Database Fundamentals

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Objective

This course is designed to introduce the fundamentals of Databases. The students will develop skills in the design, construction, modification, and use of databases. Structured Query Language (SQL) will be emphasized.

Course Duration

*Lectures:*15 hrs.

Labs: 12 hrs.

Grading System

Assignments and Lab Work	**40%**
Final Exam	**60%**

Chapter 1 : Introduction

After Completing this chapter, you should be able to do the following:

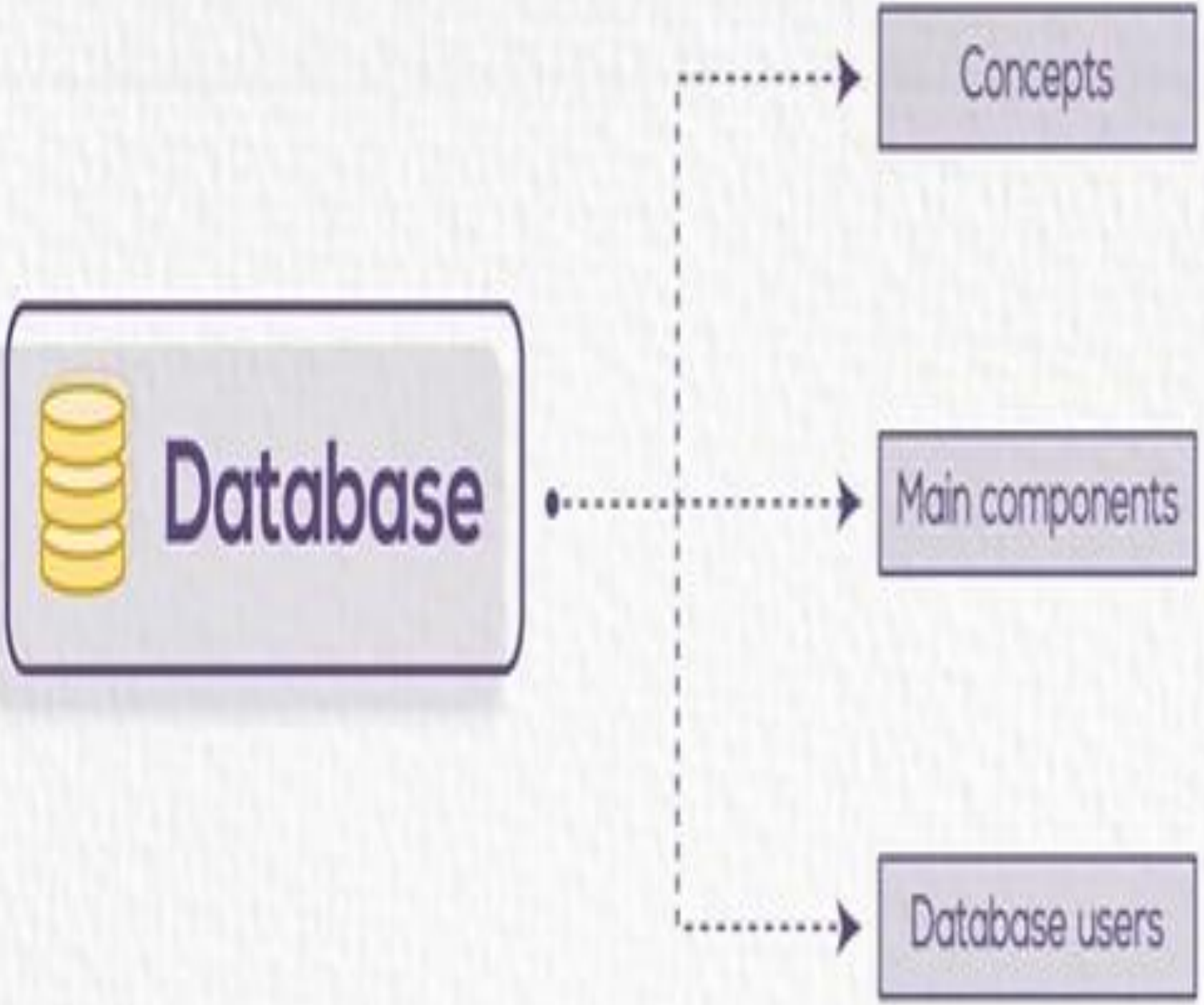
- Define Database, Database System
- Identify the Database Properties
- Define DBMS
- Functions of DBMS
- Advantages and Disadvantages of Database Systems

Database interact with:

E- commerce

Super Market

E-Mail


Database
Concepts
Main components
Database users

File Based System

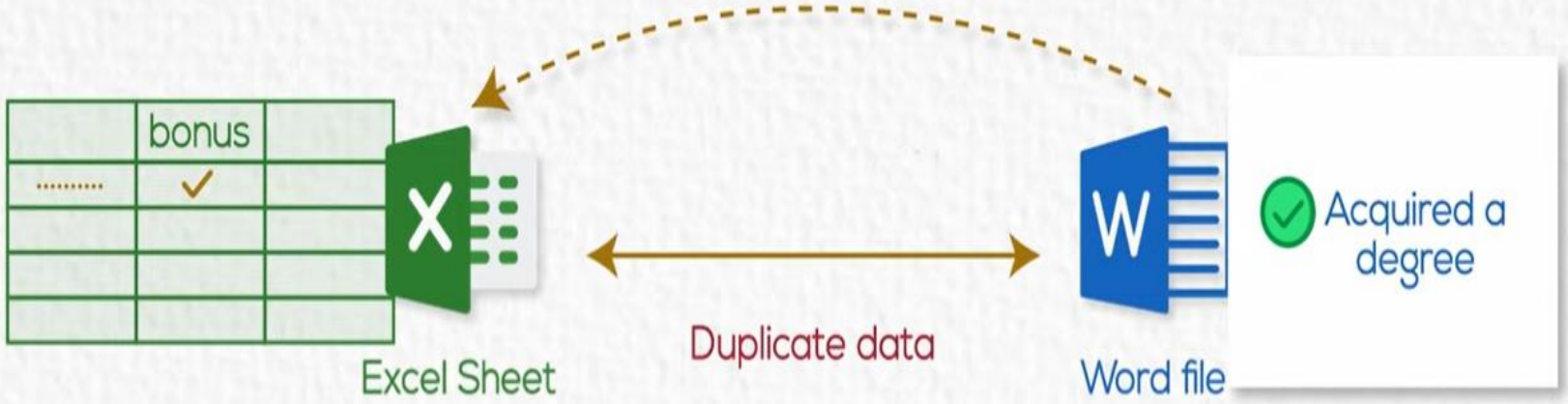
- It is a collection of programs that perform services for the end user.
- Each Program defines and manages its own data

Concepts

File Based System

Finance dept.

HR dept.

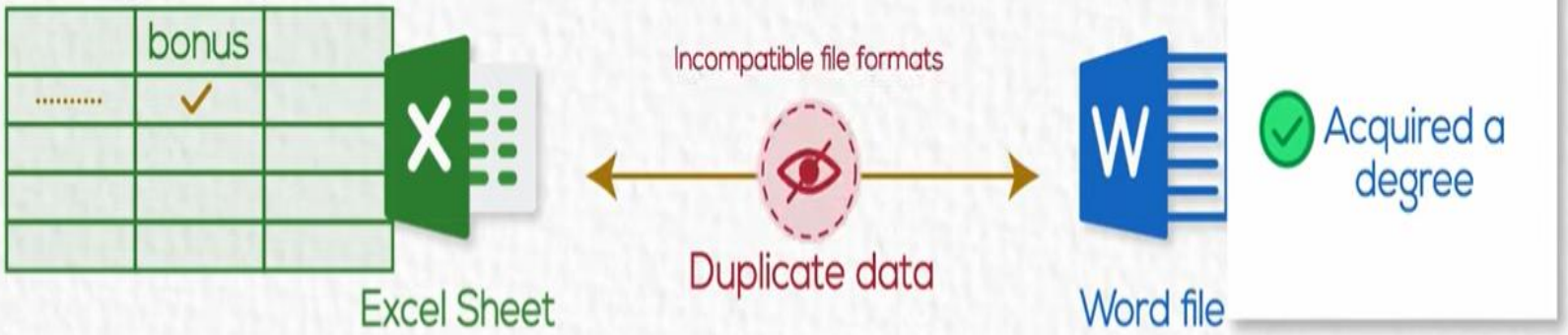


Concepts

File Based System

Finance dept.

HR dept.



