Concepts of Databases

BootCamp for Database Technologies

Lecturer: Dr. Muhammad Iqbal

CCT College Dublin

Email: miqbal@cct.ie

Databases

- **A database is a coordinated or organized group of data.**

- **Data is known as facts that can be recorded and have an implicit meaning.**

- The purpose of a database is to keep track of things.

- Database is a structure containing categories of information and relationships between these categories

- **Categories:** sales reps, customers, orders, and parts

- Relationships between categories: sales rep-to-customer and customer-to-orders

- We may say that it is a repository for a collection of computerized data files.

Purchases from the supermarket
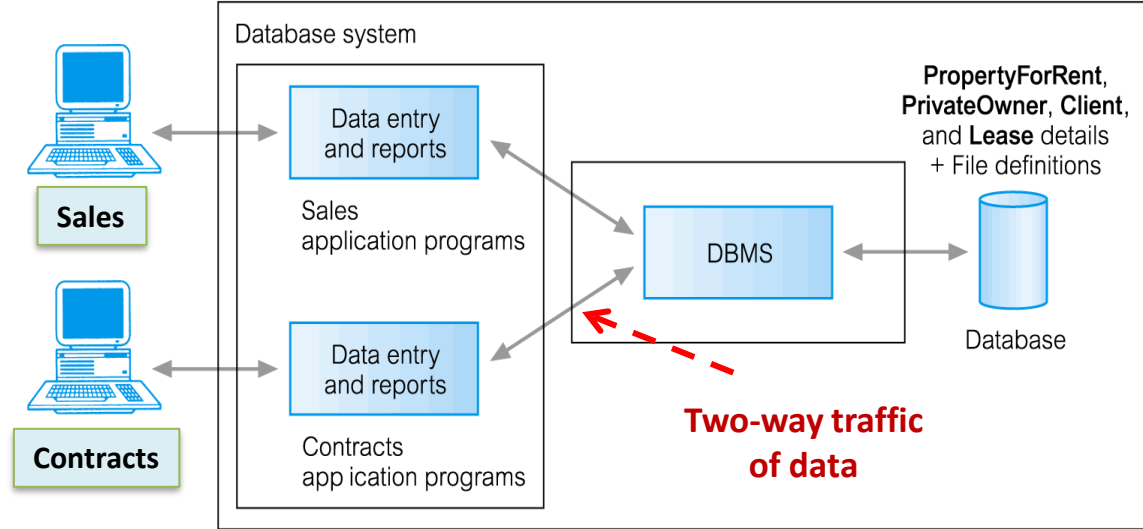
Purchases using your credit/ debit card

Booking a holiday at the travel agents or online
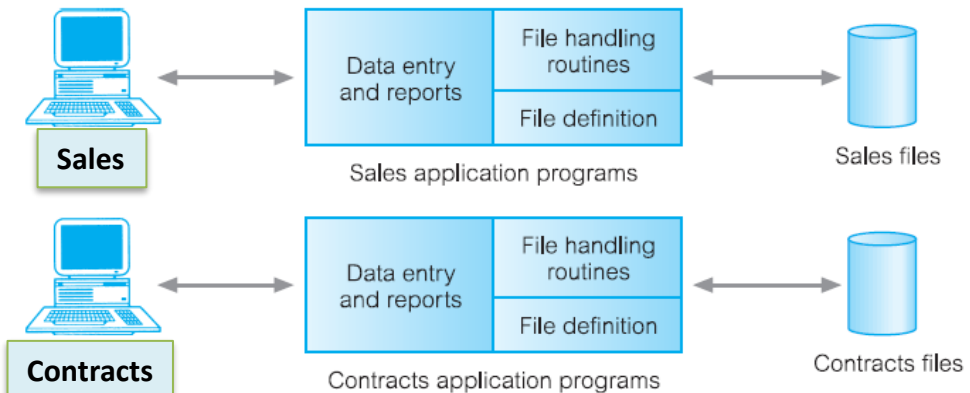
Using the local library

Database Management System (DBMS)

Database system

Sales application programs — Data entry and reports

Contracts application programs — Data entry and reports

DBMS

Database

PropertyForRent, **PrivateOwner**, **Client**, and **Lease** details + File definitions

Two-way traffic of data

Data independence allows changes to be made to the **physical data** without affecting the **logical level** and also allows some changes to be made at the logical level without affecting the **views** of the users.

