Database & Types of DBs?

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- Database is an organized collection of data stored in a computer system and is usually controlled by a Database Management Sy stem (DBMS).

- In a database, data is organized in tables consisting of rows and columns and it is indexed so data can be easily accessible.

- The data is stored in tabular format as shown below:

Id	Name	Age	Sex
1	Mike	22	M
2	Rose	21	F
3	Jay	24	M
4	Martha	22	F
5	Joe	20	M

- Types of Databases:

  Although there are different types of databases, we will mainly focus on the below two:

  a. SQL Databases

  b. NoSQL Databases

  a. SQL Databases -

   i. SQL database or relational database is a collection of highly structured tables, wherein each row reflects a data entity, and every column defines a specific information field.

   ii. Relational databases are built using the structured query language (SQL) to create, store, update, and retrieve data.

   iii. Therefore, SQL is the underlying programming language for all relational database management systems (RDBMS) such as MySQL, Oracle, Microsoft SQL Server.

  b. NoSQL Databases -

   i. NoSQL is a type of database management system (DBMS) that is designed to handle and store large volumes of unstructured and semi-structured data.

   ii. Unlike traditional relational databases that use tables with pre-defined schemas to store data, NoSQL databases use flexible data models that can adapt to changes in data structures and are capable of scaling horizontally to handle growing amounts of data.

   iii. The term NoSQL originally referred to "non-SQL" or "non-relational" databases, but the term has since evolved to mean "not only SQL," as NoSQL databases have expanded to include a wide range of different database architectures and data models.

- NoSQL Databases are generally classified into four main categories:

  a. Document databases -

   i. These databases store data as semi-structured documents, such as JSON/XML, and can be queried using document-oriented query languages.

  b. Key-value stores -

   i. These databases store data as key-value pairs, and are optimized for simple read/write operations.

  c. Column-family stores -

   i. These databases store data as column families, which are sets of columns that are treated as a single entity. They are optimized for fast and efficient querying of large amounts of data.

  d. Graph databases -

   i. These databases store data as nodes and edges, and are designed to handle complex relationships between data.

- NoSQL databases are often used in applications where there is a high volume of data that needs to be processed and analyzed i n real-time, such as social media analytics, e-commerce, and gaming. They can also be used for other applications, such as content management systems, document management, and customer relationship management.

# SQL vs NoSQL Database

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The table below summarizes the main differences between SQL and NoSQL databases.

	SQL Databases	NoSQL Databases
Data Storage Model	Tables with fixed rows and columns	Document: JSON documents, Key-value: key-value pairs, Wide-column: tables with rows and dynamic columns, Graph: nodes and edges
Development History	Developed in the 1970s with a focus on reducing data duplication	Developed in the late 2000s with a focus on scaling and allowing for rapid application change driven by agile and DevOps practices.
Examples	Oracle, MySQL, Microsoft SQL Server, and PostgreSQL	Document: MongoDB and CouchDB, Key-value: Redis and DynamoDB, Wide-column: Cassandra and HBase, Graph: Neo4j and Amazon Neptune
Primary Purpose	General purpose	Document: general purpose, Key-value: large amounts of data with simple lookup queries, Wide-column: large amounts of data with predictable query patterns, Graph: analysing and traversing relationships between connected data
Schemas	Rigid	Flexible
Scaling	Vertical (scale-up with a larger server)	Horizontal (scale-out across commodity servers)
Multi-Record ACID Transactions	Supported	Most do not support multi-record ACID transactions. However, some — like MongoDB — do.
Joins	Typically required	Typically not required
Data to Object Mapping	Requires ORM (object-relational mapping)	Many do not require ORMs. MongoDB documents map directly to data structures in most popular programming languages.

What is MongoDB?

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- MongoDB is an open-source document-oriented database that is designed to store a large scale of data and also allows you to work with that data very efficiently.

- Link to Mongo Atlas - https://www.mongodb.com/cloud/atlas/register

- It is categorized under the NoSQL (Not only SQL) database because the storage and retrieval of data in the MongoDB are not in the form of tables.

- The MongoDB database is developed and managed by MongoDB.Inc under SSPL(Server Side Public License) and initially released in February 2009.

- It also provides official driver support for all the popular languages like C, C++, C#, and .NET, Go, Java, Node.js, Perl, PHP, Python, Motor, Ruby, Scala, Swift.

- Nowadays there are so many companies that used MongoDB like Facebook, Nokia, eBay, Adobe, Google, etc. to store their large amount of data.

- As we know that MongoDB is a database server and the data is stored in these databases. Or in other words, MongoDB environment gives you a server that you can start and then create multiple databases on it using MongoDB.

- Because of its NoSQL database, the data is stored in the collections and documents. Hence the database, collection, and documents are related to each other as shown below:
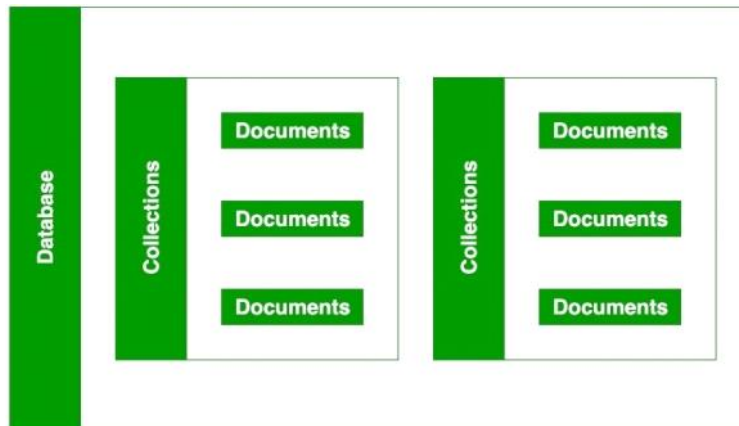
- The MongoDB database contains collections just like the MYSQL database contains tables. You are allowed to create multiple databases and multiple collections.

- Now inside of the collection we have documents. These documents contain the data we want to store in the MongoDB database and a single collection can contain multiple documents and you are schema-less means it is not necessary that one document is similar to another.

- The documents are created using the fields. Fields are key-value pairs in the documents, it is just like columns in the relation database. The value of the fields can be of any BSON data types like double, string, Boolean, etc.

- The data stored in the MongoDB is in the format of BSON documents. Here, BSON stands for Binary representation of JSON documents. Or in other words, in the backend, the MongoDB server converts the JSON data into a binary form that is known as BSON and this BSON is stored and queried more efficiently.

- In MongoDB documents, you are allowed to store nested data. This nesting of data allows you to create

complex relations between data and store them in the same document which makes the working and fetching of data extremely efficient as compared to SQL. In SQL, you need to write complex joins to get the data from table 1 and table 2. The maximum size of the BSON document is 16MB.

Pros & Cons

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Advantages of MongoDB :

- It is a schema-less NoSQL database. You need not to design the schema of the database when you are working with MongoDB.
- It does not support join operation.
- It provides great flexibility to the fields in the documents.
- It contains heterogeneous data.
- It provides high performance, availability, scalability.
- It supports Geospatial efficiently.
- It is a document oriented database and the data is stored in BSON documents.

Disadvantages of MongoDB :

- It uses high memory for data storage.
- You are not allowed to store more than 16MB data in the documents.
- The nesting of data in BSON is also limited you are not allowed to nest data more than 100 levels.