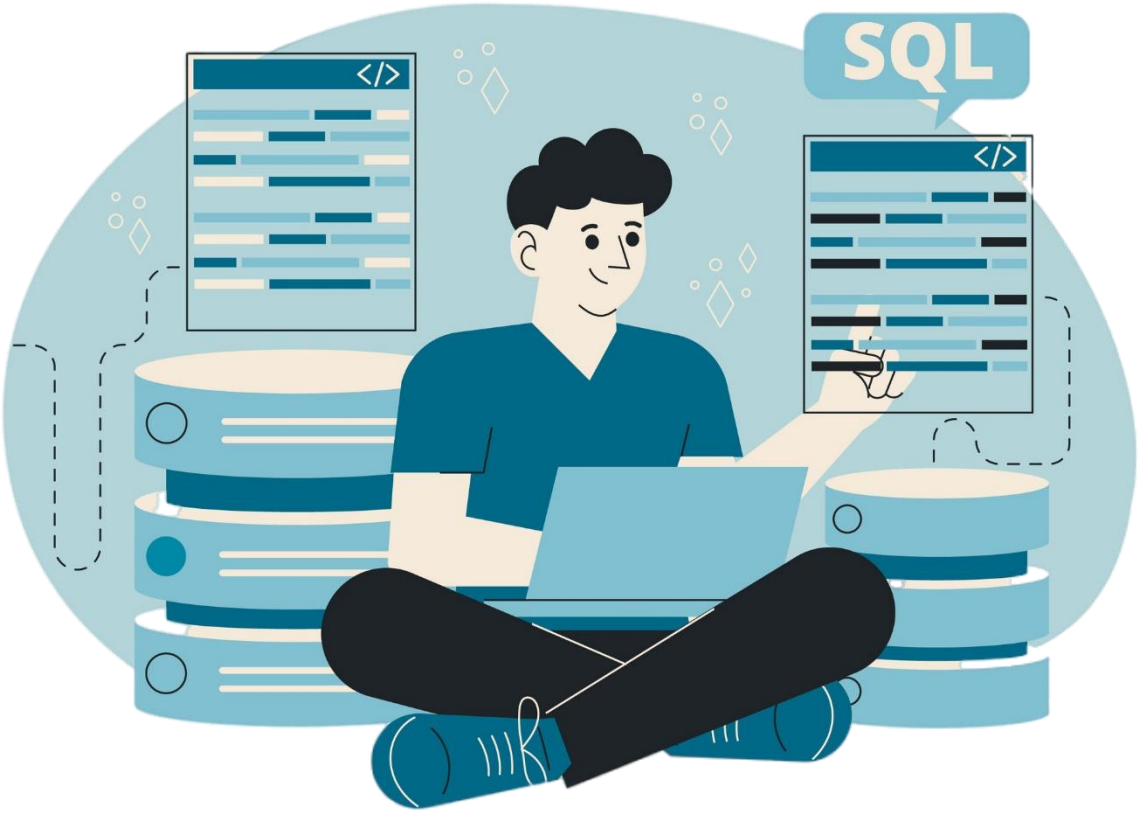
BCA-I

DBMS-01

Database Management System



01-Introduction to Database

Definitions

- **Data**
  - Fact that can be recorded or stored.
  - E.g. Person Name, Age, Gender and Weight etc.
- **Information**
  - When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.
- **Database**
  - Collection of inter-related data.
  - E.g. Books Database in Library
- **DBMS** (Database Management System)
  - Collection of inter-related data and set of programs to manipulate those data.
  - E.g. MS SQL Server, Oracle, My SQL, SQLite, MongoDB etc.
- **Metadata**
  - Metadata is data about data.
- **Data dictionary**
  - An information repository which contains metadata.
- **Data warehouse**
  - An information repository which stored data.
- **Field**
  - Character or group of characters that have a specific meaning.
  - It is also called a data item
- **Record**
  - Collection of logically related fields.

Application of DBMS

Railway reservation system:

- The railway reservation system database plays a very important role by keeping record of ticket booking, train's departure time and arrival status and also gives information regarding train late to people through the database

Library Management System:

- Now-a-days it's become easy in the Library to track each book and maintain it because of the database. This happens because there are thousands of books in the library.
- It is very difficult to keep a record of all books in a copy or register.

- Now DBMS used to maintain all the information related to book issue dates, name of the book, author and availability of the book.

Banking:

- Banking is one of the main applications of databases. We all know there will be a thousand transactions through banks daily and we are doing this without going to the bank. This is all possible just because of DBMS that manages all the bank transactions.

Universities and colleges:

- Now-a-days examinations are done online. So, the universities and colleges are maintaining DBMS to store Student's registrations details, results, courses and grade all the information in the database. For example, telecommunications. Without DBMS there is no telecommunication company. DBMS is most useful to these companies to store the call details and monthly post-paid bills.

