

SQL Server 2019 was officially released by Microsoft on **November 4, 2019**, and it represented a significant step in the evolution of SQL Server, focusing on the integration of **big data**, **enhanced performance**, **cloud capabilities**, and **advanced analytics**. SQL Server 2019 continued Microsoft's vision of a **unified data platform** that could handle both **transactional** and **analytical** workloads, enabling organizations to gain insights from their data in real-time, whether on-premises, in the cloud, or in hybrid environments.

The major theme of SQL Server 2019 was **big data integration** and the **expansion of machine learning** and **advanced analytics capabilities**. SQL Server 2019 also deepened its commitment to **hybrid and multi-cloud environments**, supporting both **on-premises** and **cloud-based workloads** with flexible deployment options.

1. Background and Context

SQL Server 2019 was a natural progression from **SQL Server 2017**, which introduced **cross-platform support** (Linux), **machine learning integration** (with Python and R), and **improved performance**. SQL Server 2019 continued to build on these innovations and placed a greater emphasis on the integration of **big data** and **AI** within the database environment.

SQL Server 2019 was designed to enable businesses to leverage both **traditional relational data** and **non-relational big data** (like Hadoop, Spark, and NoSQL) in a **seamless** and **integrated** way, providing a powerful platform for **data-driven applications** and **analytics**.

The following trends influenced SQL Server 2019's development:

- **Hybrid cloud** adoption, which was on the rise, requiring more flexibility for companies to use their data in multiple environments.
- The increasing importance of **big data** tools such as **Apache Spark** and **Hadoop**, which were traditionally outside the scope of SQL Server.
- **Machine learning** and **AI** becoming mainstream, requiring deeper integration of these technologies into the database platform.
- The need for **advanced security** and **data governance** to comply with global regulations.

SQL Server 2019 sought to address these needs, positioning itself as a **comprehensive data platform** that could handle everything from **OLTP** to **advanced analytics**.

2. Key Features and Innovations in SQL Server 2019

1. Big Data Clusters

One of the standout features of SQL Server 2019 was the introduction of **Big Data Clusters**. This feature allowed organizations to run scalable **big data** workloads on **SQL Server** by integrating with **Apache Spark**, **Hadoop**, and **other big data technologies** in a single **unified environment**.

- **Big Data Clusters** enable organizations to integrate relational data stored in **SQL Server** with **big data** stored in **Hadoop** and **Apache Spark**, creating a hybrid data environment.
- The ability to use **Spark** for distributed data processing and analytics alongside **SQL Server** for transactional data enabled powerful analytics on both structured and unstructured data.
- **PolyBase** (introduced in SQL Server 2016) was extended in SQL Server 2019 to support data queries across big data platforms, such as **HDFS** (Hadoop Distributed File System), **Azure Blob Storage**, and **other data sources**.
- The clusters were containerized, making it easier to deploy and manage using **Kubernetes**.

Example Use Case: A company could analyze large datasets (e.g., IoT sensor data, log files, and streaming data) in **Apache Spark** and combine this data with structured data from SQL Server, providing a comprehensive view of business operations.

2. Apache Spark Integration

SQL Server 2019 introduced **Apache Spark** integration, which allowed users to run large-scale **data processing** and **advanced analytics** on structured and unstructured data directly within the SQL Server environment.

- **Spark on SQL Server** enabled organizations to perform **real-time analytics**, **machine learning**, and **data processing** tasks at scale. SQL Server 2019 included support for running **Spark workloads** alongside SQL Server data.
- It integrated **T-SQL** and **Spark SQL**, allowing users to access and manipulate data from both the relational database and big data sources.
- Users could run **Spark jobs** directly from SQL Server using **SQL Server Machine Learning Services**, making it easier to use **Spark** for complex data processing without needing to manage a separate Spark cluster.

Example Use Case: A company could use **Spark** for real-time analytics on streaming data and integrate it with the SQL Server database for business intelligence and reporting.

3. Data Virtualization with PolyBase

SQL Server 2019 further enhanced **PolyBase**, a feature that allows users to query data from multiple external sources (like **Hadoop**, **Azure Blob Storage**, and **NoSQL databases**) as if the data were stored locally in SQL Server.

- **PolyBase** was extended to support new data sources, such as **Oracle**, **MongoDB**, and **Teradata**, in addition to traditional sources like **HDFS** and **Azure Blob Storage**.
- This feature provided an integrated, unified platform for accessing and analyzing both **relational** and **non-relational** data without requiring ETL (extract, transform, load) processes to move the data into SQL Server first.
- With **PolyBase**, users could query external data directly and use **T-SQL** to integrate big data into their reporting and analytical workflows.

Example Use Case: An enterprise could use PolyBase to run T-SQL queries that join data in SQL Server with data stored in a **Hadoop** cluster or a **NoSQL** database, enabling a more comprehensive data analysis workflow.

