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TRƯỜNG ĐẠI HỌC CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG VIỆT - HÀN
Vietnam - Korea University of Information and Communication Technology

Database Systems

Chapter 1

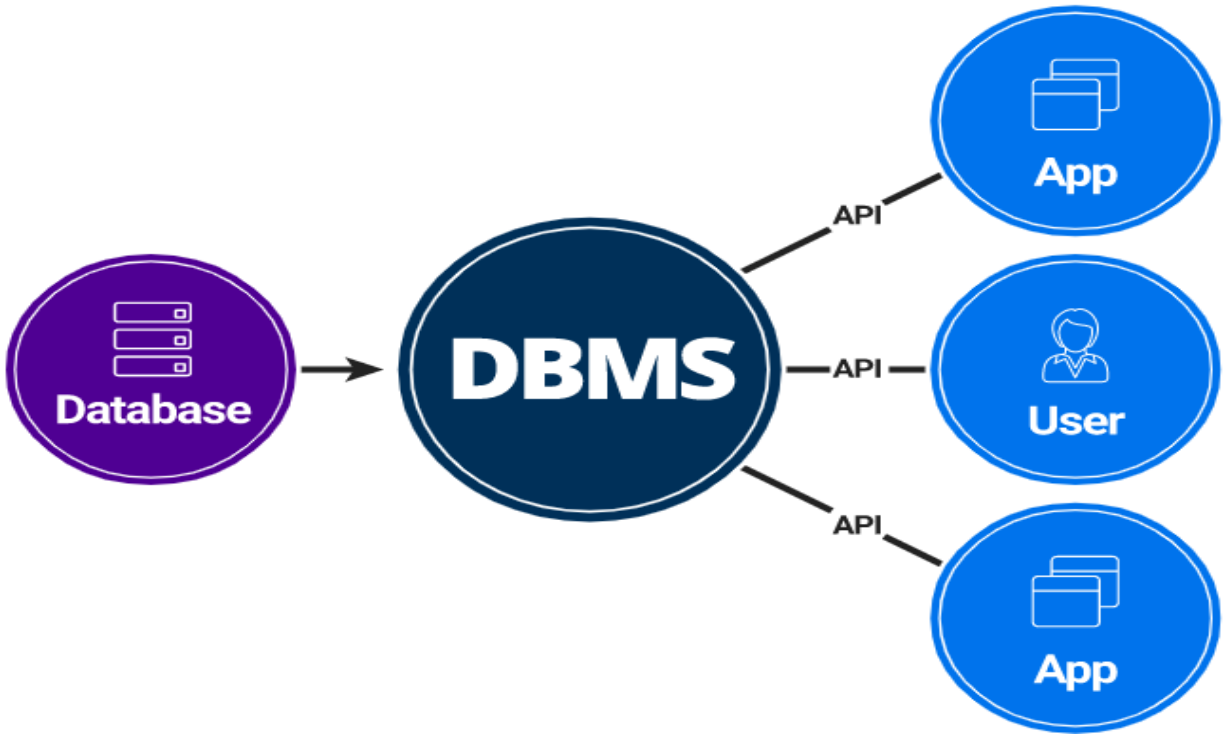
Introduction

Outline

1. Database
2. DBMS
3. Data Model
4. View of Data

Database Systems

- What is Database?
- What is Database Management System (DBMS) ?



What is a database?

- A database is a collection of data, contains information relevant to an enterprise.
- A database is an organized collection of data.
- A database is a collection of information that is organized so that it can easily be accessed, managed, and updated.

What is a DBMS?

- Database management system (DBMS) is a special software application that interacts with the user, other applications, and the database itself to capture and analyze data.
- E.g: Some popular DBMS

DBMS purpose

- To store data properly
- To provide simultaneous access to the data for many users
- To delimit the access to the data for different users
- To prevent data from loss
- To provide a way to store and retrieve database information that is both convenient and efficient.

Database systems

- Database systems are used to manage collections of data that are:
  - Highly valuable
  - Relatively large
  - Accessed by multiple users and applications, often at the same time.
- A modern database system is a complex software system whose task is to manage a large, complex collection of data.
- Databases touch all aspects of our lives

Database Applications Examples

- Enterprise Information
  - Sales: customers, products, purchases
  - Accounting: payments, receipts, assets
  - Human Resources: Information about employees, salaries, payroll taxes.
- Manufacturing: management of production, inventory, orders, supply chain.
- Banking and finance
  - customer information, accounts, loans, and banking transactions.
  - Credit card transactions
  - Finance: sales and purchases of financial instruments (e.g., stocks and bonds; storing real-time market data
- Universities: registration, grades

Database Applications Examples

- Airlines: reservations, schedules
- Telecommunication: records of calls, texts, and data usage, generating monthly bills, maintaining balances on prepaid calling cards
- Web-based services
  - Online retailers: order tracking, customized recommendations
  - Online advertisements
- Document databases
- Navigation systems: For maintaining the locations of varies places of interest along with the exact routes of roads, train systems, buses, etc.

