Database Management System -I

Introduction to Database Management System

- **Information** is the result of processing raw data to reveal its meaning

- A **database** is a shared, integrated computer structure that stores a collection of

  - End user data, that is, raw facts of interest to the end user

  - Metadata, or data about data, through which the enduser data are integrated and managed

DBMS

DBMS is a collection of programs that manages the database structure and controls access to the data stored in the database.

Role of DBMS :

- The DBMS serves as the intermediary between the user and the database.

- The only way to access the data in the files is through the DBMS

- The DBMS hides much of the database's internal complexity from the application programs and users.

Advantages

- **Improved data sharing** : DBMS enables the data in the database to be shared among multiple applications or users.

- **Improved data security.** The more users access the data, the greater the risks of data security breaches.A DBMS provides a framework for better enforcement of data privacy and security policies.

- **Better data integration :** It becomes much easier to see how actions in one segment of the company affect other segments.

- **Minimized data inconsistency :** Data inconsistency exists when different versions of the same data appear in different places.The probability of data inconsistency is greatly reduced in a properly designed database.

- **Improved data access :** The DBMS makes it possible to produce quick answers to the queries.

- **Improved decision making :** Better-managed data and improved data access make it possible to generate better quality information, on which better decisions are based.

- **Increased end-user productivity :** The availability of data, combined with the tools that transform data into usable information, empowers end users to make quick, informed decisions that can make the difference between success and failure in the global economy.

The Database System Environment

- The term database system refers to an organization of components that define and regulate the collection, storage, management, and use of data within a database environment

- The database system is composed of the five major parts i.e hardware, software, people, procedures, and data.

- **Hardware.** Hardware refers to all of the system's physical devices; for example, computers storage devices, printers, network devices , and other devices

- **Software.** To make the database system function fully, three types of software are needed: operating system software, DBMS software, and application programs and utilities.

  - Operating system software manages all hardware components and makes it possible for all other software to run on the computers. Examples of operating system software include Microsoft Windows, Linux, Mac OS, UNIX, and MVS.

  - DBMS software manages the database within the database system. Some examples of DBMS software include Microsoft SQL Server, Oracle Corporation's Oracle, MySQL AB's MySQL and IBM's DB2.

  - Application programs and utility software are used to access and manipulate data in the DBMS and to manage the computer environment in which data access and manipulation take place.

- **People.** This component includes all users of the database system. On the basis of primary job functions, five types of users can be identified in a database system: systems administrators, database administrators, database designers, systems analysts and programmers, and end users.

  - **System administrators** oversee the database system's general operations.

  - **Database administrators**, also known as DBAs, manage the DBMS and ensure that the database is functioning properly.

  - **Database designers** design the database structure. If the the architecture is poor then the DBA or System adminstrator cannot produce produce a useful database environment

  - **Systems analysts and programmers** design and implement the application programs. They design and create the data entry screens, reports, and procedures through which end users access and manipulate the database's data.

  - **End users** are the people who use the application programs to run the organization's daily operations. .

- **Procedures.**
  - Procedures are the instructions and rules that govern the design and use of the database system.
  - Procedures also are used to ensure that there is an organized way to monitor and audit both the data that enter the database and the information that is generated through the use of that data.

- **Data.**
  - The word data covers the collection of facts stored in the database.
  - the determination of what data are to be entered into the database and how that data are to be organized is a vital part of the database designer's job.

Types of database users

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DBMS Functions

A DBMS performs several important functions that guarantee the integrity and consistency of the data in the database.

- **Data dictionary management.** The DBMS stores definitions of the data elements and their relationships (metadata) in a data dictionary.

- **Data storage management.** The DBMS creates and manages the complex structures required for data storage,thus relieving you from the difficult task of defining and programming the physical data characteristics.

- **Data transformation and presentation.** The DBMS transforms entered data to conform to required data structures.

- **Security management**. The DBMS creates a security system that enforces user security and data privacy.

- **Multiuser access control.** To provide data integrity and data consistency, the DBMS uses sophisticated algorithms to ensure that multiple users can access the database concurrently without compromising the integrity of the database

- **Backup and recovery management.** The DBMS provides backup and data recovery to ensure data safety and integrity

- **Data integrity management.** The DBMS promotes and enforces integrity rules, thus minimizing data redundancy and maximizing data consistency.

- Database access languages and application programming interfaces. The DBMS provides data access through a query language.

A **query language** is a nonprocedural language—one that lets the user specify what must be done without having to specify how it is to be done.

Structured Query Language (SQL) is the de facto query language and data access standard supported by the majority of DBMS vendors.

- **Database communication interfaces.** Current-generation DBMSs accept end-user requests via multiple,different network environments.

Types of Database

Databases can be classified according to the number of users, the database location(s), and extent of use.

- The number of users determines whether the database is classified
  - single-user
  - multiuser
- Location might also be used to classify the database. It can be classified as
  - centralized
  - distributed
- The most popular way of classifying database is based on how they will be used
  - operational database
  - data warehouse

Types of Databases

1. **Single-user database** :

   - It supports only one user at a time. In other words, if user A is using the database, users B and C must wait until user A is done.

