

Database Management System

Subject Code: 3130703

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Teaching and Examination Scheme

Teaching Schemes

- ✓ Lecture (L) – 4 , Tutorial (T) – 0, Practical (P) - 2 = Credit – 5
- ✓ Total Marks of the Subject: 150

Examination Scheme

Theory Marks:

- ✓ ESE(E) – 70 (University Level Exam) (End Semester Examination)
- ✓ PA(M) – 30 (College Level Exam) (Progressive Assessment)

Practical Marks:

- ✓ ESE(V) – 30 (End Semester Examination (College level))
- ✓ PA(I) – 20 (Progressive Assessment (College Level))

Reference Books

1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “Fundamentals of Database Systems”, 7th Edition by R. Elmasri and S. Navathe, Pearson
3. “An introduction to Database Systems”, C J Date, Pearson.

Cont....

4. “Modern Database Management”, Hoffer , Ramesh, Topi, Pearson.
5. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.
6. “Understanding SQL”, Martin Gruber, BPB
7. SQL,PL/SQL – The Programing language of Oracle

List of Open Source learning website:

1. <https://www.tutorialspoint.com/dbms/>
2. <https://www.w3schools.com/sql/>
3. <https://www.codecademy.com/learn/learn-sql>

List of Experiments

1. To study DDL-create and DML-insert commands
2. Create table and insert sample data in tables.
3. Perform queries involving predicates LIKE, BETWEEN, IN etc.
4. To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.

Cont....

- 5.To study Single-row functions.
- 6.Displaying data from Multiple Tables (join)
- 7.To apply the concept of Aggregating Data using Group functions.
- 8. To solve queries using the concept of sub query.

Cont....

- 9. To apply the concept of security and privileges
- 10. To study Transaction control commands
- 11. Write Cursor
- 12. Write Trigger

What is Data?

- **Data** is defined as facts or figures, or information that's stored and used by a computer.
- **Data** is a unorganized collection of information.

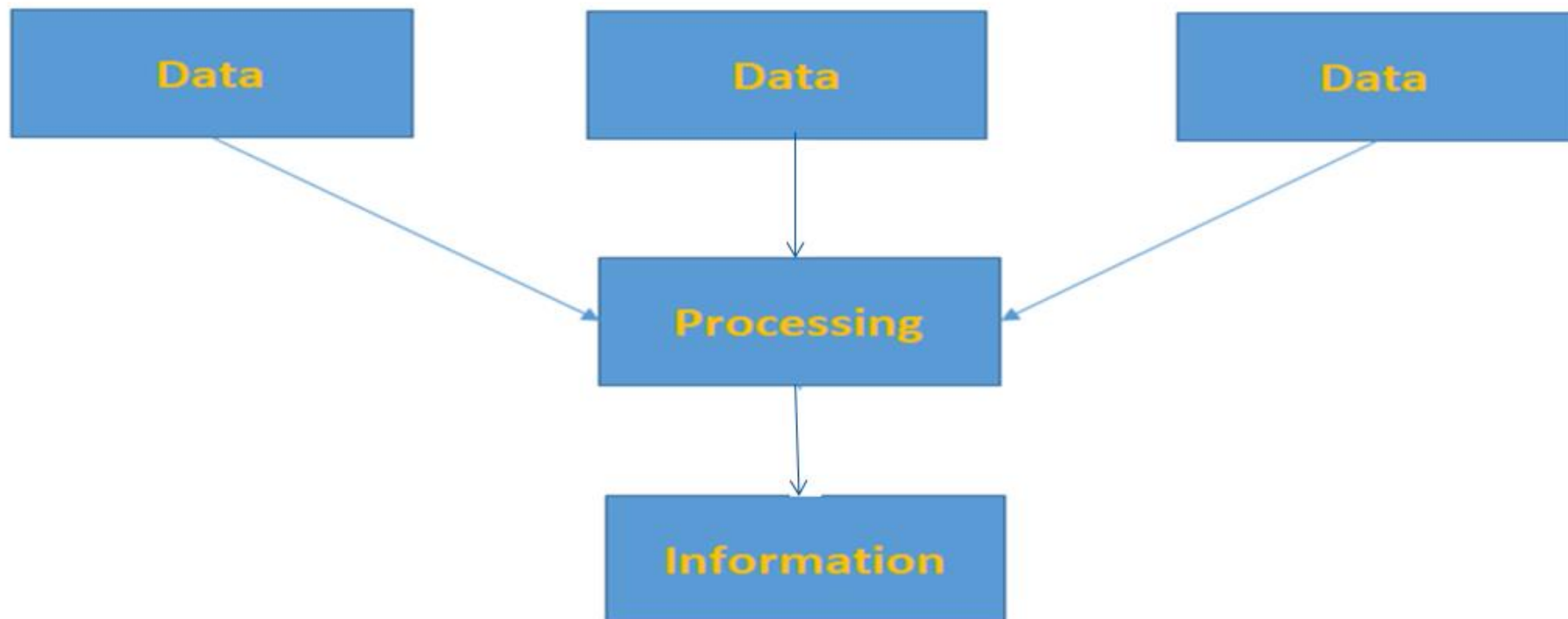
Example..

