DBMS

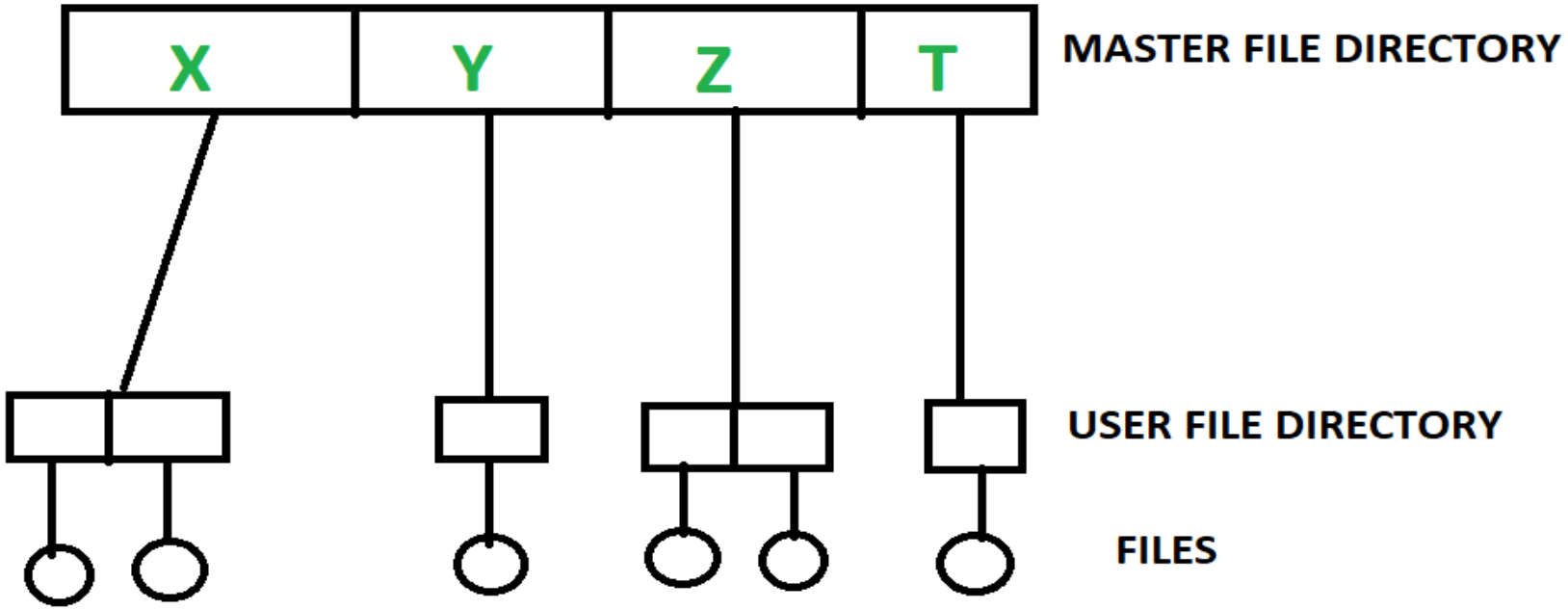
UNIT-I

File System

- The **file system** is basically a way of arranging the files in a storage medium like a hard disk.
- The file system organizes the files and helps in the retrieval of files when they are required.
- File systems consist of different files which are grouped into directories.
- The directories further contain other folders and files.
- The file system performs basic operations like management, file naming, giving access rules, etc.

File System

- **Example:** NTFS(New Technology File System), EXT(Extended File System).

