Relational Database Management System

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CHAPTER-1

Introduction To Database System

What is Data?

- Data is collection of raw facts.
- Data can be any character, text, words, number, pictures, sound, or video.
- Data has no value until it is used.
- Data does not mature.
- Data can be stored easily, and at a low cost.
- Data is not specific
- Data is the raw material.

What is Information?

- Information is also collection of raw facts but it has specific meaning.
- Data + meaning called information.
- Information is processed data.
- Information is specific.
- Information is the product.

Image source Self
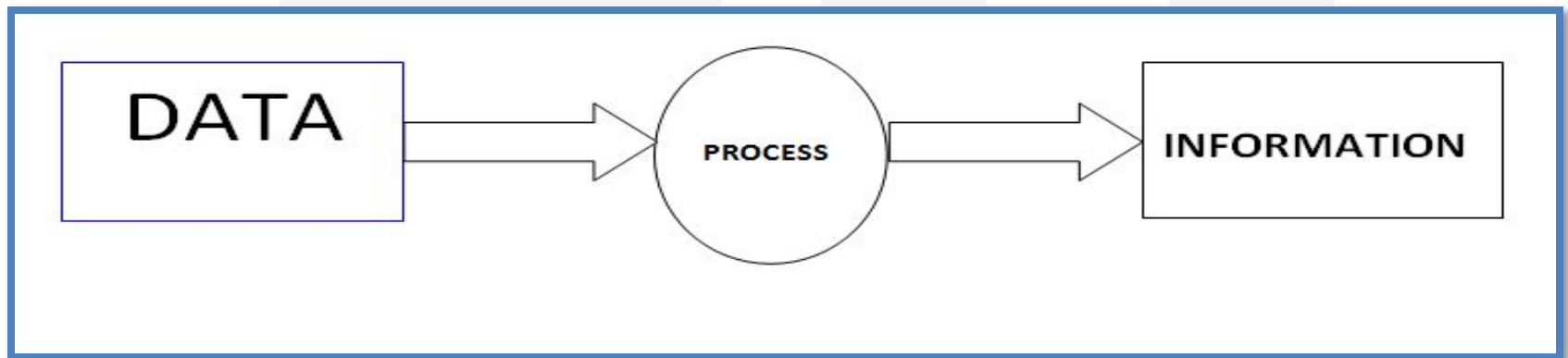
What is Database?

A database is a collection of information that is organized so that it can easily be accessed, managed, and updated.
a systematized collection of data that can be accessed immediately and manipulated by a data-processing system for a specific purpose
Database is organized collection of related information.
Database is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

Examples:
phone book
address book
Mobile contacts

What is Database Management System?

A DBMS is system software for creating and managing databases. The database management system provides users and programmers with a systematic way to create, retrieve, update and manage data.

A **DBMS** stores data in such a way that it becomes easier to retrieve, manipulate, and produce information.

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File Based Data Management

The computer systems that are used to organize and maintain data files are known as file based data systems. These file systems are used to handle a single or multiple files and are not very efficient in use.

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Advantage of File Based system

- The file Based system is not complicated and is simpler to use.
- Because of the above point, this system is quite inexpensive.
- Because the file based system is simple and cheap, it is normally suitable for home users and owners of small businesses.
- Since the file based system is used by smaller organisations or individual users, it stores comparatively lesser amount of data. Hence, the data can be accessed faster and more easily.

Disadvantages Of File based System

- The File based system is limited to a smaller size and cannot store large amounts of data.
- This system is relatively uncomplicated but this means it cannot support complicated queries, data recovery etc.
- There may be redundancy of data in the file based system as it does not have a complex mechanism to get rid of it.
- The data is not very secure in a file based system and may be corrupted or destroyed.
- The files in the file based system may be stored across multiple locations. Consequently, it is difficult to share the data easily with multiple users.

Database

Database is a systematic collection of data. Databases support storage and manipulation of data. Databases make data management easy. Let's discuss few examples.

An online telephone directory definitely use database to store data pertaining to people, phone numbers, other contact details, etc.

