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# Performance of Proposed Architecture for Data Transactions in Cloud using D1FTBC

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

***Abstract*: Cloud is a major requirement for data storage and computing power, without user direct performance. Cloud computing is a famous option for IT industries, enterprises, and government sectors because it provides everything as a service based on user demand. Cloud computing is a better environment for handling a large amount of data which is produced by social networks, health industries, transactional, etc., However, cloud has some issues during the data transaction, many researchers have proposed models and solutions for these problems but still maintaining consistency during the transaction is the biggest problem, it is one of the important properties in ACID. Further, secured architecture is another important issue in cloud environment. So this paper proposes a secured architecture and efficient D1FTBC approach for cloud data transaction. The performance analyses are evaluated at various levels. This research work may lead the transaction processing applications like banking, online reservations and shopping cart etc.,***

***Keywords: Cloud Architecture, Cloud Computing, Database Consistency, Data Transaction.***

## I. INTRODUCTION

Cloud computing is a modern technology for delivering unlimited shared resources like hardware and software to clients through the internet and these resources can be measured automatically according to customer requirements. The cloud gives a great evolutionary speed in the IT industry. One of the definitions of cloud computing is given by NIST [1], " model for enables convenient, require-demand network access for a shared group of compatible computing resources and it can be quickly delivered and issued with minimum management effort." Cloud is classified as two models that are deployment model and the service model. The three major service models of cloud are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) and the deployment models are a private cloud, community cloud, public cloud and hybrid cloud [2]. Further, the cloud has three main components namely clients, shared servers and data centers. Some key challenges in Cloud Computing include Safety, Cost and Service Level Agreement [3] [17]. Transaction in cloud is a task to transfer the sequence of information or any other relevant information among one or more entities. In cloud computing, Data Transaction Management (DTM) is one of the challenging tasks [19,20]. Normally, IaaS service model used to maintain the DTM in cloud and each data are maintained by DaaS service model. This model provides databases in the cloud environment with features such as data definition, data storage, and data recovery. Most of the famous cloud computing providers are Amazon, Google, IBM, Oracle and Microsoft provides daas with their solutions [4, 24]. Cloud resources are typically elastic, unnecessary range of computer power and required storage and pay only for what-you-use. Cloud faces problem in managing transaction data, such as bank transactions, online reservation and online shopping cart. However, some of the models and approaches provide solutions to deal with ACID properties, that are important in each transaction of a distributed environment, but still, cloud is inefficient in maintaining the better 'Consistency' state[5][6], it's one of the essential properties in ACID. Another concern is security protection for transaction data maintained in a third-party environment [7,18]. Maintaining cloud data with multiple cryptographic modes is the most secure architecture, but the problem is to provide a thorough complete architecture to the data transaction in the cloud environment after deep analysis.

## II. RELATED WORK

Syarilla et. al [8] developed web service-based application in cloud environment for evaluating the problem in multimedia transactions. In this application, the time factor is classified into two categories that is transaction time and valid time. The test result showed that this application can handle a massive amount of multimedia data easily, systematically and more openly. But security level aspects not considered in this application. Woonget. al [9] recommended a system for decoupled architecture in cloud-based DBMS and addressed the numerous issues for achieving better performance. This system used MariaDB for both transaction log and data pages and mainly focused on performance in front end side and data durability in the back end side. Except durability other ACID properties are not considered in this system. Al et.al [10] discussed the database as a service and its issues, challenges and problems. The summarization of advantages and disadvantages in cloud databases are explained briefly. Explored the impact of cloud computing in the e-commerce sector is dictated. Sruti et.al [11] proposed a model for data-intensive in cloud environment.

