Traditional File System vs DBMS

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1. What is a Traditional File System?

- **Definition:** Stores and manages data directly on the OS using files and folders (e.g., text files or Excel sheets).

- **Example:** EmployeeData.txt and Sales2023.csv.

- **Limitation:** Simple but prone to significant drawbacks.

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2. What is a Database Management System (DBMS)?

- **Definition:** Software for efficient storage, retrieval, and management of data.

- **Features:**

    o   Organizes data in tables.

    o   Accesses data using SQL queries (e.g., SELECT * FROM Employees).

    o   Ensures data security and integrity.

- **Examples:** MySQL, PostgreSQL, Oracle DB.

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3. Limitations of Traditional File Systems

1. **Data Redundancy and Inconsistency:**

    o   **Issue:** Duplicate data across files leads to inconsistencies.

    o   **DBMS Solution:** Eliminates redundancy via normalization.

2. **Difficulty in Accessing Data:**

    o   **Issue:** Requires custom programs to fetch specific data.

    o   **DBMS Solution:** Simple SQL queries enable fast data retrieval.

3. **Data Isolation:**

    o   **Issue:** Scattered data across files makes relationships hard to establish.

    o   **DBMS Solution:** Centralizes data, linking tables for easy access.

4. **Integrity Problems:**

    o   **Issue:** Enforcing data rules (e.g., "salary cannot be negative") is complex.

    o   **DBMS Solution:** Uses constraints to maintain accuracy and validity.

5. **Atomicity Problems:**

    o   **Issue:** Partial updates due to process failure cause corruption.

- o **DBMS Solution:** Ensures reliable transactions with ACID properties.

6. **Concurrent-Access Anomalies:**

    - o **Issue:** Simultaneous updates lead to data corruption (e.g., two processes updating the same file).

    - o **DBMS Solution:** Prevents conflicts with isolation mechanisms.

7. **Security Problems:**

    - o **Issue:** Relies on basic OS-level security, which is inadequate.

    - o **DBMS Solution:** Provides advanced security features like authentication, role-based permissions, and encryption.

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4. When to Use File Systems vs DBMS

- **File Systems:** Best for simple tasks (e.g., storing documents, images, or configurations).

- **DBMS:** Ideal for managing structured data requiring security, scalability, and transactions.

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5. Summary

- **File Systems:**

    - o Simpler but has limitations like redundancy, inconsistency, isolation, and lack of security.

- **DBMS Advantages:**

    - o **Data Redundancy & Consistency:** Eliminates duplicates and ensures consistency.

    - o **Accessibility:** Enables fast and simple data retrieval with SQL.

    - o **Centralization:** Links data easily.

    - o **Integrity:** Maintains accuracy with constraints.

    - o **Atomicity:** Ensures reliable transactions.

    - o **Concurrent Access:** Handles simultaneous updates safely.

    - o **Security:** Robust user-based access control and encryption.

Conclusion: DBMS is the preferred choice for structured and complex data management.