Study Unit 1: WEB-BASED DATABASE DEVELOPMENT

Outline

- Introduction to database
- Types of Databases
- Database Components
- Introduction to RDBMS
- Introduction to SQL
- MySQL - Installation

Learning Outcomes of Study Unit 1

Upon completion of this study unit, you should be able to

1.1   Introduction to Database

  o   Definition

1.2   Types of databases

- Relational databases

- Object-oriented databases

- Hierarchical database

- Cloud databases

- Network DBMS

1.3   Database Components

- Hardware

- Software

- Data

- Procedure

- Database Access Language

1.4   What is a Database Management System (DBMS)?

- Defination

- History of Database Management System

- DBMS Advantages and Disadvantages

- RDBMS Defination

- RDBMS Terminologies

1.5   MYSQL Database

- Introduction to MYSQL database

1.1   Introduction to Database

What is Database?

The A database is a systematic collection of data. They support electronic storage and manipulation of data. Databases make data management easy.

Let us discuss a database example: An online telephone directory uses a database to store data of people, phone numbers, and other contact details.

Your electricity service provider uses a database to manage billing, client-related issues, handle fault data, etc.

Let us also consider Facebook. It needs to store, manipulate, and present data related to members, their friends, member activities,

Messages, advertisements, and a lot more. We can provide a countless number of examples for the usage of databases.

1.2   Types of Databases

Here are some popular types of databases.

1.2.1   Relational Database

This type of database defines database relationships in the form of tables. It is also called Relational DBMS, which is the most popular DBMS type in the market. Database example of the RDBMS system include MySQL, Oracle, and Microsoft SQL Server database.

1.2.2   Object-Oriented Database

This type of computers database supports the storage of all data types. The data is stored in the form of objects. The objects to be held in the database have attributes and methods that define what to do with the data. PostgreSQL is an example of an object-oriented relational DBMS.

1.2.3   Hierarchical Database

This type of DBMS employs the "parent-child" relationship of storing data. Its structure is like a tree with nodes representing records and branches representing fields. The windows registry used in Windows XP is a hierarchical database example.

1.2.4   Cloud Database

A cloud database is a database which is optimized or built for such a virtualized environment. There are so many advantages of a cloud database, some of which can pay for storage capacity and bandwidth. It also offers scalability on-demand, along with high availability.

1.2.5 Network Database

This type of DBMS supports many-to-many relations. It usually results in complex database structures. RDM Server is an example of database management system that implements the network model.

1.3 Database Components
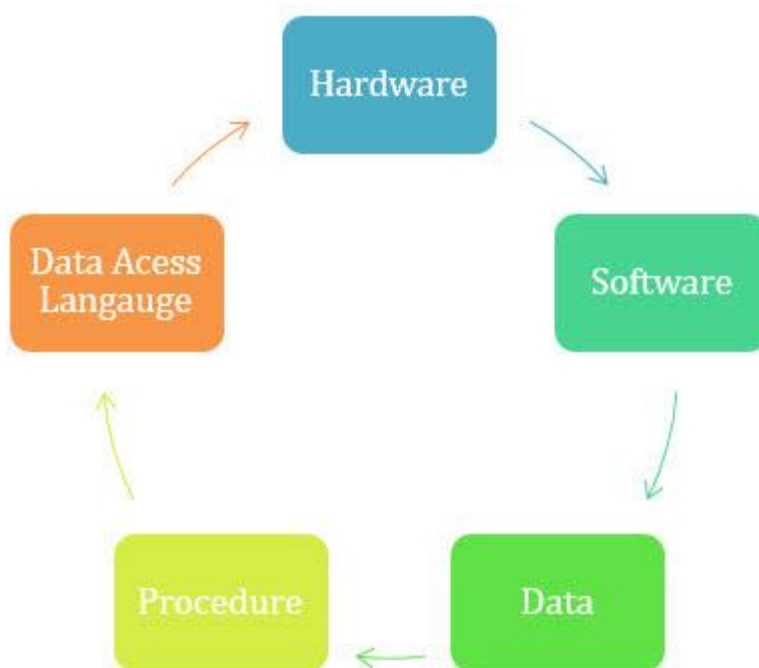
1.3.1 Hardware

The hardware consists of physical, electronic devices like computers, I/O devices, storage devices, etc. This offers the interface between computers and real-world systems.

