International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 28 Issue 3 – MARCH 2021.

ENERGY-EFFICIENT TASK OFFLOADING FOR TIME SENSITIVE APPLICATIONS IN FOG COMPUTING

Ms S. Packia Gnana Deepam[#1] and P.N.Nagarathinam[*2], P.Krishna [*3], M.Aruna[*4], K.Pavithra[*5]

[#] *Assistant Professor, Department of Computer Science and Engineering, P.S.R. Rengasamy College Of Engineering For Women, Madurai, India,*

[*] *Student ,Department of Computer Science and Engineering, P.S.R. Rengasamy College Of Engineering For Women, Madurai, India*

***Abstract*— To improve the quality of service (QOS) needed by several applications areas, upload tasks is offloaded into the Fog computing instead of the cloud. However, the availability of ongoing energy heads for fog computing servers is one of the constraints for many applications because transmitting the huge quantity of the data generated and will produce network bandwidth overhead and slow down the responsive time of the statements analyze.**

***Index Terms*— Fog Computing, Cloud Computing, Scheduling Algorithm**

I. INTRODUCTION

Recent years witness the development of cloud computing technology. With the explosive growth of unstructured data, cloud storage technology gets more attention and better development. However, in current storage schema, user's data is totally stored in cloud servers. In other words, users lose their right of control on data and face privacy leakage risk. Traditional privacy protection schemes are usually based on encryption technology, but these kinds of methods cannot effectively resist attack from the inside of cloud server. In order to solve this problem, we propose a three-layer storage framework based on fog computing. The proposed framework can both take full advantage of cloud storage and protect the privacy of data. Besides, Hash-Solomon code algorithm is designed to divide data into different parts. Then, we can put a small part of data in local machine and fog server in order to protect the privacy. Moreover, based on computational intelligence, this algorithm can compute the distribution proportion stored in cloud, fog, and local machine, respectively. Through the theoretical safety analysis and experimental evaluation, the feasibility of our scheme has been validated, which is really a powerful supplement to existing cloud storage scheme. This framework makes full use of fog server's storage and data processing capability. This framework includes three layers, the cloud server, the fog server and the local machine. Each server saves a certain part of data, the storage proportion is determined by users' allocation strategy. Firstly, user's data will be encoded on user's local machine. Then, for example, let 1% encoded data be stored in the machine. Then upload the remainder 99% data to the fog server. Secondly, on the fog server, it do similar operations to the data which comes from user's machine. There will be about 4% data stored in the fog server and then upload the remainder data to the cloud server. The above operations are based on Hash-Solomon code. Hash-Solomon code is a kind of coding methods based on Reed Solomon code. After being encoded by Hash-Solomon code, the data will be divided into k parts and generates m redundant data. Hash-Solomon code has such property, in these k+m parts of data, if someone has at least k parts, he can recover the complete data. In other word, nobody can recover the complete data with less than k parts of data. According to this property of Hash-Solomon code, in our scheme, it let no more than k-1 parts of data be stored in higher server which has larger storage capacity and let the remainder be stored in the lower server.

II. LITERATURE SURVEY

T. Wanget al., "Reliable wireless connections for fast-moving rail users based on a chained fog structure,"Inf. Sci., vol. 379, pp. 160–176, 2019.

Currently, 3G and 4G networks provide customers with high-speed wireless services almost everywhere. However, the wireless connection is often unstable and unreliable, especially for fast-moving end users (e.g., those on trains and buses). To investigate the severity of this problem, we conducted real experiments on fast-moving trains to investigate the quality of 3G connections. From the results, we found that 1) from the temporal perspective, the 3G connections were not stable and suffered from frequent disruptions of connectivity, and 2) from the spatial perspective, the connections that were established in different train compartments were largely independent. These two findings motivate us to propose a brand-new fog computing structure, which acts as an intermediate layer between the end users and the 3G infrastructure. This new fog structure introduces a series of mutually chained network gateways that

are located in different compartments. This structure addresses the aforementioned problem of unstable connectivity and thus ensures reliable wireless service for fast-moving users, such as passengers on trains. We performed a series of theoretical and empirical analyses to evaluate the performance of the newly proposed structure. All of the experimental results suggest that our proposed fog structure greatly improves the reliability of wireless connections on fast-moving trains.

J. Zeng, T. Wang, Y. Lai, J. Liang, and H. Chen, "Data delivery from WSNs to cloud based on a fog structure," inProc. Int. Conf. Adv. Cloud Big Data, 2019, pp. 104–109.

