DBMS Basic Concepts

DBMS

- Database Management System
- Term Database requires understanding of data and information
- Data: It can be anything like name, place or number, etc. Data usually refers to raw data, or unprocessed data.
- Information: It is organized or classified data so that it has some meaningful values to the receiver.
 - Information is the processed data on which decisions and actions are based.

Difference between Data and Information?

Data	Information
Data is raw facts and figures	Information is a processed form of data
For example: 12 is data	For example: When 12 is stored in row column form as shown it is information. Age 12
Data are atomic level pieces of information	Information is a collection of data
Data does not help in decision making	Information helps in decision making

Database

- A database is a shared collection of logically related data designed to meet the information needs of an organization
- The related information when placed is an organized form makes a database.
- The organization of data/information is necessary because unorganized information has no meaning.

Purpose of DBMS

An example

University Database:

Data about students, faculty, courses, research-laboratories, course registration/enrollment etc. Reflects the state of affairs of the academic aspects of the university.

Purpose: To keep an accurate track of the academic activities of the university.

Purpose of DBMS

Before DBMSs were introduced, organizations usually stored information in file processing system which has a number of disadvantages:

- Data redundancy and inconsistency
- Difficulty in accessing data
- Data isolation
- Integrity problems
- Atomicity problems
- Concurrent-access anomalies
- Sécurity problems

Database Management System

- DBMS A database management system is the software system that allows users to define, create and maintain a database and provides controlled access to the data.
- A database management system (DBMS) is basically a collection of programs that enables users to store, modify, and extract information from a database as per the requirements.

Operations on databases

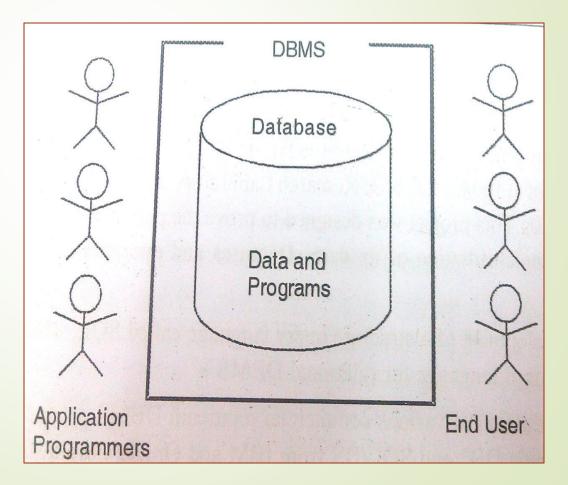
- To add new information
- To view or retrieve the stored information
- To modify or edit the existing
- To remove or delete the unwanted information
- Arranging the information in a desired order etc.

Applications of DBMS

- Banking: all transactions
- Airlines: reservations, schedules
- Universities: registration, grades
- Sales: customers, products, purchases
- Online retailers: order tracking, customized recommendations
- Manyfacturing: production, inventory, orders, supply chain
- Human resources: employee records, salaries, tax deductions

mponents of Database

- Five major components in database system environment:
 - Hardware
 - Software
 - Data/
 - Users
 - Procedures



Components of Database System

- Hardware: It is the actual computer system used for keeping and accessing the database. DBMS hardware consists of secondary storage devices like hard disks.
- Software: It is the actual DBMS. Between the physical database itself and the users of system is a layer of software, called DBMS.
- Data: Data acts as the bridge between the machine components and user components.

Components of Database System

- Users: There are number of users who can access or retrieve data on demand using the applications and the interfaces provided by DBMS. The users can be:
 - Naïve users
 - Online users
 - Application Programmers
 - Sophisticated Users
 - Data base Administrator (DBA)

Components of Database System

Procedures: It refers to the instructions and rules that govern the design and the use of the database. The users of the system and the staff that manage the database requires documented procedures on how to use or run the system.

