

# DBMS Architecture

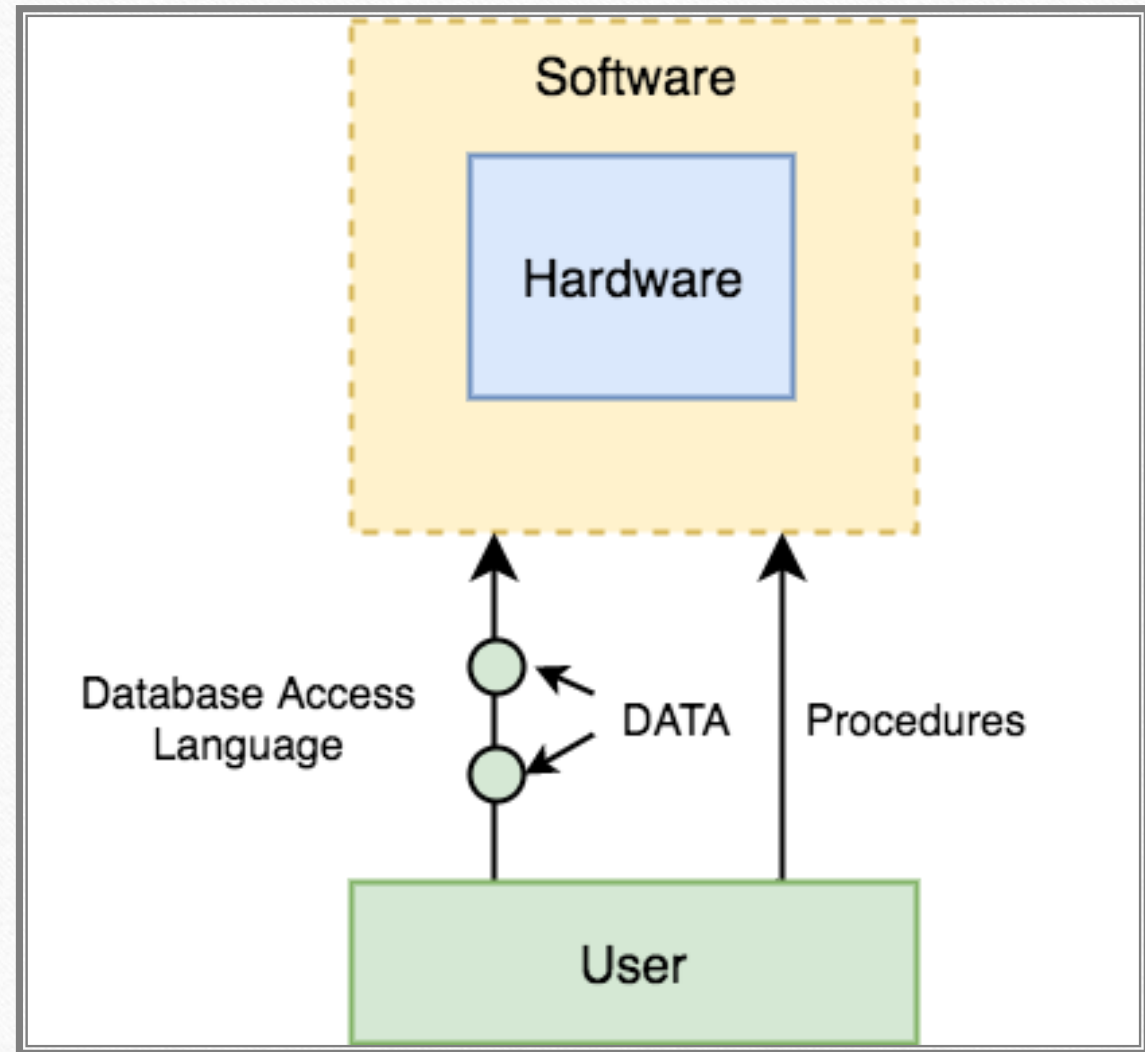
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## DBMS components