Your electricity service provider is obviously use a database to manage billing , client related issues, to handle fault data, etc.

Let's also consider the Facebook. It needs to store, manipulate and present data related to members, groups and pages, their friends, member activities, messages, advertisements and lot more.
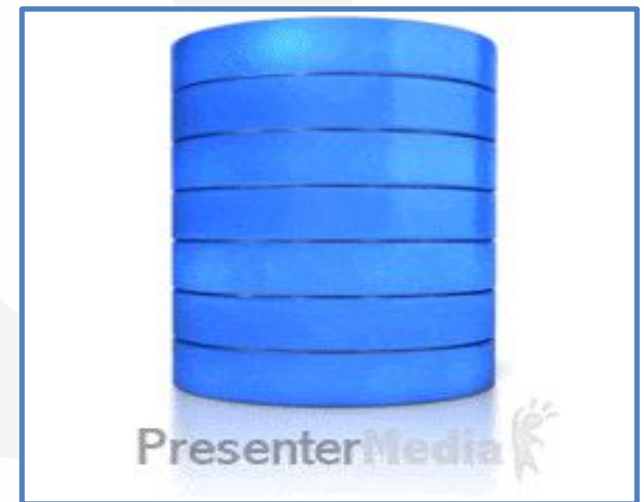

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Database Management System

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Organization of Database

- Understanding Records and Fields
- Understanding how databases are organized can help you retrieve information more efficiency, Information about each item in a database is called record.
- Elements of an individual record are called fields. Fields can be used as points of access when searching a data in database. A record in a periodical data in database would include information about a periodical article(author,source,date,title,etc)
- We might try visualizing a record in an electronic database as being part of a table.
- Each column in the table represents the fields and each row represents the individual record.
- The table below represents what an database of students in a class might look like:

Organization of Database

Last Name	First Name	Class	Hometown	Birthdate
PATEL	KRISHA	FIRST CLASS	ANAND	1-2-89
SHAH	AAYUSH	SECOND CLASS	VADODARA	8-2-91
SHARMA	ANJALI	FIRST CLASS	MUMBAI	8-5-90
GUPTA	ANIKA	Second class	MUMBAI	8-6-96

Organization of Database

If you wanted a list off students who were In second class you could target the "class" field. And you could get data of Aayush and Anika. Same for birth date
If you want that students who born in February month you target the birthdate and we can get output of krisha and aayush.
The organization of a database is very basic, regardless of who produces it.

Characteristics of Data in Database

The data in the database possess several characteristics data in the database are consistent[standard behavior],integral[necessary to make something complete],non redundant[not repetition],secured centrally managed and shared among multiple applications.

Several advantages are as below:

Single repository of data is maintained

All users access the data from the same resources

Quick retrieval of data

Reduce application development time

Flexibility in change of database structure.

Enforce Standardization.

Up-to-date information availability

Authorized access security of data.

Enforce integrity constraints and business rules

Provide backup and recovery procedure

Benefits of DBMS

Reducing Data Redundancy

The file based data management systems contained multiple files that were stored in many different computer system locations in a system or even across multiple systems. Because of this, there were sometimes multiple copies of the same file which lead to lots of data redundancy.

This is prevented in a database as there is a single database and any change in it reflected immediately. Because of this, there is no chance of encountering duplicate data in it.

E.g. Saving the same file five times to five different disks e.g. Your dictionary.

Benefits of DBMS

Sharing of Data

Data sharing implies that the data are stored in one or more servers in the network or system and that there is some software locking mechanism that prevents the same set of data from being changed by two user at the same time. Data sharing is a primary feature of a DBMS.

Data Security

Data Security is vital concept in a database. Only authorized users should be allowed to the access the database and their identity should be authenticated using a username and password. Unauthorized users should not allowed to access the database under any circumstances as it violates the integrity constraints.

Benefits of DBMS

Privacy

The privacy rule in a database means only the authorized users can access a data in database according to its privacy constraints. There are levels of database access and a user can only view the data he is allowed to view. For example - In social networking sites, access constraints are different for different accounts a user may want to access account.

