Lecture (1) Introduction

Readings: Chapters 1, 2.

Databases and database systems have become an essential component of everyday life in modern society.

1 Basic Definition

- **Database(DB): A collection of related data.**
- **Data: Known facts that can be recorded and have an implicit meaning.**
- **Mini-world: Some part of the real world about which data is stored in a database.**
- **Database Management System (DBMS): A software package/ system to facilitate the creation and maintenance of a computerized database.**
- **Database System: The DBMS software together with the data itself. Sometimes, the applications are also included.**

2 A simplified database system environment.

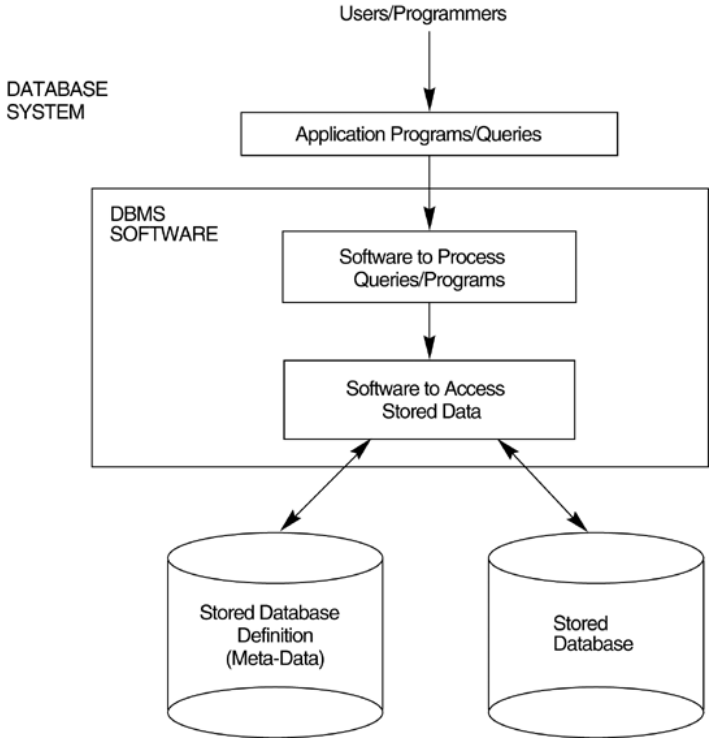

FIGURE 1 A simplified database environment

3 DB implicit properties

- **A DB represents some aspects of the real world.**
- **A DB is a logically coherent collection of data with some inherent meaning.**
- **A DB is designed, built, and populated with data for a specific purpose.**
- **A DB can be of any size depends on the application.**

4 Typical DBMS Functionality

- **Define a database: in terms of data types, structures and constraints**
- **Construct or Load the Database on a secondary storage medium**
- **Manipulating the database: querying, generating reports, insertions, deletions and modifications to its content.**
- **Concurrent processing and sharing by a set of users and programs – yet, keeping all data valid and consistent.**
- **Other features:**
  - **Protection or Security measures to prevent unauthorized access: Protection against H/W or S/W malfunction (or crashes), and security protection against unauthorized access.**

5 Main Characteristics of the Database Approach

- **Self-describing nature of a database system: A DBMS catalog stores the *description* of the database. The description is called meta-data). This allows the DBMS software to work with different databases.**
- **Insulation between programs and data: Called program-data independence. Allows changing data storage structures and operations without having to change the DBMS access programs.**
- **Data Abstraction: A data model is used to hide storage details and present the users with a *conceptual view* of the database.**
- **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.**
- **Sharing of data and multi-user transaction processing : allowing a set of concurrent users to retrieve and to update the database. Concurrency control within the DBMS guarantees that each transaction is correctly executed or completely aborted.**

6 Database Users

- **Database administrators: responsible for authorizing access to the database, for coordinating and monitoring its use, acquiring software, and hardware resources, controlling its use and monitoring efficiency of operations.**
- **Database Designers: responsible to define the content, the structure, the constraints, and functions or transactions against the database. They must communicate with the end-users and understand their needs.**
- **System analysts: responsible for defining the requirements of end users**
- **Application programmers: responsible for implementing database applications**
- **End-users: they use the data for queries, reports and some of them actually update the database content.**

7 Data Models

- **Data Model: A set of concepts to describe the *structure* of a database, and certain *constraints* that the database should obey.**
- **Data Model Operations: Operations for specifying database retrievals and updates by referring to the concepts of the data model. Operations on the data model may include *basic operations* and *user-defined operations*.**

8 Schemas versus Instances

- **Database Schema: The *description* of a database. Includes descriptions of the database structure and the constraints that should hold on the database.**
- **Schema Diagram: A diagrammatic display of (some aspects of) a database schema.**
- **Schema Construct: A component of the schema or an object within the schema.**
- **Database Instance: The actual data stored in a database at a *particular moment in time*. Also called database state (or occurrence).**