

DS1105 DATABASE MANAGEMENT SYSTEMS

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Lesson Learning Outcomes

By the end of this lesson, students will be able to:

- Explain the need for DBMS over manual file systems.
- Identify real-world applications of DBMS.
- Compare the advantages and disadvantages of DBMS.

Content

- Introduction to Database System
- Manual File System vs DBMS
- Functions of DBMS
- Advantages and Disadvantages of DBMS

Database System

- A Database System is
 - **a collection of interrelated components which used to store data.**
- It is an organized collection of data

Database System

Examples

- Bank withdrawal and deposit funds
- Hotel or airline reservation
- Computerized library system
- Purchase something online – Such as books, toys, electronic items, etc.
- Purchase a grocery item from a supermarket

Manuel File System

In earlier days, the database systems were built on top of a file system

- **Duplicate** data exists in data files related to each application
- Duplicate data becomes **inconsistent**

Multiple file formats, duplication of information in different files

- **Difficulty** in accessing data
- **Data isolation**

Multiple files and formats

Manuel File System

In earlier days, the database systems were built on top of a file system

- **Integrity** problems

Hard to add, update, or delete records

- **Uncontrolled concurrent access** by multiple users
- **Security** problems

Database System - Definition

- A database system is
a **high-level definition** of the **structure** and **relationship** between stored data, a database or databases, users, and the hardware or operating system used for the storage.
- **Aim –**
to achieve a **highly organized collection of data**, along with appropriate tools and applications that facilitate processing and access to that data

Database Management System

- Most Database systems are electronic systems that allow users to easily access, manipulate, and update data.
- Modern database systems are managed using a **Database Management System (DBMS)**

Database Management System

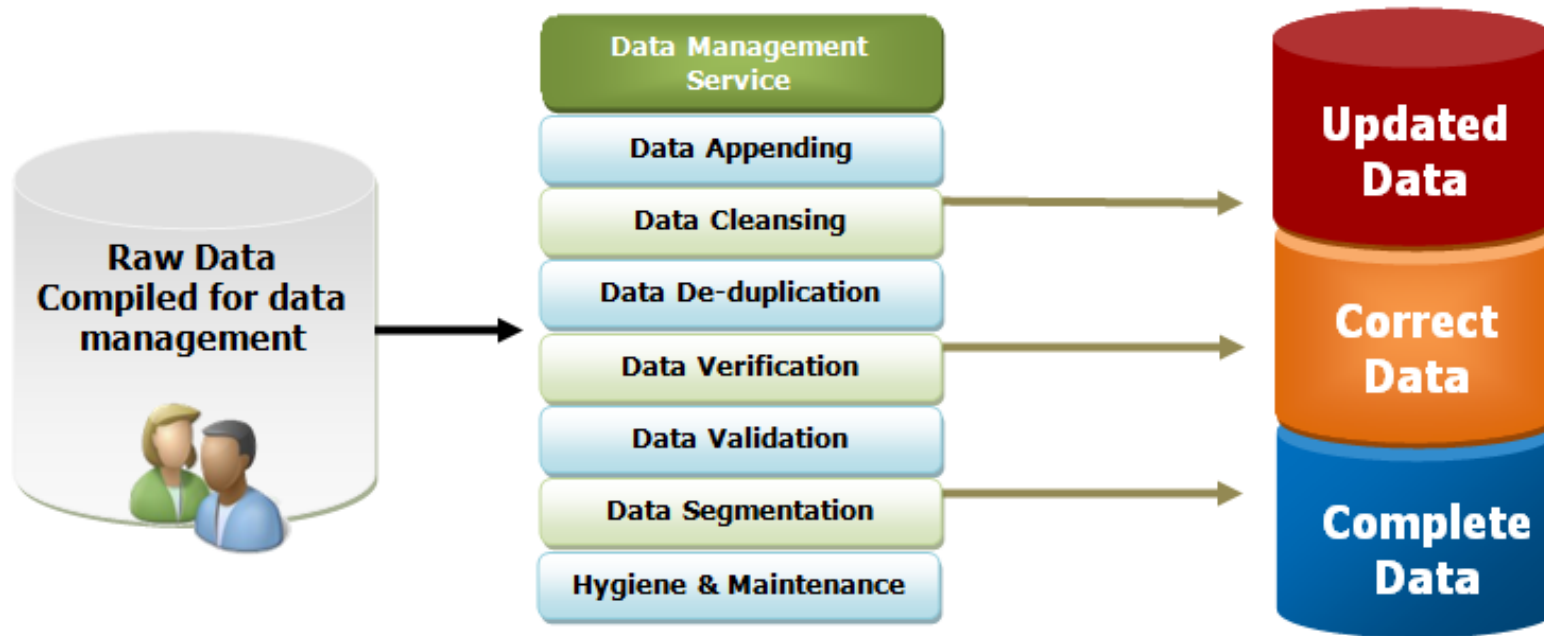
- Database Management System (DBMS) is
a collection of programs that enables users to create and maintain a database.
- General-purpose software system that facilitates the processes of defining, constructing, manipulating, and sharing databases among various users and applications.

