DATABASE ARCHITECTURE

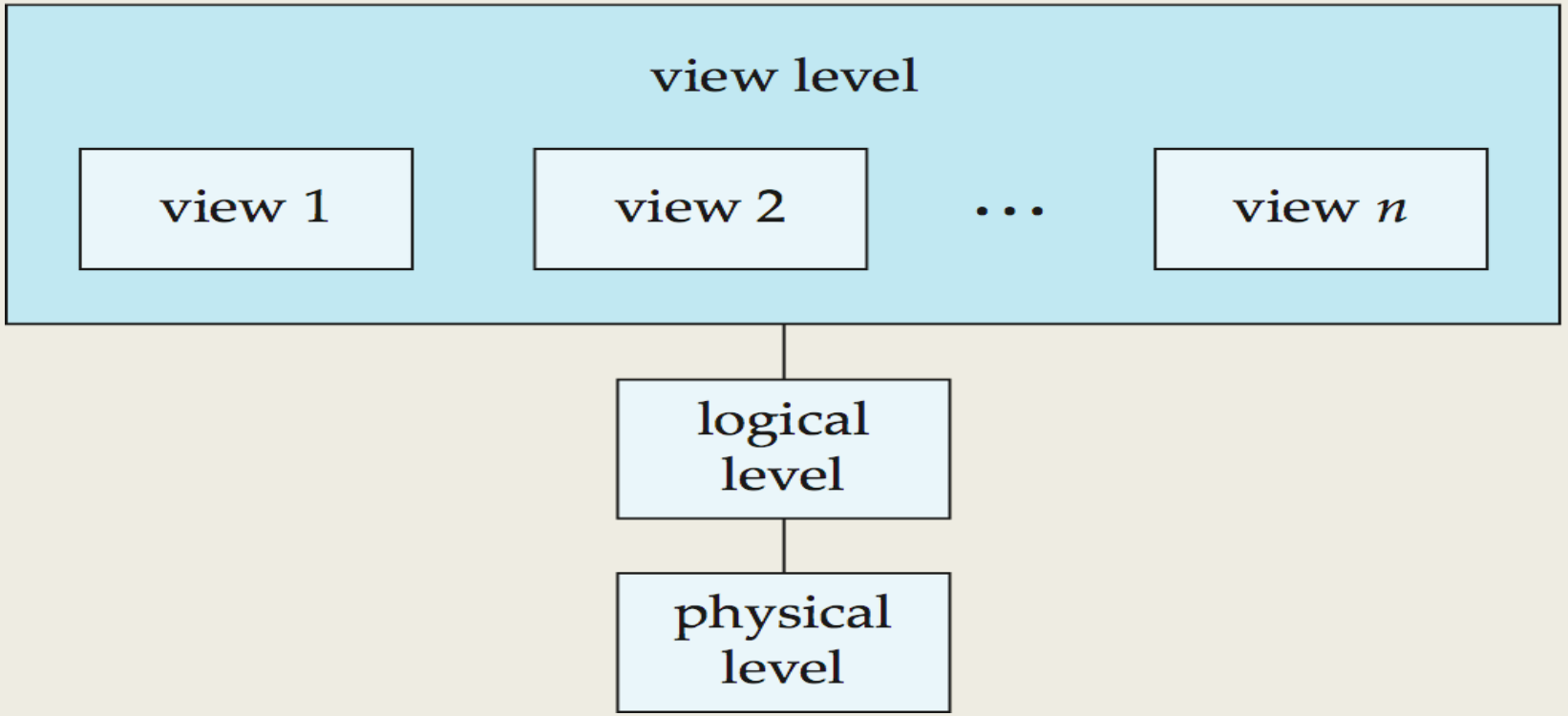
DATA MODELS

- A methodology for describing
  - *Data*
  - *Data relationships*
  - *Data semantics*
  - *Data constraints*
- Relational model
- Entity-Relationship data model (mainly for database design)
- Object-based data models (Object-oriented and Object-relational)
- Semistructured data model (XML)
- Other older models:
  - *Network model*
  - *Hierarchical model*

SCHEMAS AND INSTANCES

- SCHEMA : Description of the data to be stored in the database
  - *Rarely changes*
  - *Example : Passenger(pcode, pname, paddress,….)*
- INSTANCES : Original data in the database
  - *Frequently the number of instances changes in the DB*
  - *DB State : Data in the DB at a given moment*

3-Layer Architecture



Independence between Layers

Reservation view

External View

Logical Data Independence

Passenger
Trains
Schedule
Timing
....

Conceptual View

Physical Data Independence

Server1 Server 2 Server 3

Internal storage

Data dictionary

- Heart of Database Systems
- Contains definitions of
  - *External view : view definitions*
  - *Conceptual view : schemas, constraints, relationships*
  - *Physical storage : data structures, data types*

DBMS Language

- Data Manipulation Language
- Data Definition Language
- Data Control Language

Data Manipulation Language (DML)

- Language for accessing and manipulating the data organized by the appropriate data model
  - *DML also known as query language*
- Two classes of languages
  - *Procedural – user specifies what data is required and how to get those data (Relational algebra)*
  - *Declarative (nonprocedural) – user specifies what data is required without specifying how to get those data (Relational calculus)*
- SQL is the most widely used query language

Data Definition Language (DDL)

- Specification notation for defining the database schema

  create table emp (

  eno char(5),
  pan_no varchar(20),
  ename varchar(20),
  address numeric(8,2))

- DDL compiler generates a set of tables stored in a *data dictionary*
- Data dictionary contains metadata (i.e., data about data)
  - *Database schema*
  - *Integrity constraints*
    - Primary key (ID uniquely identifies instructors)
    - Referential integrity (references constraint in SQL)
      - *e.g. dept_name value in any instructor tuple must appear in department relation*
  - *Authorization*

SQL

- SQL: widely used non-procedural language
  - *Example: Find the name of the employee with ID E2222*

    ```
    select   name
    from     employee
    where    eno = 'E2222'
    ```

  - *select employee.eno, department.dept_name*
    from employee, department
    where instructor.dept= department.dept and department.budget > 95000
- Application programs generally access databases through one of
  - *Language extensions to allow embedded SQL*
  - *Application program interface (e.g., ODBC/JDBC) which allow SQL queries to be sent to a database*

THANK YOU

References

- Silberschatz A Korth H F and SudharshanS , “Database System Concepts”, 6th Edition, TMH publishing company limited, 2011.