Different Types of Database Users in DBMS

Application Programmers

- As its name shows, application programmers are the one who writes application programs that uses the database. These application programs are written in programming languages like COBOL or PL (Programming Language 1), Java and fourth generation language. These programs meet the user requirement and made according to user requirements. Retrieving information, creating new information and changing existing information is done by these application programs.
 - They interact with DBMS through DML (Data manipulation language) calls. And all these functions are performed by generating a request to the DBMS. If application programmers are not there then there will be no creativity in the whole team of Database.

End Users

End users are those who access the database from the terminal end. They use the developed applications and they don't have any knowledge about the design and working of database. These are the second class of users and their main motto is just to get their task done. There are basically two types of end users that are discussed below.

Casual User

These users have great knowledge of query language. Casual users access data by entering different queries from the terminal end. They do not write programs but they can interact with the system by writing queries.

Naive

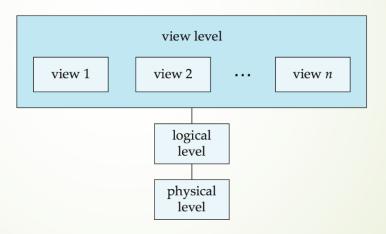
Any user who does not have any knowledge about database can be in this category. There task is to just use the developed application and get the desired results. For example: Clerical staff in any bank is a naïve user. They don't have any dbms knowledge but they still use the database and perform their given task.

- Sophisticated Users They are database developers, who write SQL queries to select/insert/delete/update data. They do not use any application or programs to request the database. They directly interact with the database by means of query language like SQL.
- **DBA (Database Administrator)**
- DBA can be a single person or it can be a group of person. Database Administrator is responsible for everything that is related to database. He makes the policies, strategies and provides technical supports.
- System Analyst
- System analyst is responsible for the design, structure and properties of database. All the requirements of the end users are handled by system analyst. Feasibility, economic and technical aspects of DBMS is the main concern of system analyst. x

Levels of Abstraction(view of data)

- Physical level: describes how a record (e.g., customer) is stored.
- Logical level: describes what data stored in database, and the relationships among the data. DBA, who decides what information to keep in the database, use the logical level of abstraction.
- View level: describe only part of database. application programs hide details of data types. Complexity remain due to variety of information stored. Views can also hide information (such as an employee's salary) for security purposes.

View of Data



An architecture for a database system

- describes that part of the database that is relevant to each user.
 - For example, one user may view dates in the form (day, month, year), while another may view dates as (year, month, day).
- Conceptual or logical level: It is the community view of the database. This level describes what data is stored in the database and the relationships among the data.
- It represents:
 - All entities, their attributes, and their relationships;
 - The constraints on the data;
 - Security and integrity information.
- database on the computer. This level describes how the data is stored in the database.

Data abstraction

A major purpose of database system is to provide user with an abstract view of data. That is, system hides certain details of how the data are stored and maintained.

Data models, Schemas, and Instances

- Data model:-A set of concepts to describe the structure of a database, and certain constraints that the database should obey.
- Schema:- The overall description of the database is called the Database Schema.
 - A schema is defined as an outline or a plan that describes the records and relationships existing at the particular level.
- Instance: Data in the database at a particular moment in time.

Database Languages

Database languages are used to create and maintain database on computer.

- 1. Data Definition Language(DDL): It is a language that allows user to define data and their relationship to other types of data.
 - CREATE
 - ALTER
 - DROP
 - TRUNCATE
 - RÉNAME
- DRÓP vs TRUNCATE
- Truncate is normally ultra-fast and its ideal for deleting data from a temporary table.
- Truncate preserves the structure of the table for future use, unlike drop table where the table is deleted with its full structure.
 - Table or Database deletion using DROP statement **cannot** be rolled back, so it must be used wisely.

Database Languages

- 2. Data Manipulation Language(DML):It provides a set of operations to support the basic data manipulation operations on the data held in databases. It allows user to insert, update, delete and retrieve data from the database.
 - DELETE
 - **■** INSERT
 - **■** SELECT
 - UPDATE

Database Languages

- 3. Data Control Language(DCL): DCL statements control access to data and the database
 - GRANT
 - REVOKE
- The GRANT command is used for conferring the authorization to the users whereas REVOKE command is used for withdrawing the authorization. Select, insert, update and delete are some of the privileges that are included in SQL standards.
- SYNTAX of GRANT Command:
- grant < privilege record> on < relation title or view title> to < user/role record>;

example to illustrate the Granting of privileges. We have two schemas for the tables Faculty and Department and accounts A1 and A2.

