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A Secure and Efficient Data Storage Backup for Multi Agent Based Cloud Model

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Abstract : Developing an efficient cloud based interactive service to end client requires a high availability, low latency with high throughput which is an issue with existing state of art technique. The agent based model which act as a middle tier module among the cloud and the end user help in addressing these issue but still there exist a complexity and overhead in handling these agent to overcome this here the author propose an efficient and secure cloud storage data backup multi agent cloud model. The proposed Multi agent model is fault tolerant, reliable, scalable, and achieve high performance in term of storage complexity, execution time and cost.

Keywords : Cloud computing, Data security, multi agent,Compression technique, pricing policy.

1. INTRODUCTION

Cloud can be defined in terms of abstraction concept as it is the abstraction of technology location and resources, it has vital in infrastructure which includes applications, network, and systems. Cloud computing is based on concept of sharing resources and achieved better resource utilization like in cloud computing resources ideal time is observed less .[1]. In Fig. 1, we see that different modes of clouds are private, public and hybrid cloud which could be combination of different clouds. The features of cloud could be elasticity, reliability and virtualization etc Cloud computing is often compared with Service oriented Architectures, Internet of Services, Grid and Cluster computing.

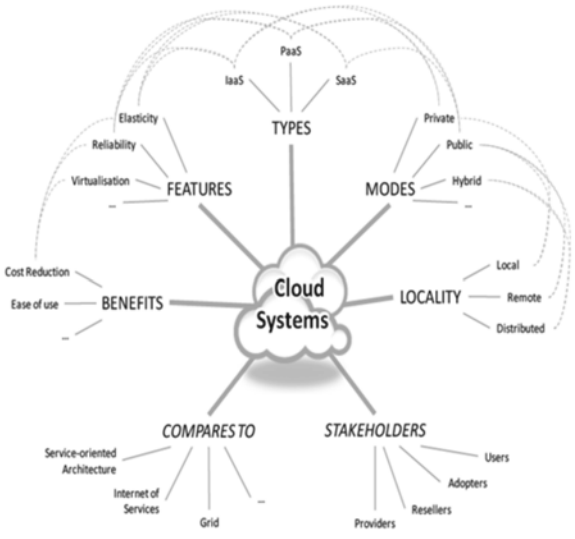

Fig. 1. Scenario Diagram of Cloud Computing.

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The location of physical resources and devices being accessed is not known by the user. It offersservices for users to develop deploy and manage their applications 'on the cloud'. As todays internet uses is increased tremendously at that time company like Amazon, google, Microsoft etc. are realized that their lots of storage space is simply wastes and not used by any proposes For that reason they are initiate to renting out their space or storage which can be used by third party on remote server known as cloud [10]. User can use this service through any device which has internet connection like mobile phones, computer etc. Amazon's Amazon Elastic Compute Cloud (EC2) and Simple Storage Solution (S3) are the current best known facilities and in Fig. 2 we can see that the cloud is broadly classified in to following category SaaS – Software as a service, PaaS platform as service and IaaS-Infrastructure as a service.

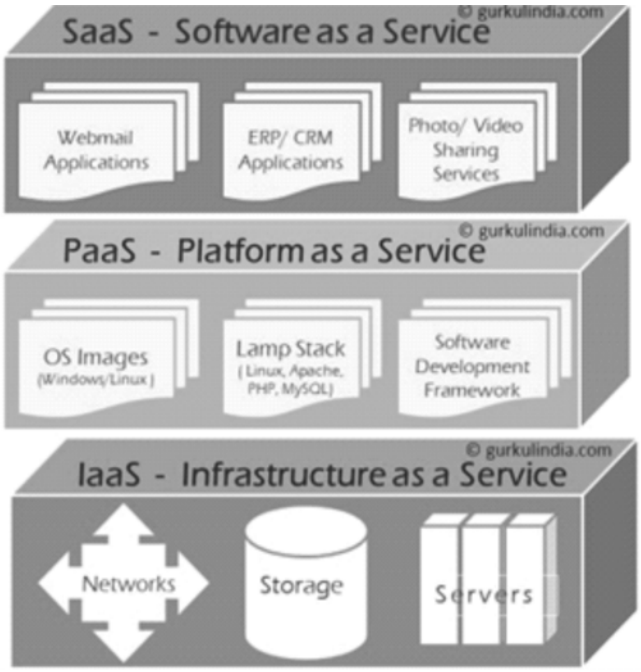

Fig. 2. Cloud Computing Services.