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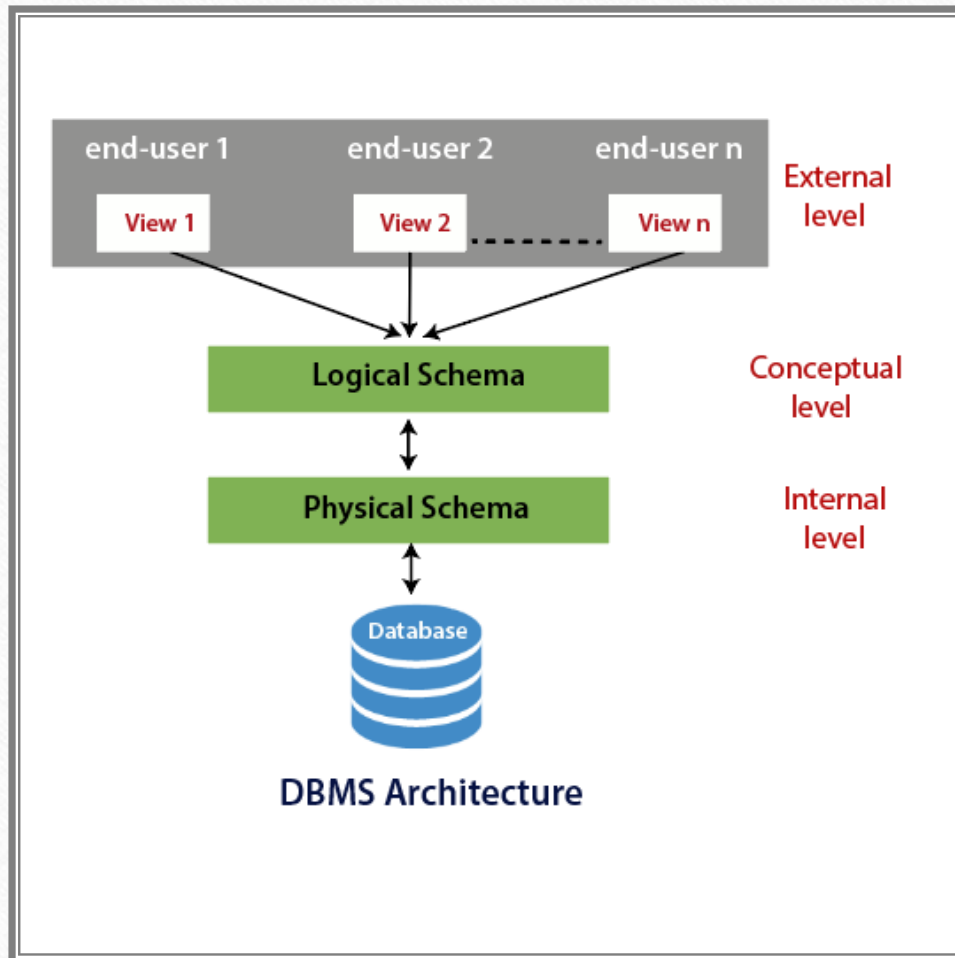
Five major components:

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





# Logical Architecture of DBMS



- It is also called as three schema architecture or ANSI/SPARC architecture or three-level architecture.
- It is also used to separate the user applications and physical database.
- Mapping is used to transform the request and response between various database levels of architecture.
- In External / Conceptual mapping, it is necessary to transform the request from external level to conceptual schema.
- In Conceptual / Internal mapping, DBMS transform the request from the conceptual to internal level.

# Physical Schema

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- An internal schema which describes the physical or actual storage structure of the database.
- The internal schema is also known as a physical schema.
- It is used to define that how the data will be stored in a block.
- The physical level is used to describe complex low-level data structures in detail.
- Database administrator decides how to divide and store the data physically.

# Conceptual Schema

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- The conceptual schema describes the design of a database at the conceptual or logical level.
- It describes the structure of the whole database through ER model and relation model.
- The conceptual level describes what data are to be stored in the database and also describes what relationship exists among those data.
- Internal details such as an implementation of the data structure are hidden.
- Database designers work at this level and create a blueprint of the data.



