ASSIGNMENT-2

WHAT IS DATABASE MANAGEMENT SYSYTEM

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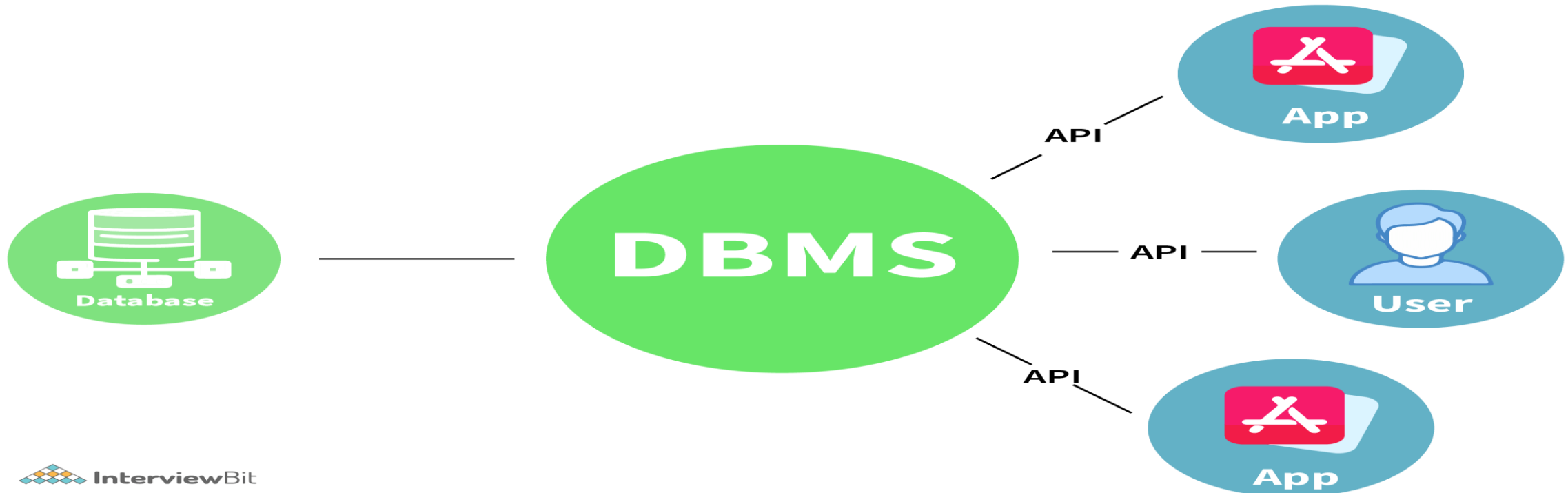
Introduction of DBMS:

A database is a collection of inter-related data which helps in the efficient retrieval, insertion, and deletion of data from the database and organizes the data in the form of tables, views, schemas, reports, etc. For Example, a university database organizes the data about students, faculty, admin staff, etc. which helps in the efficient retrieval, insertion, and deletion of data from it. **DDL** is the short name for Data Definition Language, which deals with database schemas and descriptions, of how the data should reside in the database.

•CREATE: to create a database and its objects like (table, index, views, store procedure, function, and triggers)
•ALTER: alters the structure of the existing database
•DROP: delete objects from the database
•TRUNCATE: remove all records from a table, including all spaces allocated for the records are removed
•COMMENT: add comments to the data dictionary
•RENAME: rename an object

Database Management System:

       The software which is used to manage databases is called Database Management System (DBMS). For Example, MySQL, Oracle, etc. are popular commercial DBMS used in different applications. DBMS allows users the following tasks:

- **Data Definition:** It helps in the creation, modification, and removal of definitions that define the organization of data in the database.
- **Data Updation:** It helps in the insertion, modification, and deletion of the actual data in the database.
- **Data Retrieval:** It helps in the retrieval of data from the database which can be used by applications for various purposes.
- **User Administration:** It helps in registering and monitoring users, enforcing data security, monitoring performance, maintaining data integrity, dealing with concurrency control, and recovering information corrupted by unexpected failure.

