Performance Analysis Of Proposed D1FTBC Approach For Improving Consistency In Cloud Data Transactions

J.Antony John Prabu, Dr. S Britto Ramesh Kumar

Abstract: Cloud is a computing technology; it provides several services in the application for a reliable services. The main feature of cloud is an ability to handle large amount of data without knowing about hardware form and maintenance. Although, the maintenance of consistency in data transaction is considered as a major problem of cloud database. It's one type of ACID properties. So data transaction in cloud requires better approach to maintain the consistency state. In existing, most of the researchers have developed several approaches for this issue but still it is in the infancy level. To solve this problem, this paper concentrates on developing a new approach that is D1TFBC to ensure higher level consistency. Further, the performance of the proposed approach is analyzed and results are verified with existing approaches.

Index Terms: ACID, Cloud Computing, Data Transaction, Database Consistency, Data Storage, D1FTBC, Cloud TPS.

1 INTRODUCTION

THIS Nowadays, Cloud Computing is a modern and well known technology [1]. It has grown from a promising business concept into one of the fastest growing segments of the IT industry. Moreover, various companies like Google, amazon etc., motivate their process in developing the using of cloud computing systems and increase their services to satisfy the customer need [2,3]. Not only this , cloud computing easily handles the large amount of data which comes from different applications but it also faces some difficulties during the data transaction like security and consistency [4,5]. Consistency is an important part of ACID properties, it implies the need for any database transaction to change affected data only in the permitted ways [6,7]. Any data that is stored in the cloud database should be valid according to the defined rules, including restrictions, resolutions, stimuli and its composition.It does not guarantee the correctness of the data transaction in all the ways which application programmer desires, but any programming errors will not result in violating the defined database barriers [8,9]. Therefore, consistency is more important during the data transaction in cloud. So this paper , explains the related concepts in existing work, proposed framework with its components, various phases of the protocol which is used in this approach and obtaining the results of the performance analysis of the proposed approach.

2 RELATED WORK

Pratik et.al.,[10] addressed the problems in Real Time Transaction (RTT) Management with respect to replicated distributed real time database system (RDRTDBS). This paper examined various scenarios of coordinator, cohorts & updaters and proposes measures and addressed the interaction between them. This work mainly focuses on maintaining consistency. The proposed method achieves availability, scalability and reliability that ensures high performance. Abdennaceret.al.,[11] analysed the various approaches used to maintain consistency in cloud environment. This paper addresses the problems in consistency such as architectural model, conflicts, granularity, adaptive policy, operation level, threshold, monetary costs, security and implementation tools. Listed the reason behind problems in consistency in clear manner. Explored the importance of consistency in performance. Liu et.al.,[12] developed a framework for maude (Manufacturer and User Facility Device Experience Database) in DTS(Distributed Transaction System). This Framework is tested against nine common properties of consistency to ensure DTS Quality. This model is checked against the popular DTS models like P-Store, RAMP, Walter, Jessy, and ROLA. Zhianet.al.,[13] proposed a model for distributed transaction using two phase protocol. The proposed model has introduced a heartbeat mechanism to handle the participants in the distributed environment. This mechanism uses status table to monitor the participants and two phase commit protocol is used to handle the failures. The proposed mode has achieved improvement in reliability and has reduced the rate of blocking in distributed environment. Diogoet.al.,[14] discussed the role of NoSQL in real world. This paper has reviewed the performance of 5 popular NoSQL databases (Redis, Cassandra, MongoDB, Neo4j, and OrientDB) and functionalities, real time problems of this databases are discussed in detail manner. Relation between consistency and availability is clearly stated. All databases are checked against CAP theorem in that Cassandra achieved high availability. Leijuet.al.,[15] discussed the role of transaction in distributed environment and addressed the problems in real time. Summarised the importance of ACID (Atomicity, Consistency, Isolation, and Durability)in transactions. Identify the needs of intelligence in transaction and recommended the advantages of using intelligence in transactions. Basuet.al.,[16] proposed a model to reach high consistency and this model checked in data intensive cloud environment. This model recommends CCSA (Cloud Consistency Satisfying Algorithm) for maintaining consistency. This model is checked against 5 replica servers only if the number of replica servers have increased then this model lead the entire system to failure.