# External Schema

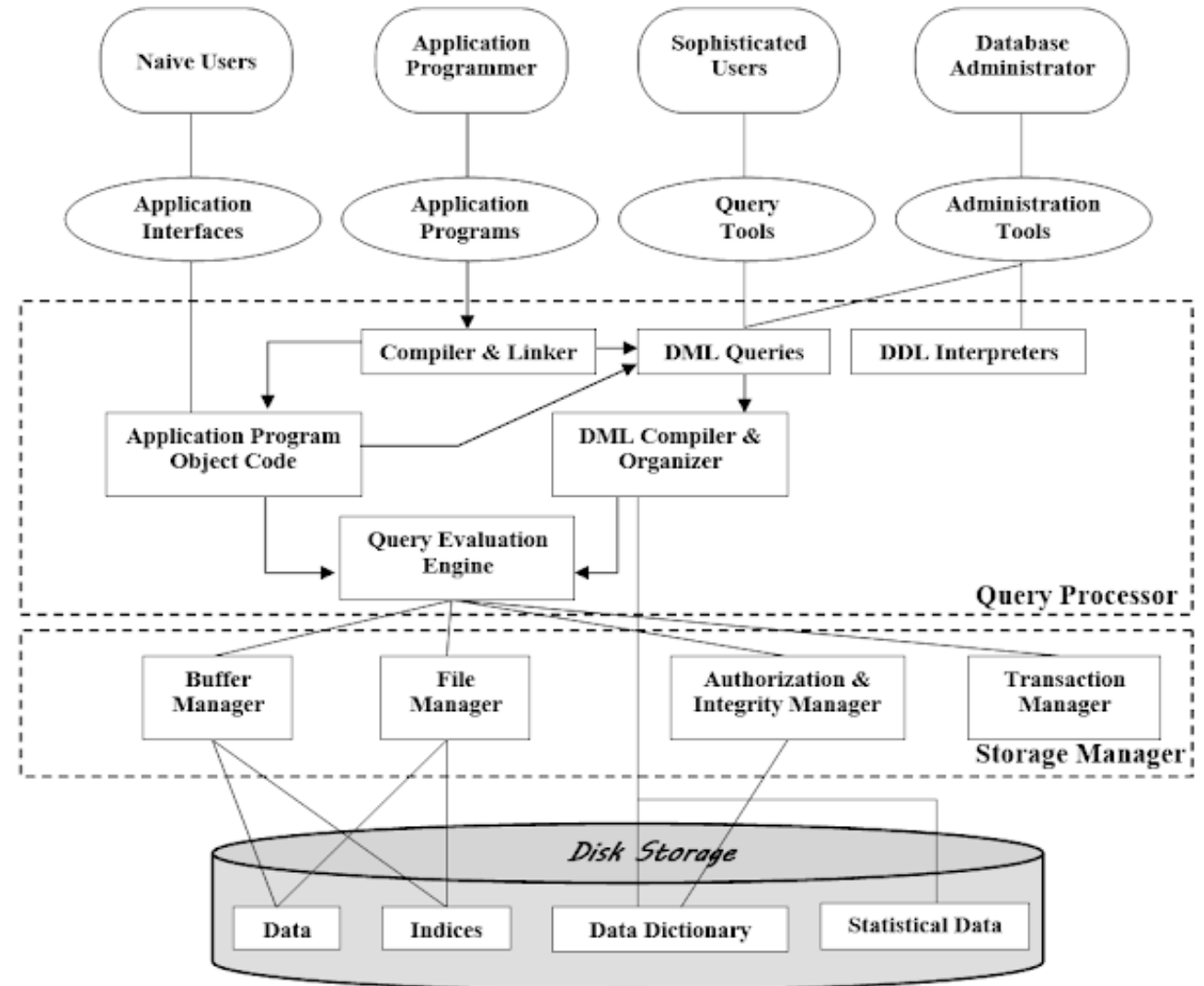
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- At the external level, a database contains several schemas that sometimes called as subschema. The subschema is used to describe the different view of the database.
- An external schema is also known as view schema.
- Each view schema provides abstracted view of the database to a user group and hides the remaining database from that user group.
- The view schema describes the end user interaction with database systems.

# Physical Architecture of DBMS

## Components:

- Users
- DBA
- Query processors
- Storage manager
- Disk storage



*Figure: System Architecture*

# Database administrator (DBA)

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**DBA** has central control of both the data and the programs that access those data.