DBMS Tools



Database Processing

- All applications interact with the same interface with the same data in a central database.



Database Processing

DBMS provides a set of functions to manage data,

- Insert
- Update
- Delete
- Search/View

Functions of DBMS

- Defining a database

Specifying the data types, structures, and constraints of the data to be stored in the database

- Constructing the database

Storing the data on some storage medium that is controlled by the DBMS

Functions of DBMS

- Manipulating a database

Querying the database to retrieve specific data,
updating the database to reflect changes and
generating reports from the data

- Sharing a database

Allows multiple

Functions of DBMS

- Protecting the database

System protection against hardware or software malfunction (or crashes)

Security protection against unauthorized or malicious access

- Maintaining the database system

Allows the system to evolve as requirements change over time

Database Users

- Database Administrators

Administering the resources such as the database, DBMS, and related software

- Database Designers

Responsible for identifying the data to be stored in the database and for choosing appropriate structures to represent and store the data

Database Users

- End users

Access to the database for querying, updating, and generating reports

- System Analysts and Application Programmers (Software Engineers)

System Analysts determine the requirements of end users and develop specifications, and Application Programmers implement these specifications as programs

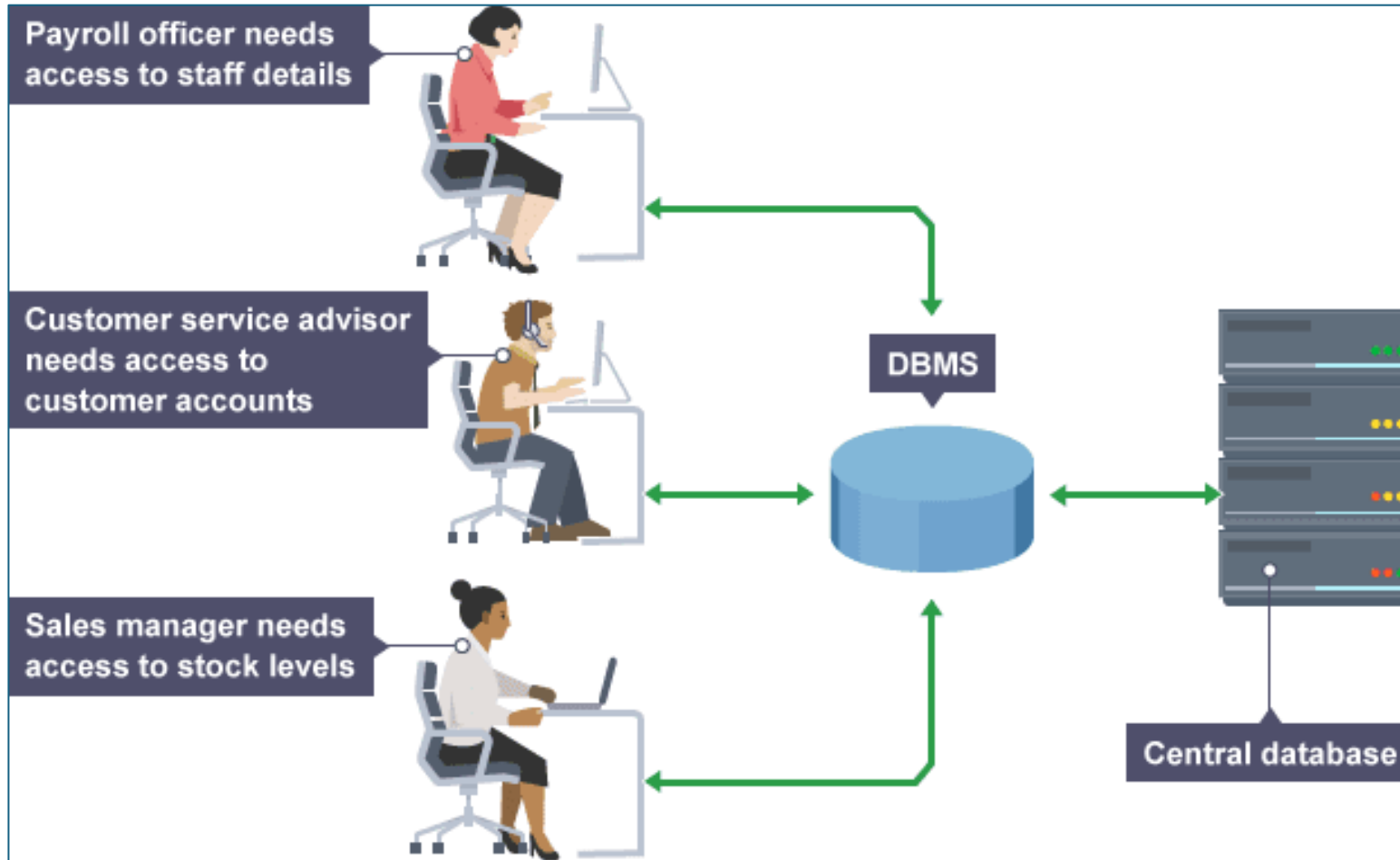
Advantages of DBMS

- Controlling redundancy
- Improving data consistency
- Restricting unauthorized access
- Sharing of data
- Providing multiple user interfaces
- Representing complex relationships among data
- Enforcing standards and integrity constraints
- Providing backup and recovery
- Increasing concurrency

Disadvantages of DBMS

- Complexity
- Cost of DBMS
- Additional hardware costs
- Cost of conversion
- Performance
- Higher impact of failures

Database Processing



Properties of a database

- A database represents some aspect of the real world, sometimes called the **mini world** or the **universe of discourse (UoD)**. Changes to the mini world are reflected in the database.
- A database is a logically coherent collection of data with some inherent meaning. A random assortment of data cannot correctly be referred to as a database.
- 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.

Properties of a database