PropertyForRent (propertyNo, street, city, postcode, type, rooms, rent, ownerNo)
PrivateOwner (ownerNo, fName, lName, address, telNo)
Client (clientNo, fName, lName, address, telNo, prefType, maxRent)
Lease (leaseNo, propertyNo, clientNo, paymentMethod, deposit, paid, rentStart, rentFinish)

File Based System (FBS)

Sales application programs — Data entry and reports / File handling routines / File definition — Sales files

Contracts application programs — Data entry and reports / File handling routines / File definition — Contracts files

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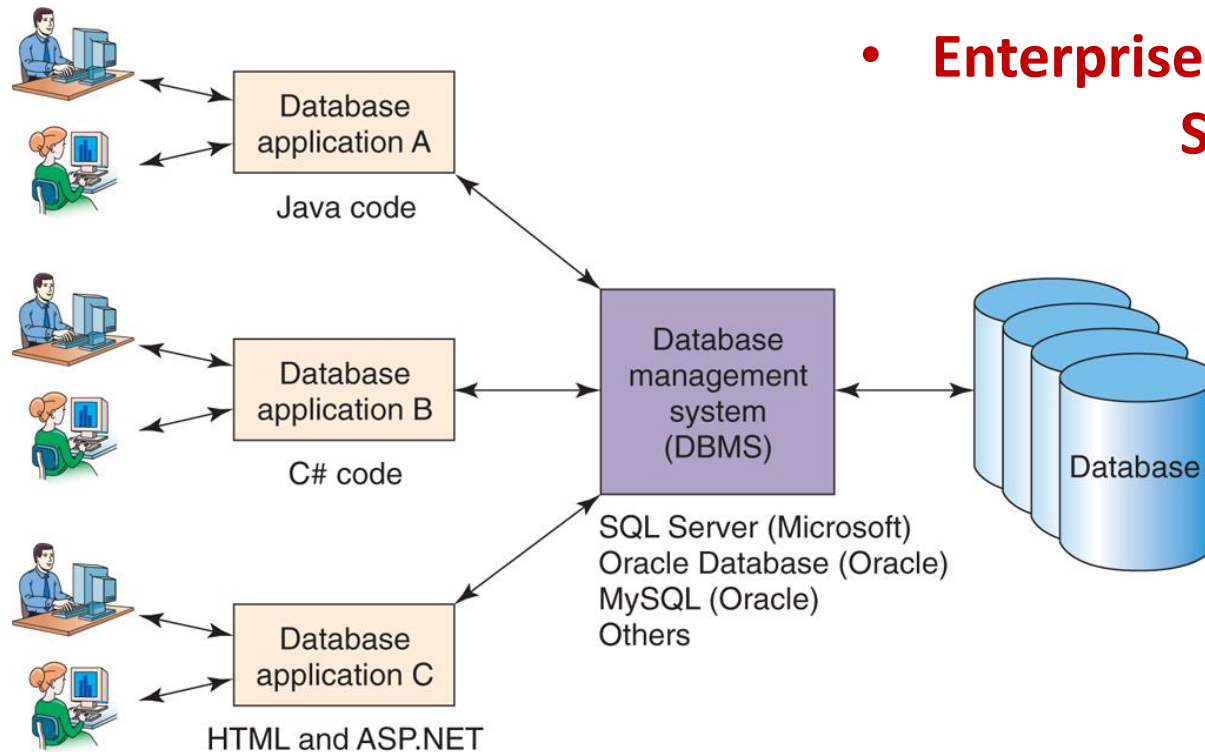 **Client** (clientNo, fName, lName, address, telNo, prefType, maxRent)

Contracts Files
  Lease (leaseNo, propertyNo, clientNo, rent, paymentMethod, deposit, paid, rentStart, rentFinish, duration)
  PropertyForRent (propertyNo, street, city, postcode, rent)
  Client (clientNo, fName, lName, address, telNo)

Organizational Database Systems

- **Enterprise-Class Database System**

- **With a DBMS, the users can to be shielded from database modifications at the logical level. This is known as 'Logical data independence'.**

