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(i) Adaptive System:-

Adaptive System responds to the change in the environment in a way to improve their performance and to survive. For example, human beings, animals.

(j) Non Adaptive System:-

Non Adaptive System is the system which does not respond to the environment. For example, machines.

(k) Permanent System:-

Permanent system persists for long time. For example, business policies.

(l) Temporary System:-

Temporary System is made for specified time and after that they are demolished. For example, A DJ system is set up for a program and it is dissembled after the program.

(m) Natural System:-

Natural systems are created by the nature. For example, Solar system, seasonal system.

(n) Manufactured System:-

Manufactured System is the man-made system. For example, Rockets, dams, trains.

(o) Information System:-

An information system is a system which provides information for decision making and/or control of the organization. Information is a material or non-material entity which reduces uncertainty about a situation or about an event. For example, information that the weather will be

fine tomorrow reduces our uncertainty about if the football game will be played or not. Organizations use information systems to process transactions, reduce costs and generate revenue. For example, banks use information systems to process customer cheques and produce statements.

(P) Real-Time System :-

A real-time system must satisfy the requirement of producing the desired result within a specified time frame (deadline). ~~Such systems are called Real-time~~ If it delivers the correct result, but after the deadline, the system is regarded as having failed. Thus, in a real-time system timely production of result is as important as its execution capability.

Real-time systems provide immediate processing and also respond to user's commands immediately. Some examples of real-time systems are:

(i) Nuclear thermal power plant: Failure to respond in time to an error condition in a nuclear thermal power plant system could result in a melt-down.

(ii) Automated factory: Failure to respond in time to an error condition in the assembly line of an automated factory could result in the production of several defective products which have to be discarded finally.

(Q) Distributed System :-

A distributed computing system consists of a collection of nearly autonomous processors or PCs. that inter-communicate to achieve a computing system. Each processor possesses a private memory and communicates with the rest through an interconnected network.

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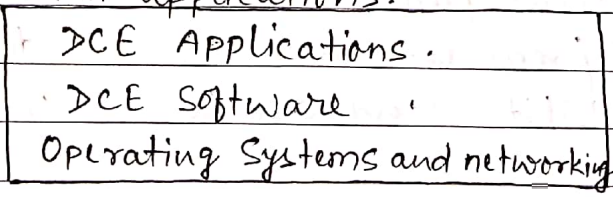
In a distributed computing system, a complex computation can be partitioned into a number of sub-computations. These sub-computations are then run concurrently on different nodes (computers) of a distributed computing system. This helps in solving single complex problems very fast. Also, work load on a single processor can be reduced by moving jobs from overloaded processor to lightly loaded ones. For example, World Wide Web (WWW), Internet (An intranet which is a portion of the internet managed by an organization.)

Major issues to be addressed in designing a distributed system include:

(i) Specifying the topology of the communication network.
(ii) Establishing rules for accessing the shared communication channels.
(iii) Allocating application functions to the processing nodes in the network.
(iv) Establishing rules for processing; communication and synchronization.

Open Software Foundation (OSF) defined Distributed Computing Environment (DCE) which is an integrated set of services and tools that can be installed on top of existing operating systems. DCE then serves as a platform for building and running distributed applications.



As shown in the figure, DCE is a middleware software layered between distributed applications and the operating system. The idea is to interconnect several machines (can be of different make) by a network, add DCE software on top of the operating system of each machine and then build and run distributed applications. The DCE layer hides the

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differences between the machines.

→ Advantages of Distributed Computing System :-

1. Several applications are inherently distributed in nature. For example, in a nationwide organization, the data pertaining to a particular branch office are locally generated at that office. There is a need for frequent and immediate access to locally generated data at each branch office. In addition, there may be a global need to view the entire database.

2. Distributed computing systems help to achieve maximum output in shorter response time. This is because the load is evenly distributed among the multiple processors available in a distributed computing system.

3. Distributed computing systems are very cost-effective. With the increase in power and decrease in price of micro-processors and increase in efficiency of computer networks, distributed computing systems have a much better price-performance ratio than a single large centralized system.

4. If one of the processor fails, the computation can be completed at some other processor and if one of the storage device fails, the information can still be retrieved from another storage device. This ensures the reliability and availability of the system.