Recent years, with the emerging technology of cloud computing, the powerful computing and storage capability of cloud computing injects new vitality into wireless sensor networks (WSNs) and motivates a series of new applications. However, the data delivery from WSNs to Cloud becomes a bottleneck because of the poor communication ability of WSNs, especially for delay-sensitive applications, which limits their further development and applications. To address this problem, we propose a fog structure which composes of multiple mobile sinks. Mobile sinks act as fog nodes to bridge the gap between WSNs and Cloud. They cooperate with each other to set up a multi-input multi-output (MIMO) network, aiming at maximizing the throughput and minimizing the transmission latency. The problem is proved to be NP-hard and we design an approximation algorithm to solve this problem with several provable properties. We compare our method to several traditional solutions. Extensive experimental results suggest that the proposed method significantly outperforms the traditional solutions.

J. Shen, D. Liu, J. Shen, Q. Liu, and X. Sun, "A secure cloud-assisted urban data sharing framework for ubiquitous-cities,"Pervasive MobileComput., vol. 41, pp. 219–230, 2019.

With the accelerated process of urbanization, more and more people tend to live in cities. In order to deal with the big data that are generated by citizens and public city departments, new information and communication technologies are utilized to process the urban data, which makes it more easier to manage. Cloud computing is a novel computation technology. After cloud computing was commercialized, there have been lot of cloud-based applications. Since the cloud service is provided by the third party, the cloud is semi-trusted. Due to the features of cloud computing, there are many security issues in cloud computing. Attribute-based encryption (ABE) is a promising cryptography technique which can be used in the cloud to solve many security issues. In this paper, we propose a framework for urban data sharing by exploiting the attribute-based cryptography. In order to fit the real world ubiquitous-cities utilization, we extend our scheme to support dynamic operations. In particular, from the part of performance analysis, it can be concluded that our scheme is secure and can resist possible attacks. Moreover, experimental results and comparisons show that our scheme is more efficient in terms of computation.

4. Z. Fu, F. Huang, K. Ren, J. Weng, and C. Wang, "Privacy-preserving smart semantic search based on conceptual graphs over encrypted outsourced data,"IEEE Trans. Inf. Forensics Security, vol. 12, no. 8, pp. 1874–1884, Aug. 2019

Searchable encryption is an important research area in cloud computing. However, most existing efficient and reliable ciphertext search schemes are based on keywords or shallow semantic parsing, which are not smart enough to meet with users' search intention. Therefore, in this paper, we propose a content-aware search scheme, which can make semantic search more smart. First, we introduce conceptual graphs (CGs) as a knowledge representation tool. Then, we present our two schemes (PRSCG and PRSCG-TF) based on CGs according to different scenarios. In order to conduct numerical calculation, we transfer original CGs into their linear form with some modification and map them to numerical vectors. Second, we employ the technology of multi-keyword ranked search over encrypted cloud data as the basis against two threat models and raise PRSCG and PRSCG-TF to resolve the problem of privacy-preserving smart semantic search based on CGs. Finally, we choose a real-world data set: CNN data set to test our scheme. We also analyze the privacy and efficiency of proposed schemes in detail. The experiment results show that our proposed schemes are efficient.

5. Z. Fu, K. Ren, J. Shu, X. Sun, and F. Huang, "Enabling personalized search over encrypted outsourced data with efficiency improvement," IEEE Trans. Parallel Distrib. Syst., vol. 27, no. 9, pp. 2546–2559, Sep.2019.

In cloud computing, searchable encryption scheme over outsourced data is a hot research field. However, most existing works on encrypted search over outsourced cloud data follow the model of "one size fits all" and ignore personalized search intention. Moreover, most of them support only exact keyword search, which greatly affects data usability and user experience. So how to design a searchable encryption scheme that supports personalized search and improves user search experience remains a very challenging task. In this paper, for the first time, we study and solve the problem of personalized multi-keyword ranked search over encrypted data (PRSE) while preserving privacy in cloud computing. With the help of semantic ontology WordNet, we build a user interest model for individual user by analyzing the user's search history, and adopt a scoring mechanism to express user interest smartly. To address the limitations of the model of "one size fit all" and keyword exact search, we propose two PRSE schemes for different search intentions. Extensive experiments on real-world dataset validate our

analysis and show that our proposed solution is very efficient and effective.

6. T. Wang et al., "Maximizing real-time streaming services based on a multi-servers networking framework,"Comput. Netw., vol. 93, pp. 199–212, 2019.