- **'Physical data independence' is the shielding of users and applications from changes in the physical storage of the database.**
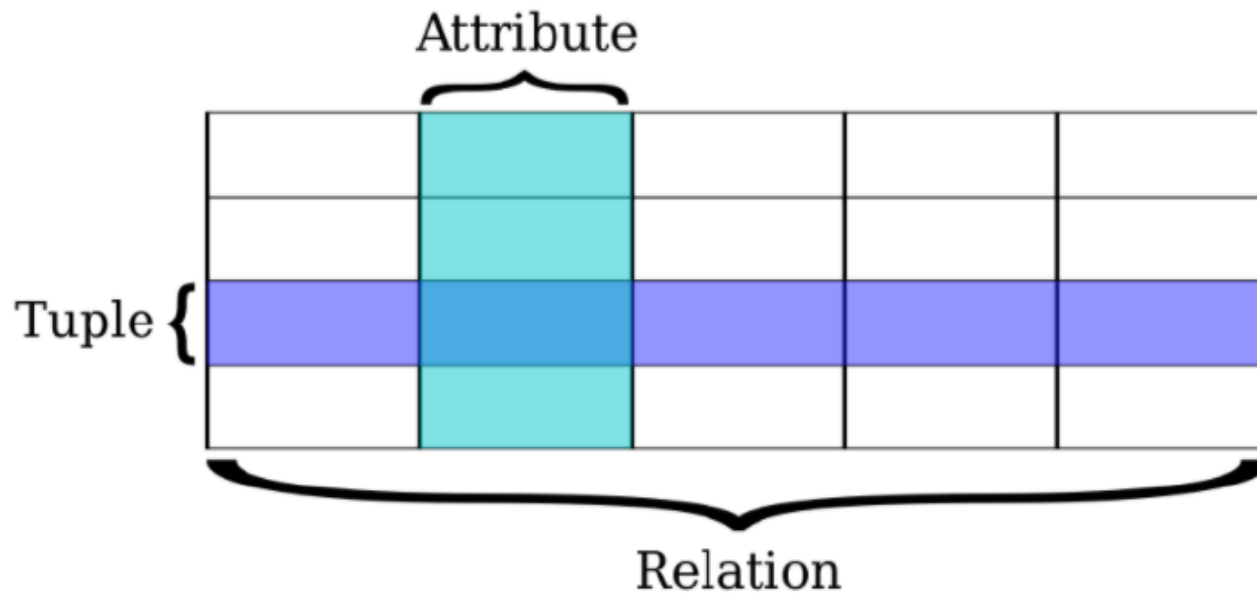
Database Relations

- **Relational Database Schema**

  - **Set of relation schemas, each with a distinct name.**

  - **If R_1, R_2, . . . , R_n are a set of relation schemas, then we can write the relational database schema, or simply relational schema, R, as**

$$R = \{R_1, R_2, . . . , R_n \}$$
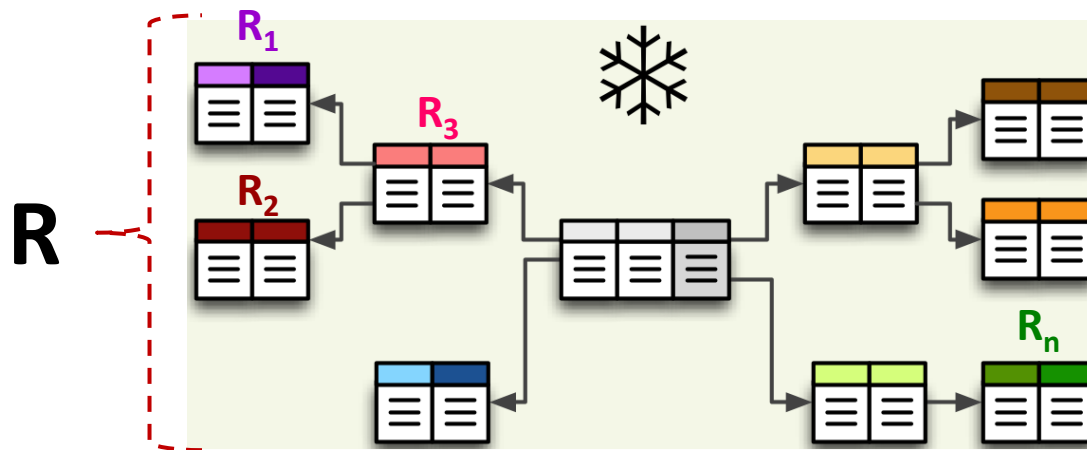
Relation in RDBMS

