Database Management Systems

Part I: Basic Concepts

Lecture 1

An Overview of Database Management

Contents

- What is Data?
- What is Database?
- What is Database Management System?
- Components of DBMS
- Applications of DBMS
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What is Data?

- Data refers to the facts.
- Generally, data are raw facts that need to be processed to produce information.
- Data can be the text, numerical values, images, audio and video.
- In DBMS, data refers to the values actually stored in the database.
- Information refers to the meaning of those values.

What is Database?

- Database is a computerized record keeping system.
- It is a repository for a collection of computerized data files.
- The user can perform various operations such as adding, inserting, retrieving, updating, deleting and removing data or files.
- A well-organized database can be easily accessed, managed and updated.

What is Database? (Cont.)

- For example, student database can include the names of the students, their roll numbers and so on.
- In the figure, student database is designed in relational approach by using table.
- In this table, rows represent the records of the files and columns represent the fields of those records.

STUDENT

Name	Student_number	Class	Major
Smith	17	1	CS
Brown	8	2	CS

Figure 1. The student database

What is Database? (Cont.)

- To define the database, we must specify the structure of the records of each file by specifying the different types of data elements to be stored in each record.
- In STUDENT database, each STUDENT record includes data to represent the student's Name, Student_number, Class, and Major.

Conventional Database System

- The conventional databases such as dictionary and phone book are manual paper-based systems.
- For example, Yangon Directory is a database of companies' names, addresses and telephone numbers organised in business categories.
- All the records are created, updated and deleted manually.
- Usually, these paper records are stored in filing cabinets.

Disadvantages of Conventional Database System

- A paper record is very easy to lose or damage.
- It is difficult and time consuming to search and update the records.
- Data can be duplicated in several records.
- Data inconsistency can also be occurred where values are updated in one record but not in others.
- When the storage of paper records is very bulky, several large filing cabinets are required.

Computerized Database System

- To overcome the problems of using conventional database system, computerized database systems have been developed.
- The computerized database stores the information by running the program on a computer.
- They store information in a format to retrieve information quickly and easily.

Advantages of Computerized Database System

- Computerized databases have several advantages over manual databases.
- Data can be processed much more quickly in searching, sorting and calculating.
- Information can be more easily available to users since there is no difficulty in data retrieval.
- Data integrity is also improved resulting in more accurate information.

What is Database Management System?

- Database Management System (DBMS) is a software to store, process and retrieve data for one or more users.
- DBMS consists of a group of programs that enable creation, utilization and maintenance of computerized database.
- In other words, DBMS is a system that allows adding, inserting, updating, retrieving, deleting and removing of data.
- Some of DBMS are Oracle, MySQL, MS SQL Server, MS Access, MS Visual Foxpro, Postgre and so on.

Components of DBMS

- Database system includes four major components, namely data, hardware, software and users.
- The following figure shows a simplified view of a database system.

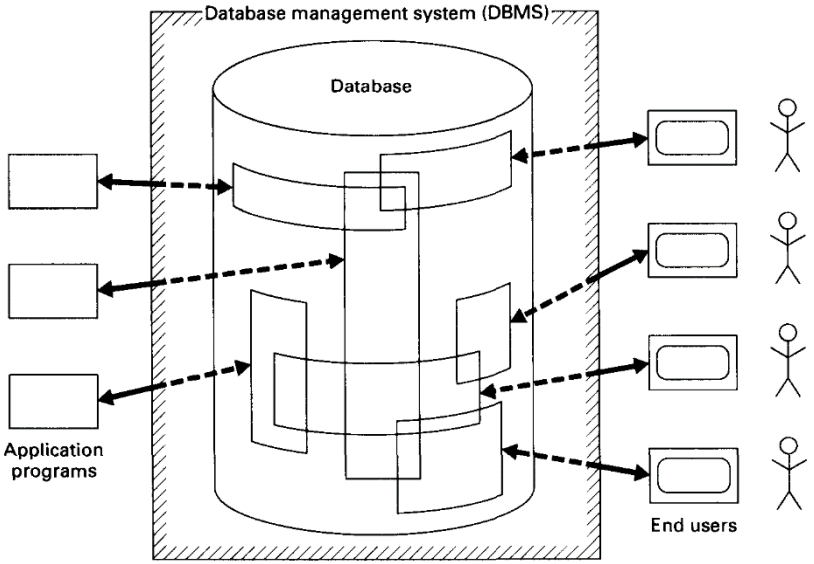

Figure 2. Simplified picture of a database system

Components of DBMS (Cont.)

