Database Management Systems

Relational Database Systems

Typical Applications

User Interface

Business Logic

Application Program

Container — Typed Data Structures used in Data Manipulation
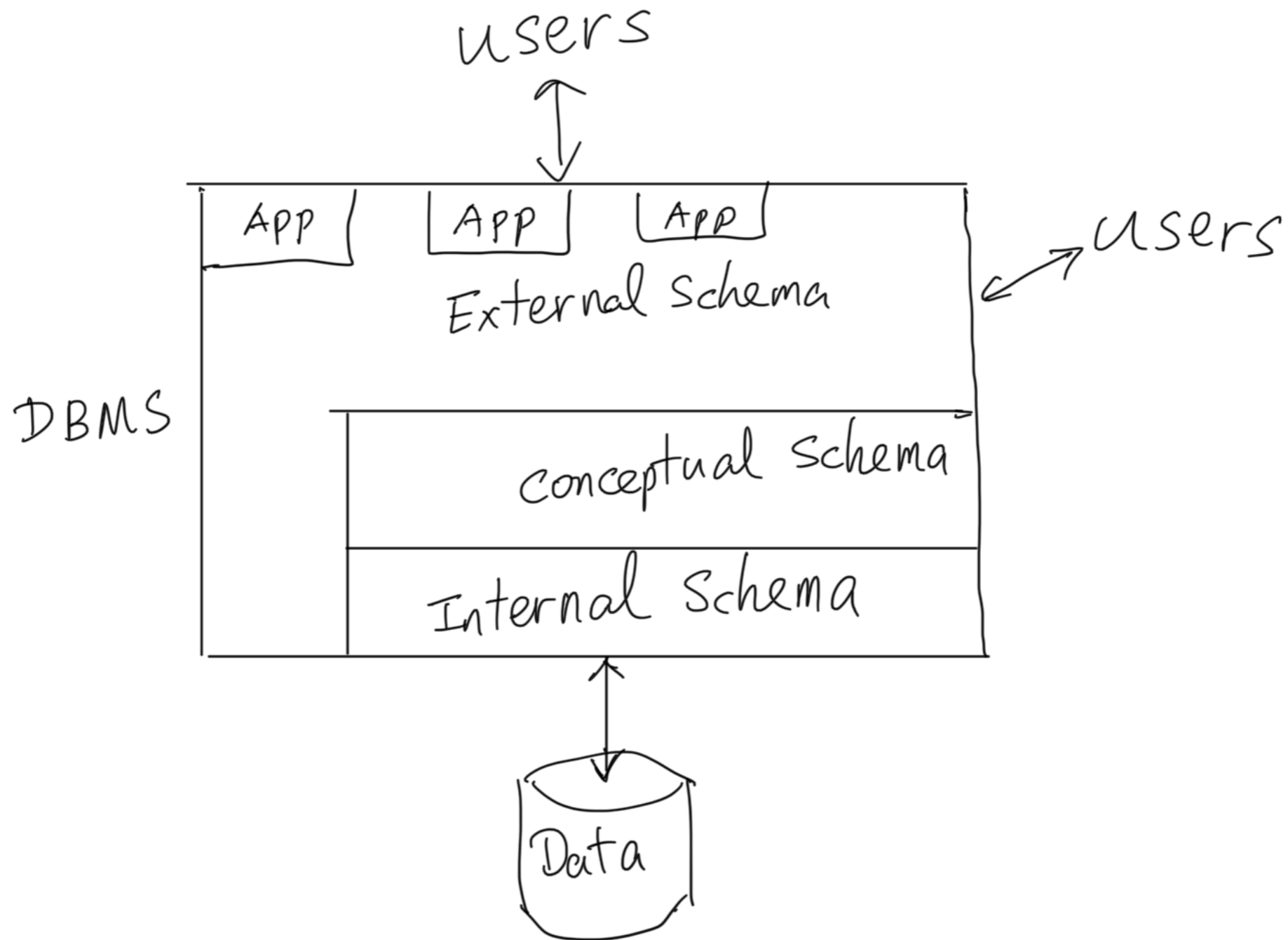
Data | I/O