4. Intelligent Query Processing (IQP)

SQL Server 2019 introduced several features under **Intelligent Query Processing (IQP)** to automatically improve query performance without requiring manual tuning.

- **Batch Mode on Rowstore:** This feature allowed **rowstore tables** (traditional relational tables) to take advantage of **batch mode execution**, which was previously available only on **Columnstore tables**. Batch mode processing improves the efficiency of complex queries by processing data in batches rather than row-by-row.
- **Scalar UDF Inlining:** SQL Server 2019 automatically **inlines Scalar User-Defined Functions (UDFs)**, which helps to reduce the performance overhead of running UDFs in queries.
- **Table Variable Deferred Compilation:** This feature improved the performance of queries that used **table variables** by delaying the **compile-time decision** of the query plan, leading to better performance in certain scenarios.

These features collectively provided more efficient query execution, improving **performance** for both **transactional** and **analytical workloads** without requiring changes to application code.

5. Enhanced Security Features

SQL Server 2019 introduced several new **security** features aimed at ensuring data confidentiality, integrity, and compliance with modern data protection regulations.

- **Always Encrypted with Secure Enclaves:** SQL Server 2019 expanded the capabilities of **Always Encrypted**, a feature introduced in SQL Server 2016, by adding **secure enclaves**. Secure enclaves allow SQL Server to perform richer operations on encrypted data without exposing sensitive data, such as performing **joins** or **aggregations** on encrypted columns.
- **Data Discovery & Classification:** SQL Server 2019 introduced the ability to **automatically discover**, **classify**, and **label sensitive data** in SQL Server databases. This feature helps organizations comply with data protection regulations, such as **GDPR** or **CCPA**, by identifying sensitive data like **credit card numbers** or **personal information** and applying appropriate **security policies**.
- **Dynamic Data Masking (DDM):** SQL Server 2019 improved the **Dynamic Data Masking** feature, which allowed users to automatically mask sensitive data for non-privileged users. This helps reduce the risk of exposing sensitive information in production environments.

6. Accelerated Database Recovery (ADR)

SQL Server 2019 introduced **Accelerated Database Recovery (ADR)**, a feature designed to reduce the recovery time after a system failure or crash.

- **ADR** improves the **database recovery process** by using a new architecture for managing transaction logs, reducing the time it takes to recover large databases and ensuring that systems can return to normal operation more quickly.
- It helps with scenarios where recovery times for **large databases** or **long-running transactions** could previously take significant amounts of time.

7. Improved Kubernetes and Container Support

SQL Server 2019 enhanced its support for **containers** and **Kubernetes**, making it easier for organizations to deploy SQL Server in containerized environments.

- SQL Server containers could be deployed on **Windows** and **Linux** with full support for **persistent storage**, allowing organizations to create scalable containerized databases that could be orchestrated with **Kubernetes**.
 - **SQL Server Big Data Clusters** were also containerized, simplifying deployment and management in cloud-native environments.
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8. Big Data and Analytics Integration

SQL Server 2019 emphasized **advanced analytics**, **big data integration**, and **AI capabilities**. Key features included:

- **Spark and Hadoop Integration:** The integration of **Apache Spark** and **Hadoop** in SQL Server 2019 enabled a **hybrid data platform** that could handle structured and unstructured data.
- **Data Lakes:** SQL Server 2019 allowed users to query data stored in **data lakes** and run **analytics** directly on this data, using **T-SQL** or **Spark**.

3. SQL Server 2019 Editions

SQL Server 2019 was released in several editions, each catering to different organizational needs:

- **Enterprise Edition:** Full set of features, including **big data clusters**, **machine learning**, **In-Memory OLTP**, and support for both **Windows** and **Linux** platforms.
- **Standard Edition:** Core database capabilities, including **high availability** features but without the advanced big data and machine learning capabilities of the Enterprise edition.
- **Web Edition:** Optimized for web hosting providers with core SQL Server functionality.
- **Express Edition:** A free, lightweight version with limited capabilities for smaller applications or non-production environments.
- **Developer Edition:** A fully-featured edition designed for development and testing, identical to the Enterprise edition but with non-production usage.

4. End of Support and Legacy

SQL Server 2019 is currently in **Mainstream Support**, which will continue until **October 2024**, after which the product will enter **Extended Support**. SQL Server 2019's broad capabilities in **big data**, **cloud integration**, **security**, and **advanced analytics** positioned it as a robust and future-proof solution for businesses looking to leverage their data for more intelligent decision-making.

5. Conclusion

SQL Server 2019 continued the trend of transforming SQL Server into a **comprehensive, unified data platform** that supports both traditional relational databases and modern big data workloads. With the introduction of **Big Data Clusters**, **Apache Spark integration**, **enhanced security features**, and **improved performance**, SQL Server 2019 provided businesses with the flexibility to scale, analyze, and manage their data in innovative ways.

The platform's ability to seamlessly integrate **structured** and **unstructured data** made it an ideal solution for organizations looking to become **data-driven** in a modern, cloud-first world.

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