Credit Card Transactions:

- The purchase of items and transactions of credit cards are made possible only by DBMS. A credit card holder has to know the importance of their information that all are secured through DBMS.

Social Media Sites:

- By filling the required details we are able to access social media platforms. Many users sign up daily on social websites such as Facebook, Pinterest and Instagram. All the information related to the users are stored and maintained with the help of DBMS.

Finance:

- Now-a-days there are lots of things to do with finance like storing sales, holding information and finance statement management etc. these all can be done with database systems.

Military:

- In military areas the DBMS is playing a vital role. Military keeps records of soldiers and it has so many files that should be kept secure and safe. DBMS provides a high security to military information.

Online Shopping(E-COMMERCE):

- Now-a-days we all do Online shopping without wasting the time by going shopping with the help of DBMS. The products are added and sold only with the help of DBMS like Purchase information, invoice bills and payment.

Human Resource Management:

- The management keeps records of each employee's salary, tax and work through DBMS.

Manufacturing:

- Manufacturing companies make products and sell them on a daily basis. To keep records of all those details DBMS is used

Airline Reservation system:

- Just like the railway reservation system, airlines also need DBMS to keep records of flights arrival, departure and delay status.

File System Disadvantages

- Data redundancy and inconsistency
- Difficulty in accessing data
- Data isolation
- Atomicity of updates
- Concurrent access
- Security Problem

Purpose of DBMS

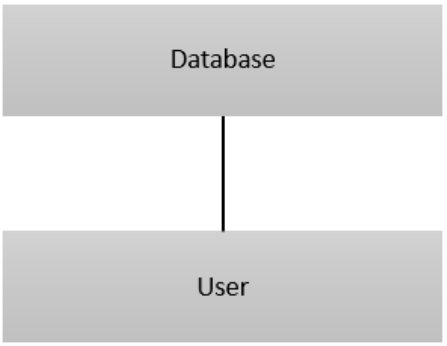
- Provides a safe and effective platform to manage vast amount of data
- Provides services like data organization, storage and manipulation
- Efficient storage and retrieval of data
- Eliminates data redundancy and anomalies
- Protection of sensitive data
- Preserve the data confidentiality by safeguarding against unauthorized access
- Provides easy collaboration
- Data backup and transaction management
- Safeguarding data against system crashes and failures

Tier Based Database Architecture

- DBMS architecture depends upon how users are connected to get their request done
- There are 3 tiers of database architecture

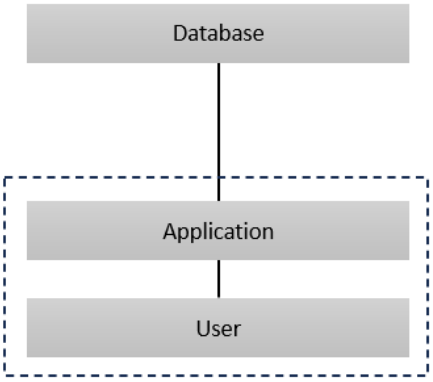
1-Tier Architecture

- Database is directly available to users
- Changes done by users will effect the database too
- It is used for development of local applications where developers can directly communicate with the database for quick response



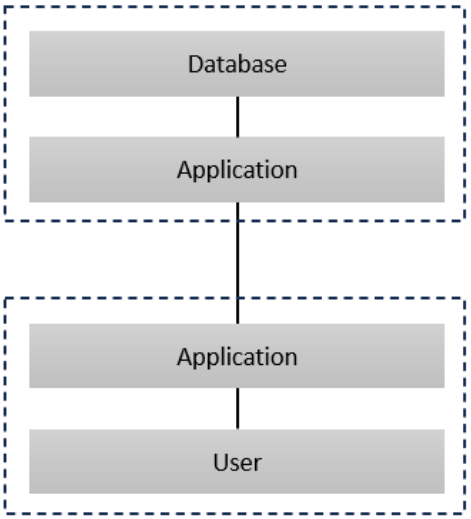
2-Tier Architecture

- In this architecture application on client-end can directly communicate with database at the server-end
- UI and application programs are run on client-end
- To communicate with DBMS client-end application establishes a connection with server-end

