Introduction to Databases

Objectives

BE ABLE TO IDENTIFY:

- Some common uses of databases

- Characteristics of file-based systems

- Problems of file-based systems

- the meaning of the term database

- the major components of a DBMS

- the advantages and disadvantages of a DBMS
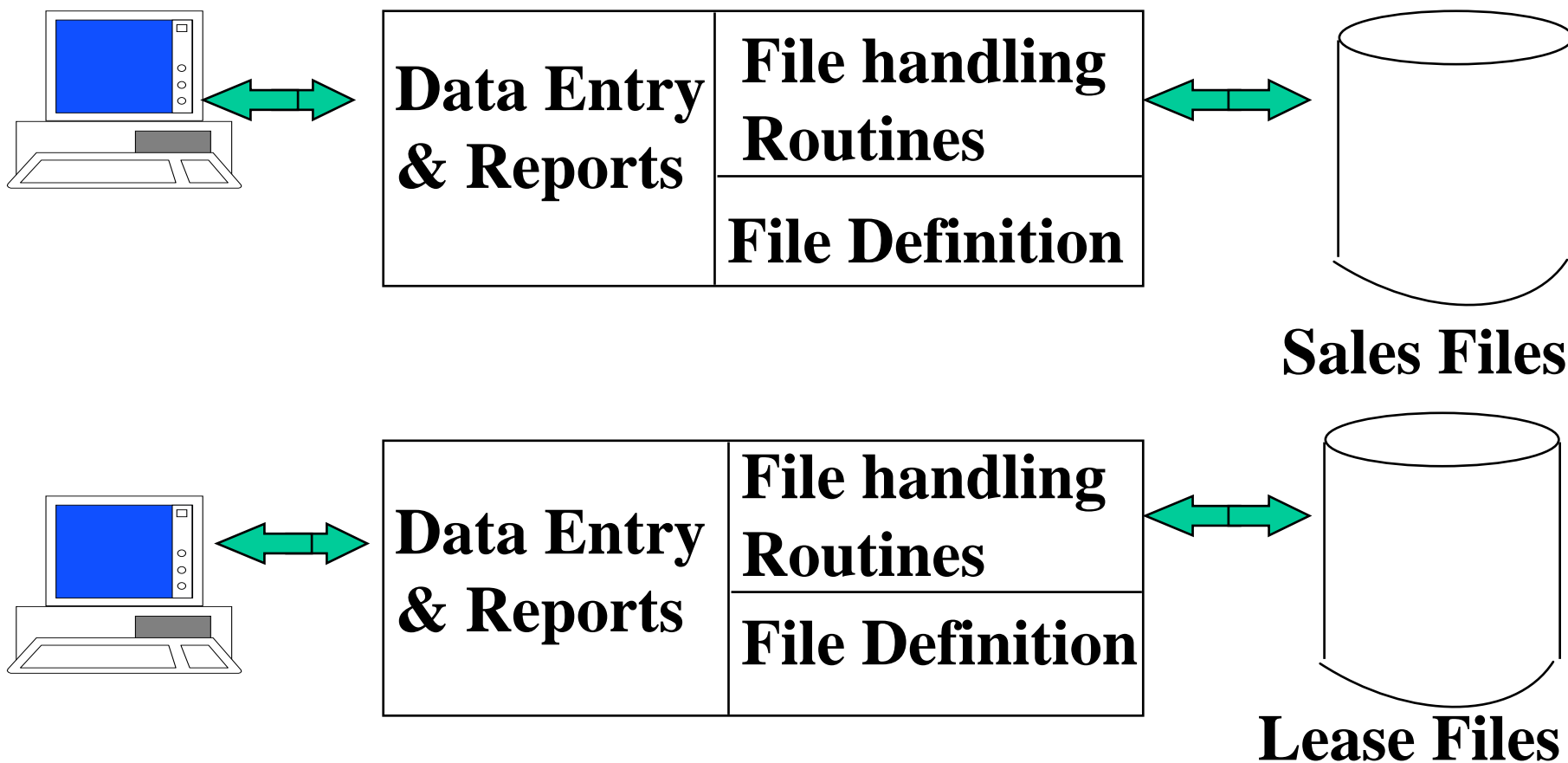
Common Uses of Databases

- Try to think why each of these need to use a database:
  - Supermarkets
  - Insurance
  - Credit Cards/Banking
  - Libraries
  - Travel Agents
  - Universities
  - Engineering

File Based Systems

DEFINITION

- A collection of application programs that perform services to end users.

- Each program defines and manages its own data.

