Introduction to Databases

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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).**
- **Major components of the DBMS environment.**
- **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
- Using the Internet
- Studying at university

File-Based Systems

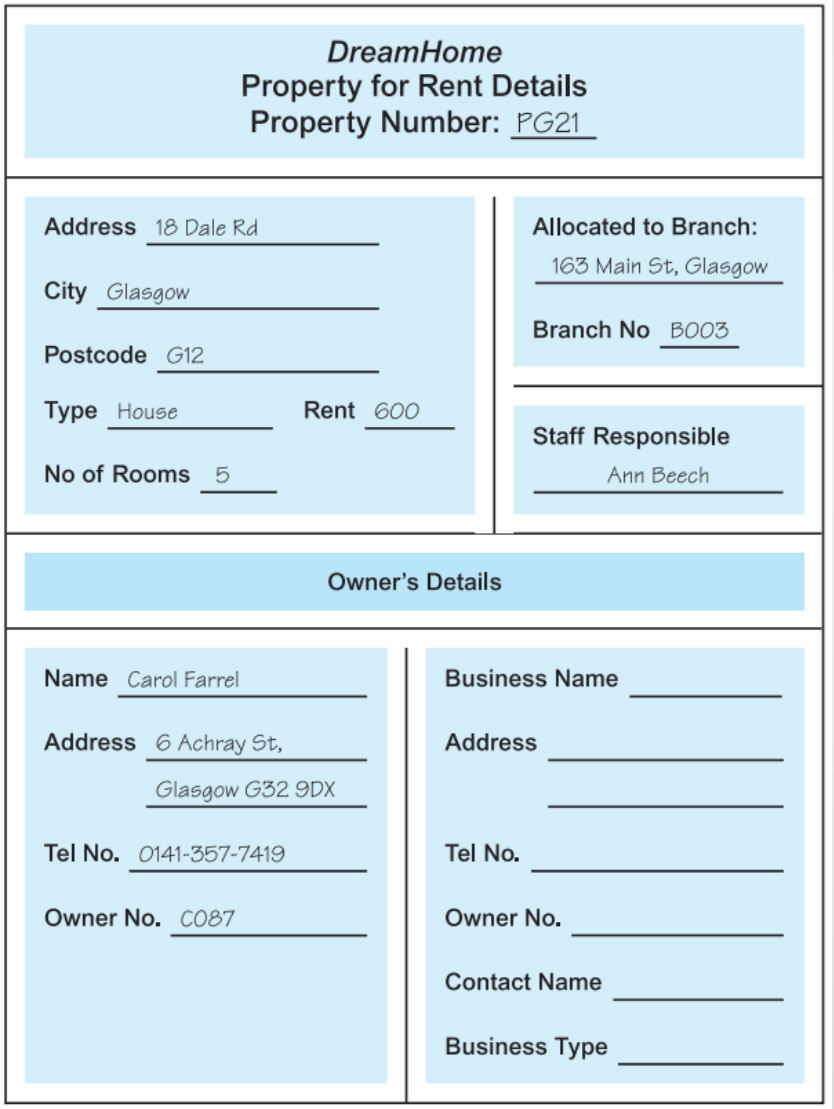
- **Why studying file-based system?**
  - Understanding the problems inherent in file-based systems may prevent us from repeating these problems in database systems.
  - If you need to convert a file-based system to a database system, understanding how the file system works will be extremely useful.

- **File-based system:**
  - A collection of application programs that perform services for the end users (e.g. production of reports).
  - Each program defines and manages its own data.

- File-based system were an early attempt to computerize the manual filing system.
  - Physical files saving information
  - E.g., Bank statement

File-Based Systems

- **Case Study:**
  - The Sales Department is responsible for the selling and renting of properties.
    - A client who wishes to offer his or her property as a rental approaches the Sales Department, fill out "Property for Rent" form.