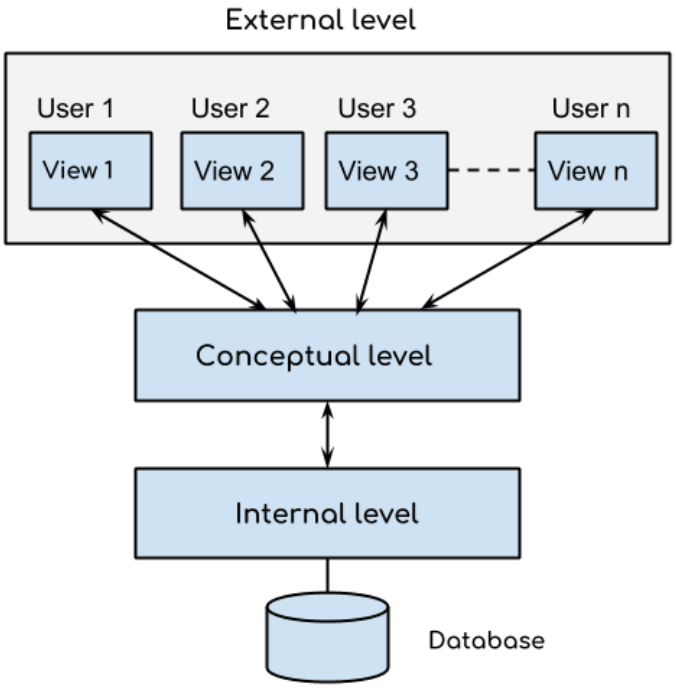


3-Tier Architecture

- In this architecture application on client-end communicates with the application on server-end which will communicate with the database
- **The client cannot communicate with database directly**
- End user has no idea about the existence of the database beyond the application server similarly the database has no idea about any other user beyond application
- It is used in case of large application



ANSI SPARC Database System



Internal Level (Physical Level):

- It describes how a data is stored on the storage devices
- Deals with physical storage of data
- It is described by Internal Schema

Conceptual Level (Logical Level):

- It describes what data are stored and what relationship exists among those data
- It hides low level complexities of physical storage
- Database administrators works at this level to determine what data to keep in the database

External Level (View Level):

- It describes only part of the entire database that an end user concern and how data are viewed by each user

- Different user needs different view of the database thus there can be many views in a view level abstraction of a database

Data Mapping

The process of transforming requests and results between the three levels is called mapping.

- **Conceptual/Internal Mapping:**
  - It relates conceptual schema with internal schema.
  - It defines correspondence between the conceptual schema and the database stored in physical devices.
  - It specifies how conceptual records and fields are presented at the internal level.
  - If the structure of stored database is changed, then conceptual/internal mapping must be changed accordingly and conceptual schema can remain invariant.
  - There could be one mapping between conceptual and internal levels.
- **External/Conceptual Mapping:**
  - It relates each external schema with conceptual schema.
  - It defines correspondence between a particular external view and conceptual schema.
  - If the structure of conceptual schema is changed, then external/conceptual mapping must be changed accordingly and external schema can remain invariant.
  - There could be several mappings between external and conceptual levels.

Data Independence

Data independency is the ability to modify a schema definition in one level without affecting a schema definition in the next higher level.

- **Physical Data Independence:**
  - Allows changing in physical storage devices or organization of file without change in the conceptual view or external view.
  - Necessary to improve performance.
  - Separates conceptual level from the internal level.
  - Easy to achieve physical data independence.
- **Logical Data Independence**
  - Ability to modify the conceptual schema without requiring any change in application programs.
  - Conceptual schema can be changed without affecting the existing external schema.
  - Necessary whenever the logical structure of the database is altered.
  - Separates external level from the conceptual view.

- It is difficult to achieve logical data independence.

Database Users

Database users are categorized based up on their interaction with the database.

Database Administrator (DBA):
- Person/team who defines the schema and also controls the 3 levels of database.
- The DBA will then create a new account id and password for the user if he/she need to access the database.
- DBA is also responsible for providing security to the database and he allows only the **authorized users** to access/modify the database.
- DBA is responsible for the problems such as **security breaches** and poor system response time.
- DBA also monitors the **recovery and backup** and provide technical support.
- The DBA has a DBA account in the DBMS which called a **system** or **superuser** account.
- DBA **repairs damage** caused due to hardware and/or software failures.
- DBA is the one having privileges to perform **DCL** (Data Control Language) operations such as GRANT and REVOKE, to allow/restrict a particular user from accessing the database.

Naïve/Parametric End Users:
- Parametric End Users are the unsophisticated who don't have any DBMS knowledge but they frequently use the database applications in their daily life to get the desired results.
- For examples, Railway's ticket booking users, Clerks in any bank

System Analyst:
- System Analyst is a user who analyses the requirements of parametric end users.
- They check whether all the requirements of end users are satisfied.

Sophisticated Users:
- Sophisticated users are familiar with the database.
- They can develop their own database applications according to their requirement.
- They don't write the program code but they interact the database by writing SQL queries directly through the query processor.

Database Designers:
- Data Base Designers are the users who design the structure of database which includes tables, indexes, views, triggers, stored procedures and constraints which are usually enforced before the database is created or populated with data.
- He/she controls what data must be stored and how the data items to be related.
- It is responsibility of Database Designers to understand the requirements of different user groups and then create a design which satisfies the need of all the user groups.

