# *Introduction to Database Concepts*



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September 2018

# *What is a Database?*

- A collection of stored data used by an application system.

# *Defining a Database*

- For the data being stored in the database, defining the database specifies:
  - the data types
  - the structures
  - the constraints

# *Manipulating a Database*

- Included functions that
  - retrieve specific information in a query
  - update the database to include changes
  - generate reports from the data

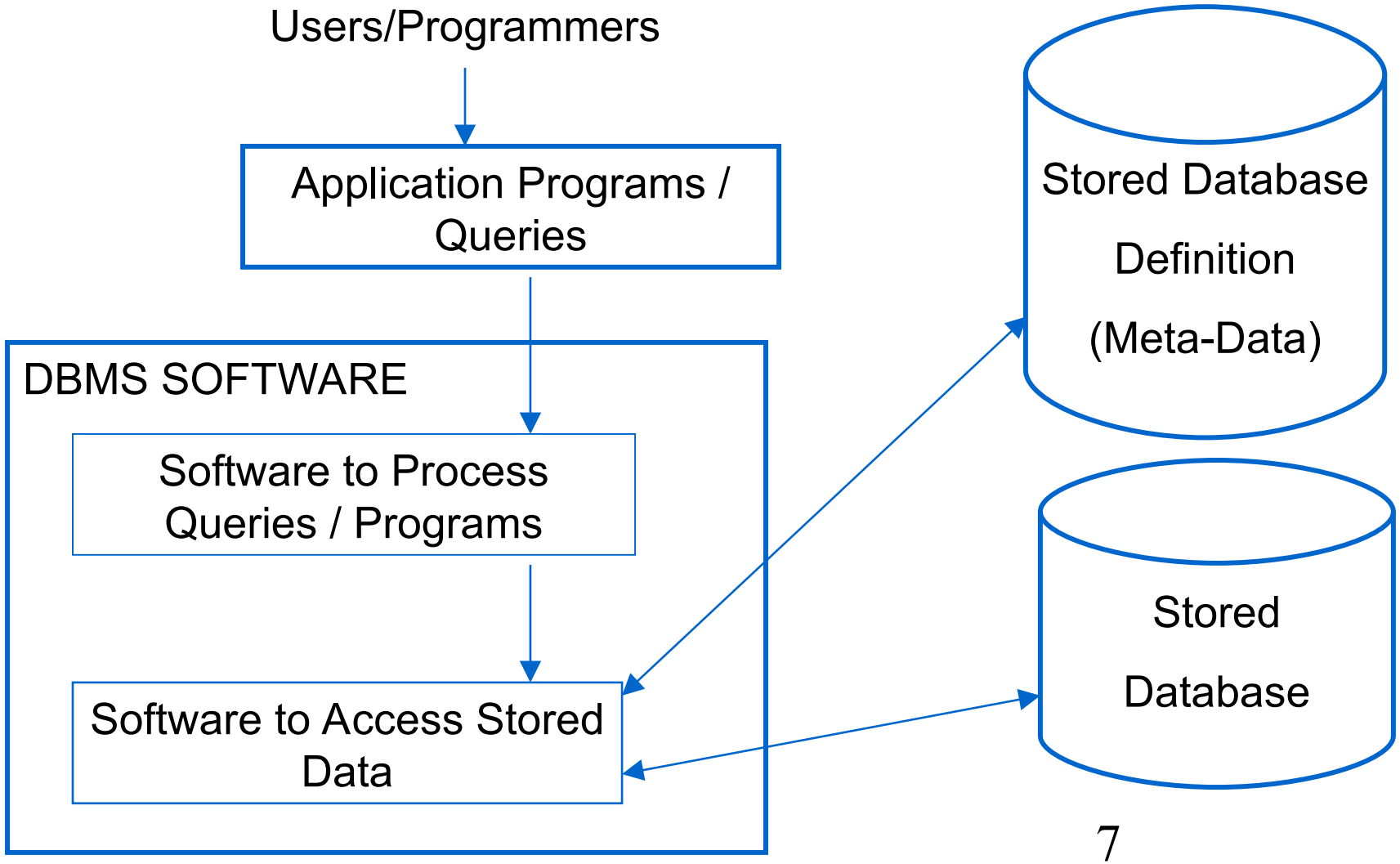
# *Sharing a Database*

- Allows multiple users and programs to access the database at the same time
- Any conflicts between applications are handled by the DBMS

