SQL (Structured Query Language)

Definition:

SQL (Structured Query Language) is a standardized programming language designed for managing and manipulating relational databases. It provides a systematic way to create, retrieve, update, and delete data in relational database management systems (RDBMS).

NOSQL (Not Only SQL)

Definition:

NoSQL (Not Only SQL) refers to a broad category of non-relational database management systems designed to handle unstructured, semi-structured, and structured data at scale. Unlike traditional SQL databases, NoSQL databases are optimized for flexibility, scalability, and high-performance data operations, particularly in distributed and cloud-based environments.

Key Characteristics:

SQL:

1. **Declarative Language**: You specify *what* data you want rather than *how* to retrieve it
2. **Standardized Syntax**: Though implementations vary, core SQL syntax follows ANSI/ISO standards
3. **Relational Foundation**: Based on relational algebra and tuple relational calculus
4. **Multi-Purpose**: Handles data definition, manipulation, and control

NOSQL:

1. **Schema-less Design:** Fields can vary from one record to another.
2. **Horizontal Scalability:** Designed to scale across multiple servers (distributed systems) rather than scaling up (vertical scaling).
3. **High Performance for Specific Workloads:** Optimized for fast read/write operations, often at the expense of strict consistency.
4. **BASE Model (vs. ACID in SQL):** Eventually Consistent – Data will become consistent over time, but not immediately.
5. **Distributed Architecture:** Built for cloud and distributed computing.

Popular SQL Databases:

- MySQL
- PostgreSQL
- Microsoft SQL Server
- Oracle Database
- SQLite

Types of NoSQL Databases:

1. **Document Stores:** MongoDB, CouchDB
2. **Key-Value Stores:** Redis, DynamoDB
3. **Column-Family Stores:** Cassandra, HBase
4. **Graph Databases:** Neo4j, Amazon Neptune

Features	**SQL**	**NoSQL**
Data Structure	Tables with rows and columns	Document-based, key-value, column-family, or graph-based
Schema	Fixed schema (predefined structure)	Flexible schema (dynamic and adaptable)
Scalability	Vertically scalable (upgrading hardware)	Horizontally scalable (adding more servers)
Data Integrity	ACID-compliant (strong consistency)	BASE-compliant (more available, less consistent)
Query Language	SQL (Structured Query Language)	Varies (e.g., MongoDB uses its own query language)

MongoDB

Definition:

MongoDB is a scalable, flexible NOSQL document database platform designed to overcome the relational databases approach and the limitations of other NoSQL solutions. MongoDB is well known for its horizontal scaling and load balancing capabilities, which has given application developers an unprecedented level of flexibility and scalability.

Features:

1.Document-Oriented

- Stores data as JSON-like BSON documents (flexible schema).
- Supports nested structures (arrays, sub-documents).

2. High Performance

- Indexing (primary, secondary, geospatial, text).
- In-memory processing for fast reads/writes.

3. Scalability

- Sharding (horizontal scaling across clusters).
- Replica Sets (auto-failover for high availability).

4. Powerful Querying

- CRUD operations + Aggregation Pipeline.
- Geospatial, text search, graph traversal.

5. ACID Transactions

- Multi-document transactions for data integrity.

6. Cloud & Security

- MongoDB Atlas (managed cloud DB).
- Encryption, RBAC, audit logs.

7. Real-Time & Specialized Data

- Change Streams (live data updates).
- Time-Series & Graph support.