Application Programmers:
- Application Programmers (System Analysts or Software Engineers) are the back-end programmers who writes the code for the application programs.
- These programs could be written in Programming languages

- Application programmers design, debug, test, and maintain set of programs called “canned transactions” for the Naïve (parametric) users in order to interact with database.

Casual Users/Temporary Users:

- Casual Users are the users who occasionally use/access the database but each time when they access the database they require the new information

Specialized users:

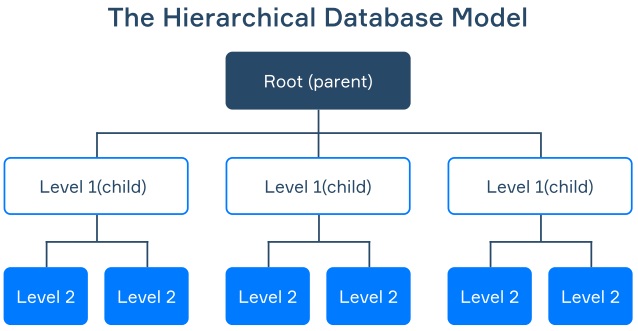
- Specialized users are sophisticated users who write specialized database application that does not fit into the traditional data- processing framework.
- Among these applications are computer aided-design systems, knowledge-base and expert systems etc.

Types of Data Models

- It defines logical structure of database
- It determines how data can be stored accessed updated in a DBMS

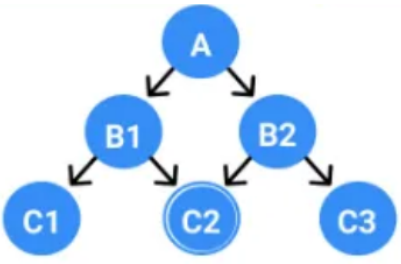
Hierarchical Model:

- It organizes data into a tree-like structure where each record has a single parent
- The hierarchy starts from the root and expands like a tree by adding child notes to the parent nodes
- In this model data is organized into tree-like structure with one-to-many relationship between two different types of data



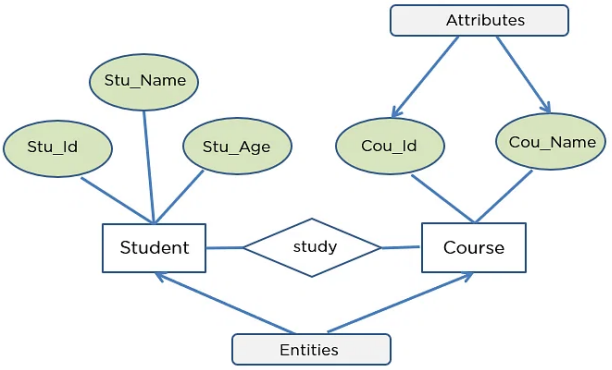
Network Model:

- It is an expansion of hierarchical data model allowing many-to-many relationship in a tree-like structure that allows multiple parents



Entity-Relational Model:

- In this model relationship are created by dividing object of interest into entity and its characteristics into attributes



Relational Model:

- In this model data is organized in two-dimensional tables and the relationship is maintained by storing common attributes

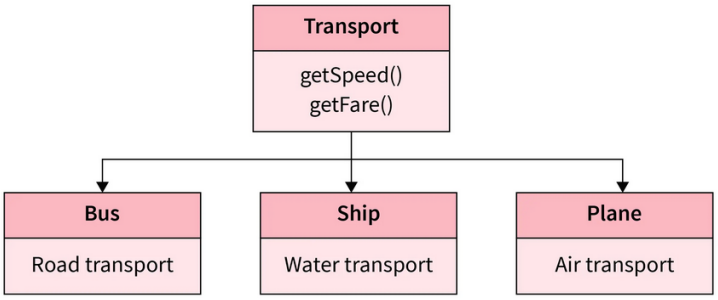
student_Id	name	age
1	Akon	17
2	Bkon	18
3	Ckon	17
4	Dkon	18

subject_Id	name	teacher
1	Java	Mr. J
2	C++	Miss C
3	C#	Mr. C Hash
4	Php	Mr. P H P

student_Id	subject_Id	marks
1	1	98
1	2	78
2	1	76
3	2	88

Object-Oriented Data Model:

- It considers each object in the world as objects and isolates it from each other
- It groups its related functionalities together and allows inheriting its functionality to other related sub-groups.



Questions

1. Explain the purpose of the database system.
2. Explain the purpose and application of DBMS.
3. List the benefits of database approach.
4. Explain different database users.
5. What are the responsibilities of a DBA?
6. Draw the three-level architecture of DBMS.
7. Explain the three-level architecture of database system.

8. What is data independence? Explain the difference between physical and logical data independence with example.
9. Explain database system 3 tier architecture with diagram in detail.
10. What is data model? Explain various data models.

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