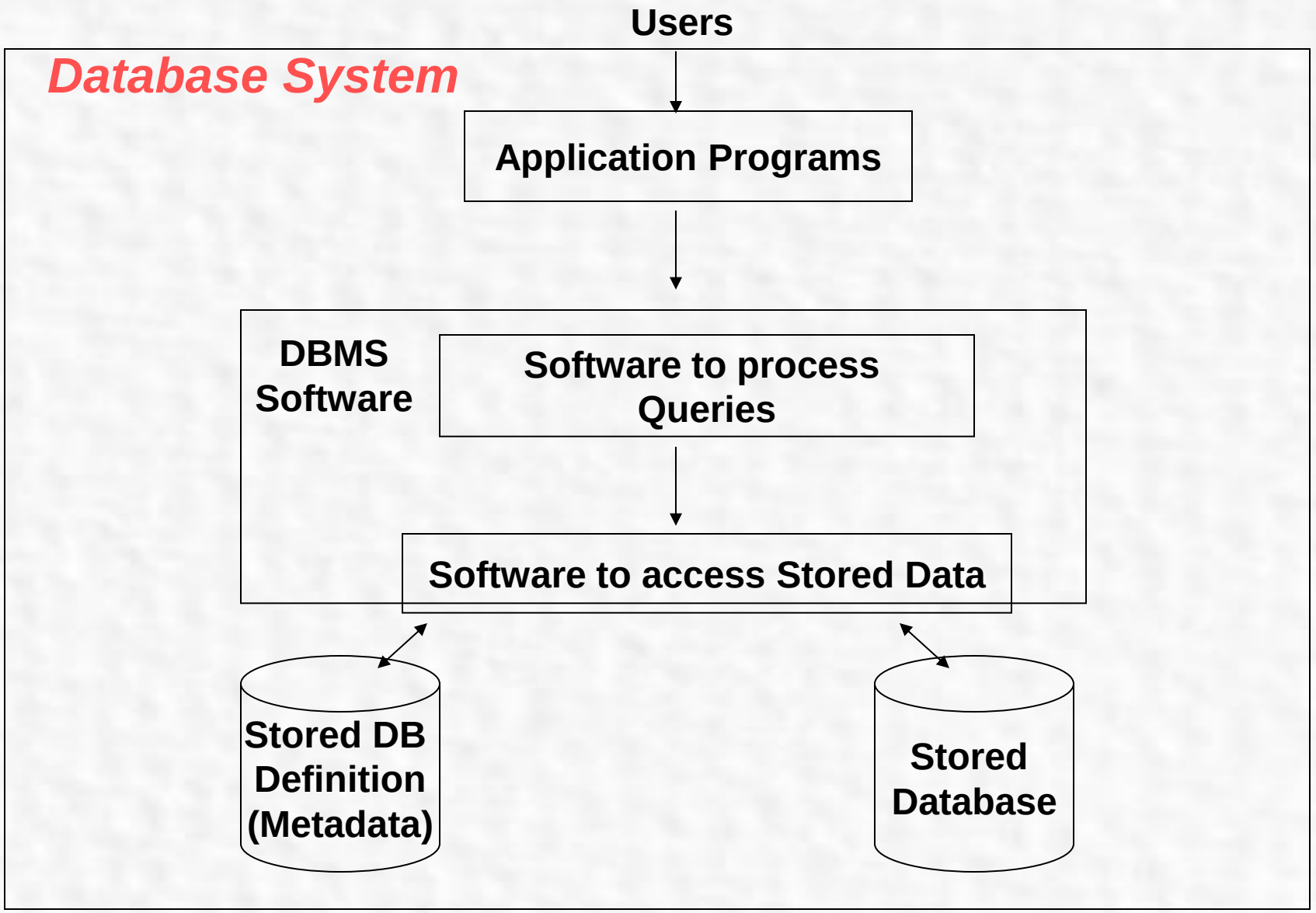
Limitations Of File based System Approach

- Separation & Isolation Of data
- Duplication Of data
- Program Data Dependence
- Incompatible File Formats

Basic Definitions

- **Database**: A collection of related data.
- **Database Management System (DBMS)**: A software package/ system to facilitate the creation and maintenance of a computerized database.
- **Database System**: The DBMS software together with the data itself. Sometimes, the applications are also included. (Software + Database)

Database Management System (DBMS)



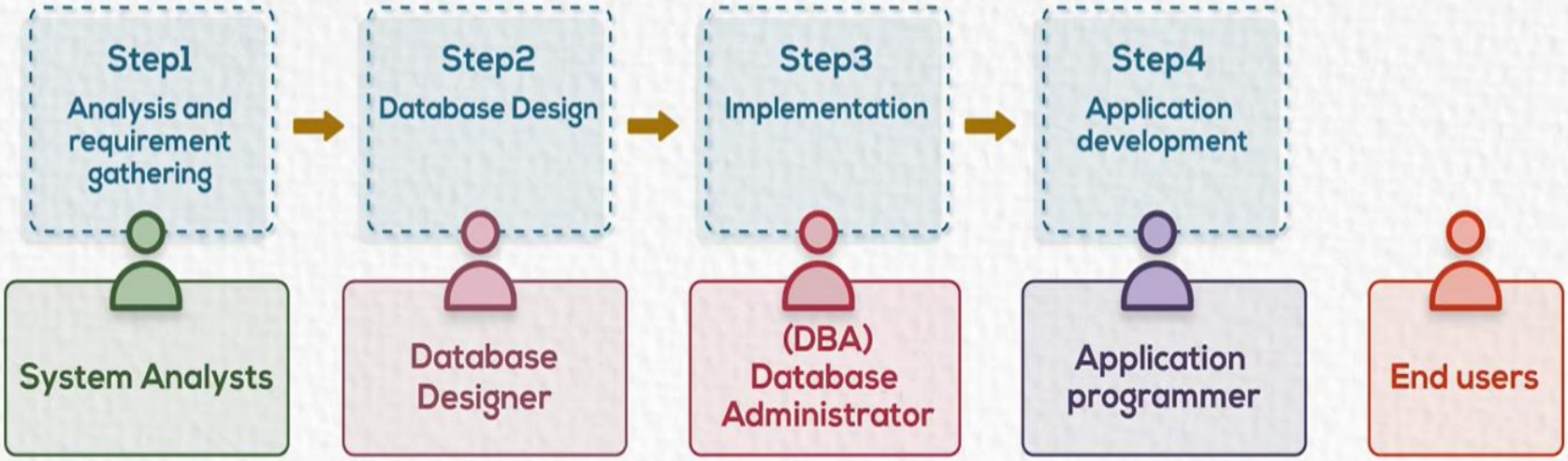
DBMS Advantages

- Controlling Redundancy.
- Restricting Unauthorized Access.
- Sharing data.
- Enforcing Integrity Constraints
- Inconsistency can be avoided.
- Providing Backup and Recovery.

DBMS Disadvantages

- Needs expertise to use (which is expensive)
- DBMS is expensive
- May be incompatible with any other available DBMS

Database Users

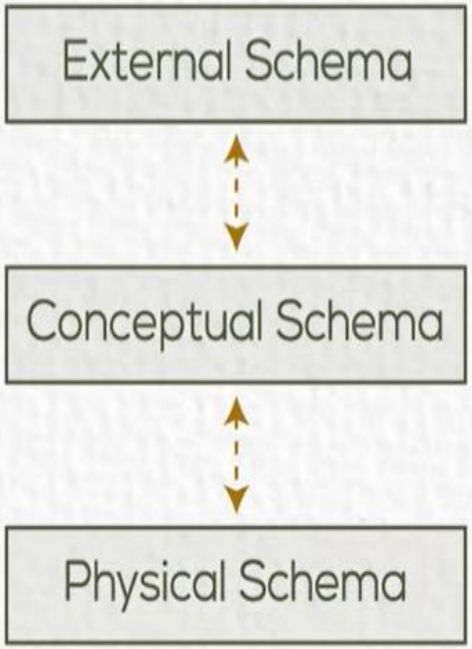


- Business analysis and requirements gathering.
- Create database design(Conceptual Schema).
- Install DBMS.
- Create DB schema and populate data.
- Create Users and authorize access to db.
- Maintain DB performance.
- Develop, test & debug the application.

