

DATABASE METHODOLOGY

Database Fundamentals

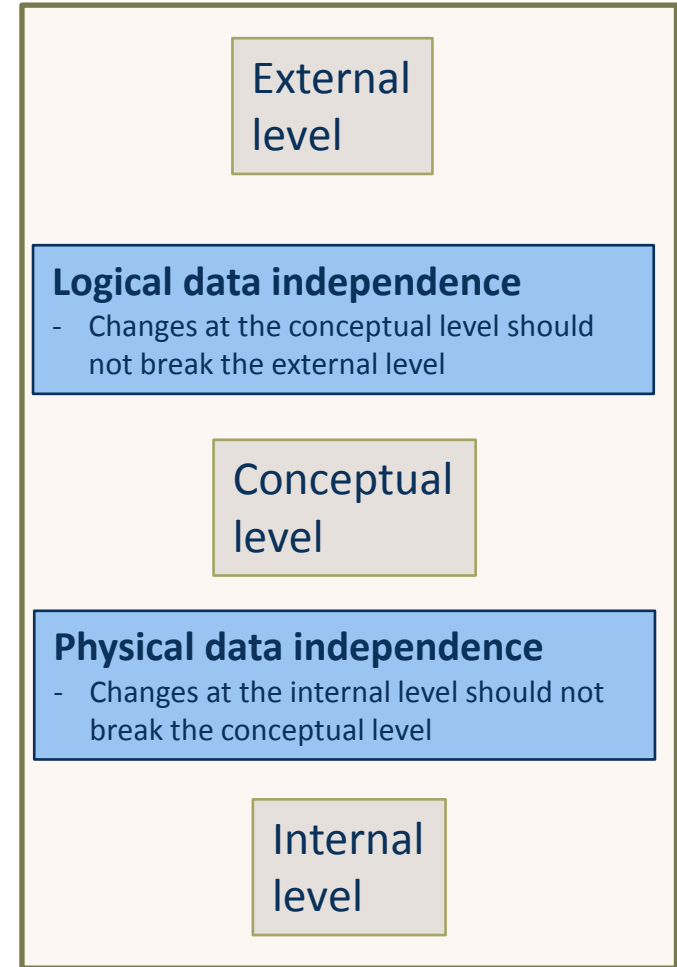
Environment

Databases - Environment

- In this module you will learn basics about the environment in which databases reside
 - The Three-Level ANSI-SPARC Architecture
 - Data Models
 - Database Languages
 - Specifically SQL (Structured Query Language)

The Three-Level ANSI-SPARC Architecture

- Separates three viewpoints (levels) of a database (DB)
 - **External level**
 - What part(s) each user sees
 - **Conceptual level**
 - Summarizes the whole DB:
 - The conceptual model
 - Constraints on the data
 - Metadata
 - Security information
 - **Internal level**
 - What the DBMS and OS see, the physical representation



- **High-level descriptions of data organization**

- Data Model: “An integrated collection of concepts for describing and manipulating data, relationships between data, and constraints on the data in an organization.”

Connelly/Begg, Database Systems

- Usually consisting of three parts:

- **Structure**

- Rules for how to construct databases in the model

- **Manipulation**

- Rules for manipulation of data and databases in the model

- **Integrity constraints**

- Means of ensuring the accuracy and correctness of data in the model

Types Of Data Models

- **Record-Based Data Models**

- Data organized in fixed-format records of different types
 - Each record has a number of fields holding the data
- **Relational Data Model**
 - A record-based data model
 - Data and relationships are organized in tables with columns and rows (records)
 - *The focus of this course*

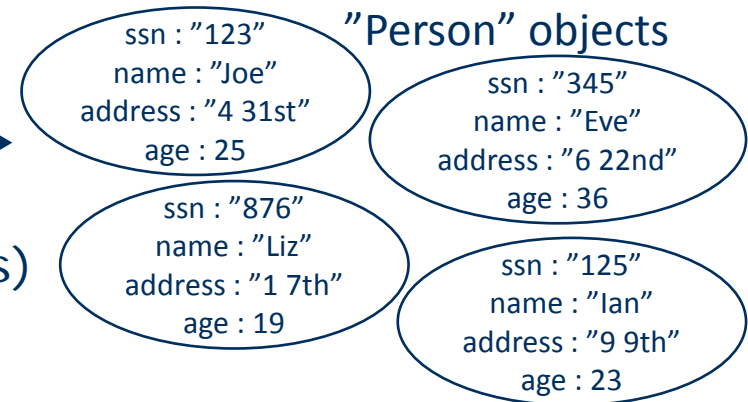
Records of type "Person"

ssn	name	address	age
123	Joe	4 31 st	25
345	Eve	6 22 nd	36
876	Liz	1 7 th	19
125	Ian	9 9 th	23



- **Object-Based Data Models**

- Data organized as entities (objects) with attributes and relationships (associations)
- Typically used for conceptual modelling



Database Languages

- A generic term for the sub-languages used for working with databases and data
 - All databases have some variant
 - Often run interactively by users
 - Must be embedded in high-level languages (i.e Java) for completeness (conditionals, iterations, etc)
 - Two parts:
 - Data manipulation (DML)
 - Data definition (DDL)

Database Language

Data Manipulation Language (DML)

Insert, modify, retrieve, and delete data in the database

Data Definition Language (DDL)

Create, alter, and delete databases and the structural parts of databases

Database Languages - Definitions

- **DML**

- “A language that provides a set of operations to support the basic data manipulation operations on the data held in the database.”

Connolly/Begg, Database Systems

- **DDL**

- “A language that allows the DBA* or user to describe and name the entities, attributes, and relationships required for the application, together with any associated integrity and security constraints.” *Connolly/Begg, Database Systems*

*DBA: Database administrator

Database Language

Data Manipulation Language (DML)

Insert, modify, retrieve, and delete data in the database

Data Definition Language (DDL)

Create, alter, and delete databases and the structural definitions of databases

SQL (STRUCTURED QUERY LANGUAGE)

- The database language used in this course
 - Since the 1980s the *de facto* industrial standard language for all *relational* database management systems (RDBMS)
 - Consists of a standardized core, but each RDBMS then implements SQL slightly differently (dialects)

- **Examples, SQL-DML:**

- `INSERT INTO Person
VALUES ('123', 'Joe', '4 31st', 20)`
- `UPDATE Person SET age = 25
WHERE ssn = '123'`
- `SELECT name, address
FROM Person
WHERE age = 25`
- `DELETE FROM Person
WHERE ssn = '123'`

- **Example, SQL-DDL:**

- `CREATE TABLE Person (
ssn STRING NOT NULL,
name STRING NOT NULL,
address STRING NOT NULL,
age INTEGER NOT NULL,
PRIMARY KEY (ssn))`

Databases - Environment

- So, now you know some basics about the database environment. You know what:
 - ANSI-SPARC's three different levels of database is.
 - A high-level Data Model is and relates to databases.
 - A database language is.

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