Chapter 1

Introduction to Databases

Chapter 1 - Objectives

- **Some common uses of database systems.**
- **Characteristics of file-based systems.**
- **Problems with file-based approach.**
- **Meaning of the term database.**
- **Meaning of the term Database Management System (DBMS).**

Chapter 1 - Objectives

- **Typical functions of a DBMS.**
- **Major components of the DBMS environment.**
- **Personnel involved in the DBMS environment.**
- **History of the development of DBMSs.**
- **Advantages and disadvantages of DBMSs.**

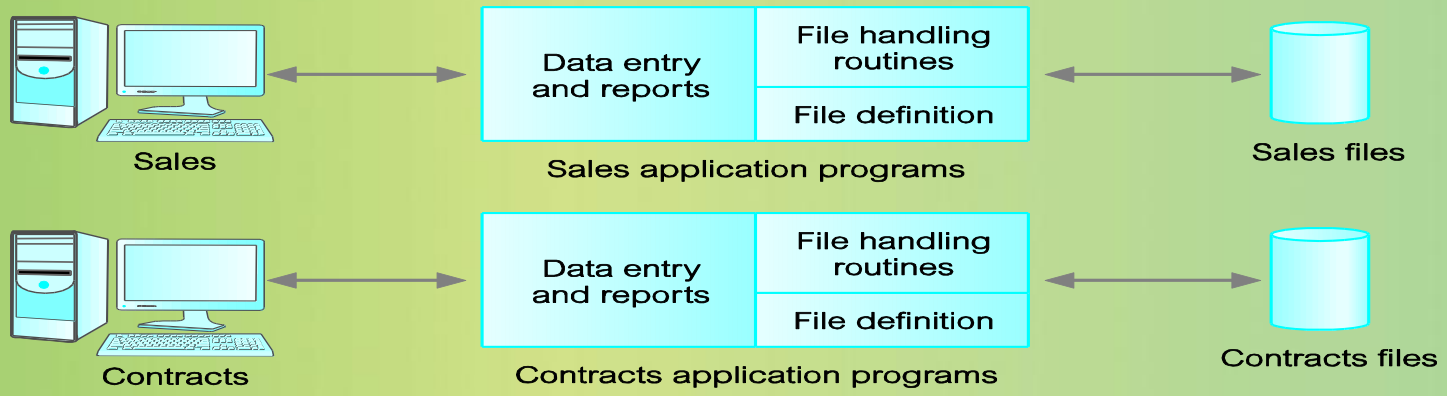
Examples of Database Applications

- **Purchases from the supermarket**
- **Purchases using your credit card**
- **Booking a holiday at the travel agents**
- **Using the local library**
- **Taking out insurance**
- **Renting a video**
- **Using the Internet**
- **Studying at university**

File-Based Systems

- **Collection of application programs that perform services for the end users (e.g. reports).**
- **Each program defines and manages its own data.**

File-Based Processing



Sales Files

PropertyForRent (propertyNo, street, city, postcode, type, rooms, rent, ownerNo)
PrivateOwner (ownerNo, fName, lName, address, telNo)
Client (clientNo, fName, lName, address, telNo, prefType, maxRent)

Contracts Files

Lease (leaseNo, propertyNo, clientNo, rent, paymentMethod, deposit, paid, rentStart, rentFinish, duration)
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Limitations of File-Based Approach

- **Separation and isolation of data**
  - **Each program maintains its own set of data.**
  - **Users of one program may be unaware of potentially useful data held by other programs.**
- **Duplication of data**
  - **Same data is held by different programs.**
  - **Wasted space and potentially different values and/or different formats for the same item.**

Limitations of File-Based Approach

- **Data dependence**
  - **File structure is defined in the program code.**
- **Incompatible file formats**
  - **Programs are written in different languages, and so cannot easily access each other's files.**
- **Fixed Queries/Proliferation of application programs**
  - **Programs are written to satisfy particular functions.**
  - **Any new requirement needs a new program.**