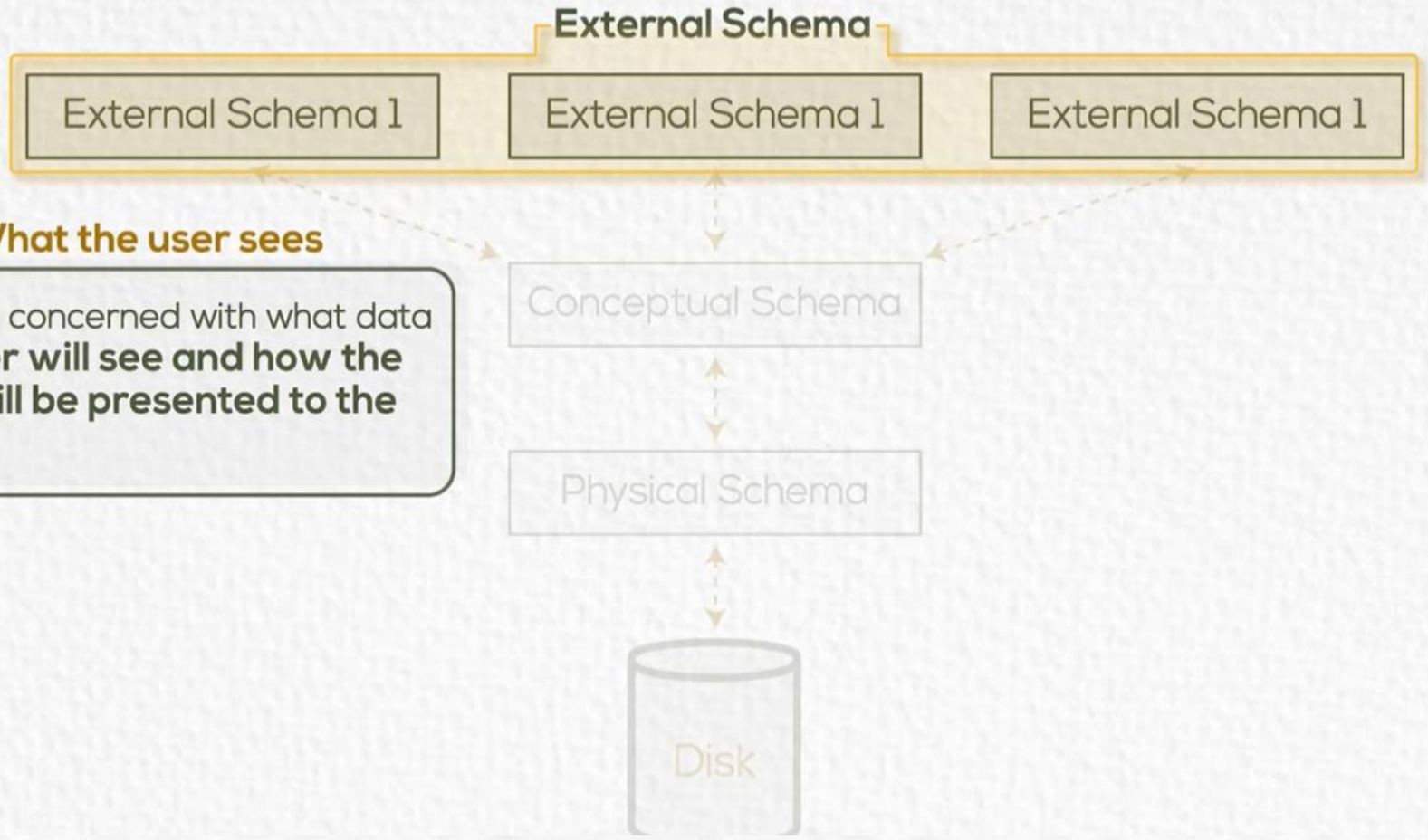
Database Users

- Database Administrator (DBA)
- System Analysts
- Database Designer
- Application programmers
- End users

DBMS Architecture (Three Schema Architecture)



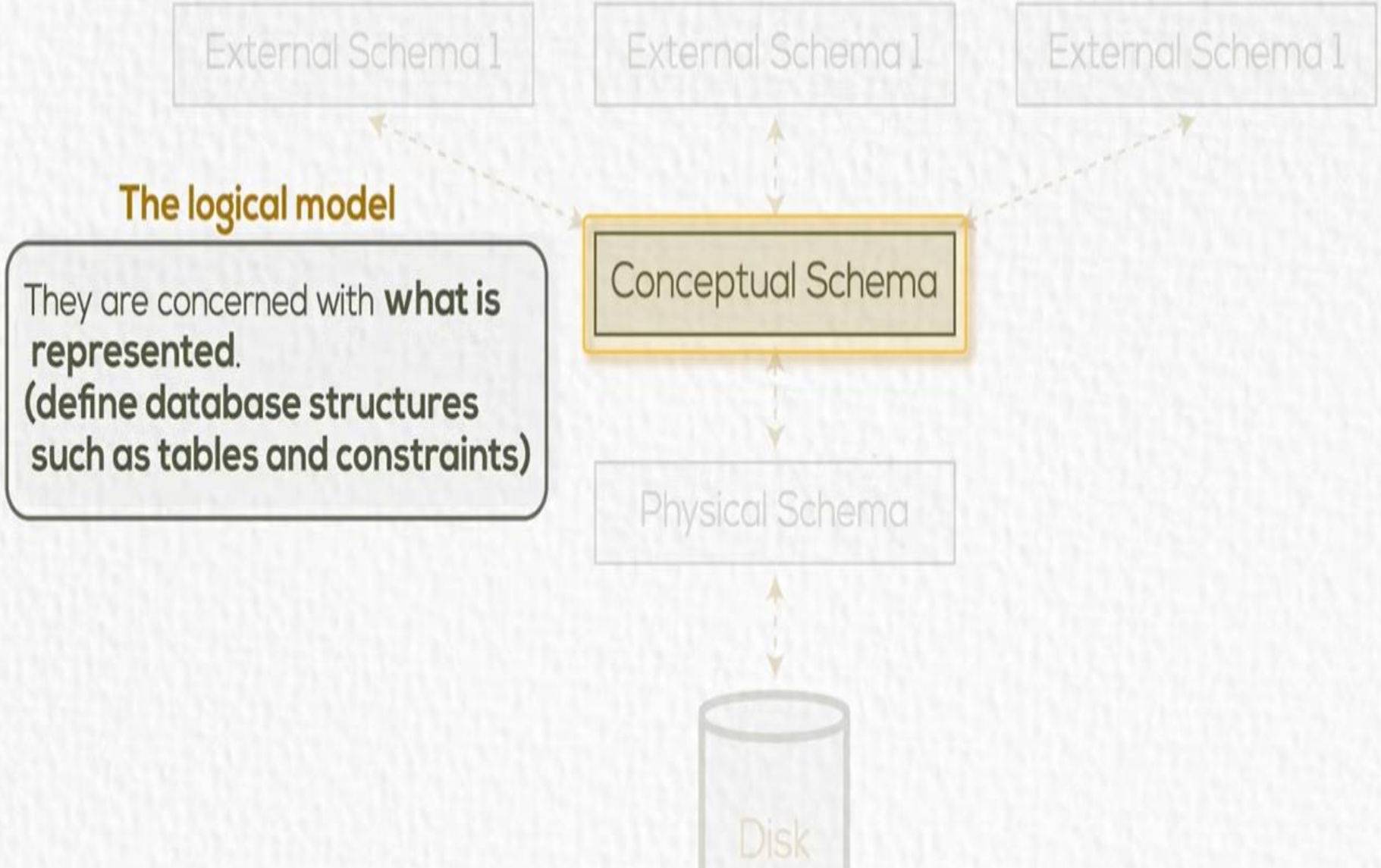
DBMS Architecture (Three Schema Architecture)



