

What is Database?

A database is an organized collection of data stored in a computer system and usually controlled by a database management system (DBMS). The data in common databases is modeled in tables, making querying and processing efficient. Structured query language (SQL) is commonly used for data querying and writing.

The Database is an essential part of our life. We encounter several activities that involve our interaction with databases, for example in the bank, in the railway station, in school, in a grocery store, etc. These are the instances where we need to store a large amount of data in one place and fetch these data easily.

Application: Company Information, Account information, manufacturing, banking, finance transactions, telecommunications.

In a database, data is organized into tables consisting of rows and columns and it is indexed so data can be updated, expanded, and deleted easily. Computer databases typically contain file records data like transactions money in one bank

account to another bank account, sales and customer details, fee details of students, and product details. There are different kinds of databases, ranging from the most prevalent approach, the relational database, to a distributed database, cloud database, and NoSQL databases.

Relational Database: A relational database is made up of a set of tables with data that fits into a predefined category.

Distributed Database: A distributed database is a database in which portions of the database are stored in multiple physical locations, and in which processing is dispersed or replicated among different points in a network.

Cloud Database: A cloud database is a database that typically runs on a cloud computing platform. Database service provides access to the database. Database services make the underlying software stack transparent to the user.

What is DBMS?

Collection of interrelated data and set of programs to access data example – MySQL, Oracle.

An interface for operations like creation, deletion, modification, etc is provided by DBMS.


DBMS allows the user to create their databases as per their requirement.

DBMS accepts the request from the application and provides specific data through the operating system.

DBMS contains a group of programs that acts according to the user's instruction.


It provides security to the database.

Database



Database is **collection of data** in a format that can be easily accessed (Digital)

A software application used to manage our DB is called DBMS (**Database Management System**)