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The author discussed the importance of consistency in cloud-based transactions. Five replica servers used for the implementation of this model in case it increases enormously then this model success is questionable. Higinio et. al [12] proposed model to solve complexity task scheduling in mobile cloud computing. The experimental result showed that this model achieved high flexibility with task scheduling. This proposed model consists of several layers in that the cloud layer is used to reduce the system workload by outsourcing. But rapidly workload increasing then this model encage with failure. Antony et.al [13] summarized cloud computing and its characteristics, advantages, disadvantages and various transactional architectures. Briefly addressed the data related problem in cloud. Explained the impact of ACID properties in cloud transaction environments. Widad et.al [14] proposed a middleware that is cloud-based middleware for transactional service adaptation (CM4TSA). The proposed middleware has a new layer called "Adaptation as a Service" which is used to ensure proper execution of each transaction. This cloud-based platform ensures elasticity in service demand and high-level abstraction in a transaction and simplified the user access which leads to a successful transaction. But this system not achieved all properties of ACID [21] [22] [23].

## III. PROPOSED ARCHITECTURE

The Storage and maintenance of cloud data are performed in the third party environment. So security is the biggest problem while storing and maintain the data in the cloud database [15] [16]. In this paper, the multi-level security architecture is proposed to overcome this problem and enhancing the consistency of data transactions [25] [26]. The consistency and security levels are ensured by the proposed architecture in cloud transactions. The following figure 1 depicted the proposed architecture.