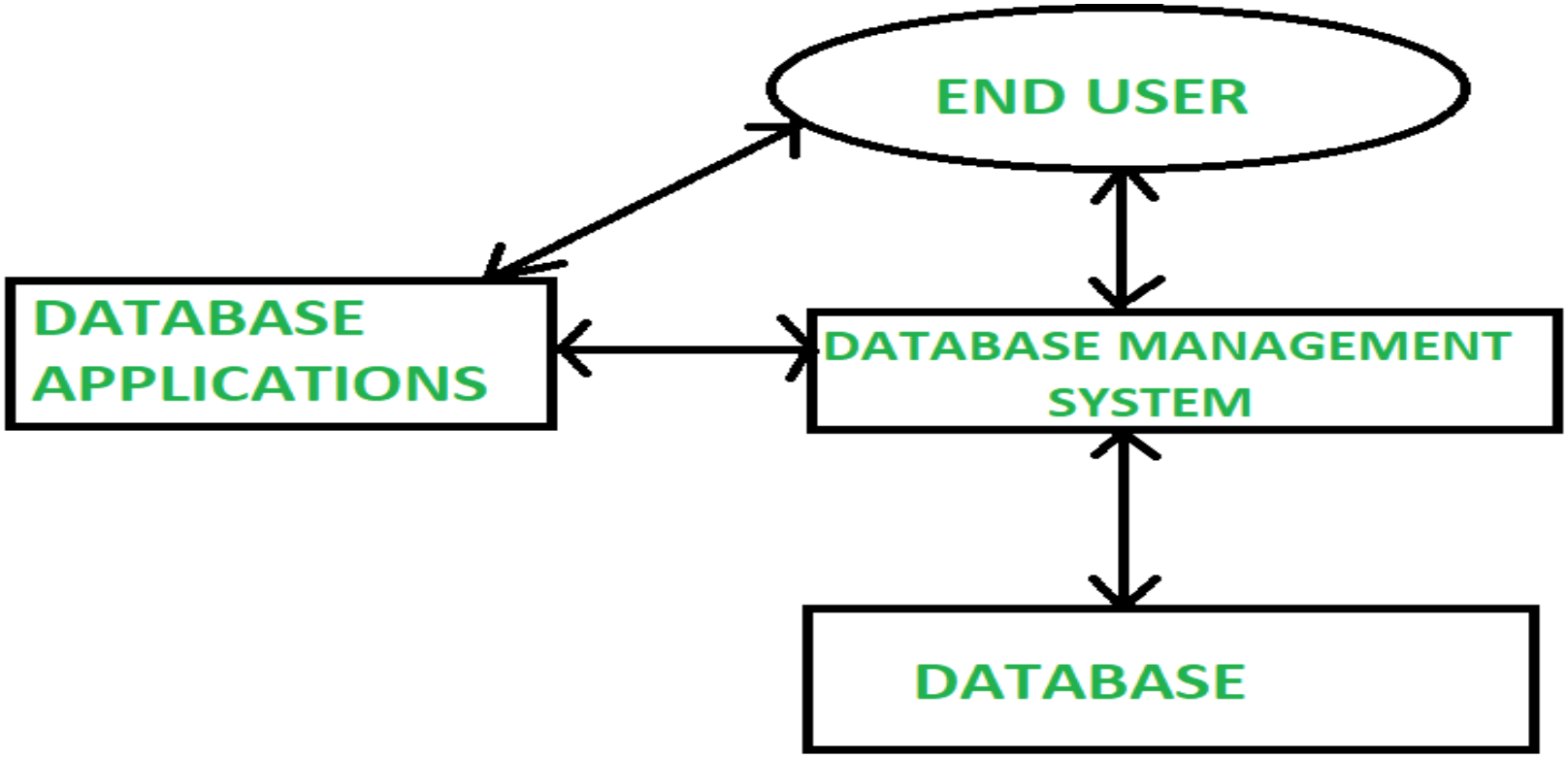


Database Management System

- Database Management System is basically software that manages the collection of related data.
- It is used for storing data and retrieving the data effectively when it is needed. It also provides proper security measures for protecting the data from unauthorized access.
- In Database Management System the data can be fetched by SQL queries and relational algebra. It also provides mechanisms for data recovery and data backup.

DBMS

- **Example:** Oracle, MySQL, MS SQL server.



Difference between File System and DBMS

Basics	File System	DBMS
Structure	The file system is a way of arranging the files in a storage medium within a computer.	DBMS is software for managing the database.
Data Redundancy	Redundant data can be present in a file system.	In DBMS there is no redundant data.
Backup and Recovery	It doesn't provide Inbuilt mechanism for backup and recovery of data if it is lost.	It provides in house tools for backup and recovery of data even if it is lost.
Query processing	There is no efficient query processing in the file system.	Efficient query processing is there in DBMS.
Consistency	There is less data consistency in the file system.	There is more data consistency because of the process of normalization.
Complexity	It is less complex as compared to DBMS.	It has more complexity in handling as compared to the file system.
Security Constraints	File systems provide less security in comparison to DBMS.	DBMS has more security mechanisms as compared to file systems.
Cost	It is less expensive than DBMS.	It has a comparatively higher cost than a file system.