# *Other Important Functions of a Database*

- Other important functions provided by a DBMS include
  - Protection
    - System protection
    - Security protection
  - Maintenance
    - Allows updates easily

# Simplified Database System Environment



# *Other Capabilities of DBMS Systems*

- Support for at least one data model through which the user can view the data
  - there is at least one abstract model of data that allows the user to see the “information” in the database
  - relational, hierarchical, network, inverted list, or object-oriented

# *Other Capabilities of DBMS Systems*

- Support for certain high-level languages that allow the user to define the structure of data, access the data, and manipulate the data
  - Data Definition Language (DDL)
  - Data Manipulation Language (DML)
  - Data Control Language (DCL)
  - query languages access data
  - operations such as add, delete, and replace

# *Other Capabilities of DBMS Systems*

- Transaction management which is the capability to provide correct, concurrent access to the database by many users at the same time
  - ability to manage simultaneously large numbers of “transactions”
    - procedures operating on the database
    - often transactions come from around the world
    - “lock-out” mechanisms

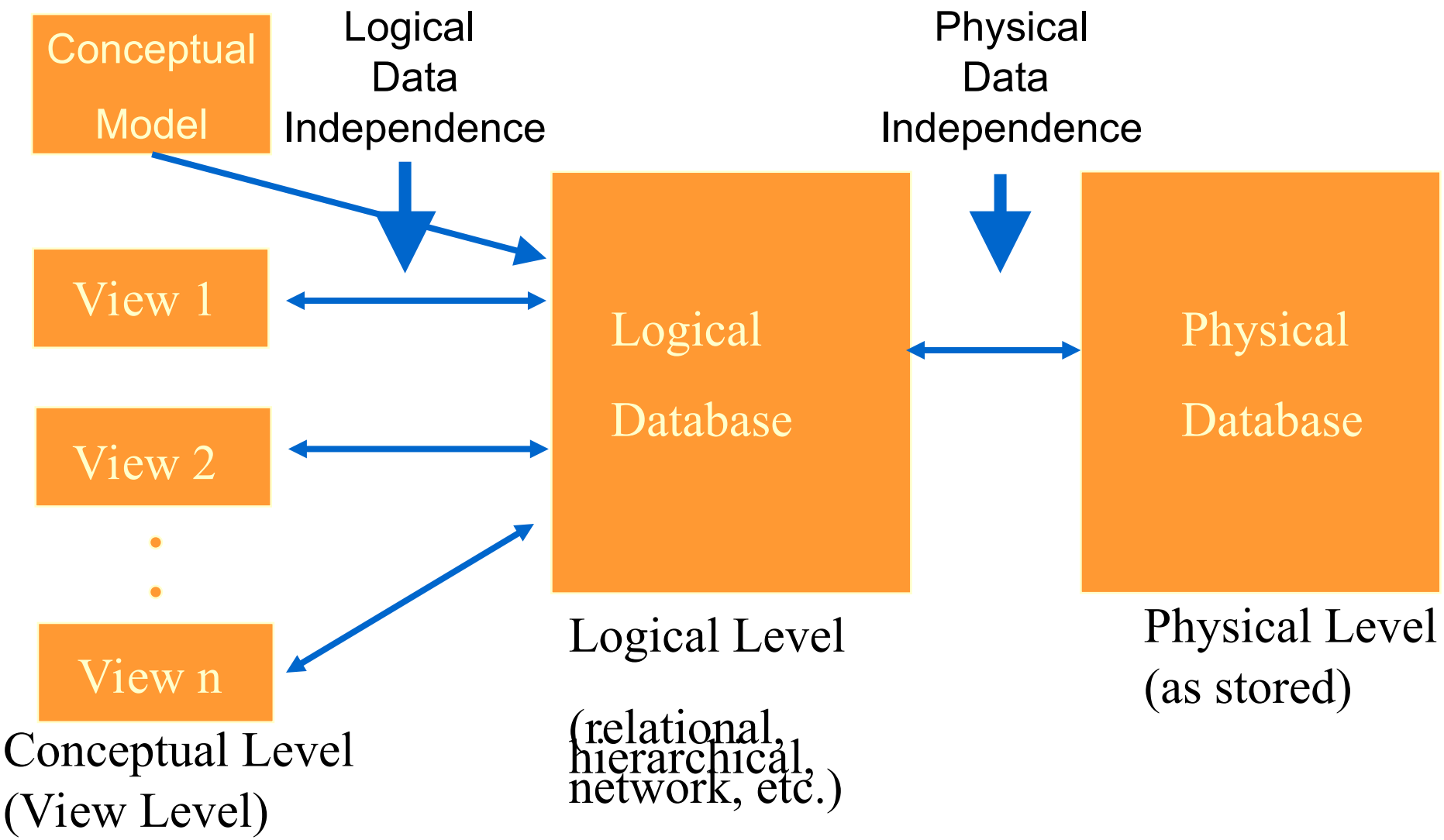
# *Other Capabilities of DBMS Systems*

- Access control which is the ability to limit access to data by unauthorized users along with the capability to check the validity of the data
  - protect against loss when database crashes
  - prevent unauthorized access to portions of data

# *Other Capabilities of DBMS Systems*

- Resiliency which is the ability to recover from system failures without losing data
  - must be able to recover from ANY type of failure
    - sabotage
    - acts of God
    - hardware failure
    - software failure
    - etc.

# Layered DBMS Architecture



# *Levels of a DBMS*

- Conceptual or External Level
  - a view or sub-schema
    - portion of the logical database
  - may be in a higher level language