Data Storage
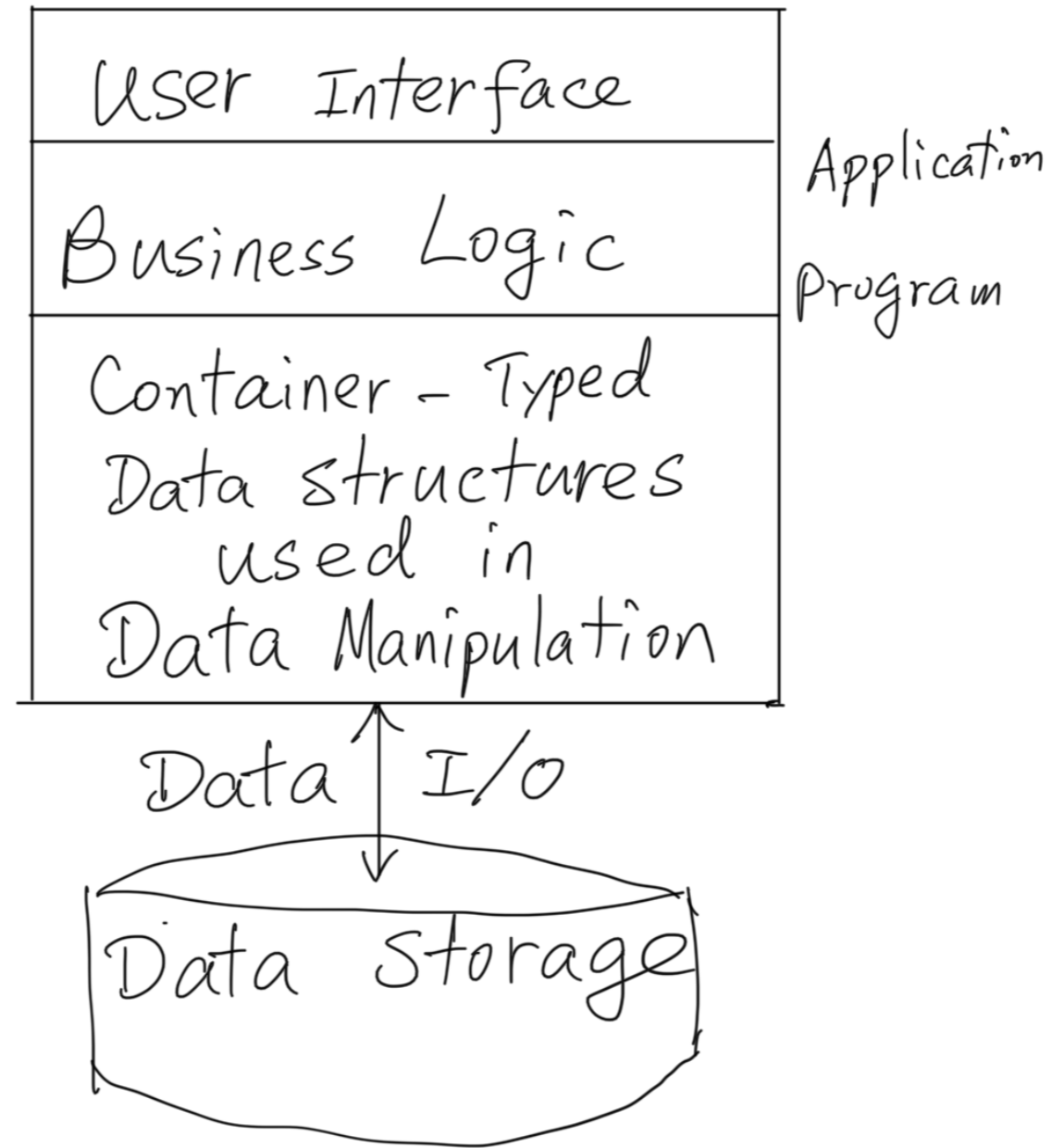
Typical Applications Using Database Systems
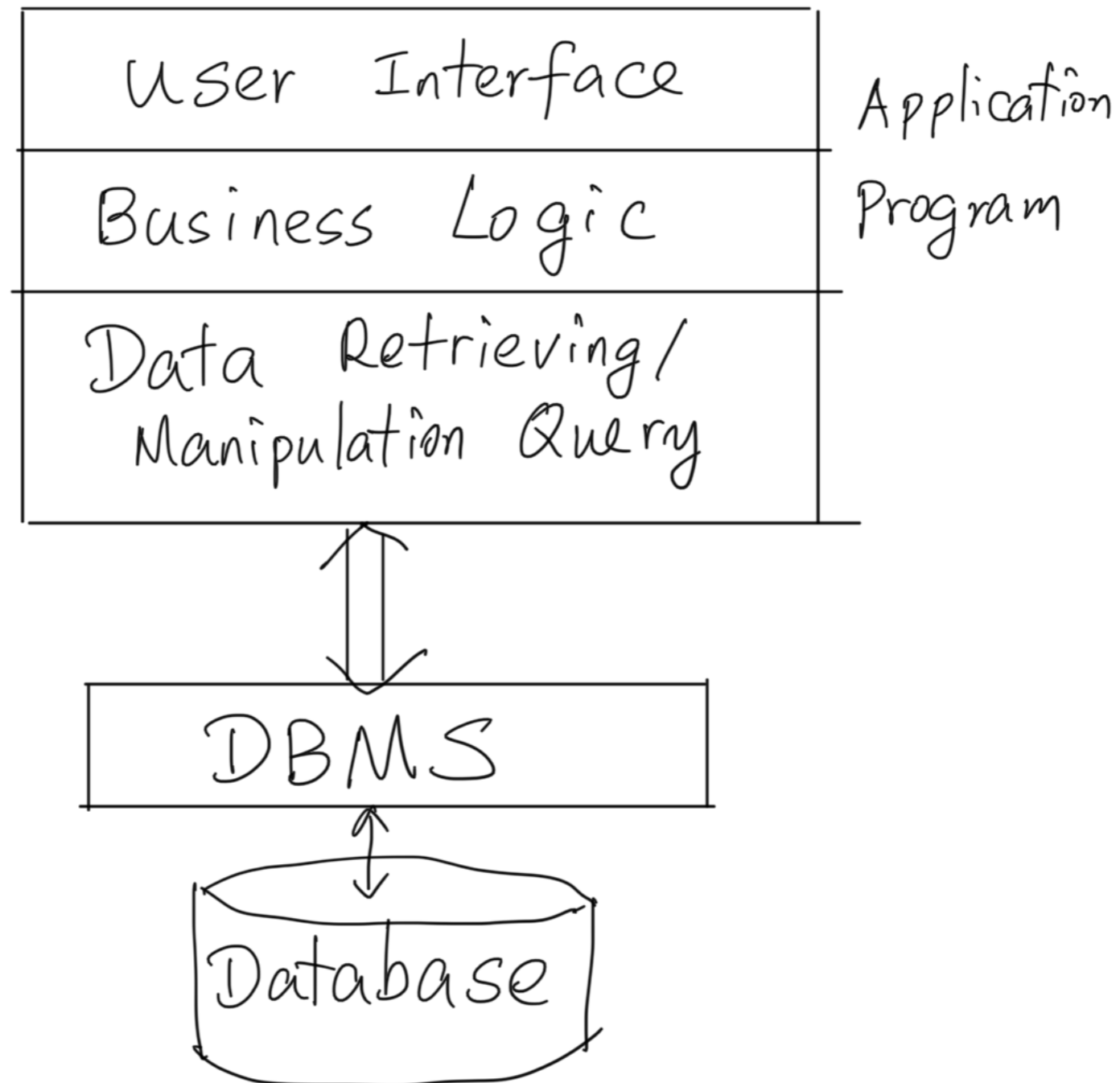
Levels of Abstraction

