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Data Management Shift using NOSQL

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Abstract - Database is an essential part of modern applications to perform data management operations. Experts have proposed many database models for data management and the relational model is most widely used and acceptable but in present era we need new data management requirements for modern applications that are not supported by traditional databases. To handle these new data management requirements we need some new database approaches like NOSQL approach which is open source, distributed and supports horizontal scaling. Modern applications based on social networking and business intelligence changes the data store strategy to a great extent. The traditional databases are not efficient for handling the Big Data that is the management of data in terms of volume, variety and velocity of data.

Keywords- NOSQL, SQL, Big Data, JSON documents.

I. Introduction

Applications change radically over the last 15 to 20 years based on many dimensions like the number of users, the production of huge amount of data or in short terms Big data etc. There are three mega concepts accountable for the adoption of NOSQL databases- Big Data, Big Users and Cloud Computing. Relational databases supports all the essential characteristics of data management like simplicity, flexibility, compatibility and scalability but fails to provide options like handling huge volumes of unstructured data when implemented in cloud environment. Present computing demands fast enough applications poor application response results in selection of some other options by users. For best user experience the selection of right database is necessary that is very fast, scalable and robust. NOSQL databases have proven the efficient databases for applications that read and write swiftly massive amount of data. Choosing a right NOSQL database for our applications is also the tricky aspect. In this research I am going to analyze the three popular NOSQL database solutions Cassandra, Mongo DB and Couchbase and how these databases behave in terms of interactive web applications.

Discussion on Cassandra, Mongo DB and Couchbase

- **Cassandra:** A distributed columnar key-value database. Read or write of data can be started from any cluster node. No single point of failure is found and supports seamless horizontal scaling. If there is a problem in any node in the cluster another node replaces it.

- **Mongo DB:** Is a schema free, document oriented NOSQL database technology and uses BSON format to store data. A BSON is simply a JSON document in binary format and allows faster and easy integration of data in most applications. Horizontal scalability is also the all feature of this kind of NOSQL database technology.

- **Couch Base:** Is a famous document database for interactive web and mobile applications. Couch base also uses JSON to store documents with low latency read and write operations. No single point of failure is found in the Couch Base architecture. The Couch Base cluster is very easy to scale-out and is based on live cluster topology changes means non application downtime during upgrading the hardware, software or database.

Key Database Criteria for Interactive Applications

There are some important factors to keep in mind when choosing a database for interactive applications:

Scalability:

When website traffic increase suddenly and database is not responding because not having enough capacity, we need to scale database swiftly and without any changes in application. Also having possibility to decrease and optimize the resources when system is at rest. Database scaling needs to be very simple operation means not dealing with complicated database concepts or any change in application.

Performance:

For better performance the database needs to support low latencies regardless of the data size and load. The read and write latency of NOSQL databases is very low because of sharing of data across nodes in clusters that is also the demand of interactive applications.

Availability:

Availability is one of the immense database concept required in modern applications. For high availability system should be able to support online upgrades, for maintenance it is very easy to remove a node without affecting the whole cluster and provide options for backups and disaster recovery in case the whole data center goes down.

Architecture:

Traditional databases are based on rigid schema and for any change in application we need to change database schema as well on the other side NOSQL databases support flexible schema and very simple query language.

The present digital world becomes more complex with Big Data means the volume, velocity and variety of data. The Big Data is a global system and is considered a data collection that increases so large and can't be managed efficiently by traditional databases management systems. The modern

application like social networking, business intelligence has changed the storage system to a great extent. To tackle these problems we have a new kind of databases commonly known as NOSQL databases.

The universe is full with smart devices that generate a huge volume of data and enterprises are dealing with massive amount of data. The data generated by these devices is very essential for an enterprise to compete with other business vendors. With this data enterprises can detect customer behavior and can also analyze various markets with best business potential. In present Big Data environment we are dealing with un-structured data that is very difficult to manage with traditional database technologies and evolve a new data management approach known as NOSQL database technology that can manage terabytes, petabytes and even Exabyte's of data. There are several challenges that enterprises face while dealing with Big Data like:

✓ The security of Big Data which contains very sensitive information, personal information and intellectual property.

✓ There may be delay in speed and availability requirements of Big Data when security mechanisms are operated.

✓ How Big Data is always safe and secure irrespective of where it is stored.

II. Problem Formulation

"Data Management Shift using NOSQL" explores the need to move towards NOSQL environment. In present era we need scale-out database architectures for data management so that we can deploy virtual machines instead of purchasing very costly servers. The term Big Data is not only considered size of data but also the variety and velocity of data. The data volume in an organization grow enormously and there is a requirement of data management for data generated from various fields like medical data, financial data etc. Today the volume of data in most organizations is in the terabyte range but soon can transfer to petabytes or hexabytes. Today in enterprises management of data is not only for structured category but also needs to manage un-structured and semi-structured type of data. The NOSQL databases are the best solution for new data management challenges.

III. Objectives

- To manage huge amounts of data (Big Data)
- To deploy Scale-out architecture.
- To deploy database for Cloud Platform.
- Faster execution of Data.
- To make high availability of Data that is the prime concern for any corporate.