DreamHome
Property for Rent Details
Property Number: PG21

Address 18 Dale Rd
City Glasgow
Postcode G12
Type House Rent 600
No of Rooms 5

Allocated to Branch:
163 Main St, Glasgow
Branch No B003

Staff Responsible
Ann Beech

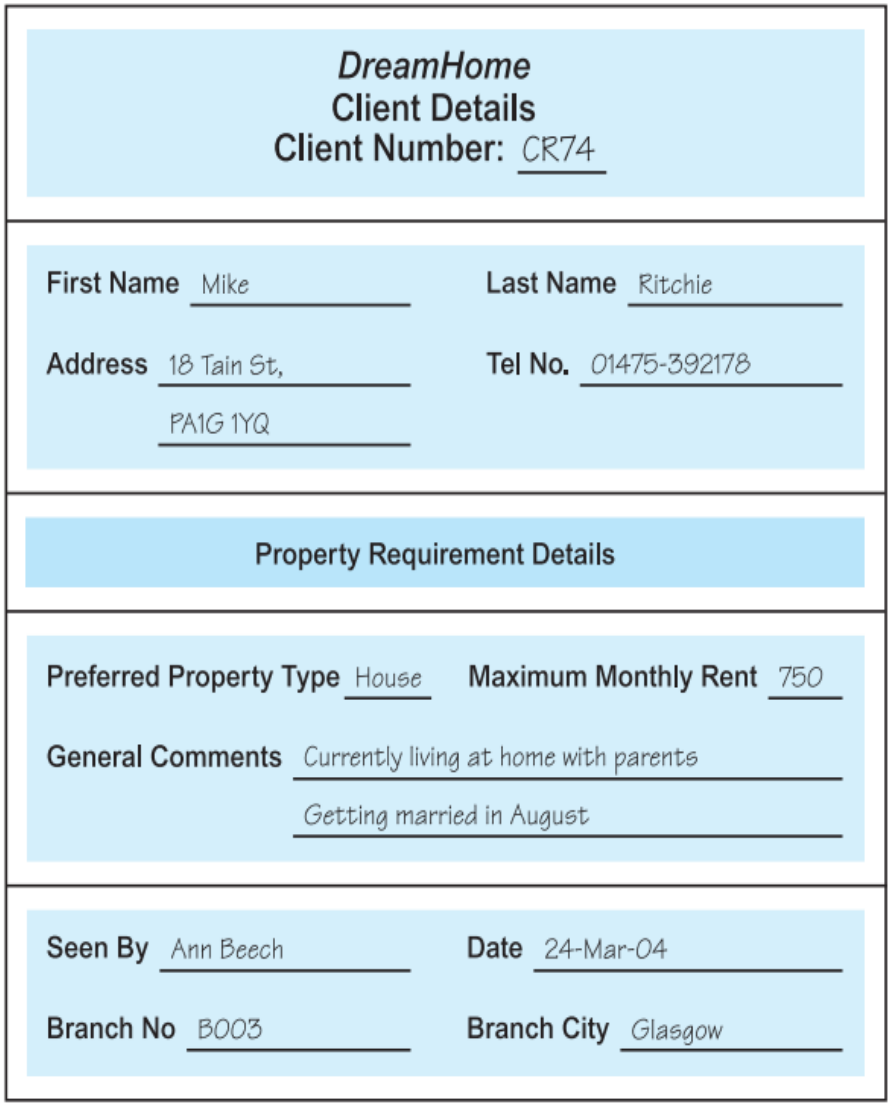
Owner's Details

Name Carol Farrel
Address 6 Achray St,
Glasgow G32 9DX
Tel No. 0141-357-7419
Owner No. C087

Business Name
Address
Tel No.
Owner No.
Contact Name
Business Type

File-Based Systems

- **Case Study:**
  - The Sales Department is responsible for the selling and renting of properties.
    - The Sales Department handles inquiries from clients, and inquiry form is filled out.



DreamHome
Client Details
Client Number: CR74

First Name Mike
Last Name Ritchie
Address 18 Tain St, PA1G 1YQ
Tel No. 01475-392178