- ✓ Country Name like INDIA that is a data.
- ✓ E.g. Person Name, Age, weight.

What is Information?

- ✓ When data is **processed, organized, structured** or **presented** in a given context so as to make it useful, it is called **information**.
- ✓ **Example:** The average score like Cricket Team, Class, Subject.

Most people believe that the terms "**data**" and "**information**" are interchangeable and mean the same thing.



Data Vs Information

Data	Information
Data is Collection of Facts	while information puts those facts into context (Bucket).
While data is unorganized,	Information is organized.
Data points are individual and sometimes unrelated.	Information maps out that data to provide a big-picture view of how it all fits together.
Data are simple text and numbers.	while information is processed and interpreted data.

What is Database Management System(DBMS)?

A **Database Management System (DBMS)** is a software package designed to define, manipulate, retrieve and manage data in a database.

e.g. SQL, Oracle, MongoDB.

Database : It is a logically related data.

e.g. Students Database in GTU.

Management: Manipulation, Searching and Security of data.

e.g. Searching exam paper in GTU

System: Program and tool manage Database.

e.g. SQL, Oracle

Application of DBMS

- ✓ DBMS is a computerized record-keeping system.
- ✓ E-Commerce (Flikart, Amazon, Shopclues, eBay etc...)
- ✓ Online Television Streaming (Hotstar, Amazon Prime etc...)
- ✓ Social Media (WhatsApp, Facebook, **Twitter**, **LinkedIn** etc...)
- ✓ Banking & Insurance
- ✓ Airline & Railway
- ✓ Universities and Colleges/Schools
- ✓ Library Management System
- ✓ Hospitals and Medical Stores
- ✓ Government Organizations



Advantages of DBMS

Reduce data redundancy (Duplication)

COMPUTER

Faculty Name	Address	Mobile	Subject
Amit	Rajkot	1234	WORKSHOP

CIVIL

Same data is stored at TWO different places.

Faculty Name	Address	Mobile	Subject
Amit	Rajkot	1234	WORKSHOP

Remove data inconsistency

COMPUTER

Same data Having different values

Faculty Name	Address	Mobile	Subject
Amit	Rajkot	1234	WORKSHOP

CIVIL

Mobile no is changed

Faculty Name	Address	Mobile	Subject
Amit	Rajkot	9825	WORKSHOP

Guaranteed Atomicity

- ✓ Ex. The Transaction of Banking System

Data Can be Shared

- ✓ Multiple user can login at a time into database to access information.
- ✓ The centralized control of data of organization.

Standards can be enforced

- ✓ Rules and Regulations for Coding and Designing

Security Restrictions

- ✓ Unauthorized user not access a database.



Integrity can be maintained

- ✓ Only accurate data is stored with in database.

Data independence can be provided

- ✓ Non Technical users can be access database system.

Providing backup and recovery services

- ✓ Can **take a regular auto or manual backup** and **use it to restore** the database if it corrupts.

Disadvantages of DBMS

- ✓ **Cost of Hardware and Software** of a DBMS is quite high which increases the budget of your organization.
- ✓ Most database management systems are often **complex systems**, so the **training** for users to use the DBMS is required.

Conti..

- ✓ In some organizations, all data is integrated into a **single database** which can be damaged because of electric failure or database is corrupted on the storage media.
- ✓ Use of the **same program at a time** by many users sometimes lead to the loss of some data.

Characteristics of DBMS

- ✓ Provides security and removes redundancy
- ✓ Self-describing nature of a database system
- ✓ Support of multiple views of the data
- ✓ Sharing of data and multiuser transaction processing
- ✓ DBMS allows entities and relations among them to form tables

Conti..

