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Maintain the Consistency of Auditing Cloud

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***Abstract*—** In day to day life cloud is most essential part. Now cloud storage are use for business purpose the cloud is popular due to their huge amount of advantages the cloud is portable we can able to access the cloud anywhere globally. A cloud service provider maintains much duplication and each piece of data are globally distributed on servers. The main problem of cloud is to handle duplication of data which is too costly to achieve powerful consistency on world wide .In this paper we present a novel consistency service model which contain a large amount of data cloud and multiple audit clouds In The Consistency Service model . a data cloud is maintain by Cloud service Provider (CSP) and the number of user constitute group and that group of user can constitute an audit cloud Which can check whether the data cloud provides the valid level of consistency or not we suggest the 2 level auditing architecture, two level auditing architecture requires a loosely synchronize clock in the audit cloud. Then, design algorithms to quantify the commonality of violations metrics, and the staleness of the value of a read metrics. Finally, a Analytical Auditing Strategy (AAS) to shows as many violations as possible. Thus system performed using a combination of simulations and real cloud deployments to validate Analytical Auditing Strategy (AAS).

Keywords- *Global Consistency Auditing, Local Consistency Auditing, Analytical Auditing Strategy (AAS).*

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I. INTRODUCTION

Cloud computing is nothing but a specific style of computing where everything from computing power to infrastructure business apps are provided as a service its computing service rather than product some others benefits of cloud is resource provisioning scalability, flexibility and low cost .Some of the cloud company gives the cloud service as per month or yearly basis e.g. Amazon DB , Microsoft Azure Storage DB and so on by using cloud storage services the customer can able to access data store any where anytime by using any device and no need of capital investment on hard ware and access your data any time. The main problem in cloud is to handle replicas it is too costly to achieve strong consistency worldwide. many cloud service provider uses weak consistency like eventual consistency to get good performance and high availability the user can able to see latest update by using ACP principle Availability consistency and partition. The most popular example of eventual consistency is DNS (Domain Name System).

Eventual consistency is not remedy for all difficulty for all application e.g. for interactive service the strong consistency is required. Following figure 1 shows all details regarding system:

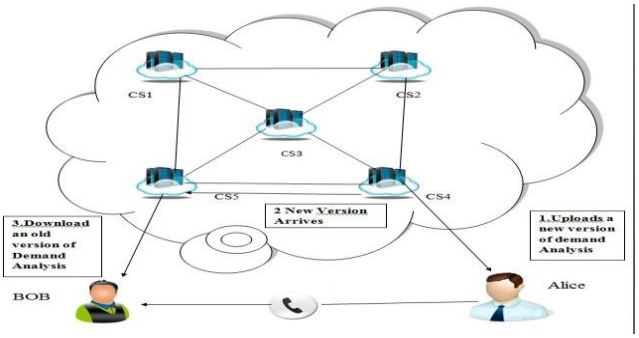

Figure 1 Causal Consistency Application

Suppose alice and bob are work under cloud storage service project. The data is replicated to 5 server CS1,CS2,CS3,CS4,CS5 respectively .uploaded the latest version of the requirement analysis to CS4 alice call bob to download latest version so here causal relationship is establish between bob s read and alice update. If the Cloud only provides eventual consistency then bob gives the permission to access old version from CS5.

So from this we can understand different application has different consistency from following example.

1) Mail server has read your write consistency and monotonic read consistency.

2) The example of causal consistency is social networking services.

In cloud storage consistency plays important role to determines correctness as well as actual cost/transaction But here we shows novel consistency service model for this situation .this consistency service module contain multiple small audit cloud and large data cloud .

