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Framing the Future of Information Systems in Afghan Dynamics

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Abstract:- Currently, entire government and private organizations using technologies such as structured databases But, when the data increases, the noted databases cannot handle big data efficiently and effectively. This research wants to use unstructured database management system technologies to satisfy user's demands. We compared CRUD operations based on key-value approach by No-SQL and SQL databases. Also, we presented the performance analysis of unstructured and structured technologies. Moreover, this paper studied the importance of the sharding and replication in the unstructured technology paradigm. This strength makes an environment for manageability, schema-less development, horizontal scalability etc. that the developer would be helped while taking decision wisely and leads to cover the weaknesses of MySQL.

Keywords:- *Information Systems; Structured and Unstructured Technologies; Replication; Sharding;*

I. INTRODUCTION

At the present, structured databases or relational databases have been useful for designers in the designing various applications across the country. Relational databases have been using from the past couple of years in Afghan dynamics to store large amount of data and retrieve the information based on users' demands. Meantime, the current relational database management systems are insufficient to meet the store and request process demands among Afghan masses because recently advanced technology introduced in Afghan settings to revitalize the Afghan society and government. In addition, relational databases lacked of huge data when web 2.0 raised. Google, Amazon, etc. faced problem when system receive millions of users request lookup against millions of rows of data [1].

In order to reduce the noted issues, the unstructured database technology has been introduced which have different categories such as graph databases, key-value, document store etc. [1]. The author of this study, recommend one of the non-relational database namely "*MongoDB*" unstructured database which is document-oriented, fast query performance, key-value store etc. It is designed to avoid join, remove fixed schema, and enhance scale up (horizontally). [2]. In other words, MongoDB worked based on document-store to enhance scalability, availability and best operations [3]. Furthermore, in MongoDB paradigm, the structure of documents are different based on JSON (Java Script Object Notation), unlike MySQL which the structure should be predefined.

This study organized as the following sections: in the section II, overview of MongoDB is discussed. In Section III comparative study is outlined with details, In the last Section IV contribution is described.

II. OVERVIEW OF MONGODB

MongoDB is a very powerful, flexible, scalable, easy to use, document-oriented database [4]. Document-oriented database amis to replace the sturctured database or remove the predefined schema approach with key-value schema [4]. Due to key-value schema, some of the operations such as adding and removing fields seems to easier and faster. Meantime, MongoDB is easy to scal to handle a huge amonut of data. Basically, most of the developer faced with a question namely " how to store big amoung of data?". To address the question, most of the studies recommend scaling a database. There are two ways to scale the databases: scaling up and scaling out [4]. Scaling up (vertical scaling) means to get a large and powerfull machine which will be very expensive. In contrast, scale out (horizontal scaling) means to add more storage space and increase the performance of the system which will be cheaper and scalable; but a little bit difficult to take care of a number of machines [4]. When MongoDB is designed for scalability so, it takes care of balance, load, redistribution, sending users' requests to the approperiate server in the scale out paradigm [4].

Furthermore, MongoDB supports replication bettween multiple servers. Replication is a method for storing identical copies of data in serveral machines safely, even something happen wrong with your system[4]. Morover, MongoDB involves autosharding. Sharding sounds to the procedure of splitting or partitioning the data in different machines [4]. This is the difficult and complicated portion during the configuration of the system. Indeed, MongoDB is relatively the best way to apply for huge amount of data to offer comprehensive package of services .

The author of this study listed here some predominant features of MongoDB database for your consideration which are the plus points of the mentioned technology.

A. Scaling out

First, As indicated earlier, MongoDB supports scaling out approach. Because, it works based on document-oriented model which makes environment to split up data on different machines without any problem. This technique provide us an opportunity to accelerate our performance and add extra space for data storage. The author draws a diagram about scaling out and scaling up for your consideration (*see Fig.1*).

