

Architecture Concepts

Data Models

- **Data Models** are used to define the **structure, operations, and integrity constraints** that are **supported**.
 - There are a large amount of data models, some of the more popular ones include: the relational model, the document model, and the network model.
- The **data model** that should be used to **solve a problem** is determined by the **specific requirements of the problem**.
- There are **four categories of data models**:
 1. **Conceptual, high-level, data models** — These **describe data** in concepts that are **close to the way that external users perceive the data**.
 2. **Physical, low-level, data models** — These **describe data** in concepts that **detail how the data is physically stored**.
 3. **Implementation, representation, data models** — These **describe data** in concepts that are a **hybrid of (1) and (2)**. There is some information regarding the way the data is stored, but overall it is still very high-level.
 4. **Self-Describing data models** — These **describe how data is being stored, near the actual data that is being stored**.

Schemas vs Instances

- A **schema** is a **description of the data that is being stored** (typically referring to the entire database).
- A **schema construct** is a **sub-component of the schema** (for example a table).
- An **instance** is a **record that is actually being stored**.
- The **state of a database** refers to **all of the records stored** within the **database** at a **particular moment in time**.
- The act of **saving the database state** is called **creating a snapshot of the database**.
- The **database state** is said to be **valid** when all of the **data that is stored within the database** satisfies the **structure and constraints of the schema**.
- The **schema of a database** can also be referred to as **"intension"**.
- The **state of a database** can also be referred to as **"extension"**.

Three-Level Architecture

- **Database Management Systems** use a **three-level architecture** to achieve: **data-program separation, data-independence, and multi-view support**.
- The three levels are defined as follows:
 1. The **first schema** is an **external schema** that is used for **user views**.
 2. The **second schema** is a **conceptual schema** that models the **entire database** with a **data model**.
 3. The **third schema** is an **internal schema** that models the **physical data storage**.

Data Independence

- The term **data independence** refers to the ability to change a **lower-level schema without having to modify any higher-level schemas**.
- There are **two types of data independence**:
 1. **Logical Data Independence** is the ability to change the **conceptual schema** without having to change the **external schema**.
 2. **Physical Data Independence** is the ability to change the **internal schema** without having to change the **conceptual schema**.