File Based Processing

Data Entry & Reports	File handling Routines
	File Definition

Sales Files

Data Entry & Reports	File handling Routines
	File Definition

Lease Files

Limitations of File Based Systems

- Separation & Isolation of Data

- Data Dependence

- Duplication of Data

- Incompatible file formats

- How do we resolve these problems?

The Database Approach

DEFINITION

- A shared collection of logically related data designed to meet the information requirements of an organisation

Database Processing

Sales

Leases

Data Entry & reports

Application Programs

Data Entry & reports

App. Programs
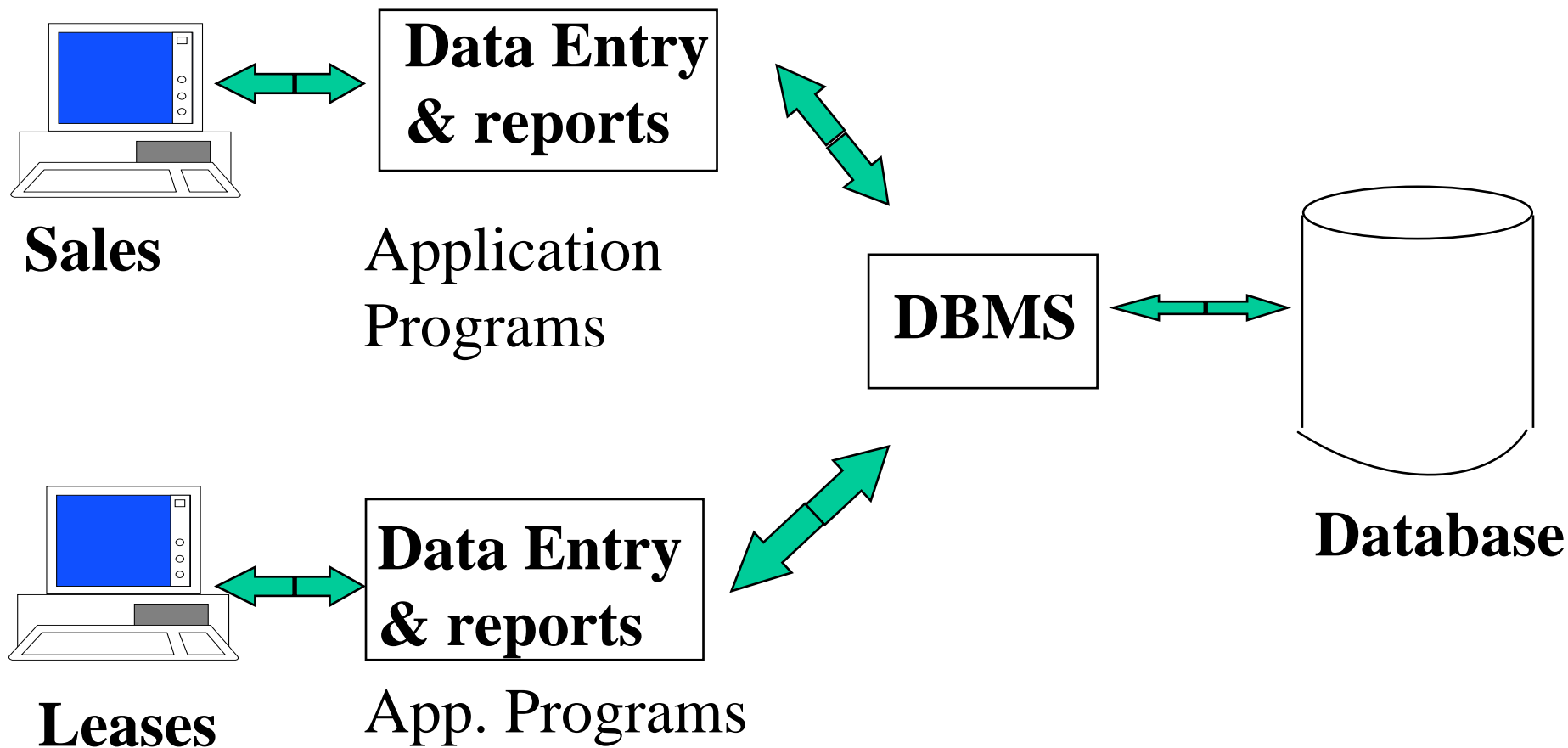
DBMS

Database

Database Management System (DBMS)

DEFINITION

- A software system that enables users to define, create and maintain the database and which provides controlled access to the database

Facilities of a DBMS

- Allows users to define the database (DDL)

- Allows users to insert, update, delete & retrieve data (DML)

- Provides controlled access
  - a security system
  - an integrity system
  - a concurrency control system
  - a recovery system
  - a user accessible catalogue

