

Database Management System

A *database management system (DBMS)* is a collection of programs that enables users to **create and maintain databases and control all access to them**. The primary goal of a DBMS is to provide an environment that is both convenient and efficient for users to retrieve and store information.

The DBMS facilitates the processes of *defining, constructing, manipulating* and *sharing* databases among various users and applications.

Defining a database involves specifying the data types, structures, and constraints of the data to be stored in the database. The database definition or descriptive information is also stored by the DBMS in the form of a database catalog or dictionary; it is called **meta-data**, as shown in figure (1).

Constructing the database is the process of storing the data on some storage medium that is controlled by the DBMS.

Manipulating a database includes functions such as querying the database to retrieve specific data, updating the database, and generating reports from the data.

Sharing a database allows multiple users and programs to access the database simultaneously.

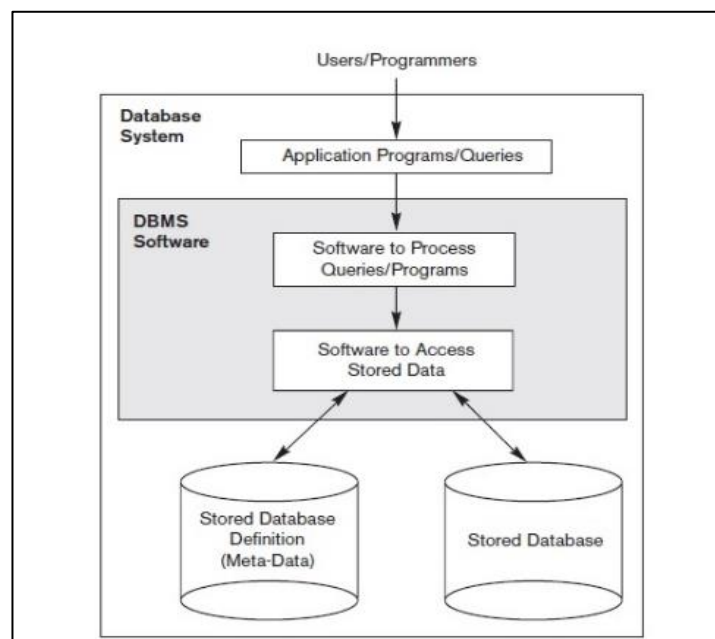


Figure (1): A simplified database system environment.

Advantages of using the DBMS

1- Control of data redundancy

In the database approach, ideally, each data item is stored in only one place in the database. In some cases, data redundancy still exists to improve system performance, but such redundancy is controlled by application programming and **kept to minimum** by introducing as little redundancy as possible when **designing the database**.

2- Enforcement of integrity constraints

Database management systems must provide the ability to define and enforce certain constraints to **ensure that users enter valid information and maintain data integrity**. A *database constraint* is a restriction that dictates what can be entered in a table such as a *Data type*, for example, determines the sort of data permitted in a field, for example numbers only. *Data uniqueness* such as the primary key ensures that no duplicates are entered. Constraints can be simple (field based) or complex (programming).

3- Restriction of unauthorized access

Not all users of a database system will have the **same accessing privileges**. For example, one user might have *read-only*, while another might have *read and write privileges*. For this reason, a database management system should provide a security subsystem to create and control different types of user accounts and restrict unauthorized access.

4- Query Language

DBMS is prepared with query language, which makes it more efficient to retrieve and manipulate data. A user can apply as many and as **different filtering options** as required **to retrieve a set of data**.

5- Transaction processing

A database management system must include **concurrency control subsystems**. This feature **ensures that data remains consistent and valid** during transaction processing even if several users update the same information.

6- Backup and recovery facilities

Backup and recovery are methods that allow to **protect data from loss**. The database system provides a backing up and recovering data. If a hard drive fails and the database stored on the hard drive is not accessible, the only way to recover the database is from a backup. If a computer system fails in the middle of a complex update process, the recovery subsystem is responsible for making sure that the database is **restored to its original state**.