Backup and Recovery

DBMS automatically takes care of backup and recovery. The users don't need to backup data periodically because this is taken care of by the database management system. Moreover, it also restores the database after a crash or system failure to its previous condition of it.

Benefits of DBMS

Data Consistency

Consistency in database systems refers to the requirement that any given **database required** transaction must change affected **data** only in allowed ways. Any **data** written to the **database** must be valid according to all defined condition and rules, including constraints, cascades, triggers, and any combination thereof.

For **example**, a column in a **database** may only have the values for a coin flip as "heads" or "tails." If a user were to attempt to put in "sideways," **consistency** rules for the **database** would not allowed it

Functions of DBMS

- Data Dictionary Management,
- Data Storage Management,
- Data Transformation and Presentation,
- Security Management,
- Multi user Access Control,
- Backup and Recovery Management,
- Data Integrity Management,
- Database Access Languages and Application Programming Interfaces and
- Database Communication interfaces.

Functions of DBMS

1. Data Dictionary Management

Data Dictionary Management is the one of the most important function of DBMS.

That is, **data** that provides information about the database's tables, views, constraints, stored procedures, etc. stored within the database. If we take a table as an **example**, the **dictionary** will store information such as: its name and other attributes.

2. Data Storage Management

Data Storage management refers to the **management** of the **data information storage** equipment's that are used to store the user / computer generated **data**. So it is a tool or set of processes used by an administrator to keep your **data** and **storage** equipment's safe and secure. Typical examples of such tools include: **Data** Dynamics Inc.

Functions of DBMS

3. Data transformation and presentation

 The database management system transforms entered data in to required data structures. The database management system relieves you of the chore of making a distinction between the logical data format and the physical data format. That is, the database management system formats the physically retrieved data to make it conform to the user's logical expectations.

For example, imagine an enterprise database used by a MNC company. An end user in England would expect to enter data such as July 12, 2009, as "12/07/2009." In contrast, the same date would be entered in the United States as "13/11/2009." Regardless of the data presentation format, the database management system must manage the date in the proper format for each country.

Functions of DBMS

4. Security Management

Security Management is another important function of DBMS. The database management creates a security system that enforces user security and data privacy. Security rules determine which authorized users can access the database, which data items each user can access, and which data operations (read, add, delete, or modify) the user can perform. This is important in multiuser database systems.

5. Multi User Access Control

Multiuser access control is another important database management system Function. To provide data integrity and data consistency, the database management system uses sophisticated algorithms to ensure that multiple users can access the database concurrently without compromising the integrity of the database.

Functions of DBMS

6. Backup and Recovery Management

The database management system provides backup and data recovery to ensure data safety and integrity.

Current database management systems provide special utilities that allow the DBA to perform routine and special backup and restore procedures. Recovery management deals with the recovery of the database after a data failure, such as a bad sector in the disk or a power failure. Such capability is critical to preserving the database accuracy and integrity**.**

Functions of DBMS

7. Data Integrity Management

Data integrity management is another important database management system function.

The database management system promotes and enforces integrity rules, thus minimizing data redundancy of data and maximizing data consistency.

The data relationships stored in the data dictionary are used to enforce data integrity of data. Ensuring data integrity is important database management system functionality in transaction-oriented database systems.

8. Database Access Languages and Application Programming Interfaces(API)

The database management system provides data access through a query language. A SQL query language is a non procedural language—one that lets the user specify what must be done without having to specify how it is to be done.

SQL is the defector query language and data access standard supported by the majority of database management system vendors

Functions of DBMS

9.Database Communication Interfaces

Current-generation DBMS's accept end-user requests via multiple, different network environments. For example, the DBMS might provide access to the database via the Internet through the use of Web browsers such as Mozilla Firefox or Microsoft Internet Explorer. In this environment, communications can be accomplished in several ways:

- End users can generate answers to queries by filling in screen forms through their preferred Web browser.

- The DBMS can automatically publish predefined reports on a Website.

