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NOSQL Database: Opportunities and Applications

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***Abstract*—** In Today's digital generation the growth of IT industries gradually increase with the volume of data which is generated by the most of applications. To handle such a large amount of data Relational Database are not sufficient. No SQL database is an emerging alternative to the relational database which provides high scalability, performance and high availability. The paper, discuss about different types of NoSQL database with its opportunities and applications.

Keywords*— *NoSQL Database , Relational Database

I. INTRODUCTION

A No SQL (originally referring to "non SQL" or "non-relational" No SQLdatabase provides a mechanism for retrieve and store of data in schema less model other than the Relational database [1]. Database Management System is an exhaustive term that refers to a collection of different tools System that allows the user to store modify or retrieve data based on various parameters. These are widely known as SQL databases named after the language they were queried by [2,3]. The traditional databases are based on relational modal like SQL, MySQL etc. The issues with the relational database are scalability and performance degrades rapidly when the amount of data increases. If we compare relational database and no relational database so then the non-relational database will give more performance, flexibility, and scalability. In the last few years rapidly increase in the amount of data which is generated by the different types of the information system. Big data term used to describe a large amount of data which is structured, semi-structured and unstructured data. According to the Gartner group, Big Data can be defined by 3Vs: volume, velocity, and variety [4]. NoSQL database uses the data structure and viewed as the more flexible than relational database table[5].

II. RELATED WORK

A NoSQL originally referring to "non SQL" or "non-relational" NoSQL data is very emerging technology which is widely used in the digital market to handle a large amount of data(Big data). Relational databases are not capable of complex data. NoSQL database use BASE properties which similar to ACID properties and CAP theorem.

ACID compliance in RDBMS is of paramount importance where consistency is required which ensures that transactions are completed in a single instance before changes are committed to the master database [6].ACID has a consistency of data durability and confidential of data in its long existence. The BASE has fully focused on the availability of data that's the main difference between the ACID and BASE. Even also NoSQL use CAP theorem which has three properties consistency availability partition tolerance. It's important that how ACID properties used in RDBMS An example "Imagine more than one person trying to buy the same size and colour of a shoe at the same time" ACID properties make it possible to purchase one or more transaction simultaneously.

ACID properties make it possible to for safe sharing, avoiding inaccuracy of data and allow more flexibility and efficiency. ACID make transaction safe and secure. Translation will execute successfully or else transaction fails. Translation is a collection of read and writes operation where either be succeed or fail and a transaction cannot leave system inconsistency state. If unwanted event raised like power down, system crash etc. won't be in a state with partial change. Database stays consistence before the transaction begins and after the end of the transaction.

One of biggest challenge with the RDBMS Is their scalability where many NoSQL databases are better suited the scalability where a horizontal distribution of load and data.

Objectives of the paper are:

- To study the NOSQL database
- To compare NOSQL database with SQL database.

- To understand the advantages and opportunities of NOSQL database

III. NOSQL DATABASE

NoSQL database was developed after 2009. NoSQL is generally referred as not only SQL [7].The non-relational database designed to handle large-scale data storage and massively parallel data processing .which is used by a large number of commodity servers. NoSQL databases are used by many companies such as Google, Amazon, Facebook etc. which have challenges to deal with the high quantity of data. It provides flexible schema design, easy replication support, simple API and supports a huge amount of data [8]. There are four types of NoSQL database like Key value pair NoSQL database, Document, Column and Graph.

- Key value NoSQL database

As data model perspective, the key-value database in basic NOSQL database. Data stores in NOSQL database in the key-value pair where key in unique (primary key) identity. The user can get values through the key which is assigned. This model can be useful for representing polymorphic and unstructured data. Basically it is use for store session data, storing shopping card data.

- Document NoSQL database

Document store in NoSQL database is similar to key-value pair database in which there are a key and a value. Data as a value is associated with the key which is the unique identifier for that value. The basic difference in document NoSQL database is that value is stored in structure or semi-structured data.Documents in format of XML, JSON BSON format. Documents are MongoDB, Apache Couch DB, and Elastic search. It is used in Blogging platform, Analytics platform, Content Management system.

