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Databases System Concept and Design

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Abstract:- The database system is nothing more than a method of maintaining records on computers, i.e., a system with the overarching goal of maintaining and recording information/data. A database system is a comprehensive grouping of linked files that also includes information on how the data in those files should be interpreted. Databases are used to store such connected data. For efficient decision-making, an organization needs accurate and trustworthy data. To this aim, the organization keeps records on the many aspects of preserving relationships among them.

I. INTRODUCTION TO DATABASE

The data must be accurate and trustworthy for a company to make wise decisions. For this, the organization maintains records on various aspects maintaining the relationship between them, such related data is called a database.

A database system is an integrated collection of related files, including descriptions of the interpretation of the data contained therein. Simply described, a database system is a computer-based record-keeping system. A database system is simply a computer-based system with the main objective of storing and maintaining information and data. A well-designed record-keeping system, i.e.

A software program called a database program system (DBMS) enables access to the data kept in a database. The goal of DBMS is to offer a simple and effective method for defining, storing, and retrieving the data that is present in the database. The DBMS interacts with the application software so that different applications and users may access the data in the database. In addition, the DBMS maintains centralized control of the database, prevents fraudulent or unauthorized users from accessing the data, and ensures the confidentiality of the data.

A database is a well-organized grouping of relevant material. Organized information or database serves as a basis from which desired information can be obtained or decisions can be made by further identifying or processing the data. People use many databases in their daily life. Dictionaries, telephone directories, library catalogs, etc. are examples of databases where entries are arranged alphabetically or in hierarchical order.

The value of an entity's attribute can be referred to as "DATA." Any collection of related data items of entities with similar characteristics can be referred to as a '**DATABASE**'. The collection of data does not make it a database; The way it is organized for effective and efficient use makes it a database.

One of the fastest-growing fields in computer and information science is database technology. It emerged in the late sixties because of a combination of different circumstances. There was a growing demand among users for more information provided by computers about the organization's day-to-day operations as well as information for planning and control purposes. The technology that emerged to process several types of data is called **'Database Management Technology'** and the resulting software is known as **'Database Management System' (DBMS),** which they use to manage computer-stored databases or collections of data. We do.

A. Meaning and Definition of Database:

An **entity** can be concrete as a person or a book, or it can be abstract such as a loan, a holiday, or a concept. Units are the basic units of things that can have a concrete existence or the creation of ideas or concepts. An entity set is a group of entities of the same type that share commensurate properties or characteristics.

A set of qualities serves to represent an entity. An attribute is also referred to as a data item, data element, data field, etc. Attributes Each member of an entity set has descriptive properties. A set of related entities becomes an **entity set.**

For example: In a library environment,

The term **'data'** means the value of a fact or more specifically an attribute of an entity. An entity can be an object, idea, event, condition, or condition in general. A set of characteristics describes an entity. Information in a form that can be processed by a raw computer is called data. Data is the raw material of information.

The word **'base'** means the support, basis, or principal component of anything. Hence Aadhaar supports data.

A **'database'** can be conceived of as a system whose base, whose key concept, is a particular way of handling data. In other words, a database is nothing more than a computer basa computer-based record keeping. The purpose of a database is to record and maintain information. The primary function of a database is to serve and support the information system that satisfies the cost.

A database may be defined as "an ordered collection of related data maintained with minimum redundancy, in a way that makes them available to diverse applications," in its most basic form.

B. Functions of Database:

The common theme behind the database is to handle information as a unified whole. The general objective is to make information access easy, quick, affordable, and flexible for the user.

- **Controlled redundancy:** Controlled redundancy occurs when the DBMS makes sure that identical data is consistent across all copies.