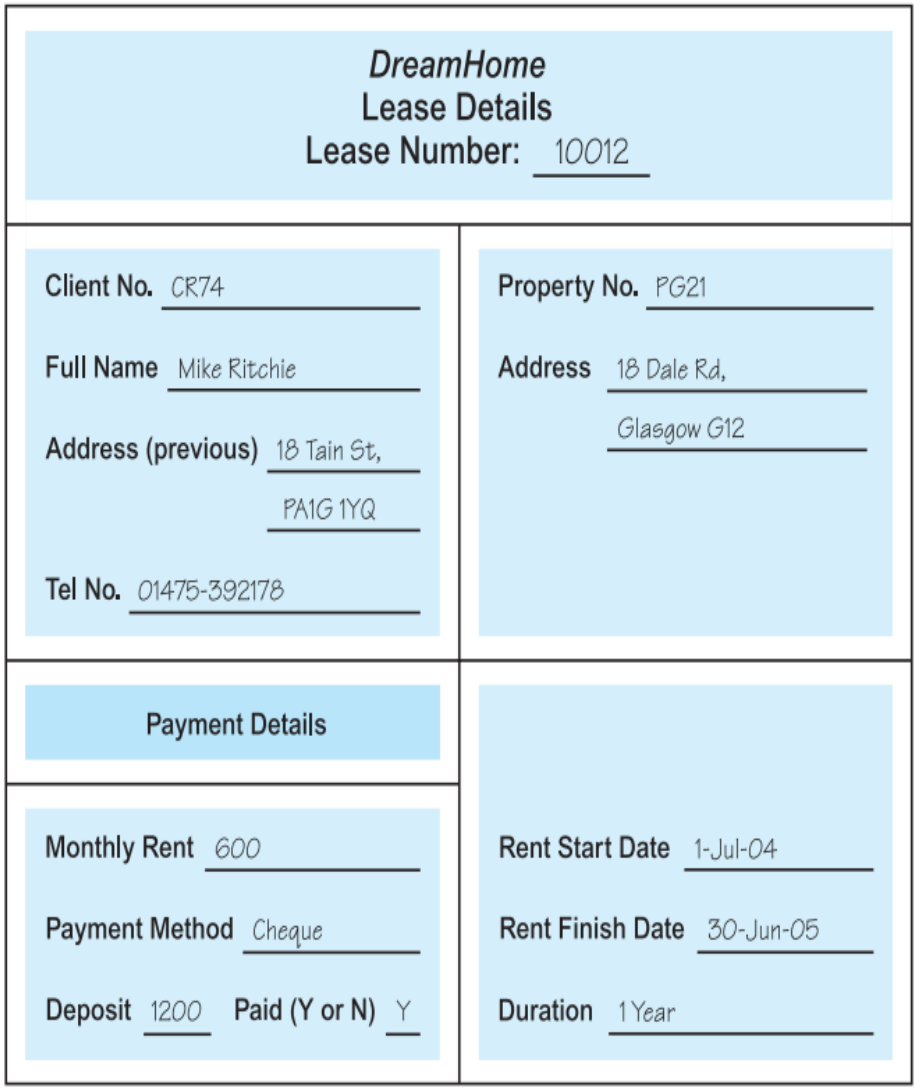
Property Requirement Details

Preferred Property Type House
Maximum Monthly Rent 750
General Comments Currently living at home with parents Getting married in August

Seen By Ann Beech
Date 24-Mar-04
Branch No B003
Branch City Glasgow

File-Based Systems

- **Case Study:**
  - The Contracts Department is responsible for handling the lease agreements associated with properties for rent.
    - Whenever a client agrees to rent a property, a form with the client and property details is filled.



DreamHome
Lease Details
Lease Number: 10012

Client No. CR74
Full Name Mike Ritchie
Address (previous) 18 Tain St, PA1G 1YQ
Tel No. 01475-392178

Property No. PG21
Address 18 Dale Rd, Glasgow G12

Payment Details

Monthly Rent 600
Payment Method Cheque
Deposit 1200 Paid (Y or N) Y

Rent Start Date 1-Jul-04
Rent Finish Date 30-Jun-05
Duration 1 Year

File-Based Systems

Sales Department

DreamHome
Client Details
Client Number: CR74

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Property Requirement Details