SQL Term	Relational DB Term	Description
Row	Tuple / Record	A data set representing a single item
Column	Attribute / Field	A labeled element of a tuple, e.g. "Address" or "Date of birth"
Table	Relation / Base relvar	A set of tuples sharing the same attributes; a set of columns and rows

Terminology of Relation/ Table

- Relation → Table
- Tuple → Row or record
- Attribute → Column or field
- Cardinality → Number of rows
- Degree → Number of columns
- Primary key → Unique identifier
- Domain → Pool of legal values
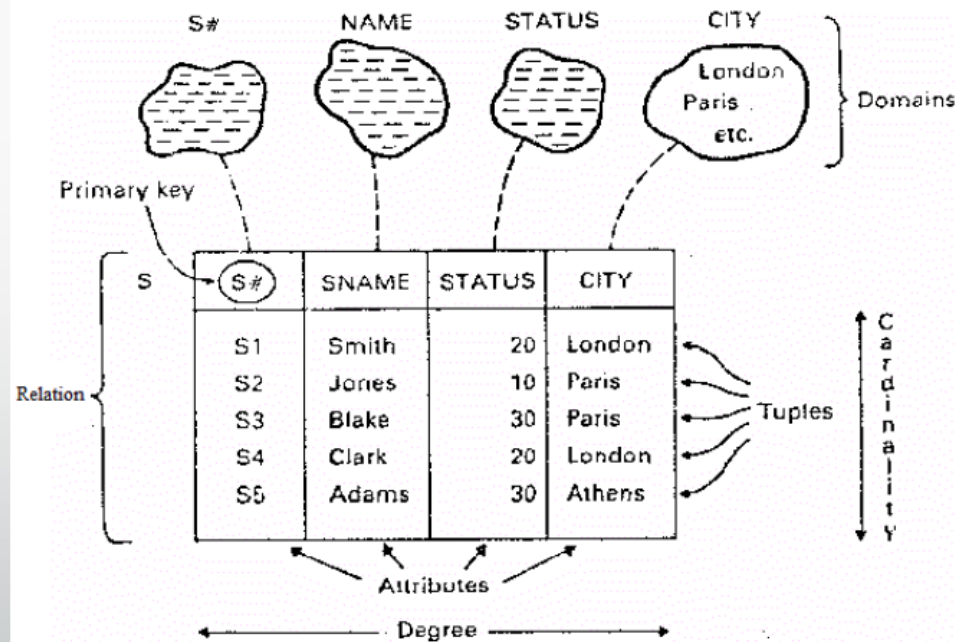
Key Fields
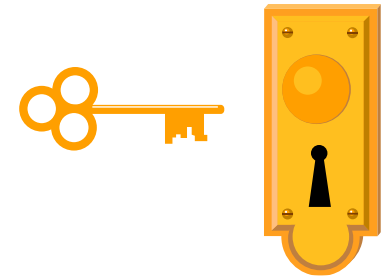
- Keys are special fields that serve two main purposes:

  - *Primary keys* are <u>unique</u> identifiers of the relation. Examples include employee numbers, social security numbers, etc. *This guarantees that all rows are unique.*

  - *Foreign keys* are identifiers that enable a <u>dependent</u> relation (on the many side of a relationship) to refer to its <u>parent</u> relation (on the one side of the relationship).

- Keys can be *simple* (a single field) or *composite* (more than one field).

- Keys usually are used as indexes to speed up the response to user queries.

