Database System

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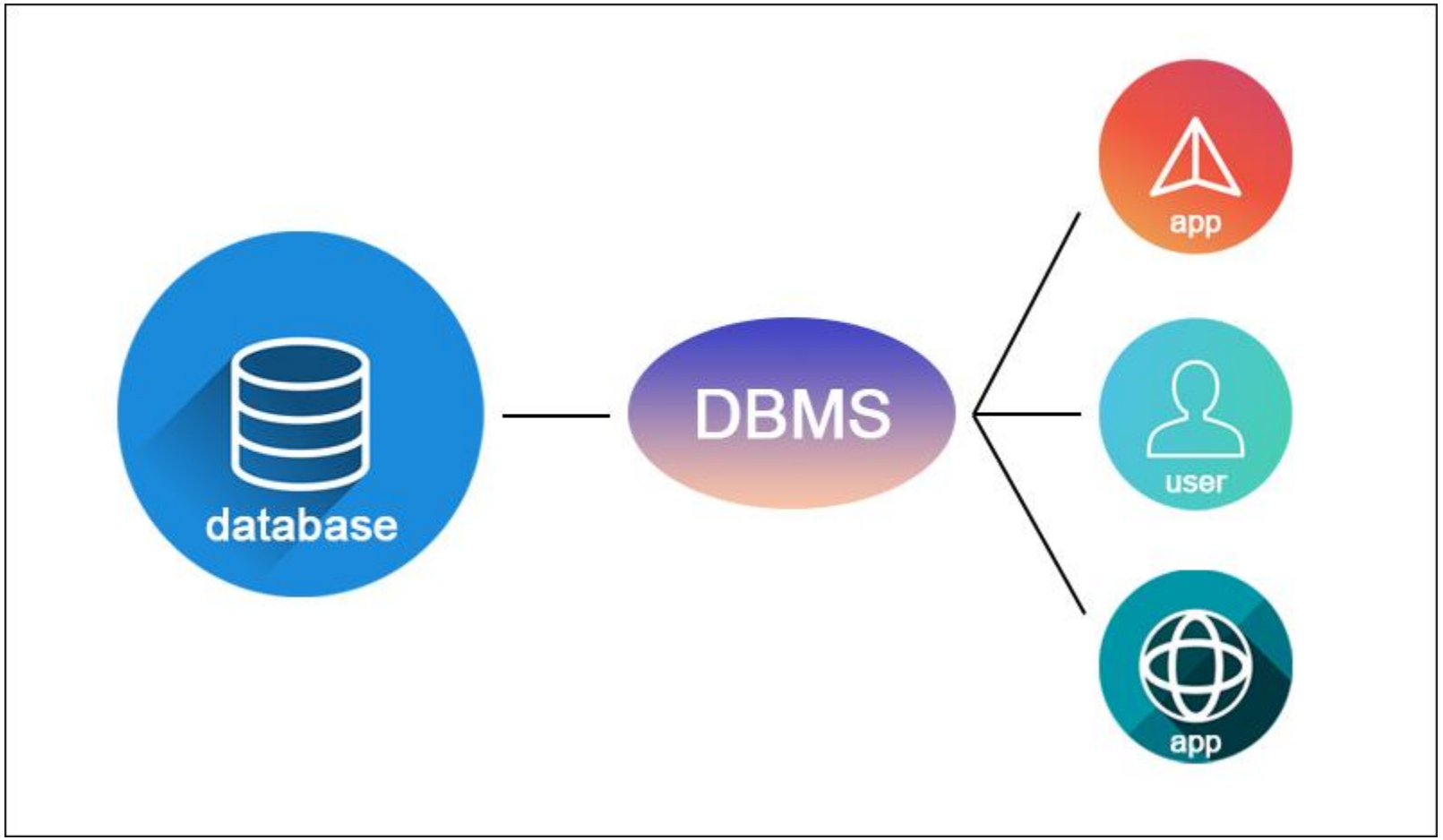
Database System (Database + DBMS)

- Database is a collection of data stored in a format that can easily be accessed
- A database-management system (DBMS) consists of a collection of interrelated data and a collection of programs to access that data.