Components of a DBMS

- Hardware
- Software
- Data
- Procedures
- People

Advantages

- Minimal data redundancy
- Consistency of data
- Integration of data
- Improved integrity
- Consistent security
- Standards
- Increased productivity

Disadvantages

- Complexity
- Additional Hardware Costs
- Size
- Performance
- Experts -Specialised Personnel
- Potential organisational Conflict
- Higher impact of failure

Types of DBMS
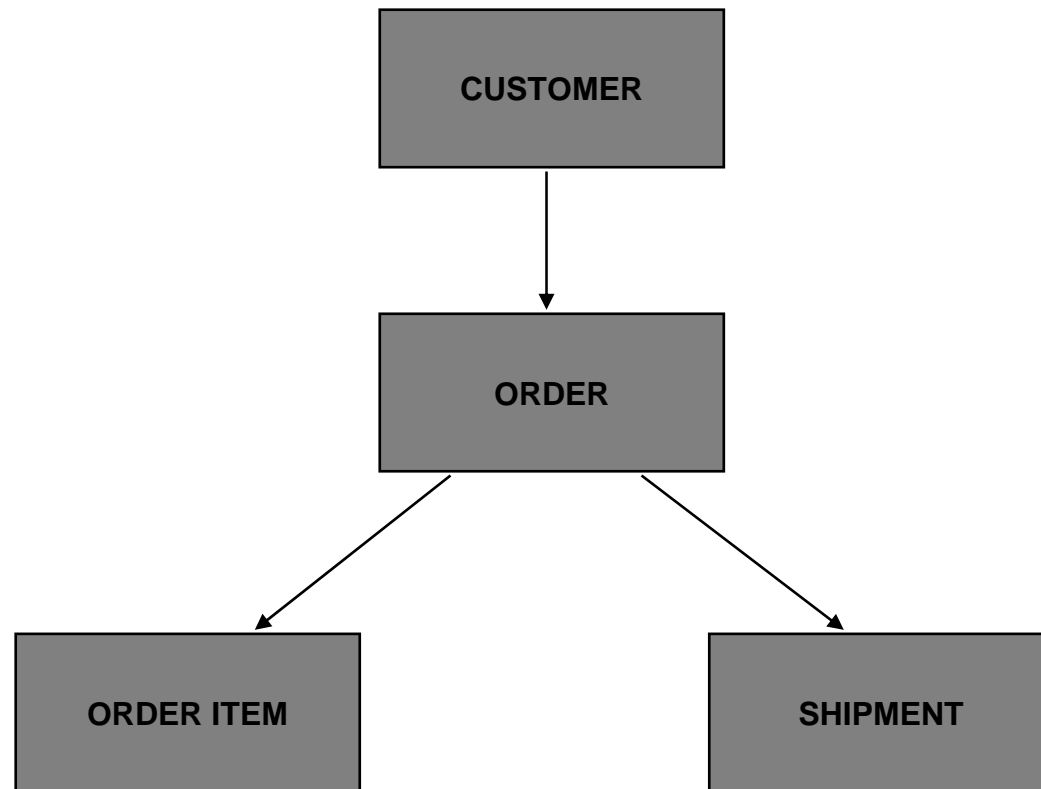
Early Types of DBMS

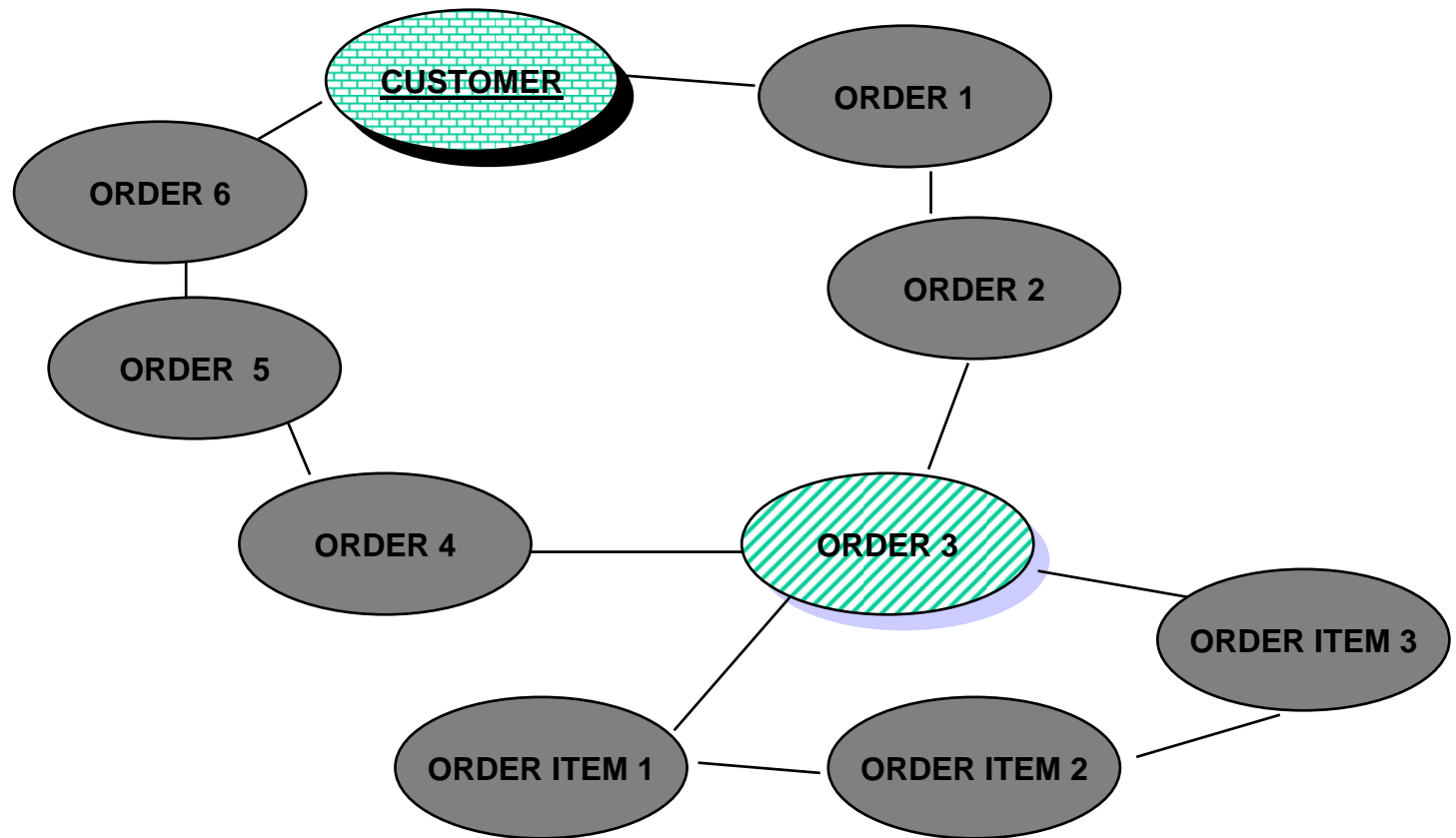- Hierarchical
- Network

Current Generation

- Relational

Advanced Systems

- Object Based

Hierarchical Model - An Example

```
        ┌──────────────┐
        │   CUSTOMER   │
        └──────┬───────┘
               │
               ▼
        ┌──────────────┐
        │    ORDER     │
        └──┬────────┬──┘
          ╱          ╲
         ▼            ▼
┌──────────────┐  ┌──────────────┐
│  ORDER ITEM  │  │   SHIPMENT   │
└──────────────┘  └──────────────┘
```

Network Model - Example

Relational Database

- Relational database system devised by Codd in 1970

- An attempt to devise a standard model with a sound mathematical basis

  – why does this differ to the previous systems?

- Most successful database model

- Most use the query language SQL

- Examples include:

  – Oracle, Microsoft Access, SQL Server, MySQL

Relational Database - Example

- **BRANCH** relation