Key Fields Examples

CUSTOMER

CustomerID	CustomerName	CustomerAddress	CustomerCity*	CustomerState*	CustomerPostalCode

Primary Key

ORDER

OrderID	OrderDate	CustomerID

Foreign Key
(implements 1:N relationship between customer and order)

ORDER LINE

OrderID	ProductID	OrderedQuantity

Combined, these are a *composite primary key* (uniquely identifies the order line)…individually they are *foreign keys* (implement M:N relationship between order and product)

PRODUCT

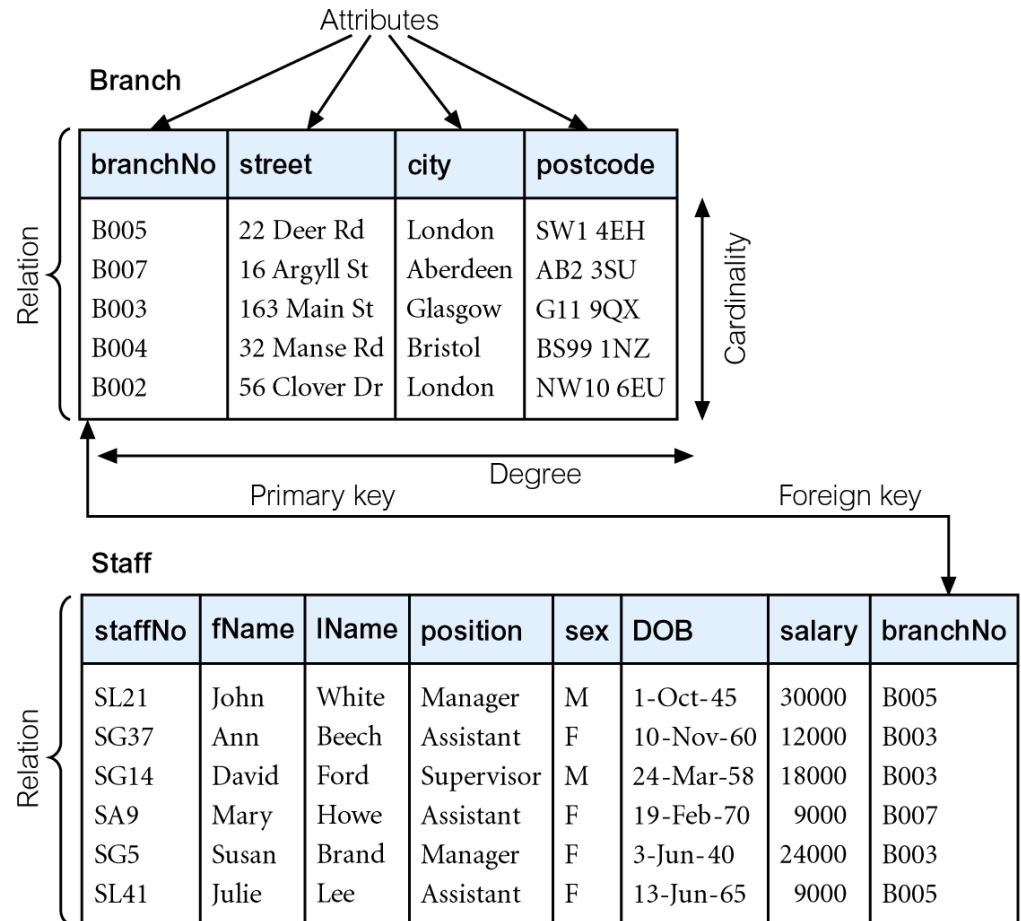| ProductID	ProductDescription	ProductFinish	ProductStandardPrice	ProductLineID

* Not in Figure 2-22 for simplicity.