  For example, if a new record with Student Number=8 is stored in the database, the DBMS will ensure stored in the database, the DBMS will ensure that this record is for Student Brown.
- **User-friendly:** Menu-Based interfaces. Forms-based interfaces. Graphical user interfaces. Natural language interfaces.
- **Data independence:** The three-schema architecture may be used to explain data independence. The ability to change the schema at one level of the database system without changing the schema at the next higher level is referred to as data independence.
- **Economy** (i.e. more information at a low cost)**:** It is important to use, store, and modify data at a low cost.
- **Accuracy and integrity:** Even though redundancy ends, the database may still contain incorrect data. Centralized control of the database helps to avoid these conditions. The accuracy of the database ensures that the quality and content of the data remain constant. Integrity control data detect inaccuracies where they occur
- **Recovery from failure:** With multi-user access to the database, the system has to recover quickly after it is down without loss of transactions. It helps to maintain data accuracy and integrity
- **Privacy and Security:** For data to remain private, safeguards must be taken to prevent unauthorized access i.e., full authority over operational data. DBMS ensures proper security through centralized control
- **Performance:** This entails the response time for appropriate inquiries for the use of data that depends on the nature of the user-database dialogue.
- **Database retrieval, analysis, and storage:** It simplifies database retrieval, examination, and archiving.
- **Compatibility:** Utility i.e. hardware/software can work with different computers.
- **Concurrency control:** This is a feature that allows simultaneous access to databases while preserving data integrity.
- **Support:** Support complex file structure and access paths. Ex.: mark.
- **Data Sharing:** A database allows data to be shared by any number of users under its control.
- **Standards can be enforced:** The goal of standardizing stored data formats is to facilitate data transfer across systems.

C. Types of Databases:

The database is considered to be a central pool of data that can be shared by a community of users. There are three yardsticks that we can deal with to determine the nature of the data. They are:

- Whether or whether the data is formatted or unformatted.
- Whether the definition of data is of the same size as the data itself.
- Whether the data is active or passive.
- Do these apply to yardstick data? We can classify the database into four types which are
  - Bibliographic Databases
  - Knowledge Databases
  - Graphic-Oriented Databases
  - Decision-making Databases

- **Bibliographic Databases:** data that is free from format (unformatted data). They are composed of textual data which, by its very nature, exhibits little or no format. These databases are frequently used in information systems and libraries. The data here may be composed of such documents with abstracts of books and keykeywordsd key phrases. Through abstracts, one can determine whether the document is of interest. The bibliographic database contains descriptive information about documents, titles, authors Journal names, volume and number, date, keywords, abstract, etc.
- **Knowledge Databases::** used in artificial intelligence applications. The data contained in them is discrete and formatted. These usually contain several types of data, with only very few occurrences of each type. Such databases with data sizes are as large as the definition of data.
- **Graphic-Oriented Databases:** could be used in computer-aided design (CAD). The data in such a database are characterized by being active. This means that data is a process that can execute. Any modification to the data can be made, as the above 1 and 2 cannot be executed on a computer.
- **Decision-making Databases:** Used in corporate management and allied administrative functions. Using the data contained in these databases, one can handle problems such as resource planning and sales forecasting. These databases are characterized by this fact and their data contents are
  - Formatted
  - Far longer than the description
  - Passive

  These decision-making databases are often referred to simply as databases. Database management systems (DBMS) can be classified for example based on the type of database being handled: bibliographic database management system, knowledge database management system, and so on.

D. *Concept of Data Structure:*

The data model determines how the data are organized. A group of data elements that are handled as a unit. Ex. Book description – is a data structure that includes data elements – author name, title, publisher's name, ISBN, and volume.

There are many different approaches to analyzing the logical structure of data in complex databases. Although all DBMSs have a common approach to data management, they vary along the way: the structure of the data.

There are three types of data structures, viz

- List Structure
- Tree / Hierarchical Structure
- Network Structure

a) List Structure:
A list is nothing more than a special data structure composed of data records where the nth record belongs (n−1) and (n−2) only because of the situation. This leads to a one-to-one relationship. This structure is illustrated below.

b) Tree / Hierarchical Structure:
A tree structure is a non-linear multilevel hierarchical structure in which each node can belong to n-nodes at any level below it. But for only one node above it in the hierarchy.

The entry is from above and the direction of search or passing is downwards and there is no branch on the tree trunk (touch).

Data collection as a parent-child relationship. The origin of the data tree is the root. Data located at different levels with a particular branch from the root is called a node. The last node in the chain is called the leaf. Each child has pointers for multiple siblings and just one pointer to parents resulting in one-to-many relationships.

c) Network Structure:
Another type of hierarchical structure is network structure. In this view as in the hierarchy approach, data are represented by records and links. A network, as opposed to a hierarchy, is a more universal organization.