3 METHODOLOGY

The proposed work introduces a new enhanced approach for ensuring the consistency in the cloud environment to execute the data transaction. The new approach is named as Depth 1 Fixed Tree Based Consistency (D1FTBC). The proposed approach has motivated to develop for decreasing the execution time while transfering the data and ensuring higher level of consistency among replica servers in the cloud environment. This framework is categorised into four parts and each part has performed with unique functionality. First part of this framework, analyze the query, the allotted tree adjusted in the second part, query execution is performed in third part and

data is updated in the third part. Several components which is listed in table 1 found in the proposed framework that is used to provide a powerful system for transaction. The proposed framework and its components are described in figure 1.The proposed approach is easy to implement, confirm the ACID properties, take less time to response time, very reliable and efficient**.**

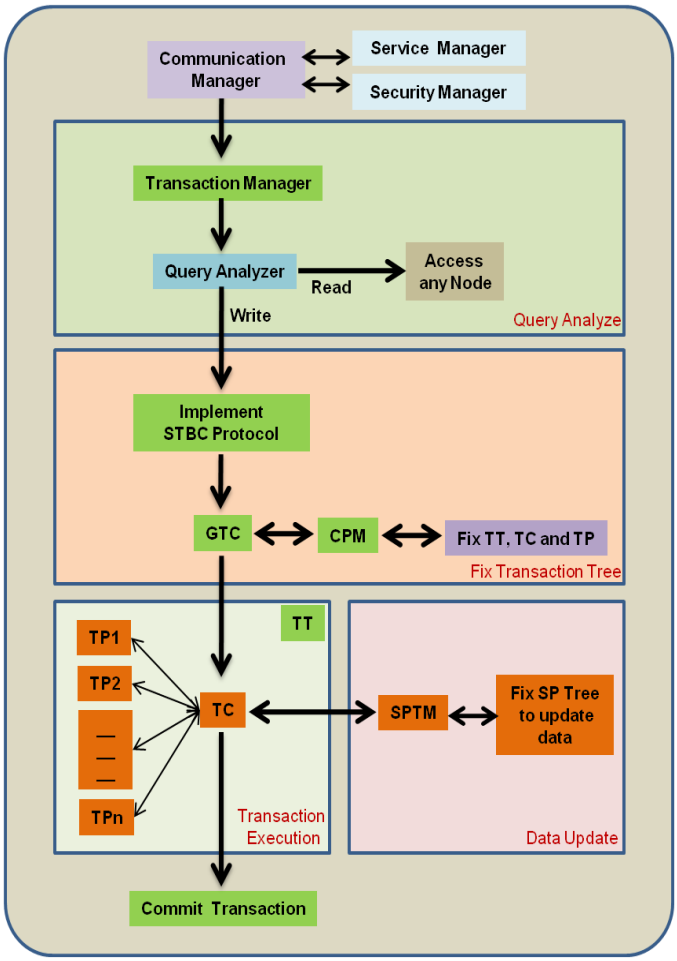

Figure: 1. Framework of Depth 1 First Tree Based Consistency

The components of the proposed work is listed and explained in the following table 1,

Table 1: Several Components of the proposed approach

S. No	Name of the component	Description
1.	User	Send request to and receive response from query manager
2.	Communication Manager (CM)	Establishes communication among CSC, CDL, SM and TM to execute a transaction
3.	Service Manager (SM)	Maintains the details of service verification from CSC for transaction in cloud
4.	Security Manager(SEM)	Maintains the log details of CDL to verify security on each transaction
5.	Transaction Manager(TM)	Takes responsibility of each transaction and check transaction activity
6.	Query Analyzer(QA)	Ensures the query whether read or write
7.	3PSTBC Protocol	Three-Phase Secured Tree Based Commit includes three phases to transaction process in cloud and activate the data transmission with ACID properties. More reliable for the proposed approach.

The following phases explain the overall process and environment of the 3PSTBC protocol which used in the D1FTBC approach to reliability.

Phase I:
In phase I, the Transaction manager(TM) sends the request to CPM to make Transaction Tree (TT) and CPM prepares the response for the request which is sent by TM as well as TM waits until CPM sends the request. Once the response is ready then CPM sends the prepared TT to TM. Finally, if TM accepts the response which from CPM then CPM Fix TT.

Phase II:
The Transaction Coordinator in this framework, transmits the request to every transaction participants for making message and these Transaction participants must be a part of Transaction Tree (TT) and wait until receive the response from all participants in the transaction. If the transaction process ready to commit, transaction participants to dispatch the vote for prepared message and third phase will start or reply No message.

Phase III:
In Phase III, the Transaction coordinators prepare to commit with all participants. The TC sends request to SPTM for preparing SPT then the SPTM preparing response and TC wait until SPTM response. SPTM the sends prepared message to TC otherwise no message is to be sent. If TC accepts the message, SPTM fix SPT. The transaction coordinator The overall methodology of D1FTBC is described as a diagram that is shown in figure 2. This figure explains the concept which is explained in the following paragraphs.