DBMS (Database Management System)



Database system Vs File processing system

- Difficulty in accessing data
- Data redundancy and inconsistency
- Atomicity problems
- Concurrent-access anomalies
- Security problems

Data Abstraction

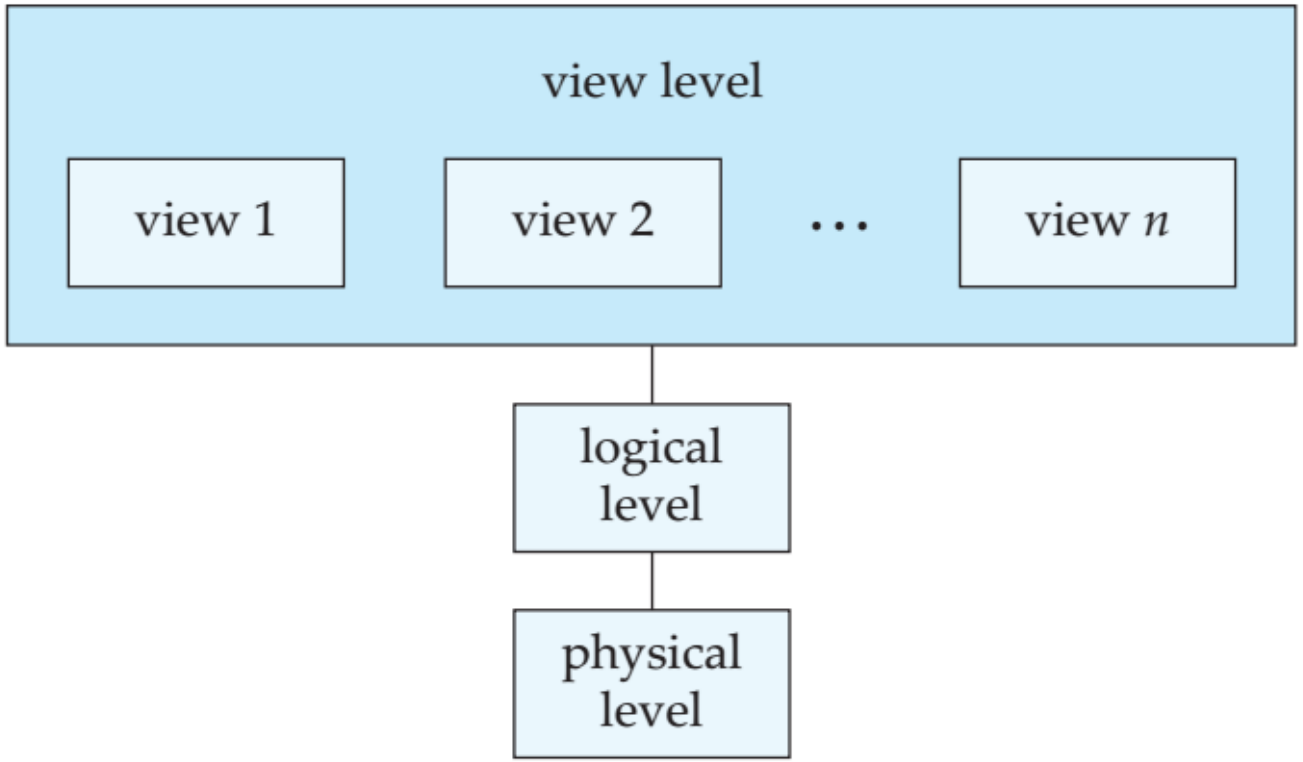
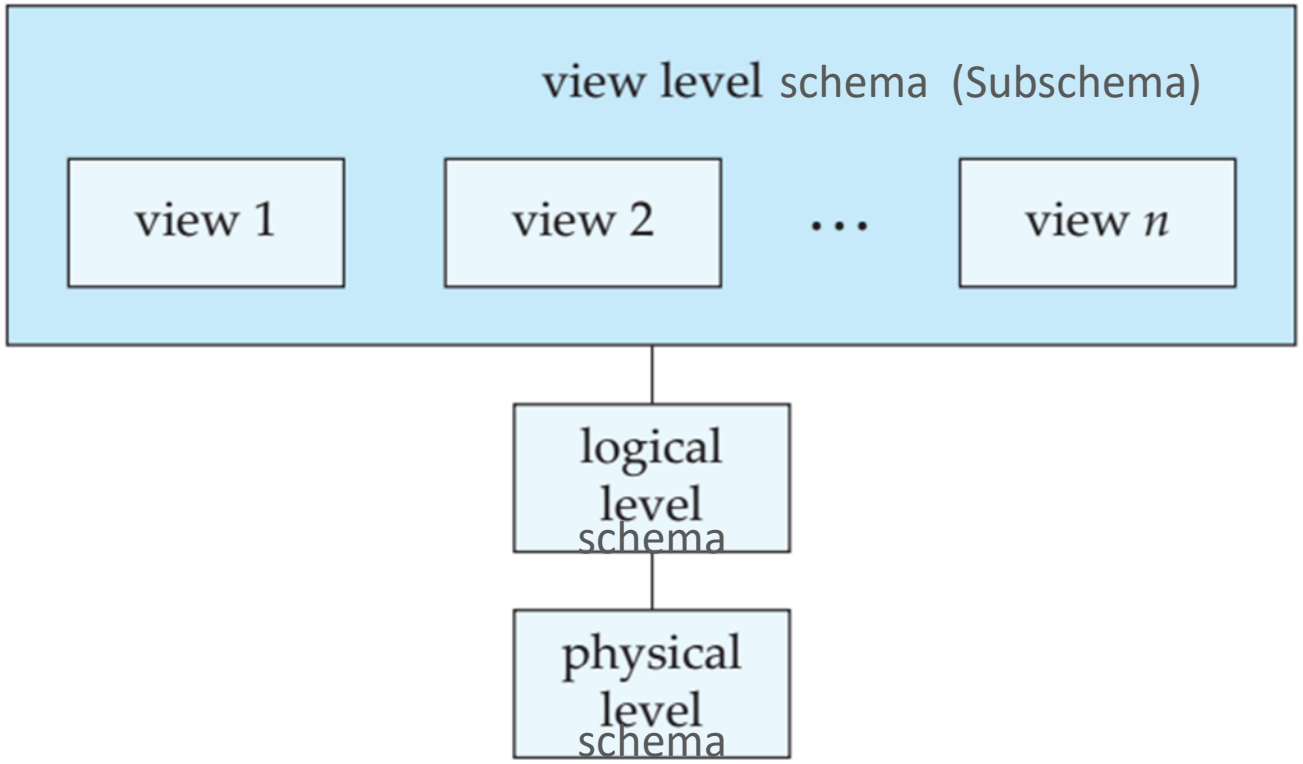