Cloud phenomenon is quickly becoming the next big thing in Internet Computing, storage and hosting both in industry and academia. Currently infrastructure-as-a-service (*Iaas*) is one of the most important and fastest growing uses of cloud computing. In this most basic cloud service model, offered service by the cloud providers like physical device (computers), storage, or load balancerand networks. One of the most pressing issues with respect to cloud computing is the resource management with respect to resource allocation, resource provisioning, resource mapping and resource adaptation. Data size and data security is another issue which poses a problem for cloud systems, but more importantly consistency maintenance, in particular when scaling up.

Previously, numerousmethods including reservation in advance, migration and rescheduling have been implemented to resolve this issue; however, there are some non-trivial practical hurdles that need to be addressed. The agent and multi agent based system in recent time seems to be an effective solution to address the aforementioned issues and has been adopted in various applications sectors such as *e*-commerce and retail sector [1], SITS (Smart intelligence transport system) [2] [3].The existing researcher recommended exploiting agents for cloud resource management [4, 5, and 6] or proactive monitoring [7] of computer networks. Numerous researcher focuses on methods for cloud resource discovery and Service Level Agreement (SLA) negotiation between cloud and end user.In [8] they identified and describedmalicious insider attacks. In [9] they developed a model to avoid the disclosure of confidential and private data by malicious attacks in the cloud environment. Many cloud provider such as IBM Tivoli, amazon cloud watch provide server management in cloud but they are not agent basedthus cannot offer the benefits of agent-based computing such as mobile code deployment, network load reduction, toleration to network failures or dynamic functional behaviour adaptation. To develop an multi agent based cloud data backup model we need to overcome the below mentioned issue and challenges.

THE ISSUE AND CHALLENGES FACED IN PROVIDING SECURE AND EFFICIENT DATA BACKUP IN CLOUD ENVIRONMENT

Resource Management is one of the main issues. At any time instant resources have to be allocated to handle effectively workload fluctuations, while providing Quality of Service (QoS) guarantees to the end users. In such systems, we need to use intelligent agents to perform resource mapping, resource provisioning, resource allocation and resource adaptation. Furthermore, the cloud resource management systems need to effectively manage nontraditional resources such as I/O bandwidth to meet the demands of data movement.

Virtualisation: It is an essential aspects or need of clouds, due to which complexity of cloud minimize or this complexity is and user is not aware of this technical complexity, flexibility is enhanced(through routing,aggregation, and translation). Virtualisation is the process which makes thing moreeasy for the user and they can develop new application and overhead is also reduced to control the system.

Management of Data : It is a very important work in terms of storage on cloud, because data is distributed among multiple resources. Consistency of data should be maintained through the large data centre which is replicated. Location of data must be known by the system (replication of data exist among data centres) and take care the workload and latencies.

Each system consider privacy or security as an important constraint if data is confidential or sensitive. For that purpose if we are dealing with cloud computing security is an critical issues we have to ensures that all security parameter like authentication, confidentiality of data, non-repudiation, integrity all considered [11].

Load balancing mechanisms : All the service which is provided by the cloud service providers are distributed among different cloud centers in order to make it easy to increase the number of the facilities when demand increases, to allow load balancing, and to enhance reliability.

Information Security : For end-users to feel comfortable with a "cloud" solution that holds their software, data and processes, there should exist considerable assurances that services are highly reliable and available, as well as secure and safe, and that privacy is protected. Hence we need to consider various security issues, such as authentication, data confidentiality and integrity, and non-repudiation.

Delays : Second – or even millisecond – can make a significant difference, when we are talking about the sensitive data which is time constraint, cloud user can experience delay in that case therefor service providers must considered all point regarding delay. Scaling decision for the data centers which is taken by the Cloud Service providers (CSP) should be accurate and CSP must considered these point like delay at the time resource setup, resource utilization, migration of existing system etc.

