

# DATABASE SYSTEMS

## Characteristics

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# Characteristics of the Database Approach

- Main characteristics of database approach
  1. Self-describing nature of a database system
  2. Insulation between programs and data, and data abstraction
  3. Support of multiple views of the data
  4. Sharing of data and multiuser transaction processing

# Main Characteristics of the Database Approach

- 1. Self-describing nature of a database system:**
  - A DBMS **catalog** stores the description of a particular database (e.g. data structures and types)
  - The description is called **meta-data**.
  - This allows the DBMS software to work with different database applications.

# Example of a simplified database catalog

## RELATIONS

Relation_name	No_of_columns
STUDENT	4
COURSE	4
SECTION	5
GRADE_REPORT	3
PREREQUISITE	2

An example of a  
database catalog for the  
database

## COLUMNS

Column_name	Data_type	Belongs_to_relation
Name	Character (30)	STUDENT
Student_number	Character (4)	STUDENT
Class	Integer (1)	STUDENT
Major	Major_type	STUDENT
Course_name	Character (10)	COURSE
Course_number	XXXXNNNN	COURSE
....	....	.....
....	....	.....
....	....	.....
Prerequisite_number	XXXXNNNN	PREREQUISITE

# Main Characteristics of the Database Approach

## 2. Insulation between programs and data:

- Allows changing data structures and storage organization without having to change the DBMS access programs.
- Called **program-data independence**
  - Physical data independence
  - Logical data independence
- Data Abstraction

# DATA INDEPENDENCE

- The ability to modify a schema definition in one level without affecting a schema definition in a higher level is called **data independence**.
- There are two kinds:
  - **Physical data independence**
    - The ability to modify the physical schema (file organization or storage structures, storage devices, or indexing strategy) without causing application programs to be rewritten
  - **Logical data independence**
    - The ability to modify the conceptual schema (the addition or removal of new entities, attributes, or relationships) without causing application programs to be rewritten

# Levels of Abstraction

- **Physical level:** describes how a record (e.g., customer) is stored.
- **Logical level:** describes data stored in database, and the relationships among the data.

**type** *instructor* = **record**

```
ID : string;  
name : string;  
dept_name : string;  
salary : integer;  
end;
```

- **View level:** application programs hide details of data types. Views can also hide information (such as an employee's salary) for security purposes.

# DATA ABSTRACTION

## **Data Abstraction:**

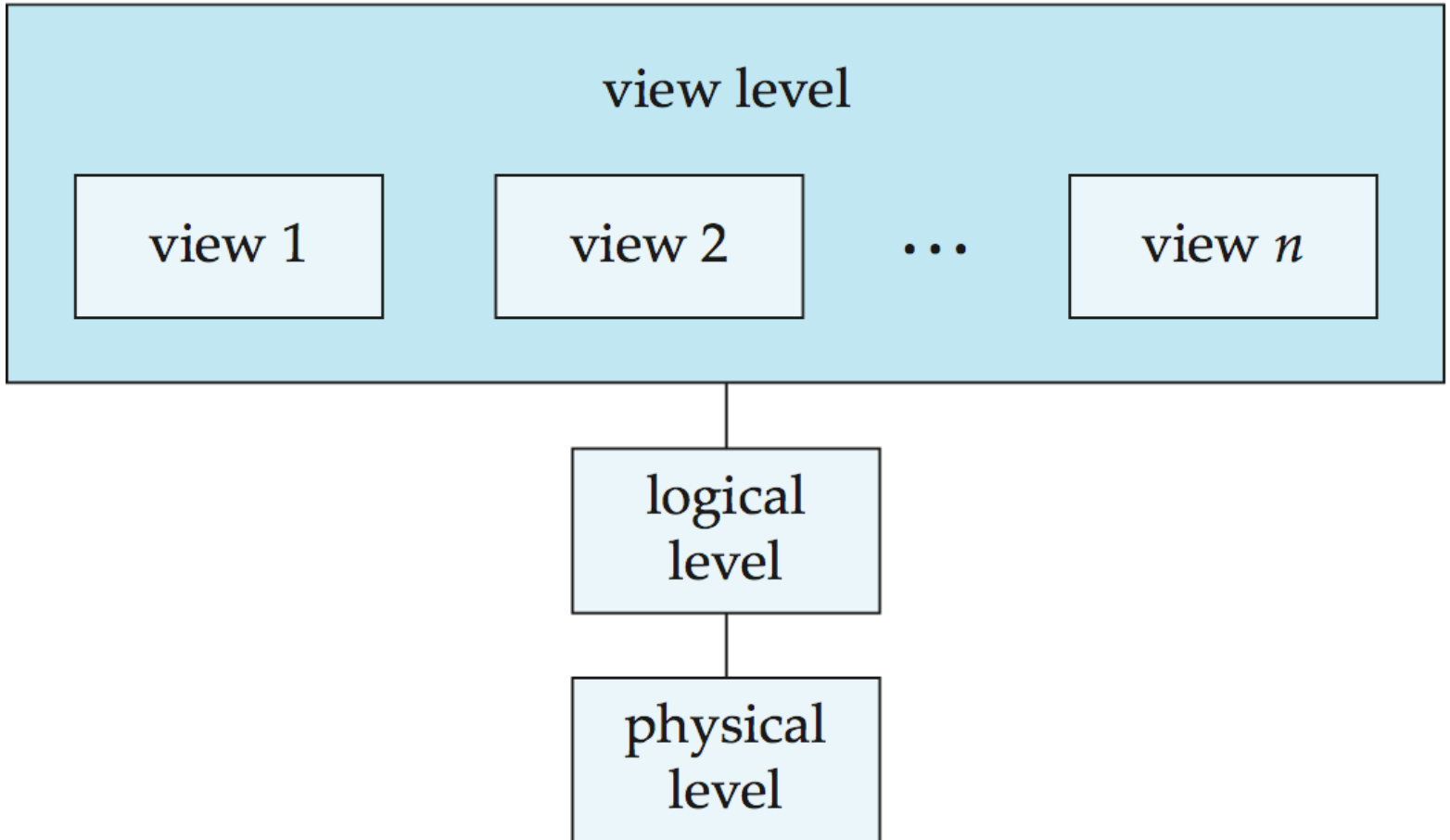
A **data model** is used to hide storage details and present the users with a conceptual view of the database.

Programs refer to the data model constructs rather than data storage details



# Data abstraction

An architecture for a database system



# Main Characteristics of the Database Approach (continued)

## 3. **Support of multiple views of the data:**

- Each user may see a different view of the database, which describes **only** the data of interest to that user.

# Main Characteristics of the Database Approach (continued)

## 4. Sharing of data and multi-user transaction processing:

- Allowing a set of **concurrent users** to retrieve from and to update the database
- *Concurrency control* within the DBMS guarantees that each **transaction** is correctly executed or aborted
- *Recovery* subsystem ensures each completed transaction has its effect permanently recorded in the database

Thank You!