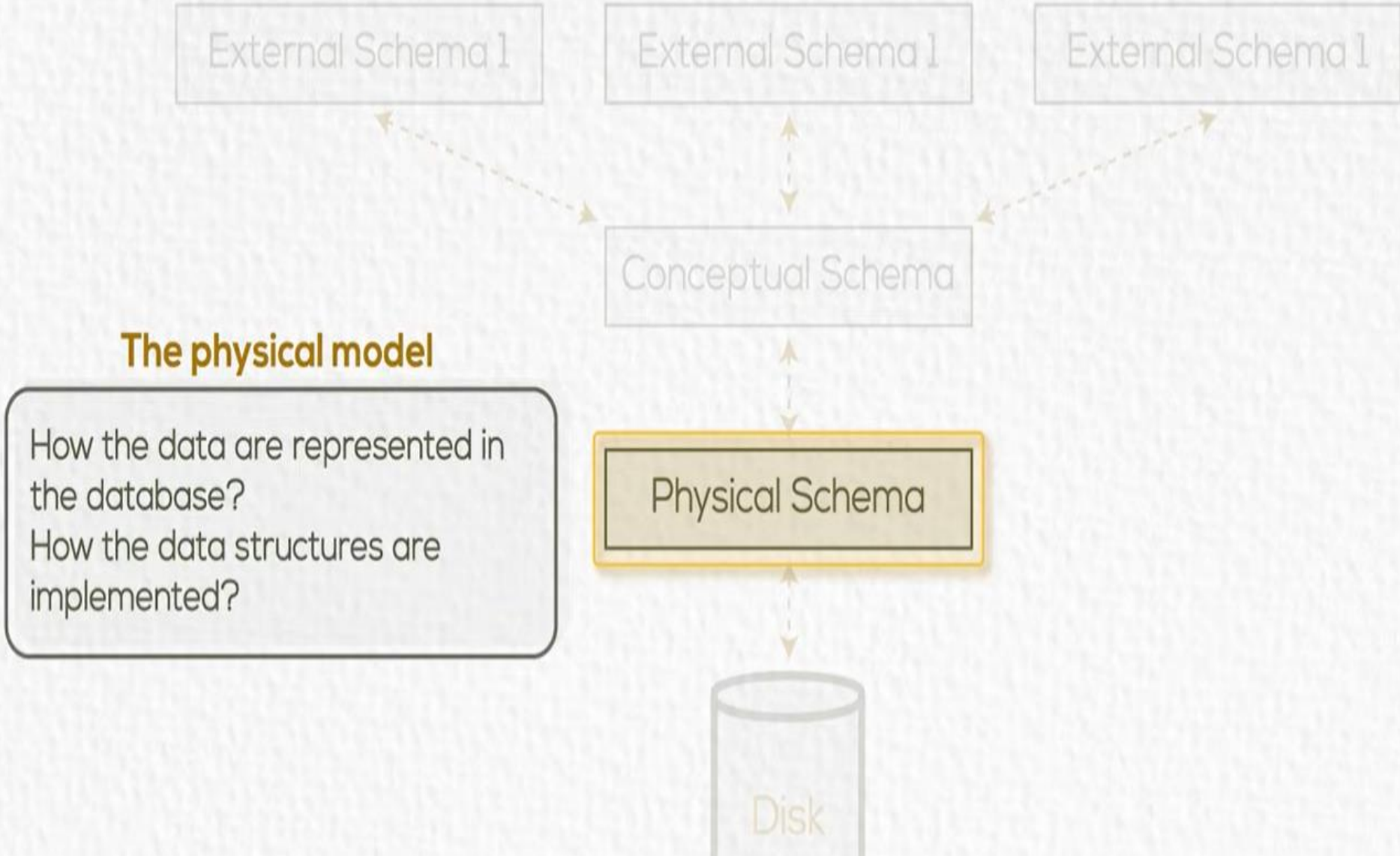
What the user sees

They are concerned with what data **the user will see and how the data will be presented to the user**.

DBMS Architecture (Three Schema Architecture)



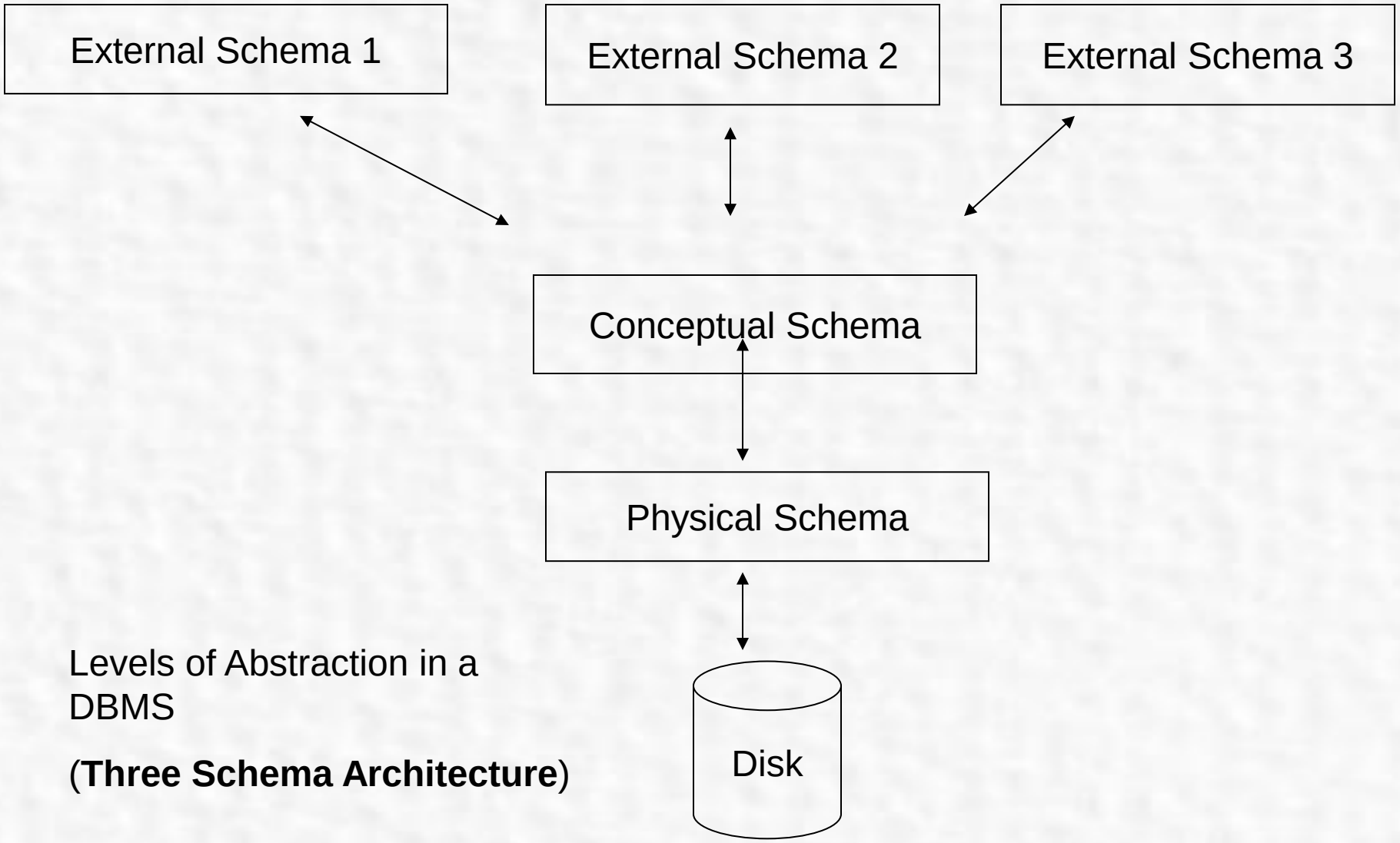
DBMS Architecture (Three Schema Architecture)



The physical model

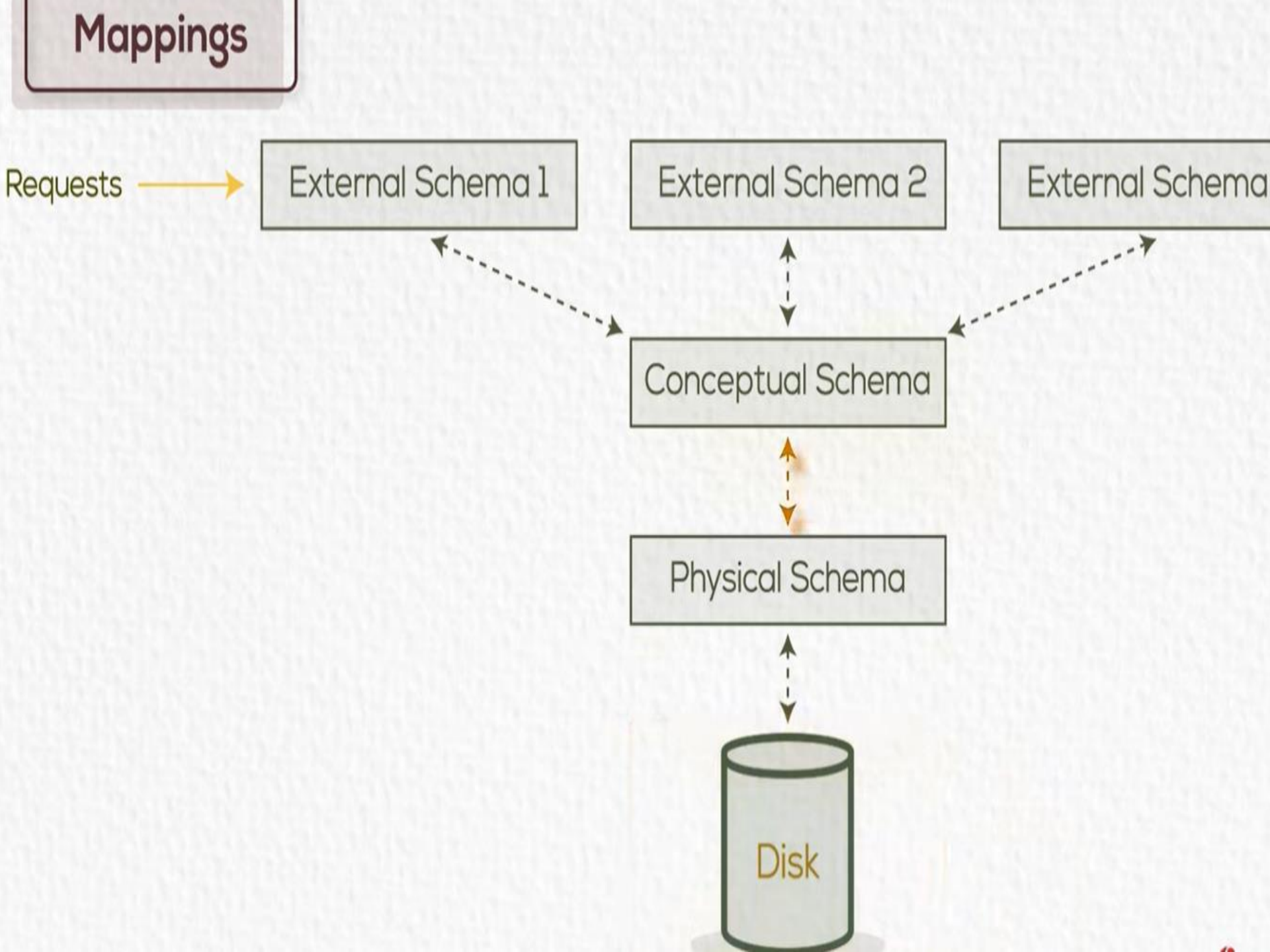
How the data are represented in the database?
How the data structures are implemented?

