1.Introduction to DBMS

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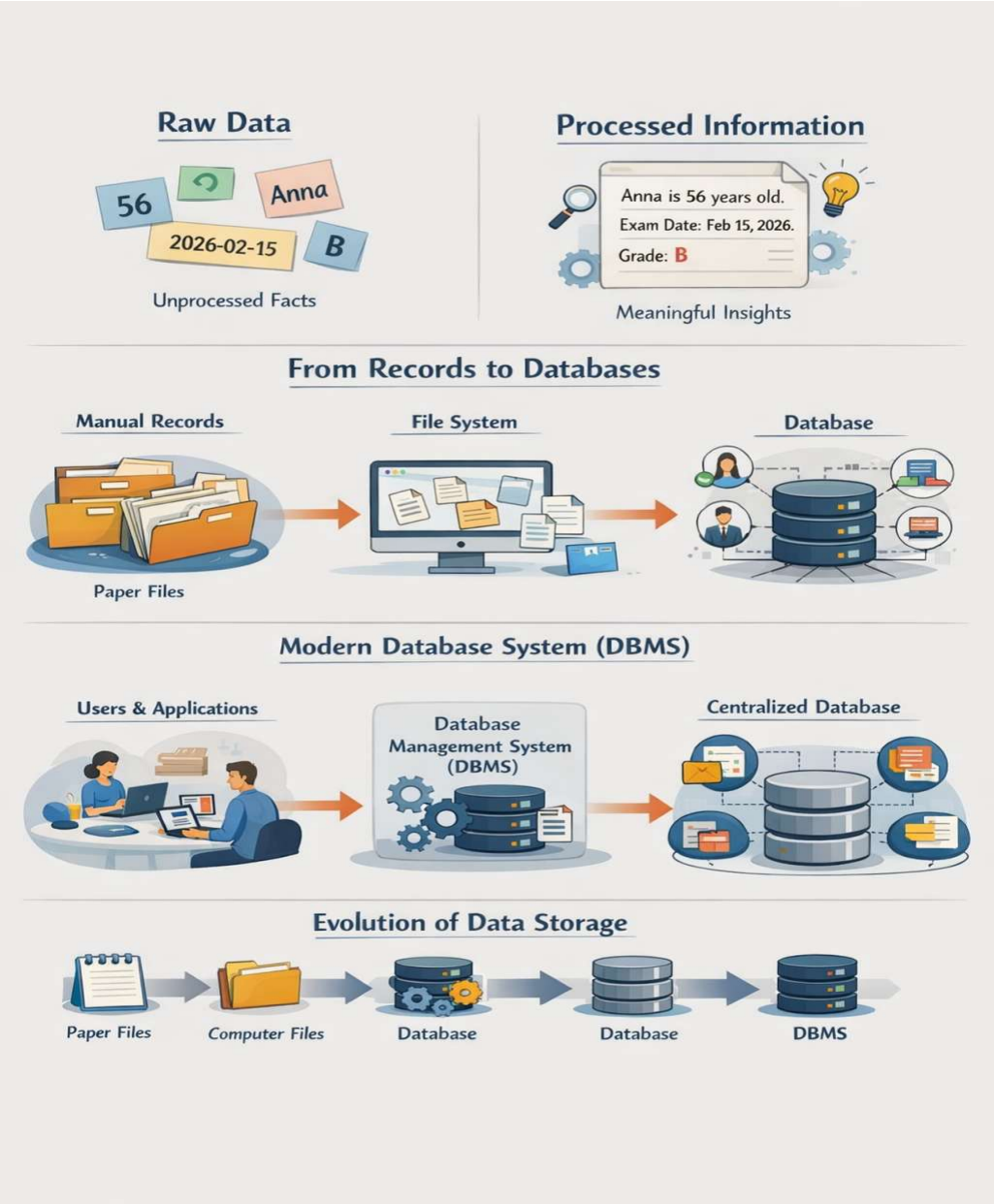

Data

Data refers to **raw, unprocessed facts and figures** that are collected from the real world. Data by itself does not convey any meaning because it lacks context and interpretation. It is simply a representation of observations, measurements, or values.

