

SQL

SQL

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is a domain-specific language used to manage data, especially in a relational database management system (RDBMS). It is particularly useful in handling structured data, i.e., data incorporating relations among entities and variables.

Introduced in the 1970s, SQL offered two main advantages over older read–write APIs such as ISAM or VSAM. Firstly, it introduced the concept of accessing many records with one single command. Secondly, it eliminates the need to specify how to reach a record, i.e., with or without an index.

Originally based upon relational algebra and tuple relational calculus, SQL consists of many types of statements, which may be informally classed as sublanguages, commonly: data query language (DQL), data definition language (DDL), data control language (DCL), and data manipulation language (DML).

The scope of SQL includes data query, data manipulation (insert, update, and delete), data definition (schema creation and modification), and data access control. Although SQL is essentially a declarative language (4GL), it also includes procedural elements.

SQL was one of the first commercial languages to use Edgar F. Codd's relational model. The model was described in his influential 1970 paper, "A Relational Model of Data for Large Shared Data Banks". Despite not entirely adhering to the relational model as described by Codd, SQL became the most widely used database language.

SQL became a standard of the American National Standards Institute (ANSI) in 1986 and of the International Organization for Standardization (ISO) in 1987. Since then, the standard has been revised multiple times to include a larger set of features and incorporate common extensions. Despite the existence of standards, virtually no implementations in existence adhere to it fully, and most SQL code requires at least some changes before being ported to different database systems.

NoSQL

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NoSQL (originally meaning "Not only SQL" or "non-relational") refers to a type of database design that stores and retrieves data differently from the traditional table-based structure of relational databases. Unlike relational databases, which organize data into rows and columns like a spreadsheet, NoSQL databases use a single data structure—such as key–value pairs, wide columns, graphs, or documents—to hold information. Since this non-relational design does not require a fixed schema, it scales easily to manage large, often unstructured datasets. NoSQL systems are sometimes called "Not only SQL" because they can support SQL-like query languages or work alongside SQL databases in polyglot-persistent setups, where multiple database types are combined. Non-relational databases date back to the late 1960s, but the term "NoSQL" emerged in the early 2000s, spurred by the needs of Web 2.0 companies like social media platforms.

NoSQL databases are popular in big data and real-time web applications due to their simple design, ability to scale across clusters of machines (called horizontal scaling), and precise control over data availability. These structures can speed up certain tasks and are often considered more adaptable than fixed database tables. However, many NoSQL systems prioritize speed and availability over strict consistency (per the CAP theorem), using eventual consistency—where updates reach all nodes eventually, typically within milliseconds, but may cause brief delays in accessing the latest data, known as stale reads. While most lack full ACID transaction support, some, like MongoDB, include it as a key feature.

Microsoft SQL Server

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Microsoft SQL Server is a proprietary relational database management system developed by Microsoft using Structured Query Language (SQL, often pronounced "sequel"). As a database server, it is a software product with the primary function of storing and retrieving data as requested by other software applications—which may run either on the same computer or on another computer across a network (including the Internet). Microsoft markets at least a dozen different editions of Microsoft SQL Server, aimed at different audiences and for workloads ranging from small single-machine applications to large Internet-facing applications with many concurrent users.

SQL injection

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In computing, SQL injection is a code injection technique used to attack data-driven applications, in which malicious SQL statements are inserted into an entry field for execution (e.g. to dump the database contents to the attacker). SQL injection must exploit a security vulnerability in an application's software, for example, when user input is either incorrectly filtered for string literal escape characters embedded in SQL statements or user input is not strongly typed and unexpectedly executed. SQL injection is mostly known as an attack vector for websites but can be used to attack any type of SQL database.

SQL injection attacks allow attackers to spoof identity, tamper with existing data, cause repudiation issues such as voiding transactions or changing balances, allow the complete disclosure of all data on the system, destroy the data or make it otherwise unavailable, and become administrators of the database server. Document-oriented NoSQL databases can also be affected by this security vulnerability.

SQL injection remains a widely recognized security risk due to its potential to compromise sensitive data. The Open Web Application Security Project (OWASP) describes it as a vulnerability that occurs when applications construct database queries using unvalidated user input. Exploiting this flaw, attackers can execute unintended database commands, potentially accessing, modifying, or deleting data. OWASP outlines several mitigation strategies, including prepared statements, stored procedures, and input validation, to prevent user input from being misinterpreted as executable SQL code.