A network structure allows relationships between entities. Here the user views the database as multiple individual record instances that can contain any number of subordinate nodes in a given node.

The network structure is equivalent to a graph structure. It brings many-to-many relationships.

The relationship between different objects is called a set.

II. INTRODUCTION TO DATABASE MANAGEMENT SYSTEM (DBMS)

A DBMS is fundamentally a group of linked data and a set of tools for accessing it. This collection of data is called a **database** that facilitates the storage, retrieval, and management of information.

A DBMS is made up of a set of programs that may access the data as well as a collection of related data. Collection of data, commonly known as databases. The main objective of DBMS is to offer a setting that is both practical and effective to use for obtaining and storing database data.

Large amounts of data may be managed through database systems. The defining of information storage structures and the supply of information manipulation tools are both components of data management.

In addition, database systems must provide for the protection of stored information despite system crashes or unauthorized access attempts. If the data is to be shared among multiple users, the system must avoid possible heterogeneous consequences.

DBMS is a software system that manages databases providing facilities for organizational access and control. DBMS is like an operator for databases. The database is inactive whereas the DBMS is active.

It provides the interface between the data file on disk and the program requesting processing.

A. *Objectives of DBMS:*

A comfortable environment for obtaining and storing database information is the main goal of DBMS. Both single-user and multi-user setups are supported.

- Make provision for the extensive string of pertinent data.
- Make it simpler for users to obtain data.
- Respond to user requests for data quickly.
- Allow quick access to the most current database updates.
- Remove irrelevant info.
- Let several users operate simultaneously.
- Permit expanding the database system.
- safeguard data against deterioration and unwanted access.
- control over the accuracy, reliability, and security of data, etc.

B. *Functions of DBMS:*

According to Codd, a thorough DBMS provides eight essential features. I.e.

- **Data storage, retrieval, and update:** Various users can access the same database, hence DBMS should support multiple user views and enable efficient storage, retrieval, and updating for all users.
- **Data dictionary and directory:** The accessible data dictionary must be kept up to date by the DBMS user.
- **Transaction integrity:** The series of actions that make up a certain commercial activity are referred to as a transaction. The user or application software should be able to establish transaction boundaries, or the logical beginning and end of transactions, to guarantee transaction integrity. then the

DBMS should make changes for successful transactions and reject changes for canceled cancelations.

- **Recovery Services:** DBMS should be able to restore the database in some system failure events. Sources of system failure include operator errors, disk head crashes, and program errors
- **Concurrency Control:** Since a database is shared by multiple users, two or more users may try to access the same data simultaneously. If two users try to update the same data record concurrently, incorrect results may occur. Since safety measures must be built into the DBMS to prevent or overcome intervention attempts.
- **Security mechanisms:** Data must be protected against accidental or deliberate misuse or distraction. DBMS provides mechanisms to control access to data and define what actions can be taken by each user.
- **Data Communication interface:** Users often access databases through remote terminates in telecommunications networks. A telecommunications monitor is used for the process of eliminating the flow of transactions from the remote. The DBMS should provide an interface with one or more telecommunications monitors so that all the necessary tasks can be done and the system assists rather than burdens the end user.
- **Integrity services:** DBMS should provide features that assist users in building the integrity of their data. A variety of edit checks and integrity constraints can be designed in DBMS and its software interfaces. These checks are usually administered through a data dictionary.

C. Components of a DBMS :

A DBMS is a complex structure used to manage, store, and manipulate data and the metadata used to describe data. It is used by a variety of users to retrieve and manipulate data under its control. A system is composed of sets of interrelated components.

- At least one person who owns and is responsible for the database.
- A set of rules and relationships that define and control the interactions between elements of a database.
- People who put data into the database.
- Those who obtain data from the database.
- Database itself.

III. DATABASE DESIGN

Database design is the design of the database structure that will be used to store and manage data rather than the design of DBMS software. Once the database design is complete, the DBMS handles all the complex activities needed to translate the designer's view of the structures into structures that are usable for the computer.

A poorly designed database generates errors that are likely to lead to poor decisions.

A poor database design can ultimately correct itself: organizations using poorly designed databases often fail because their managers do not have access to timely (or even correct) information, thereby dominating poor database design.

