



DBMS

Lecture 1

Introduction, Architecture
And
Data Models

Database

What is Database ?

- Collection of inter-related data.
- Helps in efficient retrieval, insertion and deletion of data.
- Organizes data in tables and schemas.
- Example : University database.

File Processing System

- Stores data using files in hard disks.
- Example : File based University Management System.

Issues with File System

- Data Mapping and access
- Redundancy of data
- Inconsistency of data
- Unauthorized access or security
- No concurrent access
- No backup and recovery

- DBMS = Database + Management System
- A software used to manage database.
- Allows easy insertion, updation and retrieval.
- Provides protection and security and maintain consistency.
- Examples : MySQL, Oracle, Sybase, Microsoft Access etc.

Why DBMS is required ?

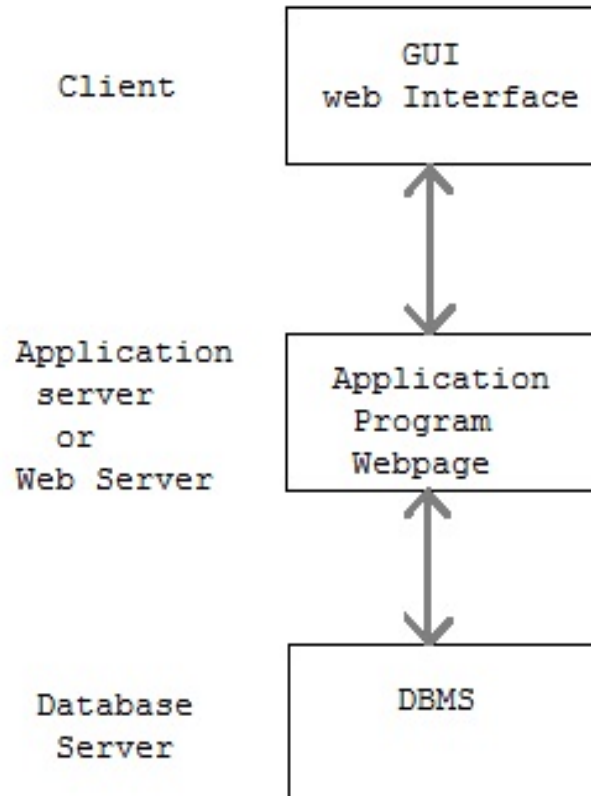
- To overcome the drawbacks of file system.
- Optimizes –
 - Storage of large data
 - Faster retrieval of data

Characteristics of DBMS

- Real world entity
- Relation based tables
- Less redundancy
- Query Language
- Consistency
- Concurrent Access
- Multiple Views
- Security

Architecture of DBMS

- 3-tier architecture

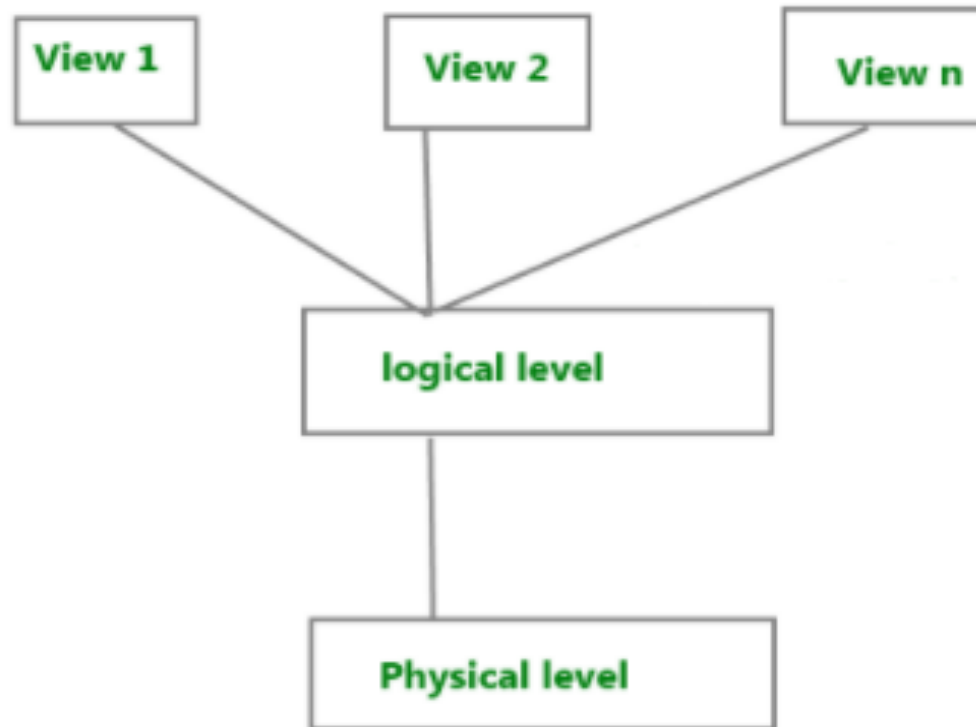


3-tier architecture

- Advantages
 - Easy to maintain and modify
 - Security
 - Performance
- Disadvantages
 - Complex