1.3.2 Software

This is a set of programs used to manage and control the overall database. This includes the database software itself, the Operating System, the network software used to share the data among users, and the application programs for accessing data in the database.

1.3.3 Data

Data is a raw and unorganized fact that is required to be processed to make it meaningful. Data can be simple at the same time unorganized unless it is organized. Generally, data comprises facts, observations, perceptions, numbers, characters, symbols, images, etc

1.3.4 Procedure

Procedure are a set of instructions and rules that help you to use the DBMS. It is designing and running the database using documented methods, which allows you to guide the users who operate and manage it.

1.3.5 Database Language

Database Access language is used to access the data to and from the database, enter new data, update already existing data, or retrieve required data from DBMS. The user writes some specific commands in a database access language and submits these to the database.

1.4   What is Database Management System(DBMS)?

1.4.1 DBMS Defination

Database Management System (DBMS) is a collection of programs that enable its users to access databases, manipulate data, report, and represent data. It also helps to control access to the database. Database Management Systems are not a new concept and, as such, had been first implemented in the 1960s.

Charles Bachman's Integrated Data Store (IDS) is said to be the first DBMS in history. With time database, technologies evolved a lot, while usage and expected functionalities of databases increased immensely.

1.4.2 History of Database Management System

Here, are the important landmarks from the history:

- 1960 - Charles Bachman designed first DBMS system.

- 1970 - Codd introduced IBM'S Information Management System (IMS).

- 1976 - Peter Chen coined and defined the Entity-relationship model also known as the ER model.

- 1980 - Relational model becomes a widely accepted database component.

- 1985 - Object-oriented DBMS develops.

- 1990 - Incorporation of object-orientation in relational DBMS.
- 1991 - Microsoft ships MS access, a personal DBMS and that displaces all other personal DBMS products.
- 1995 - First Internet database applications.
- 1997 - XML applied to database processing. Many vendors begin to integrate XML into DBMS products.

1.4.3 DBMS Advantages and Disadvantages

Advantages of DBMS

1. DBMS offers a variety of techniques to store & retrieve data.
2. DBMS serves as an efficient handler to balance the needs of multiple applications using the same data.
3. Uniform administration procedures for data.
4. Application programmers never exposed to details of data representation and storage.
5. A DBMS uses various powerful functions to store and retrieve data efficiently.
6. Offers Data Integrity and Security.
7. The DBMS implies integrity constraints to get a high level of protection against prohibited access to data.
8. A DBMS schedules concurrent access to the data in such a manner that only one user can access the same data at a time.
9. Reduced Application Development Time.

Disadvantage of DBMS

DBMS may offer plenty of advantages but, it has certain flaws-

1. Cost of Hardware and Software of a DBMS is quite high which increases the budget of your organization.
2. Most database management systems are often complex systems, so the training for users to use the DBMS is required.
3. In some organizations, all data is integrated into a single database which can be damaged because of electric failure or database is corrupted on the storage media.

4. Use of the same program at a time by many users sometimes lead to the loss of some data.

5. DBMS can't perform sophisticated calculations.

1.4.4 Introduction to RDBMS

A Relational DataBase Management System (RDBMS) is a software that –

Enables you to implement a database with tables, columns and indexes.

Guarantees the Referential Integrity between rows of various tables.

Updates the indexes automatically.

Interprets an SQL query and combines information from various tables.

These days we use relational database management systems (RDBMS) to store and manage huge volume of data. This is called relational database because all the data is stored into different tables and relations are established using primary keys or other keys known as Foreign Keys.

1.4.5 RDBMS Terminologies

Database – A database is a collection of tables, with related data.

- Table – A table is a matrix with data. A table in a database looks like a simple spreadsheet.

- Column – One column (data element) contains data of one and the same kind, for example the column postcode.

- Row – A row (= tuple, entry or record) is a group of related data, for example the data of one subscription.

- Redundancy – Storing data twice, redundantly to make the system faster.

