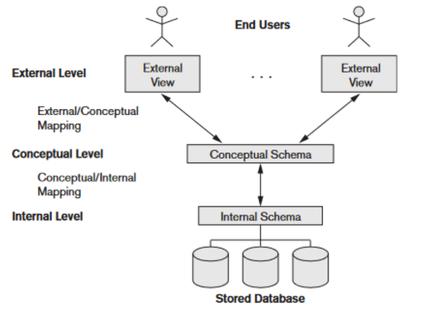
data independence - capacity to change the schema at one level without effecting the other levels i.e. not having to make changes.

Logical Data Independence - the ability to make changes at conceptual level without making changes to external level.

Physical Data Independence - the ability to make changes at the internal level without having to make changes at the conceptual level (create a new index).

Figure 2.2
The three-schema architecture.



[9]This is also known as the ANSI/SPARC (American National Standards Institute/ Standards Planning And Requirements Committee) architecture, after the committee that proposed it (Tsichritzis & Klug, 1978).

Data Models

High

Conceptual
- high level representation of the data, often reflects the view users see (ER Model).

Represenational
- medium level, reflect the conceptual model, but are closer to details of the implementation (Relational Schema). Easy to go from here to SQL.

Physical data model - how data is stored on physical machine (sophisticated users live here).

Low

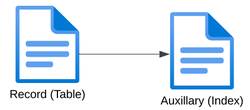
Database Languages

- Data definition language (DDL) - used by dba's and database designers to define the schema (SQL).
- Storage definition language (SDL) - used to specify the internal schema (SQL, more sophisticated languages that interact with the hardware, etc..)
- View definition language (VDL) - specifies users view (JavaScript)
- Data manipulation language - languages that allow us to manipulate our database once the schema is defined, and filled with data (SQL).

Conceptual - Entities (Represent real world objects, things, etc..), Attributes (describes the entity, or things we need to keep track of about an entity), Relationships (interactions between 1 or many entities).

Representational - (Record based models)

Physical models - formatting of records, record ordering, access path (index).



Client

Mobile Phone

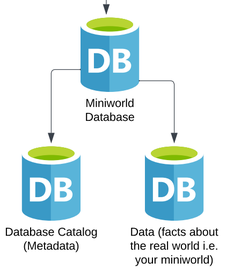
Server

SQL Server

Project

API (Java - Spring Boot)

SQL Server (DBMS)



High Natural Language, 4th Dimensional Languages

Compiler Java

Low Aseembly, Machine Language (0101)

Customer (Entity)

Relationship (works for)

Employee (Entity)

Person

Customer
Employee