Data

- Data is one of the important factor of database.
- There are two types of data: user data and metadata.
- User data contains the data stored in the various tables of the database in the form of rows and columns.
- Metadata, known as data about data, stores the information such as how many tables, their names, how many columns and their names, primary keys, foreign keys, etc.

Components of DBMS (Cont.)

Hardware

- The two portions of the database hardware consist of:
  - secondary storage volumes that are used to hold the stored data, together with the associated I/O devices, devices controller, I/O channels, and so on and
  - processors and associated main memory that are used to support the execution of the database system software.

Components of DBMS (Cont.)

Software

- Between the physical database itself and the users of the system is a layer of software called database manager or database management system.
- DBMS software helps the user to interact with the database.
- All requests from the users for access to the database are handled by DBMS.

Components of DBMS (Cont.)

Software

- DBMS allows the users for adding and removing files, retrieving data from and updating data in such files or tables and so on.
- All these operations are handled by query languages like MySQL, Oracle, etc.
- DBMS is the most important software component in the overall system.

Components of DBMS (Cont.)

Users

- DBMS is used by various users or clients for various purposes.
- Some may involve in retrieving data and some may involve in backing it up.
- Three broad classes of users are as follows.
  - Application Programmer
  - End User
  - Database Administrator

Components of DBMS (Cont.)

Users: Application Programmer

- This is the group of people who actually works on designing the database by means of application programs.
- The application programmers are responsible for writing application programs that use the database.
- They write programs in various programming languages like C, C++, Java or Pascal to interact with databases.

Components of DBMS (Cont.)

Users: Application Programmer

- The application programs operate on the data in all the usual ways for retrieving existing information, inserting new information, deleting or changing existing information.
- All of these functions are performed by issuing the appropriate request to the DBMS.

Components of DBMS (Cont.)

Users: End User

- The second class of user is end users.
- This group contains the persons who actually take advantage of database system.
- The end users interact with the database management system from online workstations or terminals.
- They conduct various operations on database like retrieving, updating, deleting, etc.

Components of DBMS (Cont.)

Users: Database Administrator

- The third class of user is the database administrator or DBA.
- The administration and maintenance of database is taken care by DBA.
- DBAs are responsible for installing and upgrading the DBMS servers, designing and implementing the database, performance tuning, migration database servers, backup and recovery, security and documentation.

Applications of DBMS

- DBMS can be used in many applications.
- Some applications are as follows:
  - Transactions Management System in Banking
  - Reservations Management System in Airlines
  - Student Management System in Universities
  - Product Management System in Sales
  - Inventory Management System in Manufacturing
  - Employee Management System in Human Resources

Advantages of DBMS

- The advantages of using DBMS are as follows.

1. Redundancy can be reduced.
2. Inconsistency can be avoided.
3. The data can be shared.
4. Standards can be enforced.
5. Security restrictions can be applied.
6. Integrity can be maintained.
7. Conflicting requirements can be balanced.

Summary

- Database system is a computerized record keeping system.
- It involves data, hardware, software and user.
- Users can be divided into application programmers, end users and database administrator.
- Database can be integrated and shared.
- Data independence is one of the most important benefits of database system.

Next Lecture

Part I: Basic Concepts

An Architecture for a Database System

- External Level
- Conceptual Level
- Internal Level
- Mappings
- Client/Server Architecture
- Distributed Processing

Textbook and References

Textbook

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Additional References

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