MySQL

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MySQL () is an open-source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius's daughter My, and "SQL", the acronym for Structured Query Language. A relational database organizes data into one or more data tables in which data may be related to each other; these relations help structure the data. SQL is a language that programmers use to

create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

MySQL is free and open-source software under the terms of the GNU General Public License, and is also available under a variety of proprietary licenses. MySQL was owned and sponsored by the Swedish company MySQL AB, which was bought by Sun Microsystems (now Oracle Corporation). In 2010, when Oracle acquired Sun, Widenius forked the open-source MySQL project to create MariaDB.

MySQL has stand-alone clients that allow users to interact directly with a MySQL database using SQL, but more often, MySQL is used with other programs to implement applications that need relational database capability. MySQL is a component of the LAMP web application software stack (and others), which is an acronym for Linux, Apache, MySQL, Perl/PHP/Python. MySQL is used by many database-driven web applications, including Drupal, Joomla, phpBB, and WordPress. MySQL is also used by many popular websites, including Facebook, Flickr, MediaWiki, Twitter, and YouTube.

PostgreSQL

PostgreSQL (/ˈpoʊstˌrʌskjuːl/ POHST-gres-kew-EL) also known as Postgres, is a free and open-source relational database management system (RDBMS) emphasizing

PostgreSQL (POHST-gres-kew-EL) also known as Postgres, is a free and open-source relational database management system (RDBMS) emphasizing extensibility and SQL compliance. PostgreSQL features transactions with atomicity, consistency, isolation, durability (ACID) properties, automatically updatable views, materialized views, triggers, foreign keys, and stored procedures.

It is supported on all major operating systems, including Windows, Linux, macOS, FreeBSD, and OpenBSD, and handles a range of workloads from single machines to data warehouses, data lakes, or web services with many concurrent users.

The PostgreSQL Global Development Group focuses only on developing a database engine and closely related components.

This core is, technically, what comprises PostgreSQL itself, but there is an extensive developer community and ecosystem that provides other important feature sets that might, traditionally, be provided by a proprietary software vendor. These include special-purpose database engine features, like those needed to support a geospatial or temporal database or features which emulate other database products.

Also available from third parties are a wide variety of user and machine interface features, such as graphical user interfaces or load balancing and high availability toolsets.

The large third-party PostgreSQL support network of people, companies, products, and projects, even though not part of The PostgreSQL Development Group, are essential to the PostgreSQL database engine's adoption and use and make up the PostgreSQL ecosystem writ large.

PostgreSQL was originally named POSTGRES, referring to its origins as a successor to the Ingres database developed at the University of California, Berkeley. In 1996, the project was renamed PostgreSQL to reflect its support for SQL. After a review in 2007, the development team decided to keep the name PostgreSQL and the alias Postgres.

History of Microsoft SQL Server

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Transact-SQL

Transact-SQL (T-SQL) is Microsoft's and Sybase's proprietary extension to the SQL (Structured Query Language) used to interact with relational databases

Transact-SQL (T-SQL) is Microsoft's and Sybase's proprietary extension to the SQL (Structured Query Language) used to interact with relational databases. T-SQL expands on the SQL standard to include procedural programming, local variables, various support functions for string processing, date processing, mathematics, etc. and changes to the DELETE and UPDATE statements.

Transact-SQL is central to using Microsoft SQL Server. All applications that communicate with an instance of SQL Server do so by sending Transact-SQL statements to the server, regardless of the user interface of the application.

Stored procedures in SQL Server are executable server-side routines. The advantage of stored procedures is the ability to pass parameters.

Data definition language

In the context of SQL, data definition or data description language (DDL) is a syntax for creating and modifying database objects such as tables, indices

In the context of SQL, data definition or data description language (DDL) is a syntax for creating and modifying database objects such as tables, indices, and users. DDL statements are similar to a computer programming language for defining data structures, especially database schemas. Common examples of DDL statements include CREATE, ALTER, and DROP. If you see a .ddl file, that means the file contains a statement to create a table. Oracle SQL Developer contains the ability to export from an ERD generated with Data Modeler to either a .sql file or a .ddl file.

Join (SQL)

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A join clause in the Structured Query Language (SQL) combines columns from one or more tables into a new table. The operation corresponds to a join operation in relational algebra. Informally, a join stitches two tables and puts on the same row records with matching fields. There are several variants of JOIN: INNER, LEFT OUTER, RIGHT OUTER, FULL OUTER, CROSS, and others.

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