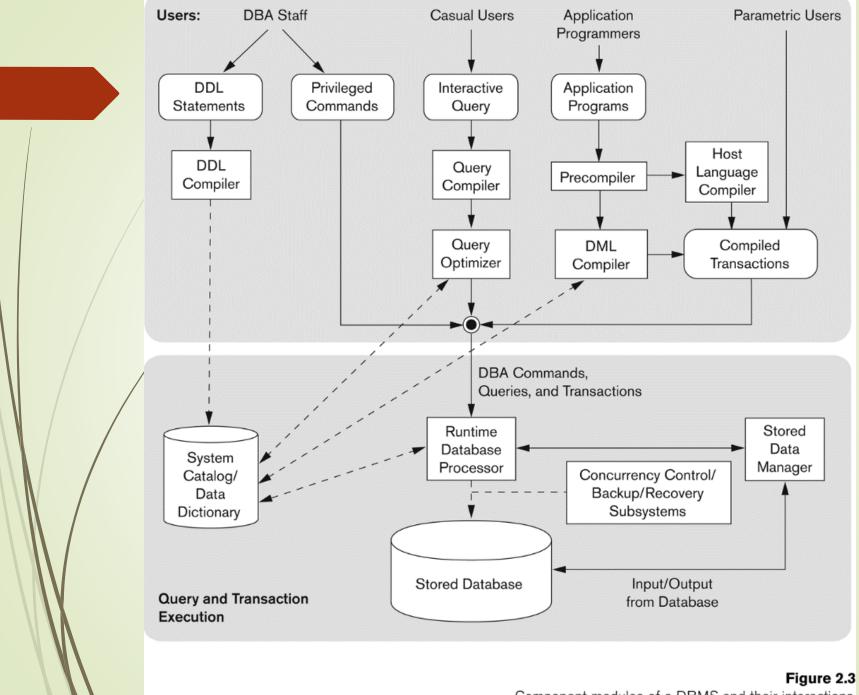
GRANT SELECT, INSERT, UPDATE ON FACULTY, DEPARTMENT TO A1, A2;

In the above given example, the account A1 and A2 are allowed to perform the select, insert and update operations on the employee and department table.

- SYNTAX of REVOKE Command:
- revoke <privilege list>
 on <relation name or view name>
 from <user/role list>;
- Let's take the similar example to illustrate the Revoking of privileges.
- **REVOKE** INSERT, UPDATE **ON** FACULTY, DEPARTMENT **FROM** A1, A2;
- In the above given example, the A1 and A2 accounts are withdrawn from their rights and are not permitted to perform insert and update operations on the employee and department table.

- 4. Transaction Control Language(TCL): TCL statements manage the change made by DML statements, and group DML statements into transactions.
- <u>COMMIT</u>: COMMIT command to make changes permanent save to a database during the current transaction.
- <u>ROLLBACK</u>: ROLLBACK command execute at the end of current transaction and undo/undone any changes made since the begin transaction.
- <u>SAVEPOINT</u>: SAVEPOINT command save the current point with the unique name in the processing of a transaction.
- <u>AUTOCOMMIT</u>: Set AUTOCOMMIT ON to execute COMMIT Statement automatically.
- <u>SET TRANSACTION</u>: PL/SQL SET TRANSACTION command set the transaction properties such as read-write/read only access.