Schema for four relations (Pine Valley Furniture Company)
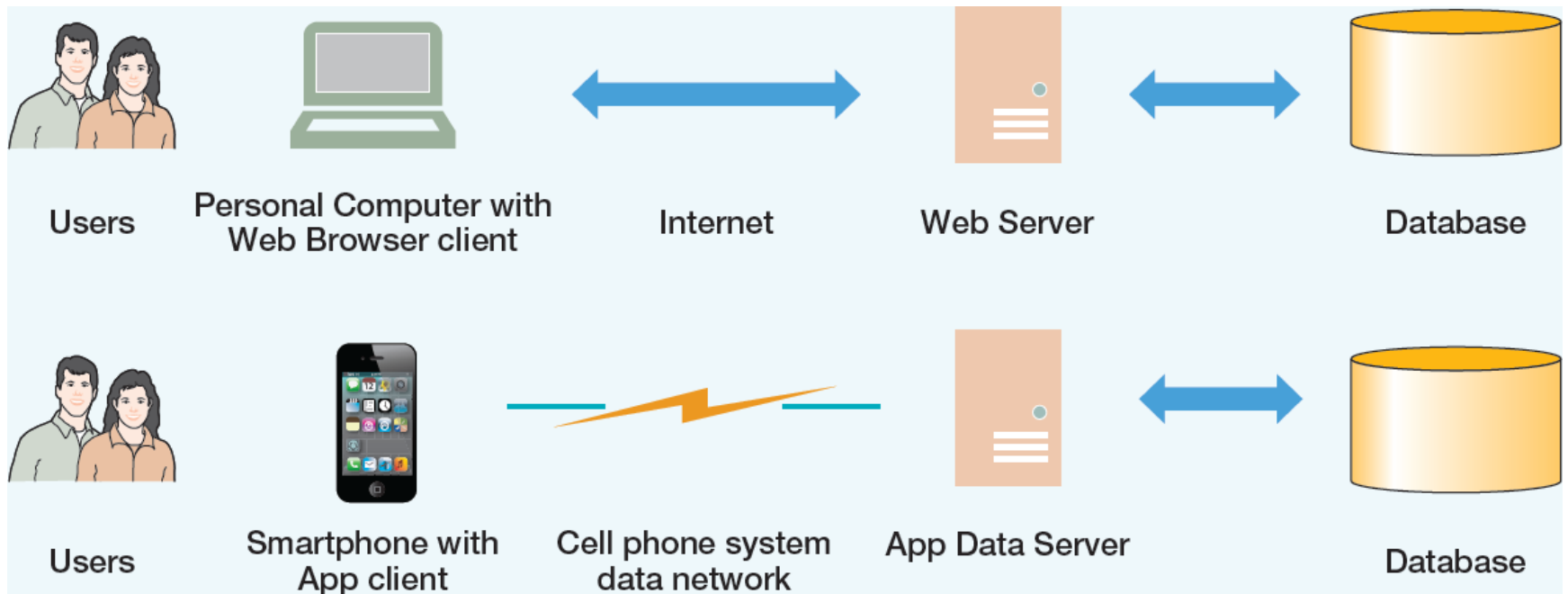
PK and FK Relationship

Attributes can appear in any order in the relation and convey the same meaning.

The figures show the instances of the Branch and Staff relations.

The Internet and Mobile Device World
Client-Server Architecture

Users — Personal Computer with Web Browser client — Internet — Web Server — Database

Users — Smartphone with App client — Cell phone system data network — App Data Server — Database

Major Benefits of Database

- **Shared data**

- **Reduced redundancy**

- **Reduced inconsistent data**

- **Transaction support**

- **Support for data integrity**

- **Security enforcement**

- **Support for standards**

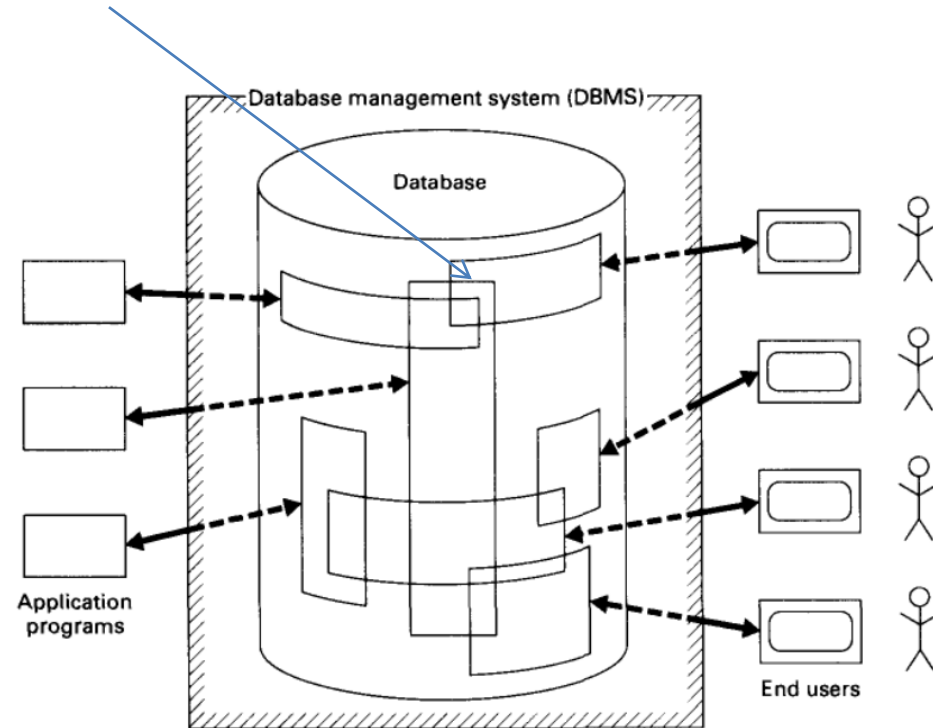- **Conflicting requirements can be met**