branchNo	street	city	postcode
B005	22 Deer Rd	London	SW1 4EH
B007	16 Argyll St	Aberdeen	AB2 3SU
B003	163 Main St	Glasgow	G11 9QX

- **STAFF** relation

StaffNo	Name	Position	Salary	branchNo
SL21	John White	Manager	30000	B005
SG37	Ann Beech	Assistant	12000	B003
SG14	David Ford	Supervisor	18000	B003

SQL

What is it?

Structured **Q**uery **L**anguage

- Used in ORACLE and other DB systems

- Non-procedural - i.e. Specify what you want not how to get it

- SQL - (also pronounced SEQUEL)

    directly related to the development of the RELATIONAL MODEL by E.F.Codd.

Example SQL Queries

- select branchNo, city

  from branch;

- select *

  from branch

  where branchNo = 'B003';

- select b.branchNo, name

  from branch b, staff s

  where b.branchNo = s.branchNo;

Object Databases

- Current generation systems have a need to handle complex data for complex applications such as
    - computer aided design
    - computer aided software engineering
    - geographic information systems
    - interactive web sites

- Relational systems are inadequate for these systems
    - Why do you think this is?

Object Database Types

- ## Object-oriented
  - extend a programming language such as Java with persistency and a query language

- ## Object-relational
  - extend a current RDBMS (e.g. Oracle) with object-oriented extensions

- ## We will revisit Object databases in a later lecture