5. Distributed computing systems provide better flexibility in meeting user needs. Different computers are more suitable for performing different types of operations. For example, computers with ordinary power are suitable for performing data-processing activities and high power computers are required for performing complex mathematical computations.

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→ Disadvantages of Distributed Computing System :-

1. Security is lower, steps need to be taken to protect confidentiality and integrity of data.
2. Linking heterogeneous(विषमांगी) systems may not always be cost-effective.
3. Maintenance is a problem - as there may be too many different systems on different platforms located at various places all over the globe.

⇒ Development of a Successful System :-

For making a successful system, the following principles should be followed:

1. Both customers and developers should be involved for accuracy in the information.
2. A problem solving approach should be adopted. The classic problem solving approach is as follows:
   (a) Study, understand the problem and its context
   (b) Define the requirements of a solution
   (c) Identify candidate solutions and select the best solution
   (d) Design and implement the solution
   (e) Observe and evaluate the solution's impact and refine the solution accordingly.
3. Phases and activities should be established.
4. For consistent development of a system, some standards should be established.

These standards are:

(a) Documentation standards :-

It should be an ongoing activity during the system development life cycle.

(b) Quality Standards :-

Checks should be established at every phase for ensuring that the output of every phase meets the

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Striking (ध्यान आकर्षित करनेवाली)

business and technology expectations.

© Automated Tool standards :-

Hardware and software platforms should be finalized for the development of Information system. Automated tool standards prescribe (निर्धारित करना) technology that will be used to develop and maintain information systems and to ensure consistency, completeness, and quality.

5. Development of information system should be considered as Capital investment: The developer of an information system should think about several solutions of a particular problem and every solution should be evaluated for cost-effectiveness and risk management.

Cost-effectiveness is defined as the result obtained by striking a balance between the cost of developing and operating an information system and the benefits derived from that system.

Risk management is defined as the process of identifying, evaluating and controlling what might go wrong in a project before it becomes a threat to the successful completion of the project or implementation of the information system.

Multiple feasibility checkpoints should be built into system development methodology. At each checkpoint, the developers should consider the following options:

(a) Cancel the project if it is no longer feasible.

(b) Re-evaluates and adjusts the cost and schedule if project scope is to be increased.

© Reduce the scope if the project budget and schedule are fixed and not sufficient to cover all the project objectives.

6. Divide and Conquer approach is the way of making a complex problem easier. In this approach, the larger problem (system) is divided into smaller problems (subsystem).

⇒ Joint Application Development:-

It is defined as a structured approach in which users, managers, and analysts work together for several days in a series of intensive meetings to specify or review system requirements. The important feature of JAD is joint requirements planning, which is a process whereby highly structured group meetings are conducted to analyze problems and define requirements.

The typical participants in a JAD are as follows:

1. JAD session leader:-

The JAD leader organizes and runs the JAD. This person is trained in group management and facilitation as well as system analysis. The JAD leader sets the agenda and sees that it is met. The JAD leader remains neutral on issues and does not contribute ideas or opinions but rather concentrates on keeping the group on the agenda, resolving conflicts and disagreements, and soliciting all ideas.

2. Users:-

The key users of the system under consideration are vital participants in a JAD. They are the only ones who have a clear understanding of what it means to use the system on a daily basis.

3. Managers:-

The role of managers during JAD is to

approve project objectives, establish project priorities, approve schedules and costs and approve identified training needs and implementation plans.

4. Sponsors:-

A JAD must be sponsored by someone at a relatively high level in the company i.e. the person from top management. If the sponsor attends any session, it is usually at the very beginning or at the end.

5. Systems Analysts:-

Members of the systems analysis team attend the JAD session although their actual participation may be limited. Analysts are there to learn from customers and managers, but not to run or dominate the process.

6. Scribe (लिपिक):-

The scribe takes down the notes during the JAD sessions. This is usually done on a personal computer or a laptop. Notes may be taken using a word processor. Diagrams may directly be entered into a CASE tool.

⇒ Benefits of Joint Application Development:-

1. Actively involves users and management in project development.
2. Reduces the amount of time required to develop a system, and
3. Incorporates prototyping as a means for confirming requirements and obtaining design approvals.
4. The accelerated analysis of the requirements as well as speedy design and efficient delivery ultimately leads to cost savings for the organisation.