Data Independence	There is no data independence.	In DBMS data independence exists, mainly of two types: 1) Logical Data Independence. 2)Physical Data Independence.
User Access	Only one user can access data at a time.	Multiple users can access data at a time.
Meaning	The users are not required to write procedures.	The user has to write procedures for managing databases
Sharing	Data is distributed in many files. So, it is not easy to share data.	Due to centralized nature data sharing is easy
Data Abstraction	It give details of storage and representation of data	It hides the internal details of Database
Integrity Constraints	Integrity Constraints are difficult to implement	Integrity constraints are easy to implement
Attributes	To access data in a file , user requires attributes such as file name, file location.	No such attributes are required.
Example	Cobol, C++	Oracle, SQL Server

Advantages of Database Management System

1. **Reduction of Redundancy:** This is perhaps the most significant advantage of using DBMS. Redundancy is the problem of storing the same data item in more one place. Redundancy creates several problems like requiring extra storage space, entering same data more than once during data insertion, and deleting data from more than one place during deletion. Anomalies may occur in the database if insertion, deletion etc are not done properly.

2. **Sharing of Data:** In a paper-based record keeping, data cannot be shared among many users. But in computerized DBMS, many users can share the same database if they are connected via a network.

Advantages of Database Management System

3. **Data Integrity:** We can maintain data integrity by specifying integrity constrains, which are rules and restrictions about what kind of data may be entered or manipulated within the database. This increases the reliability of the database as it can be guaranteed that no wrong data can exist within the database at any point of time.

4. **Data security:** We can restrict certain people from accessing the database or allow them to see certain portion of the database while blocking sensitive information. This is not possible very easily in a paper-based record keeping.

Disadvantages of DBMS

1. As DBMS needs computers, we have to invest a good amount in acquiring the hardware, software, installation facilities and training of users.

2. We have to keep regular backups because a failure can occur any time. Taking backup is a lengthy process and the computer system cannot perform any other job at this time.

3. While data security system is a boon for using DBMS, it must be very robust. If someone can bypass the security system then the database would become open to any kind of mishandling.

Application of DBMS

- There are different fields where a database management system is utilized. Following are a few applications that utilize the information base administration framework.

1. Railway Reservation System

- In the rail route reservation framework, the information base is needed to store the record or information of ticket appointments, status of train's appearance, and flight. Additionally, if trains get late, individuals become acquainted with it through the information base update.

2. Library Management System

- There are many books in the library so; it is difficult to store the record of the relative multitude of books in a register or duplicate. Along these lines, the data set administration framework (DBMS) is utilized to keep up all the data identified with the name of the book, issue date, accessibility of the book, and its writer.

3. Banking

- Database the executive's framework is utilized to store the exchange data of the client in the information base.

4. Education Sector

- Presently, assessments are led online by numerous schools and colleges. They deal with all assessment information through the data set administration framework (DBMS). In spite of that understudy's enlistments subtleties, grades, courses, expense, participation, results, and so forth all the data is put away in the information base.

5. Credit card exchanges

- The database Management framework is utilized for buying on charge cards and age of month to month proclamations.

6. Social Media Sites

- We all utilization of online media sites to associate with companions and to impart our perspectives to the world. Every day, many people group pursue these online media accounts like Pinterest, Facebook, Twitter, and Google in addition to. By the utilization of the data set administration framework, all the data of clients are put away in the information base and, we become ready to interface with others.

7. Broadcast communications

- Without DBMS any media transmission organization can’t think. The Database the executive’s framework is fundamental for these organizations to store the call subtleties and month to month postpaid bills in the information base.

8. Accounting and Finance

- The information base administration framework is utilized for putting away data about deals, holding and acquisition of monetary instruments, for example, stocks and bonds in a data set.