Cloud service provider maintain data cloud and audit cloud contain a group of users that working on that project And service level Agreement will be form between audit cloud and data cloud .which will decide how much will be charged if the data cloud failed to SLA and what type of consistency the data cloud should provide .the implementation of data cloud is not visible to all user due to virtualization technique. it is very difficult for user to check whether each replica in data cloud is newest one or not . we permit the user in audit cloud to check cloud consistency by analyzing the trace interactive operation .we don't require a global clock among all user for total ordering of operation so we use loosely synchronized clock for our solution. For partial order of operation each user maintain logical vector .so here we develop 2 level of Auditing Structure .The two level auditing structure basically contain 2 auditing

1. Local Auditing

2. Global Auditing

Local Auditing: structure each user can perform local auditing with local trace operation periodically .this auditing focuses on monotonic read and read your write consistency .which can be perform by light-weight online algorithm the local auditing algorithm is online algorithm

Global Auditing: the auditor can be selected from audit cloud .the main works of the auditor is to perform global auditing with global trace operation .this auditing focuses on causal consistency because causal consistency perform by constructing directed graph .the directed acyclic graph is constructed then causal consistency is obtain .Finally we propose analytical auditing strategy which appropriate reads to reveal many unsuccessful result

II. LITERATURE SURVEY

Cloud computing faces a big problem to maintain consistency so here we first discuss consistency of model I distributed systems. Mainly cloud consistency can be classified in two types data centric consistency and cloud centric consistency as shown in figure 2.

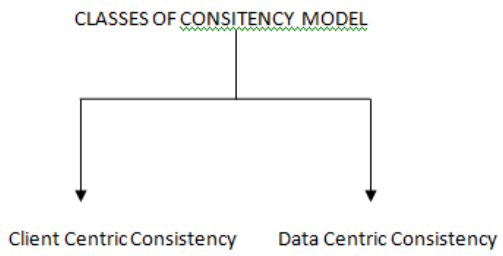

Figure 2:Classes of consistency Model

Data Centric consistency: Let us considers the internal state of a storage system. Which checks update flow through the system and what guarantees the system can provide with respect to updates.

Client Centric consistency: This concentrates on specifies customer requirement, i.e., the way to customers observe data updates. Their work also denotes consistency from strict consistency to weak consistency. Maximum consistency denotes maximum cost and reduced availability

The consistency requirements depending on actual availability of the data and the authors provide techniques which make the system dynamically adapt to the consistency level by tracing the state of the data. Ref. [1]. from the users' point of view we check the level of consistency provided by cloud service provider .existing solution can be derived into 2 types benchmark-based verifications [5]–[8]and traced base verification[2], [4]. Trace-based verifications contain three consistency semantics:, Lamport who propose these 3 semantic regularity, atomicity and safety

If a register is safe if read that is not concurrent with any write returns the value of the most recent write, and a read that is equal to a write can return any value

If register is regular read that is not concurrent with any write returns the value of the most recent write, and a read that is concurrent with a write returns the value of the most recent write, or the value of the concurrent write.

A register is atomic if every read returns the value of the most recent write. Misra [6] is the first to present an algorithm for checking whether the trace on a read/write register is atomic.

He Ref. [2] proposed offline algorithms for verifying whether a key-value storage system has regular register, atomic register and safe register properties by constructing a directed graph. Ref. [4]he proposed an online verification algorithm by using the GK algorithm [7], and various metrics used to quantify the severity of unsuccessful result. The main drawback of the existing trace-based verifications is that a global clock is required among all users. Our result belongs to trace-based verifications .To overcome this drawback so we used loosely synchronize clock

We illustrate the consistency service model. Then, we describe the structure of *the user operation table* (UOT), with which each user records his operations. Finally, we provide a two-level auditing structure and related definitions.

A) **Consistency Service Model***:* Consistency service model contain data cloud and multiple audit cloud as shown in fig2

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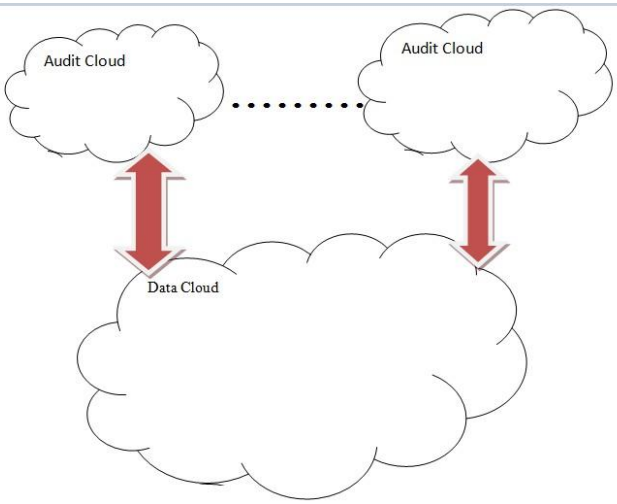

Figure 3. Consistency as a service model.