DBMS Architecture



Levels of Abstraction in a DBMS

(**Three Schema Architecture**)


Mappings
Requests
External Schema 1
External Schema 2
External Schema
Conceptual Schema
Physical Schema
Disk

Mappings

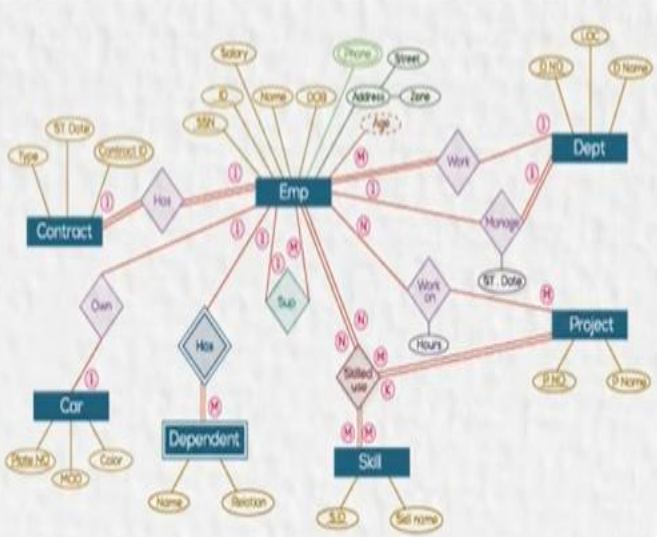
- Definition: It is the processes of transforming requests and results between levels.
- These mappings may be time-consuming. However, a certain amount of mapping between the conceptual and internal levels is necessary.

Data Independence

- The capacity to change the schema at one level without having to change the schema at the next higher level

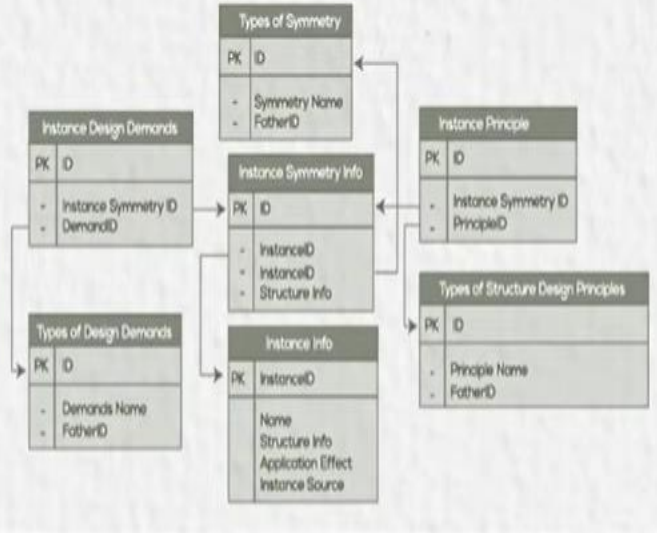
Data Models

The logical model /conceptual model



provide concepts that are close to the way many users perceive data, entities, attributes and relationships. (Ex. ERD)

The physical model



describes how data is stored in the computer and the access path needed to access and search for data.

Data Models

- High Level or Conceptual data models provide concepts that are close to the way many users perceive data, entities, attributes and relationships. (Ex. ERD)

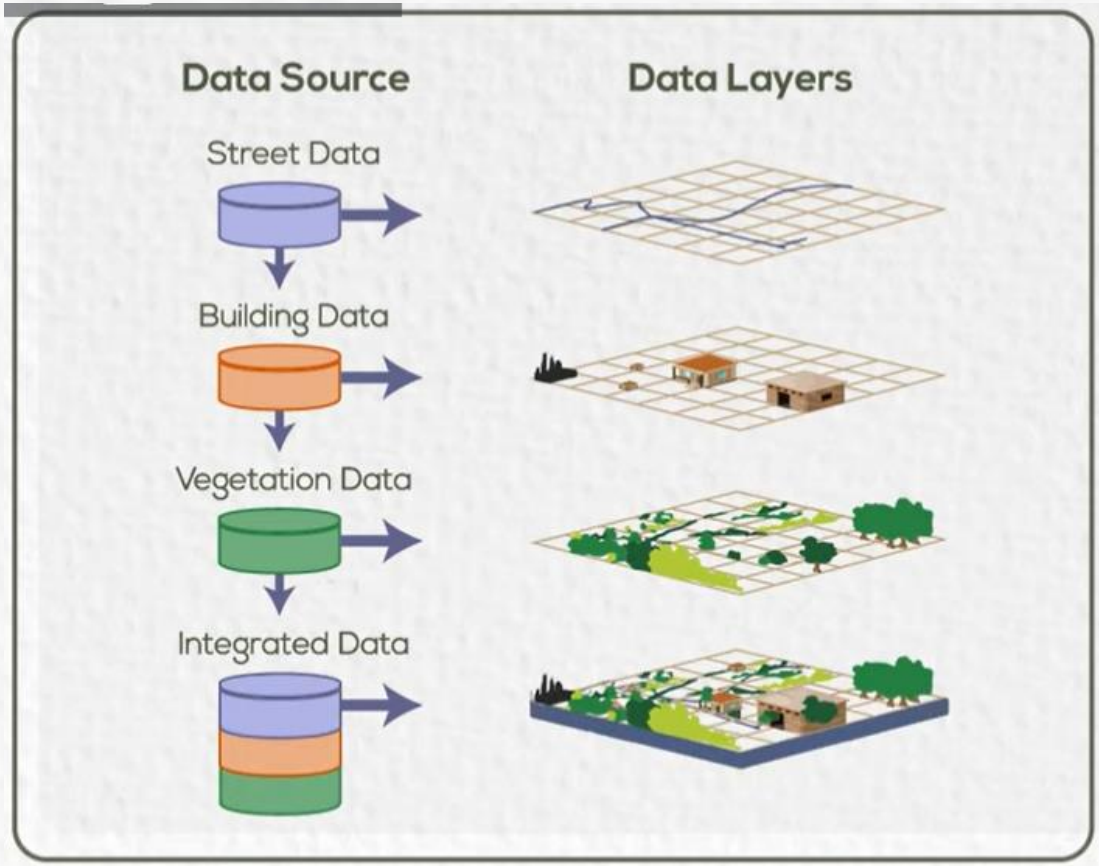
- Physical data models describes how data is stored in the computer and the access path needed to access and search for data.