9. E-Commerce Websites

- These days, web-based shopping has become a major pattern. Nobody needs to visit the shop and burn through their time.
- Everybody needs to shop through web based shopping sites, (for example, Amazon, Flipkart, Snapdeal) from home.
- So all the items are sold and added uniquely with the assistance of the information base administration framework (DBMS). Receipt charges, installments, buy data these are finished with the assistance of DBMS.

10. Human Resource Management

- Big firms or organizations have numerous specialists or representatives working under them. They store data about worker's compensation, assessment, and work with the assistance of an information base administration framework (DBMS).

11. Manufacturing

- Manufacturing organizations make various kinds of items and deal them consistently. To keep the data about their items like bills, acquisition of the item, amount, inventory network the executives, information base administration framework (DBMS) is utilized.

12. Airline Reservation System

- This framework is equivalent to the railroad reservation framework. This framework additionally utilizes an information base administration framework to store the records of flight takeoff, appearance, and defer status.

13. Healthcare System

- DBMS is used in healthcare to manage patient data, medical records, and billing information.

14. Security

- DBMS provides security features to ensure that only authorized users have access to the data.

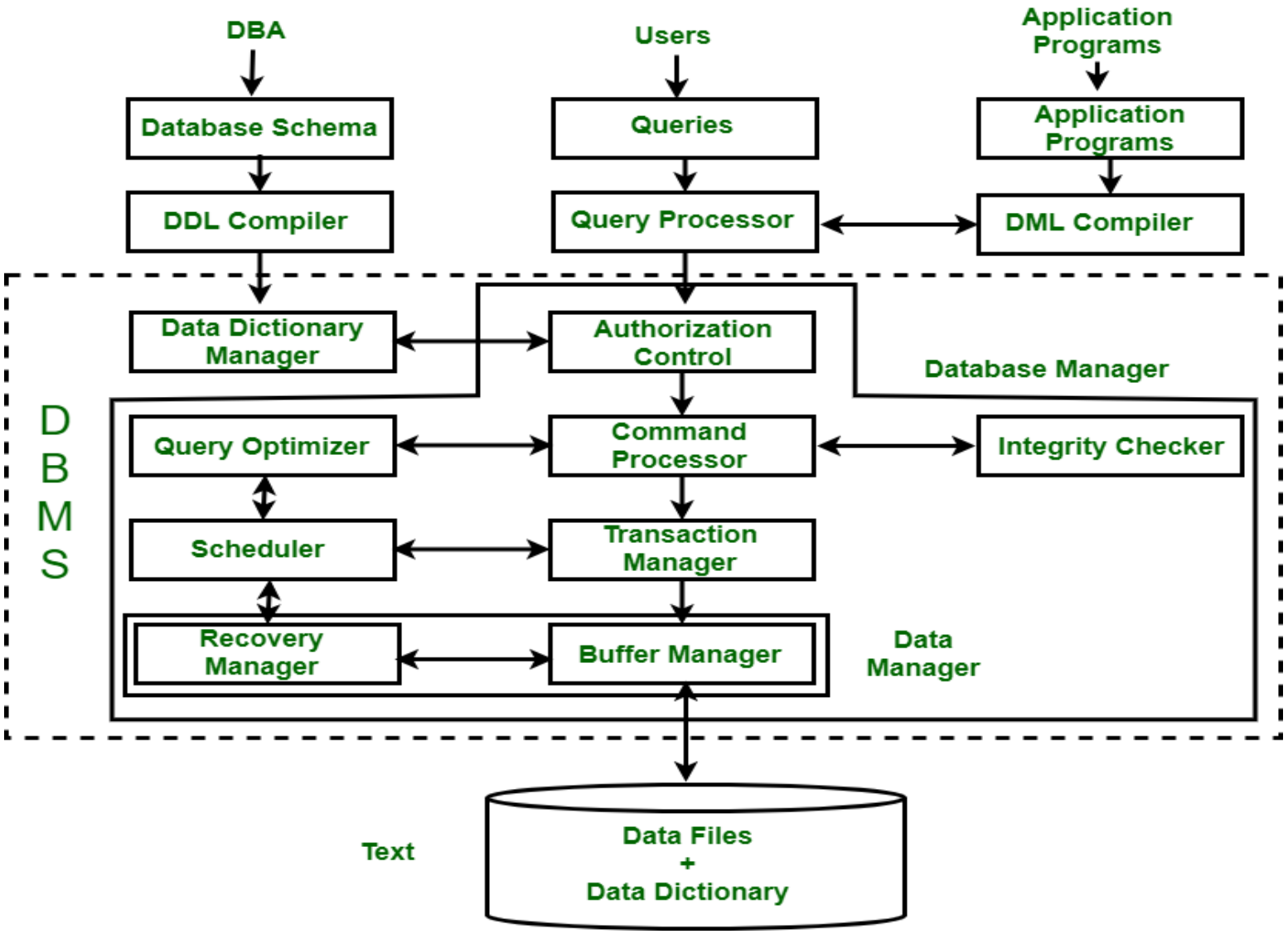
15. Telecommunication

- Database Management Systems (DBMS) are essential to the telecommunications industry because they manage enormous volumes of data on billing, customer information, and network optimization.

Structure of Database Management System

- Database Management System (DBMS) is software that allows access to data stored in a database and provides an easy and effective method of –
- Defining the information.
- Storing the information.
- Manipulating the information.
- Protecting the information from system crashes or data theft.
- Differentiating access permissions for different users.