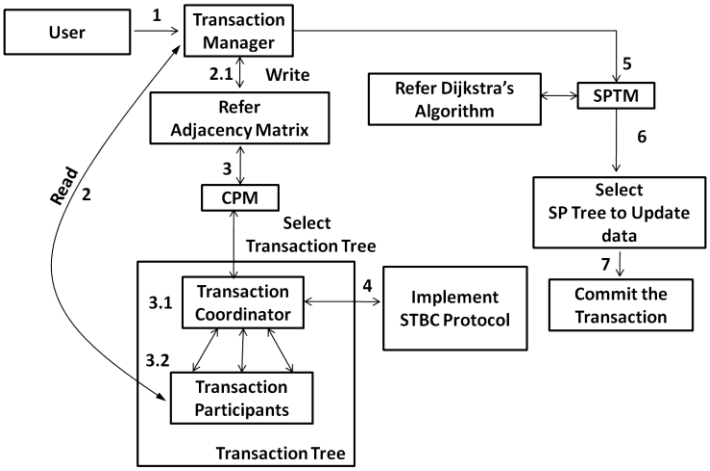

***Figure 2:** Methodology of the proposed approach D1FTBC*

4 Result and Discussion

The proposed framework of D1FTBC with 3PSTBC protocol is used during the transaction in the cloud and these two frameworks are successfully installed into the multi layer secured architecture [17]. Many transaction services are provided between virtual machine and database in cloud. The performance of transaction services in this framework are evaluated and explained in this section. Basically transactions are divided into read and write transactions. Each transaction processing system must satisfy these combinations of transaction to improve the consistency in cloud environment. So the read and write transaction ratio are evaluated that against from the ratio of various consistency response time. The read and write transaction ratio start and end ratio of read and write transaction respectively, 5:1 and 1:5. Further the execution time of the various read and write ratio in transaction are evaluated and depicted in the figure 3.

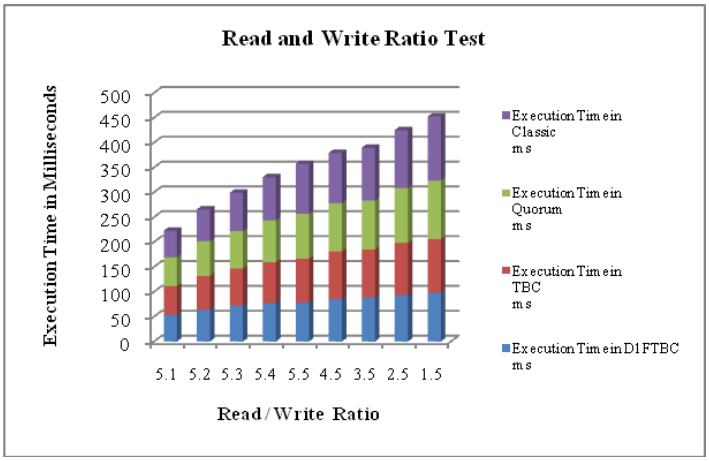

Figure 3: *Performance evaluation of various read and write ratio*

The evaluated results of various read and write ration in the proposed approach shows the better results that is classic approach gives better result when the server utilized more numbers of read transactions. If the read and write transaction provides the ratio like 5:5 , the proposed approach shows better result than others and also system faces more number of write transaction the proposed approach performs well. There are various transaction performances carried based on the following characteristics to ensure the consistency of the D1FTBC approach, which is explained in the following steps, Performance of the writing transaction to increase the number of servers In which, the execution time are calculated to various consistency approaches and it increases the number of replica servers. The replica servers are increased from 5 to 12 when the transaction quantity is 1000 per minute. The performance analysis on this approach is assessed for writing and reading transaction that are shown by the following figures 4 and 5.

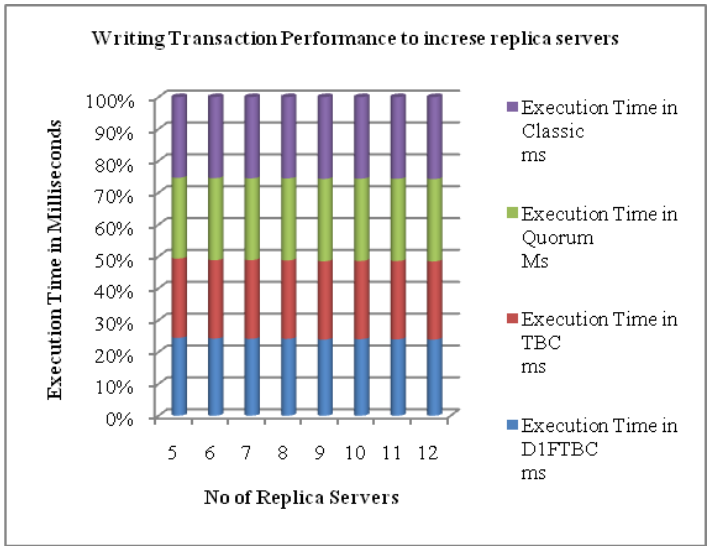

Figure 4: Performance analysis on writing transaction to increase replica servers