TYPES OF DATABASES

There are various types of databases used for storing different varieties of data:
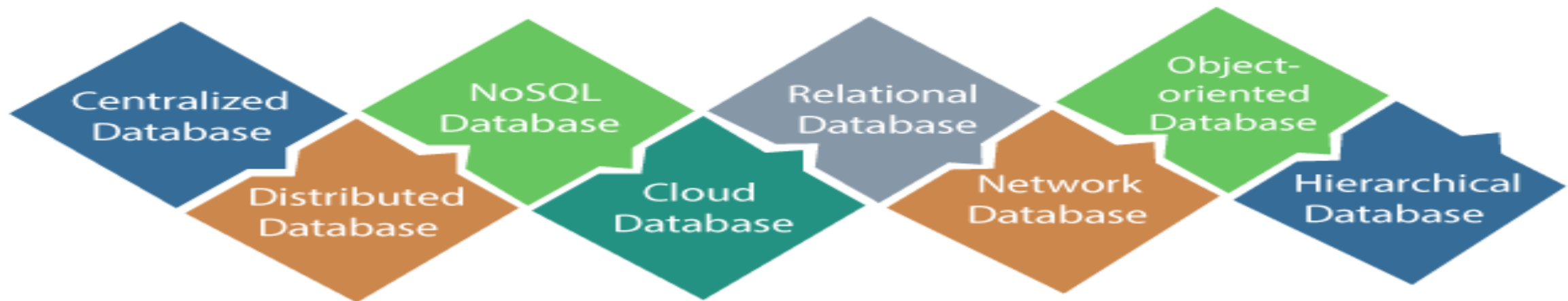

1) Centralized Database

It is the type of database that stores data at a centralized database system. It comforts the users to access the stored data from different locations through several applications. These applications contain the authentication process to let users access data securely. An example of a Centralized database can be Central Library that carries a central database of each library in a college/university.

2) Distributed Database

Unlike a centralized database system, in distributed systems, data is distributed among different database systems of an organization. These database systems are connected via communication links. Such links help the end-users to access the data easily. **Examples** of the Distributed database are Apache Cassandra, HBase, Ignite, etc.
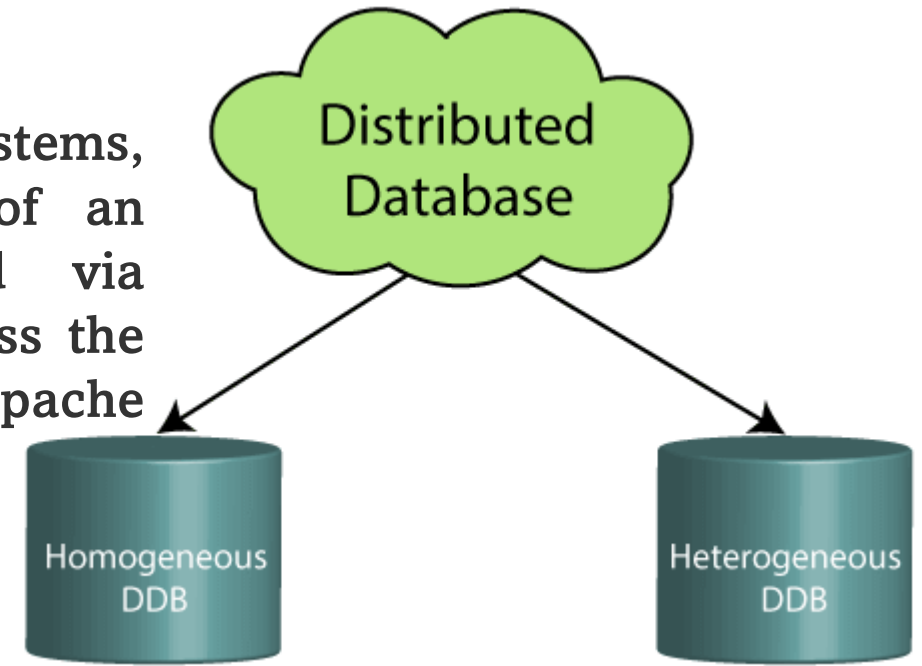
3) Relational Database

This database is based on the relational data model, which stores data in the form of rows(tuple) and columns(attributes), and together forms a table(relation). A relational database uses SQL for storing, manipulating, as well as maintaining the data. E.F. Codd invented the database in 1970. Each table in the database carries a key that makes the data unique from others. **Examples** of Relational databases are MySQL, Microsoft SQL Server, Oracle, etc.