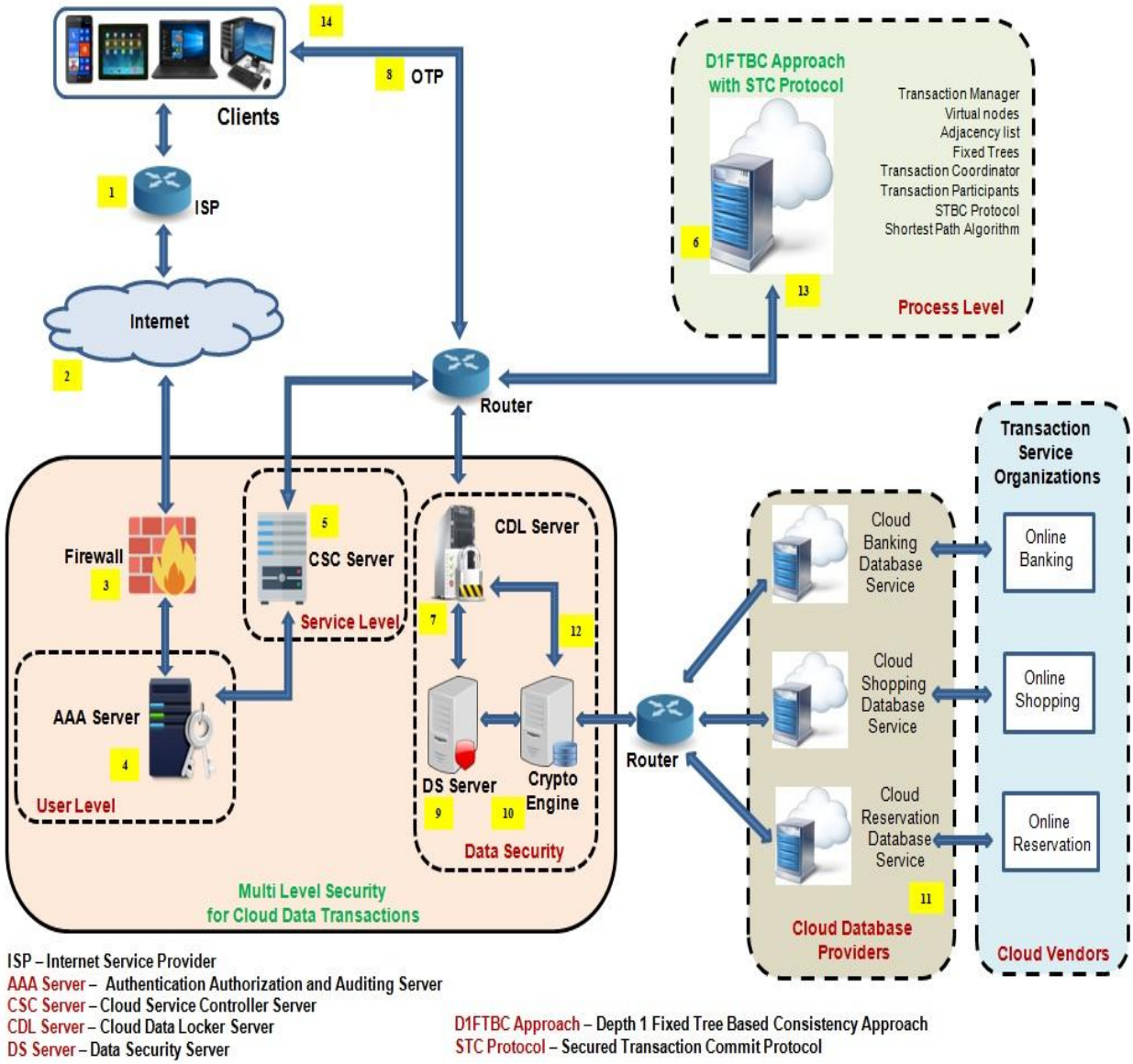


**Figure 1: Proposed Architecture For Secure Data Transmission In Cloud Environment**

The several levels of the proposed architecture are Depth 1 Fixed Tree-Based Consistency (D1FTBC) approach, Authentication Authorization and Auditing (AAA) Server, Cloud Service Controller (CSC), Cloud Data Locker (CDL). These levels are described in the following table 1.

**Table 1: Several levels of proposed Architecture**

| Levels of the proposed architecture | Why it is used? | Process | Components |
|---|---|---|---|
| Authentication Authorization and Auditing (AAA) server | Enhances the security of user and device | Authentication, Authorization and Auditing | AAA server such as Communication Manager (CM), System Models (SM), Security Manager (SEM)and User Credential DB Manager (UCDBM) |
| Cloud Service Controller (CSC) | service authentication is improved | Receives the request and check the authentication | Communication Manager(CM), Security Manager(SEM), Service Manager(SM), Service Policy Verifier (SPV), Service Profile (SP), Integrated Service Manager(ISM), Crypto Engine(CE), Cloud VM Monitor (CVMM), VM Instrospection Tool (VMI) and VMM Profile Tool (VMMP) |
| Depth 1 Fixed Tree-Based Consistency (D1FTBC) Approach | Used for data transmission | Execute each transaction without any fail | Communication Manager (CM), Service Manager(SM), Security Manager (SEM), Transaction Manager(TM), Query Analyzer(QA), 3PSTBC Protocol, Global Transaction Coordinator (GTC), Consistency Performance Metric (CPM), Fixed Tree/ Transaction Tree(TT), Adjacency Matrix, Transaction Coordinator, Transaction Participants, Shortest path Trees, Shortest Path Tree Manager |
| Cloud Data Locker (CDL) | enhances security module of data storage | Strengthen user, service and data storage level security. | Communication Manager (CM), Cloud Data Locker Manager(CDLM), Data Security (DS) Server, Crypto Engine (CE) and Cloud Database (CDB) |

### A. Pseudocode for Proposed Architecture

Step 1:
A user sends transaction Request to AAA server
Step 2:
AAA server acknowledge transaction request
Step 3:
A user sends the PIN for verification
Step 4:
AAA server validates the PIN and enters to CSC server
Step 5:
CSC verify the Cloud service policy and Cloud Vendors submit the service policy
Step 6:
CSC verify the Cloud VM monitor
Step 7:
Cloud DB Providers Submit Write Query to D1FTBC
Step 8:
D1FTBC Request to Access the data
Step 9:
CDL Send data access request to DS
Step 10:
CDL Send OTP to Client Verification
Step 11:
CDL Send DSN to DB provider for verification
Step 12:
DS Access data through Crypto Engine and Crypto Engine Encrypt/Decrypt the Cloud Data
Step 13:
D1FTBC Commit Transaction
Step 14:
D1FTBC Update data to all virtual machines
Step 15:
D1FTBC Send Response to the User