- ✓ It follows the ACID concept (Atomicity, Consistency, Isolation, and Durability)
- ✓ DBMS supports multi-user environment that allows users to access and manipulate data in parallel

Basic terms

Metadata

- Metadata is **data about data**.
- Data such as table name, column name, data type, authorized user and user access privileges for any table is called metadata for that table.

FACULTY

Emp_Name	Address	Mobile_No	Subject
Amit Vyas (Varchar)	Rajkot	1234 (Number)	DBMS

Metadata

Metadata of above table is:

- Table name such as Faculty
- Column name such as Emp_Name, Address, Mobile_No, Subject
- Datatype such as Varchar, Decimal
- Access privileges such as Read, Write (Update)



Data Dictionary

Field

- A field is a **character or group of characters** that have a specific meaning.
- E.g, the value of Emp_Name, Address, Mobile_No etc are all fields of Faculty table.

FACULTY

Emp_Name	Address	Mobile_No	Subject
Amit Vyas	Rajkot	1234	DBMS
Jay	Surat	2525	ADA

Record / Tuple(Row)

- A record is a **collection of logically related fields**.
- E.g, the collection of fields (Emp_Name, Address, Mobile_No, Subject) forms a record for the Faculty.

Amit Vyas	Rajkot	1234	PPS
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Students

File.. Collection
of Record

Sr.no	Name	City
1	Amit	Rajkot
2	Dip	Baroda
3	Jay	Surat
4	Bhavik	Surat
5	Vivek	Gandhinagar

Record

3	Jay	Surat
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Fields..
Categories of
description

Points to be Discussed

Data Abstraction

- ✓ Internal Level/Schema
- ✓ Conceptual Level/Schema
- ✓ Physical Level/Schema

Data Independence

- ✓ Logical Data Independence
- ✓ Physical Data Independence

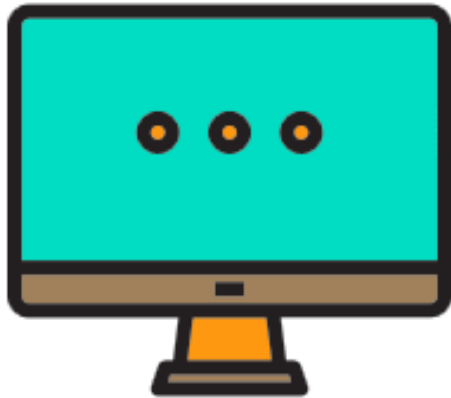
Data Abstraction:

- ✓ In order to make the system efficient in terms of **retrieval** of data, and **reduce complexity** in terms of usability of users, developers use **abstraction** i.e. hide irrelevant details from the users. This approach simplifies database design.



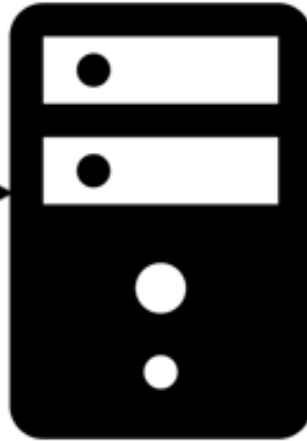
3-Levels ANSI SPARC (Standards Planning And Requirements Committee) Database System

External Level/
View Level



Client

Conceptual Level/
Logical Level



Server

Internal Level
/Physical



Database



How data are viewed
by each users?



User 1

View 1



User 2

View 2



User 3

View 3

**View
Level**

What data are stored and
What relationships exist?

Conceptual
Level

**Logical
Level**

How the data are actually
stored on storage devices?

Internal
Level

**Physical
Level**

Database

Internal Level/Schema (Physical Level/Schema)

- ✓ The internal schema defines the physical storage structure of the database.
- ✓ The internal schema is a **very low-level** representation of the entire database.
- ✓ It contains multiple occurrences of multiple types of internal record. In the ANSI term, it is also called "stored record".

Conceptual Level/Schema (Logical Level/Schema)

- ✓ The conceptual schema describes the Database structure of **the whole database** for the community of users. This **schema hides information** about the physical storage structures and focuses on describing data types, entities, relationships, etc.
- ✓ This logical level comes between the user level and physical storage view. However, there is only single conceptual view of a single database.

External Level/Schema (View Level/Schema)

- ✓ An external schema describes the part of the database which specific user is interested in.
- ✓ An external view is just the content of the database as it is seen by some specific particular user. **For example, a user from the sales department will see only sales related data.**

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Main Purpose of Database Schema

The main purpose of data abstraction is achieving data independence in order to save time and cost required when the database is modified or altered.

