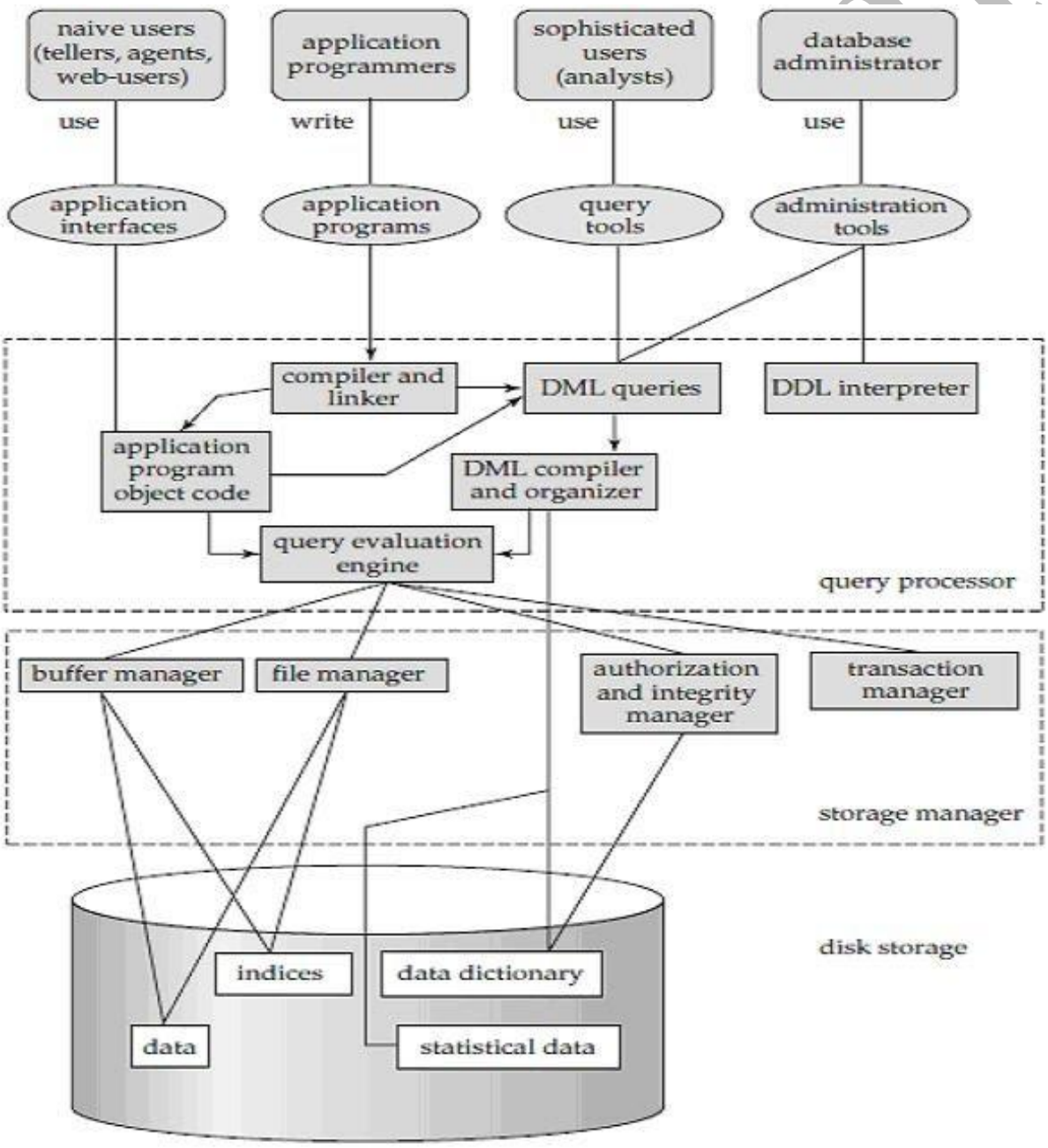
Structure of a DBMS

A database system is partitioned into modules that deal with each of the responsibilities of the overall system. The functional components of a database system can be broadly divided into the storage manager and the query processor components. The storage manager is important because databases typically require a large amount of storage space. The query processor is important because it helps the database system simplify and facilitate access to data.



At very high level, a database is considered as shown in above diagram. Let us see them in detail below.

- **Applications: –** It can be considered as a user friendly web page where the user enters the requests. Here he simply enters the details that he needs and presses buttons to get the data.
- **End User: –** They are the real users of the database. They can be developers, designers, administrator or the actual users of the database.
- **DDL: –** Data Definition Language (DDL) is a query fired to create database, schema, tables, mappings etc in the database. These are the commands used to create the objects like tables, indexes in the database for the first time. In other words, they create structure of the database.
- **DDL Compiler: –** This part of database is responsible for processing the DDL commands. That means these compiler actually breaks down the command into machine understandable codes. It is also responsible for storing the metadata information like table name, space used by it, number of columns in it, mapping information etc.
- **DML Compiler: –** When the user inserts, deletes, updates or retrieves the record from the database, he will be sending request which he understands by pressing some buttons. But for the database to work/understand the request, it should be broken down to object code. This is done by this compiler. One can imagine this as when a person is asked some question, how this is broken down into waves to reach the brain!
- **Query Optimizer: –** When user fires some request, he is least bothered how it will be fired on the database. He is not all aware of database or its way of performance. But whatever be the request, it should be efficient enough to fetch, insert, update or delete the data from the database. The query optimizer decides the best way to execute the user request which is received from the DML compiler. It is similar to selecting the best nerve to carry the waves to brain!
- **Stored Data Manager: –** This is also known as Database Control System. It is one the main central system of the database. It is responsible for various tasks