4) NoSQL Database

Non-SQL/Not Only SQL is a type of database that is used for storing a wide range of data sets. It is not a relational database as it stores data not only in tabular form but in several different ways. It came into existence when the demand for building modern applications increased. Thus, NoSQL presented a wide variety of database technologies in response to the demands. We can further divide a NoSQL database into the following four types:

5) Cloud Database

A type of database where data is stored in a virtual environment and executes over the cloud computing platform. It provides users with various cloud computing services (SaaS, PaaS, IaaS, etc.) for accessing the database. There are numerous cloud platforms, but the best options are:

- Amazon Web Services(AWS)
- Microsoft Azure
- Kamatera
- PhonixNAP
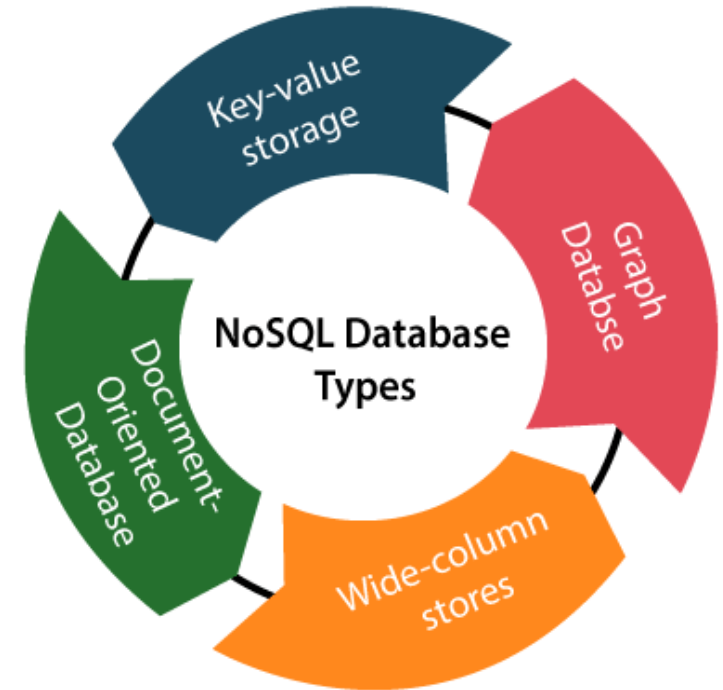
6) Object-oriented Databases

The type of database that uses the object-based data model approach for storing data in the database system. The data is represented and stored as objects which are similar to the objects used in the object-oriented programming language.

7) Hierarchical Databases

It is the type of database that stores data in the form of parent-children relationship nodes. Here, it organizes data in a tree-like structure.