We have namely two levels of “data independence” arising from these levels of abstraction :

- ✓ **Physical Level Data Independence**
- ✓ **Logical Level Data Independence**

Physical Data Independence

- ✓ Physical Data Independence is the ability to **modify the physical schema without requiring** any change in logical (conceptual) schema and application programs.

Cont..

- ✓ Modifications at the internal levels are occasionally necessary to improve performance.
- ✓ **Possible modifications at internal levels** are changes in file structures, compression techniques, hashing algorithms, storage devices, etc.

Logical Data Independence

- ✓ Logical data independence is the **ability to modify the conceptual schema** without requiring any change in application programs.
- ✓ Modification at the logical levels is necessary whenever the logical structure of the database is changed.

Cont..

- ✓ Application programs are heavily dependent on logical structures of the data they access. So any change in logical structure also requires programs to change.

Logical Data Independence	Physical Data Independence
Logical Data Independence is mainly concerned with the structure or changing the data definition.	Mainly concerned with the storage of the data.
It is difficult as the retrieving of data is mainly dependent on the logical structure of data.	It is easy to retrieve.
Compared to Physical independence it is difficult to achieve logical data independence.	Compared to Logical Independence it is easy to achieve physical data independence.

Logical Data Independence	Physical Data Independence
You need to make changes in the Application program if new fields are added or deleted from the database.	A change in the physical level usually does not need change at the Application program level.
Modification at the logical levels is significant whenever the logical structures of the database are changed.	Modifications made at the internal levels may or may not be needed to improve the performance of the structure.
Concerned with conceptual schema	Concerned with internal schema
Example: Add/Modify/Delete a new attribute	Exemple: change in compression techniques, hashing algorithmes, Storage devices.



Role of DBA (Database Administrator)

Role of DBA

Schema Definition

- ✓ DBA **defines the logical schema** of the database.

Storage Structure and Access Method Definition

- ✓ DBA **decides how the data is to be represented** in the database & how to access it.

Defining Security and Integrity Constraints

- ✓ DBA **decides on various security and integrity constraints**.

Granting of Authorization for Data Access

- ✓ DBA **determines which user needs access to which part** of the database.

Communication with Users

- ✓ DBA **provide necessary data** to the user.

Cont....

Assisting Application Programmer

- ✓ DBA **provides assistance to application programmers** to develop application programs.

Monitoring Performance

- ✓ DBA **ensures that better performance is maintained** by making a change in the physical or logical schema if required.

Backup and Recovery

- ✓ DBA **backing up the database** on some storage devices such as DVD, CD or magnetic tape or remote servers and **recover the system in case of failures**, such as flood or virus attack from this backup.

File Oriented System

- ✓ **State the advantages of Database management systems over file processing system.**

What is File Oriented System?

- The file management system is also a **database management system** where data is stored in the form of files.
- Each file does **not have any relation** with other files. Tables are stored in the files, and sometimes only a single table is stored in a file which is also known as a flat file.

- **DBMS:** A Database Management System (DBMS) is application software that allows users to efficiently define, create, maintain and share databases.
- Defining a database involves specifying the data types, structures and constraints of the data to be stored in the database. Maintaining a database with updating the database whenever required.

Advantages of DBMS over File Systems

- ✓ **Data Redundancy**
- ✓ **Data Inconsistency**
- ✓ **Data Searching**
- ✓ **Data Sharing**
- ✓ **Integrity**
- ✓ **Interfaces**
- ✓ **Security**

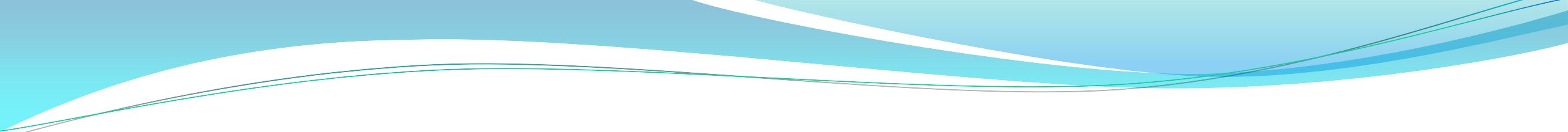
File Oriented System Disadvantage ...