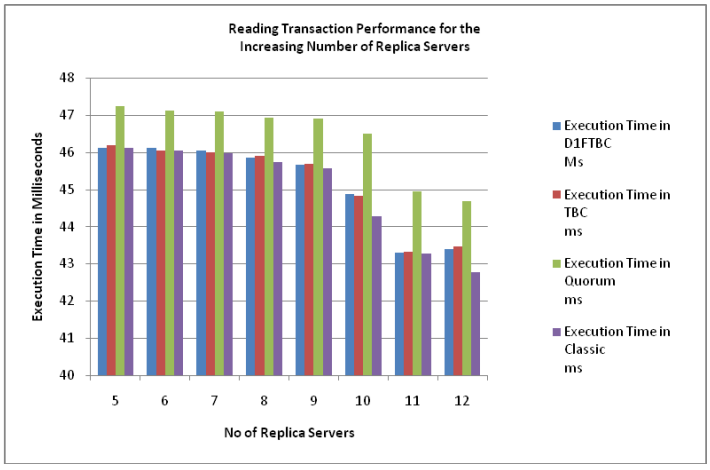

Figure 5: Performance analysis on reading transaction to increase replica servers

The results writing transaction performance, D1FTBC approach has increased the replica servers in the range from 5 to 12 within minimum execution time while Quorum approaches and Classic approach consumes the execution time respectively, 91. 38 ms for 5 replica servers and 98.67ms for 12 servers. As well as the classic approaches in reading transaction increases the number of replica servers with small execution time than other approach and proposed approach provide next level of better result. Like the performance for increasing replica servers in read and write transaction , arrival rate in read and write transaction increases. In which the arrival rate increasing in the range from 50 to 400 / minute with minimum 5 standard replicas in both read and write transaction. The performance evaluation of arrival rate is shown in figures 6 and 7.

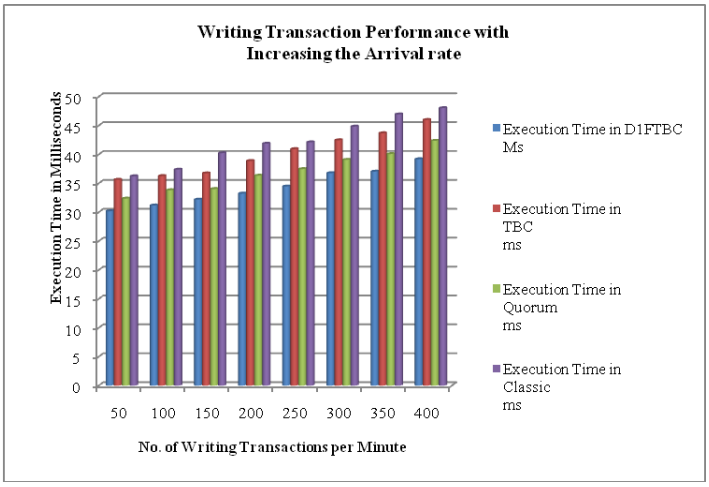

Figure 6: Performance analysis on writing transaction with increasing arrival rate.

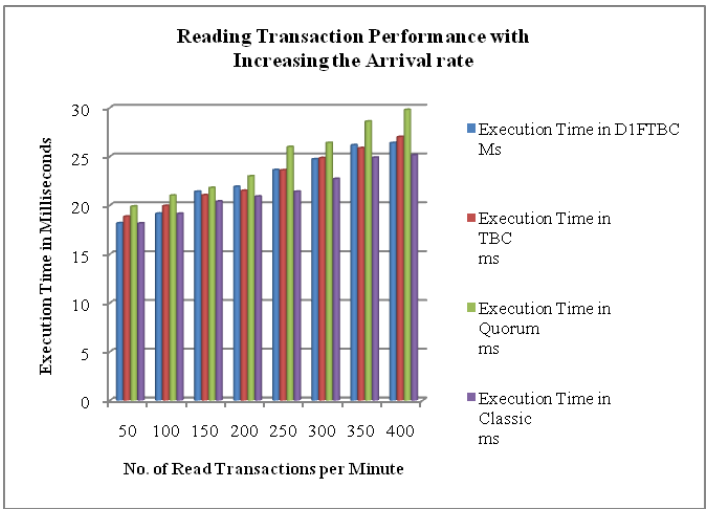

Figure 7: Performance analysis on writing transaction with increasing arrival rate.