Data get stored in the form of records that are connected via links. Each child record in the tree will contain only one parent. On the other hand, each parent record can have multiple child records.
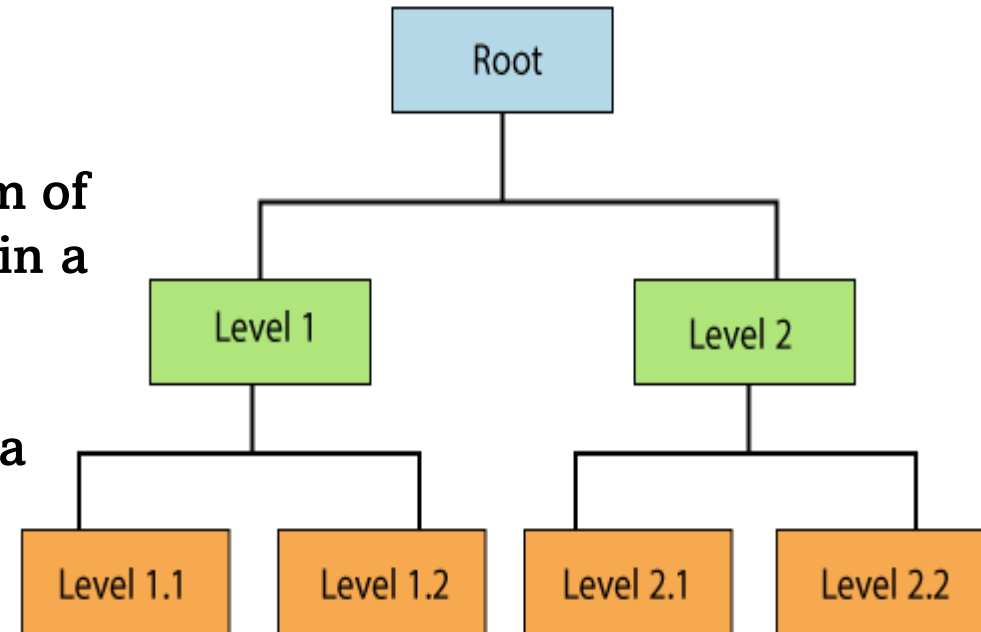
Hierarchical Database

8) Network Databases

It is the database that typically follows the network data model. Here, the representation of data is in the form of nodes connected via links between them. Unlike the hierarchical database, it allows each record to have multiple children and parent nodes to form a generalized graph structure.

9) Personal Database

Collecting and storing data on the user's system defines a Personal Database. This database is basically designed for a single user.

10) Operational Database

The type of database which creates and updates the database in real-time. It is basically designed for executing and handling the daily data operations in several businesses. For example, An organization uses operational databases for managing per day transactions.

11) Enterprise Database

Large organizations or enterprises use this database for managing a massive amount of data. It helps organizations to increase and improve their efficiency. Such a database allows simultaneous access to users.

Need for DBMS

A **Data Base Management System** is a system software for easy, efficient and reliable data processing and management. It can be used for:
•Creation of a database.
•Retrieval of information from the database.
•Updating the database.
•Managing a database.

It provides us with the many functionalities and is more advantageous than the traditional file system in many ways listed below:

1) Processing Queries and Object Management:
In traditional file systems, we cannot store data in the form of objects. In practical-world applications, data is stored in objects and not files. So in a file system, some application software maps the data stored in files to objects so that can be used further.
We can directly store data in the form of objects in a database management system. Application level code needs to be written to handle, store and scan through the data in a file system whereas a DBMS gives us the ability to query the database.

2) Controlling redundancy and inconsistency:

Redundancy refers to repeated instances of the same data. A database system provides redundancy control whereas in a file system, same data may be stored multiple times. For example, if a student is studying two different educational programs in the same college, say ,Engineering and History, then his information such as the phone number and address may be stored multiple times, once in Engineering dept and the other in History dept. Therefore, it increases time taken to access and store data. This may also lead to inconsistent data states in both places. A DBMS uses **data normalization** to avoid redundancy and duplicates.

3) Efficient memory management and indexing:

DBMS makes complex memory management easy to handle. In file systems, files are indexed in place of objects so query operations require entire file scans whereas in a DBMS , object indexing takes place efficiently through database schema based on any attribute of the data or a data-property. This helps in fast retrieval of data based on the indexed attribute.

4) Concurrency control and transaction management:

Several applications allow user to simultaneously access data. This may lead to inconsistency in data in case files are used. Consider two withdrawal transactions X and Y in which an amount of 100 and 200 is withdrawn from an account A initially containing 1000. Now since these transactions are taking place simultaneously, different transactions may update the account differently. X reads 1000, debits 100, updates the account A to 900, whereas Y also reads 1000, debits 200, updates A to 800. In both cases account A has wrong information. This results in data inconsistency. A DBMS provides mechanisms to deal with this kind of data inconsistency while allowing users to access data concurrently. A DBMS implements ACID(atomicity, durability, isolation,consistency) properties to ensure efficient transaction management without data corruption.