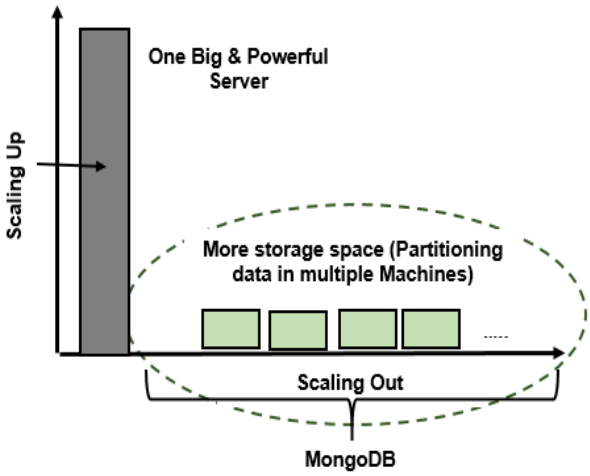

Fig.1: Scaling out and scaling up approach

B. Replication

We pointed out earlier regarding replication, but in this section we are going to add a little bit deeply information for your consideration and understanding. Replication method in the MongoDB paradigm is a technique to store huge volume of data on multiple servers with highly secure situation [4]. To apply the replication approach, we have to creat replica set which is a set of machines with one primary machine (responsible for receiving requests) and serveral secondary machines (keeping copies of primary machine). Secondary machines support us incase primary goes down then secondaries can select a new primary machine among themeselves to provide services to the rest of the machines in the organization (*see Fig.2*) [4]. Furthermore, we should keep in mind, replication across the data centers could be slower than within a single. Morver, replication provides us high availability due to atutomatic recovering capablity and allows the machines to pick up the new primary machine among others.

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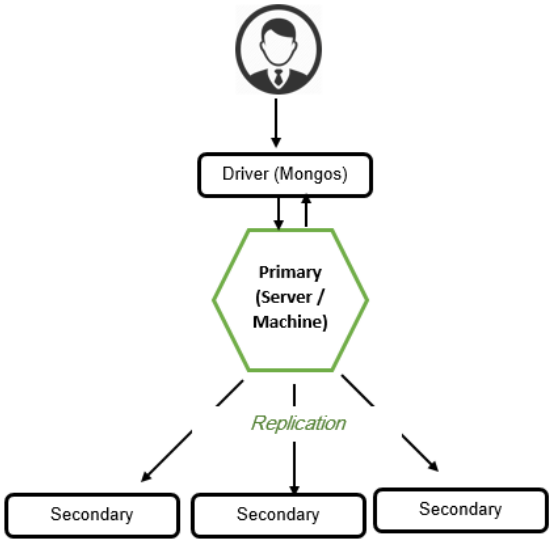

Fig.2: Replication

C. Sharding

When the size of data increases, a server would not be capable to keep the entire data even read and write operations in the process. To tackle the issue, MongoDB provides sharding. As mentioned before, sharding is a process to store a huge amount of data through multiple servers in different locations [4] (*see Fig.3*). Because, a local disk in the organization is not adequate to store the data. Further, all write requests go to the master node (primary machine) and scale up (vertical scaling) approach is too expensive to implement. As conclusion, sharding improves the performance and adding capacity to the system as horizontal scaling (scaling out) without any issues and which enhance the overall working of the system.

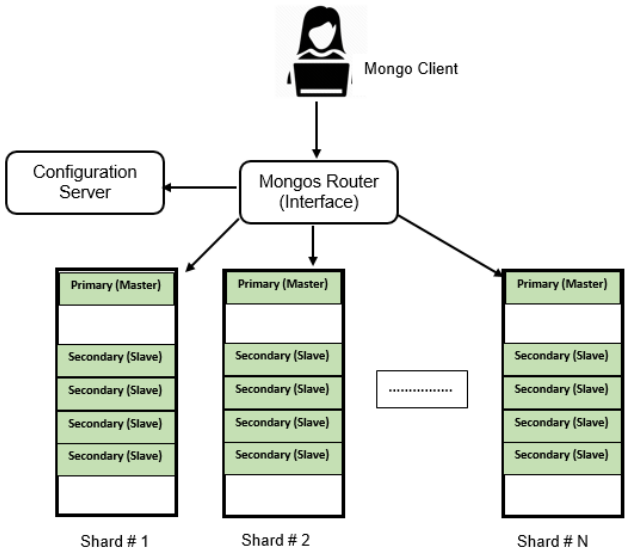

Fig.3: Sharding in MongoDB

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In addition to the mentioned features, the author came up with some other useful features which empower MongoDB database services to the users such as : aggregation and data processing, automatic updates operation, fast query support, indexing supporting etc. (*see Fig. 4*).

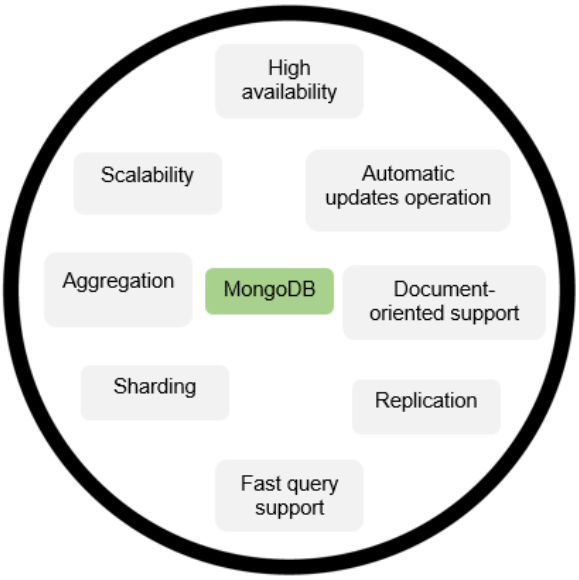

Fig. 4: Important features of MongoDB

III. COMPARTIVE STUDY

In the digital age, developing an application needs to storage for huge amount of data in the datacenter. Much more databases are available for developer to use it. However, selecting the appropriate one is a little bit difficult but meantime makes development of project easier and faster [5]. Basically, most of developer use relational databases for developing the applications which represent data as rows and columns in the two dimensional table with predefined schema [8]. Furthermore, this kind of databases need time to apply read and write operations and complex query to extract demands information from database [5].

