A Three-Layer Privacy Preserving Cloud Storage Technique Based on Fog Computing

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Abstract- *Recent years the highly development of cloud computing technology. With the explosive growth of cloud storage technology gets more attention and better development. However, in current storage schema, user's data is totally stored in cloud storage servers. In traditional approach the users lose their right of control on data and face privacy leakage .Existing method of privacy protection schemes are usually based on encryption technology, but these kinds of techniques cannot effectively resist attack from the inside of cloud storage server. In order to solve this problem, we develop a three-layer security model based on fog computing. The proposed methodology can both take full benefits of cloud storage and protect the privacy of data. Besides, Hash-Solomon code algorithm is designed to divide data into three parts. Then, we can put a small part of data in local machine and fog server in order to protect the data privacy. Moreover, based on artificial intelligence, this algorithm can regulate the distribution proportion stored in cloud server, fog server, and local machine, respectively. Through the theoretical analysis the feasibility of our technique has been validated, which is really a powerful method to traditional cloud storage technique.*

Keywords- Cloud computing, cloud storage space, fog computing, seclusion protection.

I. INTRODUCTION

Confidentiality is a basic for strong security in all online computing sides, but confidentiality alone is not satisfies. Companies and customers are ready to use online computing only if they have the belief that their data and privacy details will stay confidential and safe. Thus to produce a trusted surrounding for users, we need to create a software, assist and works with confidentiality in mind. The location of physical assets and accessories being allowed in general doesn't known to the particular customer. It also affords services for customer to form up, use and maintain their data and privacy details in the applications on the cloud server, which maintains and manages the virtualization of assets by itself. Cloud storage memory is a method of networked online memory in which the secure data is stored in virtual group of stash that is generally being introduced by the third party. Cloud storage memory makes data stored remotely to be limitedly cached on Android phones, Personal computer or other Internet connected devices.

With the rapid development of network bandwidth, the Volume of customer's data is increasing geometrically. Data user's requirement cannot be satisfied by the capacity of local machine any more. Therefore, persons try to find new methods to store their personal data. For more powerful storage capacity, a growing number of data users select cloud server storage. Cloud server storage is a cloud computing system which provides data storage and secure management service. With a cluster of advantages, network technology and distributed data file system technology, cloud server storage makes a huge number of different storage devices work together coordinately.

Besides, depending on the property of the Hash-Solomon algorithm code, the methodology can ensure the original data cannot be recovered by partial data. On another hand, mistreatment Hash-Solomon code algorithm can turn out a little of redundant information blocks which can be normalized in decipherment procedure. Raising the number of redundant blocks can increase the reliability of the cloud storage, but it also results in additional cloud data storage. By reasonable allocation of the cloud data, our technique can really protect the privacy of user's data. The Hash-Solomon code algorithm needs complex calculation, which can be assisted with the Artificial Intelligence (AI). Paradigms of AI are with success employed in recent years to deal with varied challenges, as an example, the issues in Wireless sensor networks (WSNs) field. AI provides adaptative mechanisms that exhibit intelligent behavior in advanced environments like WSNs. Thus in our paper, we take application of AI to do some calculating works in the fog server. Compared with existing methods, our technique can provide a secure privacy protection from interior, especially from the CSPs.

II. RELATED WORK

The importance of security in cloud server has attracted a lot of attention no matter in industry. There are a large number of researches about secure cloud architectures in recent years. In order to solve the privacy leakage issue in cloud storage, use variety encryption techniques in different positions. Solve the privacy leakage problem with the help of auditing or building their own cloud secure framework. However, there is a common defect in these articles.

Once the CSP is un-trusted, all of these techniques are invalid. They cannot resist internal attacks the CSP from selling customer's data to earn illegal profit. The private data will be decoded once malicious attackers get it no matter how advanced the encryption techniques are because customer's data was integrally stored in cloud storage. Therefore, we propose a three layer security model in this paper. By dividing file with specific code and combining with TLS framework based on fog computing architecture, we can achieve high secure privacy protection of data. It does not mean that we abandon the encryption technique. In our technique encryption also help us to protect fine-grained secure of the cloud data.