FIG. 1.4 Simplified picture of a database system

An Introduction to Database Systems, C. J. Date, Addison-Wesley Publisher Company.

SQL Categories

- SQL statements can be divided into four major categories

1. **Data definition language (DDL)**

2. **Data manipulation language (DML)** statements

3. **SQL/ Persistent Stored Modules (SQL/ PSM)** statements

4. **Transaction control language (TCL)** statements

Components of a Database System with SQL
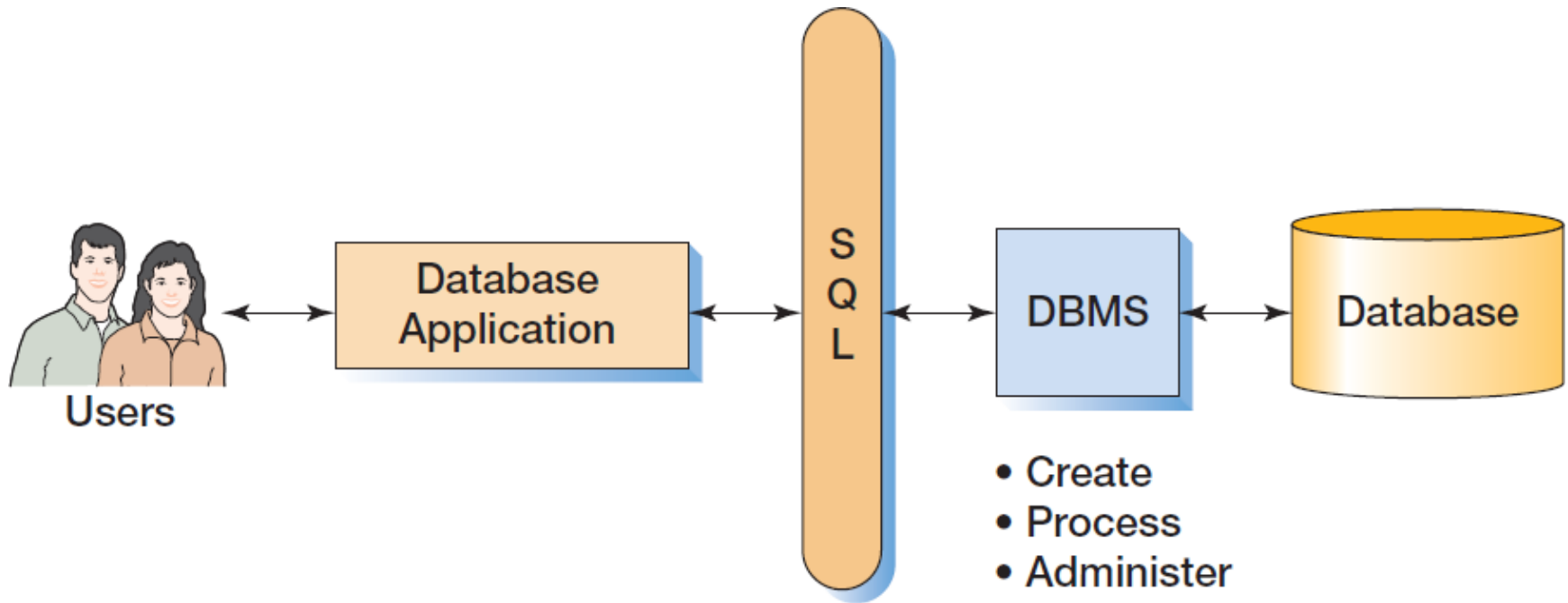
References/ Resources

- Thomas Connolly, Carolyn Begg 2014, Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition Ed., Pearson Education [ISBN: 1292061189] [Present in our Library]

- https://www.mamp.info/en/mamp/windows/