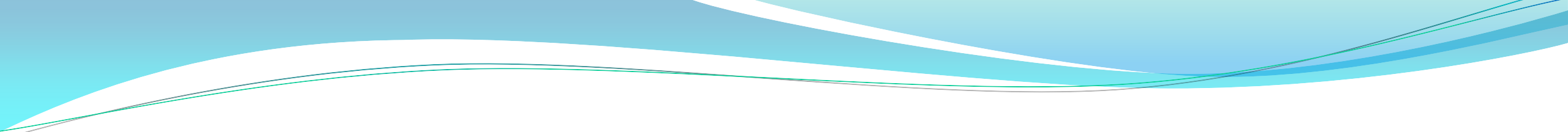
- ✓ Back-up
- ✓ Data Retrieval
- ✓ Editing
- ✓ Remote Access
- ✓ Sharing

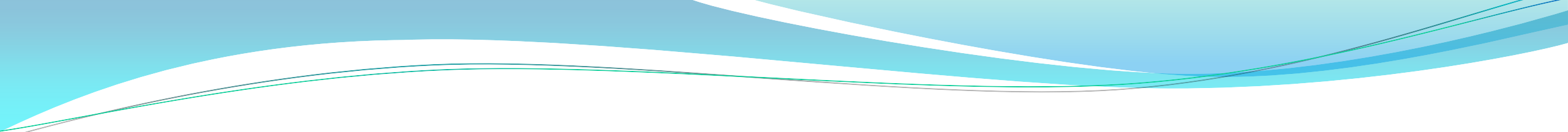
DA (Data Administrator) and DBA(Database Administrator)

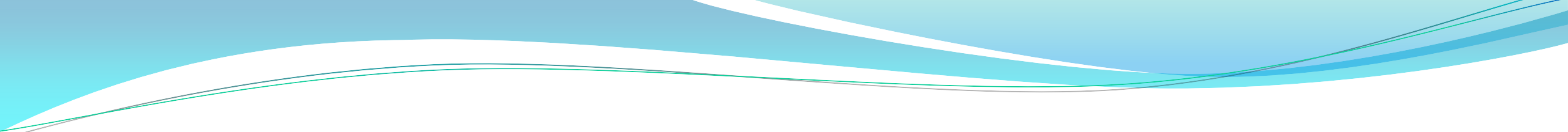
- ✓ DA – It determines what data to be stored in database based on requirements of the organization.
- ✓ DBA – It provides necessary technical support for implementing a database.

Data Administrator(DA)	Database Administrator(DBA)
A manager or senior level person.	A technical person of Database
It is organization level or Project Leader	Technical support
the requirement gathering, analysis, design phases.	design, development, testing, operational phases.
who controls the data of the database.	who controls the data of the database.
Business focused person	Technology person

- 
- ✓ DA – It involved more in the requirement gathering, analysis, design phases.
 - ✓ DBA – It involved in more on design, development, testing, operational phases.

- 
- ✓ DA - It is person in organization who controls the data of the database.
 - ✓ DBA – It is a person in the organization who controls the use of the database and design.

- 
- ✓ DA – A manager or senior level person.
 - ✓ DBA- A technical person having knowledge of database technology.

- 
- ✓ DA – Business focused person, but they need to understand more about database technology.
 - ✓ DBA – Technology person but they should understand more about the business to administer the database effectively.

Database Architecture (Types of Database users)

Naive Users (End Users)

- ✓ **Unsophisticated users** who have zero knowledge of database system
- ✓ End user interacts to database via sophisticated software or tools
- ✓ e.g. Clerk in bank