Bandwidth : Management of bandwidth is a critical task because it is associated with different type of service and integrating through a link. In bandwidth management to avoid the congestion decision making is an important task for acceptance or rejection of new arrival cell.

Network Loads : Cloud applications can present varying workloads. It isnecessary to monitor the of Cloud services and workloads appears on that for identifying the common behaviors, patterns, and explore load forecasting approaches that can potentially lead to more efficient resource provisioning and consequently improved energy efficiency.

In order to cater the above mentioned issue , we must solve the challenge how to enable utilization of the cloud infrastructures without disclosing security sensitive information assets of users (data, applicationsor computations) to a cloud provider but it also time enable cloud users to exploit advantages of cloud computing in a secure and reliable way, and enable cloud service providers to efficiently and securely manage cloud infrastructure for their customers without direct access to customer's information assets by adopting a multi agent based cloud model by considering the cost involved for computation.

The paper organization is as follows : The proposed multi agent basedmodels are presented in Section two. The results and the experimental study are presented in the section three. The concluding remark is discussed in the last section.

2. PROPOSED MODEL

Here the authors have devolvedan efficient agent based cloud data backupmodel and runtime, which improves the level of the agent abstraction. The proposed efficient cloud backup model is a multi-agent based, but it contrast when compared to existing agent based methodology by consideringagent as virtual bodies, not as physical ones. Firstly the proposed agentis considered to be existsalways, virtually. It can neither be created nor destroyed explicitly. Thus improves the memory utilization and improves the lifetime of server. Secondly the agents are dynamically invoked, if there is no instances in the memory of an agent, a message transmitted to the agent causes a fresh instance to be created on aserver which is vacant. Agent instance which is unused is dynamicallyregained at the execution time resource supervision. An agent never fails: if a server T crashes, the new upcoming message can be sent to the agent N that was running on T causes proposed model to automatically re-instantiate N on another server, eliminating the need for applications to supervise and explicitly re-create failed agent. Thirdly the proposed model can automatically create multiple instances of the same stateless agent, seamlessly scaling out agents.

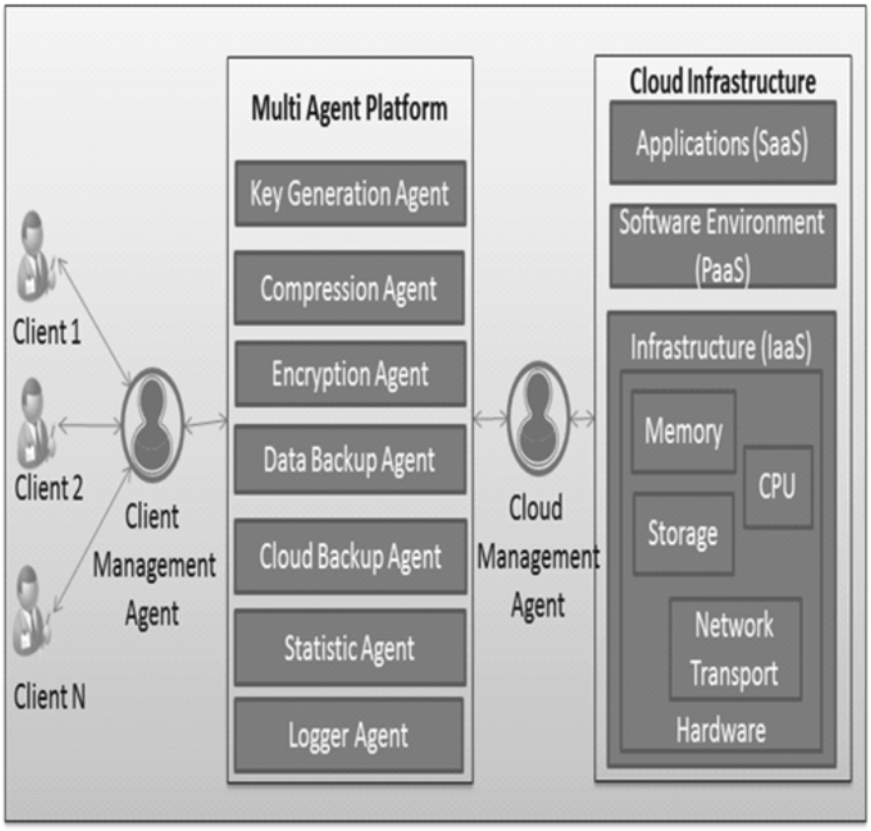

Fig. 3. Multiagent secure and efficient cloud backup model.