Database Approach

- **Arose because:**
  - **Definition of data was embedded in application programs, rather than being stored separately and independently.**
  - **No control over access and manipulation of data beyond that imposed by application programs.**
- **Result:**
  - **the database and Database Management System (DBMS).**

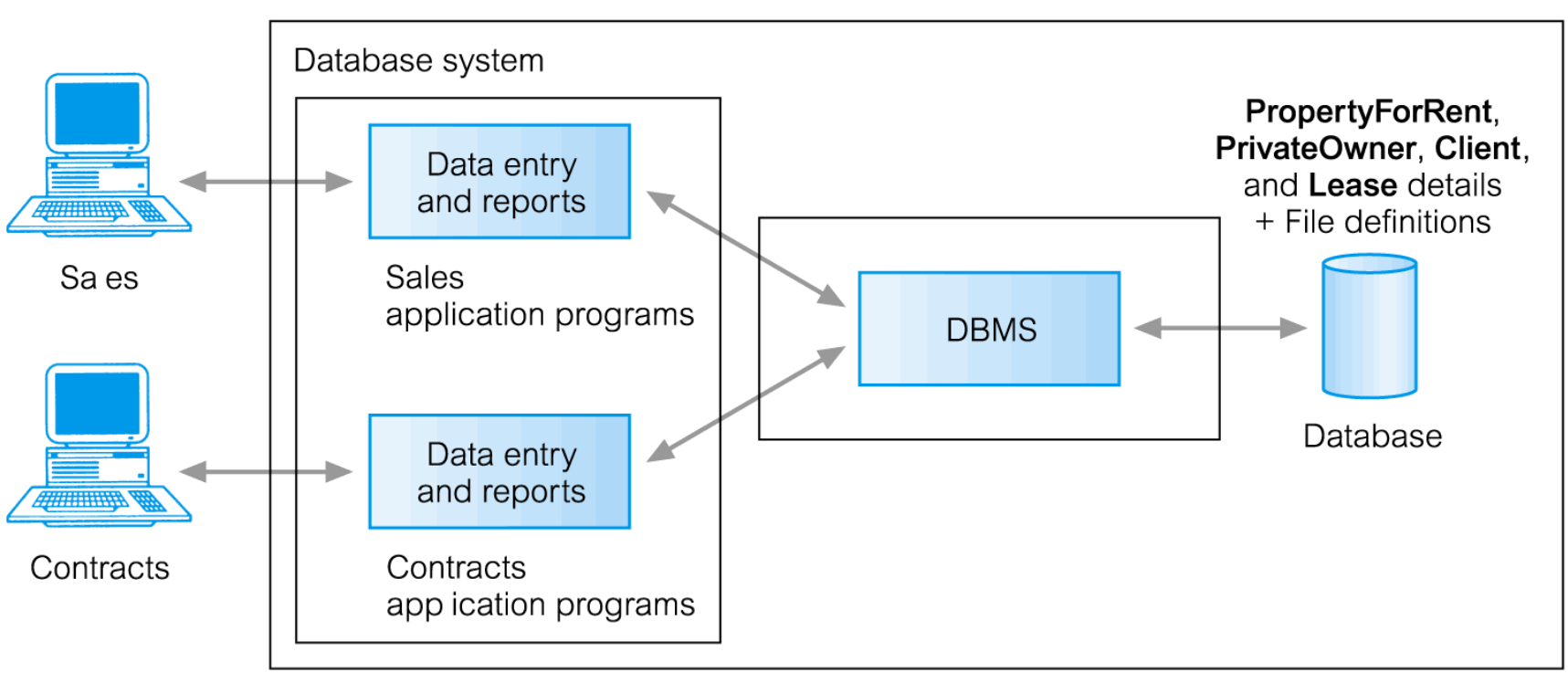
Database

- **Shared collection of logically related data (and a description of this data), designed to meet the information needs of an organization.**
- **System catalog (metadata) provides description of data to enable program–data independence.**
- **Logically related data comprises entities, attributes, and relationships of an organization's information.**

Database Management System (DBMS)

- **A software system that enables users to define, create, maintain, and control access to the database.**
- **(Database) application program: a computer program that interacts with database by issuing an appropriate request (SQL statement) to the DBMS.**

