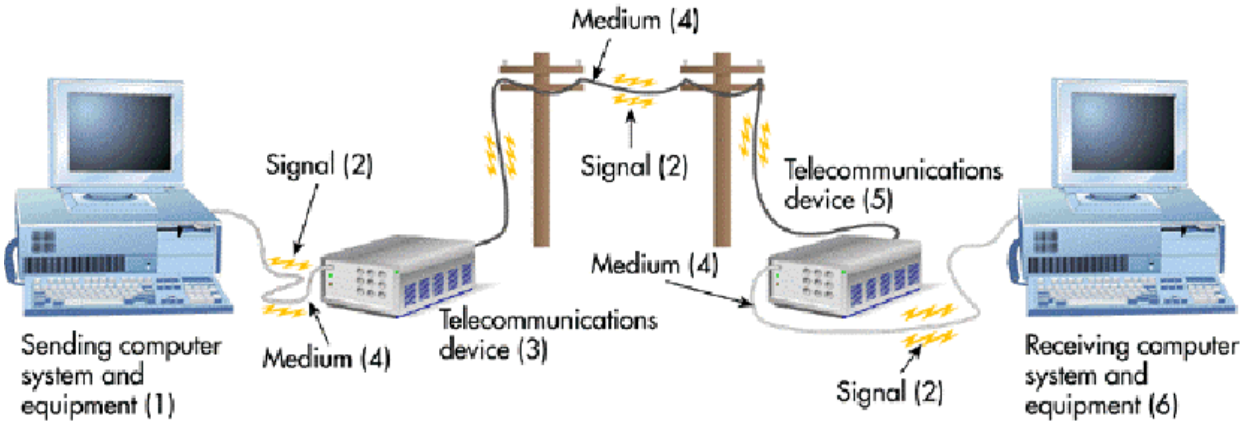
5. Messages represent the actual data that is being transmitted

In the case of a telephone network, the messages would consist of audio as well as data.

6. Protocols specify how each type of telecommunication systems handle the messages For example, GSM and 3G are protocols for mobile phone communications, and TCP/IP is a protocol for communications over the Internet.

While early telecommunication systems were built without computers, almost all systems we use today are computerized in some way.

- **Telecommunication devices**
  - Relay signals between computer systems and transmission media



- **Computer network…**
  - The communications media, devices, and software needed to connect two or more computer systems and/or devices
  - Used to share hardware, programs, and databases across the organization
  - Fosters teamwork, innovative ideas, and new business strategies

Telecommunication channels

A data communication channel is a path through a medium that data can take to accomplish a communication task. In effect, channels are “data highways” carrying signals from sending stations to receiving stations along predefined routes.

Telecommunication channels are characterized according to transmission rate, transmission mode and transmission direction.

Telecommunications Media

Transmission media are classified as

- **Guided media** - in which the signal moves along an enclosed path. Guided media require wiring. They include:

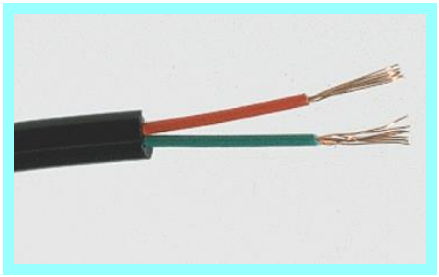
1. Twisted pair
2. Coaxial cable
3. Fiber optic cable

- **wireless media** - the signal is broadcast (radiated in many directions) over the air or space and received through an antenna. They include:

1. Terrestrial Microwave
2. Satellite Transmission
3. Radio Transmission

Types of Telecommunications Media (1)

- ❑ **Twisted pair wire cable**
    - Insulated pairs of wires historically used in telephone service and to connect computer devices



A type of cable that consists of two independently insulated wires twisted around one another. One wire carries the signal while the other wire is grounded and absorbs signal interference. Twisted-pair cable is used by older telephone networks and is the least expensive type of local-area network (LAN) cable. Other types of cables used for LANs include coaxial cables and fiber optic cables.

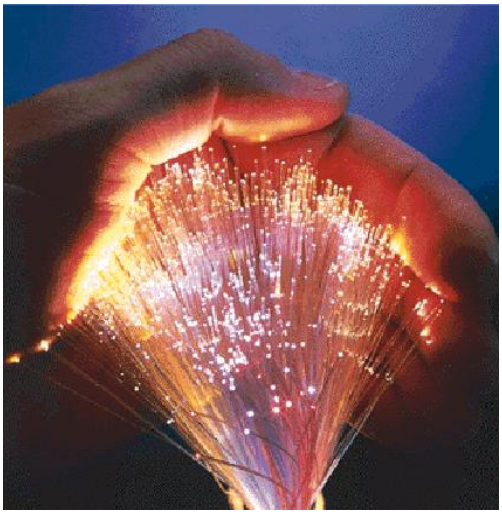
- ❑ **Coaxial cable**
    - Consists of an inner conductor wire surrounded by insulation, called the dielectric
    - The dielectric is surrounded by a conductive shield, which is surrounded by a non-conductive jacket. Coaxial cable has better data transmission rate than twisted pair

A type of wire that consists of a centre wire surrounded by insulation and then a grounded shield of braided wire. The shield minimizes electrical and radio frequency interference. Coaxial cabling is the primary type of cabling used by the cable television industry and is also widely used for computer networks. Although more expensive than standard telephone wire, it is much less susceptible to interference and can carry much more data. Because the

cable television industry has already connected millions of homes with coaxial cable, many analysts believe that they are the best positioned to capitalize on the much-heralded information highway.

Types of Telecommunications Media (2)

- **Fiber-optic Cable**
  - Many extremely thin strands of glass or plastic bound together in a sheathing which transmits signals with light beams
  - Can be used for voice, data, and video



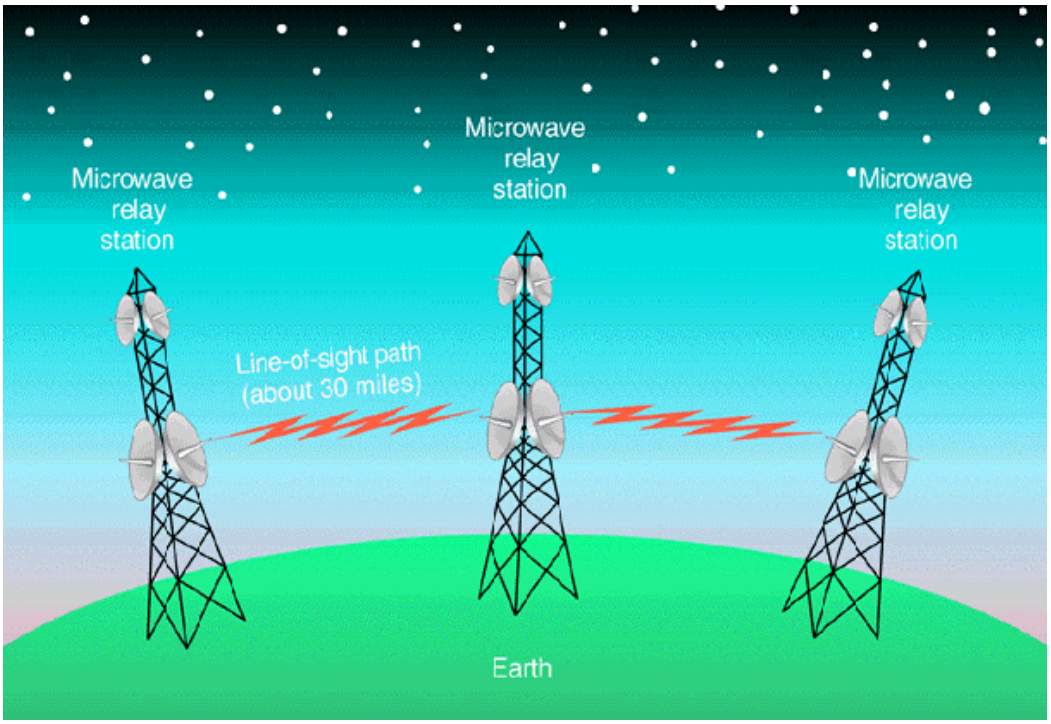
A technology that uses glass (or plastic) threads (fibers) to transmit data. A fiber optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages modulated onto light waves.

Fiber optics has several advantages over traditional metal communications lines:

- Fiber optic cables have a much greater bandwidth than metal cables. This means that they can carry more data
- Fiber optic cables are less susceptible than metal cables to interference
- Fiber optic cables are much thinner and lighter than metal wires
- Data can be transmitted digitally (the natural form for computer data) rather than analogically.

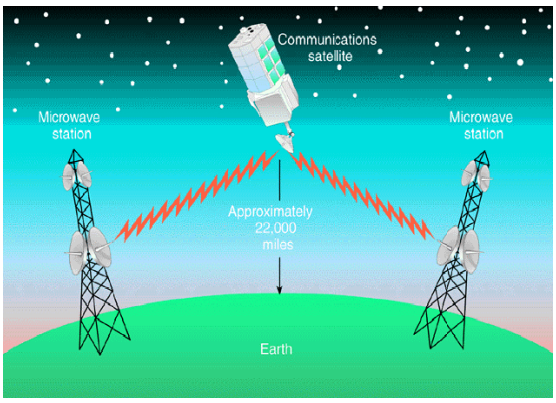
Types of Telecommunications Media (3)

- **Microwave Communications**
  - Line-of-sight devices which must be placed in relatively high locations
  - Microwave usage
    - Information is converted to a microwave signal, sent through the air to a receiver, and recovered



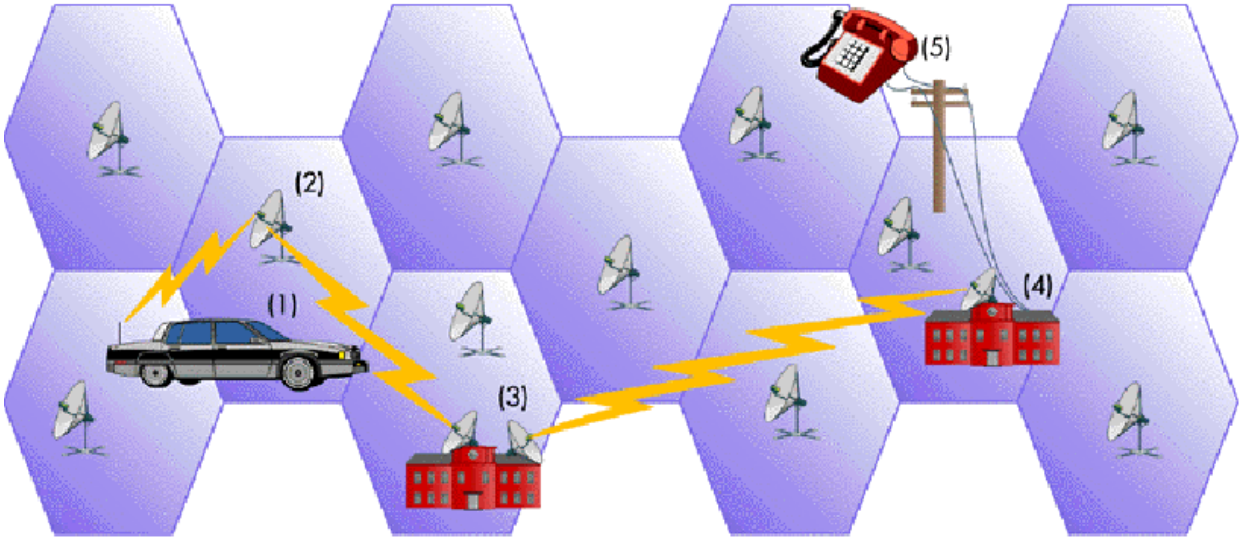
Types of Telecommunications Media (4)

- **Satellite transmission**
  - Communications satellites are relay stations that receive signals from one earth station and rebroadcast them to another
  - They use microwave signals.



Types of Telecommunications Media (5)

- **Cellular transmission**
  - Signals from cells are transmitted to a receiver and integrated into the regular network



Refers to communications systems, especially the Advance Mobile Phone Service (AMPS), that divide a geographic region into sections, called cells. The purpose of this division is to make the most use out of a limited number of transmission frequencies. Each connection, or conversation, requires its own dedicated frequency, and the total number of available frequencies is about 1,000. To support more than 1,000 simultaneous conversations, cellular systems allocate a set number of frequencies for each cell. Two cells can use the same frequency for different conversations so long as the cells are not adjacent to each other. For digital communications, several competing cellular systems exist, including GSM and CDMA.

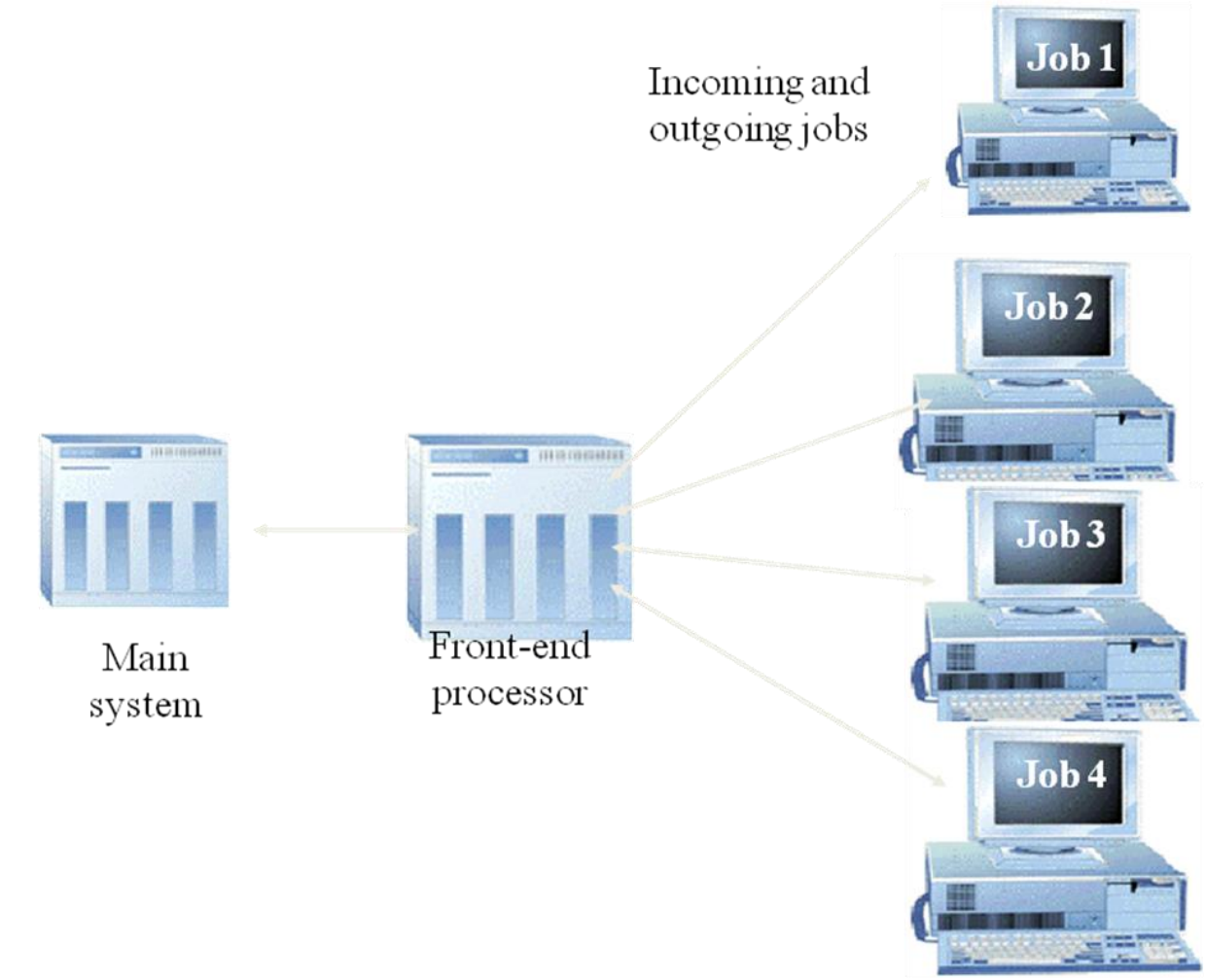
Types of Telecommunications Media (6)