- The DBMS can connect to third-party systems to distribute information via e-mail or other productivity applications.
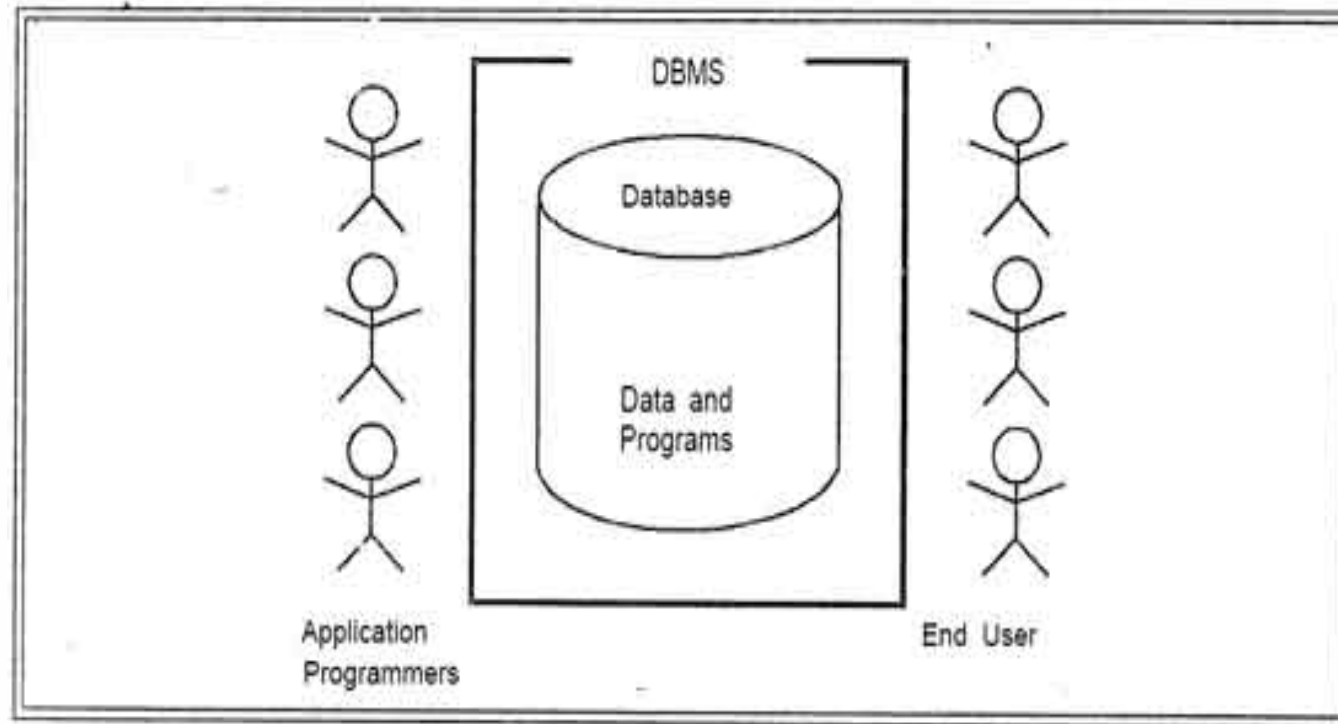
Components Of DBMS

There are five major components in the database system environment and their interrelationship is.

- Hardware
- Software
- Data
- Users
- Procedures

Components Of DBMS

Image From Self

Components Of DBMS

1. Hardware:

- The hardware is the actual computer system used for keeping and accessing the data in database.

- Conventional database management system hardware consists of secondary storage devices, usually hard disks, on which the database physically resides, together with the associated Input-Output devices, device controllers and· so forth.

- Databases run on some range of machines, from Microcomputers to large mainframes computer.

- Other hardware issues for a database management system includes database machines, which is hardware designed specifically to support a database system.

Components Of DBMS

2. Software:

- The software is the actual database management system. Within the physical databases itself (i.e. the data actually stored) and the users of the system is a layer of software, usually called the DBMS.