As shown in figure 3 the Cloud Service Provider maintain Data cloud .data cloud is key value data storage system hence unique key is assign to each piece of data ,cloud service provider maintain data cloud and audit cloud contain a group of users that working on that project And service level Agreement will be form between audit cloud and data cloud .which will decide how much will be charged if the data cloud failed to SLA and what type of consistency the data cloud should provide .the implementation of data cloud is not visible to all user due to virtualization technique. it is very difficult for user to check whether each replica in data cloud is newest one or not . we permit the user in audit cloud to check cloud consistency by analyzing the trace interactive operation .we don't require a global clock among all user for total ordering of operation so we use loosely synchronized clock for our solution. For partial order of operation each user maintain logical vector .so here we develop 2 level of auditing Structure .The two level auditing structure basically contain 2 auditing

B) User Operation Table(UOT) : Every user maintains a User Operation Table to record logical operation elements logical vector ,physical vector as well as operation are inserted into user operation table. Every operation has write operation or read operation .let us consider
operation as op , write $W(K, a)$,$read\ R(K, a)$ .where W(K , a) is nothing but writing the value a to data which is identified by key K. $R(K, a)$ stands reading data which is identified by key K and whose value is a. let us consider $W(K, a)$ as $R(K, a)$'s *dictating write*, and $R(K, a)$ as $W(K, a)$'s *dictated read*. we have the following properties: A read must have a unique dictating write. A write may have either zero or more dictated reads. From the value of a read, we can know the logical and physical vectors of its dictating write. Let there are N users in the audit cloud and A logical per physical vector is a vector of N logical per physical clocks, 1 clock / user, sorted in ascending order of user ID. For a user with ID_i where $1 \leq i \leq N$. logical vector is $< LvC_1, LvC_2, \ldots, LvC_N >$, where LvC_i is logical clock, and LvC_j is the latest logical clock of user j to his best knowledge; his physical vector is $< Pv\,C_1, Pv\,C_2, \ldots, Pv\ C_N >$, where $Pv\,C_i$ is his physical clock, and $Pv\,C_j$ is the latest physical clock of user $j$to the best of his knowledge. Logical vector is modernize by using vector clock algorithm and physical vector also gets modernize in the similar way as logical vector excluding physical clock rises as time passes . regardless of execution of event . Update process is given below:
Initially all clocks are zero for two vector .the users continuously rises his own physical clock in physical vector as sell as rises his one logical clock in logical vector ,by one the moment event take place . two vector will be sent with message ,as soon as user receive message he modernize every elements in the vector with maximum value in his own vector along with value in receive vector .consider there are three user in audit cloud A,B,C respectively where $ID_A < ID_B < ID_C$

Each user update vector the details working of vector is shown inn the fig 3

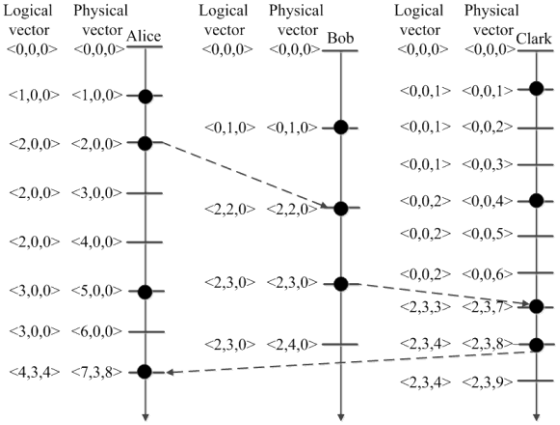

Figure 4: Logical and Physical Vector

As shown in figure 4 as A w(k,a)is <2,0,0><2,00>hence here logical and physical vector.