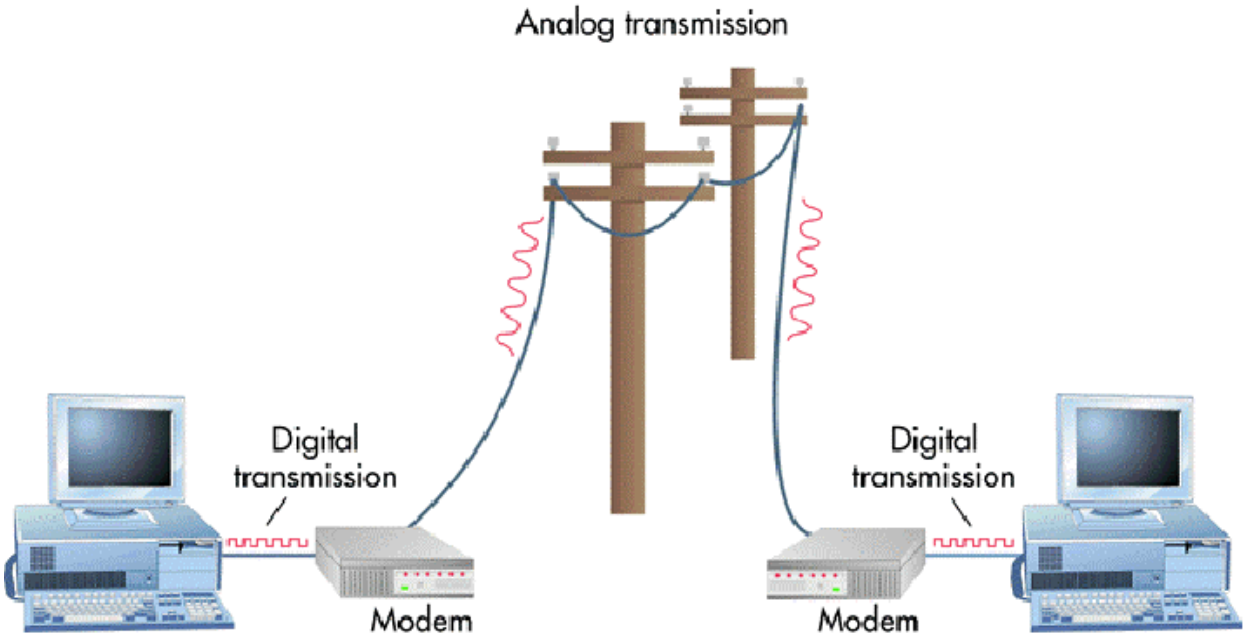
- **Infrared transmission**
    - Involves sending signals through the air via light waves
    - Requires line-of-sight and short distances (a few hundred yards)
    - Used to connect various computing devices such as handheld computers

DATA COMMUNICATION HARDWARE

- **Host Computer**
    - The host performs the data processing for the network. The incoming messages are handled in the same manner as data received from any other type of input unit. After processing messages can be transmitted back to the front end processor for routing.
- **Front-end processor…**
    - Special purpose computers that manage communication to and from a computer system
    - **Modem**

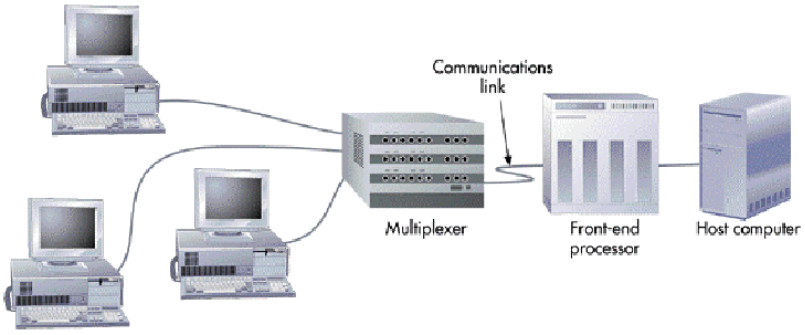
- Modulates a digital signal into an analog signal for transmission via analog medium, then demodulates the signal into digital for receiving





Modem is the acronym for modulator-demodulator. A modem is a device or program that enables a computer to transmit data over telephone lines. Computer information is stored digitally, whereas information transmitted over telephone lines is transmitted in the form of analog waves. A modem converts between these two forms. Fortunately, there is one standard interface for connecting external modems to computers called RS-232. Consequently, any external modem can be attached to any computer that has an RS-232 port, which almost all personal computers have. There are also modems that come as an expansion board that you can insert into a vacant expansion slot. These are sometimes called onboard or internal modems.

- **Multiplexer**
  - Allows several telecommunications signals to be transmitted over a single communications medium at the same time



A communications device that multiplexes (combines) several signals for transmission over a single medium. A demultiplexor completes the process by separating multiplexed signals from a transmission line. Frequently a multiplexor and demultiplexor are combined into a single device capable of processing both outgoing and incoming signals.

A multiplexor is sometimes called a mux.

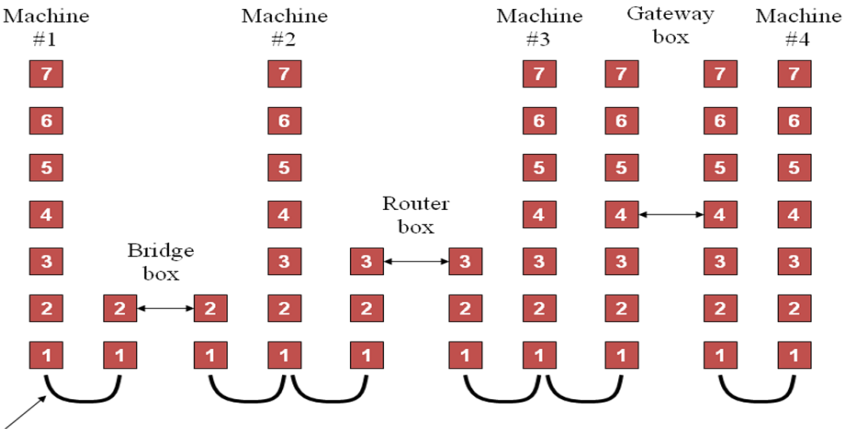
- **Bridge**
  - Connects two or more networks, with the same protocol, at the media control portions of the data link layer
  - Router
  - Operates at the network level of the OSI model and features more sophisticated addressing software than bridges. Can determine preferred paths
- **Gateway**
  - Operates at or above the OSI transport layer and links LANs or networks that employ different architectures and use dissimilar protocols

❑ **Switch**

Routes or switches data to its destination

❑ **Bus**

It has connections to all hosts and can simulate broadcasting by sending a message to all of them, one at a time



Communications software

Provides error checking, message formatting, communications logs, data security and privacy, and translation capabilities for networks.

Various types of softwares are explained

❑ **Network operating system (NOS)**

- Systems software that controls the computer systems and devices on a network and allows them to communicate with each other

❑ **Network management software**

- Enables a manager on a networked desktop to monitor the use of individual computers and shared hardware, scan for viruses, and ensure compliance with software licenses

❑ **Access control software**

- This software establishes access betweendifferent devices, terminals, and computers in the network and checks the transmission mode, transmission speed, and transmission direction.

❑ **Terminal control Software**

- This software controls the transmission of data over the network.

❑ **Terminal Emulation software**

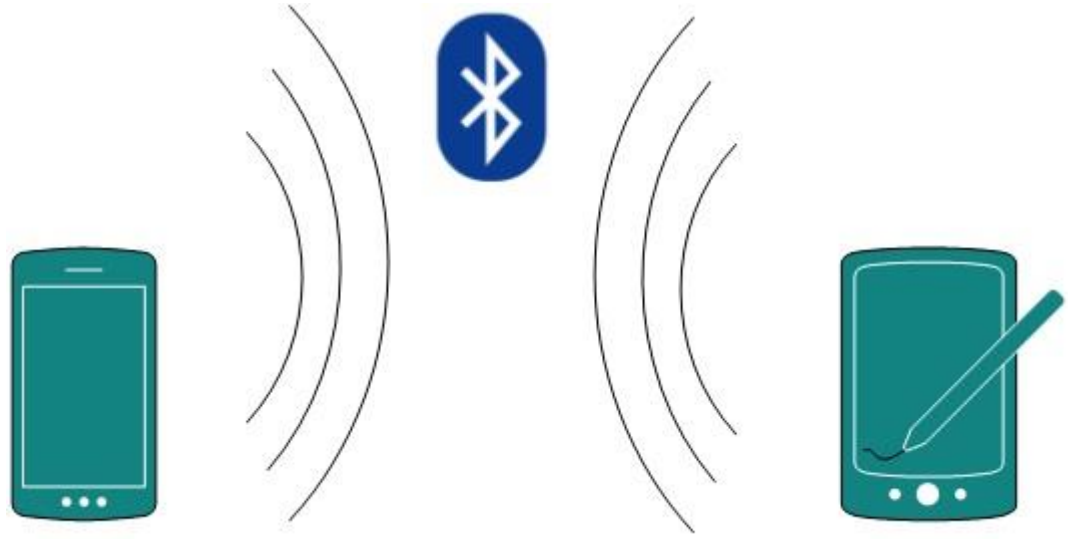
- This software enables a microcomputer to behave like a specific terminal when it interacts with a mainframe.

- **Network control software**
    - This software coordinates, controls and manages complete operations of network.It establishes priorities for data waiting to be transmitted, checks for any transmission error, route messages, and maintain statistics on system use.
- **Error correction and detection software**
    - It ensures that errors, caused by any other problem, are detected and corrected
- **Security software**
    - This software prevents unauthorized access to data and monitors the use of the network.

Communication Networks

- **Personal Area Network**

A Personal Area Network or simply PAN, is smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard and mouse, Bluetooth enabled headphones, wireless printers and TV remotes for example.



[*Personal Area Network* | *Bluetooth*]

Piconet is an example Bluetooth enabled Personal Area Network which may contain up to 8 devices connected together in a master-slave fashion.

- **Private Branch Exchange**

A PBX (private branch exchange) is a telephone system within an enterprise that switches calls between enterprise users on local lines while allowing all users to share a certain number of external phone lines. The main purpose of a PBX is to save the cost of requiring a line for each user to the telephone company's central office.

The PBX is owned and operated by the enterprise rather than the telephone company (which may be a supplier or service provider, however). Private branch exchanges used analog technology originally. Today, PBXs use digital technology (digital signals are converted to analog for outside calls on the local loop using plain old telephone service (POTS).

A PBX includes:

- Telephone trunk (multiple phone) lines that terminate at the PBX
- A computer with memory that manages the switching of the calls within the PBX and in and out of it
- The network of lines within the PBX
- A console or switchboard for a human operator (optional)

In some situations, alternatives to a PBX include centrex service (in which a pool of lines are rented at the phone company's central office), *key telephone systems*, and, for very small enterprises, primary rate Integrated Services Digital Network (ISDN).

- **Integrated Services Digital Networks(ISDNs)**

The ISDN is a digital communication network that uses the public telephone network and allows users to transmit data, voice, text and video communications in digital form over telephone lines.Since it is a digital network , it eliminates the need for a modem to convert analog signals to digital signals and viceversa, it does not require any rewriting since ISDN uses coaxial or fibre optic cables, it promotes uniformity and standardization through a set of standard interfaces. Because of this reason, ISDN is regarded as heart of a global information revolution.

ISDN works basically on five principles.

- **Openness:**

It means all ISDN products will be standardized.This brings order and uniformity to the complex task of developing a network

- **Modularity:**

It enables the organization to upgrade or replace any part in a network without replacing the entire network.

- **Communication based intelligence:**

It provides users with a way to configure their network connections to meet their requirements.

- **Network management and control:**

This is one of the complex and challenging tasks that information system managers face.

- **Integrated products and services :**

This allows the use of a wide variety of products and services on the network, such as voice networking data networking, teleconferencing etc.

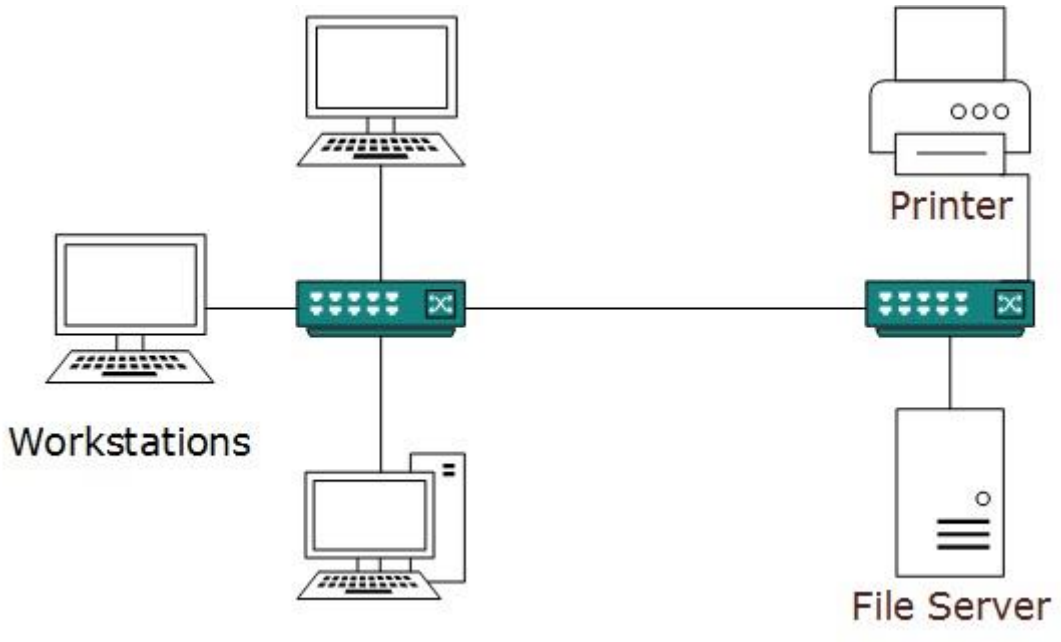
The basic building block of ISDN is a 64kbps(thousand bits per second) channel, referred to as a **B-channel**. Each B-channel is used to transmit user information.

Another channel called the **D-channel**, carries signaling and control information used to initiate, redirect or terminate calls.

- **Local Area Network**

A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network. Usually, Local Area Network covers an organization's offices, schools, college/universities etc. Number of systems may vary from as least as two to as much as 16 million

LAN provides a useful way of sharing resources between end users. Resources like Printers, File Servers, Scanners and internet is easy sharable among computers.



[*Image: Local Area Network*]

Local Area Networks are composed of inexpensive networking and routing equipment. It may contains local servers serving file storage and other locally shared applications. It mostly operates on private IP addresses and generally do not involve heavy routing. LAN works under its own local domain and controlled centrally.

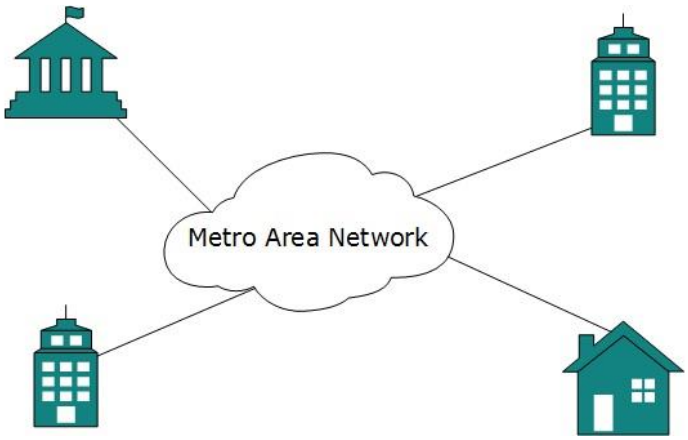
LAN uses either Ethernet or Token-ring technology. Ethernet is most widely employed LAN technology and uses Star topology while Token-ring is rarely seen.

LAN can be wired or wireless or in both forms at once.

- **Metropolitan Area Network**

MAN, generally expands throughout a city such as cable TV network. It can be in form of Ethernet, Token-ring, ATM or FDDI.

Metro Ethernet is a service which is provided by ISPs. This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a City.

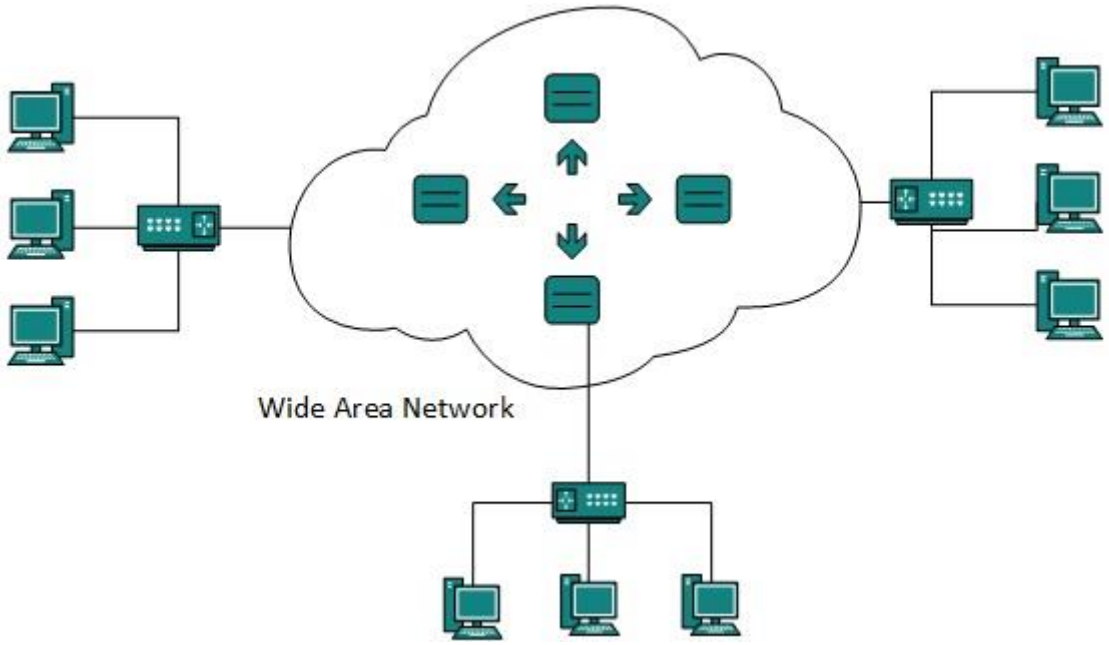


[Metropolitan Area Network]

Backbone of MAN is high-capacity and high-speed fiber optics. MAN is works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or Internet.