Figure 1.1 The three levels of data abstraction.

Database Schema

- The overall design of the database is called the database schema



Data Models

- Data model: a collection of conceptual tools for describing data, data relationships, data semantics, and consistency constraints
- A data model provides a way to describe the design of a database at the physical, logical, and view levels.
- Relational model
- Entity-Relationship model …

Database Languages

- DDL: We specify a database schema by a set of definitions expressed by a special language called a data-definition language (DDL)
- DML: A data-manipulation language (DML) is a language that enables users to access or manipulate data as organized by the appropriate data model
  - They are basically two types:
    - **Procedural DMLs** require a user to specify *what* data are needed and *how* to get those data.
    - **Declarative DMLs** (also referred to as **nonprocedural DMLs**) require a user to specify *what* data are needed *without* specifying how to get those data.

Types of Database

- Relation Database (SQL)
  - MySQL
  - SQL Server
  - Oracle …
- Non Relational Database (noSQL)

Relational Databases (SQL)

- Relational Database Management Systems (RDBMS)
  - Help users create and maintain a relational database
    - mySQL, Oracle, postgreSQL, mariaDB, etc.
- Structured Query Language (SQL)
  - Standardized language for interacting with RDBMS
  - Used to to perform C.R.U.D operations, as well as other administrative tasks (user management, security, backup, etc).
  - Used to define tables and structures
  - SQL code used on one RDBMS is not always portable to another without modification.

SQL (Structured Query Language)

- SEQUEL (Structured English Query Language)
- SQL (Structured Query Language)

Primary Key and Foreign Key

Student

student_id	name	major
1	Jack	Biology
2	Kate	Sociology
3	Claire	English
4	Jack	Biology
5	Mike	Comp. Sci

Primary Key

Employee

emp_id	first_name	last_name	birth_date	sex	salary	branch_id
100	Jan	Levinson	1961-05-11	F	110,000	1
101	Michael	Scott	1964-03-15	M	75,000	2
102	Josh	Porter	1969-09-05	M	78,000	3
103	Angela	Martin	1971-06-25	F	63,000	2
104	Andy	Bernard	1973-07-22	M	65,000	3

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Branch

branch_id	branch_name	mgr_id
2	Scranton	101
3	Stamford	102
1	Corporate	108