Functions of a DBA include:

- **Schema definition** by executing a set of data definition statements in the DDL.
- **Storage structure and access-method definition**
- **Schema and physical-organization modification** to reflect the changing needs of the organization and to improve performance.
- **Granting of authorization for data**
- **Routine maintenance**

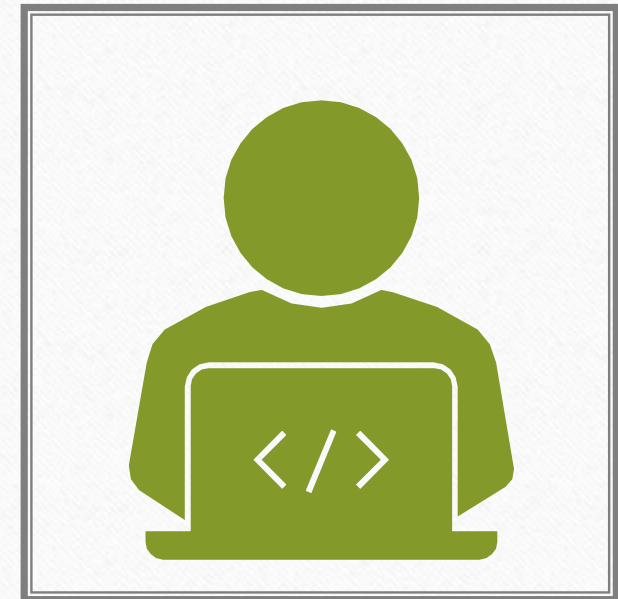




# Users

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- **Application Programmer or Software Developer:** Develop and design the parts of DBMS.
- **Specialized users:** Write specialized database applications that do not fit into the traditional data processing framework.
- **Sophisticated users:** Form requests in a DB query language.
- **Naïve users:** Invoke one of the permanent application programs that have been written previously.



# Query processors

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**DML Pre-compiler :** It translates DML statements in a query language into low level and it also transform user's request into an equivalent but more efficient form.

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**Embedded DML Pre-compiler :** It converts DML statements embedded in an application program to normal procedure calls in the host language.

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**DDL Interpreter :** It interprets the DDL statements and records them in a set of tables containing meta data or data dictionary.

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**Query Evaluation Engine :** It executes low-level instructions generated by the DML compiler.



# Storage Manager

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They provide the interface between the low-level data stored in the database and application programs and queries submitted to the system.

- **Authorization and Integrity Manager :** It tests for the satisfaction of integrity constraints checks the authority of users to access data.
- **Transaction Manager :** It ensures that the database remains in a consistent state despite the system failures and that concurrent transaction execution proceeds without conflicting.
- **File Manager :** It manages the allocation of space on disk storage and the data structures used to represent information stored on disk.
- **Buffer Manager :** It is responsible for fetching data from disk storage into main memory and deciding what data to cache in memory.

# Disk storage

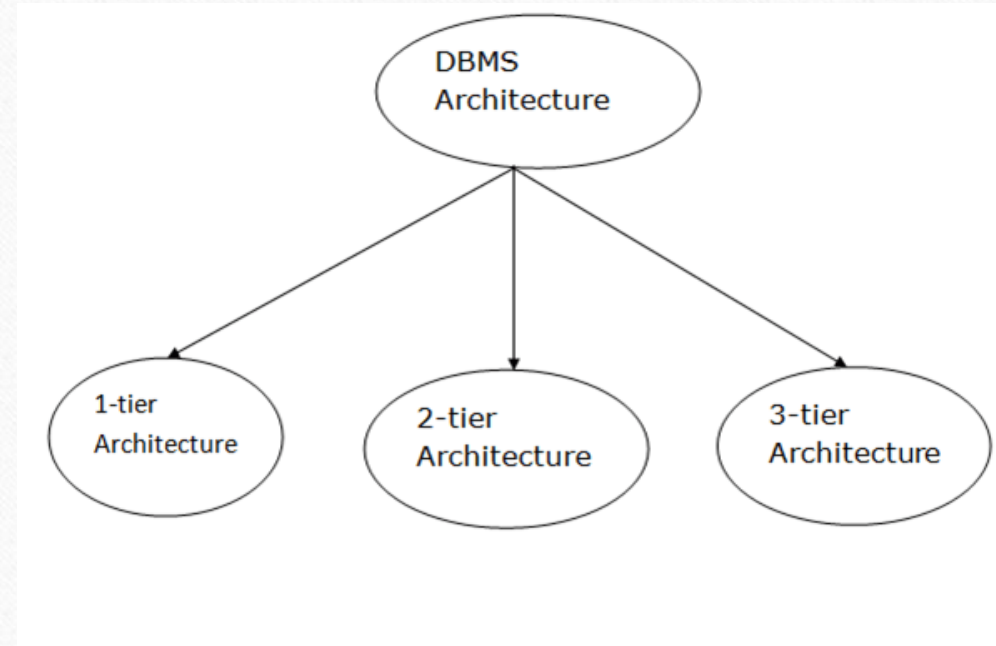
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- **Data Files** : It stores the database.
- **Data Dictionary** : It stores meta data (data about data) about the structure of the database.
- **Indices** : Provide fast access to data items that hold values.
- **Statistical Data** : It stores statistical information about the data in the database. This information is used by query processor to select efficient ways to execute query.