- **Wide Area Network**

As name suggests, this network covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These networks provides connectivity to MANs and LANs. Equipped with very high speed backbone, WAN uses very expensive network equipment.



[*Image: Wide Area Network*]

WAN may use advanced technologies like Asynchronous Transfer Mode (ATM), Frame Relay and SONET. WAN may be managed under by more than one administration.

Internetwork

A network of networks is called internetwork, or simply Internet. It is the largest network in existence on this planet. Internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol. Present day, Internet is widely implemented using IPv4. Because of shortage of address spaces, it is gradually migrating from IPv4 to IPv6.

Internet enables its users to share and access enormous amount of information worldwide. It uses www, ftp, email services, audio and video streaming etc. At huge level, internet works on Client-Server model.

Internet uses very high speed backbone of fiber optics. To inter-connect various continents, fibers are laid under sea known to us as submarine communication cable.

Internet is widely deployed on World Wide Web services using HTML linked pages and is accessible by some client software known as Web Browsers. When a user requests a page using some web browser located on some Web Server anywhere in the world, the Web Server responds with the proper HTML page. The communication delay is very low.

Internet is serving many proposes and is involved in many aspects of life. Some of them are:

- Web sites
- E-mail
- Instant Messaging
- Blogging
- Social Media
- Marketing
- Networking
- Resource Sharing
- Audio and Video Streaming

Networks and Distributed Processing

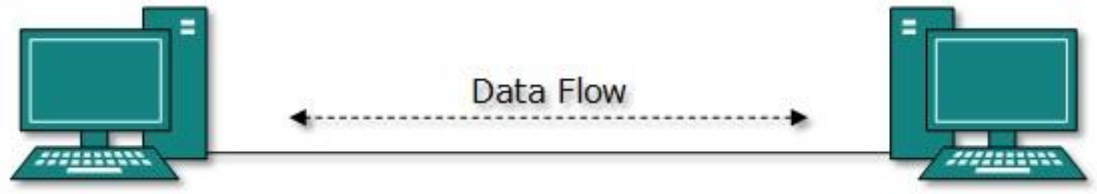
- **Centralized processing**
  - Data processing that occurs in a single location or facility
- **Decentralized processing**
  - Data processing that occurs when devices are placed at various remote locations
- **Distributed processing**
  - Data processing that occurs when computers are placed at remote locations but are connected to each other via telecommunications devices

Topology of computer networks

A Network Topology is the way computer systems or network equipment connected to each other. Topologies may define both physical and logical aspect of the network. Both logical and physical topologies could be same or different in a same network.

Point-to-point

Point-to-point networks contains exactly two hosts (computer or switches or routers or servers) connected back to back using a single piece of cable. Often, the receiving end of one host is connected to sending end of the other end and vice-versa.

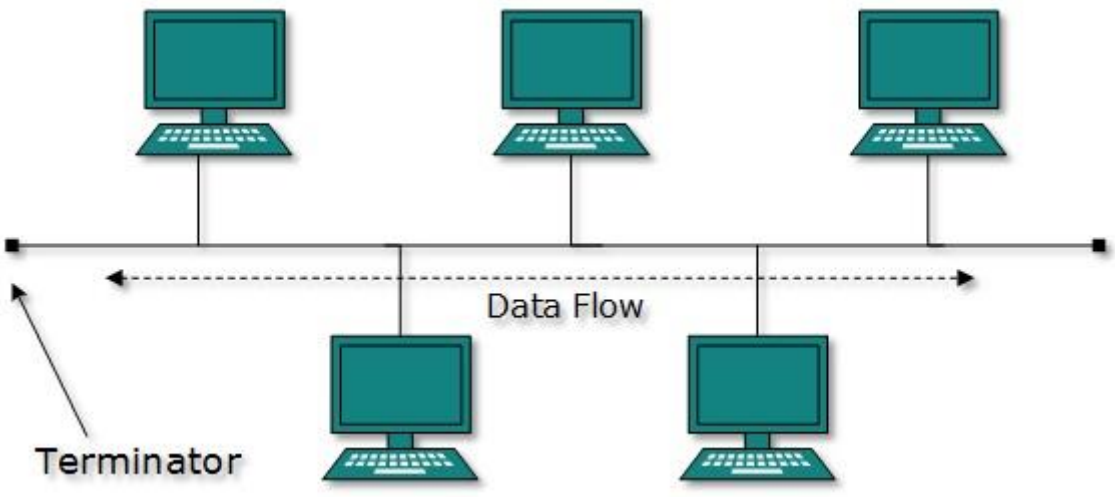


[Point-to-point Topology]

If the hosts are connected point-to-point logically, then may have multiple intermediate devices. But the end hosts are unaware of underlying network and see each other as if they are connected directly.

Bus Topology

In contrast to point-to-point, in bus topology all device share single communication line or cable. All devices are connected to this shared line. Bus topology may have problem while more than one hosts sending data at the same time. Therefore, the bus topology either uses CSMA/CD technology or recognizes one host has Bus Master to solve the issue. It is one of the simple forms of networking where a failure of a device does not affect the others. But failure of the shared communication line make all other devices fail.

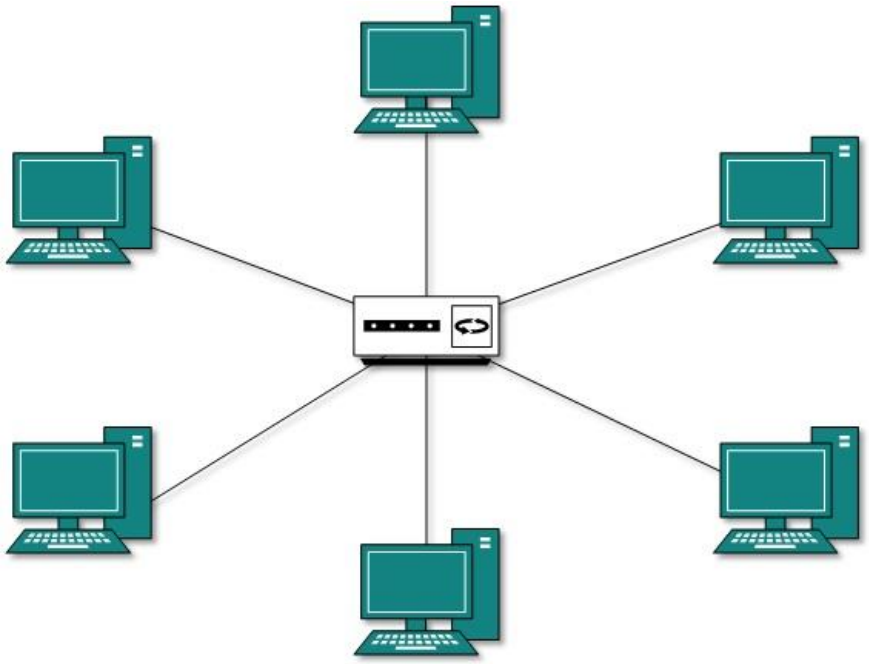


[*Image: Bus Topology*]

Both ends of the shared channel have line terminator. The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.

Star Topology

All hosts in star topology are connected to a central device, known as Hub device, using a point-to-point connection. That is, there exists a point to point connection between hosts and Hub. The hub device can be Layer-1 device (Hub / repeater) or Layer-2 device (Switch / Bridge) or Layer-3 device (Router / Gateway).

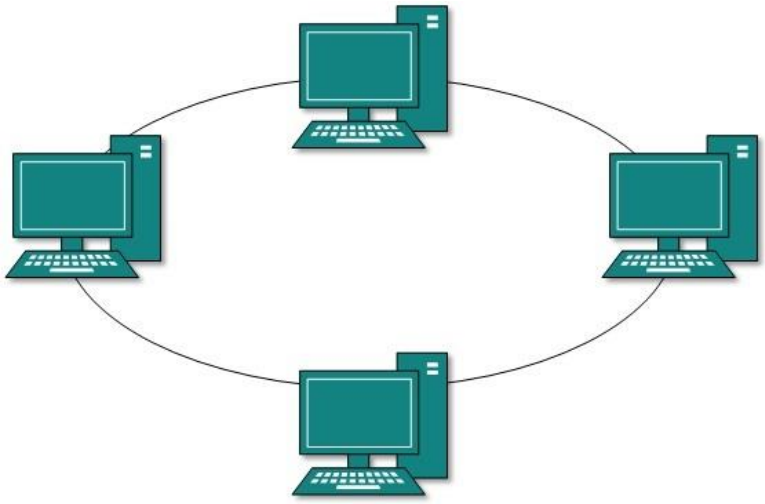


[Star Topology]

As in bus topology, hub acts as single point of failure. If hub fails, connectivity of all hosts to all other hosts fails. Every communication happens between hosts, goes through Hub only. Star topology is not expensive as to connect one more host, only one cable is required and configuration is simple.

Ring Topology

In ring topology, each host machine connects to exactly two other machines, creating a circular network structure. When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts. To connect one more host in the existing structure administrator may need only one more extra cable.

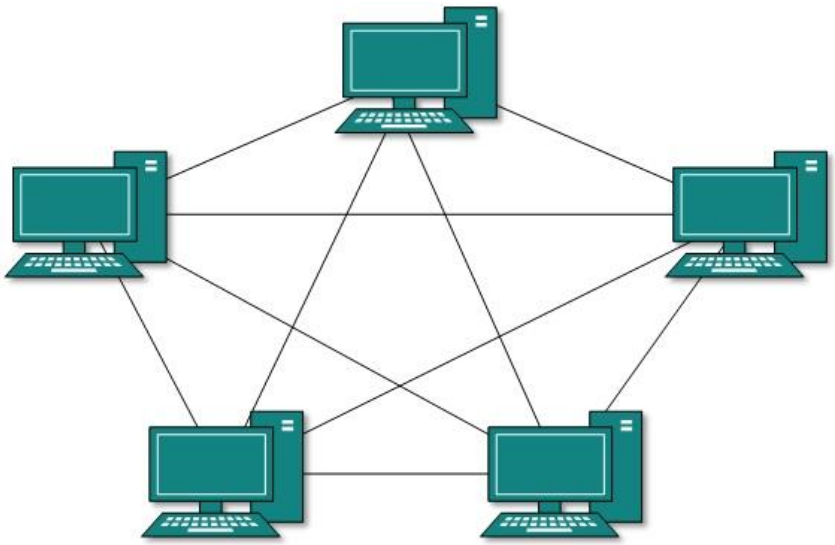


[Ring Topology]

Failure of any host results in failure of the whole ring. Thus every connection in the ring is point of failure. There exists methods which employs one more backup ring.

Mesh Topology

In this type of topology, a host is connected to one or two or more than two hosts. This topology may have hosts having point-to-point connection to every other hosts or may also have hosts which are having point to point connection to few hosts only.



[Full Mesh Topology]

Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes into two flavors:

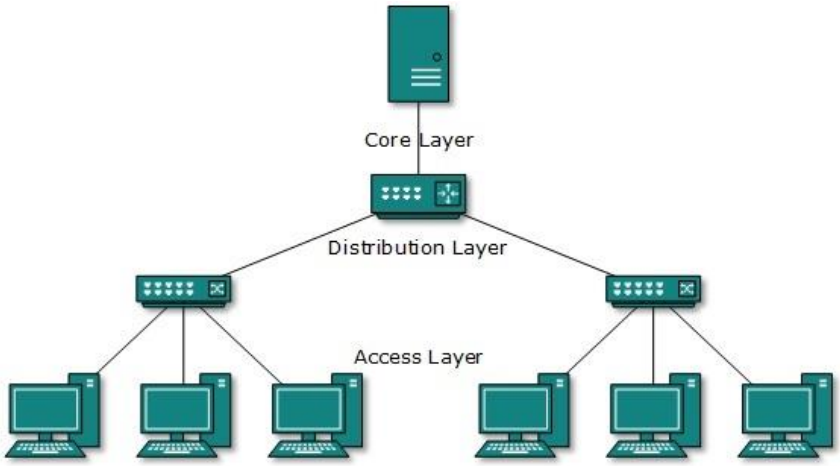
- **Full Mesh**: All hosts have a point-to-point connection to every other host in the network. Thus for every new host n(n-1)/2 cables (connection) are required. It provides the most reliable network structure among all network topologies.
- **Partially Mesh**: Not all hosts have point-to-point connection to every other host. Hosts connect to each other in some arbitrarily fashion. This topology exists where

we need to provide reliability to some host whereas others are not as such necessary.

Tree Topology

Also known as Hierarchical Topology is the most common form of network topology in use present day. This topology imitates as extended Star Topology and inherits properties of Bus topology.

This topology divides the network in to multiple levels/layers of network. Mainly in LANs, a network is bifurcated into three types of network devices. The lowest most is access-layer where user's computer are attached. The middle layer is known as distribution layer, which works as mediator between upper layer and lower layer. The highest most layer is known as Core layer, and is central point of the network, i.e. root of the tree from which all nodes fork.



[Tree Topology]

All neighboring hosts have point-to-point connection between them. Like bus topology, if the root goes down, the entire network suffers. Though it is not the single point of failure. Every connection serves as point of failure, failing of which divides the network into unreachable segment and so on.

Daisy Chain

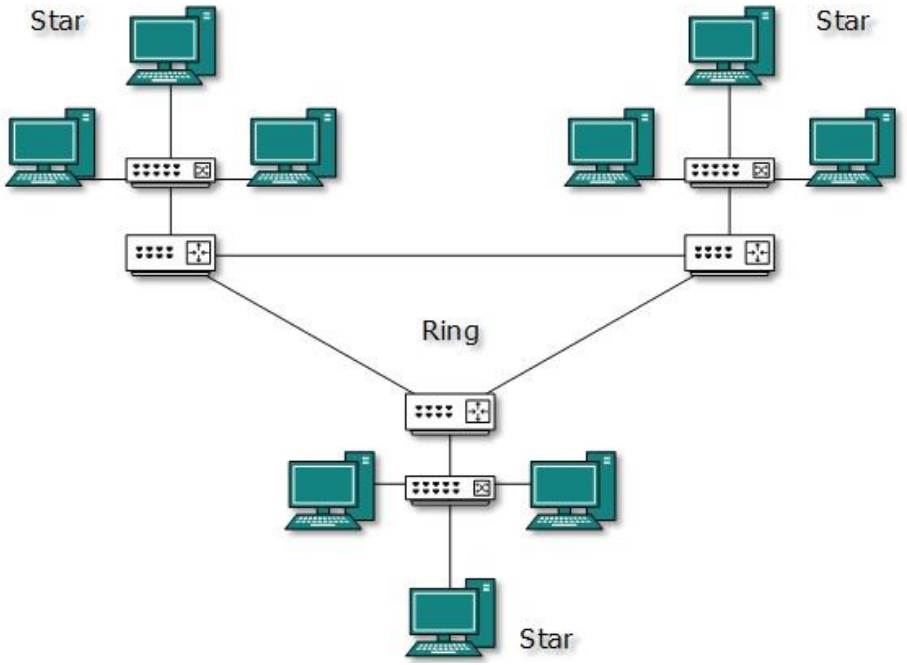
This topology connects all its hosts in a linear fashion. Similar to Ring topology, all hosts in this topology are connected to two hosts only, except the end hosts. That is if the end hosts in Daisy Chain are connected then it represents Ring topology.

[Daisy Chain Topology]

Each link in Daisy chain topology represents single point of failure. Every link failure splits the network into two segment. Every intermediate host works as relay for its immediate hosts.

Hybrid Topology

A network structure whose design contains more than one topology is said to be Hybrid Topology. Hybrid topology inherits merits and demerits of all the incorporating topologies.