- All requests from users for access to the database are handled by the database management system. One general function provided by the database management system is thus the shielding of database users from complex hardware-level detail.

- The database management system allows the users to communicate with the database. In a sense, it is the mediator within the database and the users.

Components Of DBMS

3. Data:

- It is the most important component of database management system environment from the end users point of view.

- As shown in observes that data acts as a bridge within the machine components and the user components. The database contained the operational data and the meta-data, the 'data about data'.

- The database should be contain all the data needed by the a organization. One of the major features of data in databases is that the actual data are separated from the programs that use the data.

- A database should always be designed, built and populated for a particular audience, user and for a specific purpose.

Components Of DBMS

4. Users:

- There are a number of users who can access or retrieve data on the demand using the applications and interfaces provided by the database management system.

- Each type of user needs different type of software capabilities. The users of a database system can be classified in the following groups, depending on their degrees of expertise or the mode of their interactions with the database management system. The users can be:

- Naive Users

- Online Users

- Application Programmers

- Sophisticated Users

- Data Base Administrator

Components Of DBMS

- **Naive Users** : Naive Users are those users who must need not be aware of the presence of the database system or any other system supporting their usage. Naive users are end users of the database who work with a menu driven application program, where the type and range of response is always indicated to the audience or user .

- A full user of an Automatic Teller Machine falls in this category. The one by one user is instructed through each step of a transaction. Then responds by pressing a coded key. The operations that can be performed by valve users are very limited and affect only a precise portion of the data in database. For example, in the case of the user of the ATM, user's action affects only one or more of his/her own accounts**.**

Components Of DBMS

- **Online Users:** Online users are those who may communicated with the database directly via an online terminal. These users are aware of the presence of the data in database system and may have acquired a certain amount of expertise with in the limited interaction permitted with a data in database.

- **Sophisticated Users:** Such users in database interact with the system without, writing programs.

- Instead, they form their requests in database. Each such query is submitted to a very processor whose function is to breakdown data manipulation language statement into instructions that the storage manager understands.

Components Of DBMS

- **Specialized Users:** Such users are those, who write specialized in data in database application that do not fit into the fractional data-processing framework. For example: CAD systems, knowledge base and expert system, systems that store data with complex data types (for example, graphics data and audio data).

- **Application Programmers:** Professional programmers are those who are responsible for developing application programs and user interface. The application programs could be written using the commands available to manipulate a database.

Components Of DBMS

- **Database Administrator:** The database administrator is the person or group in charge for implementing the database system ,within an organization. Database administrator has all the system privileges allowed by the DBMS and can assign and revoke levels of access to and from other users. database administrator is also responsible for the evaluation, selection and implementation of database management system package.

Data Dictionary

- A data dictionary is a set of files that contains a database metadata. The data dictionary contains records about other objects in the database, such as data ownership, data relationships to other objects, and other data in database.

- The data dictionary is a component of any relational database. because of its mandatory use, it is invisible to most database users. Typically, only DBA interact with the data dictionary.

Data Dictionary

- The most of metadata in the data dictionary includes the following:

- Names of all tables in the database and their owners

- Names of all indexes and the columns to which the tables in those indexes related.

- Constraints defined on tables, including primary keys, foreign-key relationships to other tables, and not-null constraints

Internal level

- The lowest level of data abstraction.

- It shows How the data are actually stored on storage devices.

- It is also known as physical level.

- It is a internal view of physical storage of data.

- It deals with complex low level data structures, file structures and access all the methods in detail.

- It also deals with Data Compression and Encryption techniques, if used.

Conceptual level

- It is a next higher level than internal level of data abstraction.

- It describes What or how data are stored in the database and What relationships exist among those data.

- It is also known as Logical level.

- It hides low level complexities of physical storage of database.

- Database administrator and designers work at this level to determine What or how data to keep in database. Application developers also work in this level .

External level

- It is a highest level of data abstraction.

- It describes only one part of the entire database that a end user concern.

- It is also known as an view level.

- End users need to access only part of the database rather than entire database.

- Different user need different views of database. And so, there can be many view level abstractions of the same database.

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