The availability of DBMS makes it possible to deal with far more sophisticated uses of data resources if the database is designed to use that available power. The type of data structures created within the database and the range of relationships between them play a powerful role in determining how effective DBMS is. Therefore, database designs become an important activity in the database environment.

The database design is greatly simplified when we use the model. A database model is a collection of logical constructs used to represent the data structure and the data relationships found within the database i.e. simplified abstraction of real-world events or situations. If the models are not logically sound, the database designs derived from them will not deliver the promise of the database system to effective information drawn from an efficient database. The foundation of excellent applications is good database designs, which are produced by good models.

A. Goals of Database Design:

Database design usually involves defining the logical characteristics of a database and designing the layout of the database file structure.

The main objective of database design is

- To meet the specified user and information content requirements of the application.
- Providing a natural and easy way to understand the structure of information.
- To satisfy processing demands and any performance goals such.
  - ➢ Response time
  - ➢ Processing time
  - ➢ Storage space

The main objective of database design is to ensure that the database efficiently meets the reporting and information needs of users.

The database ought to be created so that:

- It eliminates or reduces data redundancy.
- Preserves the data's independence and integrity.

B. Logical and Physical View of Database:

Computer Application Program DBMS Operating System (IOCS)* Database

User logical (View) Program logical View Overall logical View Physical View

1 2 3

1* IOCS- Input/ Output Control System

In database design, multiple views of data must be considered by individuals who use them. There are three ideas:

- The overall logical view
- The program's logical view
- Physical view

The logical view is what the data looks like, regardless of how they are stored while.

The physical view is the way data exists in physical storage, it is related to how data in storage is stored, accessed, or related to other data.

There are THREE logical perspectives, ONE physical view, and FOUR views of the data.

The logical view is the user's view ew, the programmer's view, and the overall logical view (schema).

The overall logical view (schema) helps the DBMS decide what data the application should act on in the storage required by the program.

A database management system (DBMS) is a group of linked files and a collection of software tools that let users access and alter these files. A major objective of the database system is to provide users with an abstract view of the data i.e. the system hides some details of how the data is stored and maintained.

C. An Architecture for a Database System :

a) Data Abstraction:
Many database system users are not computer-trained, developers hide complexity from users through multiple levels of abstraction, to simplify users' interaction with the system. The three general layers of architecture are internal, conceptual, and outward.

- **Internal / Physical level:** The internal level is closest to physical storage i.e. related o the way the data is stored. It is the lowest level of abstraction that explains how data is stored. Complex low-level data structures are defined in depth at the physical level.
- **Conceptual /Logical levell:** There is a "level of scalar" between the inner and the outer. The next higher level of abstraction describes what data is stored in the database, and what relationships exist between those data. The entire database is thus described in terms of a small number of relatively simple structures. Database administrators (DBAs) utilize this level to determine what data should be maintained in the database.
- **External / View level:** The external level, which is connected to how specific users perceive the data, is the one that is closest to the users. This is the most abstract level, although it only describes a portion of the whole database. Despite the use of simple structures at the logical level, some complexity remains due to the large size of the database. Many users of database systems will not be concerned with all this information. Instead, such users need to access only a portion of the database so that their interaction with the system is simple, with the visual level of abstraction defined. The system is capable of offering several perspectives for the same database.

If the external level is related to individual user views, the conceptual level can be thought of as defining the community user view. In other words, there will be several "external views," each of which will have a more or less abstract representation of some part of the database, and a single "conceptual view," with a similar abstract representation of the database in its entirety.

Similarly, there will be a single "internal view", which represents the total database stored.

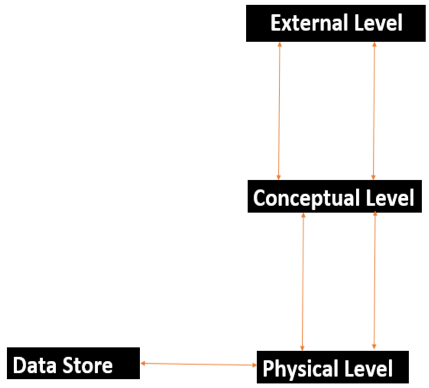

Fig. 1: The three tiers of a DBMS's architecture

b) Instances and schemes:
As data is added or removed, databases evolve. The collection of information stored in a database at a particular moment is called an instance of a database. The database schema refers to the general layout of the database. Schemas are sometimes changed, if at all.