DBMS Other Functions

- Text/Number/Image/Audio/ Video

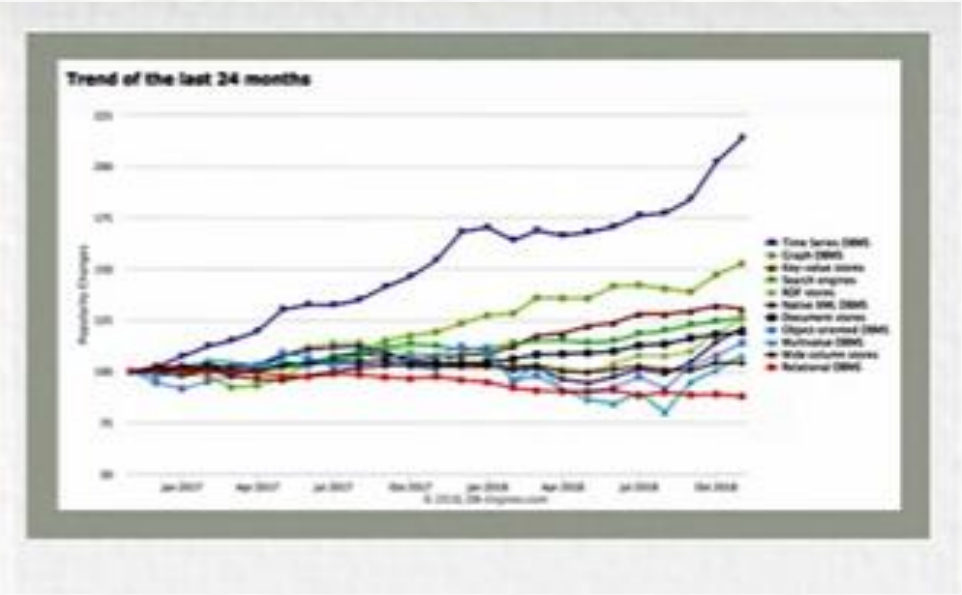
DBMS Other Functions

- Spatial Data



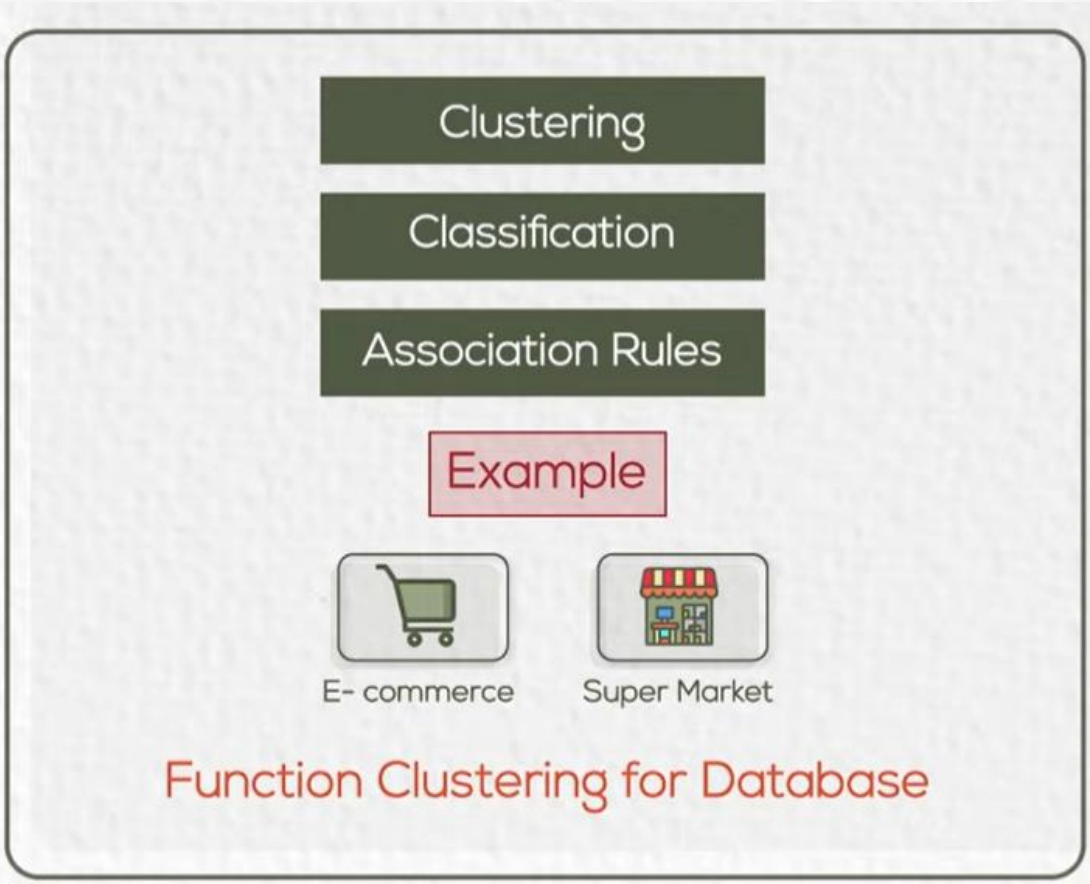
DBMS Other Functions

- Time Series

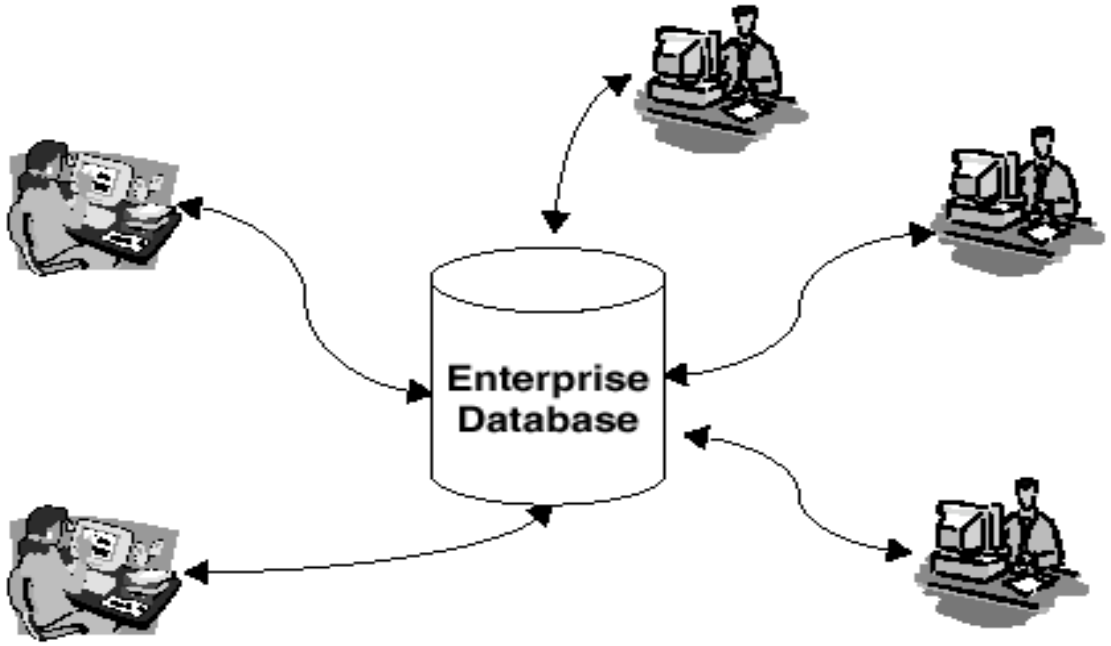


DBMS Other Functions

- Data mining



Database Environment



All data at a single site.

Data access from remote sites through communication links.

Easy to administer.

Uncertain data availability.

Common Examples:

Personal Database

Central Computer Database

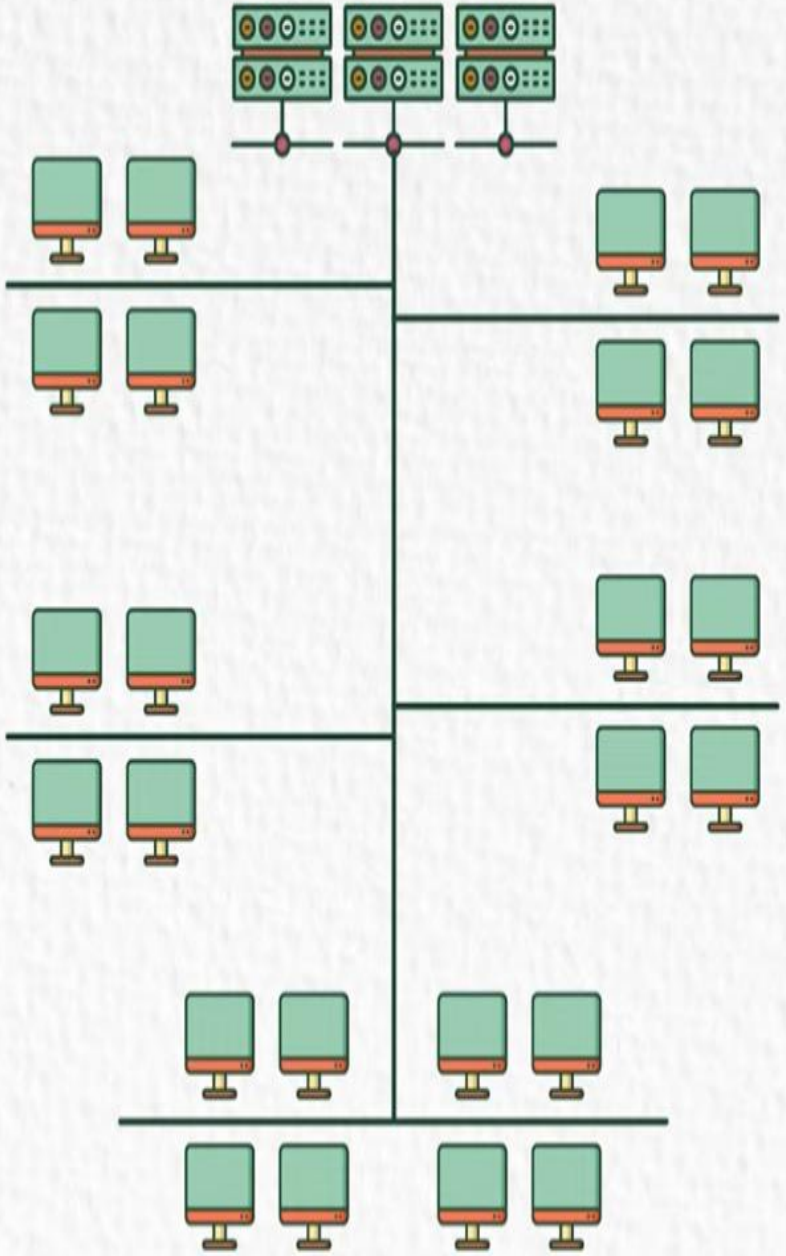
Client/Server Database

Centralized database.