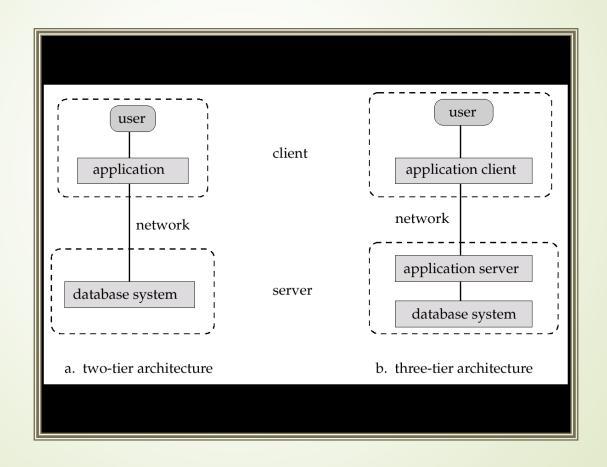
Structure and Components of DBMS



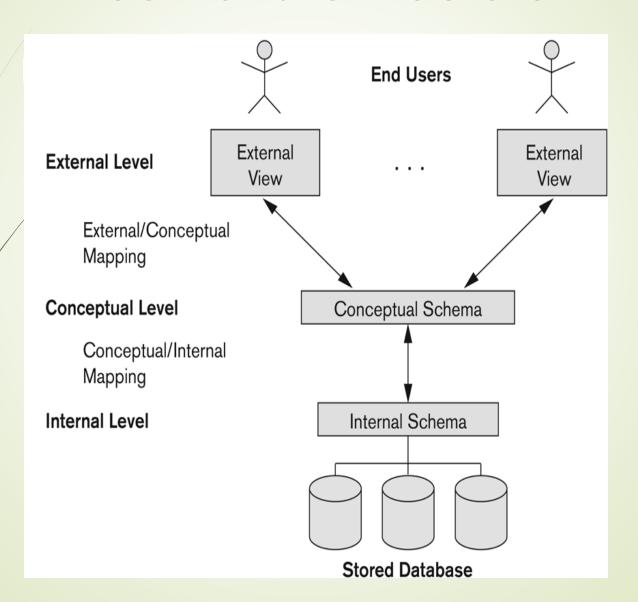
Component modules of a DBMS and their interactions.

Database Architecture

Two-tier and three-tier architecture



Three-tier architecture



Independence-Achievement of Layered Architecture of DBMS

- Two kinds of data independence:
 - Logical data independence
 - Physical data independence

Data Independence

- Logical Data Independence: The capacity to change the conceptual schema without having to change the external schemas and their application programs.
- Physical Data Independence: The capacity to change the internal schema without having to change the conceptual schema.

Pata Independence

- The processes of transforming requests and results between the levels are called mappings.
- When a schema at a lower level is changed, only the mappings between this schema and higher-level schemas need to be changed in a DBMS that fully supports data independence. The higher-level schemas themselves are unchanged. Hence, the application programs need not be changed since they refer to the external schemas.

Mcqs

- In three-tier architecture, intermediate layer between database and client servers is classified as
- A. functional server
- B. transaction server
- C. application server
- D. disk server
- 2. Process of converting requests into results between three-schema architecture internal, external and conceptual levels is called
- A. mapping
- B. pitching
- C. transforming
- D. dependence

	3. Levels in	which three schema architecture can be defined includes
	Α.	internal schema
/	В.	conceptual schema
	C.	external schema
	D.	all of above
	4. Database	e management architecture in which there is middle level between database server and client server is classified as
	Α.	three-tier architecture
	В.	two-tier architecture
	C.	single-tier architecture
	D.	three way DBMS module

	5. Inf	5. Information stored in information repository can be accessed by			
	A.	client servers			
	B.	host computers			
/	C.	security managers			
	D.	database administrators			
	6. In	database management system, term which is used to represent real world concept or object is classified a			
	A.	entity			
	B.	attribute			
	C.	relationship			
	D.	abstraction			

7)A logical schema
 A.is the entire database
 B.is a standard way of organizing information into accessible parts.
 C.Describes how data is actually stored on disk.
 D. All of the above

8)An advantage of the database management approach is

A.data is dependent on programs

B.data redundancy increases

C.data is integrated and can be accessed by multiple programs

D. none of the above

9) Grant and revoke are statements.

A. DDL

B. TCL

C. DCL

D. DML

■ 10) DBMS helps achieve

A. Data independence

B. Centralized control of data

C. Neither A nor B

D. Both A and B

 11) command can be used to modify a column in a table

A. alter

B. update

C. set

D. create