A schema describes the perspective at each of these levels. A schema is an outline or a scheme that describes the records and relationships present in the scene. The term schema is used in the database literature for plural rather than schemata, grammatically correct words. Additionally, the schema explains how entities at one level of abstraction can be translated to the following level Database systems consist of several schemas, divided according to the level of abstraction (which we discussed). At the lowest level is the physical schema; At the intermediate level is the logical schema, And there is a subschema at the highest level.

In general, database systems support a physical schema, a logical schema, and several sub-schemas.

c) Data independence
The ability to modify the schema definition in one level without affecting the schema definition in the next higher level is called data independence. There are two levels of data independence namely.

- Physical data independence: The application can modify the physical schema without rewriting the program. Modifications at the physical level are sometimes necessary to prove performance.

- Logical data independence The application hacanodify logical schemas without rewriting the program. Modifications at the logical level are sometimes necessary whenever the logical structure of the database is changed.
- Logical data independence is more difficult to achieve than physical data independence because application programs are heavily dependent on the logical structure of the data they access.

d) Database languages:
A subset of the overall language, the data sublanguage (DSL) is related to database objects and operations. DSL is a user/user. Is the query language that is embedded in the host language. In principle, any given DSL is a combination of two languages:

- **Data Definition Language (DDL):** is what the database schema specifies. A collection of definitions describes the database schema. This definition includes all entities and their respective characteristics as well as relationships between entities. The result of a compilation of DDL statements is a set of tables e. data is stored in a special file called a dictionary or data directory, which receives the metadata i.e. data about the data. This file is consulted before reading or modifying the actual data in the database system.

  The storage structure and access methods used by database systems are specified by a set of definitions in a particular type of DDL called data storage and definition language.
- **Data Manipulation Language (DML):** This is the one that is used to express data queries and updates i.e. manipulating the data in the database. Helps in DML
  - ➢ Retrieval of information stored in a database
  - ➢ Insertion of new information into a database
  - ➢ Deletion of information from the database
  - ➢ Modification of information stored in an existing database.

A DML is a language that enables users to access or manipulate data arranged by appropriate data models.

There are two types:

- Procedural DMLs: The user needs to specify what data is needed and how to obtain those data.
- Non- Procedural DMLs: The user needs to specify what data are needed without specifying how to obtain those data.

- **Mapping:** There are two levels of mapping:
  - ➢ one between the system's conceptual and exterior levels; and
  - ➢ second between conceptual and internal levels.
  - ➢ The internal mapping defines the correspondence between the conceptual view and the stored database. External/conceptual mapping defines the correspondence between a particular external view and a conceptual view.

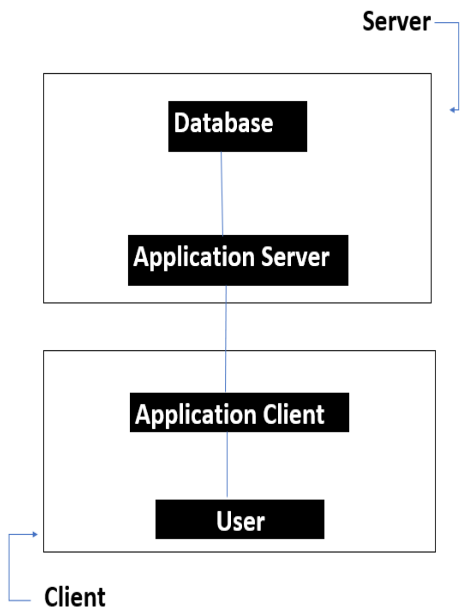

Fig. 2: Database System Architecture

The program that controls all database access is known as a DBMS. What happens conceptually is the following:

- A user issues an access request using some special data manipulation language (DML);
- Intercepts and interprets DBMS requests;
- DBMS inspects, in turn, external schema, external/external schema. Conceptual mapping, conceptual schema, conceptual/conceptual mapping, etc. internal mapping, and storage structure definition; and
- DBMS performs the necessary operations on the stored database.

D. Storage Structures:

Storage structures describe how data can be organized into secondary storage i.e. direct access media such as disk packs, drums, etc.