[Hybrid Topology]

The above picture represents an arbitrarily Hybrid topology. The combining topologies may contain attributes of Star, Ring, Bus and Daisy-chain topologies. Most WANs are connected by means of dual Ring topology and networks connected to them are mostly Star topology networks. Internet is the best example of largest Hybrid topology

Generally, networks are distinguished based on their geographical span. A network can be as small as distance between your mobile phone and its Bluetooth headphone and as large as the Internet itself, covering the whole geographical world, i.e. the Earth.

Protocols and Network Architecture

Protocol

Rules that ensure communications among computers of different types and from different manufacturers.

A protocol has three major components:

- A set of characters having same meaning to the receiver
- A set of rules for timing and sequencing messages.
- A set of methods for detecting and correcting errors.

Some popular protocols are TCP/IP(Transmission Control Protocol/Internet protocol), System Network Architecture(SNA), System Application Architecture(SAA), XMODEM, YMODEM and Kermit.

Open Systems Interconnection (OSI) Model

The International Standards Organization (ISO) has developed the OSI model in order to organizing protocols. The ***open system*** approach opens the field to a broad array of competing vendors, a situation that benefits users to ensure that they are not locked into a closed, proprietary protocol structure of a specific manufacturer.

1. Gives both users and vendors flexibility in conforming to a standard.

2. Users can select a protocol for any layer of the model, as long as the protocol performs the necessary services and provides the same interface to the adjacent layers.

3. If a layer has to be changed, only the hardware or software implementing that layer need be modified.

4. A protocol layer in one node interacts with the corresponding layer in another one.

This model has seven layers:

Layer and its Function

1.Physical Layer: Provides access to the telecommunications medium and ensures transmission of the bit stream over it

2.Data Link Layer: Ensures error-free transmission of frames (blocks) of data over a network link

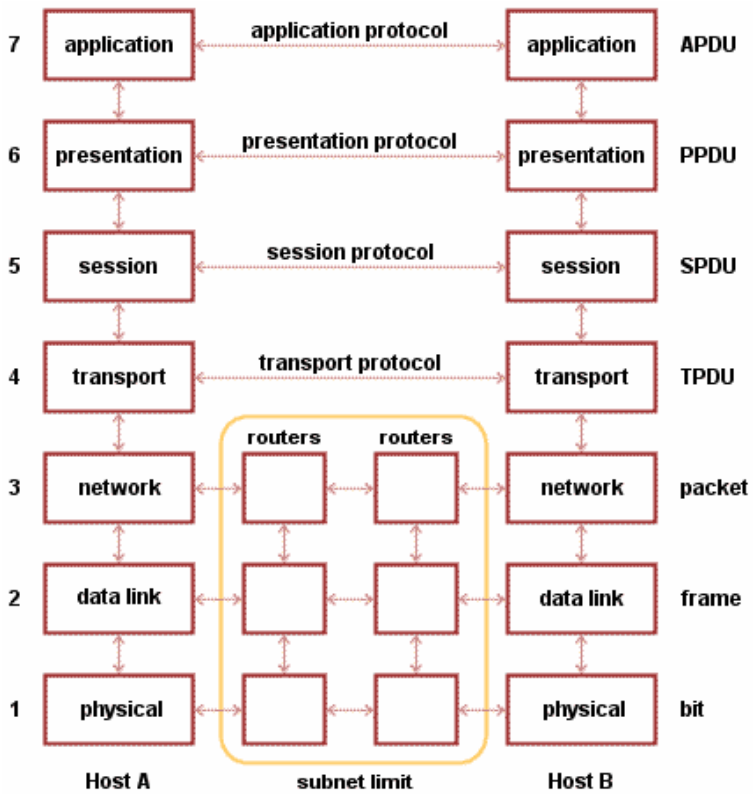
3.**Network Layer:** Routes messages (or packets) from source to destination by selecting connecting links

4.Transport Layer: Provides reliable end-to-end connection between two communicating nodes. When packet switching is used this layer breaks a message into packets

5.**Session Layer:** Establishes, maintains, and terminates a connection (session) between two applications running on communicating nodes. A session lasts, for example, from a long-on to a specific application to a log-off.

6.**Presentation Layer:** Provides any necessary conversions of the character being sent (encryption/decryption, compression/decompression, or character code conversions). Issue requests for establishing and terminating a session to the session layer

7.**Application Layer** Provides services to communicating application programs; examples include file transfer, running a remote program, allocating a remote peripheral, and ensuring integrity of remote databases.



- ❑ TCP/IP
  - TCP/IP = Transmission Control Protocol/Internet Protocol Standard originally developed by the U.S. government to link defense research agencies; it is the primary communication protocol of the Internet
- ❑ Systems Network Architecture (SNA)
  - IBM communication protocol
- ❑ Ethernet
  - Protocol standard developed forLANs using a bus topology
- ❑ X.400 and X.500
  - An international standard for message handling and network directories

A network architecture is a set of standards, or protocols for telecommunication hardware and software. It is intended tomaximise modularity, user friendliness, reliability, and ease of network maintenance.

It must establish standards for all all its elements- the hardware, the software and the user interface.

Network Communications Management

It is the systematic planning, implementing, monitoring, and revision of all the channels of communication within an organization, and between organizations; it also includes the organization and dissemination of new communication directives connected with an

organization, network, or communications technology. Aspects of communications management include developing corporate communication strategies, designing internal and external communications directives, and managing the flow of information, including online communication. New technology forces constant innovation on the part of communications managers.

- As a manager, one must take a contingency approach to communicating with their employees and communicate on a personal level. It's the manager's responsibility to determine if their employee's personality falls under the following: Reactors, Workaholics, Persisters, Dreamers, Rebels, or Promoters.

Network management system components assist with:

- Network device discovery - identifying what devices are present on a network.
- Network device monitoring - monitoring at the device level to determine the health of network components and the extent to which their performance matches capacity plans and intra-enterprise service-level agreements (SLAs).
- Network performance analysis - tracking performance indicators such as bandwidth utilization, packet loss, latency, availability and uptime of routers, switches and other Simple Network Management Protocol (SNMP) -enabled devices.
- Intelligent notifications - configurable alerts that will respond to specific network scenarios by paging, emailing, calling or testing a network administrator.

Client-Server Computing

The client-server technology is defined as a form of shared or distributed computing in which tasks and computing power are split between servers and clients . Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function. Clients therefore initiate communication sessions with servers which await incoming requests .

A client is a user who accesses the network by means of a desktop computer .A server is a computer that provides control function for the network .Components and functions of a client-server system

The client-server architecture includes :

- Front end (client) software :-The front-end software provides the user interface (what the user sends and receives), communication with at least one server, and data manipulation .
- Back –end (server) software :- The back-end s/w primarily controls data acquisition supports transaction management and recovers lost transactions, incases of system failure

- Other components of client s/w are tools for developing user interfaces, applications, communications s/w to communicate with the server, document management systems and relational database management systems .

In a client-server system

1> The server influences the way the client responds to a user request .

2> A no. of clients can access the server at the same time .

3> Client processes and server processes are independent of each other .

Development of client-server system

Before the development of a client-server system the requirements are :

- Identification and definition of the type of application
- Assessment of the n/w requirements
- Selection of the architecture
- Development of the logical and physical design of the system
- Testing, implementation and maintenance of the system

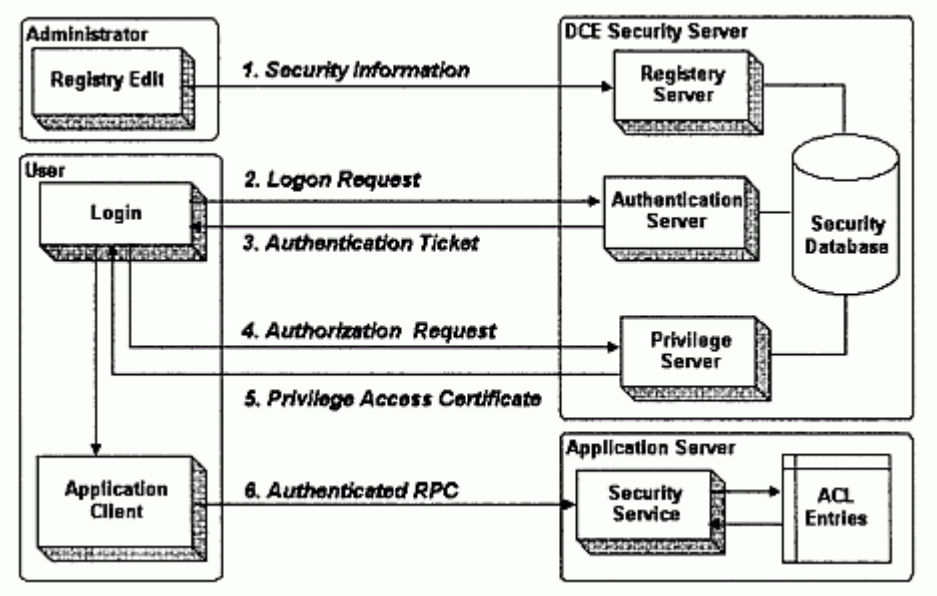
Then the development of client-server application is based on the following components :

- Communication services
- Distribution services
- Application services
- Organisation-specific applications
- Industry-specific applications
- System management and security

Client/server computing comprises three building blocks:

- The client
- The server (may be more than one)
- The network (tying the client and server together).

A logical and physical separation exists between the client and server and the client/server system co-ordinates the work of both of these components and efficiently uses each one's available resources to complete assigned tasks. This separation of client and server provides an open and flexible environment where mix and match of hardware and operating systems is the rule. The network ties everything together. Today the client applications run predominantly on PCs connected to a network (or LAN). The servers are also connected to the network and know how to connect to their clients.



Security in client/server

The distribution of services in client/ server increases the susceptibility of these systems to damage from viruses, fraud, physical damage and misuse than in any centralised computer system. With businesses moving towards multi-vendor systems, often chosen on the basis of cost alone, the security issues multiply. Security has to encompass the host system, PCs, LANs, workstations, global WANs and the users.

The client machines pose a threat to security as they can connect to the servers, and access their data, that are elsewhere in an organisation. One large problem is that they are easily accessible and easy to use. They are usually located in open plan offices that present a pleasant environment for users (and intruders) making it impossible to lock them away when unattended. Products are available that offer a measure of physical security by locking or bolting equipment and cabling into place.

Client Security

Physical protection for the client machines can include disk drive locks, or even diskless workstations to prevent the loading of unauthorised software and viruses. The cases can be fitted with locks to prevent access to the hard drives, and memory. One of the greatest risks with the client workstations is that the operating system is easily and directly accessible to the end user which exposes the whole system to a number of risks. The workstation operating system assumes that the person who turns it on is the owner of all files on the computer, including the configuration files. Even if the client/server application has good security, that security might not be able to counteract attacks at the operating system level which could corrupt data passed to other tiers of the client/server system. The tighter security now being offered with Windows NT addresses some of these issues.

Network Security

The network connecting clients and servers is a less than secure vehicle that intruders can use to break into computer systems and their various resources. Using publicly available utilities and hardware an attacker can eavesdrop on a network, or "sniff" the network to read packets of information. These packets can contain useful information, e.g. passwords, company details, etc, or reveal weaknesses in the system that can be used to break into the system.

Encryption of data can solve the problem of attackers sniffing the network for valuable data. Encryption involves converting the readable data into unreadable data. Only those knowing the decryption key can read the data. A problem here is that some network operating systems don't start encryption until the user has been authenticated (i.e. the password is sent unencrypted).

Most systems employ re-usable passwords for authenticating users which allows an attacker to monitor the network, extract the login information and access the system posing as that user. Even if the password is encrypted the intruder can just inject that packet into the network and gain access. The problem is compounded when, to maintain that single system illusion, only one login is required to access all servers on the network. Customers want a "single system image" of all networked computing resources, in which all systems management and administration can be handled within a single pool of system resources.

Server Security

The first line of defence for the server(s) is to have the server centre in a secure location where access, by authorised personnel only, can be supervised and administration can be performed simply. The server should be attached to an uninterruptable power supply as this protects the server by filtering the mains and provides backup power should the supply fail. This allows the server to shut itself down in a controlled manner to protect data.

The servers should be protected with the level of password security applicable to the business. Upgrades to the server software should be planned, monitored and controlled with updates done out of hours. Virus protection should also be active on PC-based servers.

To ensure privacy of the data the entire contents of the database can be encrypted using either cryptogram or advanced DES encryption mechanisms. The level of encryption is dependant on government regulations. For example, SQLBase supports a minimum of 40-bit encryption.

User Security

The first line of defence against illegal entry to a multi-user client/server system is user identification and authentication. It follows, that the easiest way to gain illegal entry to the system is by obtaining a valid users ID and password. The problem with keeping passwords

secret has been around since passwords were invented. For example, they can be discovered when:

- The user picks a short password or one that is easy to guess, such a spouse's name
- The user keeps a list of passwords taped on the screen or in a desk drawer
- The users share their passwords with other users
- An attacker phones the user, posing as one of the companies IT staff, and requests the user's password to fix an unnamed problem.

To overcome this a good security policy and strong password management must be implemented. A security policy will set guidelines for minimum password length, types of passwords that can be chosen, how often passwords should be changed, and so on. Password management utilities are available to check for guessable passwords, for minimum lengths and regularly ask users to change their passwords.

Client-Server costs computation

The factors that must be taken into consideration when computing client-server costs are ;

- Hardware
- Software
- Peripherals
- Accessories
- Training for end-users, managers, network administrators etc.
- Contract negotiations
- Outside consultants

Advantages of Client-Server Systems

- **Centralization**

In this architecture there is a centralized control. Servers help in administering the whole set-up. Access rights and resource allocation is done by Servers.

- **Proper Management**

All the files are stored at the same place. In this way, management of files becomes easy. Also it becomes easier to find files.

- **Back-up and Recovery possible**

As all the data is stored on server it is easy to make a back-up of it. Also, in case of some break-down if data is lost, it can be recovered easily and efficiently.

- **Upgradation and Scalability in Client-server set-up**

Changes can be made easily by just upgrading the server. Also new resources and systems can be added by making necessary changes in server.

- **Accessibility**

From various platforms in the network, server can be accessed remotely.

- **Security**

Rules defining security and access rights can be defined at the time of set-up of server.

Disadvantages

- Too many requests from the clients may lead to congestion, overload can lead to breaking-down of servers.
- If downloading a file from server gets abandoned due to some error, download stops altogether. However, if there would have been peers, . ve to install and manage this type of computing.
- You need professional IT people to maintain the servers and other technical details of network.

DECISION SUPPORT SYSTEM

Decision support system is defined as a set of well-integrated, user-friendly, computer-based tools that combine data with various decision-making models-quantitative and qualitative – to solve semi-structured and unstructured problems .

Characteristics of DSS:

The three major characteristics of DSS are :

1. DSS are designed specifically to facilitate decision processes,

2. DSS should support rather than automate decision making, and

3. DSS should be able to respond quickly to the changing needs of decision makers.

1. **Facilitation**. DSS facilitate and support specific decision-making activities and/or decision processes.
2. **Interaction**. DSS are computer-based systems designed for interactive use by decision makers or staff users who control the sequence of interaction and the operations performed.
3. **Ancillary**. DSS can support decision makers at any level in an organization. They are NOT intended to replace decision makers.
4. **Repeated Use**. DSS are intended for repeated use. A specific DSS may be used routinely or used as needed for ad hoc decision support tasks.
5. **Task-oriented**. DSS provide specific capabilities that support one or more tasks related to decision-making, including: intelligence and data analysis; identification and design of alternatives; choice among alternatives; and decision implementation.

6. **Identifiable**. DSS may be independent systems that collect or replicate data from other information systems OR subsystems of a larger, more integrated information system.
7. **Decision Impact**. DSS are intended to improve the accuracy, timeliness, quality and overall effectiveness of a specific decision or a set of related decisions.

Objectives of DSS

The major objectives of DSS are :

- Assist managers in making decisions to solve semi-structured problems
- Support the manager's judgement rather than try to replace it
- Improve the manager'sdecision-making effectiveness rather than its efficiency

Components of DSS

The main component of DSS are :

1. Hardware
2. Software

1. Hardware: - There is no fixed hardware configuration for designing, developing, aintaining and executing DSS. The hardware configuration for a DSS is mainly determined by:-

a) The size of the database

b) The DBMS package which one intends to use.

c) The type of model that are being used.

d) Ways in which reports/presentations are expected.

2. Software: - There are three main s/w components of DSS :-

a) Database Management Sub-System

b) Model Management Sub-system

c) Dialogue Management Sub-system

a) Database Management Sub-system:- Normally there are two sources of data such as internal source or external source. Database management system provides facilities for organizing, storing and queering these data. It acts as an information bank. DBMS software provides various facilities to modify and delete for database creation, manipulate the data present in database, query the data in the database. The architecture of a database management system includes External Schema,Conceptual Schema, and Internal Schema.

b) Model Management Sub-system:- A model presents the relationship between various parameters of the system. It gives a mathematical description of reality. The model builder provides a structured framework for developing models by helping decision makers.