## 5) Access Control and ease in accessing data:

A DBMS can grant access to various users and determine which part and how much of the data can they access from the database thus removing redundancy. Otherwise in file system, separate files have to be created for each user containing the amount of data that they can access. Moreover, if a user has to extract specific data, then he needs a code/application to process that task in case of file system, e.g. Suppose a manager needs a list of all employees having salary greater than X. Then we need to write business logic for the same in case data is stored in files. In case of DBMS, it provides easy access of data through queries, (e.g., SELECT queries) and whole logic need not be rewritten. Users can specify exactly what they want to extract out of the data.

- **6) Integrity constraints:** Data stored in databases must satisfy integrity constraints. For example, Consider a database schema consisting of the various educational programs offered by a university such as(B.Tech/M.Tech/B.Sc/M.Sc/BCA/MCA) etc. Then we have a schema of students enrolled in these programs. A DBMS ensures that it is only out of one of the programs offered schema , that the student is enrolled in, i.e. Not anything out of the blue. Hence, database integrity is preserved.

- Apart from the above mentioned features a database management also provides the following:

  - **Multiple User Interface**
  - **Data scalability, expandability and flexibility**: We can change schema of the database, all schema will be updated according to it.
  - Overall the time for developing an application is reduced.
  - **Security:** Simplifies data storage as it is possible to assign security permissions allowing restricted access to data.

Characteristics of DBMS

- It uses a digital repository established on a server to store and manage the information.
- It can provide a clear and logical view of the process that manipulates data.
- DBMS contains automatic backup and recovery procedures.
- It contains ACID properties which maintain data in a healthy state in case of failure.
- It can reduce the complex relationship between data.
- It is used to support manipulation and processing of data.
- It is used to provide security of data.
- It can view the database from different viewpoints according to the requirements of the user.
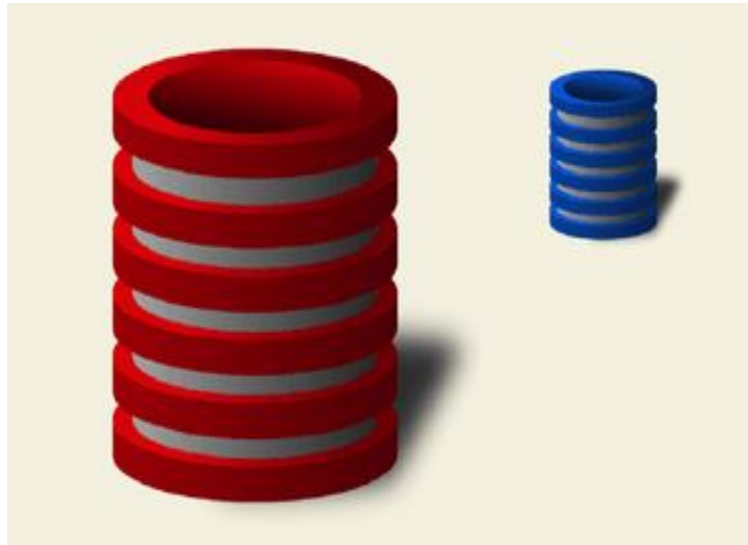
Advantages of DBMS

•**Controls database redundancy:** It can control data redundancy because it stores all the data in one single database file and that recorded data is placed in the database.

•**Data sharing:** In DBMS, the authorized users of an organization can share the data among multiple users.

•**Easily Maintenance:** It can be easily maintainable due to the centralized nature of the database system.

•**Reduce time:** It reduces development time and maintenance need.

•**Backup:** It provides backup and recovery subsystems which create automatic backup of data from hardware and software failures and restores the data if required.