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Contracts Department

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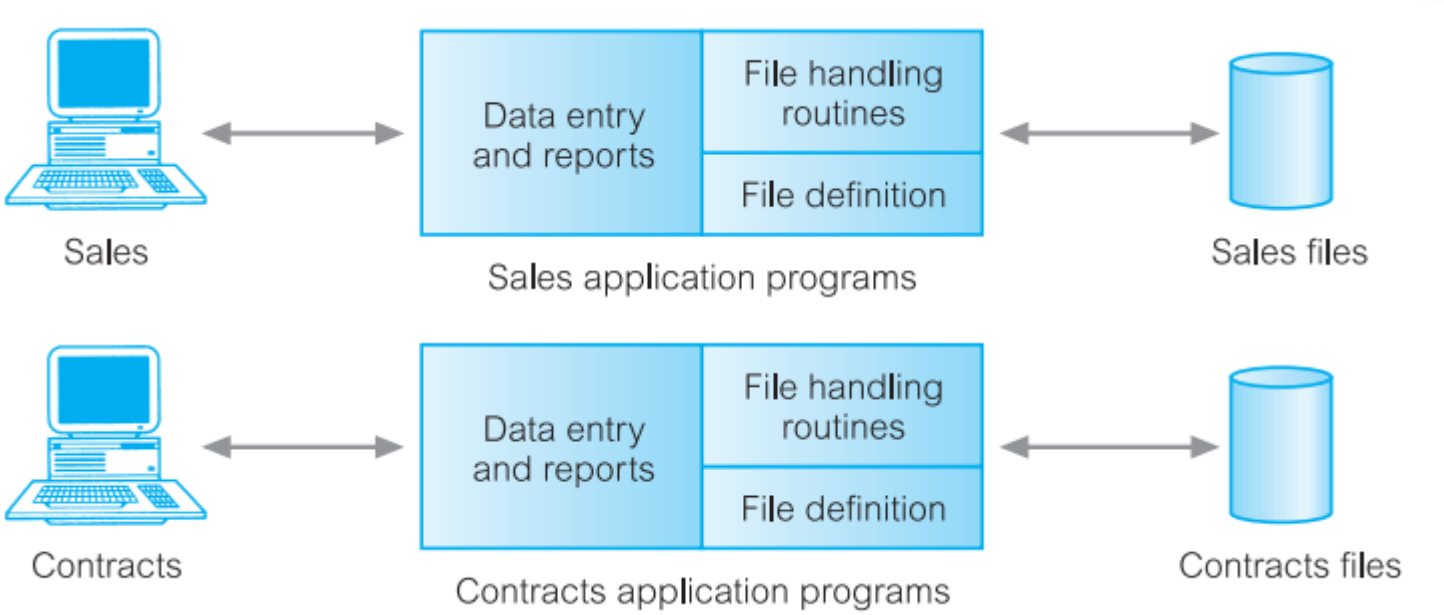
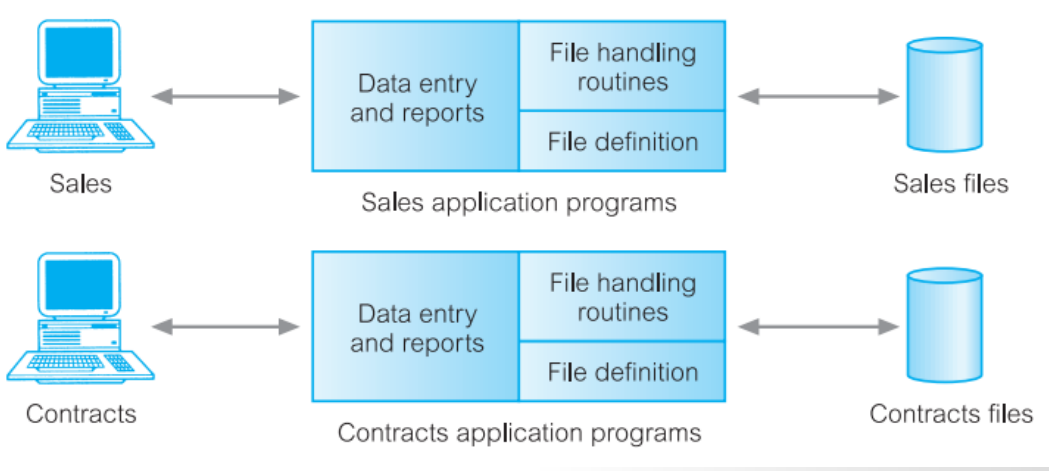
File-Based Systems