A model management subsystem provides the following: -

1. A model base management system which helps in the creation of models and maintenance of the same.
2. An external interface which permits a user to choose a model to be executed and provides facilities for entering data.
3. An interface to the database.

c) Dialogue Management Sub-system:- This acts as the gateway for the user to communicate with the DSS. It provides menus and icons for the user to communicate effectively with the system. It converts the queries given by the user into forms which the other subsystems can recognize and execute. It keeps a track of activities that are being performed.

The major activities of a Dialogue management subsystem are :

1. Provides menus and icons for the user to communicate effectively with the system.
2. Provides necessary on-line context sensitive help to various kinds of users.
3. Converts the queries given by the user into forms which the other subsystems can recognize and execute.
4. Keeps track of the activities that are being performed.

Functions of DSS

There are five functions of DSS facilitating managerial decision making .They are :

- Model building
- What-if analysis
- Goal seeking
- Risk analysis
- Graphical analysis

Model building – It allows decision makers to identify the most appropriate model for solving the problem at hand .It takes into account input variables, intrerrelationships among the variables, problem assumptions and constraints .

What-if analysis – It is the process of assessing the impact of changes to model variables, the values of the variables , or the interrelationships among the variables .

Goal seeking – It is the process of determining the input values required to achieve a certain goal

Risk analysis – It allows managers to assess the risks associated with various alternatives .Decisions can be classified as low- risk, medium- risk and high -risk . A DSS is useful in high risk environments .

Graphical analysis – It helps managers to quickly digest large volumes of data and visualize the impacts of various courses of action.

Office Information System:-

- Introduction:-These combinations of information technologies that have a dramatic impact on day to day office operations are called Office Information System (OIS).
- Originally OA was intended to assist secretarial and clerical workers, but its ability to facilitate both format and informal communications with people both inside and outside the organisation attracted managers and professionals as users.
- All of these users use OA to increase their productivity.

Office Automation:-

- The terms expressed the concept that office activity is cantered on the processing of words.
- The intent was to draw the same attention to office products that had been lavished on computers and data processing.

Nature of the Job in office:-

- Generally there are five types of office workers in the office:-
- **Managers**-Managers generally spend most of their time in planning .coordinating and controlling the activities of other people.
- **Staff Professional**:-Staff professional support the activities of managers .These professionals have no direct line responsibility ,i.e., their role is mostly one of planning ,analysing ,and informing management of their findings.
- **Line professionals:-**Line professionals include sales persons and purchasing agents. They typically interact daily with such outside groups as the organisations customers and suppliers.
- **Secretaries:**-Secretaries are normally assigned to one or more knowledge workers in an office. They perform such support tasks as typing, filing answering phones a keeping appointment calendars.
- **Clerical Personal:**-Clerical Personal are usually not assigned to any one in particular. Generally, they support the entire department/section/division. Typical tasks of clerks are filing, typing, assisting in report preparation.

Evolution of Office System:-

- In 1964 a seemingly modest typing called word processing appeared. Since then, information processing in the office has never been the same.
- The electronic office of today looks entirely different from the mechanised office of just a few years ago. Even more dramatic changes are in store.

- Now we are beginning to witness the virtual corporation, which gives people the ability the work from any place without being confined by physical boundaries.

Types of Office Automation Systems:-

- There are four major types of office automation system these are:
- Document Management System
- Communication System
- Tele-conferencing System
- Office Support System

Document Management System:-

- Document Management System are computer-based tools that provide access to repositories of data, regardless of their form or location. The retrieved documents can be displayed in different formats, edited, distributed and integrated using other communication system.

Word Processing:-

- The most widely used and recognised office system technology is word processing. It involves hardware and software tools that allow the computer system to become more then a powerful type-writing device.

Desktop Publishing:-

- Desktop publishing is the use of a computer to be prepared printed output. It consists of a micro computer configuration.
- The configuration includes a high resolution cathode ray tube screen and a laser printer and is driven by DTP software.

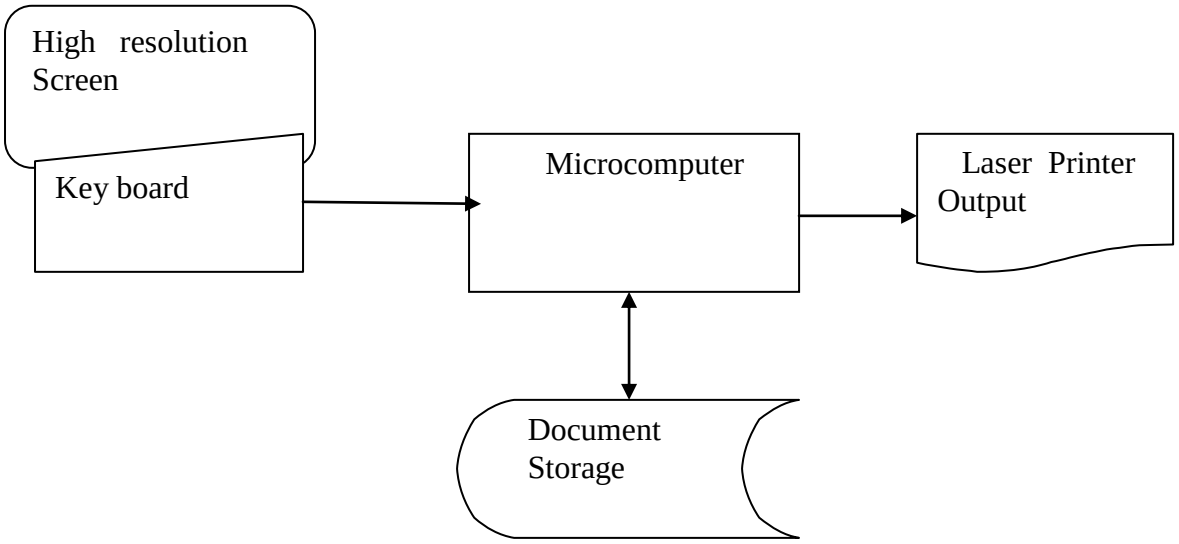


Fig: A DTP System

- DTP application fall into three areas:-
- *Administrative applications* include documents intended for such internal use as correspondence, reports and newsletters.
- *Technical applications* include such training materials as slides, overhead transparencies and manuals.
- *Corporate graphics* include advertisements, brochures and other documents intended for use outside the firm.

Multimedia System Development:-

1. **Define The Problem:-** The system analyst identifies the users needs and determine that the solution requires multimedia.
2. **Design The Concept:**- The System analyst and user possibly working with such communication professionals as procedures, directors and video engineers, engage in concept design by determining the overall message and conducting a walkthrough of all major sequences.
3. **Design the Content:**-The Developers engage in content design by preparing detail application specification. This is where the media selected. It is important to avoid Christmas tree look of incorporation too much multimedia and too little system functionality.
4. **Write The Script:**- The dialogue and all of the detailed elements of the sequences are determined.
5. **Design The Graphics:**- Graphics are selected that support the dialogue. Any necessary sets or props to be used in videos are designed.
6. **Produce The System:**-The system developers produce the various parts and integrate them into a system. In addition to development of the application software, the tasks involve such specialised activates as video editing, and authoring. Authoring is the integration of the separate elements through the use of special prewritten software.
7. **Conduct User Test:**- The system analyst educates the user in system use and gives the user an opportunity to become familiar with all of the features. If the system is satisfactory the user puts iy into use. Otherwise the prototyping process is repeated by reverting back to an earlier step. This iterative process is repeated until the user is satisfied with the system.
8. **Use The System:**- The user benefits from System Use.
9. **Maintain The System:**-Just like any other computer-based system, the multimedia system must be maintained. The main difference is that the user cannot be expected

to perform the maintained. This is the task of the specialist and professionals. Multimedia is not an end user computing application.

Communication System:-

- EDI Method – Electronic Data Interchange Method:- EDI may be introduced where a group of organisations wish to ensure that electronic transaction are passed between one another.
- EDI groups require EDI service in order to effect the data exchanges. These are often provided by a third-party organisation.

Benefits of EDI.

EDI ensures:-

- The speed with which an inter-organisation transaction is processed, is minimized.
- The paperwork involved in transaction processing is eliminated.
- The costs of transaction processing are produced, as much as the need for human interpretation and processing in removed.
- Reduced human involvement reduces error.

Electronic Mail:-

- Electronic mail, popularly known as E-mail, is a system that allows a person or a group electronically communicate with others through a network, in written from at any time, from anywhere in the world.

Electronic Mail Service:-

- It can acquire its own hardware and software and install an in-house system, or it can subscribe to an electronic mail service that provides the necessary computing and communication facility for a fee. In the latter case a subscriber needs only furnish the terminal to tie into the network.

Voice Mail:-

- It facilitates oral communication. In this system the sender dictates a message by speaking them over the telephone rather than typing them. A special device called a codes converse the analogue signal of the sender's voice into a digital message.

Facsimile:-

- It is popularly known as fax, systems are commonplace in most organisations today. Fax technology uses telephones, modems and scanners to transmit text and graphics to an individual or organisation anywhere in the world. The scanner in the fax machine scans the document at one and at the other end, a built-in modem receives the message, and printer prints it.

Internet:-

- The internet has emerged from the academic research world to become one of the most significant driving forces business change and innovation.

The Main world Wide Features :-

- A standard way of providing information on web pages stored electronically on a host computer. This would include text, formatting, graphics, audio, video.
- The use of hyperlink to direct a web page reader to another web page on the same website or to a different website.
- Easy to use software that would enable users to transfer quickly between pages on a website or between different website at the click of a mouse.
- Its successor software browser, Netscape, led to an explosion in the development of the website and the accessing of these by users. Other browser include info seek, hot java and Microsoft explore. A user essentially needs to use a browser to interact with a internet.
- It is possible to identify reasons and advantages an organisation might be expected to reap by using a website these are:-
- Reduction in cost of advertising
- Cheaper & easier provision of information.
- Ease of update
- Lack of need to maintain a shop front
- The ease of crossing geographical boundaries
- The absence of the middleman
- Reciprocal arrangement
- Web communities
- Commercial advertisement

E-Commerce – The Future of Business:-

- The new buzzword is E-Commerce, the idea of doing business electronically over the internet. It has many offshoots now, including E-Business & E-tailing.
- E-commerce can be divided into:-
    - E-tailing or “virtual storefronts” on websites with online catalogues, sometimes gathered into a “virtual mall”.
    - Collection and use of demography data through the internet.
    - Edythe business to business exchange of data.
    - E-Mail and fax as media to reach customers.
    - Business to business by buying & selling.
    - The security of business transactions.

Teleconferencing Systems:-

- The main feature of this system is that they reduce operating costs and increase productivity because decision makers do not have to travel to attend face to face meetings.

Audio Conferencing:-

- The person who organises the conference should solve as a moderator, making certain that all participants have an opportunity to speak and that the objectives of the conference are achieved.
- The number of participants should be kept to a manageable size, say not more than ten.
- A copy of the conference agenda should be made available to the participants in advance.
- When participants speak, they should identify themselves.
- A taped record of the conference should be kept.
- A hard copy record should be prepared from the tapped record, and distributed to all participants.

Video Conferencing:-

- There are three basic type of video conferencing based on the signal capability:-
  - One-way video & One-way audio: Video and audio signal are sent from a signal transmitting site to one or more receiving site.
  - One way video & Two way audio: The two way audio capability allows people at the receiving sites to talk to people are the transmitting site while everyone views the same video images.
  - Two way video with Two way audio:- The video & audio communication between all sites are two-way.

INFORMATION SYSTEMS IN BUSINESS

INTRODUCTION

The role of information systems in organisational productivity has been extremely challenging. The benefits of information systems are often intangible, manifesting themselves in areas such as improved customer service and greater organizational responsiveness.

The various functional area in business, including manufacturing, marketing, finance and accounting, quality control and human resources have all been influenced by information

systems. Functional areas using information systems, to capture new markets, achieve a competitive edge in existing markets and provide effective customer service.

There are many different types of information systems: transaction processing systems, MIS, Intelligent support systems, consisting of decision support systems, expert system, executive information system and office automation systems.

FUNCTIONAL AREAS OF BUSINESS

Every business consists of several well-define functions. These functions are often organised into areas or departments. These areas are known as the functional areas of business. In each functional area, a set of business functions is performed.

There are five functional areas in an organization. They are:-

- Manufacturing
- Quality Control
- Marketing
- Accounting and Finance
- Human Resources

In each of the functional area,a data flow model portrays the local decision making environment.

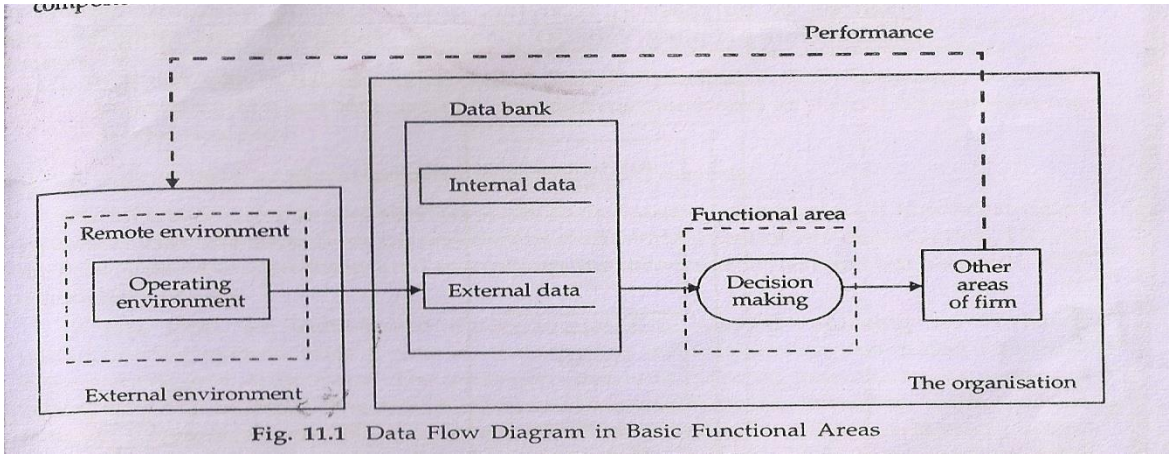


Fig. 11.1 Data Flow Diagram in Basic Functional Areas

External Environment:-The external environment contains two components:

1. Operating Environment: It consists of consumers, suppliers, competitors, distributors and labour supply.
2. Remote Environment: It consists of economic, social, political, technological and industry concerns.

Data Bank:-The term data bank is used generally to describe the general storage of data. A data bank can include data existing in files and in computer databases.

Internal Data:-Those datas generated from the firm's transaction processing system or from internal forecasts.

External Data:-These are collected from monitoring the environment.

Decision Making:-Decision making is the key of each functional data flow model. This process consists of selecting those data needed to make a decision and then making the decision.

Other Areas of The Firm:-Information produced by decision making in one functional area is often used in another. For example sales forecast prepared by the marketing department.

Feedback Mechanism:-The dotted feedback arrow indicates that decisions made by the firm ultimately affect its performance in the marketplace.

MANUFACTURING INFORMATION SYSTEMS

Manufacturing information system is a system that supports the manufacturing functions of purchasing, receiving, quality control, inventory management, material requirements planning, capacity planning, production scheduling and plant design.

The term manufacturing should be considered in terms of delivering both goods and services.

Production systems, a subset of manufacturing information systems are directly associated with the production of goods and services.