The proposed model as shown in above Fig. 3 improves the efficiency of user secure data backup to cloud in a cost efficient way by introducing the following multi agent model

Client management agent : This agent monitor the number of user in system and collects the task from different user and submit the task to the proposed the multiagent model.

Data backup agent : This agent collects the task information from the client management agent and then process the data backup task by doing data compression then encrypts data and sends it to cloud management agent.

Data compression agent : This agent model collects the data of the user that exist locally in user system folder and then this data are then compressed and sent to the data encryption agent.

Key generation agent : This agent generates key based on public key or asymmetric based cryptography mechanism. Here the author consider based key generation algorithm due to its proven security and are widely used and adopted by various industry standards.

Data encryption agent : Here we considered asymmetric based encryption by using Crypto service provider.

Cloud backup agent : Once the data backup agent completes it task it send the securely compressed and encrypted data to the cloud backup agent and this agent transmit the data to the cloud management agent.

Statistic agent : This agent logs statistics showing changes to folders and Receives FolderChangesMessage. So that the in future updation these folder are backed up again.

Logger agent : This agent generates the log of every successful or failure of task and update it to cloud storage.

Cloud management agent : This agent collect the compressed and encrypted data from cloud backup agent then transmit this data to the cloud storage location.

The proposed secure multi-agent cloud backup model is presented below : Let D be the database to be stored to the cloud, were the D are considered to be matrix of identical size of data vector and were every data vector has *b* blocks. The data blocks are the element of a finite field. The data D is encoded by the encoding agent and processed to distributed cloud storage; the encoded database matrix E incluses a set of $i = h + p$, were is the original data and *p* is the parity bits added.

Let C($h + p$, p) be cyclic error correcting code, using this the parity bit *p* is added to *h* data in order to reconstruct the data *h* form $h + p$ data and parity. In cloud the vector $h + p$ are stored in different storage location in order to address data loss if any failure of *p* from $h + p$ data location and storage overhead for this operation is *p*/*h*.

Let $D = (D_1, D_2, D_3, \ldots D_h)$ and $DS = (F_{1S}, F_{2S}, F_{3S}, \ldots F_{bS})^V$ where ($s \in \{1, \ldots, h)$ and, $B \leq 2^p - 1$, where all these block are the element of finite field set. The systemic layout for I/O (input/output) efficiency with parity bit is achieved by using matrix, C obtained from a $h \times (h + p)$ matrix.

$$\begin{pmatrix} 1 & 1 & \ldots & 1 & 1 & \ldots & 1 \\ \varphi_1 & \varphi_2 & \ldots & \varphi_h & \varphi_{h+1} & \ldots & \varphi_i \\ : & : & : & : & : & : & : \\ \varphi_1^{h-1} & \varphi_2^{h-1} & \ldots & \varphi_h^{h-1} & \varphi_{h+1}^{h-1} & \ldots & \varphi_i^{h-1} \end{pmatrix}$$

Where $\varphi_t (t \in \{t, \ldots, i\})$ are arbitrarily distinctive element picked from finite field set. Once the row transformation is completed the matrix C can be computed as follows

$$C = (U/K) \begin{pmatrix} 1 & 1 & \ldots & 0 & k_{11} & k_{12} & \ldots & k_{1p} \\ 0 & 1 & \ldots & 0 & k_{21} & k_{22} & \ldots & k_{2p} \\ : & : & : & : & : & : & : & : \\ 0 & 0 & \ldots & 1 & k_{h1} & k_{h2} & \ldots & k_{hp} \end{pmatrix}$$

Where K is the secret parity bit generation with matrix size $h \times p$ and U is a $h \times h$ identity matrix. The final encoded file is computed by $D \times C$ which is as follows

$$E = D \bullet C = (C^{(1)}, C^{(2)}, C^{(3)}, \ldots C^{(h)}, C^{(h+1)}, C^{(h+2)}, \ldots C^{(i)})$$

$$= (D_1, D_2, D_3, \ldots, D_h, C^{(h+1)}), \ldots C^{(i)}),$$

Where $C^{(t)} = \left(C_1^{(t)}, C_2^{(t)}, C_3^{(t)}, \ldots, C_b^{(t)}, \right)(t \varepsilon \{1, \ldots, i\})$, the product operations replicate the data vector of D and remaining is the $\left(C^{(h+1)}, \ldots, C^{(i)}\right)$ are *p* parity bit computed based on D.

