Relational Databases

A relational database management system (RDBMS) is a database management system that is based on the relational model. It has the following major components: Table, Record / Tuple / Row, field and column / attribute. Example of the most popular RDBMS are MySQL, Oracle, IBM DB2 and Microsoft SQL server database.

Relational databases have the following properties:

- Values are atomic
- All of the values in a column have the same data type.
- Each row is unique.
- The sequence of column is insignificant
- The sequence of rows is insignificant
- Each column has a unique name.
- Integrity constraints maintain data consistency across multiple tables.

Database Indexes

A database index is a data structure that improves the speed of data retrieval operations on a database table. Indexes are used to quickly locate data without having to search the entire table, making them essential for efficient database performance, especially when working with large datasets.

Indexes Working

Indexes work by creating a separate structure that maps the values of a specific column or set of columns to the corresponding row locations in the table. When a query is executed, the database engine can use the index to directly access the relevant rows without having to scan the particularly for queries that involve searching for specific values or range of values.

Types of Index

① → B-Tree Indexes
- ↳ Most commonly used type of index.
- ↳ They are balanced, meaning that the data is distributed evenly across the index, ensuring efficient access.

② → Hash Indexes
- ↳ Uses hashing function to map column values to their corresponding row locations.
- ↳ They provide fast lookups based on the exact value of a column, but they do not support range queries.

③ → Bitmap Indexes
- ↳ Uses bit array to represent the presence or absence of a value in a column for each row in the table.
- ↳ They are particularly useful for queries that involve multiple equality comparisons on the same column.

Benefits of Indexes

- → Improved performance
- → Efficient resource utilization
- → Scalability
- → Optimized Query execution

NOSQL Databases

NoSQL databases are a type of databases that provide a different approach to data storage and management compared to traditional relational databases like SQL. NoSQL databases are designed to handle large amounts of data and offer flexibility in data modeling, scalability & performance.

Unlike relational databases, which organize data in tables with predefined schemas, NoSQL databases uses different data models such as key-value stores, document stores, wide-column stores or graph databases.

NoSQL databases are often used for applications that require high availability, real-time processing or the ability to handle massive amounts of data. They are commonly employed in web applications, mobile app development, big data analytics and IoT (Internet of Things) systems.