

# DATABASE MANAGEMENT SYSTEM (DBMS)

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# Main Characteristics of the Database Approach

- **Self-describing nature of a database system:**
  - A DBMS **catalog** stores the description of a particular database (e.g. data structures, types, and constraints)
  - The description is called **meta-data**.
  - This allows the DBMS software to work with different database applications.
- **Insulation between programs and data:**
  - Called **program-data independence**.
  - Allows changing data structures and storage organization without having to change the DBMS access programs.

# Main Characteristics of the Database Approach (continued)

- **Data Abstraction:**
  - A **data model** is used to hide storage details and present the users with a conceptual view of the database.
  - Programs refer to the data model constructs rather than data storage details
- **Support of multiple views of the data:**
  - Each user may see a different view of the database, which describes **only** the data of interest to that user.

# Main Characteristics of the Database Approach (continued)

- **Sharing of data and multi-user transaction processing:**
  - Allowing a set of **concurrent users** to retrieve from and to update the database.
  - *Concurrency control* within the DBMS guarantees that each **transaction** is correctly executed or aborted
  - *Recovery* subsystem ensures each completed transaction has its effect permanently recorded in the database
  - **OLTP** (Online Transaction Processing) is a major part of database applications. This allows hundreds of concurrent transactions to execute per second.

# Additional Implications of Using the Database Approach

- Potential for enforcing standards:
  - This is very crucial for the success of database applications in large organizations. **Standards** refer to data item names, display formats, screens, report structures, meta-data (description of data), Web page layouts, etc.
- Reduced application development time:
  - Incremental time to add each new application is reduced.

# Additional Implications of Using the Database Approach (continued)

- Flexibility to change data structures:
  - Database structure may evolve as new requirements are defined.
- Availability of current information:
  - Extremely important for on-line transaction systems such as airline, hotel, car reservations.
- Economies of scale:
  - Wasteful overlap of resources and personnel can be avoided by consolidating data and applications across departments.

# Extending Database Capabilities

- New functionality is being added to DBMSs in the following areas:
  - Scientific Applications
  - XML (eXtensible Markup Language)
  - Image Storage and Management
  - Audio and Video Data Management
  - Data Warehousing and Data Mining
  - Spatial Data Management
  - Time Series and Historical Data Management
- The above gives rise to *new research and development* in incorporating new data types, complex data structures, new operations and storage and indexing schemes in database systems.



# When not to use a DBMS

- Main inhibitors (costs) of using a DBMS:
  - High initial investment and possible need for additional hardware.
  - Overhead for providing generality, security, concurrency control, recovery, and integrity functions.
- When a DBMS may be unnecessary:
  - If the database and applications are simple, well defined, and not expected to change.
  - If there are stringent real-time requirements that may not be met because of DBMS overhead.
  - If access to data by multiple users is not required.

# When not to use a DBMS

- When no DBMS may suffice:
  - If the database system is not able to handle the complexity of data because of modeling limitations
  - If the database users need special operations not supported by the DBMS.

# Database Users

- Users may be divided into
  - **Actors on the Scene:** Those who actually use and control the database content, and those who design, develop and maintain database applications.
  - **Workers Behind the Scene:** Those who design and develop the DBMS software and related tools, and the computer systems operators.

# Database Users

- Actors on the scene
  - **Database administrators:**
    - Responsible for authorizing access to the database, for coordinating and monitoring its use, acquiring software and hardware resources, controlling its use and monitoring efficiency of operations.

④ DBA ⇒ Centralized control of Database is exerted by a person or group of person under the supervision of high level Administrator. This person or group of persons referred as Database Administrator (DBA).

→ It is responsible for the technical operation of Database.

→ The main aim of DBA is to Design & maintain the Database system & provide access to the users.

Responsibilities of DBA ⇒

- ① Granting different types of Authorization which part of Database various users can access.
- ② Ensuring regular & accurate update of DB.
- ③ Identifying & resolving user's problem.

- (4) Schema & physical organisation Modification.
- (5) storage structure & access method Definition.
- (6) Maintaining Database Software & related Documents & tools.
- (7) Ensuring regular backup of DB.
- (8) Collaborating in the design & development of a Database to meet new users needs.

In other terms →

(1) Recovery from failure → DBA restoring the Database, If system fails DBA should keep backup

(2) Upgradation → It ~~should~~ should know changing requirement of user & make upgradation

(3) Authorization & security → unauthorized data access is not permitted.

(4) Availability → It means that authorized user can access & change data as needed to support the business ie 24x7 service in terms of H/W & H/W congestion.

- **Database Designers:**

- Responsible to define the content, the structure, the constraints, and functions or transactions against the database. They must communicate with the end-users and understand their needs.

# Categories of Users

## Classification of DBMS Users

- (7)
- ① Naive Users ⇒ who do not aware of the presence of the Database System.  
ie ⇒ ① Automatic Teller Machine (ATM) responds by giving a coded key. ② Users of menu oriented Application program.
  - ② Online Users ⇒ who may communicate with Database Directly via online Terminal ③ Indirectly via a user interface ④ Application program. They have limited ~~later~~ interaction.
  - ③ Application programmers ⇒ who are responsible for developing Application programs. ⑤ user interfaces utilized by the naive ⑥ online users. Application written in a programming language of C, COBOL etc & include commands required to manipulate DB.



# Categories of End-users

- Actors on the scene (continued)
  - **End-users:** They use the data for queries, reports and some of them update the database content. End-users can be categorized into:
    - **Casual:** access database occasionally when needed
    - **Naïve** or Parametric: they make up a large section of the end-user population.
      - They use previously well-defined functions in the form of “canned transactions” against the database.
      - Examples are bank-tellers or reservation clerks who do this activity for an entire shift of operations.

# Categories of End-users (continued)

- **Sophisticated:**

- These include business analysts, scientists, engineers, others thoroughly familiar with the system capabilities.
- Many use tools in the form of software packages that work closely with the stored database.

- **Stand-alone:**

- Mostly maintain personal databases using ready-to-use packaged applications.
- An example is a tax program user that creates its own internal database.
- Another example is a user that maintains an address book