Data storage and Querying

* How tables are actually stored in HDD by Database software?

Although a database system provides a high-level view of data, ultimately data have to be stored as bits on one or more storage devices. A vast majority of databases today store data on magnetic disk (and, increasingly, on flash storage) and fetch data into main memory for processing, or copy data onto tapes and other backup devices for archival storage. The physical characteristics of storage devices play a major role in the way data are stored, in particular because access to a random piece of data on disk is much slower than memory access. Disk access takes tens of milliseconds, whereas memory access takes a tenth of a microsecond.

Hierarchy

Databases

⇓

Files

⇓

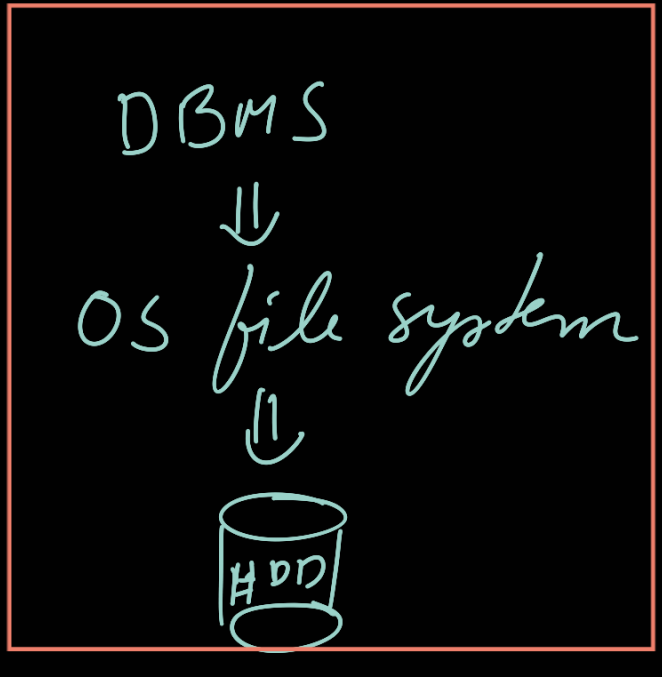
Records → Tuple/rows

⇓

Fields/columns/attributes

User queries have to be executed on the database contents, which reside on storage devices. It is usually convenient to break up queries into smaller operations, roughly corresponding to the relational-algebra operations. Chapter 12

* We have learnt how files/BLOB are stored by file system
* But how records inside a file is structured and stored in harddisk
* DBMS works on top of OS file system



In preceding chapters, we have emphasized the higher-level models of a database. For example, at the *conceptual* or *logical* level, we viewed the database, in the relational model, as a collection of tables. Indeed, the logical model of the database is the correct level for database *users* to focus on. This is because the goal of a database system is to simplify and facilitate access to data; users of the system should not be burdened unnecessarily with the physical details of the implementation of the system.

RAID (Redundant Array of Independent Disks) is a data storage virtualization technology that combines multiple physical disks into a single logical unit to improve performance, provide redundancy, or both. It's commonly used in servers and storage systems to protect data from hardware failures and to enhance read/write speeds.

Key RAID Concepts

1. **Redundancy**:
    - Some RAID configurations offer redundancy by storing data across multiple disks in ways that protect against data loss if a disk fails.
2. **Performance**:
    - Certain RAID levels enhance read and/or write speeds by spreading data across multiple disks, allowing data to be accessed or written to several disks simultaneously.
3. **Fault Tolerance**:
    - By storing data in a way that allows recovery after a disk failure, RAID can improve data reliability and uptime.