To ensure the correctness of data stored in cloud the agent verifies the cloud storage server. The agent generate a signature v for each $E^{(t)}$ $(t \in \{1, \ldots,\})$, by using pseudorandom function F(•) and pseudorandom permutation, a(•) a verification key p_{vrfy} and final key p_{fnl}. To generate the S^{th} signature for cloud storage server t. The role of agent is as follows,

Firstly a random verification param y_s of finite field by $y_s = F_{pvrfy}(S)$ and a final key $p_{fnl}^{(s)}$ based P_{fnl}on .

Secondly, a arbitrarily chosen set of indices S is computed as follows,

$$\{S_n[1, ..., b] | 1 \le n \le a\}, \text{ Where } S_n = a_{p_{fnl}^{s}(n)}.$$

Finally, compute the signature as follows,

$$= \sum_{n}^{a} \gamma_s^n \times E^{(t)}[S_n], \text{ Where } E^{(t)}[S_n] = C_{s_n}^n.$$

Once signature is generated the agent stores this information for data verification on cloud server.

The proposed multi agent model reduces the overhead of signature generation between the cloud provider and its users and achieves a cost effective, fault tolerant and secure cloud storage backup.

The experimental study of our proposed approach is evaluated in the below sub section of this paper.

3. EXPERIMENTAL RESULT AND ANALYSIS

The experimental study is conducted using windows 10 enterprises, 64-bit operating system, 64-bit,I-5 Quad core processor, with 16GB of RAM. We have used Dotnet framework 4.5 and C# as the programming language. We have conducted experimental study on following parameter for computation time and cost on Amazon S3 Cloud and compared our proposed model with existing algorithmand conducted experimental study and the experimental study is conducted using Amazon S3 Cloud computing platform. $m_S^{(t)}$

In Fig. 4, the computation time of data backup to cloud is evaluated for both proposed and existing approaches by varying the file size from 12.5 mb to 1000 mb. The proposed average computation time for storage backup to cloud is improved by 79.807% over existing approach which is shown in Fig. 5.

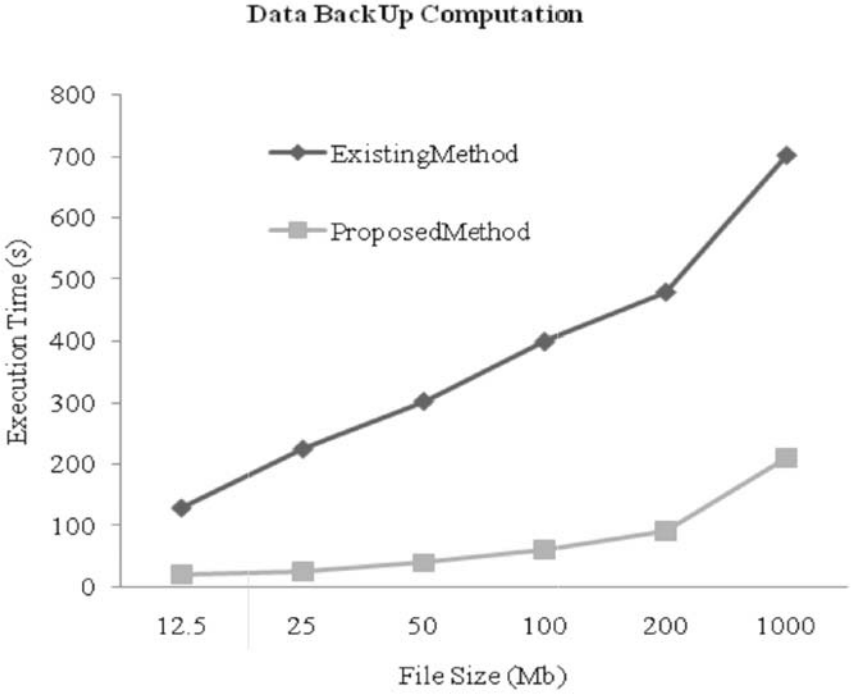

Fig. 4. Data backup computation time for varied file size.