Performance analysis on reading and writing transaction with arrival rate is evaluated, in which proposed D1FTBC approach provides the better result for writing transaction like the effect of arrival rate which is higher within minimum amount of execution time than existing approaches. The arrival rate for read transaction is in both higher and lower stage on classic approach and execution time is small, so classic approach is considered better approach than others for read transaction with increased arrival rate. The final characteristic of proposed approach is combined service request and the arrival rate of this request is evaluated, which is increased from 100 to 800. The following figure 8 explains that the proposed approach provide the better result than other existing approach in both read and write transaction is based on the arrival rate (higher and lower) with minimum execution time.

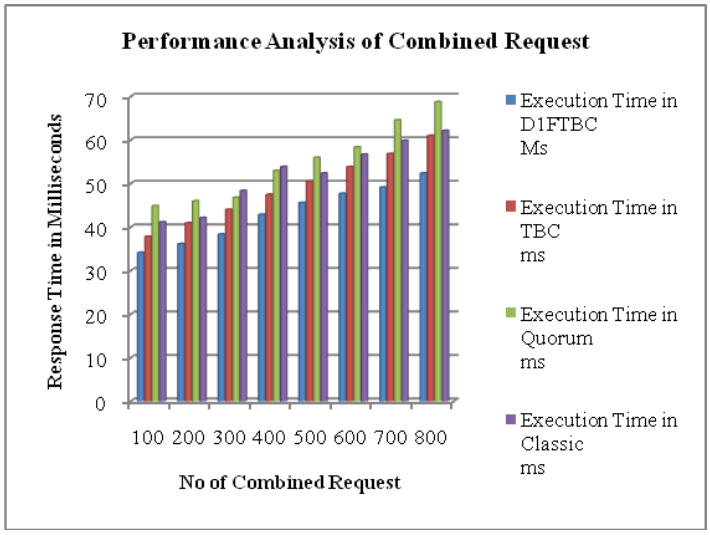

Figure 8: Performance analysis on combined (read and write) request.

Further, the performance on the components of D1FTBC is analyzed to ensure the transaction consistency in cloud database. In which, the components execution against for increasing service request arrival rate, like 50 to 500 request per minute. The figure 9 is describes the performance analysis of different components of proposed approach, which against increasing arrival rate

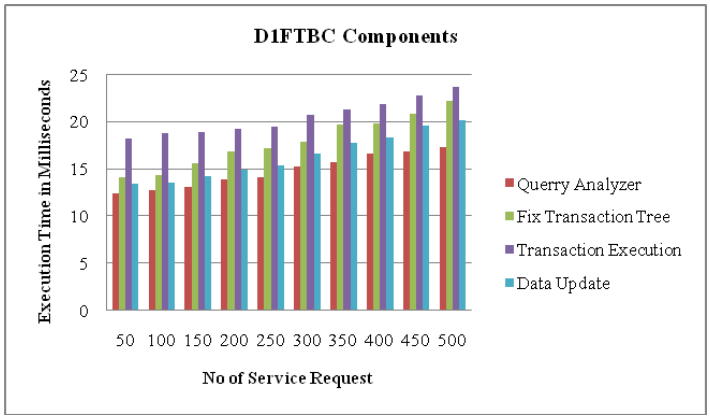

Figure 9: Performance analysis of the components of the D1FTBC approach

The execution time and the service request of the proposed approach are differentiated by using the plot in this figure. From the components of D1FTBC approach , the higher response is received by transaction execution which plays a vital role in commit protocol of transaction. The components are fix transaction tree and data update provides medium level of execution time and the query analyzer gives a low level of execution time than other components of the proposed approach. Moreover, the has plot increased linearly which is based on the workload of the components to ensures the performance of the proposed approach D1FTBC.

4 Conclusion

The major task which is faced in software industry is maintaining the higher consistency state while data transaction on cloud environment. Most approaches are created to achieve the better consistency state in data transaction but still improvement is needed. So this paper, proposes a new approach named as D1FTBC with 3PSTBC protocol to improve the consistency rate in data transaction on cloud environment. The components of the proposed approach are explained in detail and protocol is more reliable which is used in this approach. The performance evaluation is successfully evaluated for all components and proposed approach has provided the better consistency rate than the other existing approaches.

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