Data can exist in many forms:

- Numbers (age, salary, marks)
- Text (names, addresses)
- Symbols and characters
- Images, audio, and video
- Sensor readings and logs

For example, the value 72 could represent marks, temperature, weight, or a year. Without context, it is impossible to understand what this value actually means.

Data is usually collected automatically or manually and serves as the **basic input** for any system. At this stage, data is not suitable for decision-making

because it does not explain *what happened* or *why it matters*.
In simple terms, **data is potential knowledge**, but it has not yet been converted into something useful.

Information

Information is **processed, organized, and interpreted data** that has meaning and relevance. When data is placed into a context and analyzed, it becomes information.
Processing may include:

- Sorting
- Filtering
- Calculating
- Classifying
- Summarizing

For example:

- Data: 72
- Information: *The student scored 72 marks in Python*

Here, the data value is connected to a subject, an entity (student), and a condition (marks), which makes it meaningful.
Information helps answer important questions such as:

- Who?
- What?
- When?
- Where?
- How?

Unlike data, information is **useful for decision-making**. Managers, systems, and applications rely on information to plan, predict, and act.
In short:

Data is raw input, information is meaningful output.

Relationship Between Data and Information

Data and information are not separate entities; they are part of a continuous process.

Raw Data → Processing → Interpretation → Information

A system collects data, processes it using rules or logic, and produces information. Without data, information cannot exist. Without processing, data cannot become information.
This transformation is the foundation of all information systems.

Need for Data Storage

As human activities, organizations, and businesses expanded, the volume of data increased rapidly. Institutions such as schools, hospitals, banks, and governments needed to store information for long periods.
Some common reasons for storing data:

- Record keeping
- Legal compliance
- Analysis and reporting
- Future reference
- Automation of processes

However, storing data without proper organization created serious challenges, leading to the evolution of structured storage systems.

Early Data Storage: Manual File System

Before computers, data was stored manually using:

- Registers
- Files
- Ledgers
- Paper documents

Each record was written by hand and stored physically.

Problems with Manual Storage

- Searching for records was very slow
- High chance of human errors
- Difficult to update or correct data

- Data could be lost due to fire, water, or misplacement
- Not scalable for large organizations

As data volume increased, manual systems became impractical and inefficient.

Computer File System Approach

With the introduction of computers, data storage shifted to **electronic files** such as:

- Text files
- CSV files
- Excel sheets
- Binary files

Each application maintained its own set of files. This was faster than manual systems but introduced new problems.

Limitations of File Systems

- **Data redundancy**: Same data stored in multiple files
- **Data inconsistency**: Changes in one file not reflected in others
- **Poor data sharing**: Files were isolated per application
- **Lack of security**: No proper access control
- **Complex maintenance**: Large programs required to manage files

As systems grew larger, managing data through files became chaotic and error-prone

Birth of the Database Concept

To overcome the limitations of file systems, the concept of a **database** was introduced.
A database is a **centralized, structured collection of related data** that is stored electronically and shared across multiple applications.
Instead of each application managing its own files, all data is stored in one common location.
This approach ensures:

- Single source of truth
- Better organization
- Easier access and updates

Databases marked a major shift from application-centric data management to **data-centric systems**.
A database is an organized collection of data that is stored and managed electronically. It allows users to efficiently store, retrieve, update, and manage data. Databases are used to handle large amounts of information in various applications such as websites, business systems, and applications. Example: A customer database in an e-commerce website may store customer details like name, email, contact number, and purchase history.

Database Management System (DBMS)

A Database Management System (DBMS) is software that provides an interface between users/applications and the database.
The DBMS is responsible for:

- Defining data structure
- Storing data efficiently
- Retrieving data quickly
- Updating and deleting records
- Managing concurrent access
- Enforcing security rules
- Maintaining data integrity

Users interact with the database **only through the DBMS**, not directly with the data files.
Examples of DBMS:

- MySQL
- PostgreSQL
- Oracle
- SQL Server
- MongoDB

Advantages of Databases Over File Systems

Databases solved major file system problems:

- Reduced data redundancy
- Improved data consistency
- Centralized control

- Better data security
- Faster query processing
- Support for multiple users
- Logical relationships between data

This made databases essential for modern applications.

Real-World Relevance

Modern systems like:

- Banking applications
- E-commerce platforms
- Social media apps
- Cloud services

All rely on databases to handle massive amounts of data reliably and securely.