- Two kinds of data independence or abstraction: physical and logical.

- separation of view from conceptual schema enables logical data independence.

- separation of conceptual schema from physical schema enables physical data independence.

Architecture

Database Schema

- Schema does not contain any data. It is a description of how the data is organized in the database.

- External Schema: views, tailored to specific customer groups; describes data as seen by an application program or by an end user.

- Conceptual Schema: entities, relationships, attributes; describes the base logical structure of all data.

- Internal Schema: storage organization, index information; describes how the database is physically encoded.

Basics of the Relational Database (I)

- data are organized in tables/relations

- a table consists attributes (columns, data fields) and tuples (records, rows)

- a database consists a collection of tables/relations

- schemas

  - schema of a relation (table schema): things to describe a relation, including name of the relation and the set of attributes

  - schema of a database: a set of the table schema for all the relations in the database

- domains: each attribute (column) of each tuple must be atomic and it should be associate with a domain (collection of legal/valid values)

Basics (II)

- An instance of a database consists a collection of true propositions (facts) represented as the data currently stored in the database.

  - order doesn't matter in a relation (neither vertically nor horizontally)

- The interpretation of the data is defined by the schema designers.

- Database itself does not know what the relations and records mean.

- The relations define truth of relationships between objects without carrying too much what the objects are.

- Different things are true in different databases.

- As a summary: databases store data, not information. Users of the databases should interpret the data to obtain information. The database schema may give users some hint about how to interpret the data.

Database Topics

- Database models in general and Relational model in particular

- ER modelling (Database Design)

- Query Languages: Relational Algebra, Datalog (Relational Calculus), and SQL

- Database Application Programming

- Functional Dependencies and Normal Forms

- Transaction Management

- Recovery

- Constraints and Security

- Database Storage and Indexing