Data Abstraction

Levels of Data Abstraction



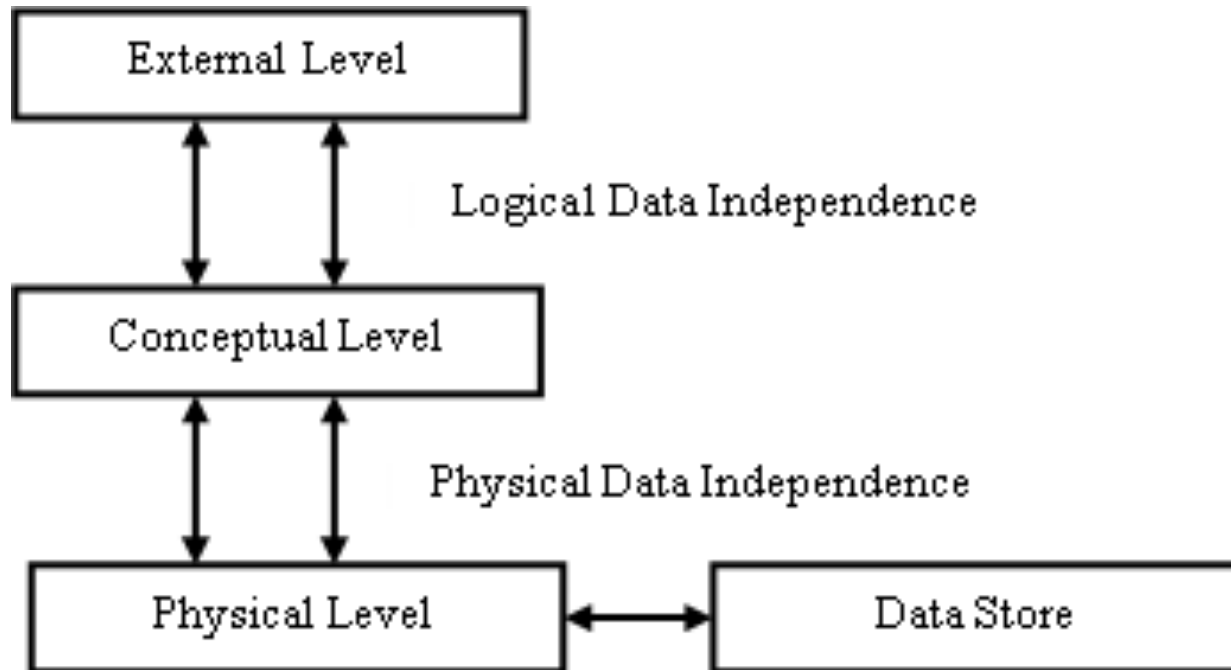
Three Levels of data abstraction

Instance

- Physical Schema
- Logical Schema
- View Schema

Data Independence

Data Independence



Data Independence

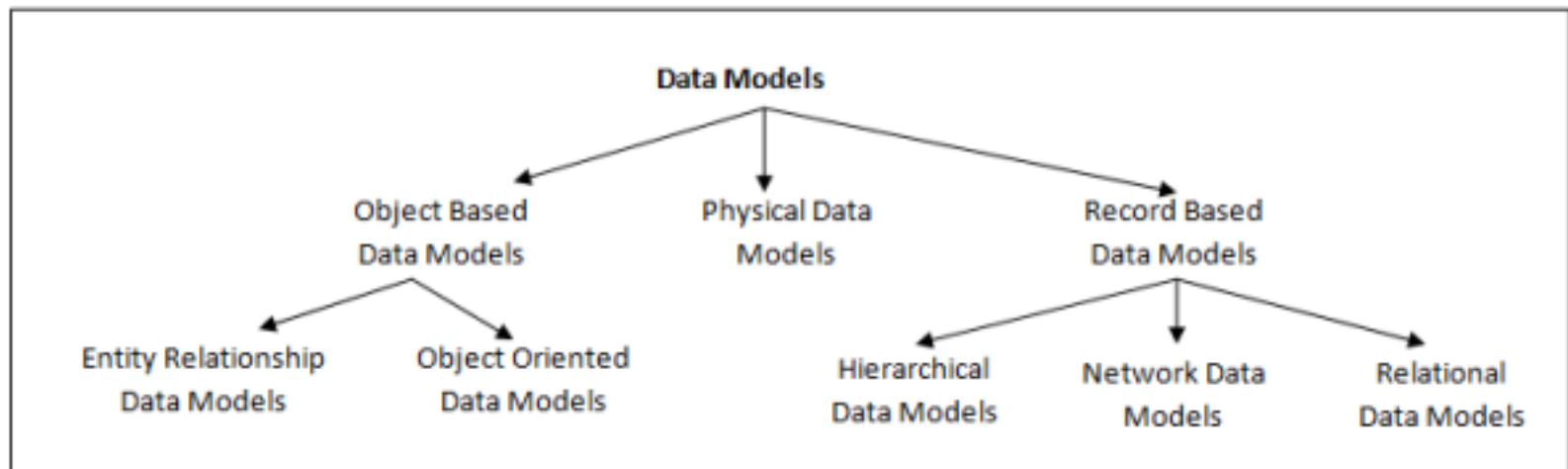
- Physical Data independence
- Conceptual or Logical Data independence