Centralized Database Environment

- **Mainframe environment**
- **Client/Server environment**
- **Internet Computing environment:**

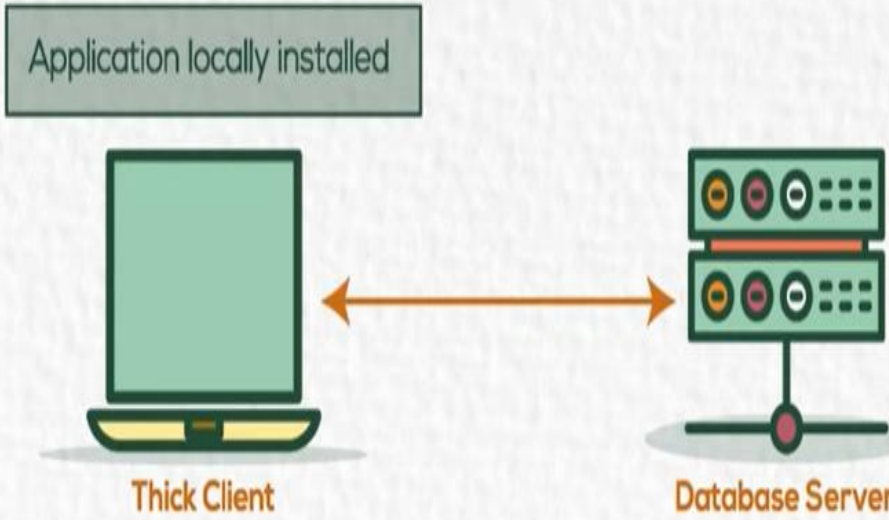
① Mainframe environnement.



Problems with this environment

- The processing depends on one server.
- The performance is very slow.
- Database and application layer has Single Point of failure.

② Client/Server environment.



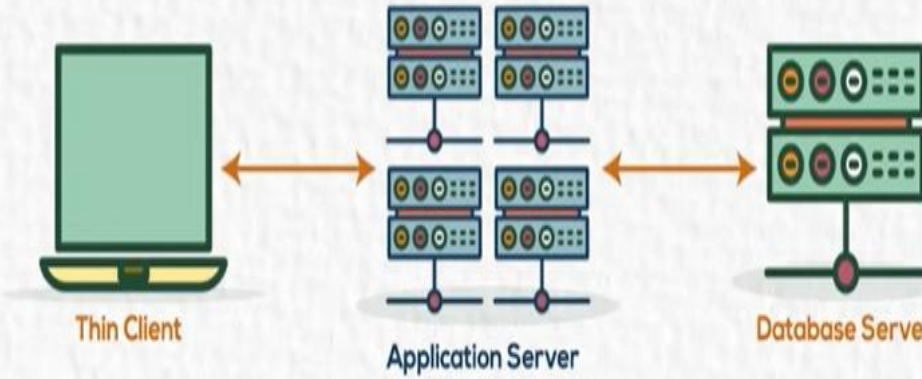
Problems with this environment

- Database is a single point of failure.
- High cost For support.

Advantages

- Application layer **isn't** a single Point of failure.

③ Internet Computing environment (Three-tier architecture).



Problems with this environment

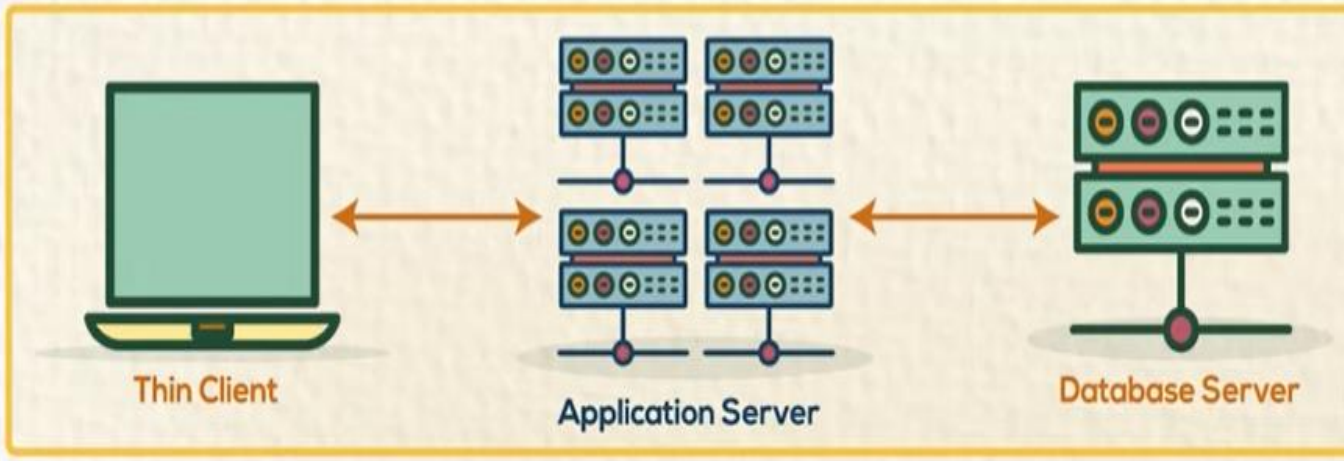
- Application server is a single point of failure.
- Database is a single point of failure.

Advantages

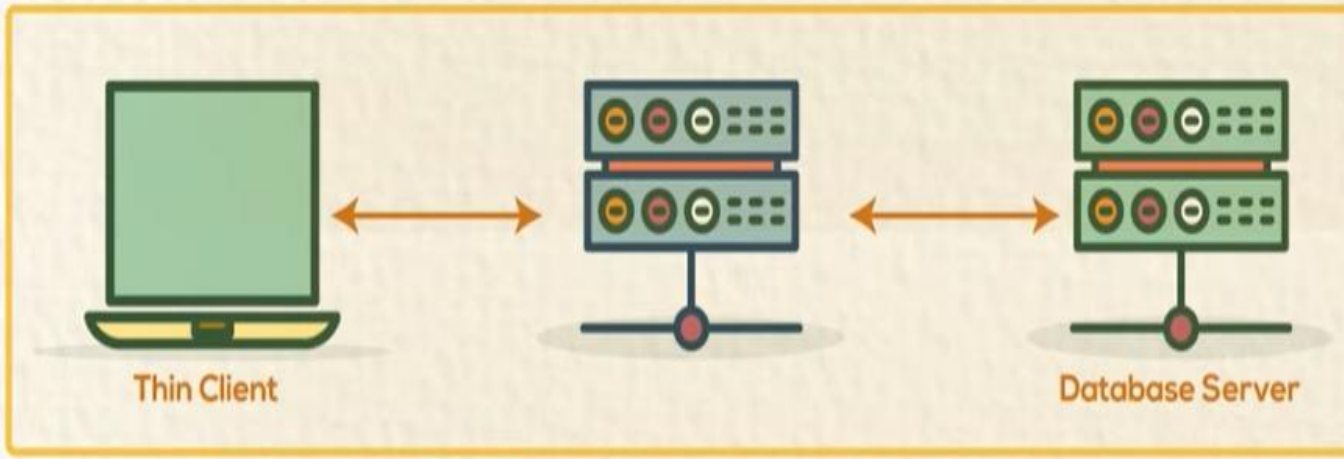
- Lower cost for support and maintenance.

③ Internet Computing environment (Three-tier architecture).