- **Data Theft:** When somebody steals the information stored on databases, and servers, this process is known as Data Theft.
- The database system is divided into three components: Query Processor, Storage Manager, and Disk Storage. These are explained as following below.



Architecture of DBMS

1. Query Processor: It interprets the requests (queries) received from end user via an application program into instructions. It also executes the user request which is received from the DML compiler.
Query Processor contains the following components –

- **DML Compiler:** It processes the DML statements into low level instruction (machine language), so that they can be executed.
- **DDL Interpreter:** It processes the DDL statements into a set of table containing meta data (data about data).
- **Embedded DML Pre-compiler:** It processes DML statements embedded in an application program into procedural calls.
- **Query Optimizer:** It executes the instruction generated by DML Compiler.

2. Storage Manager: Storage Manager is a program that provides an interface between the data stored in the database and the queries received. It is also known as Database Control System. It maintains the consistency and integrity of the database by applying the constraints and executing the DCL statements. It is responsible for updating, storing, deleting, and retrieving data in the database.
It contains the following components –

- **Authorization Manager:** It ensures role-based access control, i.e,. checks whether the particular person is privileged to perform the requested operation or not.

- **Integrity Manager:** It checks the integrity constraints when the database is modified.

- **Transaction Manager:** It controls concurrent access by performing the operations in a scheduled way that it receives the transaction. Thus, it ensures that the database remains in the consistent state before and after the execution of a transaction.

- **File Manager:** It manages the file space and the data structure used to represent information in the database.

- **Buffer Manager:** It is responsible for cache memory and the transfer of data between the secondary storage and main memory.