User operations are expressed (via DML) in terms of external records and must be converted by DBMS to corresponding operations on internal or stored records. These latter operations must be converted into operations at the actual hardware level, i.e. to perform operations on physical records or blocks.

The component responsible for this internal/physical conversion is called the access method. Its function is to hide all device-dependent details from the DBMS and present the DBMS with a stored record interface. Thus, the stored interface is equivalent to the internal level in the same way that the user interface is equivalent to the exterior level. The real hardware level corresponds to the physical record interface.

The stored record interface allows the DBMS to view the storage structure as a collection of stored files, each containing all occurrences of one type of stored record (see architecture of DBMS).

In particular, the DBMS knows (a). What stored files exist, and, for each, (b) the structure of the corresponding stored record, (c) the stored field(s), if any, on which it is indexed, and (d) the stored field(s), if any, can be used as a search argument for direct access. Each of these details will be included in the storage structure specification.

E. Phases in Database Design:

a) First phase:

The overall objective of the database preliminary study is that

- Analyze organization/system state
- Define problem and constraints
- Define objectives
- Define scope and boundaries.

b) Second phase:

The second stage focuses on the design of database models that will support organizational operations and objectives.

In this step, we can identify six main steps of database design:

- Requirements collection and analysis
- Conceptual database design
- Choice of DBMS
- Data model mapping
- Physical database design
- Database system implement

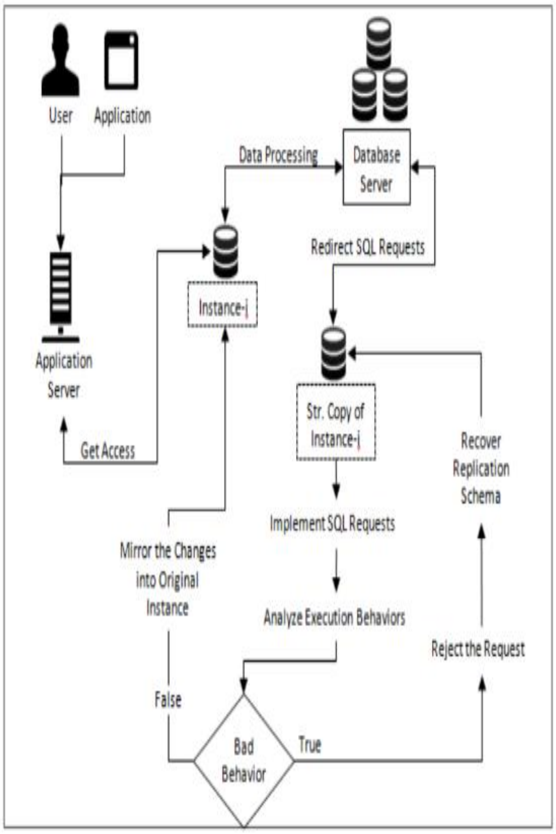

Fig. 3: Procedure flow in database design

- **Conceptual Design:** It consists of two parallel activities.
  - ➢ Conceptual scheme design
  - ➢ Transaction design

  - ➢ Phase 1's data requirements are examined in the first conceptual design activity, which also results in a conceptual database plan.

  - ➢ The second activity transaction design examines the database applications analyzed in Step 1 and produces high-level specifications for presentation. The goal of step 2 is to produce a conceptual schema for the database i.e. independent of a specific DBMS.

    In this step, data modeling is used to create an abstract database structure that depicts real-world objects most realistically. Conceptual models must embody a clear understanding of the transaction or system and its working areas. This design is software and hardware-independent

- **Data Analysis and Requirements:** Before we can design the database effectively, we must know the expectations of the users and the intended users of the database in as much detail as possible. The process of identifying and analyzing intended users is called "collection and analysis of requirements."

  This first step in conceptual design is to discover data element characteristics. Appropriate data element characteristics are those that can be done with inappropriate information. So designers have to focus on:
  - ➢ information needs;
  - ➢ information users ;
  - ➢ information sources;
  - ➢ information constitution.

  To develop an accurate data model, the designer must have a complete and complete understanding of the organization's data. Consequently, the designer must identify the goals and objectives, and rules of the organization and analyze their impact on the nature, role, and scope of the data.