The primary decisions made in the manufacturing include,

- Product design
- Production
- Facility design
- Quality control

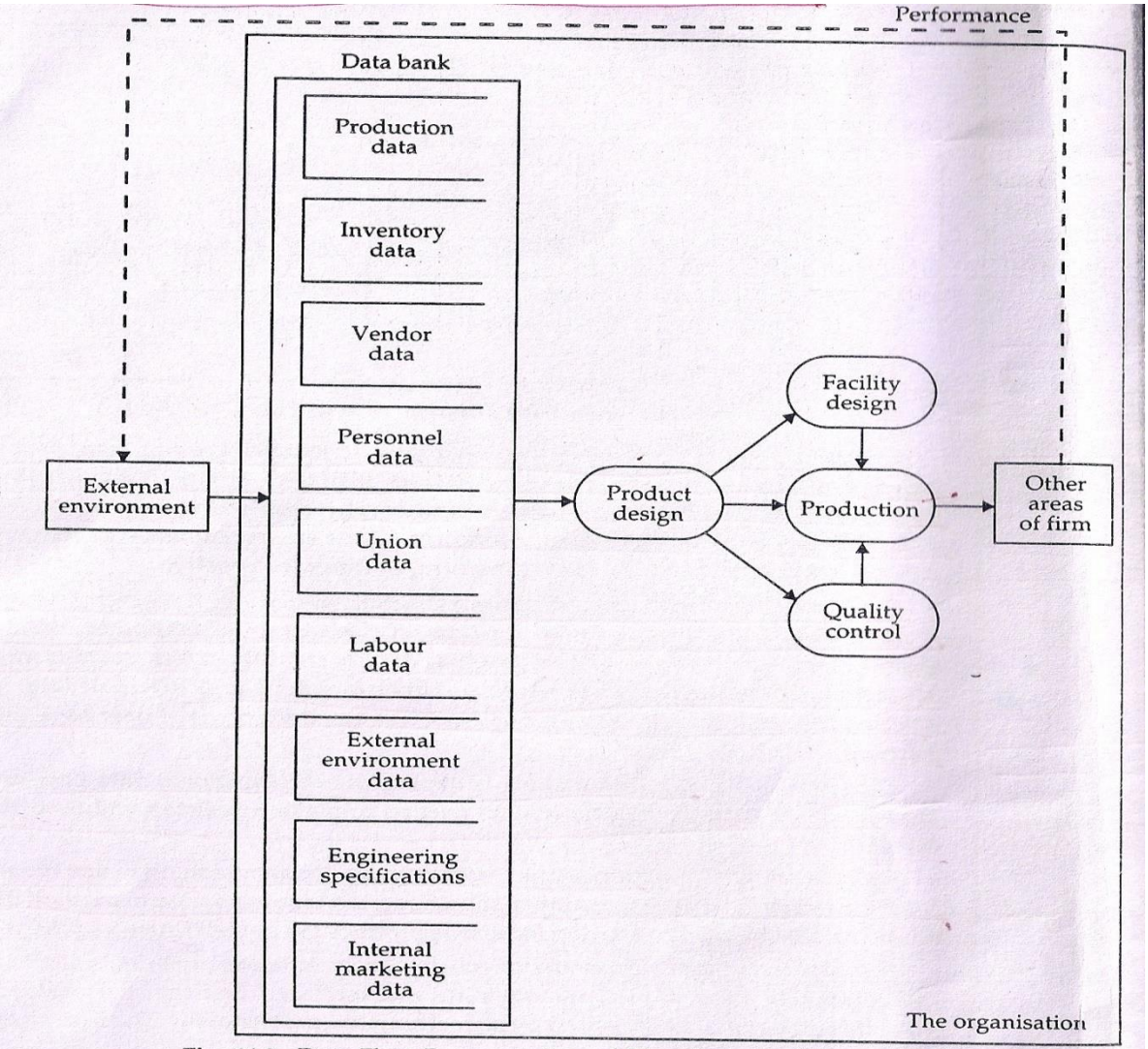


Fig. 11.2 Data Flow Representation of Manufacturing Information System

Product design:-It is the starting point of the manufacturing process. It is the step in which the design and technical specifications for the product are finalized. Product design and engineering are becoming more computerized through approaches such as Computer Aided Design(CAD),Computer Aided Engineering(CAE) and robotics.

Production:-It is the process of making new products from raw materials. The production process consists of many interrelated activities.

There are two basic types of production methods:

1. Job Shop
2. Process

Some firms are trying to integrated CAD,CAM and other manufacturing activities,a concept known as Computer Integreted Manufacturing(CIM). CIM increases a firms compatibility for planning , productivity , responsiveness, control and innovation.

Agile Manufacturing:- It refers to manufacturing environment that are dynamic and flexible enough to instantaneously produce customized good and services in varying quantities. Agile manufacturing has four main characteristics:

1. The ability to thrive on constant change.
2. Recognition by the organization that people are its main asset.
3. Incorpopration of the virtual company idea through the use of telecommunication.
4. A focus on creating products and services with real added value.

Quality Control:-It relates to activities which ensure that the final product is of standard quality. Its function is concerned with detecting existing quality deficiencies, as well as with preventing future product quality problem. Quality control is therefore both an important area of expense and an important area of opportunity.

Sources of Manufacturing Information

Information needed for manufacturing decisions stems from a variety of data sources as shown in fig:

- **Production data:** By using terminals around the production floor, data on production processes can be quickly gathered and processed. These data are used for billing and in almost every of production control.
- **Inventory data:** It include inventories of raw materials, goods-in-process and finished good. Accurate raw material data are especially important in a manufacturing situation.
- **Vendor data**: Vendor data show sources and prices for raw material. Often vendor data are maintained by the purchasing department, although sometimes the manufacturing area will personally buy certain items.
- **Personnel data:** It show various statistics on current manufacturing personnel. Often,in the courses of production, people switch assignments, so personnel skill must be reviewed to fit the right person for the right job.
- **Union data:** Many types of labour today are unionized production shops usually have strict regulations regarding such items as pay scales, hiring and firing, promotion and working conditions.
- **Labour data:** Raw materials and people are at the core of manufacturing a product. While vendor are the source of raw materials, the labour market is the source of people.
- **External environment data:** To manufacturing managers, the most pressing information need in the area of external environment data is the outlook for raw material prices and labour availability.

- **Engineering specifications:** It indicate whether something can be built and how. It contain such facts as sizes of screws, whether a certain drill bit is suitable for wood , metal, masonry; how to built a sub-assembly of a certain type and so on.
- **Internal marketing data:** Marketing ends where manufacturing begins, so marketing output is manufacturing input. Marketing specifies the number of units of good that must be produced in each time period in order to meet consumer demand.

MARKETING INFORMATION SYSTEMS

Marketing strategies consists of a mixture of ingredients that has been named the marketing mix: product, promotion, place and price. They are known as the four Ps.

Product: It is what the customer buys to satisfy a perceived want or need.

Promotion: It is concerned with all the means of encouraging the sale of the product**.**

Place: It deals with the means of physically distributing the product to the customer through a channel of distribution.

Price: It consists of all the elements relating to what the customer pay for the product.

There are three types of marketing information :

- **Marketing Intelligence:** The information that flows into the firm from the environment.
- **Internal Marketing Information:** Information collected within the firm.
- **Marketing Communications:** Information that flows from the firm outward to the environment.

A marketing information system can be defined as a computer-based system that works in conjunction with other functional information system to support the firm's management in solving problems that relate to marketing the firm's product.

A marketing information system is a system that meets the information needs of an organisation in sales, distribution, advertising, market analysis, market intelligence, product research, service management, customer profile and other marketing functions.

Inputs of Marketing Information Systems

Information used for marketing, decisions arrived at from different data sources,the most important of which are shown below.

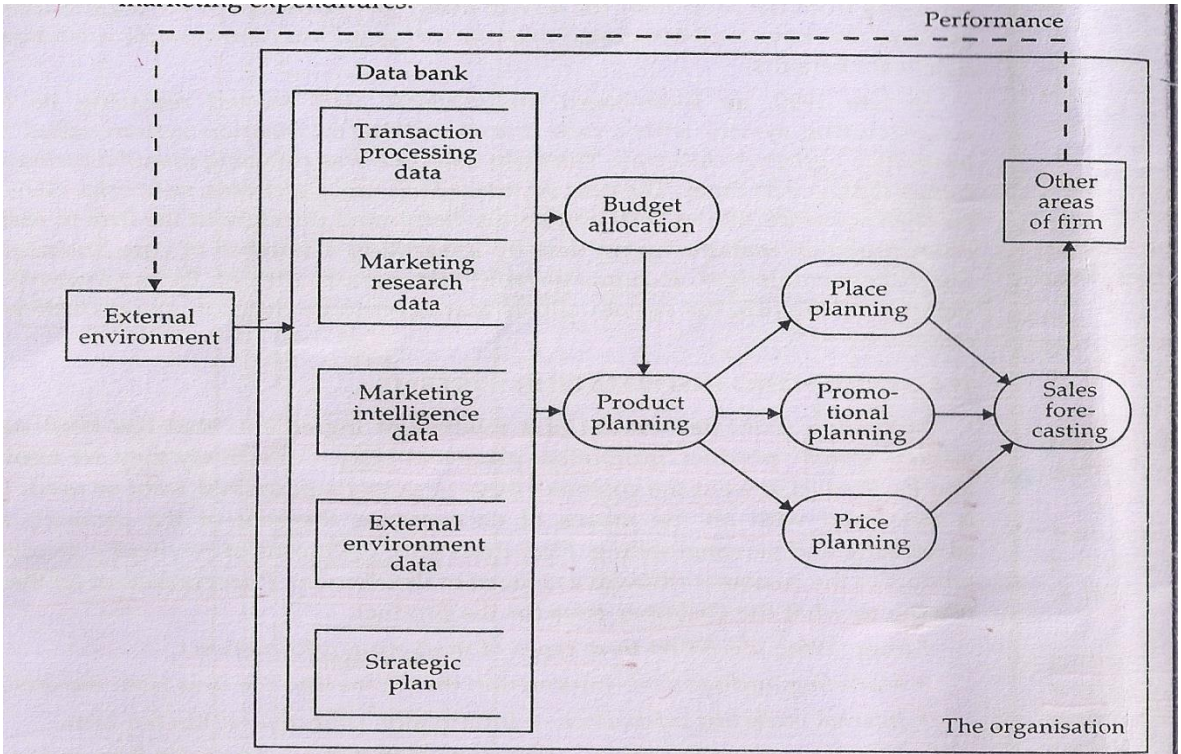


Fig. 11.3 Data Flow Representation of the Marketing Information System

- **Transaction processing data:** It show the sales that result from specific mixes of the four Ps. They are useful for appraising performance and controlling marketing expenditures.
- **Marketing research data:** Marketing are responsible for gathering consumer-related data that can be used to support marketing decisions; for example personal interviews, phone interviews and mail surveys.
- **Marketing intelligence data:** Marketing intelligence refers to information about the strategies of competitors. Most marketing intelligence information is collected in an unstructured or semistructured manner.
- **External environment data:** In marketing, success is largely attributable to what will happen in the future external environment.
- **Strategic plan:** It is really the starting point of all marketing decisions. It contains the types of products that the firm plans to supply to the consumer marketplace. The tactical marketing plan addresses what, how, when and where questions that are appropriate to the implementation of the strategic plan

Outputs of Marketing Information Systems:

Each output subsystem provides information about its part of the marketing mix i.e four Ps.

- **Product planning:** it is often complicated, unstructured decision. A number of factors contribute to a product's success or failure. Complicating these product

planning decision are the fact that the choice of consumers constantly change and that competitors always develop new products.

The four stages in the life cycle are introduction, growth, maturity and decline. A number of techniques have been developed to provide the manager with the information needed for making product-oriented decisions.

- **Place planning:** It refers to the channels of distribution that a firm uses to get its products to the consumer. The resources flowing through a channel includes a supplier, manufacturer, wholesaler, retailer and consumer.

Information that flow in the direction opposite to the material flow is called *Feedback Information.*

The flow of information towards the consumer is called *Feedforward Information.*

- **Promotion:** Promotion is composed of two principal area:
    i. Personal selling
    ii. Advertising

Technology is vital to the selling effort in several ways:-

a. Tying in customers and suppliers
b. Increasing selling time
c. Increasing effectiveness of the client site
d. Identifying selling opportunities
e. Making salespeople more efficient

- **Price:** Depending on the firm's pricing policies, the price area can run close to promotion in terms of decision support difficulty. Some firm engage in cost-based pricing by determining their costs and then adding a desired mark-up. This approach is a rather caution one. A less caution pricing policy is demand-based pricing.
- **Budget allocation:** Two other important decision making areas, in addition to four Ps, are the allocation of the marketing budget and sales forecasting. Marketing does not have an unlimited source of fund. Thus, a budget must limit the overall size of expenditure.
- **Sales forecast:** It reflects estimates by the marketing personnel on future product sales. Since it is the main source of firm's revenue, sales forcast is an important part of the financial plan.

QUALITY INFORMATION SYSTEMS

Quality information systems are standalone system or embedded system that help an organization to achieve its quality goal. The quality plan is derived from the strategic information plan.

The information systems(IS) department plays a major role in ensuring the success of TQM effort in an organization. An information system can promote quality and provide tools and techniques to help the firms achieve its quality goals. It also help firms achieve quality certification.

The role of IS may vary one organization to the next, or even from one program to the next. There are four major areas where IS plays an important role in the certification process. They are:-

1. **Partial system overhaul:** Here the existing systems are partially revamped in order to update them and make them more responsive to the changing needs of decision makers.
2. **Full system overhaul:** Here the old system is replaced with a new system. Sometimes be necessitated by outdated equipment or system that can no longer be updated or maintained.
3. **Training:** It is another area where IS can play an important role in quality certification. User must be well-trained in systems that are partially or fully overhaul. This has a direct impact both on quality and on productivity.
4. **Oversight:** It is a time consuming task. It requires coordination and cooperation among departments. It can facilitating role by ensuring the free flow of information between decision makers.

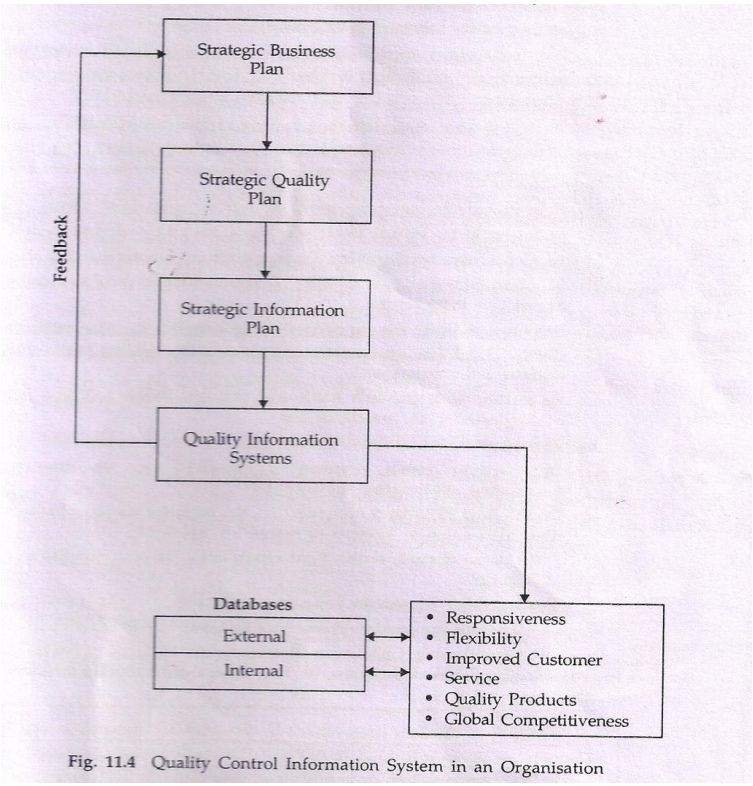


Fig. 11.4 Quality Control Information System in an Organisation

FINANCIAL AND ACCOUNTING INFORMATION SYSTEM

Financial and accounting information system (FAIS) is a system that provides information related to the accounting and financial activities in an organization. It includes budgeting, cash and asset management, capital budgeting, portfolio analysis, general ledger, account receivable, inventory control and payroll system. Other systems include record keeping, account analysis, cash management, financial analysis, leasing options, insurance claim processing and investment management.

Financial information plan is derived from the strategic information plan and the strategic business plan. Most financial and accounting managers operate under the 'tyranny of the urgent ', a strategic financial plan and an integrated set of information system that support the plan are a necessity for the survival and growth of any organization.