## IV EXPERIMENTAL STUDY AND RESULTS

The performance analysis of the proposed work is described in this section. The execution time is measured by an experimental study with respect to User Authentication, Service Authentication, Data Transaction Analysis, Secure Communication between various servers, Data level access Time with Security, Latency Analysis, System Throughput and Hit Ratio on the Proposed Architecture. Visual Studio 2012 Asp.NET Software is required to implement the proposed approach deployed in the Windows Azure Platform as a Service. The obtained simulation results of this experiment explained in the graphical format. The element of the proposed architecture focused to enhance the security and consistency of the cloud data transmission that elements are such as AAA server, CSC server, CDL server, D1FTBC server, cloud DB and Cloud Storage server. The Performance Analysis of the proposed system assures that the proposed architecture works efficiently with advanced performance. The performance analysis of the proposed architecture performed in various aspects described in the following section,

### A. Performance analysis on user authentication

PAISCDTCD setup is used to manage the authentication protocol and user identities are validated remotely as well as locally. The user side security is strengthening by communication of the AAA server with the user. User authentication is verified by the username and password.

The communication is maintained by the communication manager and access permission of each user maintained by system models. While validating the username and password, the response will provide in a millisecond to each service request send per minute by the user. The response time and service requests are measured during the verification. The performance analysis of user authentication is depicted in figure 2. PIN verification is required for each transaction at the entry-level of the service provided and response time measured in a millisecond to each request per minute.

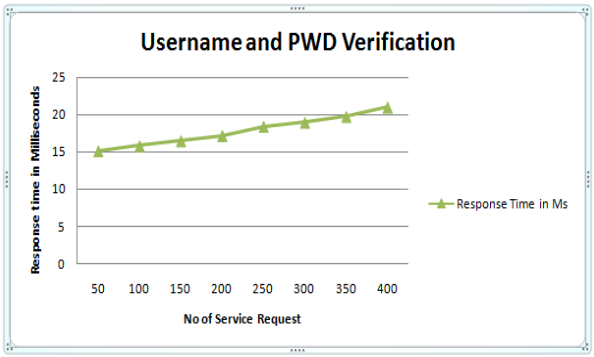


**Figure 2: Analysis Of Username And Password Verification**

The performance analysis of the pin verification is shown in figure 3, it exhibits the response time for each request with a linear line.

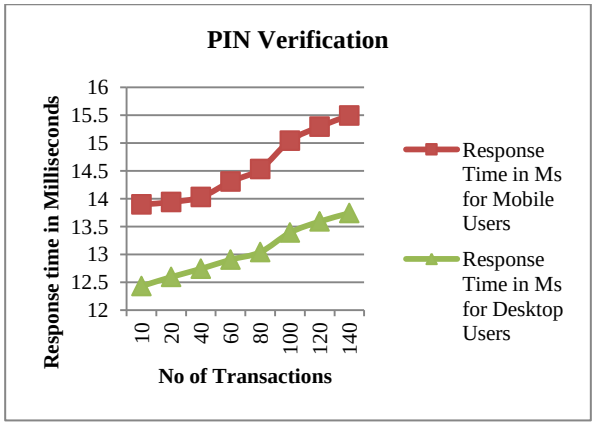


**Figure 3: Analysis Of PIN Verification With Response Time**

The processing time for encrypting, decrypt and retrieve credential data of the user is a part of the AAA server to reinforce user and device-level security. Figure 4 shows the performance analysis of the pin verification of credential data, it depicts that is the processing time is growing linearly depending on the number of service requests

