COMPARISON BETWEEN SQL AND NOSQL

VS

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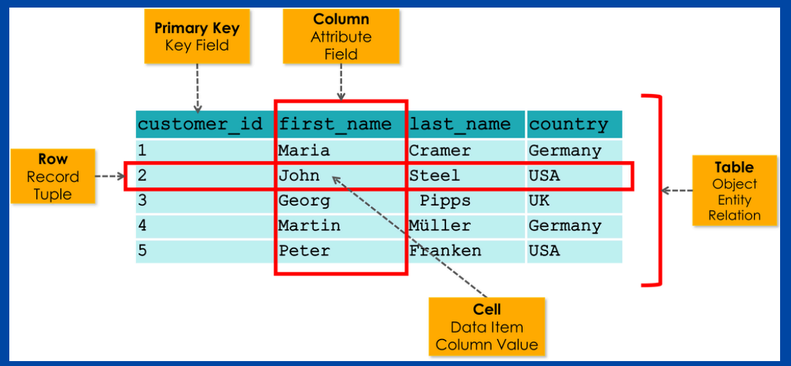
DEFINITION AND CARACTERISTICS OF SQL

SQL stands for Structured Query Language. SQL databases are relational databases that organize data in tables with rows and columns, and they are best used for structured data with clearly defined relationships.

It was created by Donald D. Chamberlin and Raymond F. Boyce in the 1970s, following the relational model proposed by Edgar F. Codd all of whom were engineers at IBM . Systems like Oracle (1979), MySQL (1995), and PostgreSQL (1996) have since become industry standards widely supported by both enterprises and the open-source community.

CARACTERISTICS OF SQL DATABASES

- Best suited for well-defined structured data: such as names and quantities.
- Organized in columns and rows: data is stored in structured tables.
- Relational model: based on relationships between entities.
- Manages relationships between entities



SQL TABLE

DEFINITION AND CARACTERISTICS OF NOSQL

NoSQL stands for **Not Only SQL**. NOSQL databases are non-relational databases that store data in a manner other than the tabular relations used within SQL databases. While SQL databases are best used for structured data, NoSQL databases are suitable for structured, semi-structured, and unstructured data.

They emerged in the late 2000s to address the scalability and flexibility needs of web applications and big data. MongoDB, the one we will see was created in 2007 by 10gen (now MongoDB Inc.), grew as an open-source project supported by a large developer community.

TYPES OF NO SQL DATABASES

- 📄 Document databases: Store data in documents (JSON, BSON, XML). Examples: MongoDB, CouchDB.
- 🔑 Key-Value stores : Data is stored as key-value pairs, great for caching and fast lookups. Example: Redis, DynamoDB.
- 📊 Column-oriented databases: Store data in columns instead of rows, optimized for analytics and large datasets. Example: Apache Cassandra, HBase.
- 🌐 Graph databases: Focus on relationships between entities, ideal for social networks, recommendations. Example: Neo4j

CARACTERISTICS OF NOSQL DATABASES

- Provides schema flexibility: Documents within collections can have varying structures, allowing for easy updates and accommodation of evolving data requirements.
- Performs efficient create, read, update, and delete (CRUD) operations: well-suited for read and write-intensive applications due to their ability to retrieve whole documents.
- Provides scalability: horizontal scalability by sharding data across clusters.

DIRECT COMPARISON

Criteria	SQL	NoSQL (MongoDB)
Performance	Good for complex queries on structured data	Good for large-scale, high-volume data, especially unstructured
Scalability	Vertical scaling (scale-up servers)	Horizontal scaling (add servers easily)
Flexibility	Fixed schema, hard to change	Schema-less, easily adapts to new data types
Consistency	Strong consistency (ACID)	Eventual consistency (BASE)
Query complexity	Complex queries possible (joins, subqueries)	Limited joins, relies on aggregation pipelines

WHEN TO USE SQL AND NOSQL(MONGODB)

SQL

- Complex queries and reporting are needed
- Data is highly structured with clear relationships
- Strong consistency and ACID transactions are required

Examples: Banking, ERP, structured business apps

MONGO DB

- Data is semi-structured or unstructured
- Horizontal scalability is important
- Rapid development and schema flexibility are needed

Examples: Big data, social media, real-time analytics, content management

Key considerations:
Infrastructure cost and team expertise
Type of data and volume
Long-term maintainability

Conclusion:
SQL and NoSQL are complementary; the choice depends on data type, scale, and application requirements.