File-based processing in Sales and Contracts Departments



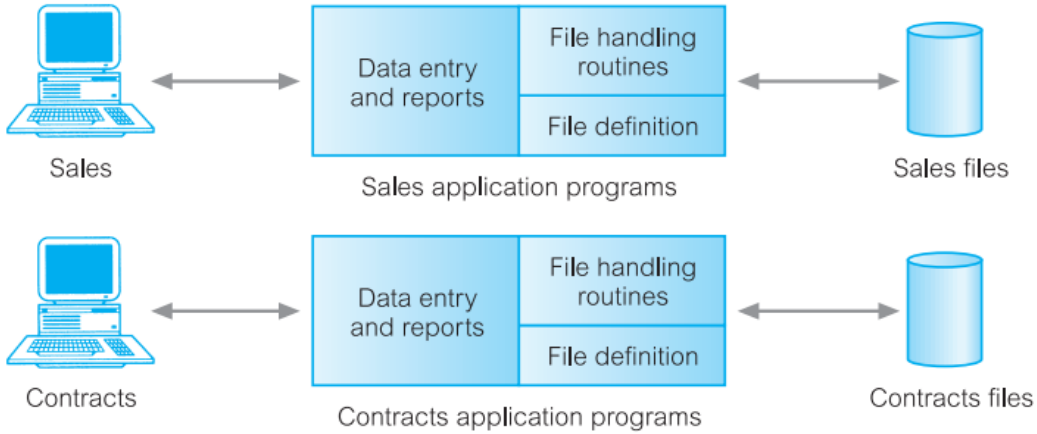
Limitations of File-Based Approach

- **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.
  - **Data integrity problem**.



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

- **Limitations of the file-based approach can be attributed to two factors:**
  - 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:**
  - **Database** and **Database Management System (DBMS)**.

Database

- **Database:**
  - A **shared collection** of **logically related data** and **a description of this data**, designed to meet the information needs of an organization.
  - The database is a single, possibly large repository of data that can be used simultaneously by many users.

- **System catalog:**
  - System catalog (metadata) provides **description of data** to enable program–data independence.

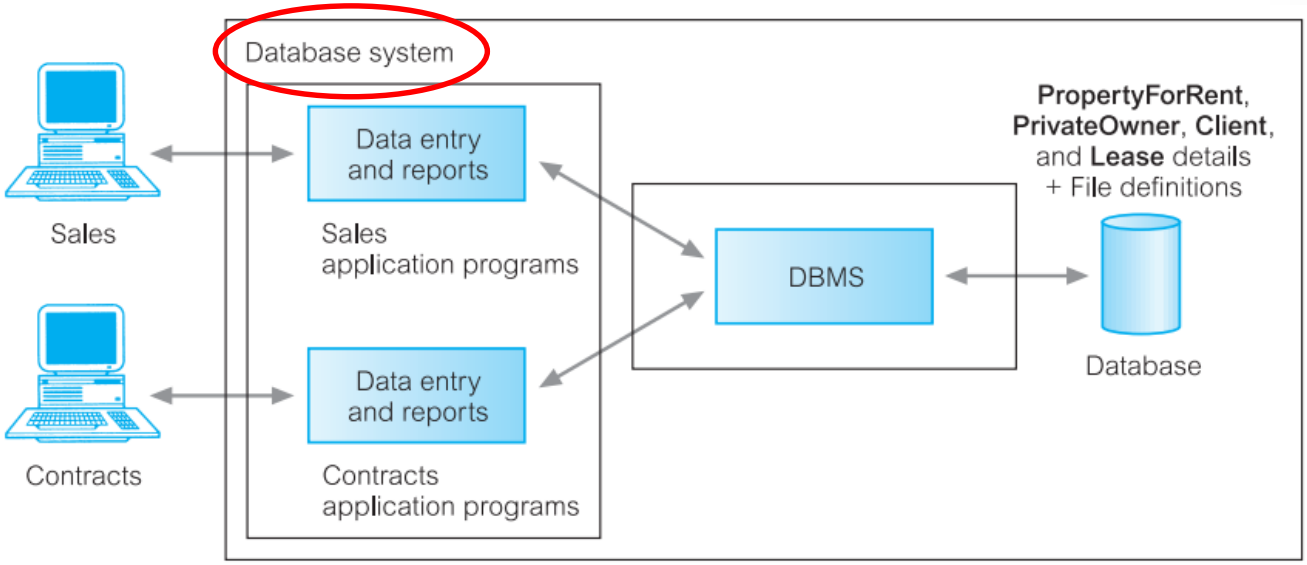
- Logically related data comprises entities, attributes, and relationships of an organization's information.
  - Entity: a distinct object in the organization that is to be represented in the database
  - Attribute: a property that describes some aspect of the object
  - Relationship: an association between entities

Database Management System (DBMS)