III. EXISTING SYSTEM

User uploads data to the cloud storage server directly. Subsequently, the Cloud Server Provider (CSP) will take place of customer to manage the data. In consequence, customer does not actually control the physical storage of their cloud data, which results in the separation of ownership and management of data.

In order to solve the privacy leakage issue in cloud computing, previous techniques proposed a privacy-preserving and copy- deterrence CBIR scheme using encryption techniques. This technique can protect the image content and features well from the semi-honest cloud server, and deter the image customers from illegally distributing the retrieved images.

Existing methods consider that in traditional situation, user's data is stored through cloud service provider even if CSP is trustworthy attackers can still get customer's data if they control the cloud management node. When customer requests data from cloud server, the customer sends a password to the server for identification. Taking it into consideration that the privacy password may be intercepted, the structure uses asymmetric response mode.

IV. PROPOSED METHOD

A. Three Layer Privacy

Now the cloud service server is divided into three different layers for enhance the security purpose and to prevent the location awareness. The three different privacy preserving layers are Cloud computing, Fog computing and local machine. A complete storage data is now divided and stored into three different layers. The ratio of the partition of storage data is major part of the data is stored in the cloud storage, neither high nor low range of storage data is stored in the fog computing and finally lower amount of local machine. When the stored cloud data required it can be combined into a single data using pattern matching techniques.

B. Encryption

While uploading the data in three layers, first it is encrypted using Hash Solomon code of encryption techniques. The data is combined with appending bit and it is encrypted. Now the encrypted stored data is stored in three layers. When the customer requires the complete data, it is decrypted first and combined with the other parts and given to the customer as a complete original data.

C. Fog Computing

Fog computing is similar with cloud computing. It consists of little latency and raising the geographical range of distribution. Fog computing can achieve the data processing and restricted storage capability. Fog computing consist of three-level structural design, the highest is a cloud computing layer, it can be used as storing data and computing data. The center layer is the fog computing layer. Fog computing layer can execute critical data spread to cloud server. And at last the third layer is wireless sensor network layer. This layer's major job is to gather data and upload it to the fog server. In accumulation, the rate of transmit flanked by the fog computing layer and other layers is faster than the rate between the cloud layer and the subordinate layer.

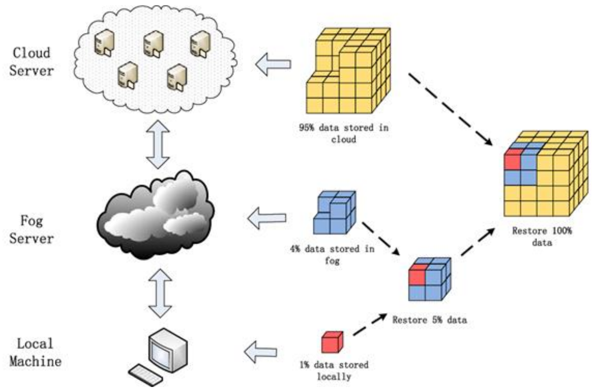


Fig. 1 Proposed system architecture

D. Three-Layer Privacy Preserving Cloud Storage system Based on Fog Computing Model

In order to defend user's privacy, we recommend a TLS frame-work based on fog computing model. The TSL structure can give client a certain power of executive and efficiently protect user's seclusion. As mentioned, the internal attack is complicated to defy. Conventional approaches work well in solving outer at-tack, but when CSP itself has problems, conventional ways are all unacceptable. Dissimilar from the habitual approaches, in our method, user's data is separated into three different-size parts with encoding knowledge. Each of them will require a part of key information for secrecy. Combining with the fog computing model, the three parts of data will be stored in the cloud server, the fog server and client's local machine according to the categorize from large too little. By this technique, the attacker cannot recuperate the client's unique data even if he gets all the data from a confident server. As for the CSP, they also cannot get any helpful information lacking the data stored in the fog server and local machine because mutually of the fog server and local machine are prohibited by clients.