3. Disk Storage: It contains the following components –

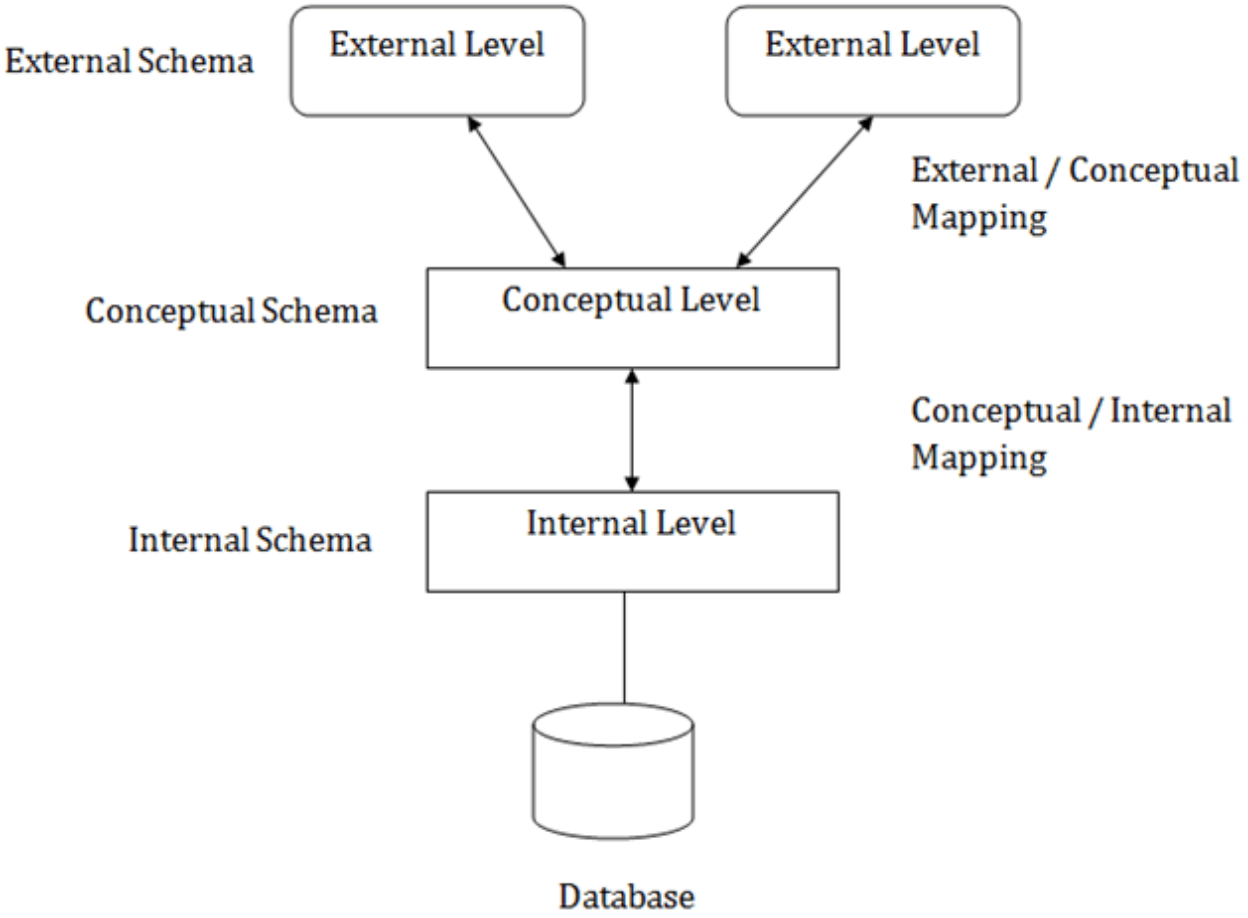
- **Data Files:** It stores the data.

- **Data Dictionary:** It contains the information about the structure of any database object. It is the repository of information that governs the metadata.
- **Indices:** It provides faster retrieval of data item.

Three schema Architecture

- The three schema architecture is also called ANSI/SPARC architecture or three-level architecture.
- This framework is used to describe the structure of a specific database system.
- The three schema architecture is also used to separate the user applications and physical database.
- The three schema architecture contains three-levels. It breaks the database down into three different categories.

Three schema Architecture



Three schema Architecture

- The structure of a Database Management System (DBMS) can be divided into three main components: the Internal Level, the Conceptual Level, and the External Level.
- Internal Level: This level represents the physical storage of data in the database. It is responsible for storing and retrieving data from the storage devices, such as hard drives or solid-state drives. It deals with low-level implementation details such as data compression, indexing, and storage allocation.

Three schema Architecture

- Conceptual Level: This level represents the logical view of the database. It deals with the overall organization of data in the database and the relationships between them. It defines the data schema, which includes tables, attributes, and their relationships. The conceptual level is independent of any specific DBMS and can be implemented using different DBMSs.

Three schema Architecture

- External Level: This level represents the user's view of the database. It deals with how users access the data in the database. It allows users to view data in a way that makes sense to them, without worrying about the underlying implementation details. The external level provides a set of views or interfaces to the database, which are tailored to meet the needs of specific user groups.
- The three levels are connected through a schema mapping process that translates data from one level to another. The schema mapping process ensures that changes made at one level are reflected in the other levels.

