Database Management Systems

ICT1212

Databases and Database Users

Department of ICT
Faculty of Technology
University of Ruhuna

Lesson 01

Course Plan

- Lectures – 02 Hours per Week
- Evaluation

- Mid Term Examination 20%
- 3 Quizess 10 %

Eligibility & Evaluation Criteria

- Eligibility
  - **80%** Attendance is **MANDATORY**
- Evaluation Criteria
  - 10% From Quizzes
  - 20% From Assessments
  - 70% From Theory Final Exam

Course Outline

- Introduction to Database Concepts and Architecture.
- Database Concepts and Architecture.
- Data Modeling using Entity Relationship Diagrams.
- The Relational Data Model.
- The Relational Algebra.
- SQL the Relational Database Standard. .
- Practical Experience with a Relational DBMS Providing SQL.
- Normalization as a Process for Verification of Data Model Design
- SQL Interaction with Programming Interfaces.
- Desktop Database Packages.

What is a Database?

- A **database** is a collection of related data
- A database is designed, built, and populated with data for a specific purpose. It has an intended group of users and some preconceived applications in which these users are interested.

What is Database Management System?

- A **database management system (DBMS)** is a collection of programs that enables users to create and maintain a database.
- The DBMS is hence a *general-purpose software system* that facilitates the processes of *defining*, *constructing*, *manipulating*, and *sharing* databases among various users and applications.
- DBMS include *protecting* the database and *maintaining* it over a long period of time

Why **N**ot Traditional File Systems?

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- Redundancy in defining and storing data
- Wasted storage space
- Redundant efforts to maintain common data up-to-date

Types of Databases and Database Applications

- Traditional applications:
  - Numeric and textual databases
- More recent applications:
  - Multimedia databases
  - Geographic Information Systems (GIS)
  - Biological and genome databases
  - Data warehouses
  - Mobile databases
  - Real-time and active databases

Recent Developments in DBs

- Social Networks started capturing a lot of information about people and about communications among people-posts, tweets, photos, videos in systems such as:
  - Facebook
  - Twitter
  - Linked-In
- All of the above constitutes data
- Search Engines, Google, Bing, Yahoo: collect their own repository of web pages for searching purposes

Recent Developments in DBs

- New technologies are emerging from the so-called non-SQL, non-database software vendors to manage vast amounts of data generated on the web:
  - Big data storage systems involving large clusters of distributed
  - NOSQL (Non-SQL, Not Only SQL) systems
- A large amount of data now resides on the "cloud" which means it is in huge data centers using thousands of machines.

Example

- UNIVERSITY database for maintaining information concerning
  - Students
  - Courses
  - Grades

in a university environment.

Characteristics of the Database Approach

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- Self-Describing Nature of a Database System
- Insulation between Programs and Data, and Data Abstraction
- Support of Multiple Views of the Data
- Sharing of Data and Multiuser Transaction Processing

Self-Describing Nature of a Database System

- Database system contains not only the database itself but also a complete definition or description of the database structure and constraints.
- The DBMS software must work equally well with *any number of database applications.*

Insulation between Programs and Data, and Data Abstraction

- *Program-data independence*
  - *The structure of data files is stored in the DBMS catalog separately from the access programs*
- *Program - operation independence*
  - The *interface* (or *signature*) of an operation includes the operation name and the data types of its arguments (or parameters). The *implementation* (or *method*) of the operation is specified separately and can be changed without affecting the interface.
- Data Abstraction
- Operation Abstraction

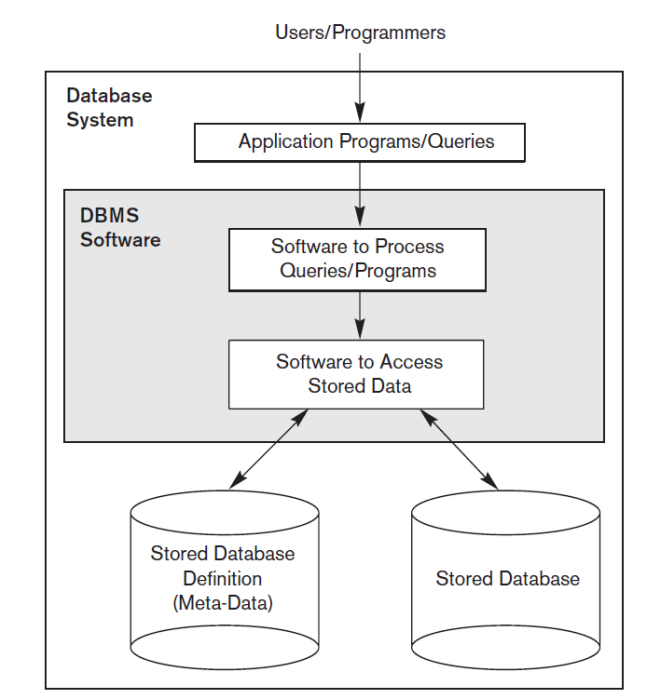
Support of Multiple Views of the Data

- A database typically has many users, each of whom may require a different perspective or view of the database.
- A view may be a subset of the database or it may contain virtual data that is derived from the database files but is not explicitly stored
- A multiuser DBMS whose users have a variety of applications must provide facilities for defining multiple views