As shown in Fig. 1, the TLS structure makes complete use of fog server's storage space and data processing capacity. The structural design includes three levels, the cloud server, the fog server and the local machine. Every server saves a definite part of data; the storage space fraction is resolute by clients' portion strategy. Firstly, user's data will be prearranged on client's local machine. Then, for example, let 1% programmed data be stored in the device. Then upload the remains 99% data to the fog server. Secondly, on the fog server, we do related operations to the data which comes from client's mechanism. Present will be about 4% data stored in the fog server and then upload the residue data to the cloud server. The beyond functions are based on Hash-Solomon code. Hash-Solomon code is a type of coding methods stand on Reed-Solomon code. Subsequent to being programmed by Hash-Solomon code, the data will be divided into k parts and generates m unneeded data. Hash-Solomon code has such belongings, in these k+m parts of data, if someone has at slightest k parts, he can recuperate the entire data. In other word, nonentity can recuperate the entire data with less than k parts of data. According to this possession of Hash-Solomon code, in our method, we let no more than k-1 parts of data be stored in superior server which has better storage ability and let the residue be stored in the lower server. In this way, the user cannot recover the absolute data even if one of the three layers' data was stolen. Thus we can guarantee the seclusion of user's data. Then we believe the significance of k and measuring that we want to save r% data on the fog server. In the Hash-Solomon code, we have descriptions as follows:

Definition 1 Invalid Ratio: the ratio of the numeral of malfunction data blocks to the number of data blocks which will be used in programming. In other words, the proportion of the figure of data blocks stored in subordinate server to the number of data blocks stored in the higher server. For exemplar, the fraction of the numeral of data blocks stored in the local machine to the amount of data blocks stored in the fog server. In the similar way, the part of the figure of data blocks stored in the fog server to the numeral of data blocks stored in the cloud server.

Definition 2 Maximal Invalid Ratio: the maximal unacceptable ratio is the proportion of the number of unfounded data to the number of all data blocks when the higher server can just recuperate the entire data by the data blocks stored in them. If there was one more unacceptable data blocks, the higher server can't recover the entire data anymore.

In Hash-Solomon code, the Maximal Invalid Ratio can be stated as $_{k}\ {}_{+}{}^{m}{}_{m}$ .. For expediency we just think two layers circumstances. Assuming that there is x MB data which is organized to accumulate. Behind encoding, there will be ^{k} ${}^{+}{}_{m}{}^{m} * x$ data. We arrange to save r% in the lower server.

In categorize to circumvent the upper server recovers the data; the significance of k, m and r must assure the correlation:

$$\frac{m}{k+m} \leq \frac{k+m}{k} * r \qquad (1)$$

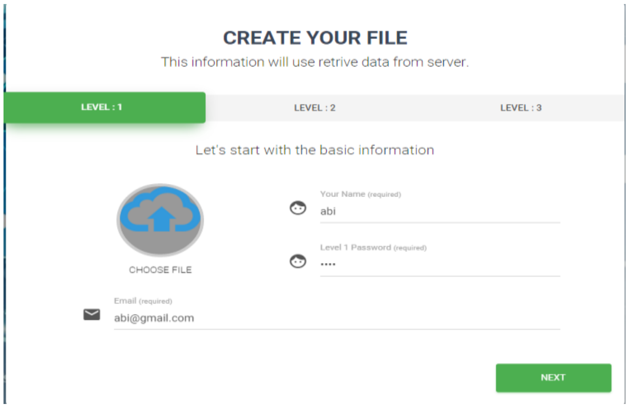
Through efficient conversion, the correlation between *k m* and *r* can be articulated as formula (2). We can see that if the limit *r* is determined, the limit *k* can be expressed by *m*. So we can only think the proportion and the numeral of data blocks when we use our method.

$$k = \frac{(m - 2mr) + \sqrt{(2mr - m)^2 \ - 4m^2\, r^2}}{2r} \qquad (2)$$

The constraint *k* is the number of blocks behind data being separated, the parameter *m* is the number of unneeded data blocks and the parameter *r* is the storage space ratio of dissimilar servers. Be-sides, the fog server comprise Computational Intelligence which can help the arrangement with manipulative the outcomes of the values of *k* and *m*, because of the nodes in the fog server having its individual computing authority.