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⇒ System Analyst :-

A System analyst is the person responsible for the development of software and hardware solutions to the efficient working of an organization. Analysts study the environment and problems of an organization to determine whether a new information method can provide solutions to the problems. If so, he/she participates in the design and implementation of an appropriate information system and submits a report for development of such new projects for the approval of planners and management. The main job of a system analyst is to provide right type of information, in right quantity at the right time in a cost effective manner to the management or the end user.

⇒ Role of a Systems Analyst :-

The success of an information system development is based on the role of systems analyst. Some important roles of a Systems Analyst are as follows :

1. Change Agent :-

The analyst may be viewed as an agent of change. A candidate system is designed to introduce change and reorientation in how the user organization handles information or makes decisions. Then, it is important that the user accepts change. For user acceptance, analysts prefer user participations during design and implementation. Analyst carefully plans, monitors and implements change into the user domain because people inherently resist changes. In the role of a change agent, Systems Analyst may use different approaches to introduce changes to the user organization.

2. Defining Requirement :-

The analyst's role is to understand the

requirements of the users. This is achieved by various fact finding techniques like interviewing, observation, questionnaire etc. The information should be collected in such a way that it will be useful to develop such a system which can provide additional features to the users apart from the desired.

3. Investigator and Monitor :-

A systems analyst may investigate the existing system to find the reasons for its failure. The role of an investigator is to extract the problems from existing systems and create information structures that uncover previously unknown trends that may have a direct impact on organization. The role of a Monitor is to undertake and successfully complete a project. In this role, analysts must monitor programs in relation to time, cost and quality.

4. Gathering Facts, Data and Opinions of Users :-

After determining the necessary needs and collecting useful information the analyst starts the development of the system with active cooperation from the users of the system. Time to time, the users update the analyst with the necessary information for developing the system. The analyst while developing the system continuously consults the users and acquires their views and opinions.

5. Solving Problems :-

Systems analyst is basically a problem solver. An analyst must study the problem in depth and suggest alternate solutions to management. Problem

solving approach usually incorporates the following general steps:

(i) Identify problem

(ii) Analyse and understand the problem

(iii) Identify alternative solutions and select the best solution.

6. Motivator :-

System acceptance is achieved through user participation in its development, effective user training and proper motivation to use the system. The analyst's role as a motivator becomes obvious during the first few weeks after implementation.

7. Psychologist :-

In system development, systems are built around people. The analyst plays the role of psychologist in the way s/he reaches people, interprets their thoughts, assesses their behaviour and draws conclusions from these interactions. Psychologist plays a major role during the phase of fact finding.

8. Architect :-

As architect the analyst creates a detailed physical design of candidate systems. A systems analyst makes the design of information system architecture on the basis of end user requirements. This design becomes the blue print for the programmers.

These multiple roles require analysts to be orderly, approach a problem in a logical way, and pay attention to details. They prefer to concentrate on objective data, seek the best method, and be highly prescriptive (निर्देशात्मक). They appear

to be cool and studious. They focus on method and plan, point out details, are good at model building, perform best in structured situations.

⇒ Qualifications of a Systems Analyst :-

A systems analyst must fulfil the following requirements:

ⓐ Working knowledge of information technology
ⓑ Computer programming experience and expertise
ⓒ General business knowledge
ⓓ Problem solving skills
ⓔ Communication skills
ⓕ Interpersonal skills
ⓖ Flexibility and adaptability
ⓗ Thorough (पूर्ण) knowledge of analysis and design methodologies.

In summary, the skills that are required can be classified into the following:

1. Analytical skills
2. Technical skills
3. Management skills
4. Interpersonal skills

1. Analytical Skills :-

Analytical skill is the ability to visualize, articulate (व्यक्त करना), conceptualize or solve both complex and uncomplicated problems by making decisions that are sensible. Such skills include demonstration of the ability to apply logical thinking to breaking complex problems into their component parts. Analytical skills can be classified into the following categories:

ⓐ System study

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ⓑ Organizational knowledge
ⓒ Problem identification
ⓓ Problem analysis and problem solving.