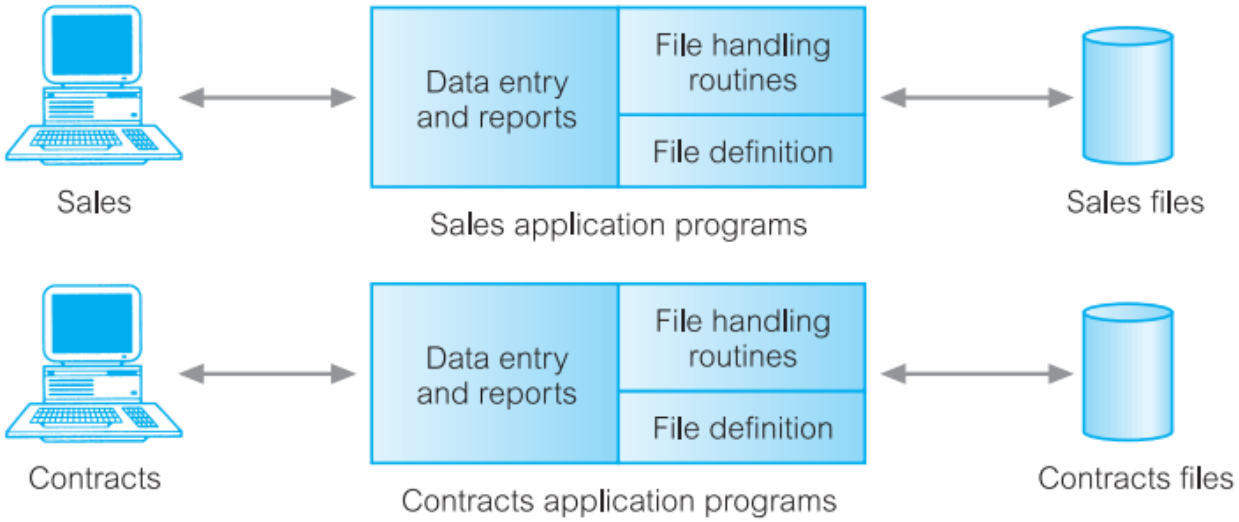
- **DBMS**:
  - A **software system** that enables users to define, create, maintain, and control access to the **database**.
  - A DBMS is the software that interacts with the user's **application programs** and the **database**.

- **Database application program:**
  - A computer program that interacts with database by issuing an appropriate request (SQL statement) to the DBMS.

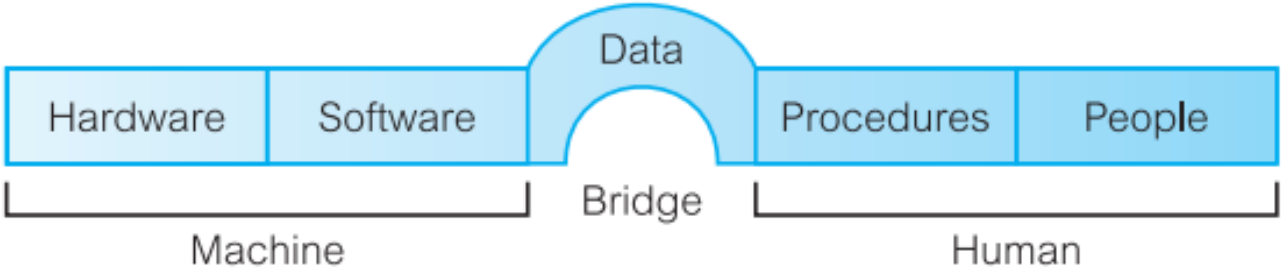
Database Management System (DBMS)



File-based System



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.
- **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)**
  - DA is responsible for the management of the data resource, including database planning, development and maintenance of standards, policies and procedures, and conceptual/logical database design.
- **Database Administrator (DBA)**
  - DBA is responsible for the physical realization of the database, including physical database design and implementation, ….
- **Database Designers**
  - Designers are concerned with identifying the data, the relationship between the data, and the constraints on the data that is to be stored in the database.
- **Application Programmers**
  - Once the database has been implemented, the application programs that provide the required functionality for the end-user must be implemented.
- **End Users**

Advantages of DBMSs

- Control of data redundancy
- Data consistency
- Sharing of data
- Improved data integrity
- Improved security
- Increased concurrency
- Improved backup and recovery services
- And more…

Disadvantages of DBMSs

- Complexity
- Size
- Cost of DBMS
- Additional hardware costs
- And some…