Types of Financial and Accounting Information Systems

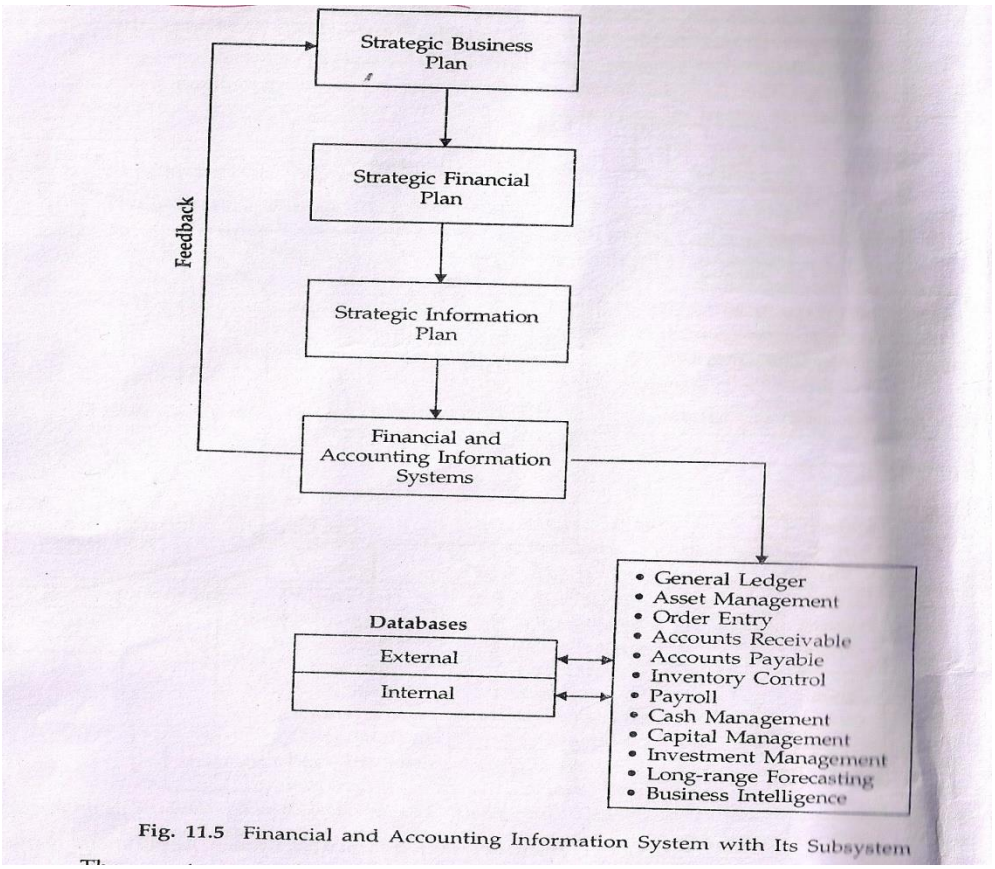


Fig. 11.5 Financial and Accounting Information System with Its Subsystem

Various functions of FAIS are explained :-

General ledger systems: It generate the firm's income statement and balance sheets and are responsible for managing new and old accounts in the firm.

Asset management system: It maintain an inventory of the firm's long term assets and ensure that accounting practices for firm assets comply with regulatory standards.

Order entry systems: It capture and manage different kinds of data relating to a transaction, such as number of unit sold, customer billing, credit history, sales tax and inventory levels.

Accounts receivable and accounts payable: It capture and process data, such as creditor and customer billing information, payments received and owed, credit terms, account balances and payment schedules.

Inventory control system: It captures, processes and manages all data related to the firm's inventory.

Payroll systems: It capture and process data related to wages and salaries including central and state taxes, other payroll deduction, employee benefits, overtime and related data.

These systems are designed to support mostly operational decisions. There are other kinds of FAIS to support tactical and strategic decision making in the organization such as the following:

Cash management systems: Systems that ensure that the organisation has enough cash to conduct normal business, to receive the best possible return on its short-term cash deposits.

Capital budgeting systems: It ensure the acquisition and disposal of capital assets such as land, buildings and so on.

Investment management systems: It ensure that the organization gets the best possible returns on its long-term investments.

Integrated Financial and Accounting Systems

FAIS are often integrated with other functional systems in the organization to facilitate data sharing and team decision making. Financial decisions are not made in vaccume; they often involve marketing, manufacturing and human resources. A radically different form of accounting called ABC accounting. ABC refers to Activity Based Costing. ABC accounting system assigns overhead costs based on actual consumption of resources.

RESEARCH AND DEVELOPMENT INFORMATION SYSTEMS

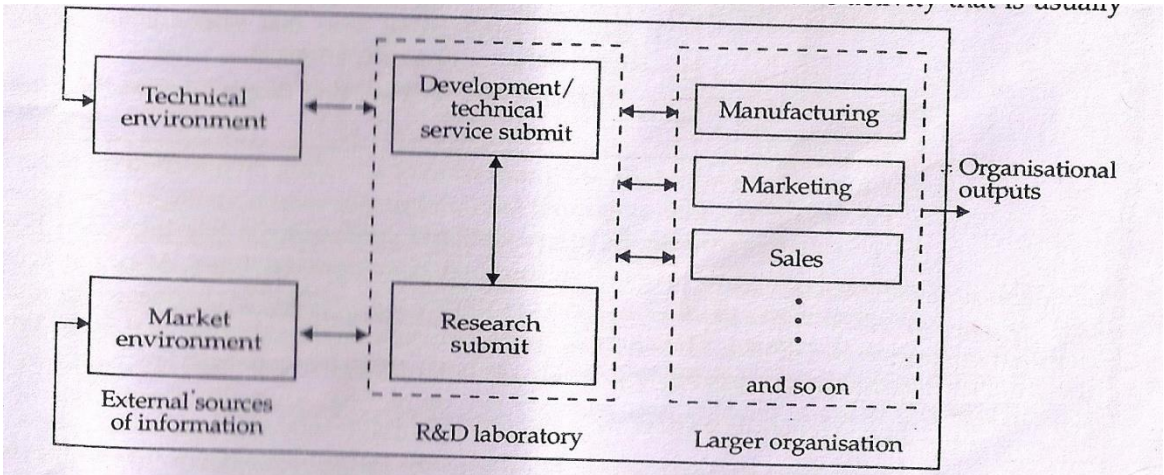


Fig. 11.6 Information Flow in R&D

Advances in information technology have spawned specialized information systems in many other business areas. The significant area receiving considerable attention is R&D. R&D is responsible for creating and developing new products or services in order to capitalize on recognized opportunities. R&D also be responsible for overcoming recognized weaknesses in current organisational production and operation processes in order to make them more efficient, cost effective and competitive.

R&D is an open system that has important information and communication exchanges with the external environment and other organisational subunits.

The productivity of R&D professionals has increased because of these changes, resulting in reduced product development times. The access to external databases and to other sources of external information has increased dramatically.

HUMAN RESOURCE INFORMATION SYSTEMS

Human resource information system (HRIS) is a system that supports the planning, control, coordination, administration and management of an organisation's human resources. HRIS also includes a large number of subsystems that address the information needs of various human resource functions. They provide managers with information, policies and procedures concerning recruiting, layoffs, employee evaluation, promotion, termination, transfer, salary eqity monitoring, job descriptions and responsibilities, training, affirmative action plan (AAP) and equal employment opportunities(EEO).HRIS will be a necessity for most of the big giants if they are to keep up with increasing government regulations and respond to personal information queries about employees.

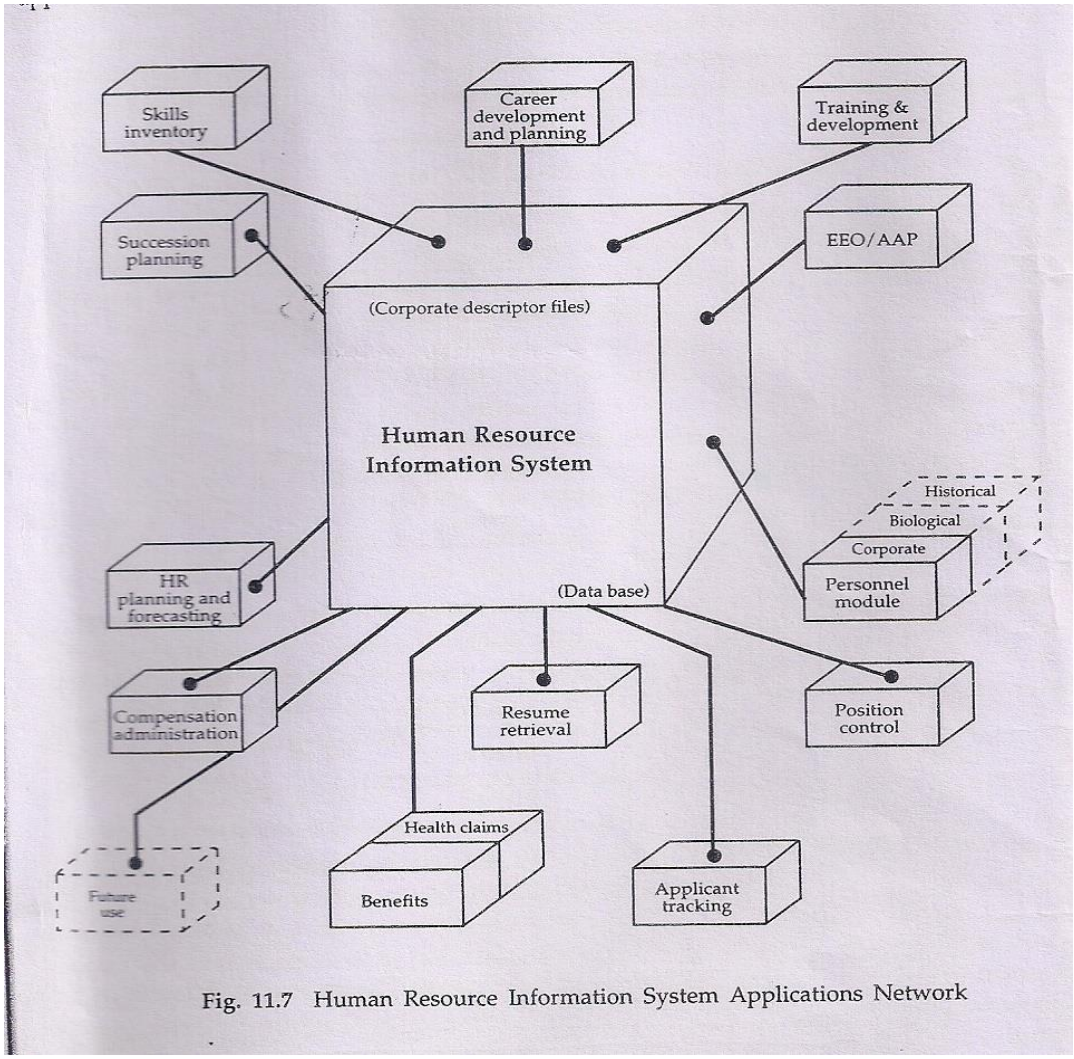


Fig. 11.7 Human Resource Information System Applications Network

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HRIS can be used only to enhance HR decisions, in fact they can be used to cut costs, increase efficiency and achieve a competitive edge in the marketplace.

Human Resource Information System Development

The HRIS is derived from the strategic business plan, the strategic human resources plan and the strategic information plan. Some sub-system within the HRIS are personnel data, payroll, benefits, administration, equity monitoring, processing job applications, monitoring positions, training and development, safety, worker compensation, union negotiations and collective bargaining.

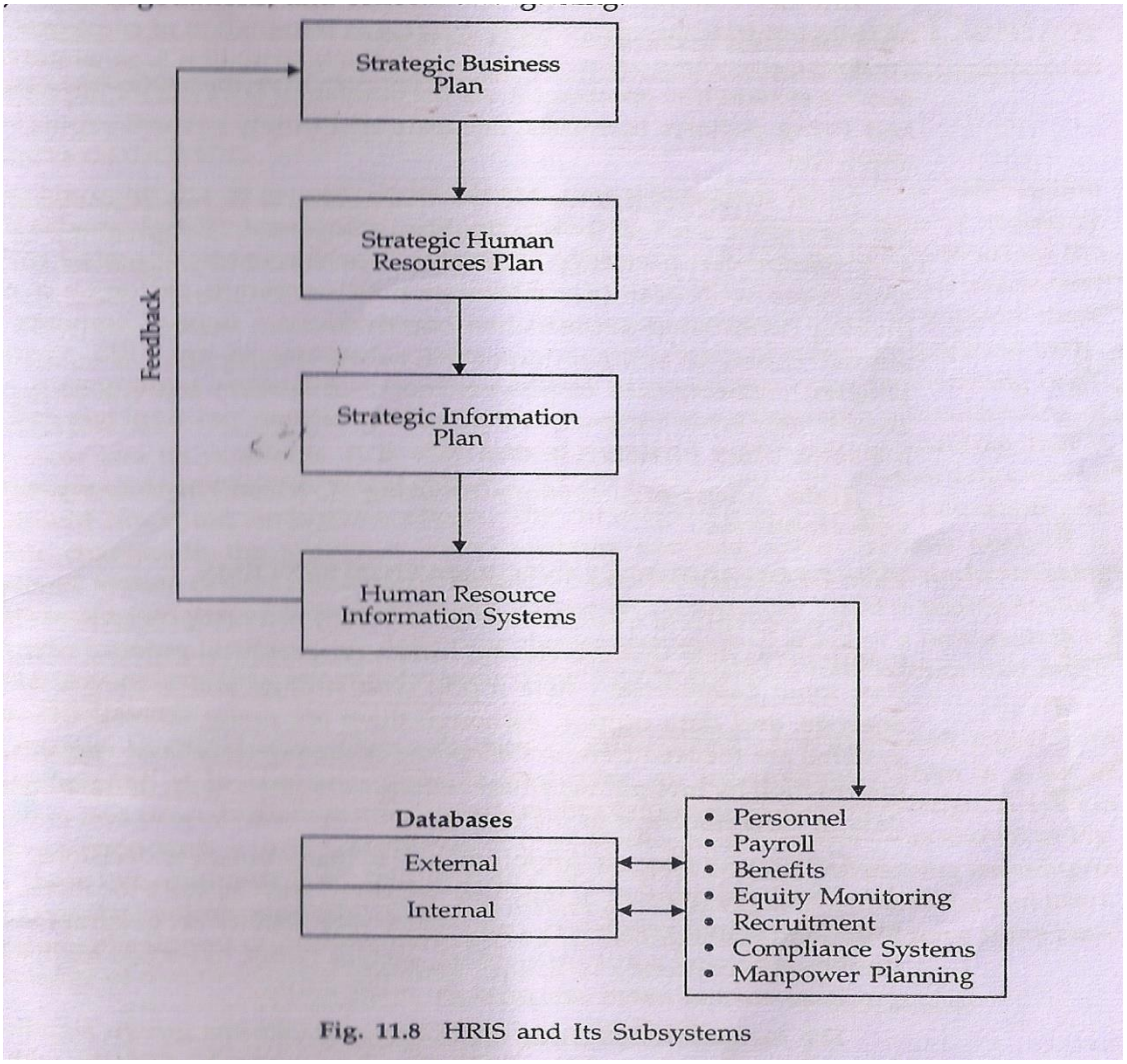

Fig. 11.8 HRIS and Its Subsystems

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HRIS is a database that contains detailed personal and professional information about each employee in the organisation. Personal data include name, age, gender, address and social security number; professional data include educational level, job title, job description, department code, year of employment, number of promotions, performance evaluations and so on.

HRIS subsystem manages records and generates information regarding recruitment, transfer, promotion, layoff and termination of employees. The number of lawsuits for improper hiring, promotion and firing policies increases, accurate and timely recordkeeping becomes even more important.

Other subsystems of the HRIS include systems that develop and maintain job titles and job descriptions for all jobs in the firm, compensation and benefits information systems and manpower planning system.

GEOGRAPHICAL INFORMATION SYSTEMS

A geographical information system (GIS) is a computer-based system that stores and manipulates data that are viewed from a geographical point of reference. This system has four main capabilities:

1. Data input
2. Data storage and retrieval
3. Data manipulation and analysis
4. Data output

A GIS is one of the powerful and versatile tools as it can create information by integrating different data, sometimes from different sources and display the data in different ways to the end-user.

GIS is an excellent decision making tool that integrates geographical data with other business data. For organizations with a customer focus, a GIS provides clear profiles ofr customers and their needs;hence these tools can be integrated with any of the functional area of the business.

CROSS-FUNCTIONAL SYSTEMS

Nowadays, emphasis is given on building cross-functional systems that facilitate the flow of information among all units in an organization. Decision-making should not be compartmentalized in functional areas, but should instead be viewed in the context of the entire organization. In the coming tears, computer skills will be grouped with the basic skills of reading, writing and arithmetic and computer-literate individuals with a good understanding of information system will be eagerly sought after by employers.

SYSTEM ANALYSIS AND DESIGN

INTRODUCTION

System analysis is an important activity that takes place when new information system are being built or existing ones are changed. It includes collection of necessary data and developing plans for new systems

The systems are often made up of many interrelated tasks. Changes to any one of these tasks or the addition of new tasks can affect existing ones. It is, therefore, necessary to spend considerable time gaining a thorough understanding of the system and its problem. The investigation into system operation and possible changes to the system is called System Analysis. People who analyse system use the understanding of the existing system and its problems to design and eventually build a usable system.

It is known that a system is a collection of interrelated parts that work together to achieve one or more common goals; an information system is a set of processes and procedures that transform data into information and knowledge.

A system has five components:-

1. Input
2. Processes
3. Output
4. Feedback
5. Control

These five components are central to any information system. It is important that everyone in the organisation should have some basic knowledge of methodologies and other aspects of system development.