ⓐ System Study:-

The first important skill of systems analyst is to know about the system. It involves identification of each of the system's characteristics such as inputs, outputs, processes etc. Information systems can be seen as subsystems in larger organizational systems, taking input and returning output to their organizational environments.

Data flow diagram clearly illustrates inputs, outputs, system boundaries, the environment, subsystems and inter-relationship.

ⓑ Organizational knowledge:-

A person who work in an organization must understand the functions and procedures of the particular organization (or enterprise). Selected areas of organizational knowledge for a systems analyst are given below:

1. How work officially gets done in a particular organization: In this area, knowledge about the following is required:
   (i) Terminology, abbreviations (संक्षिप्त रूप) and acronyms (संक्षिप्त शब्दों के प्रथम अक्षरों से बना शब्द))
   (ii) Policies
   (iii) Standards and procedures
   (iv) Formal organization structure
   (v) Job description.

2. Understanding the organization's internal politics:- In this area, knowledge is required about the following:
   (i) Influence and inclinations (झुकाव, शौक, पसंद) of key personnel

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(ii) Finding the experts in different concerned subject areas
(iii) Critical events in the organization's history
(iv) Informal organization structure
(v) Coalition (सहयोगी संगठन) membership and power structures.

3. Understanding the organization's competitive and regulatory environment:- In this area, knowledge is required about the following:
(i) Government regulations
(ii) Competitors from domestic and international fronts
(iii) Products, services and markets
(iv) Role of technology.

4. Understanding the organization's strategies and tactics:- In this area, the requisite knowledge is as follows:
(i) Short as well as long term strategy and plans
(ii) Values and missions.

(c) Problem Identification :-

A problem can be defined as the difference between an existing situation and a desired situation. So, problem solving is the process of finding a way to reduce differences. In order to identify problems that need to be solved, the systems analyst must develop a model to define the differences between what is present and what ought (चाहिए) to be present.

(d) Problem Analysis and Problem Solving :-

Once a problem has been identified, systems analyst must analyse the problem and determine how to solve it. He/she begins to formulate alternative solutions to the problem. Now alternatives are compared and typically

one is chosen as best solution. Once the analyst, users and management agree on the general suitability of a solution (feasibility), they prepare a plan for implementing it.

2. Technical Skills :-

A systems analyst needs technical skills not only to perform tasks assigned to him/her but also to communicate with the other people with whom s/he works in systems development. The technical knowledge of a Systems Analyst must be updated from time to time. In order to develop computer based information systems, systems analyst must understand information technologies, their potentials and their limitations.

In general, a Systems Analyst should be as familiar as possible with such families of technologies such as:

(a) Microcomputers, workstations, minicomputers, and mainframe computers,
(b) Programming languages,
(c) Operating systems, both for PC's and networks,
(d) Database and file management systems,
(e) Data communication standards and software for local and wide area networks,
(f) System development tools and environments (such as forms & report generators and graphical user interface design tools), and
(g) Decision support systems and data analysis tools.

He/she should know all of the above as well as modern methods and techniques for describing, modeling and building systems.

3. Management Skills :-

When a systems analyst is asked to lead a

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project team then management skills are required. Systems analyst needs to know the process of managing his/her own work and how to use organizational resources in the most productive ways possible. There are four categories of management skills:

(a) Resource management
(b) Project management
(c) Risk management
(d) Change management.

(a) Resource Management:-

A systems analyst must know how to get the most out of a wide range of resources i.e. system documentation, information technology and money. A team leader must learn how to best utilize the particular talents of other team members. He/she must also be able to delegate responsibility, empower(सशक्त बनाना) people to do the tasks they have been assigned.

Resource management includes the following capabilities:

(i) Predicting resource usage (budgeting)
(ii) Tracking and accounting for resource consumption
(iii) Learning how to use resources effectively
(iv) Evaluating the quality of resources used
(v) Securing resources from abusive(अत्यधिक) use
(vi) Relinquishing or releasing the resources when they can no longer be useful or needed.

(b) Project Management:-

A project is defined as a sequence of unique, complex and connected activities having one goal or purpose and that must be completed by a specific time, within budgets and according to specifications.