Introduction to NoSQL

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NoSQL is a type of database management system (DBMS) that is designed to handle and store large volumes of unstructured and semi-structured data. Unlike traditional relational databases that use tables with pre-defined schemas to store data, NoSQL databases use flexible data models that can adapt to changes in data structures and are capable of scaling horizontally to handle growing amounts of data.

The term NoSQL originally referred to “non-SQL” or “non-relational” databases, but the term has since evolved to mean “not only SQL,” as NoSQL databases have expanded to include a wide range of different database architectures and data models.

NoSQL databases are generally classified into four main categories:

1. **Document databases:** These databases store data as semi-structured documents, such as JSON or XML, and can be queried using document-oriented query languages.
2. **Key-value stores:** These databases store data as key-value pairs, and are optimized for simple and fast read/write operations.
3. **Column-family stores:** These databases store data as column families, which are sets of columns that are treated as a single entity. They are optimized for fast and efficient querying of large amounts of data.
4. **Graph databases:** These databases store data as nodes and edges, and are designed to handle complex relationships between data.

NoSQL databases are often used in applications where there is a high volume of data that needs to be processed and analyzed in real-time, such as social media analytics, e-commerce, and gaming. They can also be used for other applications, such as content management systems, document management, and customer relationship management.

databases. It is important to carefully evaluate the specific needs of an application when choosing a database management system.

NoSQL originally referring to non SQL or non relational is a database that provides a mechanism for storage and retrieval of data. This data is modeled in means other than the tabular relations used in relational databases. Such databases came into existence in the late 1960s, but did not obtain the NoSQL moniker until a surge of popularity in the early twenty-first century. NoSQL databases are used in real-time web applications and big data and their use are increasing over time.

- NoSQL systems are also sometimes called Not only SQL to emphasize the fact that they may support SQL-like query languages. A NoSQL database includes simplicity of design, simpler horizontal scaling to clusters of machines and finer control over availability. The data structures used by NoSQL databases are different from those used by default in relational databases which makes some operations faster in NoSQL. The suitability of a given NoSQL database depends on the problem it should solve.
- NoSQL databases, also known as “not only SQL” databases, are a new type of database management system that have gained popularity in recent years. Unlike traditional relational databases, NoSQL databases are designed to handle large amounts of unstructured or semi-structured data, and they can accommodate dynamic changes to the data model. This makes NoSQL databases a good fit for modern web applications, real-time analytics, and big data processing.
- Data structures used by NoSQL databases are sometimes also viewed as more flexible than relational database tables. Many NoSQL stores compromise consistency in favor of availability, speed and partition tolerance. Barriers to the greater adoption of NoSQL stores include the use of low-level query languages, lack of standardized interfaces, and

- Most NoSQL stores lack true ACID(Atomicity, Consistency, Isolation, Durability) transactions but a few databases, such as MarkLogic, Aerospike, FairCom c-treeACE, Google Spanner (though technically a NewSQL database), Symas LMDB, and OrientDB have made them central to their designs.
- Most NoSQL databases offer a concept of eventual consistency in which database changes are propagated to all nodes so queries for data might not return updated data immediately or might result in reading data that is not accurate which is a problem known as stale reads. Also some NoSQL systems may exhibit lost writes and other forms of data loss. Some NoSQL systems provide concepts such as write-ahead logging to avoid data loss.
- One simple example of a NoSQL database is a document database. In a document database, data is stored in documents rather than tables. Each document can contain a different set of fields, making it easy to accommodate changing data requirements
- For example, “Take, for instance, a database that holds data regarding employees.”. In a relational database, this information might be stored in tables, with one table for employee information and another table for department information. In a document database, each employee would be stored as a separate document, with all of their information contained within the document.
- NoSQL databases are a relatively new type of database management system that have gained popularity in recent years due to their scalability and flexibility. They are designed to handle large amounts of unstructured or semi-structured data and can handle dynamic changes to the data model. This makes NoSQL databases a good fit for modern web applications, real-time analytics, and big data processing.

Key Features of NoSQL :

1. **Dynamic schema:** NoSQL databases do not have a fixed schema and can accommodate changing data structures without the need for migrations or schema alterations.
2. **Horizontal scalability:** NoSQL databases are designed to scale out by adding more nodes to a database cluster, making them well-suited for handling large amounts of data and high levels of traffic.
3. **Document-based:** Some NoSQL databases, such as MongoDB, use a document-based data model, where data is stored in semi-structured format, such as JSON or BSON.
4. **Key-value-based:** Other NoSQL databases, such as Redis, use a key-value data model, where data is stored as a collection of key-value pairs.
5. **Column-based:** Some NoSQL databases, such as Cassandra, use a column-based data model, where data is organized into columns instead of rows

6. **Distributed and high availability:** NoSQL databases are often designed to be highly available and to automatically handle node failures and data replication across multiple nodes in a database cluster.
7. **Flexibility:** NoSQL databases allow developers to store and retrieve data in a flexible and dynamic manner, with support for multiple data types and changing data structures.
8. **Performance:** NoSQL databases are optimized for high performance and can handle a high volume of reads and writes, making them suitable for big data and real-time applications.

