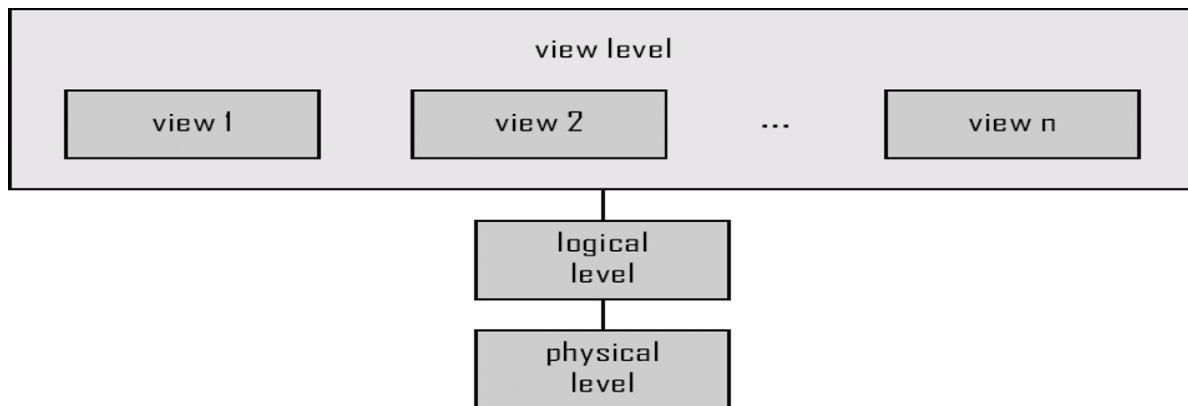


DATABASE MANAGEMENT SYSTEMS
UNIT 1 – TOPIC 3
LEVELS OF ABSTRACTION & DATA INDEPENDENCE

LEVELS OF DATA ABSTRACTION

In a Database Management System (DBMS), abstraction refers to the process of hiding the complexity of the underlying data structure and operations from the users. This abstraction is essential for managing large volumes of data efficiently and for providing a simplified interface for users to interact with the database.



There are 3 level architecture of database design.

Physical level / Internal View: (How) it is the lowest level of data abstraction. It tells us how the data is actually stored in memory. While designing the database few basic information needs to be considered like, storage allocation, indexing methods, data retrieval mechanisms, usability, size of the memory etc.

Example : record : customer

Logical level / Conceptual View: (What) The conceptual level, also known as the logical level, is the level of abstraction that defines the overall structure (schema) of the database. It hides the details of the physical storage from the database users and applications. It defines the relationships and constraints among the data elements without specifying how the data is physically stored.

The conceptual level is designed to provide a high-level view of the database that is independent of any specific implementation. It allows users to define the structure of the database in a way that is meaningful to them without worrying about the details of how the data is stored or accessed.

Example :

```
type customer = record
  customer_id : string;
  customer_name : string;
  customer_street : string;
  customer_city : string;
end;
```

View level / External View: (Who)

The external level, also known as the View level, is the highest level of abstraction and is closest to the end users. It defines how the data is viewed by the users or applications that access the database. It provides a high-level view of the database that is tailored to the specific needs of each user or application.

The external level is designed to provide a level of abstraction that shields the users or applications from the complexities of the underlying database. It allows users to work with the data in a way that is meaningful to them without worrying about the details of how the data is stored or organized.

Benefits of Levels of Abstraction in DBMS

The levels of abstraction in DBMS provide several benefits to users and applications, including:

- The levels of abstraction in DBMS provide a separation between the way data is viewed by users or applications and how it is stored and accessed by the database management system. This allows changes to be made to the physical storage and access methods without affecting the external or conceptual levels.
- The levels of abstraction in DBMS make it easier for database administrators to manage the database. They can make changes to the physical storage and access methods without affecting the users or applications that interact with the database.
- The levels of abstraction in DBMS allow the database management system to optimize the physical storage and access methods for performance without affecting the way data is viewed by users or applications.
- The levels of abstraction in DBMS allow users or applications to view the data in a way that is meaningful to them without worrying about the underlying implementation details. This makes it easier to adapt to changing business requirements and user needs.

Data Independence

The ability to modify the schema in one level without affecting the schema in next higher level is called data independence. It helps to keep the data separated from all programs that makes use of it.

- **Physical Data Independence** – The ability to modify the physical schema without changing the logical schema. It helps to keep the data separated from all program that makes use of it. **Example:** The Conceptual structure of the database would not be affected by any changes like utilizing a new storage device, change in storage size of the database system server, modifying the data structures used for storage, using an alternate file organization technique, changing from sequential to random access files etc.
- **Logical data independence:** The ability to modify the logical schema without affecting the schema in next higher level (external schema). The user view of the data would not be affected by any changes to the conceptual view of the data. These changes may include insertion or deletion of attributes, altering table structures entities or relationships to the logical schema, etc.