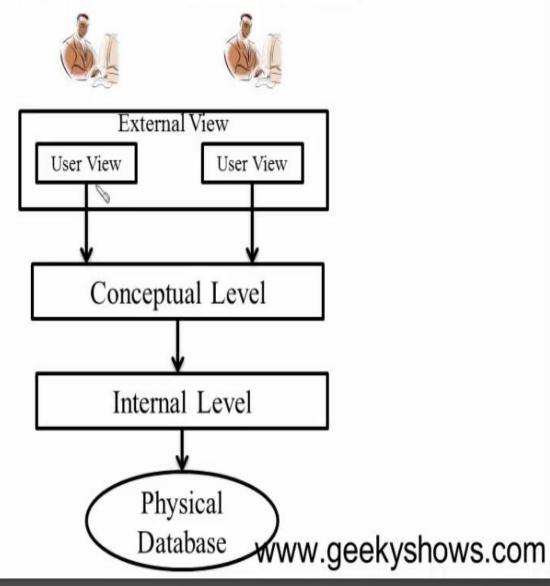   - A single-user database that runs on a personal computer is called a **desktop database.**

2. **Multiuser database**

   - It supports multiple users at the same time.

   - When the multiuser database supports a relatively small number of users (usually fewer than 50) or a specific department within an organization, it is called a **workgroup database**.

   - When the database is used by the entire organization and supports many users (more than 50, usually hundreds) across many departments, the database is known as an **enterprise database.**

3. **Centralized database**: A database that supports data located at a single site is called a centralized database.

4. **Distributed database :** A database that supports data distributed across several different sites is called a distributed database.

5. **Operational database :** A database that is designed primarily to support a company's day-to-day operations is classified as an **operational database** (sometimes referred to as a transactional or production database).

6. **Data warehouse** : This type of database focuses primarily on storing data used to generate information required to make tactical or strategic decisions

Architecture of DBMS

- Logical DBMS Architecture or Three Level Architecture of DBMS
  - The External or View Level
  - The conceptual or Global Level
  - The Internal or Physical Level
- Physical DBMS Architecture

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- Three level architecture is also called three schema architecture

- This framework is used for describing the structure of specific database systems (small systems may not support all aspects of the architecture)

External View

- Highest or Top level of data abstraction (No knowledge of DBMS S/W and H/W or physical storage).

- This level is concerned with the user.

- Each external schema describes the part of the database that a particular user is interested in and hides the rest of the database from user.

- There can be n number of external views for database where n is the number of users.

- All database users work on external level of Dbms

Conceptual View

- This level is in between the user level and physical storage view.

- It hides the details of physical storage structures and concentrates on describing entities, data types, relationships, user operations, and constraints.

Internal View

- It is the lowest level of data abstraction. (it has the knowledge about s/w and h/w)

- At this level, it keeps the information about the actual representation of the entire database i.e. the actual storage of the data on the disk in the form of records or blocks.

- It is close to the physical storage method.

- The internal view is the view that tells us what data is stored in the database and how.

Working of three level architecture
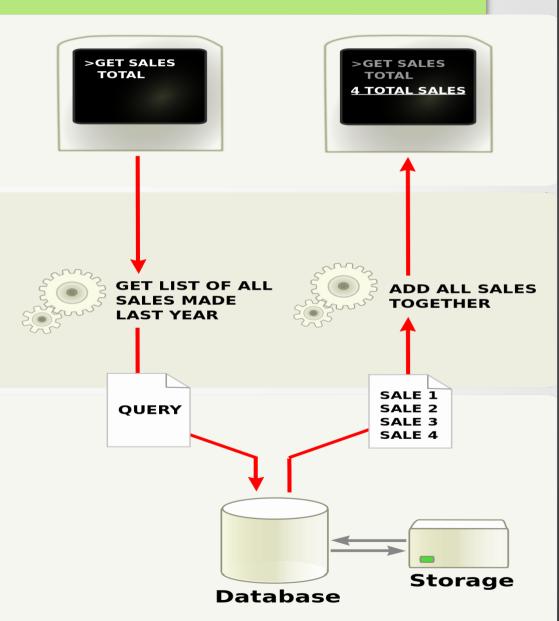
Presentation tier

The top-most level of the application is the user interface. The main function of the interface is to translate tasks and results to something the user can understand.

>GET SALES TOTAL

>GET SALES TOTAL
4 TOTAL SALES

Logic tier

This layer coordinates the application, processes commands, makes logical decisions and evaluations, and performs calculations. It also moves and processes data between the two surrounding layers.

GET LIST OF ALL SALES MADE LAST YEAR

ADD ALL SALES TOGETHER

Data tier

Here information is stored and retrieved from a database or file system. The information is then passed back to the logic tier for processing, and then eventually back to the user.

QUERY

SALE 1
SALE 2
SALE 3
SALE 4

Database

Storage

Disadvantages of DBMS

- **Increased costs :** The cost of maintaining the hardware, software, and personnel required to operate and manage a database system can be costly

- **Management complexity :** databases systems hold crucial company data that are accessed from multiple sources, security issues must be assessed constantly.

- **Maintaining currency :** To maximize the efficiency of the database system, you must keep your system updated.

- **Vendor dependence :** Given the heavy investment in technology and personnel training, companies might be reluctant to change database vendors.

- **Frequent upgrade/replacement cycles :** DBMS vendors frequently upgrade their products by adding new functionality.