In recent years, we have witnessed substantial exploitation of real-time streaming applications, such as video surveillance system on road crosses of a city. So far, real world applications mainly rely on the traditional well-known client–server and peer-to-peer schemes as the fundamental mechanism for communication. However, due to the limited resources on each terminal device in the applications, these two schemes cannot well leverage the processing capability between the source and destination of the video traffic, which leads to limited streaming services. For this reason, many QoS sensitive application cannot be supported in the real world. In this paper, we are motivated to address this problem by proposing a novel multi-server based framework. In this framework, multiple servers collaborate with each other to form a virtual server (also called cloud-server), and provide high-quality services such as real-time streams delivery and storage. Based on this framework, we further introduce a $(1-\epsilon)$ approximation algorithm to solve the NP-complete "maximum services"(MS) problem with the intention of handling large number of streaming flows originated by networks and maximizing the total number of services. Moreover, in order to backup the streaming data for later retrieval, based on the framework, an algorithm is proposed to implement backups and maximize streaming flows simultaneously. We conduct a series of experiments based on simulations to evaluate the performance of the newly proposed framework. We also compare our scheme to several traditional solutions. The results suggest that our proposed scheme significantly outperforms the traditional solutions.

7. T. Wanget al., "Reliable wireless connections for fast-moving rail users based on a chained fog structure,"Inf. Sci., vol. 379, pp. 160–176, 2019.

Vehicles equipped with modems for cellular networks can be utilized to collect connectivity data while being on the road and to monitor the current network properties. If these data are grabbed from many vehicles and transferred to a central server, the data can be aggregated and allow a prediction of future network capabilities for other vehicles which we define as Connectivity Map. This makes different kinds of communication optimizations possible. Due to the mobility of the vehicles and the high dynamics in cellular networks, it is necessary to get very detailed and accurate data. In this paper, we present our approach to collect such data. We analyze the most important 3G network characteristics, with a strong focus on the vehicular mobility and its impacts. The resulting influences on the communication have to be considered to generate adaptive Connectivity Maps with the collected data.

8. Z. Xia, X. Wang, X. Sun, and Q. Wang, "A secure and dynamic multikeyword ranked search scheme over encrypted cloud data,"IEEE Trans. Parallel Distrib. Syst., vol. 27, no. 2, pp. 340–352, Feb. 2019.

Due to the increasing popularity of cloud computing, more and more data owners are motivated to outsource their data to cloud servers for great convenience and reduced cost in data management. However, sensitive data should be encrypted before outsourcing for privacy requirements, which obsoletes data utilization like keyword-based document retrieval. In this paper, we present a secure multi-keyword ranked search scheme over encrypted cloud data, which simultaneously supports dynamic update operations like deletion and insertion of documents. Specifically, the vector space model and the widely-used TF x IDF model are combined in the index construction and query generation. We construct a special tree-based index structure and propose a "Greedy Depth-first Search" algorithm to provide efficient multi-keyword ranked search. The secure kNN algorithm is utilized to encrypt the index and query vectors, and meanwhile ensure accurate relevance score calculation between encrypted index and query vectors. In order to resist statistical attacks, phantom terms are added to the index vector for blinding search results. Due to the use of our special tree-based index structure, the proposed scheme can achieve sub-linear search time and deal with the deletion and insertion of documents flexibly. Extensive experiments are conducted to demonstrate the efficiency of the proposed scheme.

III. METHODOLOGY

A new concept called fog computing (FC) has been proposed to make the computational capabilities. FC takes the task to reduce the congestion and data analysis that produces when sending this task to the cloud. We use first come first serve algorithm to schedule the task. First Come First Serve (FCFS) is an operating system scheduling algorithm that automatically executes queued requests and processes in order of their arrival. It is the easiest and simplest CPU scheduling algorithm. In this type of algorithm, processes which requests the CPU first get the CPU allocation first.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

1. Data Owners

In this module, data owner who want to upload the file in server they should first register it and get the id and password. According to the id and password they navigate the upload file and request upload file to TPA. If the data owner want to download the file they first send search request to the TPA and send key request to the TPA and all process are completed they true data owner means download the files.

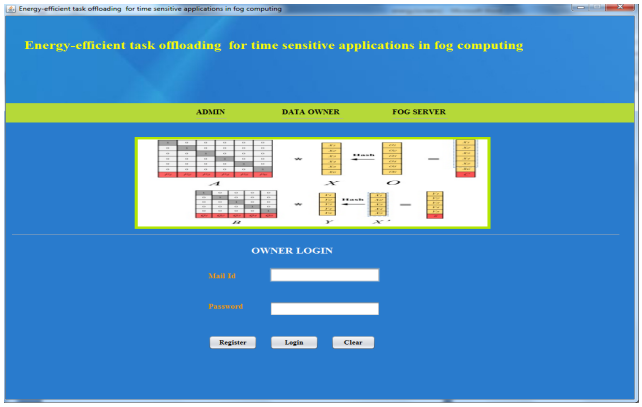

Figure 1: Data Owner

2. FOG

In this module, TPA login to the page and view upload request from data owners and accept that data owner request. Now TPA started to split the data and encrypt it by using key generation process and store into 3 layer of servers namely local server, cloud server and fog server. If the data owner need key TPA will send the file key for download process.