Application Programmers

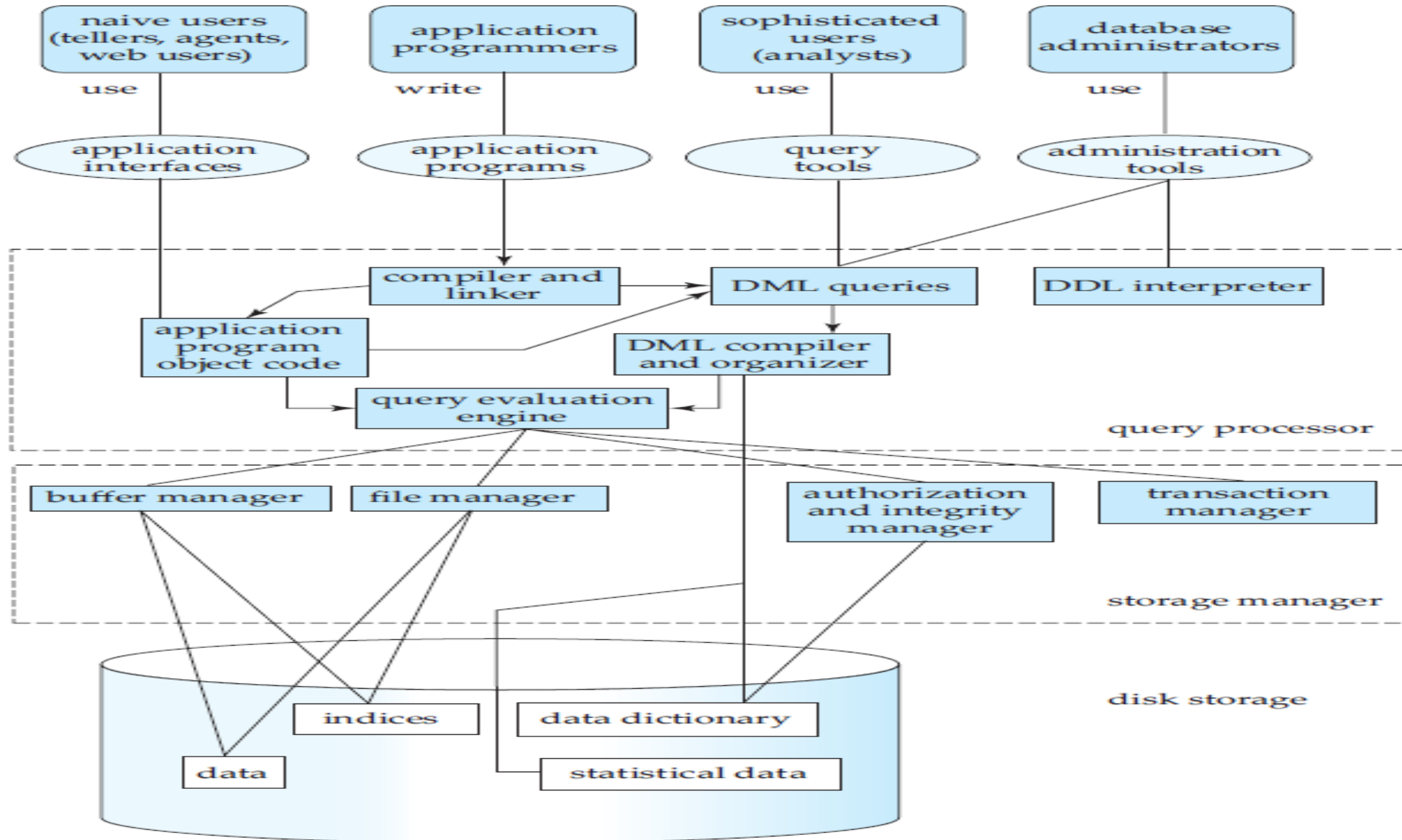
- ✓ **Programmers** who write software using tools such as Java, .Net, PHP etc...
- ✓ e.g. Software developers