Advantages of NoSQL: There are many advantages of working with NoSQL databases such as MongoDB and Cassandra. The main advantages are high scalability and high availability.

1. **High scalability :** NoSQL databases use sharding for horizontal scaling. Partitioning of data and placing it on multiple machines in such a way that the order of the data is preserved is sharding. Vertical scaling means adding more resources to the existing machine whereas horizontal scaling means adding more machines to handle the data. Vertical scaling is not that easy to implement but horizontal scaling is easy to implement. Examples of horizontal scaling databases are MongoDB, Cassandra, etc. NoSQL can handle a huge amount of data because of scalability, as the data grows NoSQL scale itself to handle that data in an efficient manner.
2. **Flexibility:** NoSQL databases are designed to handle unstructured or semi-structured data, which means that they can accommodate dynamic changes to the data model. This makes NoSQL databases a good fit for applications that need to handle changing data requirements.
3. **High availability :** Auto replication feature in NoSQL databases makes it highly available because in case of any failure data replicates itself to the previous consistent state.
4. **Scalability:** NoSQL databases are highly scalable, which means that they can handle large amounts of data and traffic with ease. This makes them a good fit for applications that need to handle large amounts of data or traffic
5. **Performance:** NoSQL databases are designed to handle large amounts of data and traffic, which means that they can offer improved performance compared to traditional relational databases.
6. **Cost-effectiveness:** NoSQL databases are often more cost-effective than traditional relational databases, as they are typically less complex and do not require expensive hardware or software.
7. **Agility:** Ideal for agile development.

1. **Lack of standardization** : There are many different types of NoSQL databases, each with its own unique strengths and weaknesses. This lack of standardization can make it difficult to choose the right database for a specific application
2. **Lack of ACID compliance :** NoSQL databases are not fully ACID-compliant, which means that they do not guarantee the consistency, integrity, and durability of data. This can be a drawback for applications that require strong data consistency guarantees.
3. **Narrow focus :** NoSQL databases have a very narrow focus as it is mainly designed for storage but it provides very little functionality. Relational databases are a better choice in the field of Transaction Management than NoSQL.
4. **Open-source :** NoSQL is open-source database. There is no reliable standard for NoSQL yet. In other words, two database systems are likely to be unequal.
5. **Lack of support for complex queries :** NoSQL databases are not designed to handle complex queries, which means that they are not a good fit for applications that require complex data analysis or reporting.
6. **Lack of maturity :** NoSQL databases are relatively new and lack the maturity of traditional relational databases. This can make them less reliable and less secure than traditional databases.
7. **Management challenge :** The purpose of big data tools is to make the management of a large amount of data as simple as possible. But it is not so easy. Data management in NoSQL is much more complex than in a relational database. NoSQL, in particular, has a reputation for being challenging to install and even more hectic to manage on a daily basis.
8. **GUI is not available :** GUI mode tools to access the database are not flexibly available in the market.
9. **Backup :** Backup is a great weak point for some NoSQL databases like MongoDB. MongoDB has no approach for the backup of data in a consistent manner.
10. **Large document size :** Some database systems like MongoDB and CouchDB store data in JSON format. This means that documents are quite large (BigData, network bandwidth, speed), and having descriptive key names actually hurts since they increase the document size.

Types of NoSQL database: Types of NoSQL databases and the name of the databases system that falls in that category are:

1. **Graph Databases**: Examples – Amazon Neptune, Neo4j
2. **Key value store:** Examples – Memcached, Redis, Coherence
3. **Tabular:** Examples – Hbase, Big Table, Accumulo

When should NoSQL be used:

1. When a huge amount of data needs to be stored and retrieved.
2. The relationship between the data you store is not that important
3. The data changes over time and is not structured.
4. Support of Constraints and Joins is not required at the database level
5. The data is growing continuously and you need to scale the database regularly to handle the data.

In conclusion, NoSQL databases offer several benefits over traditional relational databases, such as scalability, flexibility, and cost-effectiveness. However, they also have several drawbacks, such as a lack of standardization, lack of ACID compliance, and lack of support for complex queries. When choosing a database for a specific application, it is important to weigh the benefits and drawbacks carefully to determine the best fit.

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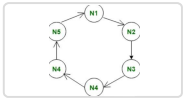

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