Data Models

- Entity -
 - Anything about which data will be collected/stored
- Attribute
 - Characteristic of an entity
- Relationship
 - Describes an association among entities
 - One-to-one (1:1) relationship
 - One-to-many (1:M) relationship
 - Many-to-many (M:N or M:M) relationship
- Constraint
 - A restriction placed on the data

Importance Of Data Models

Types of Data Models



Physical Data Models

Record based Data Models



- Hierarchical Data Models
- Network Data Models
- Relational Data Models

Object based Data Models

- Entity relationship Data Models
- Object Oriented Data Models

ER Model

- ER Model is a graphical approach to database design which describes how data is related to each other.
- It uses Entity/Relationship to represent real world objects. It works around real-world entities and the associations among them.
- In this, we disintegrate data into entities, attributes and setup relationships between entities, all this can be represented visually using the ER diagram.

ER Model - Components

- Entity
- Attribute
- Relationships

- An entity in an ER Model is a real-world entity having properties called attributes or it is anything about which data are to be collected and stored.
- For example, in a school database, a student is considered as an entity. Student has various attributes like name, age, class, etc.

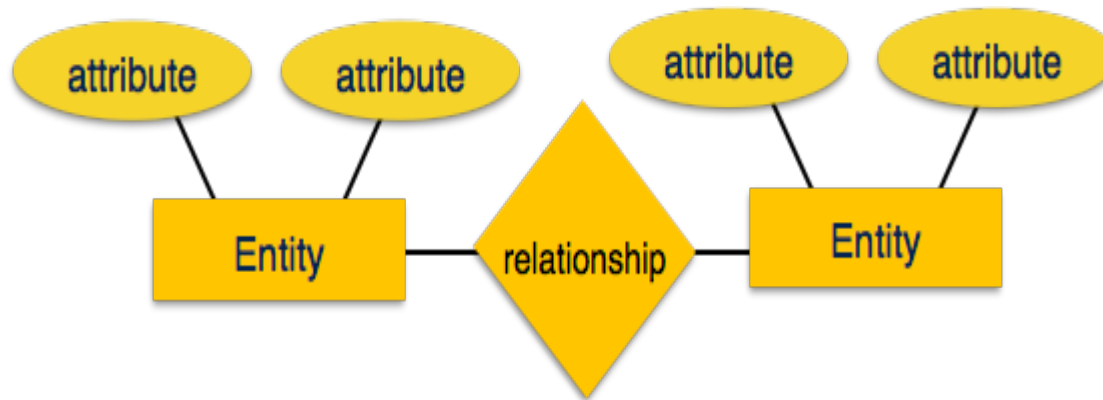
- The logical association among entities is called *relationship*. Relationships are mapped with entities in various ways. Mapping cardinalities define the number of association between two entities.
- Mapping cardinalities –
 - one to one
 - one to many or many to one
 - many to many

Entity Set

- Entity set is - collection of similar entities of same type that share the same attributes.
- For example, a Faculty set may contain all the teachers of a college, Set of all persons, Set of Companies etc.

ER Model

- Based on -
 - Entities and their *attributes*.
 - Relationships among entities.



Attributes

- It is the name of the column. An attribute gives the characteristics of the entity.
- If a Student is an Entity, then student's **roll no.**, student's **name**, student's **age**, student's **gender** etc will be its attributes.

Types of Attributes

- Simple attribute
- Composite attribute
- Derived attribute
- Single-valued attribute
- Multi-valued attribute

Draw ER Diagram

- For a university which has many departments.
- One department
 - Many instructors
 - Many courses
 - One HOD
- One Course
 - One instructor
 - Many students
 - One department
- One instructor -
 - one department
 - Head of only one department
 - Many courses
- Student
 - Many courses

Steps to draw -

- Identify the Entities
- Identify the relationships
- Identify the key attributes
- Identify other relevant attributes

Relational Model

Terminologies



- Tables
- Attribute
- Tuple
- Degree
- Cardinality
- NULL Values

Constraints

- While designing Relational Model, we define some conditions which must hold for data present in database are called Constraints.
- These constraints are checked before performing any operation (insertion, deletion and updation) in database. If there is a violation in any of constraint, operation will fail.
- There are three main integrity constraints –
 - Key constraints
 - Domain constraints
 - Referential integrity constraints