Common types of databases

- **Commercial/Accounting databases**
  - Store customers, transactions, …
- **Engineering databases**
  - Such as Building Information Model databases
- **Image databases**
  - Stores images and their metadata
- **Spatial database**
  - Stores combinations of spatial and non-spatial data

1. **A Database system**
   1. DB+DBMS
2. **A Database Management System**
   1. Software used to create, administer and query a database
3. **A Database**
   1. Is a collection of data organized in a way enabling the computer to efficiently store and retrieve data;
   2. …is a repository of logically related data;
   3. Databases support the persistence of large volumes of data
   4. Databases store data AND their structure (Schema + Data)

Interaction with a DBMS

- **Through a data query language**
- **Enables all the operations in data lifecycle:**
  1. The specification of data storage structures (e.g., tables)
  2. Loading of data into these structures
  3. Queries about the data
  4. Modification of data in the data structures
  5. Deletion of data
  6. Discarding of the storage data structures
  7. Management of access and data protection

Spatial databases

- **Share all of the mentioned characteristics;**
- **Support all of the mentioned properties;**
- **Add extras:**
  - the support for spatial data types (conceptual/ logical schema);
  - efficient spatial data storage (physical schema); and
  - efficient spatial access methods and query methods (indexes, algorithms);
  - extend the query language to provide support for spatial operators between spatial data.

Pros of a Database

- **Persistent storage of data and their structure (Self-describing)**
- **Data Integrity over data lifecycle**
- **Security and user management**
- **User Views**
- **Data Independence**
- **Support for concurrency**
- **(possible) Support for distributed storage**
- **User interaction through a query language or interface**
- **High performance**

Levels of data abstraction
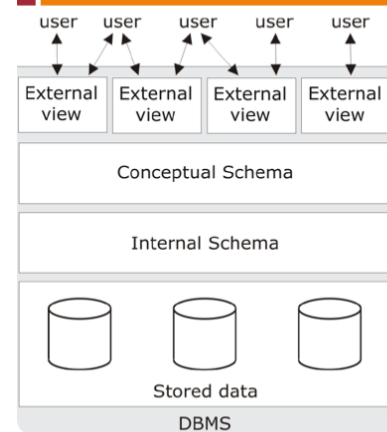
- **External schema:** Partial view of the database for a particular application
- **Conceptual or logical schema:** User-oriented data representation
- **Internal or physical schema:** How the data are physically stored in the database

Elements of a DBMS

1. **Query compiler:** parses and analyses the query, creates executable code
2. **Query optimizer:** find efficient execution strategy
3. **Constraint enforcer:** enforces integrity constraints
4. **Runtime database processor:** executes code
5. **Stored data manager:** interacts with OS for physical access to data
6. **System catalog/data dictionary:** stores metadata – info about the data model: internal, conceptual & views
7. **Concurrency, control, backup, recovery units:** additional possible units
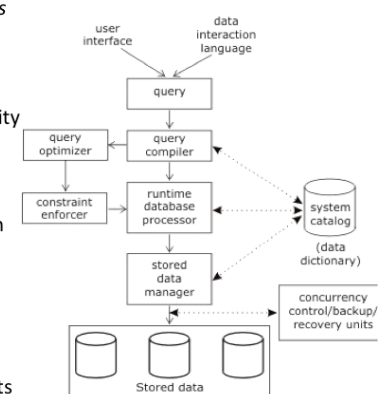
What makes Spatial databases

- **Spatial data types (Geometries) – spatial phenomena are located on Earth's surface;**
- **Spatial query methods to efficiently retrieve and manipulate spatial data based on spatial properties;**
- **Spatial extensions to query language, to interrogate the database;**
- **Spatial data structures/indexes – for efficient organisation and querying of spatial data;**