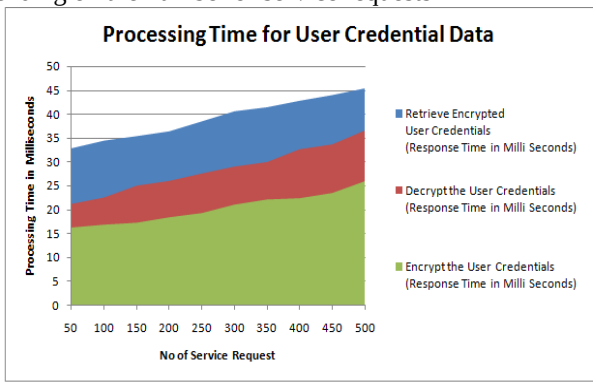


**Figure 4: Analysis Of Processing Time For User Credential Data**

## B. Performance Analysis of Service Authentication

The service authentication performance is evaluated by the CSC sever, it ensures service policy and working ability. The processing time for various components in the CSC server is estimated and also response time VMM tool also analyzed to each request per minute. The processing time of service authentication when increasing the service request is shown in figure 5.

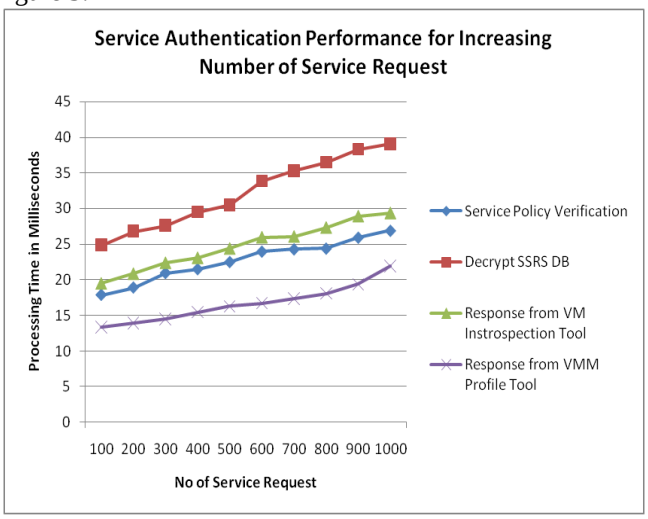


**Figure 5: Analysis Of Service Authentication Performance When An Increasing Number Of Service Request**

In which, the performance comparisons are performed for various components. From this, Decrypt SSRS DB shows the maximum processing time 39.09793 ms and VMM Profile Tool shows the minimum processing time 21.9475 ms for 1000 service request.

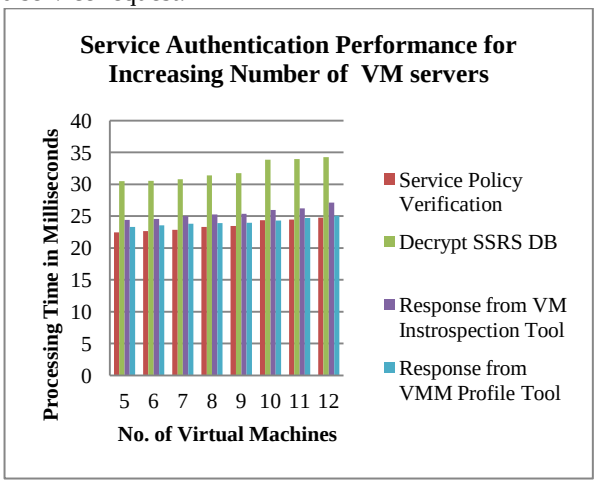


**Figure 6: Analysis Of Service Authentication Performance When An Increasing Number Of VM Servers**

Figure 6 shows the performance of service authentication when increasing virtual machines (VM), in which, the number of virtual machines ranging from 5 to 12 significantly, the proposed system reveals the standard processing time. This exhibits better results such as increasing or decreasing virtual machines.

