DBMS NOTES – SV

[donnemartin/system-design-primer: Learn how to design large-scale systems. Prep for the system design interview. Includes Anki flashcards. (github.com)](https://github.com/donnemartin/system-design-primer#database)

A **database** is an organized collection of data, so that it can be easily accessed and managed. Eg. MySQL, Oracle, MongoDB, PostgreSQL, SQL Server.

| **SQL** | **NoSQL** |
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| Relational DBMS | Non-relational / distributed DBMS. |
| Fixed or predefined schema | Dynamic schema |
| Not suited for hierarchical data storage. | Suited for hierarchical data storage. |
| Suited for complex queries. TABLE BASED. | Not so good for complex queries. KEY-VALUE / GRAPH / DOCUMENT BASED. |
| Vertically Scalable – (New resources are added in the existing system to meet the expectation.) | Horizontally scalable – (New server racks are added in the existing system to meet the higher expectation.) |
| Follows ACID property(Atomicity, Consistency, Isolation, Durability)  [EG: MYSQL, POSTGRESQL] | Follows CAP(consistency, availability, partition tolerance)  [EG. MONGODB, REDIS] |

**Advantages of cloud database like (GCP, AWS, Oracle DB): Lower costs, Automated & accessible.**

**DBMS** is a software for storing and retrieving users' data with proper security measures.

Four Types of DBMS systems are:

* Hierarchical database (data in tree like structure, parent-child relation)
* Network database (entities organized in graph like… accessed by several paths… child may have multiple parents)
* Relational database (most used… normalized data in rows/cols.)
* Object-Oriented database(data stored in objects & structure which is called classes.)

Need for DBMS

* Create/retrieve/update/manage db…
* Processing Queries
* Controlling redundancy and inconsistency
* Efficient memory management and indexing
* Concurrency control and transaction management
* Access Control and ease in accessing data
* Integrity constraints

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| **DBMS** | **File System** |
| DBMS is a collection of data but user need not write the procedures. | Also a collection of data, but user has to write the procedures for managing the database. |
| DBMS gives an abstract view of data that hides the details. | File system provides the detail of the data representation and storage of data. |
| DBMS provides a crash recovery mechanism, i.e., DBMS protects the user from the system failure. | File system doesn't have a crash mechanism, i.e., if the system crashes while entering some data, then the content of the file will lost. |
| DBMS provides a good protection mechanism. | It is very difficult to protect a file under the file system. |
| DBMS contains a wide variety of sophisticated techniques to store and retrieve the data. | File system can't efficiently store and retrieve the data. |
| DBMS takes care of Concurrent access of data using some form of locking. | In the File system, concurrent access has many problems like redirecting the file while other deleting some information or updating some information. |

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| S.NO | Two-Tier Database Architecture | Three-Tier Database Architecture |
| 1 | It is a Client-Server Architecture. | It is a Web-based application. |
| 2 | In two-tier, the application logic is either buried inside the user interface on the client or within the database on the server (or both). | In three-tier, the application logic or process resides in the middle-tier, it is separated from the data and the user interface. |
| 3 | Two-tier architecture consists of two layers : Client Tier and Database (Data Tier). | Three-tier architecture consists of three layers : Client Layer, Business Layer and Data Layer. |
| 4 | It is easy to build and maintain. | It is complex to build and maintain. |
| 5 | Two-tier architecture runs slower. | Three-tier architecture runs faster. |
| 6 | It is less secured as client can communicate with database directly. | It is secured as client is not allowed to communicate with database directly. |
| 7 | It results in performance loss whenever the users increase rapidly. | It results in performance loss whenever the system is run on Internet but gives more performance than two-tier architecture. |
| 8 | Example – Contact Management System created using MS-Access or Railway Reservation System, etc. | Example – Designing registration form which contains text box, label, button or a large website on the Internet, etc. |

Functions of a **DBA** include

* **Schema deﬁnition**.The DBA creates the original database schema by executing a set of data deﬁnition statements in the DDL.
* **Storage structure and access-method deﬁnition.**
* **Schema and physical-organization modiﬁcation**.The DBA carries out changes to the schema and physical organization to reﬂect the changing needs of the organization, or to alter the physical organization to improve performance.
* **Granting of authorization for data access.** By granting different types of authorization, the database administrator can regulate which parts of the database various users can access. The authorization information is kept in a special system structure that the database system consults when ever someone attempts to access the data in the system.
* **Routine maintenance**. Examples of the database administrator’s routine maintenance activities are:

1. Periodically backing up the database, either onto tapes or onto remote servers, to prevent loss of data in case of disasters such as ﬂooding.
2. Ensuring that enough free disk space is available for normal operations, and upgrading disk space as required.
3. Monitoring jobs running on the database and ensuring that performance is not degraded by very expensive tasks submitted by some users.