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Key Aggregate Searchable Encryption for Group Data Sharing Via Cloud Data Storage

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Abstract— the ability of preferentially sharing encrypted data with unlike users through public cloud storage might really ease security distress, by possibility data disclose in the cloud. A key test to design such encryption idea lies in the well-organized management encryption keys. The preferred flexibility of allocating any group documents with any group of users by attaining weightage different encryption keys to be used for different documents. On the other hand, this involves the need of securely distributing to users by a large number of keys for both encryption and search, and those users have to progress to store the received keys. The indirect need for secure communication, storage, and complexity clearly cause the unreasonable approach. In this paper, we concentrate on this practical problem, by suggesting the novel concept of key aggregate searchable encryption (KASE) and instantiating the idea through a real KASE scheme, in which a data owner wants to share out a single key to a user for distributing a large number of documents, and the user needs to present a single trapdoor to the cloud for questioning the shared documents.

Keywords—data sharing, Searchable encryption, data privacy, cloud storage

1. INTRODUCTION

Nowadays the storage in the cloud has materialized as a capable answer for suitable and on-demand accesses to huge amounts of information shared over the Internet. Business users are being paying attention by cloud storage due to its several benefits, including lower cost, better agility, and improved resource utilization. Everyday users are also sharing private data, such as photos and videos, with their friends through social network applications based on cloud. On the other hand, while benefiting from the expediency of sharing data through cloud storage, users are also gradually worried about accidental data reveal by the cloud. Such data revealing, will be performed by malicious opponent or a mischievous cloud operator, can habitually direct to severe violation of private data or confidential data regarding bussiness. To speak about users anxiety over possible data reveal in cloud storage, a general approach is for the data owner to encrypt all the data before uploading them in to the cloud, such that presently the encrypted data may be get back and decrypted by individuals who contains the decryption keys. Such cloud storage is often called the cryptographic cloud storage [6].Though; the encryption of data builds it demanding for users to search and then preferable retrieve only the data including the given keywords. A common solution is to employ a searchable encryption (SE) scheme in which the data owner is required to encrypt potential keywords and upload them to the cloud together with encrypted data, such that, for retrieving data matching a keyword, the user will send the matching keyword to the cloud to react for the search over the encrypted data.

Even though merging a searchable encryption Scheme with cryptographic cloud storage can accomplish the essential security needs of a cloud storage, executing such a system for large scale application relating huge number of users and large number of files may still be delayed by realistic issues relating the well-organized management of encryption keys, which, to the finest of our knowledge. Primarily, the want for selectively sharing encrypted data with different users usually demands different encryption keys to be used for different files. On the other hand, this involves the number of keys that need to be spread to users, both for them to search over the encrypted files and to decrypt the files, will be relative to the number of such files. Such a large number of keys must not only be spread to users via secure channels, but also be securely stored and handled by the users in their devices. The implicit requirement for secure communication, storage, and computational difficulty may cause system ineffectiveness.

In this paper, we propose the novel concept of key-aggregate searchable encryption (KASE), and instantiating the concept through a concrete KASE method. The proposed KASE scheme relates to any cloud storage that supports the searchable group data sharing feature, which means any user may prefer to distribute a group of files which are selective with a group of selected users, while permitting the final to carry out keyword search above the earlier. To maintain searchable group data sharing the main needs for efficient key management are double. Primarily, a data owner wants to allocate a single aggregate key (instead of a group of keys) to a user for sharing any number of files. Subsequent, the user needs to submit a single aggregate trapdoor to the cloud for performing keyword search over any quantity of shared files. KASE scheme can assure both requests.

2. RELATED WORK:

1) Primarily we describe a common structure of keyaggregate searchable encryption (KASE) collected from several polynomial algorithms for security parameter setup, key generation, encryption, key extraction, trapdoor generation, trapdoor adjustment, and trapdoor testing. We then explain both functional and security requirements for scheming a valid KASE scheme.