Following table 1 shows details regarding operations performed on user.

Table 1: User operation table

Alice operation log

Operation	Logical vector	Physical vector
W(a)	<1,0,0>	<1,0,0>
W(b)	<3,0,0>	<5,0,0>
R(b)	<5,3,5>	<8,3,7>

Bobs Operation log:

Operation	Logical vector	Physical vector
W(c)	<0,1,0>	<0,1,0>
R(c)	<2,4,0>	<2,5,0>
W(d)	<2,5,0>	<2,6,0>

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Clarks Operation log:

Operation	Logical vector	Physical vector
R(c)	<0,0,1>	<0,0,1>
R(d)	<0,0,2>	<0,0,4>
R(a)	<2,3,5>	<2,3,10>

General review of Two Level Auditing Structure

In this part local consistency is verified .every user perform local auditing separately with his own user operation table

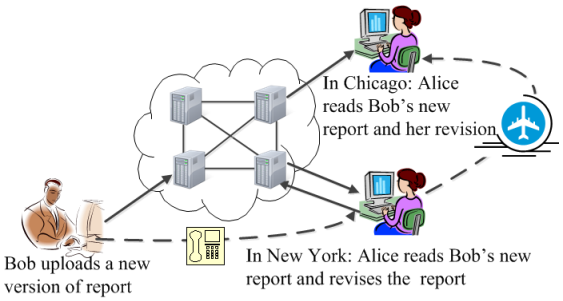

Figure 5. An application has various consistencies

Here we discuss three consistencies

- Monotonic read Consistency
- Read your Write consistency
- Causal Consistency

Monotonic read Consistency:

If any process read the value of data X as well as successive read on data X then same value or more recent value is obtain

Read your Write Consistency:

If write of process on data X will be seen by successive reads on data X by the same process

Causal Consistency:

Write which are causally related then it must be seen to all processes in the same arrangement Concurrent writes may be seen in different arrangement and different machines

III. ALGORITHMIC STRATEGY

Algorithmic strategy contain following algorithms:

A. Local Auditing Algorithm:

1. initially user_operation_table with null while issue an operation op do
2. if op = w(a) then

   record w(a) in user_operation_table
3. if op = r(a) then

   w(b) Belongs to user_operation_table is the last write
4. if w(a) -> w(b) then

   read your write consistency is violated

   r(c) belongs to user_operation_table is the last read
5. if w(a) -> w(c) then

   monotonic consistency is violated
6. record r(a) in user_operation_table

B. Global Auditing Algorithm

1. for every operation in the global trace is represent by a vertex
2. for operation op1 and op2 do
3. if op1->op2
   Then time edge is added between op1 and op2
4. if op1=w(a),op2=r(a) op1 and op2 comes from different user then data edge is inserted between op1 and op2
5. if op1=w(a) and op=(b) and op1 and op2 comes from different users and w(a)->w(b)->r(b)
   then causal edge is inserted between op1 and op2
6. verify whether the graph is directed acyclic graph by topological sorting method

Global auditing algorithm contain all strategy describe in figure 6.

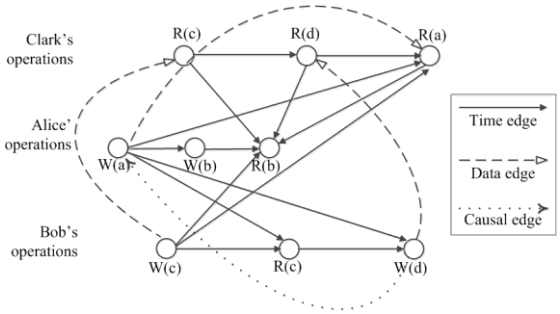

Figure 6. Global consistency graphs

IV. SYSTEM FUNCTIONALITY

It is very is to prove effectiveness of local auditing. For monotonic-read consistency user is required to read the a latest value or same value. If the dictating write of a latest read before the dictating write of the last read, we realized that monotonic- read consistency get unsuccessful result. Read your write consistency, user required to read his latest writes. Hence if the dictating write of a new read before his last write, we realize that read-your-write consistency get unsuccessful result.
For causal consistency we can prove that