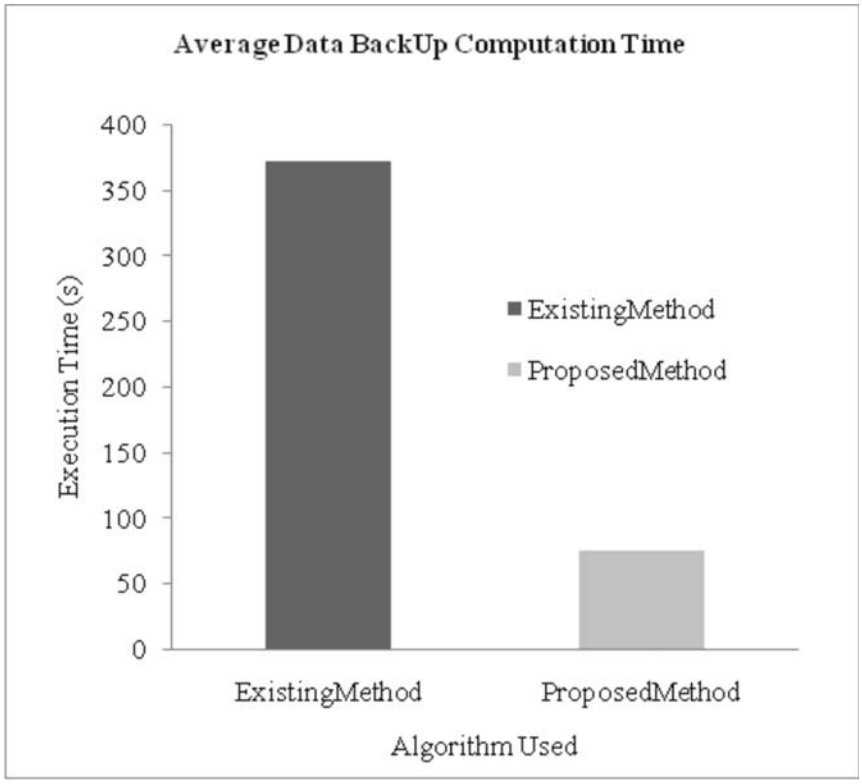

Fig. 5. Average data backup computation time

The cost is calculated for amazon cloud which charges 0.16$ per hour usage of cloud environment. In Fig. 6, the costinvolved data backup to cloud is evaluated for both proposed and existing approaches by varying the file size from 12.5 mb to 1000 mb. The proposed average cost for storage backup to cloud is reduced by 80% over existing approach which is shown in Fig. 7.