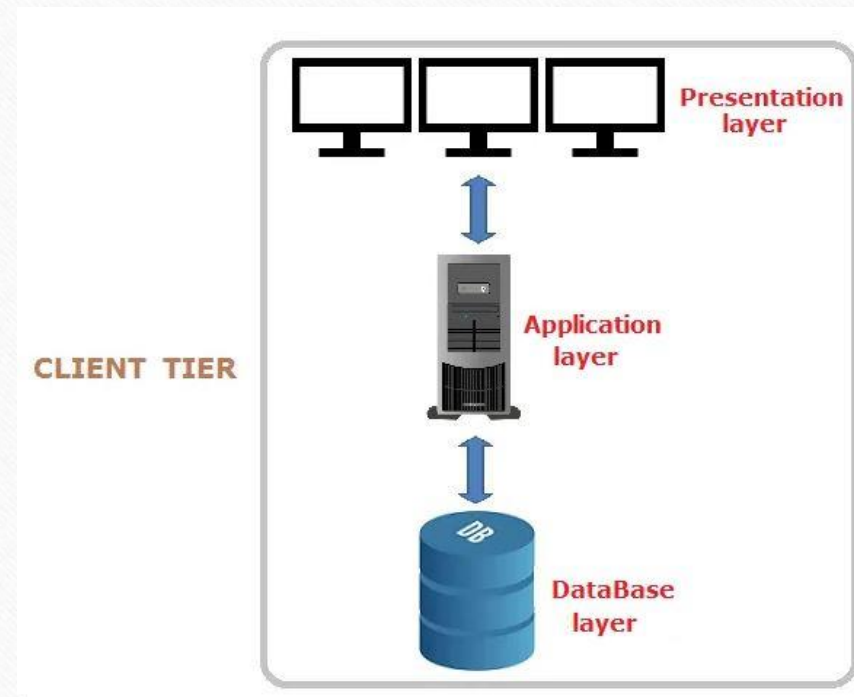
# Application Architecture

- DBMS is not always directly available for users and applications to access and store data in it.
- It can be **centralized**, **decentralized** or **hierarchical**, depending upon its architecture.
- DBMS architecture depends upon how users are connected to the database to get their request done.



# 1-Tier Architecture

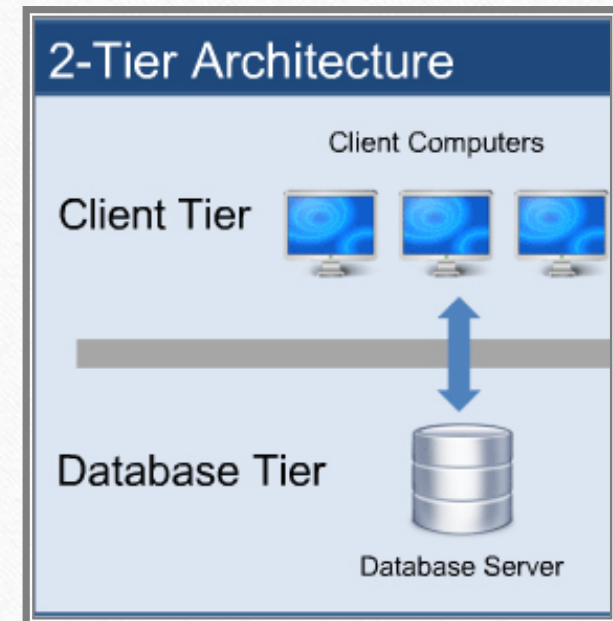
- In this architecture, the database is directly available to the user. It means the user can directly sit on the DBMS and uses it.
- Any changes done here will directly be done on the database itself. It doesn't provide a handy tool for end user
- It is used for development of the local application, where programmers can directly communicate with the database for the quick response.
- It is also called as client-tier architecture.