Purpose of Database Systems

In the early days, database applications were built directly on top of file systems, which leads to:

- Data redundancy and inconsistency: data is stored in multiple file formats resulting induplication of information in different files
- Difficulty in accessing data
  - Need to write a new program to carry out each new task
- Data isolation
  - Multiple files and formats
- Integrity problems
  - Integrity constraints (e.g., account balance > 0) become "buried" in program code rather than being stated explicitly
  - Hard to add new constraints or change existing ones

Purpose of Database Systems (Cont.)

- Atomicity of updates
  - Failures may leave database in an inconsistent state with partial updates carried out
  - Example: Transfer of funds from one account to another should either complete or not happen at all
- Concurrent access by multiple users
  - Concurrent access needed for performance
  - Uncontrolled concurrent accesses can lead to inconsistencies
    - Ex: Two people reading a balance (say 100) and updating it by withdrawing money (say 50 each) at the same time
- Security problems
  - Hard to provide user access to some, but not all, data

Database systems offer solutions to all the above problems

University Database Example

- Data consists of information about:
  - Students
  - Instructors
  - Classes
- Application program examples:
  - Add new students, instructors, and courses
  - Register students for courses, and generate class rosters
  - Assign grades to students, compute grade point averages (GPA) and generate transcripts

Data Models

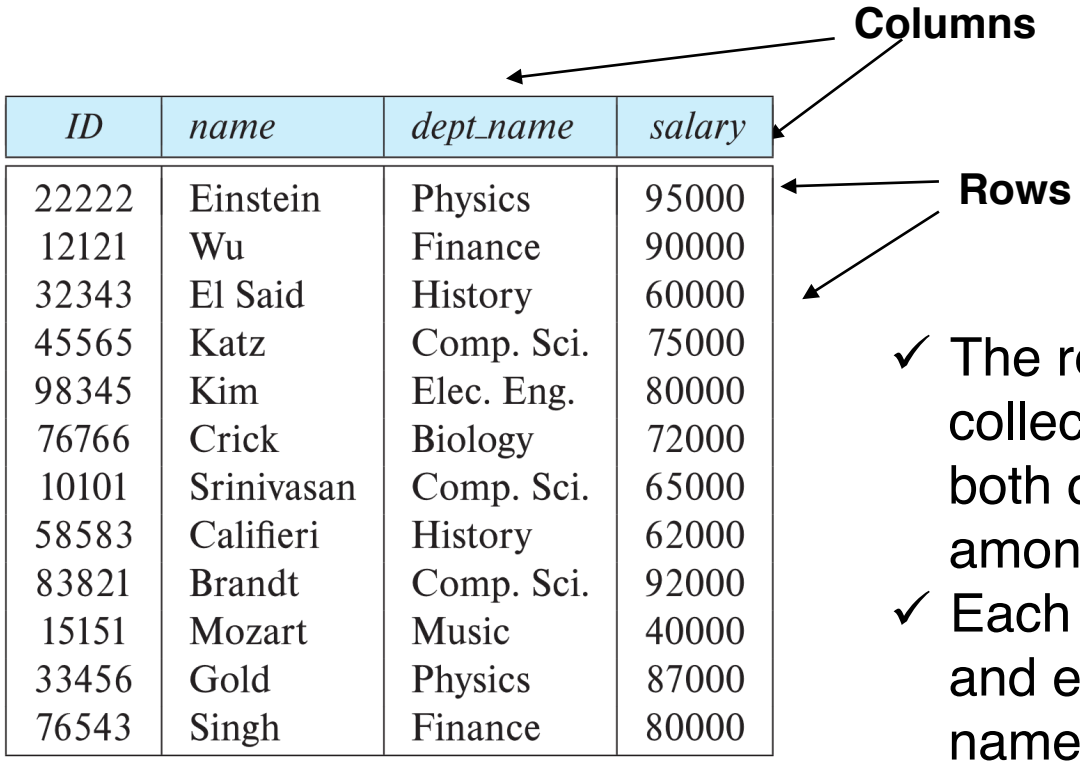
- Underlying the structure of a database is the data model: a collection of conceptual tools for describing
  - Data
  - Data relationships
  - Data semantics
  - Consistency constraints

Data Models

- There are a number of different data models:
  - **Relational model**
  - Entity-Relationship data model (mainly for database design)
  - Object-based data models (Object-oriented and Object-relational)
  - Semi-structured data model (XML)
- Other older models:
  - Network model
  - Hierarchical model