Sharing of Data and Multiuser Transaction Processing

- Allow multiple users to access the database at the same time
- Concurrency control

A simplified Database System Environment



Homework

- ACID

Actors on the Scene

Identify the people whose jobs involve the day-to-day use of a large database.

- **Database Administrators** :- administrating the database & the DBMS

Responsibilities :-

- authorizing access to the database
- coordinating and monitoring the use of database
- acquiring software and hardware resources as needed
- accountable for problems such as breach of security or poor system response time

Actors on the Scene

- **Database Designers** :- responsible for identifying the data to be stored in the database and for choosing appropriate structures to represent and store this data

Responsibilities :-

- communicate with all prospective database users, in order to understand their requirement
- identifying the data to be stored in the database
- choosing appropriate structures to represent and store this data
- develop a **view** of the database that meets the data and processing requirements

Actors on the Scene

- **End Users**
  - people whose jobs require access to the database for querying, updating, and generating reports.

Categories :-

- **Casual end users**
  - occasionally access the database, but they may need different information each time.
  - They use a sophisticated database query language to specify their requests.
  - Typically middle- or high-level managers or other occasional browsers.
- **Naive** or **parametric end users**
  - Make up a sizable portion of database end users.

    Their main job function revolves around constantly querying and updating the

Actors on the Scene

- **End Users**
  - people whose jobs require access to the database for querying, updating, and generating reports.

Categories :-

- **Sophisticated end users**
  - Include engineers, scientists, business analysts, and others who thoroughly familiarize themselves with the facilities of the DBMS
  - Implement their applications to meet their complex requirements.
- **Stand-alone users**
  - Maintain personal databases by using ready-made program packages that provide easy-to-use menu- or graphics-based interfaces.
  - An example is the user of a tax package that stores a variety of personal financial data for tax purposes.

Actors on the Scene

- **System Analysts and Application Programmers (Software Engineers, Software Developers)**
  - **System analysts**
    - determine the requirements of end users, especially naive and parametric end users
    - Develop specifications for canned transactions that meet these requirements.
  - **Application programmers**
    - Implement above specifications as programs;
    - then they test, debug, document, and maintain these canned transactions.
    - Should be familiar with the full range of capabilities provided by the DBMS to accomplish their tasks.

Workers behind the Scene

Associated with the design, development, and operation of the DBMS *software and system environment.*

- **DBMS system designers and implementers**
  - Design and implement the DBMS modules and interfaces as a software package
- **Tool developers**
  - Design and implement **tools**
- **Operators and maintenance personnel** (system administration personnel)
  - Responsible for the actual running and maintenance of the hardware and software environment for the database system

Advantages of Using a DBMS

- Controlling Redundancy
- Restricting Unauthorized Access
- Providing Persistent Storage for Program Objects and Data Structures
- Providing storage structures (e.g. indexes) for efficient query processing
- Providing Multiple User Interfaces
- Representing Complex Relationships Among Data
- Enforcing Integrity Constraints
- Providing Backup and Recovery

Implications of the Database Approach

- Potential for Enforcing Standards
- Reduced Application Development Time
- Flexibility
- Availability of Up-to-Date Information
- Economies of Scale

A Brief History of Database Applications

- Hierarchical and Network Systems
- Relational Databases
- Complex Databases
- Interchanging Data on the Web for E-Commerce Using XML Economies of Scale
- Extending Database Capabilities for New Applications
- Databases versus Information Retrieval

DBMS භාවිතා නොකළ යුතු විට

When Not to Use a DBMS

- Main inhibitors (costs) of using a DBMS
- When a DBMS may be unnecessary
- When a DBMS may be infeasible
- When no DBMS may suffice

DBMS භාවිතා කිරීමේ ප්‍රධාන නිෂේධක (පිරිවැය).

- DBMS අනවශ්‍ය විය හැකි විට
- DBMS එකක් කළ නොහැකි විය හැකි විට
- DBMS ප්‍රමාණවත් නොවන විට

Summary

- Characteristics that distinguish the database approach from traditional file-processing applications
- Main categories of database users
- Advantages using a DBMS

References

- *Fundamentals of Database Systems*

(6th Edition) By Remez Elmasri & Shamkant B. Navathe

Questions???

Thank You