1. if the Constructed graph is not directed acyclic graph then there must be unsuccessful result
2. if constructed graph is directed acyclic graph then there must be successful result

from proposition 1 we can conclude that if graph contain a cycle then there exists an operation that is committed before it self ,which is not possible to prove so we use method of contradiction to prove that let us consider if there is not get successful result when given graph is directed acyclic graph. Unsuccessful result which indicate that two write contain W(a) and W(b) that have causal relationship according our

contradiction we have two read R(b) implies R(a) which means time edge is form between W(a) to W(b) and data edge form between W(a) and R(a) then w(a) to w(b) contain cycle hence contradicts our assumption

V. TRASH COLLECTION

In an auditing process, every user should keep all operations in his User Operation Table. Without any mediation, the size of the UOT would rises without bound. .the communication cost changes for the User Operation Table to an auditor will be excessive. Hence, we provide a Trash collection mechanism which can delete unnecessary records, while preserving the value of auditing.

In our Trash collection mechanism, each user can clear the User Operation Table , keeps only his last read and last write, after each global consistency Checking. which a user's last write and last read will always present in his User Operation Table . In Local consistency auditing, if the dictating write of a Latest read does not present in the user's User Operation Table and the dictating write is proceed by the user, The user concludes that he has unable to read his last updates, and claims that read-your-write consistency is violated. If the dictating write of this read happens before the dictating write of his last read recorded in the User Operation Table, the user concludes that user has read an old value, and which means monotonic-read consistency is violated. If the dictating write of a new read does not present in the user's User Operation Table as well as the dictating write comes from Different users, then a violation will be review by the auditor. In global consistency auditing, if there present a read that does not contain a dictating write, then the auditor says that the value of this read is too old, and claims that causal consistency is violated. The basic theme of our Analytic Auditing Strategy (AAS) is to add appropriate reads for reviewing as many unsuccessful as possible. These phenomena call these additional reads Auditing reads.

From the auditing process in the maintaining Consistency model, we observe that only reads can review violations by their values. Therefore, the basic theme of our heuristic auditing strategy (HAS) is to insert appropriate reads for reviewing as many violations as possible. We call these extra reads *auditing reads*. AAS divides physical time into L time slices, where l time slices constitute an interval. Each Time slice is associated with a state, which can be marked with either *normal* or *abnormal*. A normal state means that there is no consistency violation, and an abnormal state means that there is one violation in this time slice.

If Service Level Agreement indicates that the audit cloud can access (e.g., monetary compensation) from the data cloud if a consistency not get successful res is detected, and that the audit cloud will be charged r for a read operation. If after executing n auditing reads, the users reveal v violations, then the earned profits P can be calculated by $P = s * v - r * n$.

Under the consistency model becomes a part of the SLA, the users can obtain proportional compensation from the CSP, by revealing consistency violations and quantifying the severity of the violations. We believe that the consistency service model will help both the CSP and the users adopt consistency as an important aspect of cloud services offerings.

A. Selection of Auditor

Thus auditor Can be easily selected from the auditor cloud in which any user has ability to becoming the auditor with same chances though various user has various level chances in terms of selection of auditor .the various possibility to select an auditor is given below: we design an Identification ring for a team of users ,in which every node is assigned with a node Identification , and every user is indicated by a set of nodes present in the ring. eg if the no of nodes in the ring is n. To select an auditor, we not only choose randomly generate a number r, but also user who is denoted by the node with an Identification of in the ring to be the auditor

VI. CONCLUSION

Thus system maintains consistency service model as well as couples of levels of auditing structure which helps the user to checks whether CSP provides valid consistency or not with help of certain violations if present. User can understand which Cloud Service Provider right from the various other Cloud service provider .The Consistency is maintain by Local Consistency Auditing Cloud and Global Consistency Auditing Cloud

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