IV. Methodology

Existing Methodology

We are using database concept from decades to perform different data operations. Experts have proposed different models and the most popular one is Relational model. The famous products are SQL Server, MySQL and Oracle that are full filling requirements of all types of applications. The traditional Databases are also known as SQL databases because of query language. The relational database are used from very long time in database driven applications but in present era of computing traditional databases are facing number of challenges like managing huge quantity of data popularly known as Big Data.

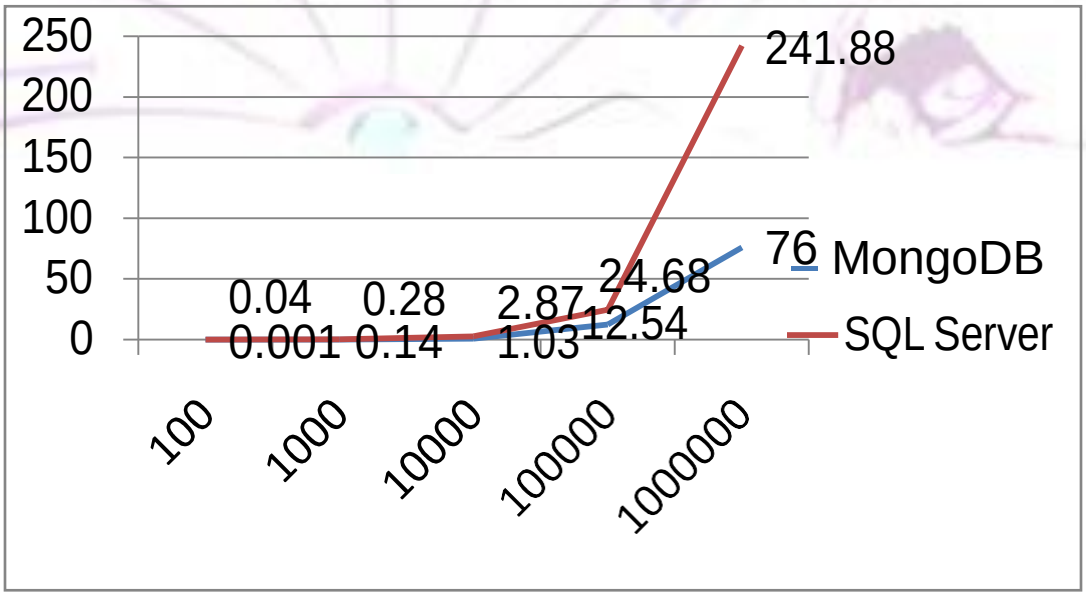
Proposed Methodology

In proposed system we are deploying NOSQL database to overcome the Big Data problem. In this research I am deploying SQL server that is very famous relational database and MongoDB that is very famous document oriented NOSQL database to check the performance based on query processing to analyze how MongoDB suits better for handling Big Data. The operations performed are Read, Write, Select and Delete.

V. Results

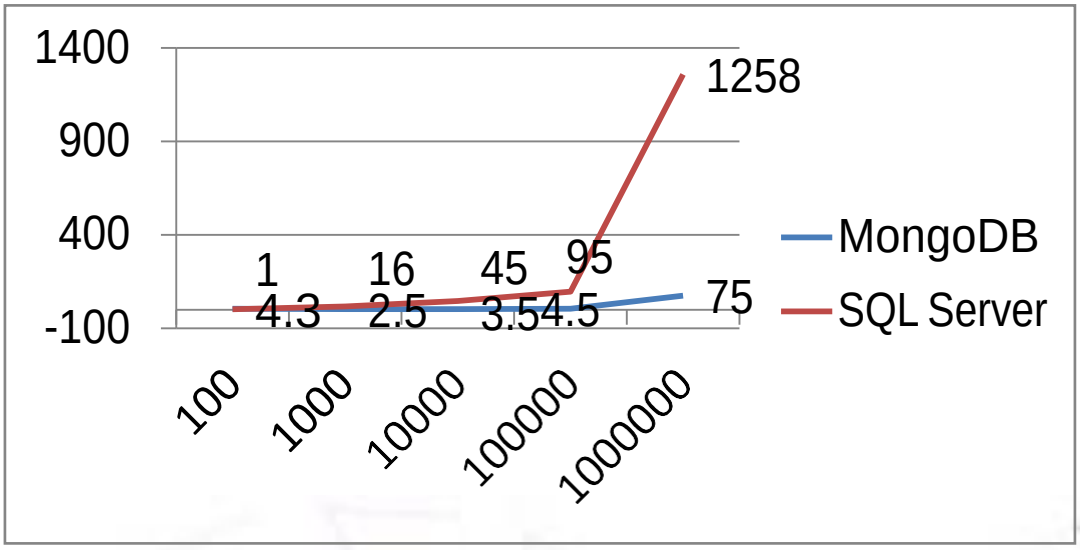
INSERT Operation:

Insert operation is performed on both the databases at scales of 100, 1,000, 10,000, 100,000 and 1,000,000 records for the table Customer in SQL and collection in MongoDB. After performing insert operation at five scales MongoDB performs operations with higher speed as compared to Relational Database. The results are described below:



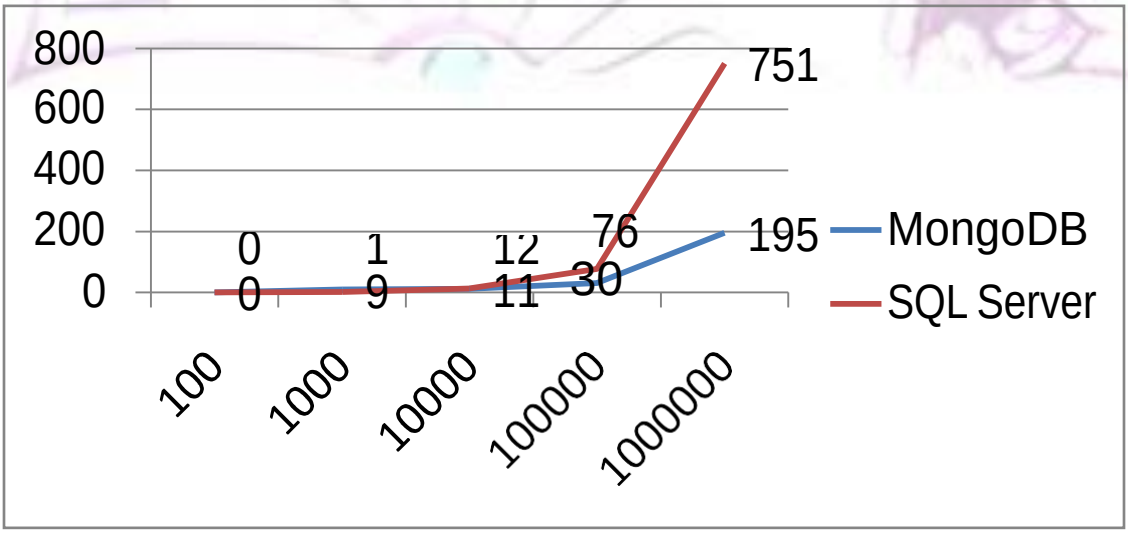
DELETE Operation:

Delete operation is performed on both the databases at scales of 100, 1,000, 10,000, 100,000 and 1,000,000 records for the table Customer in SQL and collection in MongoDB. After performing Deleteoperation at five scales MongoDB performs operations with higher speed as compared to Relational Database. The results are described below:



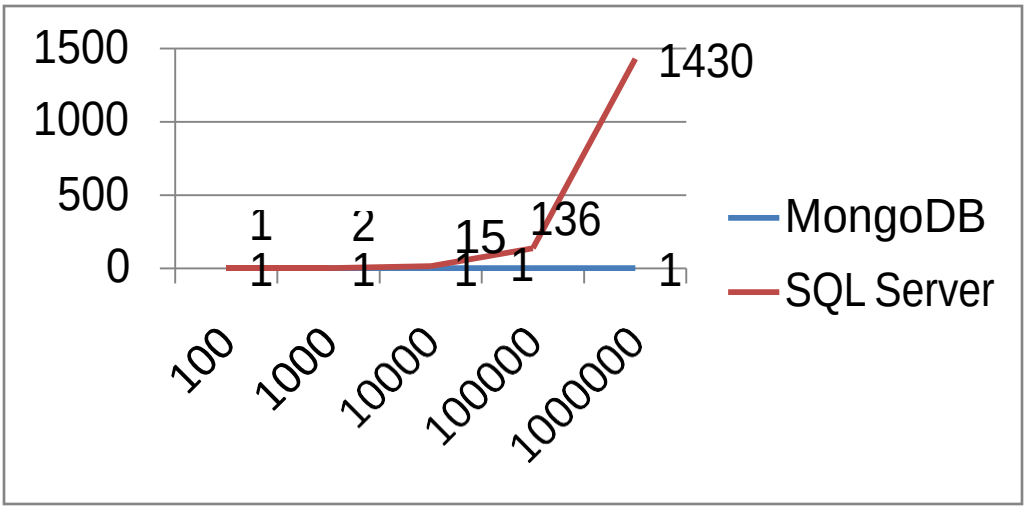
UPDATE Operation:

Update operation is performed on both the databases at scales of 100, 1,000, 10,000, 100,000 and 1,000,000 records for the table Customer in SQL and collection in MongoDB. After performing Updateoperation at five scales MongoDB performs operations with higher speed as compared to Relational Database. The results are described below:



SELECT Operation:

After performing this operation the MongoDB take less time than Relational SQL Server. Most of these tests are performed 100 times and sometimes 10 times and the results are described below.



VI. Conclusion

As for the practical work is concerned the result is very respectable in terms of deployment of NOSQL databases specifically the MongoDB. The modern application requirements need databases that support Big Data, Big Users, Internet of Things and Cloud platform and as for the traditional database technologies are concerned they are not fulfilling the above mentioned challenges.

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