2) We then instantiate the KASE skeleton by Scheming a concrete KASE scheme. After giving the full structure for the algorithms, we analyze the effectiveness of the scheme, and set up its saftey through detailed analysis.

2.1 Searchable Encryption:

Searchable encryption schemes categorized into two categories, i.e., searchable symmetric encryption (SSE) and public key encryption with keyword search (PEKS). Both SSE and PEKS can be described as the tuple SE= (Setup, Encrypt, Trapdoor(Trpdr),Test):

1. **Setup**(1^{λ}): This algorithm is run by the owner to set up the scheme. It takes as input a security parameter 1^{λ} and outputs the necessary keys.

2. **Encrypt**(l;n): This algorithm is run by the owner to encrypt the data and generate its keyword ciphertexts. It takes as input the data n, owner's necessary keys including searchable encryption key l and data encryption key, outputs data ciphertext and keyword ciphertexts Cn.

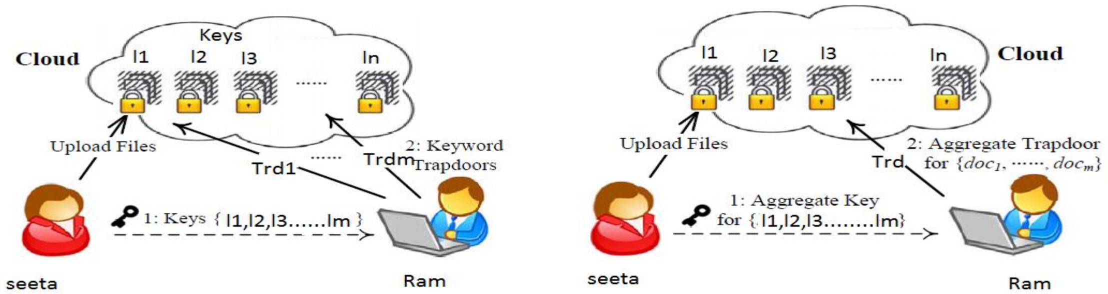
3. **Trpdr**(l;x): This algorithm is run by a user to generate a trapdoor Trd for a keyword w using key l.

4.**Test**(Trd, Cn): This algorithm is run by the cloud server to perform a keyword search over encrypted data. It takes as input trapdoor Trd and the keyword ciphertexts Cn, outputs whether Cn contains the specified keyword. For exactness, it is required that, for a message n containing keyword x and a searchable encryption key l, if (Cn←-Encrypt(l;n) and Tr ←Trpdr(l;x)), then Test(Trd, Cn)=true.

3. THE KEY-AGGREGATE SEARCHABLE ENCRYPTION (KASE) CONSTRUCTION:

In this paper, we propose the novel approach of Key-aggregate searchable encryption (KASE) as a enhanced solution, as depicted in Fig.1(b). , in KASE, seeta needs to issue a single aggregate key, instead of $\{k_i\}^{m}_{i}=1$ for sharing m documents with Ram, and ram needs to issue a single aggregate trapdoor, instead of $\{ Tr_i \}^{m}_{i=1}$, to the cloud server. The cloud server can utilize this aggregate trapdoor and some public data to carry out keyword search and revisit the result to Ram. As a result, in KASE, the delegation of keyword search right can be achieved by sharing the single aggregate key.

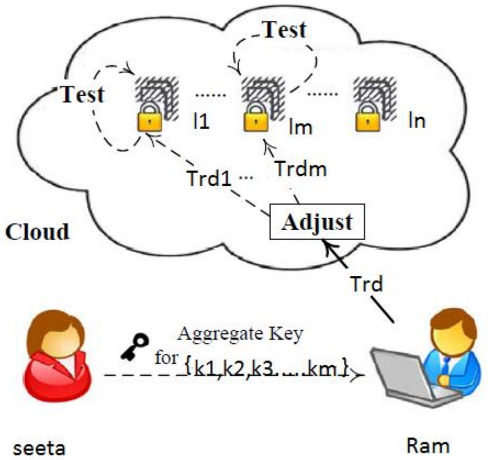
Fig. 1. keyword search in group data sharing system.