### C. Performance Analysis of D1FTBC Components

This section describes the performance analysis for the consistency of the proposed approach. The execution time of the several components of the proposed consistency approach and increasing service request arrival rate. Figure 7 describes the execution time of D1FTBC components. In carrying out the D1FTBC approach, substantially 50 to 500 of service demands, the elements of the proposed system reveal the execution, which increases the time

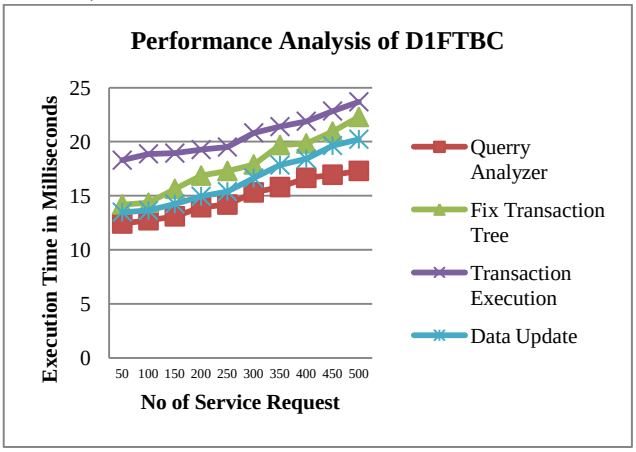


Figure 7: Execution time of D1FTBC approach components

From this, the transaction execution component exhibits the higher response compare with others and the Fix Transaction Tree and Data Update components provide the average level of execution time among Transaction Execution and Query Analyzer components and finally the Query Analyzer depicts the smaller execution time than the other components of D1FTBC. These comparisons were shown in figure 7.

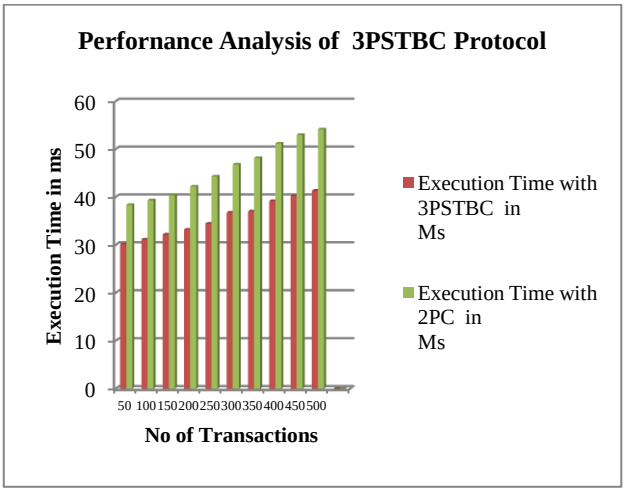


Figure 8: performance analysis of 3PSTBC protocol

Further, figure 8 depicts the performance analysis of the proposed protocol named as 3PSTBC against increasing arrival rate. In the implementation of 3PSTBC, a substantial number of 50 to 500 service requests reveals a smaller execution time than the 2PC protocol.

### D. Latency Analysis

Latency is the calculation of the gap between two points at the time of the execution of the initial and final point of the event. In which high latency means it takes time to response and low latency is a quick response. The proposed architecture includes three latency points that are CSC server to D1FTBC server, AAA server to CSC server, and D1FTBC server to CDL server.