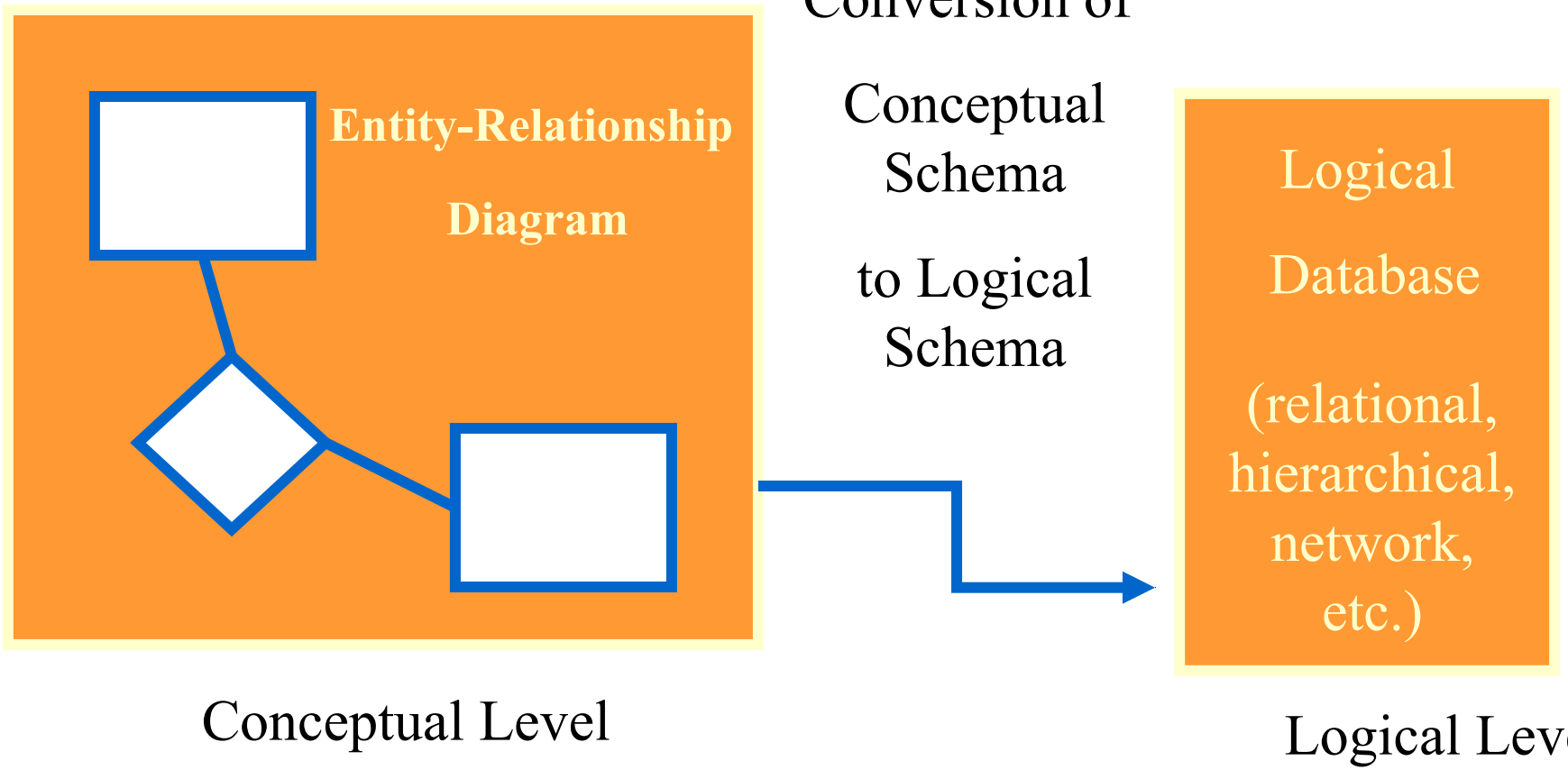
# *Levels of a DBMS*

- Logical Level
  - abstraction of the real world as it pertains to the users of the database
  - discrete mathematical model of data
  - DBMS provides a DDL to describe the logical schema in terms of a specific data model such as relational, hierarchical, network, or inverted list

# *Levels of a DBMS*

- Physical Level
  - the collection of files and indices
  - resides permanently on secondary storage device
  - actual data itself, bits and bytes

# Use of Conceptual Modeling



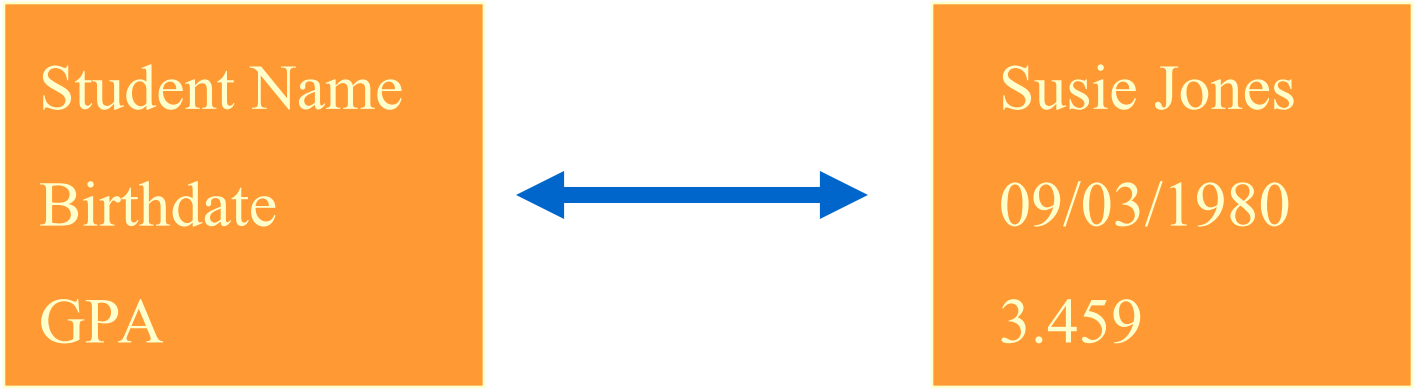
# *Basic Database Terminology*

- Instance
  - an instance of a database is the current contents of the data
  - extension of the database
  - state of the database
  - snapshot of the data

# *Basic Database Terminology*

- Schema
  - plan of the database
  - logical plan
  - physical plan
  - intention of the database

# Basic Database Terminology




Schema

Instance

# *Basic Database Terminology*

- Data Independence
  - has to do with the separation of data modeling levels

# *Basic Database Terminology*

- Physical Data Independence
  - The **separation** between the physical and logical data modeling levels.
  - Consequence -
    - physical schema can be changed without modifying logical schema