- For a database to be accurate and reliable at all times,
- It must be a true reflection of the mini world that it represents,
- Therefore, changes must be reflected in the database as soon as possible.

Classification of DBMS

According to the data model

- Relational Model
- Network Model
- Hierarchical Model
- Object Data Model
- Object-relational Model

Classification of DBMS

According to the number of users

- Single-user Systems
- Multi-user Systems

According to the distribution

- Centralized DBMS
- Distributed DBMS

Characteristics of Database System

- Real World Entity

Real-world entities are used to design DBs

- Self-Describing Nature

A DBMS should be of a Self-Describing nature as it not only contains the database itself but also the metadata.

Metadata (data about data) defines and describes not only the extent, type, structure, and format of all data but also the relationship between data.

This data represents what actions should be taken on it.

Characteristics of Database System

- Support ACID Properties

Any DBMS can support ACID (Atomicity, Consistency, Isolation, and Durability) properties.

- Concurrent Use of Database

Many users can access the data at the same time

- Insulation Between Data and Program

Any changes in the data do not have any effect on the application software

Characteristics of Database System

- Transactions

Only be completed or uncompleted

- Data Persistence

If a system failure happens in between any transaction, then it will be rolled back or fully completed, but data will never be at risk

- Backup and Recovery

Enables more effectiveness

Characteristics of Database System

- Data integrity

Protects unauthorized access to the database and makes it more secure.

Integrity ensures the quality and reliability of the database system.

- Multiple Views

Users can have multiple views of the database depending on their department and interests.

Characteristics of Database System

- Store any kind of data

Any kind of data that exists in the real world can be stored in a DBMS.

- Security

Provides different rights to access the database

- Represent complex relationships between data

Able to represent the complex relationship between data to make efficient and accurate use of data.

- Query language

Summary

- Databases provide organized and reliable data storage.
- DBMS offers functions such as defining, manipulating, and protecting data.
- Different users interact with DBMS in different roles.
- DBMS has both advantages and disadvantages.
- Databases must reflect the real world accurately.

THANK YOU