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graph LR; User((User)) --> DBMS[DBMS]; DBMS --> DB[DB]
```

- **Data modeling:** A DBMS provides tools for creating and modifying data models, which define the structure and relationships of the data in a database.
- **Data storage and retrieval:** A DBMS is responsible for storing and retrieving data from the database, and can provide various methods for searching and querying the data.
- **Concurrency control:** A DBMS provides mechanisms for controlling concurrent access to the database, to ensure that multiple users can access the data without conflicting with each other.
- **Data integrity and security:** A DBMS provides tools for enforcing data integrity and security constraints, such as constraints on the values of data and access controls that restrict who can access the data.
- **Backup and recovery:** A DBMS provides mechanisms for backing up and recovering the data in the event of a system failure.
- **DBMS can be classified into two types:** Relational Database Management System (RDBMS) and Non-Relational Database Management System (NoSQL or Non-SQL)
- **RDBMS:** Data is organized in the form of tables and each table has a set of rows and columns. The data are related to each other through primary and foreign keys.
- **NoSQL:** Data is organized in the form of key-value pairs, documents, graphs, or column-based. These are designed to handle large-scale, high-performance scenarios.

Types of Databases

Relational RDBMS

Data stored in tables



Non-relational (NoSQL)

data not stored in tables



** We use SQL to work with relational DBMS

Database Languages

- Data Definition Language
- Data Manipulation Language

- Data Control Language
- Transactional Control Language

Data Definition Language

DDL is the short name for Data Definition Language, which deals with database schemas and descriptions, of how the data should reside in the database.

- **CREATE:** to create a database and its objects like (table, index, views, store procedure, function, and triggers)
- **ALTER:** alters the structure of the existing database
- **DROP:** delete objects from the database
- **TRUNCATE:** remove all records from a table, including all spaces allocated for the records are removed
- **COMMENT:** add comments to the data dictionary
- **RENAME:** rename an object

Data Manipulation Language

DML is the short name for Data Manipulation Language which deals with data manipulation and includes most common SQL statements such SELECT, INSERT, UPDATE, DELETE, etc., and it is used to store, modify, retrieve, delete and update data in a database. **Data query language(DQL)** is the subset of “Data Manipulation Language”. The most common command of DQL is **SELECT** statement. SELECT statement help on retrieving

the data from the table without changing anything in the table.

- **SELECT:** retrieve data from a database
- **INSERT:** insert data into a table
- **UPDATE:** updates existing data within a table
- **DELETE:** Delete all records from a database table
- **MERGE:** UPSERT operation (insert or update)
- **CALL:** call a PL/SQL or Java subprogram
- **EXPLAIN PLAN:** interpretation of the data access path
- **LOCK TABLE:** concurrency Control

Data Control Language

DCL is short for Data Control Language which acts as an access specifier to the database.(basically to grant and revoke permissions to users in the database

- **GRANT:** grant permissions to the user for running DML(SELECT, INSERT, DELETE,...) commands on the table
- **REVOKE:** revoke permissions to the user for running DML(SELECT, INSERT, DELETE,...) command on the specified table

Transactional Control Language

TCL is short for Transactional Control Language which acts as a manager for all types of transactional data and all transactions. Some of the commands of TCL are

- **Roll Back:** Used to cancel or Undo changes made in the database
- **Commit:** It is used to apply or save changes in the database
- **Save Point:** It is used to save the data on the temporary basis in the database

Data Query Language (DQL):

Data query language (DQL) is the subset of “**Data Manipulation Language**”. The most common command of DQL is the **SELECT statement**. **SELECT** statement helps us in retrieving the data from the table without changing anything or modifying the table. DQL is very important for retrieval of essential data from a database.

SEQUEL

Structured

English

Query

Language

SQL

Structured

Query

Language

What is SQL

SQL stands for Structured Query Language. SQL is a computer language used to interact with relational database systems. SQL is a tool for organizing, managing, and retrieving archived data from a computer database.

When data needs to be retrieved from a database, SQL is used to make the request. The DBMS processes the SQL query retrieves the requested data and returns it to us. Rather, SQL statements describe how a collection of data should be organized or what data should be extracted or added to the database.

SQL का मतलब है स्ट्रक्चर्ड क्वेरी लैंग्वेज। SQL एक कंप्यूटर भाषा है जिसका उपयोग रिलेशनल डेटाबेस सिस्टम के साथ बातचीत करने के लिए किया जाता है। SQL एक कंप्यूटर डेटाबेस से संग्रहीत डेटा को व्यवस्थित करने, प्रबंधित करने और पुनर्प्राप्त करने के लिए एक उपकरण है।

जब डेटाबेस से डेटा पुनर्प्राप्त करने की आवश्यकता होती है, तो अनुरोध करने के लिए SQL का उपयोग किया जाता है। DBMS SQL क्वेरी को संसाधित करता है, अनुरोधित डेटा को पुनर्प्राप्त करता है और इसे हमें वापस करता है। इसके बजाय, SQL कथन वर्णन करते हैं कि डेटा के संग्रह को कैसे व्यवस्थित किया जाना चाहिए या डेटाबेस में कौन सा डेटा निकाला या जोड़ा जाना चाहिए।

Components of a SQL System

Databases

Databases are structured collections of data organized into tables, rows, and columns. They serve as repositories for storing information efficiently and provide a way to manage and access data.

Tables

Tables are the fundamental building blocks of a database, consisting of rows (records) and columns (attributes or fields). They ensure data integrity and consistency by defining the structure and relationships of the stored information.