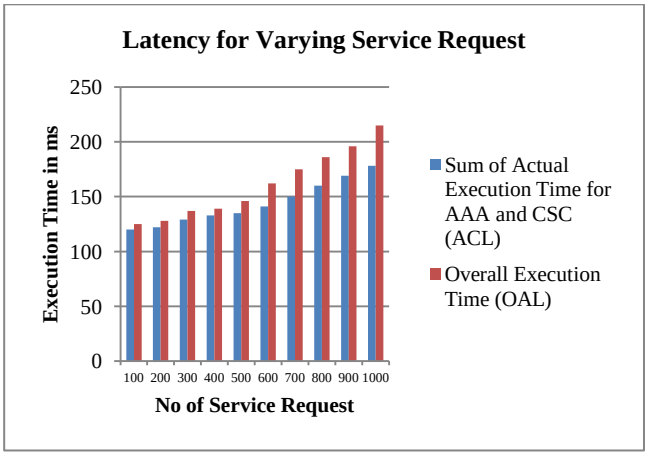


Figure 9: Latency for varying service request

In AAA server to CSC server, the increased time evaluated using the difference among the sum of actual execution and overall execution time. Figure 9 shows the various service requests of execution times in AAA sever to CSE server.

## V CONCLUSION

Cloud computing is the most wanted technology in IT industries. It provides better services for data management during the analytical process but cloud computing meets some issues when handling the transactional data. Most of the models and approaches are proposed to maintain ACID properties in cloud data transactions. Secure architecture and an efficient consistency approach are important and inevitable factors of' cloud data transactions. In this research work, the multi-layered architecture was proposed at various levels. It was developed successfully for secured transaction in cloud environment. The proposed architecture experimented through user authentication, service authentication and process level with D1FTBC approach. The latency analysis is empirically evaluated with positive results. Consistency was improved through the well-equipped components of D1FTBC approach. This research will lead to the strengthening of data transaction services in the cloud environment. In the future, the proposed architecture will improve with biometric authentication.

## REFERENCES

1. Peter Mell, Timothy Grance. The NIST Definition of Cloud Computing (Draft). NIST. 2011.
2. Furht, Borko, "Cloud computing fundamentals", In Handbook of cloud computing, Springer, Boston, MA, 2010, pp. 3-19.
3. Singh, Saurabh, Young-Sik Jeong, and Jong Hyuk Park, "A survey on cloud computing security: Issues, threats, and solutions " , Journal of Network and Computer Applications 75, 2016, pp. 200-222.
4. Rajkumar Buyya , Chee Shin Yeo , Srikumar Venugopal, James Broberg , Ivona Brandic, "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility", Future Generation Computer Systems, Elsevier,2008.
5. Kuyoro, S. O., F. Ibikunle, and O. Awodele, "Cloud computing security issues and challenges, " International Journal of Computer Networks (IJCN) 3, no. 5 , 2011, pp. 247-255.