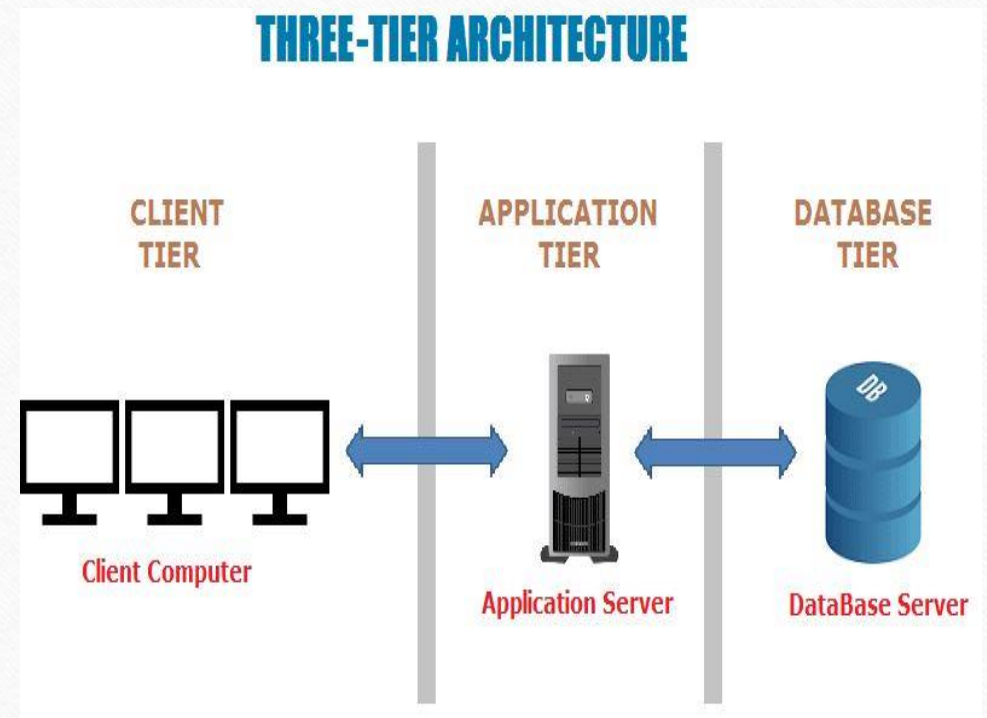
# 2-Tier Architecture

- It is same as basic client-server.
- Applications on the client end can directly communicate with the database at the server side with the help of API's like **ODBC, JDBC**.
- The user interfaces and application programs are run on the client-side.
- The server side is responsible to provide the functionalities like query processing and transaction management.
- To communicate with the DBMS, client-side application establishes a connection with the server side.



# 3-Tier architecture

- **Database (Data) Tier** – At this tier, the database resides along with its query processing languages. The relations with data and their constraints are defined at this level.
- **Application (Middle) Tier** –
  - It contains application server and the program
  - It presents an abstracted view of the database.
  - It acts as a mediator between the end-user and the database.
- **Client (Presentation) Tier** – Multiple views of the database can be provided by the application that reside in the application tier.





# MCQs

- In the three-tier architecture, the intermediate layer between database and client servers is classified as
  - Functional server
  - Transaction server
  - Application server
  - Disk server

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- C. Application server**
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- In architecture of the database in which the characteristics such as program insulations, multiple user support and the use of catalogues are achieved is classified as

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  - A. Multiple schema architecture
  - B. Single schema architecture
  - C. Two schema architecture
  - D. Three schema architecture

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- A. close module connectivity
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- B. Client side
- C. Server side
- D. Host side

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# References

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