- Column NoSQL database

In column-oriented NOSQL databases, data is stored in cells grouped in columns of data rather than as rows of data. Columns are logically grouped into column families. Read and write is done using columns rather than rows. Column families are groups of similar data that is usually accessed together. It is application are in content management systems, blogging platforms, Systems that maintain counters and services that have expiring usage.

- **Graph NOSQL Database**

The graph database is similar to an object-oriented database. It is built on the entity – attribute - value model. An entity also knew as the node which has some properties. Nodes store data about an entity of database. Relationships describe the relationship between nodes. graph databases allow for virtually any relationship to be defined on-the-fly. Some examples of graph database are Neo4j, Arango DB and Orient DB. Its applications are graph based search, IT operations and Social networks, etc.

- **To compare NOSQL database with SQL database.**

No SQL database refers **BASE(**Basically Available, Soft state, Eventually Consistent)Transaction BASE is a opposite of ACID. Base focus on the permanent availability.

CAP(Consistency Availability Partition tolerance)Theorem

Consistency: The client perceives that a set of operations has occurred all at once. Data present in all nodes are same. Data will be updated in all nodes frequently.

Availability: Every operation must terminate in an intended response. Data should be available or accessible at any time. Data will be permanently stored.

Partition tolerance: Operations will complete, even if individual components are unavailable. In case one node gets down from fault occupied in the node database should work properly without taking any pause or break either be fully executed or nor be begin the transaction.

Consistency: A transaction enforces consistency in the system state. Ensuring that end of transaction system should be in the valid state. If transaction is successfully completed then the system in the valid state otherwise automatically rollback to the previous state.

Isolation: If one or more transaction executed at the same time but they are not affected each other then It's called isolation transaction.

Durability: should be durable to hold update data .if the system fails or restart if the transaction updated chunk of data in the database and commit then the database should hold the update data never be lost.

1. **Database Schema**

   NOSQL database does not have any schema, data will be inserted into the database and modified at any time without any schema.

   SQL database has their own predefined normalized of the schema. Normalization involves 3 basics forms 1NF, 2NF, 3NF.

2. **Flexibility**

   In NoSQL database are dynamic in nature because NoSQL databases are schema-less. SQL database has predefine schema whereas column must be determined and locked before the data can be entered.

3. Complexity Queries

NOSQL databases are not suitable for complex queries because they are not as powerful as SQL queries. SQL database best suited for complex queries. **SQL database** refers **ACID(A**tomicity, **C**onsistency, **I**solation, **D**urability**)** properties for transactions.

4. Scalability

SQL database is vertically scalable. You can manage load by increasing the CPU, SSD, RAM etc. on the single server. On the other hand, NoSQL databases are horizontally scalable. You can just add a few more servers easily in your NoSQL database.

5. Data Access

In SQL database need to interlink the table using join queries and retrieve data and the same process should be followed for inserting data. In the NOSQL database, each data represent an object which contains all its related data in a document.

• Advantages of NoSQL

Elastic scaling: advantage of NoSQL is scaling out rather than scaling up. Distributing the database among the different host as load increases. RDMS might not easy to scale out on commodity cluster.

Big data: Today a Large amount of Data will be generated by IOT devices. These data are also known as big data is handled by the NoSQL database such as Hadoop , Mongo DB, firebase etc. volume of big data that can be practically managed by a single RDBMS are becoming intolerable for some enterprises.

Bye DBA: NoSQL database is designed in such way that it's required very less management automatic repair, data distribution, and simpler data models and tuning requirements. RBMS will be fully managed by DBA.

Less expensive : NoSQL database is designed to expand transparently and add clusters of cheap commodity servers while a number of data increases. Whereas RDMS rely on expensive proprietary servers and storage systems. The cost of per gigabyte or transaction/ second for NoSQL is much less than RDMS.

Flexible data model: NoSQL databases are schema-less so change management on the database will not be a headache. NoSQL database has far more relaxed to change in the data model as compare to SQL database.

IV. CONCLUSION

The main reason for making this research paper to the study NoSQL databases with its application and competitive analysis of SQL and NoSQL database. SQL databases are horizontally scalable in case of NoSQL database vertically scalable. The performance of both SQL and NoSQL database is based on the size or queries which is performed in an application.

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