6. Yimam, Dereje, and Eduardo B. Fernandez, "A survey of compliance issues in cloud computing ", Journal of Internet Services and Applications 7, no. 1, 2016, pp.1- 5.
7. J.Antony John Prabu, Dr.S Britto Ramesh Kumar, "Proposed Architecture for Secure Distributed Data Transaction Management in Cloud Environment", International Journal of Applied Engineering Research, Vol. 10, No. 82, 2015, pp. 489-497
8. Saany S.I.A., Rahman M.N.A., Mamat A.R., Nasir A.F.A.," Multimedia Data Archive Application in Cloud Environment" Proceedings of the Third International Conference on Computing, Mathematics and Statistics , Springer, Singapore, 2017, pp. 61-68.
9. Sul, Woong, Heon Y. Yeom, and Hyungsoo Jung., "Towards Sustainable High-Performance Transaction Processing in Cloud-based DBMS" , Cluster Computing 22, no. 1 , 2019,pp. 135-145.
10. Al Shehri, Waleed. (2013),"Cloud Database Database as a Service", International Journal of Database Management Systems, Vol.5, no.2, 2013,pp. 1-12.
11. Basu, Sruti, and Prasant Kumar Pattnaik, "Maintaining Consistency in Data-Intensive Cloud Computing Environment", In Progress in Computing, Analytics and Networking, Springer, Singapore, 2018, pp. 257-264.
12. Mora, Higinio, Francisco J. Mora Gimeno, María Teresa Signes-Pont, and Bruno Volckaert, "Multilayer architecture model for mobile cloud computing paradigm", Complexity 2019, pp. 1-13.
13. J.Antony John Prabu, Dr.S Britto Ramesh Kumar, "Issues and Challenges of Data Transaction Management in Cloud Environment", International Research Journal of Engineering and Technology (IRJET), Vol.2, No. 4, 2015, pp.123-128.
14. Ettazi, Widad and Hafiddi, Hatim and Nassar, Mahmoud and Ebersold, Sophie, "A cloud-based architecture for transactional services adaptation", In: International Conference on Technologies and Applications ,2015, pp1-7.
15. Ahmad Waqas, Abdul Waheed Mahessar, Nadeem Mahmood, Zeeshan Bhatti, Mostafa Karbasi, Asadullah Shah, "Transaction Management Techniques and Practices in Current Cloud Computing Environments : A Survey", International Journal of Database Management Systems ( IJDMS ) Vol.7, No.1, February 2015.
16. Amir Mohamed Talib, Rodziah Atan, Rusli Abdullah & Masrah Azrifah ,Azmi Murad , "Security Framework of Cloud Data Storage Based on Multi Agent System Architecture - A Pilot Study", 978-1-4673-1090-1/12/$31.00 ©2012 IEEE.
17. Vinit Padhye, Anand Tripathi, "Scalable Transaction Management with Snapshot Isolation on Cloud Data Management Systems ", IEEE Fifth International Conference on Cloud Computing, 2012.
18. Sebastijan Stoja, Bojan Jelai, Sran Vukmirovi, Darko Capko, Nikola Dalcekovic, "Architecture of Real-Time Database in Cloud Environment for Distributed Systems", Second International Conference on Artificial Intelligence, Modelling and Simulation, 2014
19. Hyun-wook Baek, Abhinav Srivastava and Jacobus Van der Merwe, "CloudVMI: Virtual Machine Introspection as a Cloud Service", Cloud Engineering (IC2E), 2014 IEEE International Conference on 11-14 March 2014.
20. Katarina Grolinger, Wilson A Higashino, Abhinav Tiwari, Miriam AM Capretz, "Data management in Cloud environments: NoSQL and NewSQL data stores", Journal of Cloud Computing: Advances, Systems and Applications 2013,2:22 doi:10.1186/2192-113X-2-22
21. Mohd Muntjir, Mohd Asadullah, Shabbir Hassan, Altaf Hussain, "Cloud Database Systems: A Model Conversion in Databases", 2nd International Conference on Information Technology and Electronic Commerce ICITEC 2014
22. Quang Hieu Vu, Maurizio Colombo, Rasool Asal, Ali Sajjad, Fadi Ali El-Moussa and Theo Dimitrakos, "Secure Cloud Storage: A framework for Data Protection as a Service in the multi-cloud environment", IEEE, 2015
23. Min Shen, Ajay D. Kshemkalyani, and Ta-yuan Hsu, "Causal Consistency for Geo-Replicated Cloud Storage under Partial Replication", IEEE International Parallel and Distributed Processing Symposium Workshops, /15 $31.00 © 2015 IEEE, DOI 10.1109/IPDPSW.2015.68
24. David Bermbach1, Liang Zhao2, and Sherif Sakr2, "Towards Comprehensive Measurement of Consistency Guarantees for Cloud-Hosted Data Storage Services", Researchgate, Conference Paper · August 2013, DOI: 10.1007/978-3-319-04936-6_3
25. Peter Bailis†, Ali Ghodsi†,‡, Joseph M. Hellerstein†, Ion Stoica†, "Bolt-on Causal Consistency ", SIGMOD'13, June 22–27, 2013, New York, New York, USA., Copyright 2013 ACM 978-1-4503-2037-5/13/06
26. R. Anandhi, K. chitra, " A Challenge in Improving the Consistency of Transactions in Cloud Databases - Scalability" , International Journal of Computer Applications (0975 – 8887) Volume 52– No.2, August 2012


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