Relational Model

- Example of tabular data in the relational model:



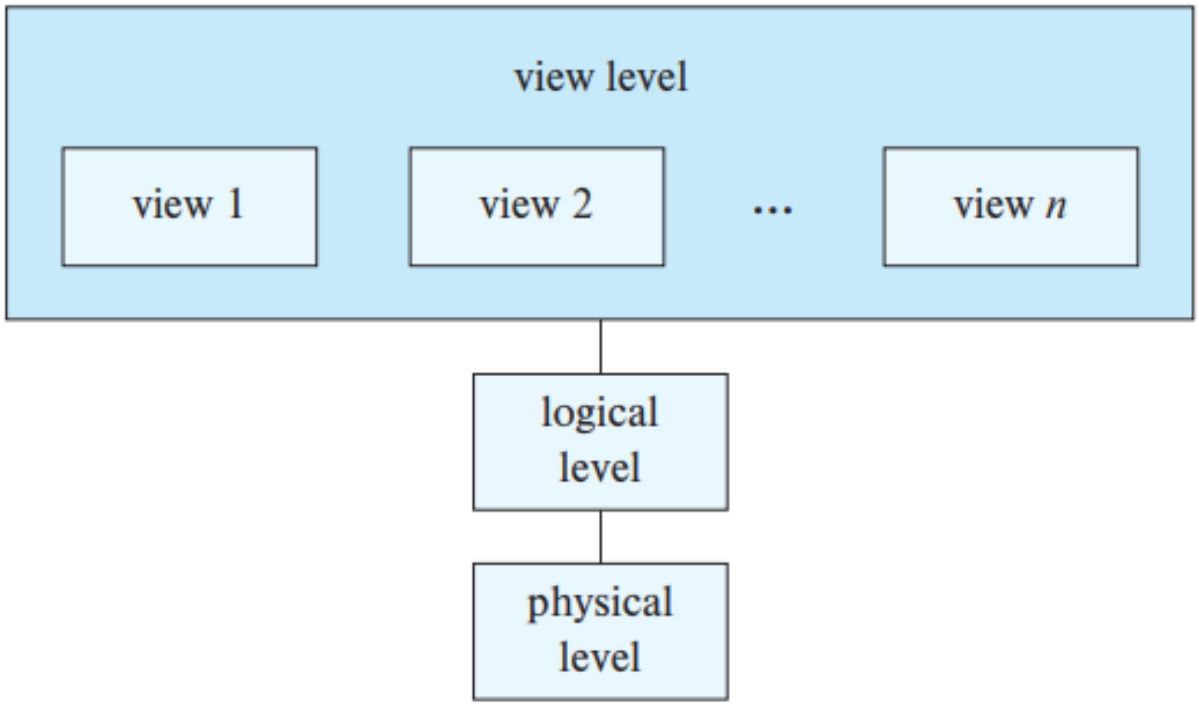
ID	*name*	*dept_name*	*salary*
22222	Einstein	Physics	95000
12121	Wu	Finance	90000
32343	El Said	History	60000
45565	Katz	Comp. Sci.	75000
98345	Kim	Elec. Eng.	80000
76766	Crick	Biology	72000
10101	Srinivasan	Comp. Sci.	65000
58583	Califieri	History	62000
83821	Brandt	Comp. Sci.	92000
15151	Mozart	Music	40000
33456	Gold	Physics	87000
76543	Singh	Finance	80000

(a) The *instructor* table

- ✓ The relational model uses a collection of tables to represent both data and the relationships among those data.
- ✓ Each table has multiple columns, and each column has a unique name.
- ✓ Tables are also known as **relations**.

View of Data

- Levels of data abstraction, to simplify users' interactions with the system:
  - The three levels of data abstraction:



Data Abstraction

- **Physical level**: the lowest level of abstraction describes ***how*** the data are actually stored.
- **Logical level**: describes ***what*** data are stored in the database, and what relationships exist among those data. E.g: Describe the type of a record *instructor* with 4 fields:

```
type instructor = record
  ID : char(5);
       name : char(20);
       dept_name : char(20);
       salary : numeric(8,2);
  end;
```

- **View level**: The highest level of abstraction describes only part of the entire database. The system may provide many ***views*** for the same database. Views can also hide information (such as an employee's salary) for security purposes.

RDBMS

- RDBMS which stands for relational database management system, is a program that lets users create, update, and administer a relational database.
- Are used in most commercial projects

RDBMS installation

- Install RDBMS Server
  - *Microsoft SQL Server 2014 Express*
- Install client application for querying data
  - *Microsoft SQL Server Management studio*

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Thank You !