Queries

Queries are SQL commands used to interact with databases. They enable users to retrieve, update, insert, or delete data from tables, allowing for efficient data manipulation and retrieval.

Constraints

[Constraints](#) are rules applied to tables to maintain data integrity. They define conditions that data must meet to be stored in the database, ensuring accuracy and consistency.

Stored Procedures

[Stored procedures](#) are pre-compiled SQL statements stored in the database. They can accept parameters, execute complex operations, and return results, enhancing efficiency, reusability, and security in database management.

Transactions

[Transactions](#) are groups of SQL statements that are executed as a single unit of work. They ensure data consistency and integrity by allowing for the rollback of changes if any part of the transaction fails.

Some other important components include:

- Data Types
- Indexes
- Views
- Security and Permissions
- Joins

What are the characteristics of SQL?

SQL may be utilized by quite a number of users, which include people with very little programming experience.

SQL is a non-procedural language.

We can without difficulty create and replace databases in SQL. It isn't a time-consuming process.

SQL is primarily based totally on ANSI standards.

SQL does now no longer have a continuation individual.

SQL is entered into the SQL buffer on one or more lines.

SQL makes use of a termination individual to execute instructions immediately. It makes use of features to carry out a few formatting.

It uses functions to perform some formatting.

How SQL Works?

A server machine is used in the implementation of the structured query language (SQL), processing database queries and returning results. The following are some of the software elements that the SQL process goes through.

स्ट्रक्चर्ड क्वेरी लैंग्वेज (SQL) के क्रियान्वयन, डेटाबेस क्वेरी को प्रोसेस करने और परिणाम लौटाने में सर्वर मशीन का उपयोग किया जाता है। SQL प्रक्रिया में निम्नलिखित कुछ सॉफ्टवेयर तत्व शामिल हैं।

Parser

The parser begins by replacing some of the words in the SQL statement with unique symbols, a process known as tokenization. The statement is then examined for the following:

पार्सर SQL कथन में कुछ शब्दों को अद्वितीय प्रतीकों से बदलकर शुरू होता है, जिसे टोकनाइजेशन के रूप में जाना जाता है। फिर कथन की निम्नलिखित के लिए जाँच की जाती है:

Correctness

The parser checks to see if the SQL statement complies with the rules, or SQL semantics, that guarantee the query statement's accuracy. The parser, for instance, looks to see if the SQL command ends with a semicolon. The parser returns an error if the semi-colon is absent.

पार्सर यह देखने के लिए जाँच करता है कि SQL कथन उन नियमों या SQL शब्दार्थों का अनुपालन करता है या नहीं, जो क्वेरी कथन की सटीकता की गारंटी देते हैं। उदाहरण के लिए, पार्सर यह देखता है कि SQL कमांड अर्धविराम के साथ समाप्त होता है या नहीं। अर्धविराम अनुपस्थित होने पर पार्सर एक त्रुटि देता है।

Authorization

The parser additionally confirms that the user executing the query has the required permissions to alter the relevant data.

पार्सर अतिरिक्त रूप से पुष्टि करता है कि क्वेरी निष्पादित करने वाले उपयोगकर्ता के पास प्रासंगिक डेटा को बदलने के लिए आवश्यक अनुमतियाँ हैं।

Relational Engine

The relational engine, also known as the query processor, develops a strategy for efficiently retrieving, writing, or updating relevant data. For instance, it looks for queries that are similar to others, uses earlier data manipulation techniques, or develops a new one. Byte code, an intermediate-level representation of the SQL statement, is used to write the plan. To efficiently perform database searches and modifications, relational databases use byte code.

रिलेशनल इंजन, जिसे क्वेरी प्रोसेसर के रूप में भी जाना जाता है, प्रासंगिक डेटा को कुशलतापूर्वक पुनर्प्राप्त करने, लिखने या अपडेट करने के लिए एक रणनीति विकसित करता है। उदाहरण के लिए, यह उन क्वेरीज़ की तलाश करता है जो दूसरों के समान हैं, पहले की डेटा हेरफेर तकनीकों का उपयोग करता है, या एक नई तकनीक विकसित करता है। SQL कथन का एक मध्यवर्ती-स्तरीय प्रतिनिधित्व, बाइट कोड, योजना लिखने के लिए उपयोग किया जाता है। डेटाबेस खोजों और संशोधनों को कुशलतापूर्वक निष्पादित करने के लिए, रिलेशनल डेटाबेस बाइट कोड का उपयोग करते हैं।

Storage Engine

The software element that interprets the byte code and executes the intended SQL statement is known as the storage engine, also known as the database engine. The data in the database files on the physical disc storage is read and stored. The storage engine delivers the outcome to the requesting application after completion.

सॉफ्टवेयर तत्व जो बाइट कोड की व्याख्या करता है और इच्छित SQL कथन को निष्पादित करता है, उसे स्टोरेज इंजन के रूप में जाना जाता है, जिसे डेटाबेस इंजन के रूप में भी जाना जाता है। भौतिक डिस्क स्टोरेज पर डेटाबेस फ़ाइलों में डेटा पढ़ा और संग्रहीत किया जाता है। स्टोरेज इंजन पूरा होने के बाद अनुरोध करने वाले एप्लिकेशन को परिणाम वितरित करता है।

SQL Rules

The rules for writing SQL queries are given below:

- A ';' is used to end SQL statements.

- Statements may be split across lines, but keywords may not.
- Identifiers, operator names, and literals are separated by one or more spaces or other delimiters.
- A comma (,) separates parameters without a clause.
- A space separates a clause.
- Reserved words cannot be used as identifiers unless enclosed with double quotes.
- Identifiers can contain up to 30 characters.
- Identifiers must start with an alphabetic character.
- Characters and date literals must be enclosed within single quotes.
- Numeric literals can be represented by simple values.
- Comments may be enclosed between /* and */ symbols and maybe multi-line.

Uses of SQL:

1. Data definition
2. Data retrieval
3. Data manipulation
4. Access control
5. Data sharing

SQL Injection

A cyberattack known as SQL injection involves tricking the database with SQL queries. To retrieve, alter, or corrupt data in a SQL database, hackers use SQL injection. To execute a SQL injection attack, for instance, they might enter a SQL query in place of a person's name in a submission form.