Database Management System (DBMS)



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Database Approach

- **Data definition language (DDL).**
  - **Permits specification of data types, structures and any data constraints.**
  - **All specifications are stored in the database.**
- **Data manipulation language (DML).**
  - **General enquiry facility (query language) of the data.**

Database Approach

- **Controlled access to database may include:**
  - **a security system**
  - **an integrity system**
  - **a concurrency control system**
  - **a recovery control system**
  - **a user-accessible catalog.**

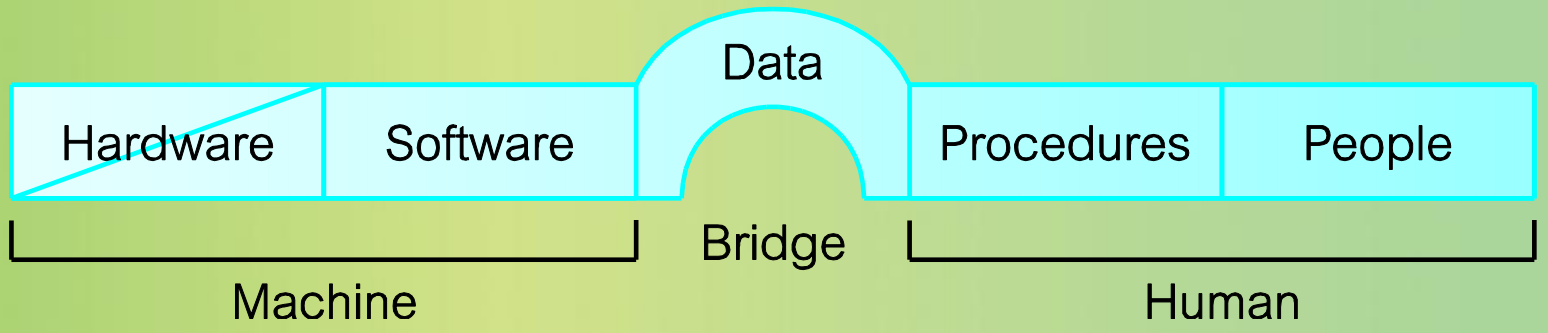
Views

- **Allows each user to have his or her own view of the database.**
- **A view is essentially some subset of the database.**

Views - Benefits

- **Reduce complexity**
- **Provide a level of security**
- **Provide a mechanism to customize the appearance of the database**
- **Present a consistent, unchanging picture of the structure of the database, even if the underlying database is changed**

Components of DBMS Environment



Components of DBMS Environment

- **Hardware**
  - **Can range from a PC to a network of computers.**
- **Software**
  - **DBMS, operating system, network software (if necessary) and also the application programs.**
- **Data**
  - **Used by the organization and a description of this data called the schema.**

Components of DBMS Environment

- **Procedures**
  - **Instructions and rules that should be applied to the design and use of the database and DBMS.**
- **People**

Roles in the Database Environment

- **Data Administrator (DA)**
- **Database Administrator (DBA)**
- **Database Designers (Logical and Physical)**
- **Application Programmers**
- **End Users (naive and sophisticated)**

History of Database Systems

- **First-generation**
  - **Hierarchical and Network**
- **Second generation**
  - **Relational**
- **Third generation**
  - **Object-Relational**
  - **Object-Oriented**

Advantages of DBMSs

- **Control of data redundancy**
- **Data consistency**
- **More information from the same amount of data**
- **Sharing of data**
- **Improved data integrity**
- **Improved security**
- **Enforcement of standards**
- **Economy of scale**

Advantages of DBMSs

- **Balance conflicting requirements**
- **Improved data accessibility and responsiveness**
- **Increased productivity**
- **Improved maintenance through data independence**
- **Increased concurrency**
- **Improved backup and recovery services**

Disadvantages of DBMSs

- **Complexity**
- **Size**
- **Cost of DBMS**
- **Additional hardware costs**
- **Cost of conversion**
- **Performance**
- **Higher impact of a failure**