- Primary Key – A primary key is unique. A key value can not occur twice in one table. With a key, you can only find one row.

- Foreign Key – A foreign key is the linking pin between two tables.

- Compound Key – A compound key (composite key) is a key that consists of multiple columns, because one column is not sufficiently unique.

- Index – An index in a database resembles an index at the back of a book.

- Referential Integrity – Referential Integrity makes sure that a foreign key value always points to an existing row.

1.5   RDBMS VS SQL

A Relational Database Management System (RDBMS) is a platform to create and manage databases. Examples of these platforms include SQL Server, Oracle, MySQL, Postgres, etc. Any RDBMS would be useless without a way to insert, modify, and retrieve that data however. That's where Structured Query Language (SQL) comes in. When you want to retrieve data, you connect to a specific database on the RDBMS and then run your sql query.

SQL is a language used to access and control RDBMSs.
RDBMS is not a language but a kind of database software

1.5.1 What is SQL?

SQL is the standard language for dealing with Relational Databases. SQL can be used to insert, search, update, and delete database records. SQL can do lots of other operations, including optimizing and maintenance of databases. OR

SQL is a standard language for storing, manipulating and retrieving data in databases.Our SQL tutorial will teach you how to use SQL in: MySQL, SQL Server, MS Access, Oracle, Sybase, Informix, Postgres, and other database systems.

1.5.2 What is SQL is used for?

Here are important reasons for using SQL

- It helps users to access data in the RDBMS system.
- It helps you to describe the data.

- It allows you to define the data in a database and manipulate that specific data.
- With the help of SQL, you can create and drop databases and tables.
- SQL offers you to use the function in a database, create a view, and stored procedure.
- You can set permissions on tables, procedures, and views.

1.5.3 History of SQL

- 1970 - Dr. Edgar F. "Ted" Codd described a relational model for databases.
- 1974 - Structured Query Language appeared.
- 1978 - IBM released a product called System/R.
- 1986 - IBM developed the prototype of a relational database, which is standardized by ANSI.
- 1989 - First ever version launched of SQL
- 1999 - SQL 3 launched with features like triggers, object-orientation, etc.
- SQL 2003 - window functions, XML-related features, etc.
- SQL 2006 - Support for XML Query Language
- SQL 2011 -improved support for temporal databases

1.5.4 List of SQL Commands

Here's a list of some of the most commonly used **SQL commands**:

- **CREATE** - defines the database structure schema
- **INSERT** - inserts data into the row of a table
- **UPDATE** - updates data in a database
- **DELETE** - removes one or more rows from a table
- **SELECT** - selects the attribute based on the condition described by the WHERE clause
- **DROP** - removes tables and databases

1.5.5 SQL Language elements

- **Keywords:** Each SQL statement contains single or multiple keywords.
- **Identifiers:** Identifiers are names of objects in the database, like user IDs, tables, and columns.
- **Strings:** Strings can be either literal strings or expressions with VARCHAR or CHAR data types.
- **Expressions:** Expressions are formed from several elements, like constants, SQL operators, column names, and subqueries.
- **Search Conditions:** Conditions are used to select a subset of the rows from a table or used to control statements like an IF statement to determine control of flow.
- **Special Values:** Special values should be used in expressions and as column defaults when building tables.

- **Variables:** Sybase IQ supports local variables, global variables, and connection-level variables.
- **Comments:** Comment is another SQL element which is used to attach explanatory text to SQL statements or blocks of statements. The database server does not execute any comment.
- **NULL Value:** Use NULL, which helps you to specify a value that is unknown, missing, or not applicable.

Self-Review Questions (SRQ) For Study Session 1

Now that you have completed this study unit, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting or Online interactive sessions.

1. Describe about database and its types.
2. Explain main components of database.
3. What is DBMS? Describe advantages and disadvantages.
4. History of DBMS and SQL.
5. What is RDBMS? Describe RDBMS Terminologies.
6. What is the basic difference between SQL and RDBMS?
7. What is SQL? Why we use it for.
8. List commonly used SQL commands.
9. Describe the main SQL language elements.

References and Additional Reading Materials

https://www.w3schools.com/sql/

https://www.tutorialspoint.com/mysql/index.htm