# DBMS

## Problem Statement

Imagine you run a railway ticket booking system using a file-based system. Every time a user searches for a ticket, the entire file (say 25GB) is loaded instead of fetching only the required 1KB of data. This leads to slow performance, high memory usage, and inefficient data retrieval. Also, multiple users booking tickets at the same time can cause data inconsistency. Also, the access management would be difficult for data inside the file or there can be small file issues.

* **Problem: File System Limitations**
  + **Slow Data Retrieval:** No indexing requires full file scan (O(n) complexity). E.g., fetching 1KB from a 20GB file needs reading the entire file.
  + **Manual Data Management:** Users must track file locations manually, leading to human errors.
  + **No Concurrency Control:** Two users editing the same file can cause overwrites and corruption.
  + **Data Redundancy:** No normalization, leading to duplicate records and wasted storage.
  + **Lack of Security & Access Control:** No granular permissions; entire files are accessible if shared.
* **Solution: DBMS Advantages**
  + **Optimized Retrieval:** Uses indexing and B-Trees for O(log n) lookup time instead of O(n).
  + **Abstracted Storage:** Users query data via SQL without knowing file locations.
  + **Concurrency Management:** Implements ACID properties to prevent data corruption.
  + **Data Normalization:** Eliminates redundancy using keys and constraints.
  + **Role-Based Access Control:** Provides fine-grained access, ensuring security.

## Which DBMS types to choose?

DBMS systems can be categorized into several types:

1. **Relational DBMS (RDBMS)**: Stores data in tables with rows and columns. Examples: MySQL, PostgreSQL, Oracle.
2. **NoSQL DBMS**: Handles unstructured or semi-structured data. Examples: MongoDB, Cassandra, Redis.
3. **Hierarchical DBMS**: Organizes data in a tree-like structure. Example: IBM IMS.
4. **Network DBMS**: Represents data as a graph. Example: IDMS.
5. **Object-Oriented DBMS**: Stores data as objects. Example: ObjectDB.