N-tier architecture

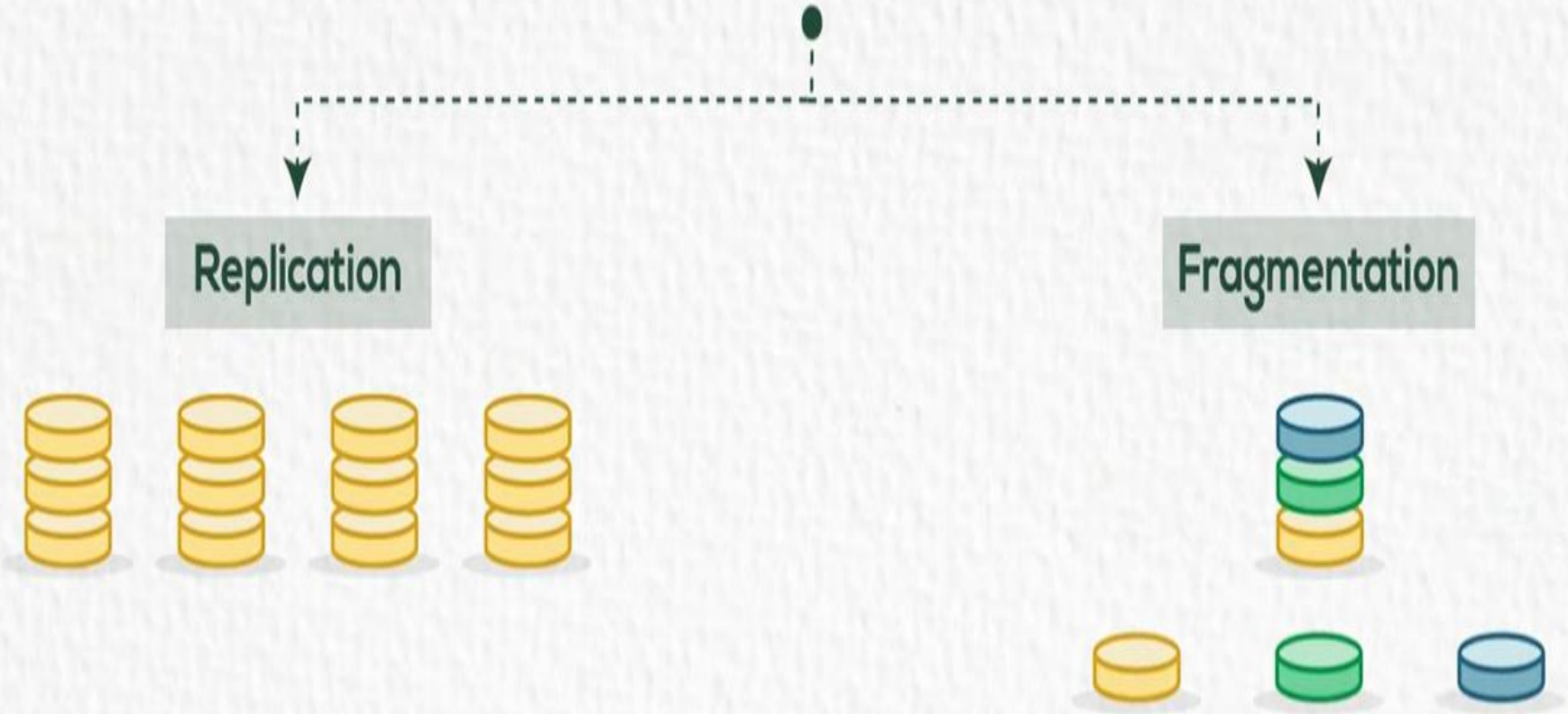


Three tier architecture



Distributed Database

Support high availability of Data base

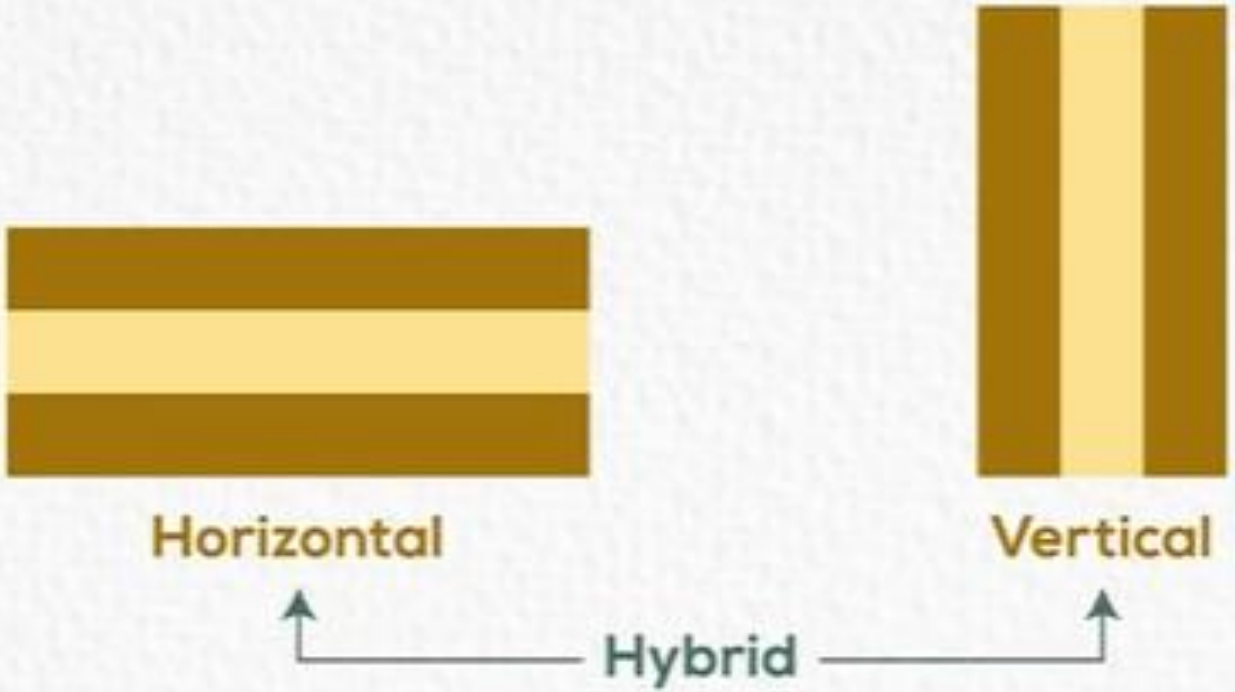


Replication

Partial Replication

Full Replication

Fragmentation



Fragmentation

Advantages

- Database is NOT a single point of failure.

Distributed Database

Replication

Partial Replication

Full Replication

Fragmentation

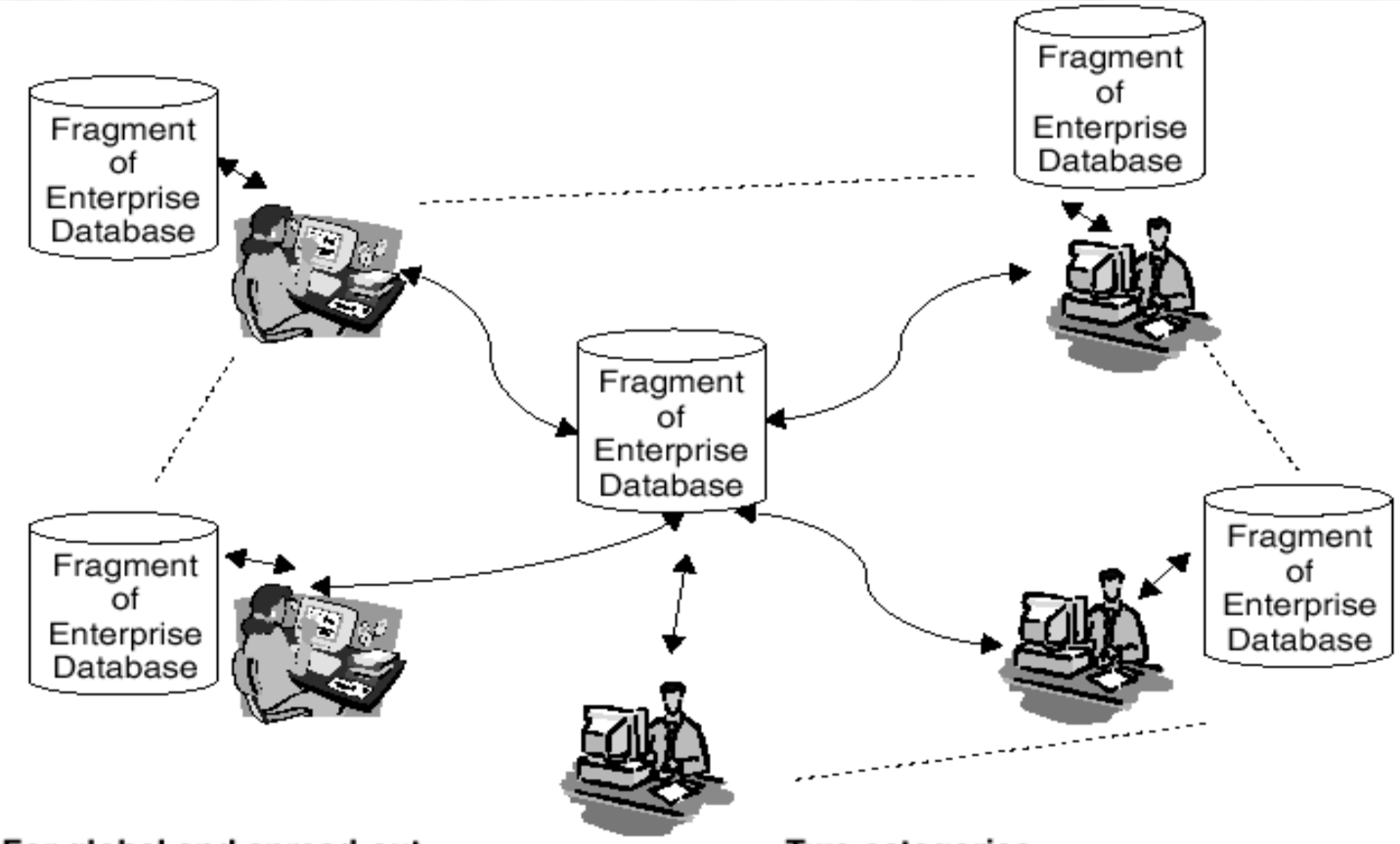
Advantages

- Database is NOT a single point of failure.

Disadvantage

- High cost.

Distributed Database



For global and spread-out organizations, centralized databases not economical.

Enterprise data distributed across multiple computer systems.

Two categories:

Homogeneous databases

Heterogeneous databases

Questions ?