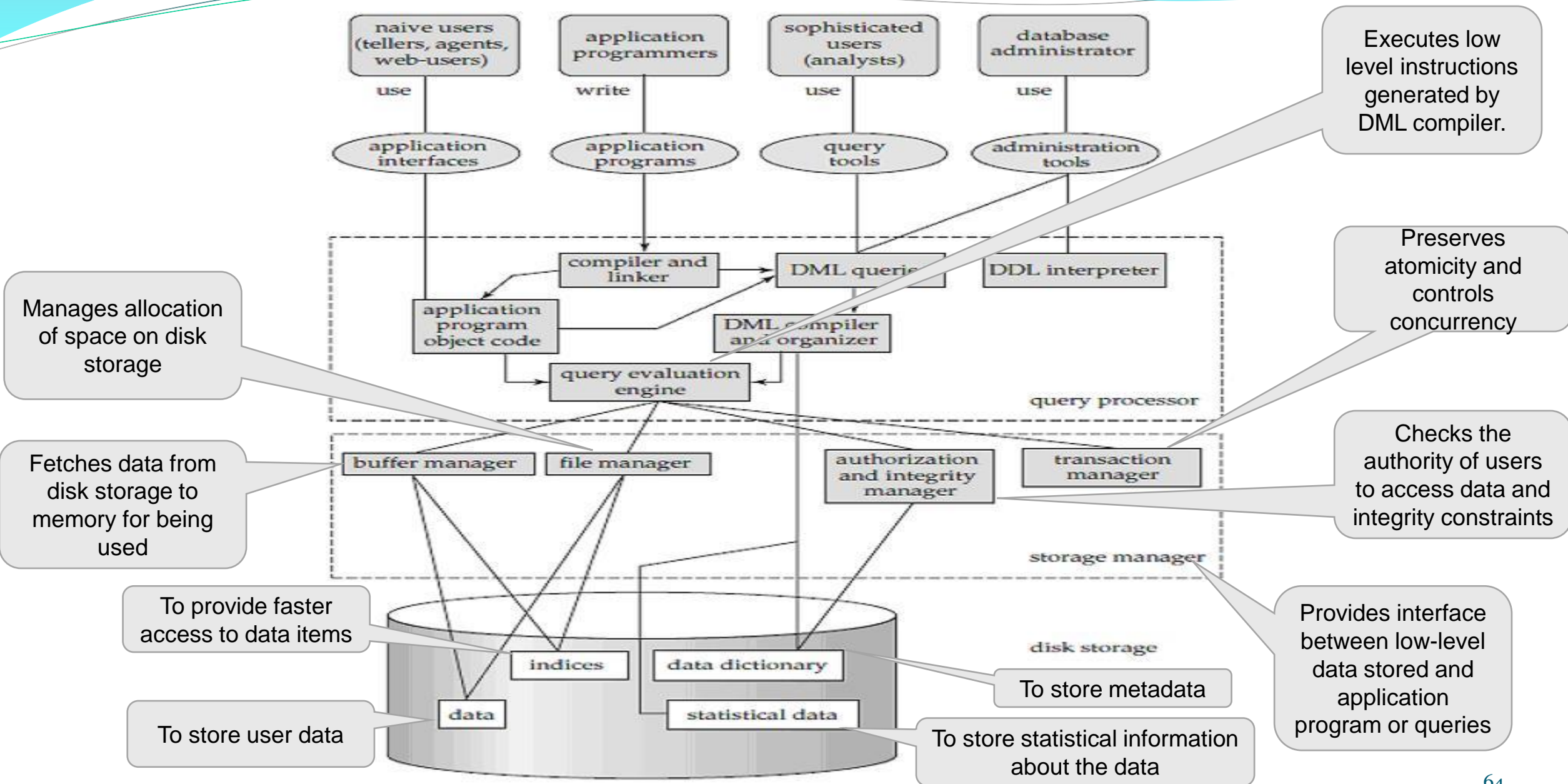
Sophisticated Users

- ✓ **Interact with database system** without using an application program
- ✓ Use query tools like SQL
- ✓ e.g. Analyst

Specialized Users (DBA)

- ✓ User **write specialized** database applications program
- ✓ Use administration tools
- ✓ e.g. Database Administrator