Three schema Architecture

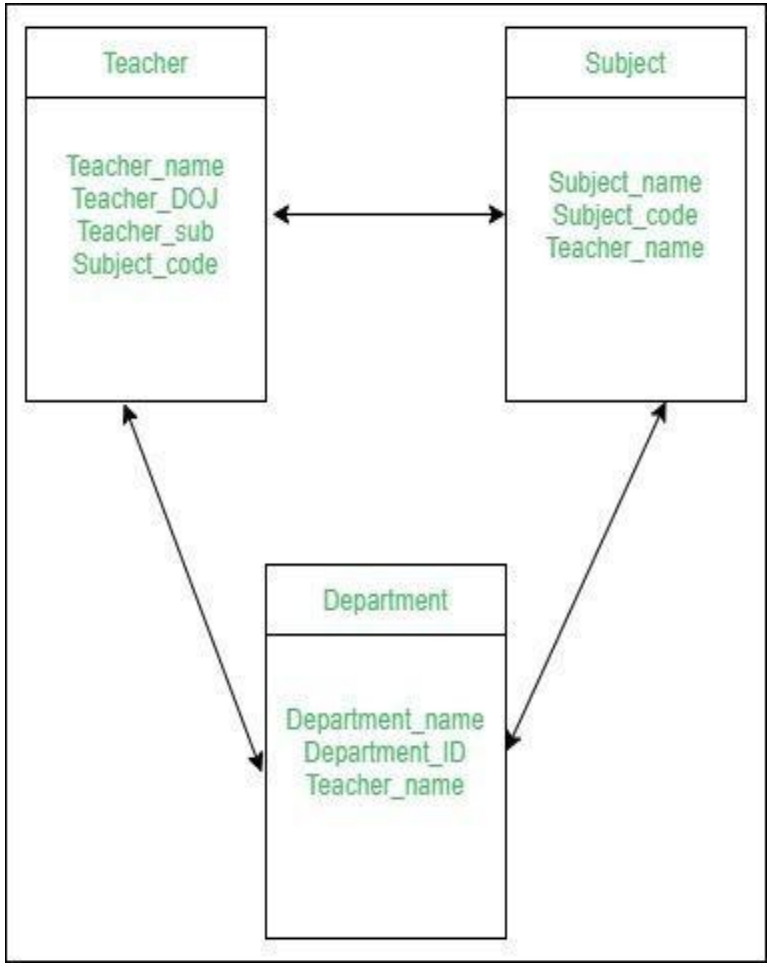
- In addition to these three levels, a DBMS also includes a Database Administrator (DBA) component, which is responsible for managing the database system. The DBA is responsible for tasks such as database design, security management, backup and recovery, and performance tuning.
- Overall, the structure of a DBMS is designed to provide a high level of abstraction to users, while still allowing low-level implementation details to be managed effectively. This allows users to focus on the logical organization of data in the database, without worrying about the physical storage or implementation details.

Instances

- An Instance is the state of an operational database with data at any given time. It contains a snapshot of the database. The instances can be changed by certain CRUD operations, such as like addition, and deletion of data. It may be noted that any search query will not make any kind of changes in the instances.
- **Example:**
  Let's say a table teacher in our database whose name is School, suppose the table has 50 records so the instance of the database has 50 records for now and tomorrow we are going to add another fifty records so tomorrow the instance has a total of 100 records. This is called an instance.

Schema

- Schema is the overall description of the database. The basic structure of how the data will be stored in the database is called schema.



- Schema is of three types: Logical Schema, Physical Schema and view Schema.
- **Logical Schema –** It describes the database designed at a logical level.
- **Physical Schema –** It describes the database designed at the physical level.
- **View Schema** – It defines the design of the database at the view level.

- **Example:**
  Let's say a table teacher in our database named school, the teacher table requires the name, dob, and doj in their table so we design a structure as:
- **Teacher table**
  name: String
  doj: date
  dob: date Above given is the schema of the table teacher.

Data Independence

- **Data Independence** is mainly defined as a property of DBMS that helps you to change the database schema at one level of a system without requiring to change the schema at the next level. it helps to keep the data separated from all program that makes use of it.
  We have namely two levels of data independence arising from these levels of abstraction:
- Physical level data independence
- Logical level data independence

Data Independence in DBMS