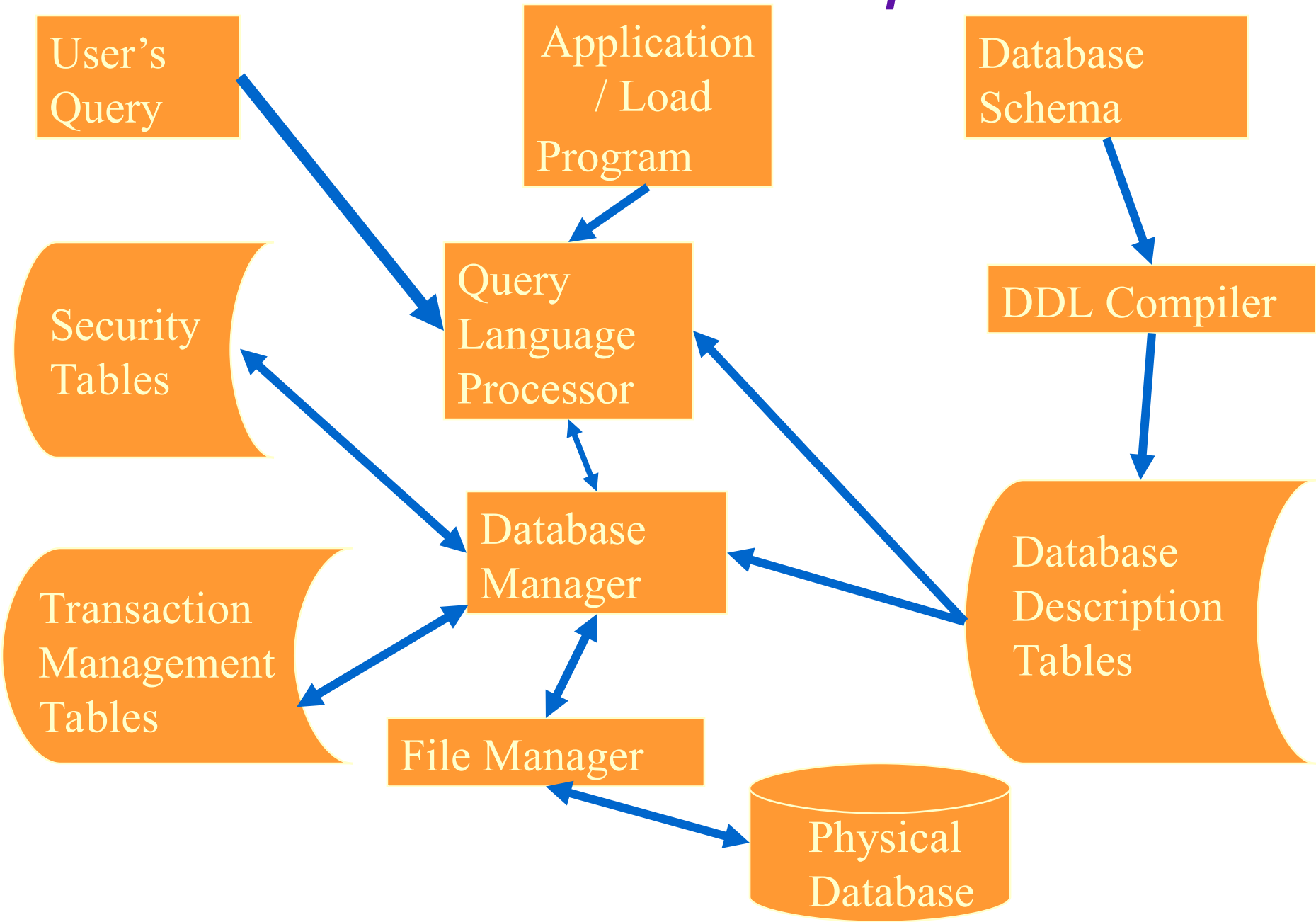
# *Basic Database Terminology*

- Logical Data Independence
  - The **separation** between the logical and conceptual (external) data modeling levels.
  - Consequence -
    - logical schema can be changed without modifying conceptual schema

# *Basic Database Terminology*

- DCL, DDL and DML
  - may be completely separate (in IMS)
  - may be intermixed (DB2)
  - Host language
    - application program in which DML commands are embedded such

# DBMS Components



# *Data Hierarchy*

- Data – stored values
- Information – computed values, can be stored (turned into data)
- Knowledge – data/information with meaning
- Wisdom – application of knowledge