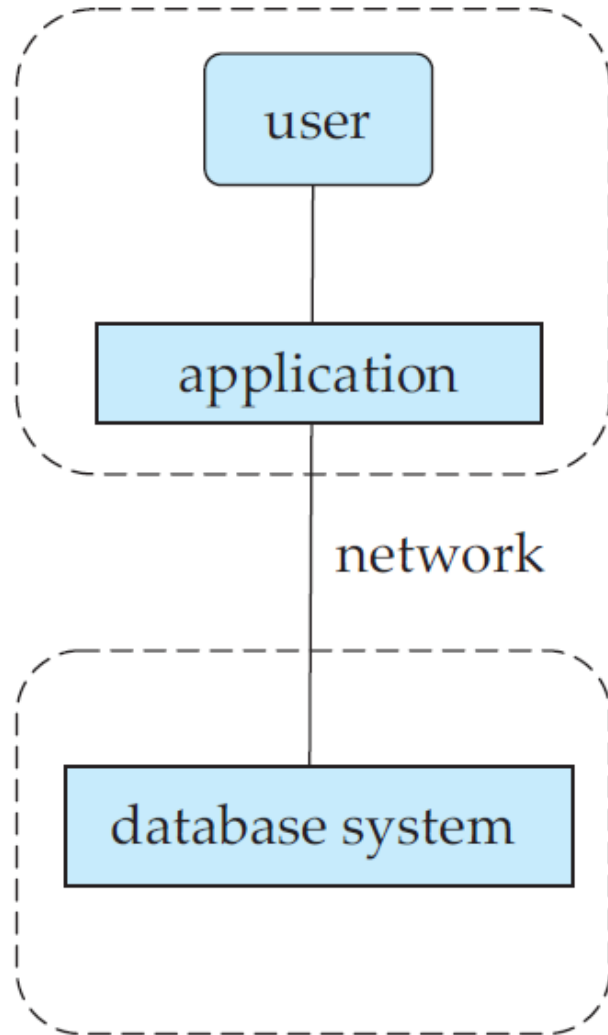




- **DDL interpreter**, which interprets DDL statements and records the definitions in the data dictionary.
- **DML compiler**, which translates DML statements in a **query language** into an evaluation plan consisting of low-level instructions that the query evaluation engine understands(SQL).
- **Query evaluation engine**, which executes low-level instructions generated by the DML compiler.

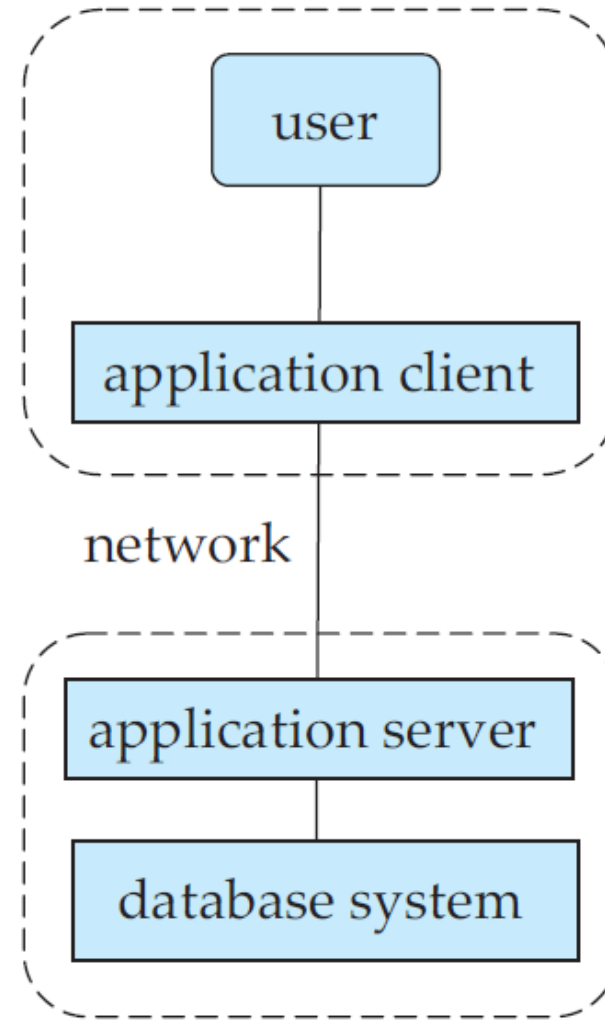


Two-tier-architecture Vs Three-tier -architecture



(a) Two-tier architecture

client



(b) Three-tier architecture

server

- **Two-tier architecture:** Most users of a database system today are **not present at the site** of the database system, but connect to it through a network.
- We can differentiate between **client** machines, on which remote database users work, and **server** machines, on which the database system runs.

- **Two-tier architecture**, the application resides at the client machine, where it invokes database system functionality at the **server machine through query language** statements. Application program interface standards like ODBC and JDBC are used for interaction between the client and the server

- **Three-tier architecture**, the client machine acts a front end and **does not contain any direct database calls**.
- Instead, the client end communicates with an **application server**, usually through a forms interface.

- The application server in turn communicates with a database system to access data.
- The **business logic** of the application, which says what actions to carry out under **what conditions**, is **embedded in the application server**, instead of being **distributed across multiple clients**.

PRIMARY KEY

- The PRIMARY KEY constraint **uniquely identifies each record in a table.**
- Primary keys must contain UNIQUE values, and **cannot contain NULL values.**
- A table can have only ONE primary key; and in the table, this primary key can consist of single or multiple columns (fields).

FOREIGN KEY

- A FOREIGN KEY is a field (or collection of fields) in one table, that refers to the PRIMARY KEY in another table.
- The table with the foreign key is called the child table, and the table with the primary key is called the referenced or parent table.

Person ID	First Name	Last Name	Age
1	Amit	Vyas	28
2	Deep	Vora	23
3	Bhavik	patel	20

Order ID	Order Number	Person ID
1	44678	3
2	22456	2
3	24562	1
4	25453	1



Thank You