In contrast, currently, developers are encourage to apply NoSQL (Not Only SQL) databases in the developing applications. The author of this paper came up with MongoDB database to revitalize the information management system in Afghan Setting. MongoDB database has valuable feature than SQL that developer would be helped to use this new technology in the database paradigm. MongoDB database is open source NoSQL database with supports horizontal scalablity to enhance the performance [7]. Moreover, this new technology includes: (i) document-oriented storage; (ii) indexes;(iii) replication plus high availability; (iv) autosharding; (v) rich query and updates; etc. [5]. The mentioned featuers of MongoDB make sence to choose the non-relational database namely " MongoDB" to enhance the information management system in the country.

In addition, the CRUD (create, read, update and delete) operations in MongoDB database are much better and faster than MySQL. This means, MongoDB provides less execution time form noted operations than relational databases [6]. We placed here comparative result regarding the insert operations for your consideration (*see Fig. 5*).

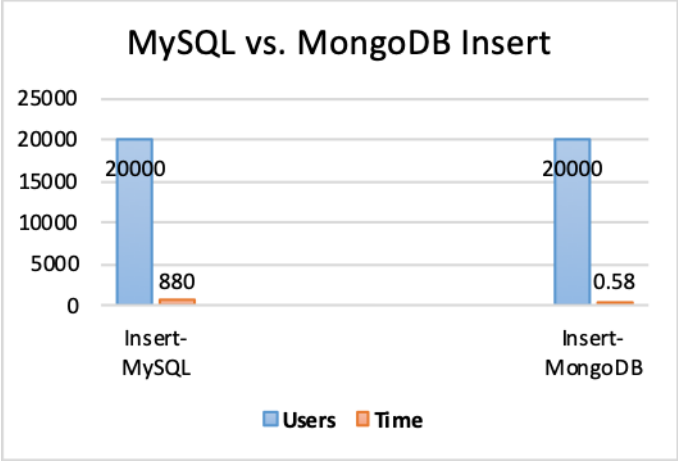

Fig. 5: MySQL vs. MongoDB insert operation

Respectively to MySQL terminology, the author placed the important terms of MongoDB in the following table for your further understanding how to play with MongoDB terms (*see Table I*).

TABLE I. TERMINOLOGY

MySQL vs. MongoDB terms	
MySQL	***MongoDB***
Database	Database
Table	Collection
Index	Index
Row	Document
Column	Field
Join	Embedded links
Group by	Aggregation

According to MongoDB official website, we also placed the important features for your consideration (*see Table II*) which the relational databases are lack of them.

TABLE II. IMPORTANT FEATURES

Features- MySQL vs. MongoDB		
Features	***MySQL***	***MongoDB***
Rich data model	No	Yes
Dyamic schema	No	Yes
Autosharing	No	Yes

Features- MySQL vs. MongoDB		
Features	***MySQL***	***MongoDB***
Easy for programmers	No	Yes
Data locality	No	Yes

A. Discussion

As mentioned the important features of MongoDB in the above tables and figures indicate that MongoDB is relatively better choice for huge data storing. Moreover, MongoDB has very important features which are encourage the developers to choose the non-relational data namely "MongoDB" for their daily work. As Fig.5 indicates that insert operation takes less time than MySQL. The developer inserted 20000 users at the same time to both MySQL and MongoDB databases. Based on result, MySQL takes 880 seconds to insert 20000 users in the databases. In contrast, MongoDB takes 0.58 seconds to insert 20000 users in the databases. Indeed, MongoDB is faster and easy than MySQL and the author recommends the non-relational database for developers to use in their organizations and research work.

IV. CONTRIBUTION

The contribution of this hot topic is to highlight the current issues related to relational databases in Afghan society and replace the MySQL culture among Afghan masses. This study would encouraged developers to use and promote non-relational databases paradigm across the country. The main point is scalability and availability which is the most important factors for big data organizations, and will applied the Not Only SQL technology to enhance their daily activities. Furthermore, the author highly recommends the mentioned technology to add in universities' curriculum and promote this technology among developers.

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