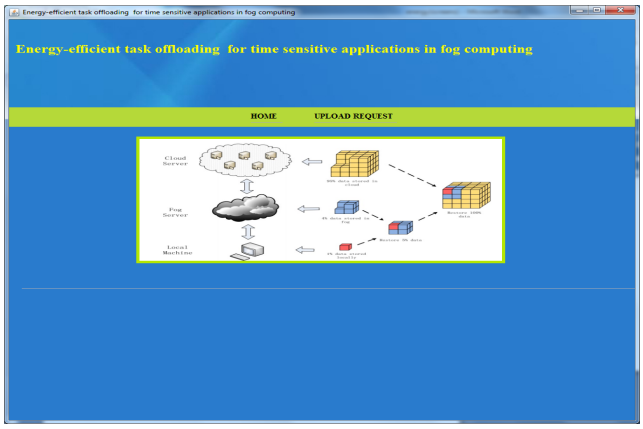

Figure 2: Fog

3. Admin

In this module, admin login to the page and view all data owner details, all upload file details and all download file details. They are authorized person to control both data owner process and file storage process.

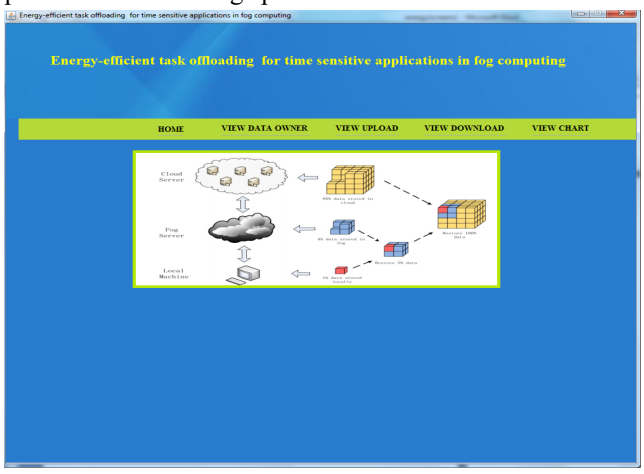

Figure 3: Admin

V. CONCLUSION

The proposed scheme is proved to be feasible. By allocating the ratio of data blocks stored in different servers reasonably, we can ensure the privacy of data in each server. On another hand, cracking the encoding matrix is impossible theoretically. Besides, using hash transformation can protect the fragmentary information. Through the experiment test, this scheme can efficiently complete encoding and decoding without influence of the cloud storage efficiency.

REFERENCES

[1] T. Wanget al., “Reliable wireless connections for fast-moving rail users based on a chained fog structure,”Inf. Sci., vol. 379, pp. 160–176, 2019.
[2] J. Zeng, T. Wang, Y. Lai, J. Liang, and H. Chen, “Data delivery from WSNs to cloud based on a fog structure,” inProc. Int. Conf. Adv. Cloud Big Data, 2019, pp. 104–109.
[3] J. Shen, D. Liu, J. Shen, Q. Liu, and X. Sun, “A secure cloud-assisted urban data sharing framework for ubiquitous-cities,”Pervasive MobileComput., vol. 41, pp. 219–230, 2019.
[4] Z. Fu, F. Huang, K. Ren, J. Weng, and C. Wang, “Privacy-preserving smart semantic search based on conceptual graphs over encrypted outsourced data,”IEEE Trans. Inf. Forensics Security, vol. 12, no. 8, pp. 1874–1884, Aug. 2019
[5] Z. Fu, K. Ren, J. Shu, X. Sun, and F. Huang, “Enabling personalized search over encrypted outsourced data with efficiency improvement,” IEEE Trans. Parallel Distrib. Syst., vol. 27, no. 9, pp. 2546–2559, Sep.2019.
[6] T. Wang et al., “Maximizing real-time streaming services based on a multi-servers networking framework,”Comput. Netw., vol. 93, pp. 199–212, 2019.
[7] T. Wanget al., “Reliable wireless connections for fast-moving rail users based on a chained fog structure,”Inf. Sci., vol. 379, pp. 160–176, 2019.
[8] Z. Xia, X. Wang, X. Sun, and Q. Wang, “A secure and dynamic multikeyword ranked search scheme over encrypted cloud data,”IEEE Trans. Parallel Distrib. Syst., vol. 27, no. 2, pp. 340–352, Feb. 2019.
[9] L. Xiao, Q. Li, and J. Liu, “Survey on secure cloud storage,” J. Data Acquis. Process., vol. 31, no. 3, pp. 464–472, 2019.