- **Entity-Relationship modeling and normalization:** Before creating the E-R model (data model) the designer must communicate and apply the appropriate standards used in the documentation of the design. Standardizing paperwork can prevent future communication problems. And bad design work is frequently the result of communication difficulties.

- **Data model verification:** The E-R model must be verified against the proposed system processes to confirm that the intended processes can be supported by the database model.

  Validation requires that a series of tests against the model can be run through:

- ➢ Views of end-user data and the necessary select, insert, update, and delete operations, as well as queries and reports.
- ➢ Access path, security, and concurrency control.
- ➢ System/ Business-imposed data requirements and constraints.

- **Distributed Database Design:** A distributed database stores logically related data in two or more physically independent sites connected through a computer network. The design parts of the database can reside in different locations. The processes accessing the database may vary from place to place.

- **DBMS Software selection:** The selection of DBMS software is important for the smooth operation of the information system. As a result, it is important to carefully consider both the benefits and drawbacks of the suggested DBMS software. The end user should be made aware of the limitations of both DBMS and the database to avoid false expectations.

  The factors that influence the purchasing decision of DBMS are: (i). cost, (ii). Features and equipment of DBMS, (iii). Underlying data model, (iv). portability, and (V). DBMS hardware requirements.

- **Logical Design:** Logical design is used to translate the conceptual design into internal models for selected DBMSs (e.g. DB2, SQL Server, Oracle, IMS, Informix, Access, Access, and so on). The logical design follows the decision to use a specific database model (hierarchical, networked, or relational). Once the database model is identified, we can map the conceptual design onto a logical design that is consistent with the selected database model. At this stage, logical design is software dependent. This involves mapping all objects in the model to specific constructs used by the selected database software. During the logical design stage, the license for using the database is also determined.

  In summary, the logical design translates software-independent conceptual models into software-dependent models by defining appropriate domain definitions, required tables, and required access restrictions.

- **Physical Design:** The step is now set to define physical requirements that allow the system to function within the selected hardware environment.

  The process of choosing the database's data storage and data access features is known as physical design. Storage characteristics are a function of the type of devices supported by the hardware, the type of data access methods supported by the system, and DBMS. The physical design affects not only the location of the data in the storage device(s) but also the performance of the system.

- **Database system implementation:** After the database is created, the data must load into the database tables. If the data is stored in a format different than that currently required by the new DBMS, the data must be converted before it is loaded.

  During the implementation and loading phase, we should also address performance, security, backup and recovery, integrity, company standards, and concurrency control.

IV. APPLICATION OF DBMS TO LIBRARY AND INFORMATION SYSTEM

There are two software packages related to library and information systems. i.e

- **DBase III Plus:** One of the most popular DBMS on personal computers. This is the third major version of the classic Debase database management system series from Ashton Tate. It is a powerful and flexible system for storing, organizing, analyzing, and retrieving information on microcomputers.

  It can be negotiated by two modes: an auxiliary/auxiliary mode. There is a menu mode and a second in command mode.

- **CDS/ISIS:** Menu is the driven generalized information storage and retrieval system specifically designed for the computerized management of structured non-numerical databases.

  It consists of 8 programs written in the Pascal language. In India, it is distributed by the National Information System for Science and Technology (NIST) of the Department of Scientific and Industrial Research, New Delhi, on behalf of UNESCO.

V. CONCLUSION

The information technology sector in India is growing at a very fast rate. Recently, new types of requirements in database processing capabilities are increasing in many areas of application. At the same time, various sophisticated techniques and powerful modeling capabilities have been developed.

The database development process includes information gathering, selection of quality information, calculation and consolidation or abstract in the case of bibliographic databases, coding, structuring compiled data into a database format, data entry and editing, updating, quality control, and maintenance at all levels.

Such databases express a concept that has gradually evolved and changed over the years since the term was coined. The implementation of the concept has become possible by improving hardware and software technology as increasingly regarded as an important corporate resource.

Large in size and rich in natural resources in India. Yet information is scarce. It is not that information is not generated, but is locked on papers to be kept in files in the custody of various government organizations and research institutes. Given the liberalization of the Indian economy and globalization of trade, India needs a database. Increasing international interaction requires the formation of relevant and viable databases

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