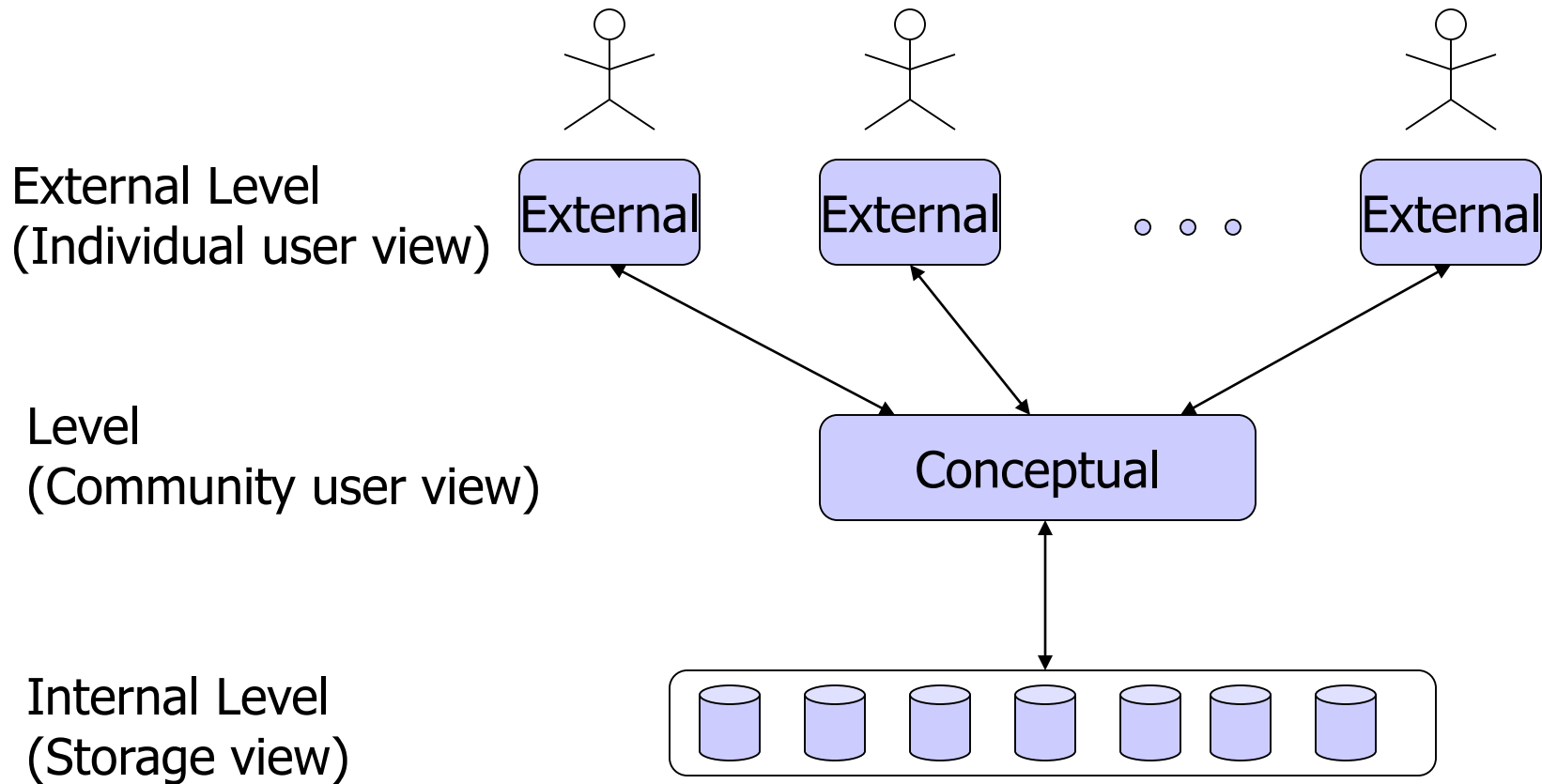


# Database System Architecture



### External (PL/I)

DCL      1 EMPP,  
          2 EMP# CHAR(6)  
          2 SAL FIXED BIN(31)

### External (COBOL)

01 EMPC,  
02 EMPNO PIC(6)  
02 DEPTNO PIC X(31)

### Conceptual

#### EMPLOYEE

EMPLOYEE_NUMBER	CHAR(6)
DEPARTMENT_NUMBER	CHAR(4)
SALARY	NUMERIC(5)

### Internal

STORED\_EMP BYTES = 20  
PREFIX TYPE=BYTES(6), OFFSET = 0  
EMP# TYPE=BYTES(6), OFFSET = 6, INDEX = EMPX  
DEPT# TYPE=BYTES(4), OFFSET = 12  
PAY TYPE=FULLWORD, OFFSET = 16

# External Level

- External view:
  - Describes abstract representation of **some portion** of the total database seen by some particular user and hides the rest of the database from that user
  - It is defined by an external schema
  - **Schema** refers to how data is organized and relations among database storage structures (e.g. tables)
- Types of users
  - Application programmers
  - End users
  - DBAs
- Data Sub-languages (DSL)
  - DSL is embedded within host language

# Conceptual Level & Internal Level

- Conceptual view
  - Describes abstract representation of the **entire database** for a community of users and hides physical storage from users
  - It is defined by a conceptual schema
  - A view of the data “as it really is”
- Library analogy
  - Catalog from computers -> Conceptual view
  - Books on shelf -> Physical storage
  - Patrons
- Internal view is the low-level representation of the entire database as physically stored