V. EXPERIMENT RESULT

The structure can take full of cloud storage and defend the privacy of data. Here the cloud computing has concerned great consideration from dissimilar sector of society. The three level cloud storage stores in to the three dissimilar parts of data parts .If the one data part misplaced we lost the data in sequence. In this future structure using the bucket conception based algorithms. In our scheme we using a bucket conception so decrease the data wastages and reduce the procedure timings. We are by means of a HASH-SOLOMON code algorithm. It's High bendable. BCH code is used in a lot of communications relevance and low amount of idleness. The Bucket entrée manages reserve represents the Access Control Lists (ACLs) for buckets inside Google Cloud Storage. ACLs let you identify who has admission to your data and to what coverage. The three layer cloud storage stores into the three different parts of data parts .If the one data part missing we lost the data information. In this proposed structure using the bucket concept based algorithms.



CREATE YOUR FILE

This information will use retrive data from server.

LEVEL : 1 LEVEL : 2 LEVEL : 3

Let's start with the basic information

CHOOSE FILE

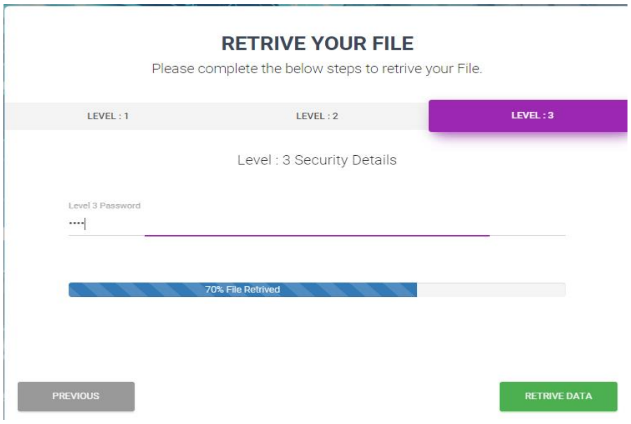
Your Name (required)
abi

Level 1 Password (required)
····

Email (required)
abi@gmail.com

NEXT

Fig. 2 First Layer Security Model



RETRIVE YOUR FILE

Please complete the below steps to retrive your File.

LEVEL : 1 LEVEL : 2 LEVEL : 3

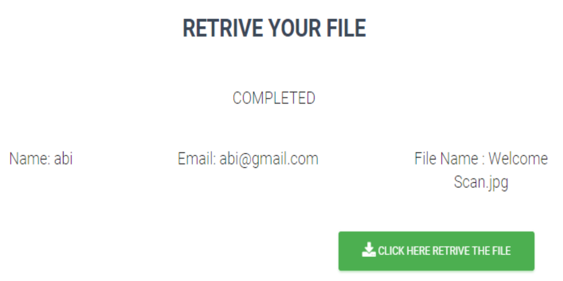
Level : 3 Security Details

Level 3 Password
····|

70% File Retrived

PREVIOUS RETRIVE DATA

Fig. 3 Second Layer Security Model



RETRIVE YOUR FILE

COMPLETED

Name: abi

Email: abi@gmail.com

File Name : Welcome Scan.jpg

CLICK HERE RETRIVE THE FILE

Fig. 4 Three Layer Security Model based on fog computing

VI. CONCLUSION

Cloud Computing makes the computer world has a wider collection of application and enhances client - friendliness by providing entrance through any type of internet connection. Even with this improved ease of use also some disadvantages. privacy is to be measured very important and is a key problem for cloud memory. Selections of techniques that can be used in order to guarantee confidentiality have been mitigated. This paper has revealed some privacy ways for avoiding the troubles in confidentiality on unsecured data stores in cloud. There are tranquil some techniques that are not addressed with in this paper.

This paper makes divergence in the techniques in the text is based on encryption schemes, based on entrance control Mechanisms, keyword exploration techniques, and query reliability and compliance schemes. The work is making well-organized privacy-preserving memory.

VII. APPENDIX

As the three layer security model based on fog computing is comprehensive by the mentioned algorithms, it can encourage inhabited by using some other algorithms to diminish the position of code and to reduce the time complication.

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