•**multiple user interface:** It provides different types of user interfaces like graphical user interfaces, application program interfaces
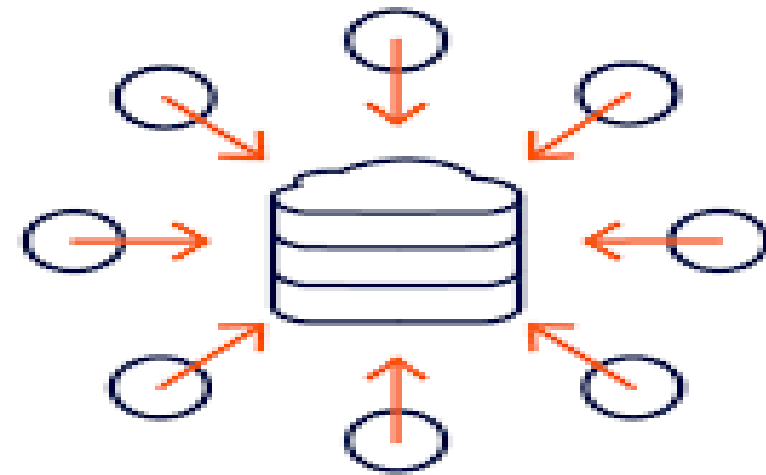
Disadvantages of DBMS

•**Cost of Hardware and Software:** It requires a high speed of data processor and large memory size to run DBMS software.

•**Size:** It occupies a large space of disks and large memory to run them efficiently.

•**Complexity:** Database system creates additional complexity and requirements.

•**Higher impact of failure:** Failure is highly impacted the database because in most of the organization, all the data stored in a single database and if the database is damaged due to electric failure or database corruption then the data may be lost forever.
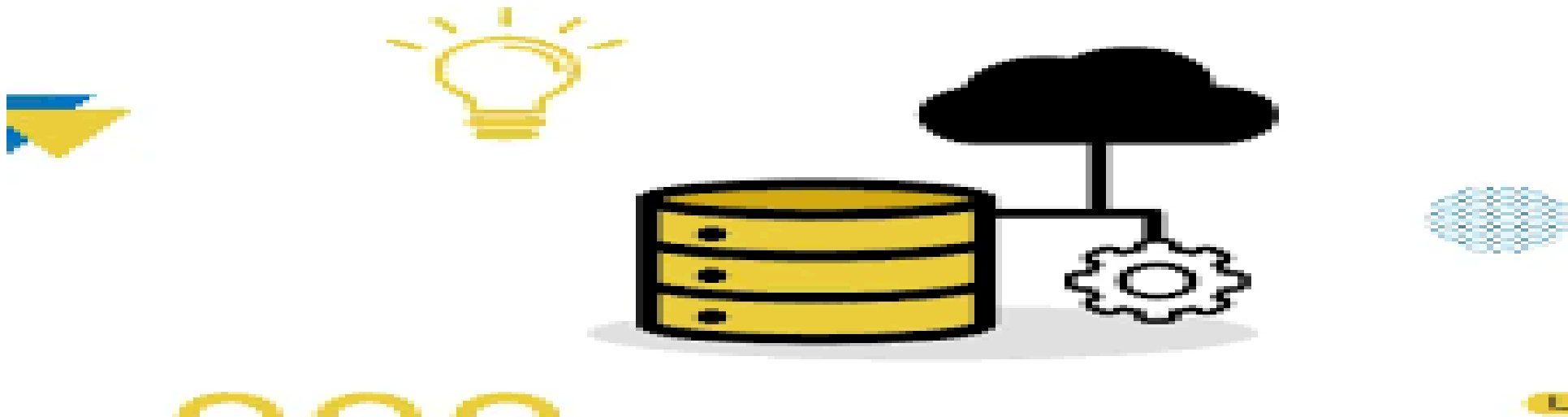
Conclusion

•Data is the raw information that has been processed and is to be translated in other forms or means.

•A relational database is the collection of organized data which is structured. Data is stored in tables in the form of rows and columns in a database for simplicity.

•The database has evolved from a flat-file system to relational and object-relational systems over the course of more than 50 years.

•There are five components in which a database is divided, each component has a prominent role and a specific task in a DBMS environment:

- Hardware
- Software
- Data
- Procedures
- Data Access Language

•Over these years, many types of databases have been introduced, each with its own specific use.

•A database management system is software that manages a database means that they stores, retrieves, and manipulates the data from a database.

•We also face challenges in maintaining a database that has to be overcome over time.