# Mappings

- Conceptual  $\Leftrightarrow$  internal mapping
  - Correspondence between the conceptual view and the stored database
  - Specify how the conceptual view is represented at the internal level
- External  $\Leftrightarrow$  conceptual mapping
  - Correspondence between the external view and conceptual view

# Data Independence

- Definition
  - The capacity to change the schema at one level of a database system without having to change the schema at the next higher level
- Logic data independence
  - The change to the conceptual schema does not need to make change to the internal schema or the stored database
- Physical data independence
  - The change to the internal schema does not need to make change to the conceptual schema
- Analogous to information hiding in OOP

# Database Languages

- Languages
  - DDL (Data Definition Language)  
Definition or declaration of database objects such as creation of tables
  - DML (Data Manipulation Language)  
Manipulation or processing of such objects such as retrieval, updates, deletion of data
- Data sub-languages (DSL) and host languages
  - DSL: SQL (Structured Query Language)
  - Host Language: C/C++, Java, PHP, other 5GLs

# Database Administrator (DBA)

- Define the conceptual schema (logical design)
- Define the internal schema (physical DB design)
- Liaise with users including user account management
- Define security and integrity constraints
- Define backup and recovery procedures
- Monitor performance and responding to changing requirements



# Database Management System (DBMS)

- DBMS is the software that handle all access to database
- Processes
  - User request
  - DBMS intercepts and analyze
  - DBMS inspects different levels and mappings between the levels
  - DBMS executes on the stored database
  - Results return

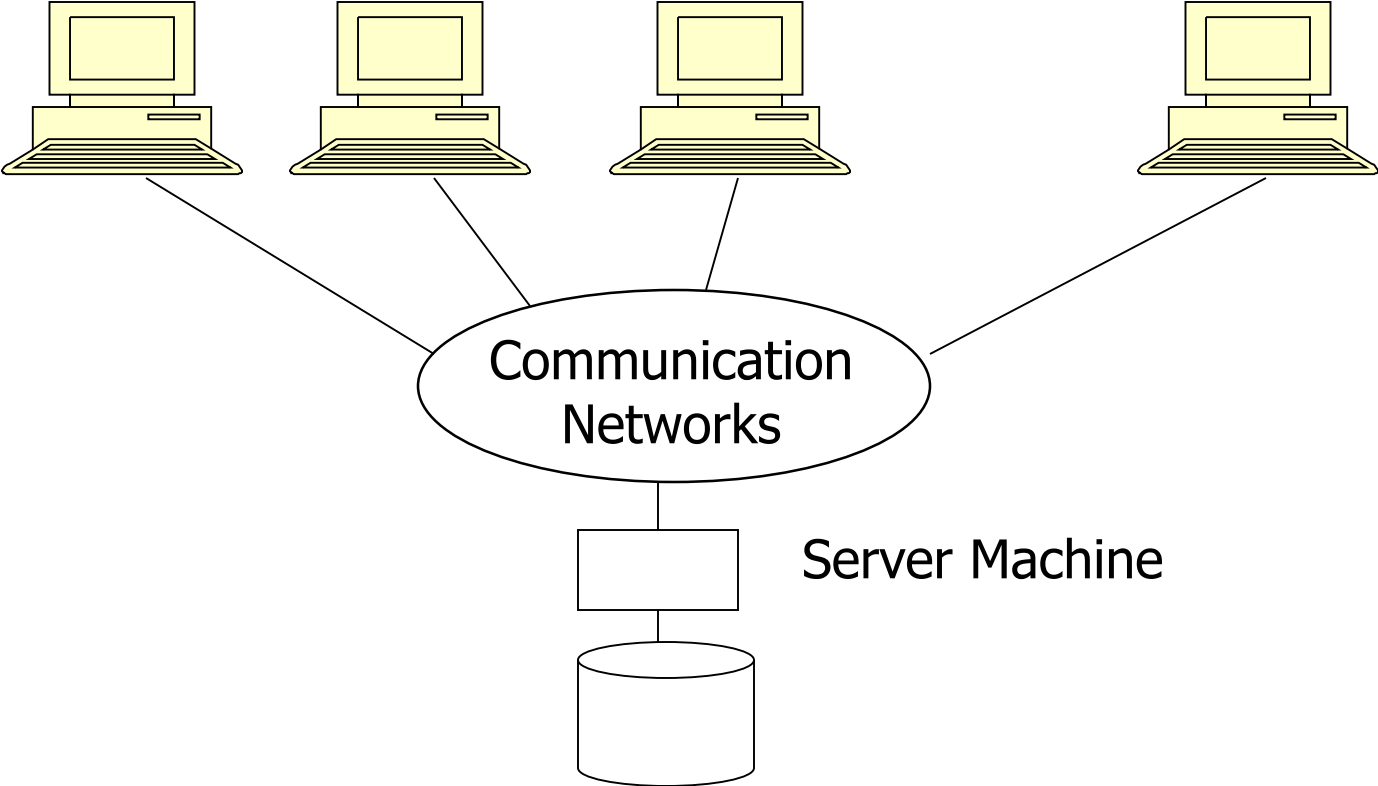
# Database Management System (DBMS)

- Functions DBMS supports
  - Data definition
  - Data manipulation
  - Optimization
  - Data security and integrity
  - Data recovery and concurrency
  - Data dictionary: 'data about the data'
  - Performance

# Client/Server Architecture

- Server: DBMS
- Clients: applications that run on top of the DBMS
  - User-written applications
  - Vendor-provided applications (tools)
    - Query language processor (SQL)
    - Report writers
    - Statistical packages
    - more ...

# Client/Server Architecture



# Client/Server Architecture