(a) Traditional approach (b) Key-Aggregate Searchable Encryption

To design a key-aggregate searchable encryption method under which any subset of the keyword ciphertexts from any set of documents is searchable with a constant-size trapdoor generated by a constant size aggregate key.

Fig. 2. Framework of key-aggregate searchable encryption.



3.2 The KASE construction

The KASE construction is composed of several algorithms. Specially, to set up the method, the cloud server would generate public parameters of the system during the **Setup** algorithm, and these public parameters can be reprocess by dissimilar data owners to distribute their files. For each data owner, they should produce a public/master-secret key pair through the **Keygen** algorithm. Keywords of each document can be encrypted through the **Encrypt** algorithm with the exclusive searchable encryption key. In that case, the data owner can apply the master-secret key to produce an aggregate searchable encryption key for a group of selected documents through the **Extract** algorithm. The aggregate key can be spread securely to approve users who need to access those documents. After that, as shown in Fig.2, an certified user can create a keyword trapdoor via the **Trapdoor** algorithm using this aggregate key, and submit the trapdoor to the cloud. After getting the trapdoor, to carry out the keyword search over the particular set of documents, the cloud server will run the **Adjust** algorithm to produce the right trapdoor for each document, and then run the **Test** algorithm to test whether the document contains the keyword.

This construction is summarized in the following.

1. Setup(1^λ, n): This algorithm is run by the cloud service provider to set up the scheme. On input of a security parameter 1^λ and the maximum possible number n of documents which belongs to a data owner, it outputs the public system parameter params.

2. **Keygen**: This algorithm is run by the data owner to generate a random key pair (pk,msk).

3.**Encrypt**(pk, i): This algorithm is run by the data owner to encrypt the i-th document and generate its keywords' ciphertexts. For each document, this algorithm will create a delta Δi for its searchable encryption key ki. On input of the owner's public key pk and the file index i, this algorithm outputs data ciphertext and keyword ciphertexts Ci.

3. **Extract**(msk, S): This algorithm is run by the data owner to generate an aggregate searchable encryption key for hand over the keyword search right for a certain set of documents to other users. It takes as input the owner's master-secret key msk and a set S which enclose the directory of documents, and then outputs the aggregate key kagg.

4. **Trapdoor**(kagg, x): This algorithm is run by the user who has the aggregate key to perform a search. It takes as input the aggregate searchable encryption key kagg and a keyword w, then outputs only one trapdoor Trd.

5. **Adjust**(params, i, S, Trd): this algorithm is run by cloud server to adjust the aggregate trapdoor to generate the right trapdoor for each different document. It takes as input the system public parameters params, the set S of documents' indices, the index i of target document and the aggregate trapdoor Tr, then outputs each trapdoor Tri for the i-th target document in S.

6.**Test**(Tr_i, i): this algorithm is run by the cloud server to perform keyword search over an encrypted document. It takes as input the trapdoor Tr_i and the document index i, then outputs true or false to denote whether the document doc_i contains the keyword w.

4. CONCLUSION & FUTURE ENHANCEMENT

Taking into consideration of the realistic problem of privacy preserving data sharing system based on public cloud storage which is need a data owner to allocate a large number of keys to users to permit them to access the documents, In this proposed concept of key-aggregate searchable encryption (KASE) and construct a concrete KASE scheme. It can provide an efficient solution to building practical data sharing system based on public cloud storage. In a KASE scheme, the owner needs to distribute a single key to a user when contributing a lot of documents with the user, and the user needs to submit a single trapdoor when they queries over all documents shared by the same owner. On the other hand, if a user wants to question over documents shared by multiple owners, that user must produce multiple trapdoors to the cloud. The future enhancement for this proposed work is to find out how to decrease the number of trapdoors under multi-owners setting by attaining the security.

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