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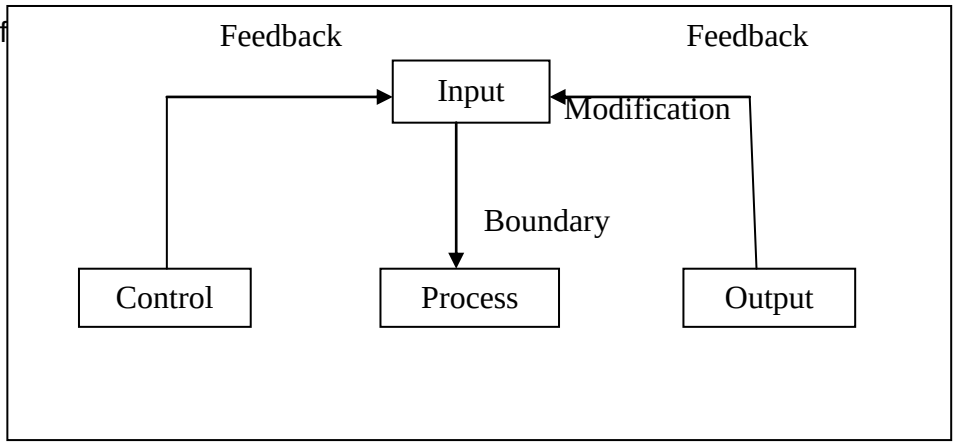

There are six different IS development methodologies. These are:

- System Development Life Cycle(SDLC)
- Prototyping
- Rapid Action Development
- End-user Development
- Software Packages
- Outsourcing

SYSTEM DEVELOPMENT LIFE CYCLE (SDLC)

The system development life cycle (SDLC) is a framework for developing computer based information systems. The SDLC is generally easy to recognize and well-acknowledged.

It consists of five phases:

- Problem definition
- System analysis

- System design and programming
- System testing and implementation
- System maintenance

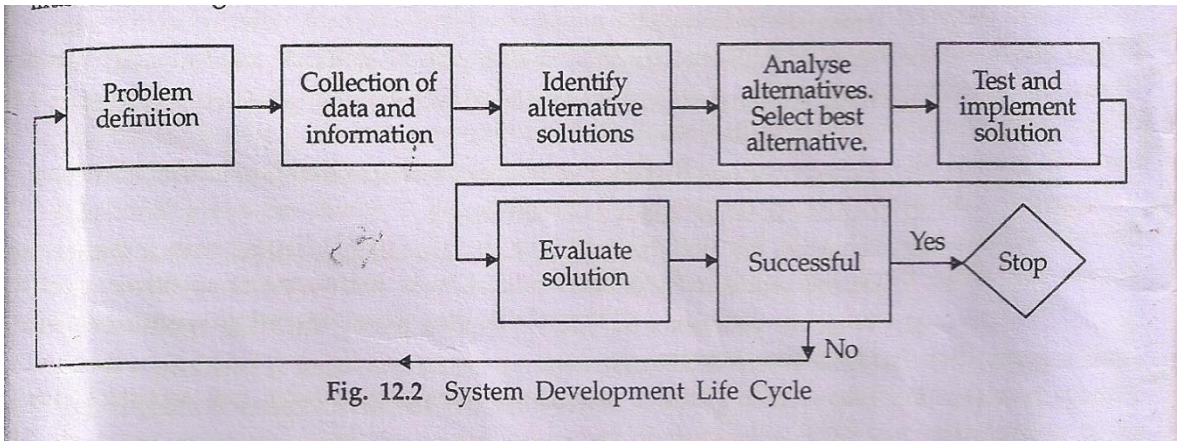

Fig. 12.2 System Development Life Cycle

Problem/System Definition

System definition is the process of defining the current problem, determining why a new system is needed, and identifying the objectives of the proposed system. The main aim is to answer' why do we need a system?' and 'what are the objectives of the new system?'

System Analysis

In this phase, a detailed problem analysis is undertaken to better understand the nature, scope, requirements and feasibility of the new system. Main activities included in this phase are:

- **Understanding the problem:** It emphasises the clarification and understanding activities set out. Developers and user should fully understand the existing problems and the weaknesses of the existing system. The output of this phase results in a detail model of the system. The model describes the system functions, system data and information flows.
- **Feasibility analysis :** The feasibility analysis carefully examines technical, economic, operational, scheduling, legal and strategic factors of a system to make sure that the system can be successfully developed.
  - **i) Technical feasibility:** It determines whether the proposed system can be developed and implemented using existing technology or whether new technology are required.

ii) **Economic feasibility:** It evaluates the financial aspects of the project by performing a cost-benefit analysis and assessing both tangible and intangible benefits of the system.

iii) **Operational feasibility:** It determines whether there will be any problems in implementing the system in its operational environment.

iv) **Schedule feasibility:** Its studies address the time it will take to complete the project, taking into consideration available resources and additional resources required.

v) **Legal feasibility:** It takes into account factors such as copyrights, patents and state regulations.

vi) **Strategic feasibility:** It look into factors such as ability of the system to increase market share, give the firm a competitive advantage in the marketplace, enhance the productivity of knowledge workers and achieve other strategic goals of the firm.

- **System requirements:** In this phase, system specification are identified by asking who, what, where, when and how. System requirements, therefore, establish various functions of the new system so that it can achieve the objectives established in the problem definition phase.

System Design and Programmming

System design is the determination of the processes and data that are required by a new system. A system of technical, organizational and managerial considerations, along with user preferences and resource constraints, should be taken into consideration before designing a system.

There are two types of design exit:-

- **Logical design:** It identifies the records and relationships to be handled by the system.
- **Physical design:** It proceeds, after logical design is complete, in two steps:
    i. an initial broad-level design
    ii. a detailed design

System Testing and Implementation

Testing is one of the most difficult tasks in system development. It requires creativity, persistence and a thorough understanding of the system. It involves its performance matches system requirements and meets the expectation of end-user.

There are three types of testing:-

1. **Unit testing:** A system is viewed as a collection of program and each program is individually tested.

2. **System testing:** Testing is performed of the entire system to ensure that its component units will function effectively when brought together as a system.
3. **Acceptance testing:** The developers and users test the system under actual or simulated operating condition to ensure that it is acceptable to user.

System Maintenance

It ensures that it continues to meet the growing and changing needs of user through system modifications as and when it requires. System maintenance starts after the system becomes operational, and should last as long as the system is in use. Maintenance is the key to continuing to drive the maximum benefits from a system.

Maintenance costs usually increase with time and when it is more expensive than to develop a new one, the organization must decide to abandon the existing system and build a new system.

It is basically performed for three reasons:

- To correct errors
- To keeps systems current
- To improve the systems

The SDLC is one of the most common and traditional system development methodologies. It is based on a systems approach to problem-solving.

Limitation of SDLC

The system development life cycle is appropriate to those system that are highly structured and routine, such as TPS and MIS. It has some inherent limitations for its inflexible, sequential processes. These are:

1. Structured method are no more applicable, because things done today are fast, cheap and reality checking.
2. Step-by-step approach of the SDLC does not suit the PC-based system.
3. SDLC assumes that system requirements can be frozen during the system analysis phase.
4. The SDLC works better in stable environments, whereas the world of information system today is turmoil. The number and complexity of operating system, user interfaces, network choices, software languages and development tools have grown manifold.

PROTOTYPING

Prototyping is an important component of rapid application development (RAD) is the approach where systems are developed swiftly, without having undergone a complete analysis and specification. The system that is developed is known as the *prototype.* The

process relies on the prototype system itself being an aid to the specification. It also relies on the presence of software tools to produce prototypes quickly.

Types of Prototypes

There are two types of prototypes:

1) **Discardable prototype:** The steps involved in discardable prototype are as follows:
   - **i.** Identify user needs.
   - **ii.** Develop a prototype, using one or more prototyping tools.
   - **iii.** Determine if the prototype is acceptable.
   - **iv.** Code the operational system.
   - **v.** Test the operational system.
   - **vi.** Determine if the operational system is acceptable.
   - **vii.** Use the operational system.
2) **Operational prototype:** For developing this prototype, the first three steps are the same as for discardable prototype. The next step is as follow:

Iv Use the prototype.

This approach is possible only when the prototyping tools enable the prototype to contain all of the essential element of the new system.

Discardable prototype serves as the blue-print for the operational system.

Advantages of Prototyping

User and information experts like prototyping for the following reasons:

- Communications between the systems analyst and user are improved.
- The expert can do a better job of determining the user's needs.
- The user plays a more active role in system development.
- The expert and the user spend less time and effort in developing the system.
- Implementation is much easier because the user knows what to expect.
- A system developed through operational prototyping is capable of easy adaptation.

Disadvantages of Prototyping

- Prototyping is iterative in nature, therefore there is no definite deliverable or completion deadline.
- Code inefficiencies may be a drawback in terms of functionality.
- The computer-human interface provided by certain prototyping tools may not reflect good design techniques.

RAPID APPLICATION DEVELOPMENT (RAD)

A methodology that has the same objective of speedy response to user needs as does prototyping but is broader in scope, is called rapid application development (RAD). RAD is a

term coined by James Martin, computer consultant and auther, for a development life cycle intended to produce system quickly without sacrificing quality. It is an integrated set of strategies, methodologies and tools that exists within an overall framework called information engineering (IE).

Essential Ingredients of RAD

RAD requires four essential ingredients, they are:

1. **Management:** It should be experimenters, who like to do things in a new way or early adapters, who quickly learn how to use new methodologies.
2. **People:** RAD recognizes the efficiencies that can be achieved through the use of several specialized teams. There can be teams for requirements planning, user design, construction, user review and cutover.
3. **Methodologies:** The basic RAD methodology is the RAD life cycle, which consists of four phases:
    (i) Requirement planning
    (ii) User design
    (iii) Construction
    (iv) Cutover

These phases, like the SDLC, reflect the system approach. User play key roles in each phases, participating with information experts.

4. **Tools:** RAD tools consist mainly of fourth generation languages and computer-aided software engineering tools that facilitate prototyping and code generation.

END-USER COMPUTING

It refers to a situation in which the end-user of an information and decision support system are involved in the design, development, maintenance and use of the system and its applications. In end-user computing, users of the system will be expected to play a leading role in most, they are:

- Identification of the need for a system or application.
- Specification of the type of system and software to satisfy that need.
- Purchase/resourceing of the hardware/software.
- Development of the application according to corporate standards.
- Use of the application for business purposes.
- Management of security/backup for the application.

Types of End-User Computing

End-user computing involving a range of individuals with different types of skills, access to and relationship with the computer system.

Skills of end-user: There are six categories and end-user may progress from one category to another. Recognition of this will aid-user management:

- Non-programming end-user
- Command-level end-user
- Programming-level end-user
- Functional support personnel
- End-user support personnel
- Data-processing programmers

Maturity of end-user computing: The model has five stages in which the degree of integration of the application is taken as the measure of maturity.

- Isolation
- Standalone
- Manual integration
- Automated integration
- Distributed integration

Managing End-User Computing

There are three essential activities in managing end-user computing. They are:

1) **Coordination:** It is vital to develop an integrated information environment within the organization and to ensure that all end-user follow standard development policies and procedure.
2) **Support:** Supporting end-user involves providing all the resources that they need to develop, manage, implement and maintain information systems. This includes problems and system selection, providing backup for applications and systems, helping with system development, ensuring that all systems are properly documented, facilitating error resolution, providing information on resources available within organization.
3) **Evaluation:** It provides managers with the information needed to resolve the paradox inherent in simultaneously supporting and controlling, facilitating and restricting, enabling and disciplining, nurturing and regulating and fostering and restraining end-user.

SOFTWARE PACKAGES OUTSOURCING

Software packages designed for specific tasks, such as word processing, financial analysis, inventory control, scheduling, payroll system are available to develop information system. They are the effective tool to quickly develop systems. These software packages range in complexity from very simple to highly sophisticated systems. It reduces system development cost, time and manpower considerably. Outsourcing is the hiring of outside professional

services to meet the in-house needs of an organization. Outsourcing means using external agencies to create, process, manage and maintain information system and to provide the firm with a wide range of information-related services. It can be classified into four broad categories, they are :

1) Strategic focus
2) Economics of scale
3) Market forces
4) Technical consideration

COMPARISON IS DEVELOPMENT METHODOLOGIES

Six different methodologies are there for developing information systems and their advantages and disadvantages. Each methodology has its own strength and weaknesses.

1) SDLC:

Advantages:

- It is suitable for large projects.
- It provides structure and control.

Disadvantages:

- It is expensive, time consuming, inflexible and limited role of user.

2) PROTOTYING:

Advantages:

- High user emphasis, promotes teamwork.
- It reduces wastage, flexible.

Disadvantages:

- Sometimes used as an excuse for poor development methods.
- High level of stress.

3) RAPID APPLICATION DEVELOPMENT

Advantages:

- It involves management, people, methodologies and tools.
- It involves both CASE and prototyping.

Disadvantages:

- The system is delivered in modules, not all at once.
- Goals are set by end-users instead of management.

4) APPLICATION SOFTWARE

Advantages:

- It eliminates some development problems.
- Reduces overhead costs and speed up development.

Disadvantages:

- Fitting the problem to the tools.
- Allows only limited customization.

5) **END-USER MOVEMENT**

Advantages:

- It develop speed and reduces IS backlog.

Disadvantages:

- Lack of control results in laxity and security.

6) OUTSOURCING

Advantages:

- Business can focus on strategic areas.
- It reduces obsolescence and cost-effective.

Disadvantages:

- It eliminates jobs and can cause moral problem.
- Loose control over quality of system.

OTHER TOOLS FOR INFORMATION SYSTEM DEVELOPMENT

Modeling tools plays three important roles in system development, they are:

1) **Communication:** It helps end-users and developers to communicate effectively with each other and are specially useful in representing system specifications.
2) **Experimentation:** It allows developers to experiment with different design and development approaches and learn by trial and error.
3) **Prediction:** It designed to help users and developers predict the impact of a new system on a firm, including the system financial and human resource implication and its effect on competition.

COMPUTER AIDED SOFTWARE ENGINEERING

Computer Aided Software Engineering (CASE) is a category of software for transferring some of the systems development workload from the human developers to the computer. There are many CASE software available in the market that accomplish this objectives to various degrees.

There are four categories:

i. **Upper CASE tools:** It can be used by the firm's executives when they engage in strategic planning.

ii. **Middle CASE tools:** It can be used during the analysis and design phases to document the processes and data of both the existing and new system.

iii. **Lower CASE tools:** It is used during the implementation and use phases to help the programmer develop, test and maintain code.

iv. **Integrated CASE tools:** It offers the combined coverage of the upper, middle and lower CASE tools.

CHALLENGES IN DEVELOPING INFORMATION SYSTEMS

There are two major challenges in system development in most of the organizations:

1. **Backlog:** It occurs when the development of an information system has been delayed because of lack of resources. In many organizations, backlog continues to grow at a rapid rate.
2. **Runaway projects**: The project that are behind schedule and over budget. It is a universal problem. Often runaway project are the result of poor management than of technological complexities.

Review Questions

2 Marks

1. What is structure analysis?
2. What is the difference between analysis and design?
3. What is prototyping?
4. Explain the outsourcing?

5 Marks

1. Explain the five components of an information system and discuss the components in other systems?
2. What are the five different system development methodologies for information systems?
3. What is computer aided software engineering? What are the categories?

7 Marks

1. Discuss five phases of SDLC. Explain the type of system for which SDLC is appropriate.
2. What is end-user computing? Discuss the main features of end-user computing?
3. What do you understand by rapid application development? Explain the essential ingredients of rapid application development.
4. What is prototyping? Write the advantages and disadvantages of prototyping?

2 Marks

1. Explain about electronic accounting?
2. What is computer integrated manufacturing?
3. What are the advantages of marketing information system?
4. What is cross-function system?
5. Explain some of the advantages of information systems to an organization?

5 Marks

1. What do you mean by a marketing information system? Explain three types of marketing information?
2. Describe agile manufacturing. What are the four main characteristics of agile manufacturing?
3. What is GIS? What are the main capabilities of GIS?
4. How is quality information system plays a significant role in quality certification?
5. Explain various functions of financial and accounting information systems?

7 Marks

1. Briefly describe the functional area of business? Explain with a neat sketch, how the data flow in a functional area?
2. Explain the sources of manufacturing information?
3. What do you mean by HRIS? Explain the HRIS application network with diagram?
4. What are the characteristics of R&D information systems? What impacts do these have on the productivity of R&D professionals and on the competitiveness of the firm?
5. Describe the different input and output of marketing information system?

More Questions

Short questions:

1. Definition of MIS?
2. What are the functions of MIS?
3. Explain the information flow in a system?
4. What do you mean by a system in MIS?
5. What is strategic planning?
6. What is management control explain in two sentences?
7. Explain different levels of management in two to three sentences?
8. What are the characteristics of information?

9. What is a system cycle?

10. Explain the transaction processing system in two to three sentences?

11. Explain decision support system into two to three sentences?

12. What are the steps in the transaction processing system?

13. What are the data processing and the revalidation?

14. Explain about the data storage?

15. Explain decision making in MIS in two to three sentences?

16. What types of decisions are taken?

17. What are the criteria for DSS?