- It converts the requests received from query optimizer to machine understandable form. It makes actual request inside the database. It is like fetching the exact part of the brain to answer.
- It helps to maintain consistency and integrity by applying the constraints. That means, it does not allow inserting / updating / deleting any data if it has child entry. Similarly it does not allow entering any duplicate value into database tables.
- It controls concurrent access. If there is multiple users accessing the database at the same time, it makes sure, all of them see correct data. It guarantees that there is no data loss or data mismatch happens between the transactions of multiple users.
- It helps to backup the database and recover data whenever required. Since it is a huge database and when there is any unexpected exploit of transaction, and reverting the changes are not easy. It maintains the backup of all data, so that it can be recovered.

❖ **Data Files: –** It has the real data stored in it. It can be stored as magnetic tapes, magnetic disks or optical disks.

❖ **Compiled DML: –** Some of the processed DML statements (insert, update, delete) are stored in it so that if there is similar requests, it will be re-used.

❖ **Data Dictionary: –** It contains all the information about the database. As the name suggests, it is the dictionary of all the data items. It contains description of all the tables, view, materialized views, constraints, indexes, triggers etc.

Functions of DBMS

- DBMS free the programmers from the need to worry about the organization and location of the data i.e. it shields the users from complex hardware level details.
- DBMS can organize process and present data elements from the database. This capability enables decision makers to search and query database contents in order to extract answers that are not available in regular Reports.
- Programming is speeded up because programmer can concentrate on logic of the application.

- It includes special user friendly query languages which are easy to understand by non programming users of the system.

Services provided by DBMS

The service provided by the DBMS includes:-

- Authorization services like log on to the DBMS start the database stop the Database etc.
- Transaction supports like Recovery, Rollback etc,
- Import and Export of Data.
- Maintaining data dictionary
- User's Monitoring

People who deal with Database

1. 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.

2. Application Programmers

They are the developers who interact with the database by means of DML queries. These DML queries are written in the application programs like C, C++, JAVA, Pascal etc. These queries are converted into object code to communicate with the database. For example, writing a C program to generate the report of employees who are working in particular department will involve a query to fetch the data from database. It will include a embedded SQL query in the C Program.

3. 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. These users will be scientists, engineers, analysts who thoroughly study SQL and DBMS to apply the concepts in their requirement. In short, we can say this category includes designers and developers of DBMS and SQL.

4. Database Administrators

The life cycle of database starts from designing, implementing to administration of it. A database for any kind of requirement needs to be designed perfectly so that it should work without any issues. Once all the design is complete, it needs to be installed. Once this step is complete, users start using the database. The database grows as the data grows in the database. When the database becomes huge, its performance comes down. Also accessing the data from the database becomes challenge. There will be unused memory in database, making the memory inevitably huge. These administration and maintenance of database is taken care by database Administrator – DBA.

A DBA has many responsibilities. A good performing database is in the hands of DBA.

- **Installing and upgrading the DBMS Servers: –** DBA is responsible for installing a new DBMS server for the new projects. He is also responsible for upgrading these servers as there are new versions comes in the market or requirement. If there is any failure in upgradation of the existing servers, he should be able revert the new changes back to the older version, thus maintaining the DBMS working. He is also responsible for updating the service packs/ hot fixes/ patches to the DBMS servers.

- **Design and implementation: –** Designing the database and implementing is also DBA's responsibility. He should be able to decide proper memory management, file organizations, error handling, log maintenance etc for the database.

- **Performance tuning: –** Since database is huge and it will have lots of tables, data, constraints and indices, there will be variations in the performance from time to time. Also, because of some designing issues or data growth, the database will not work as expected. It is responsibility of the DBA to tune the database performance. He is responsible to make sure all the queries and programs works in fraction of seconds.

- **Migrate database servers: –** Sometimes, users using oracle would like to shift to SQL server or Netezza. It is the responsibility of DBA to make sure that migration happens without any failure, and there is no data loss.

- **Backup and Recovery: –** Proper backup and recovery programs needs to be developed by DBA and has to be maintained him. This is one of the main responsibilities of DBA. Data/objects should be backed up regularly so that if there is any crash, it should be recovered without much effort and data loss.

- **Security: –** DBA is responsible for creating various database users and roles, and giving them different levels of access rights.

- **Documentation: –** DBA should be properly documenting all his activities so that if he quits or any new DBA comes in, he should be able to understand the database without any effort. He should basically maintain all his installation, backup, recovery, security methods. He should keep various reports about database performance.

In order to perform his entire task, he should have very good command over DBMS.