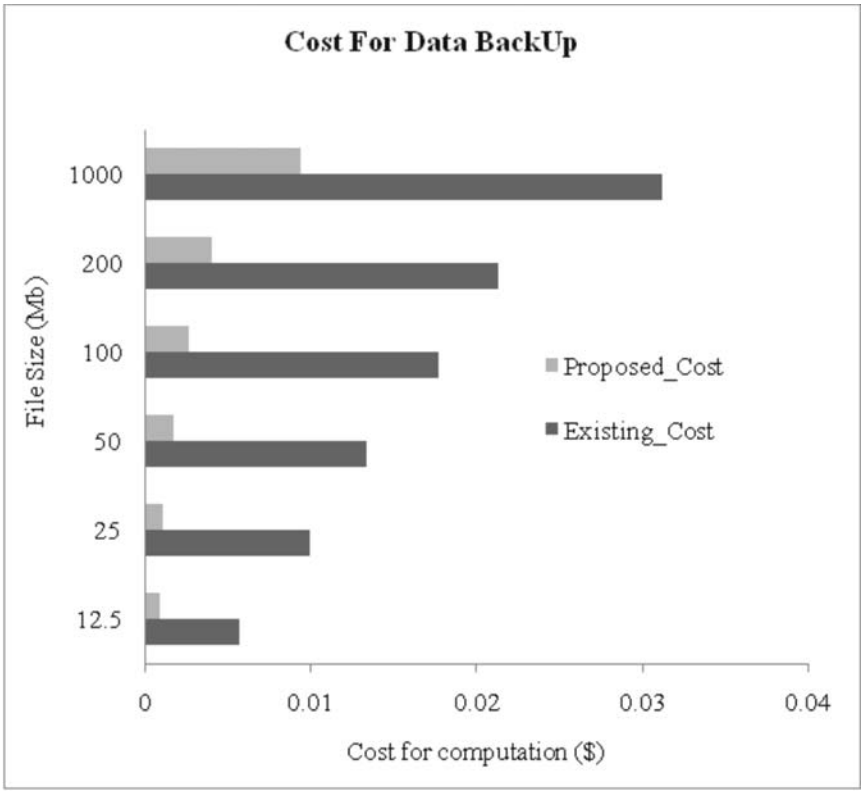

Fig. 6. Cost for data backup.

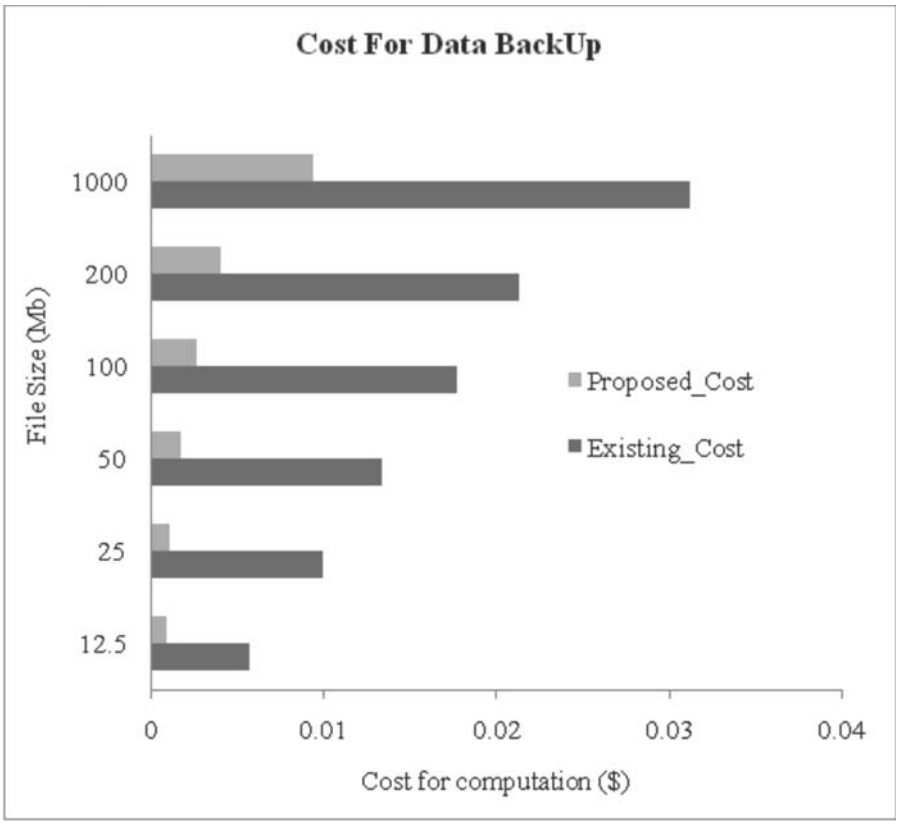

Fig. 7.Average cost for data backup

4. CONCLUSION

To develop an efficient cloud based interactive service to end client requires a high availability, low latency with high throughput which is an issue with existing state of art technique. To address this here the author presented a multi agent based cloud storage backup model. The agent acts as a middle tier between cloud provider and the end user. The experimental result conducted show that the proposed system is efficient, secure, scalable and fault tolerant. The outcome shows that the proposed multiagent model reduces the computation time and also reduces the storage backup cost by considering security of data. The proposed computation time is reduced by 79.807% and the cost is reduced by 80% over existing approaches.

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