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A Reliable Data Sharing Approach for Dynamic Groups in Cloud

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ABSTRACT:

Benefited from cloud computing, users can achieve an effective and economical approach for data sharing among group members in the cloud with the characters of low maintenance and little management cost. Meanwhile, we must provide security guarantees for the sharing data files since they are outsourced. Unfortunately, because of the frequent change of the membership, sharing data while providing privacy-preserving is still a challenging issue, especially for an untrusted cloud due to the collusion attack. Moreover, for existing schemes, the security of key distribution is based on the secure communication channel, however, to have such channel is a strong assumption and is difficult for practice. In this paper, we propose a secure data sharing scheme for dynamic members. Firstly, we propose a secure way for key distribution without any secure communication channels, and the users can securely obtain their private keys from group manager. Secondly, our scheme can achieve fine-grained access control, any user in the group can use the source in the cloud and revoked users cannot access the cloud again after they are revoked. Thirdly, we can protect the scheme from collusion attack, which means that revoked users cannot get the original data file even if they conspire with the untrusted cloud. In our approach, by leveraging polynomial function, we can achieve a secure user revocation scheme. Finally, our scheme can achieve fine efficiency, which means previous users need not to update their private keys for the situation either a new user joins in the group or a user is revoked from the group.

Index Terms—Access control, privacy-preserving, key distribution, cloud computing

1. INTRODUCTION:

CLOUD computing, with the characteristics of intrinsic data sharing and low maintenance, provides a better utilization of resources. In cloud computing, cloud service providers offer an abstraction of infinite storage space for clients to host data. It can help clients reduce their financial overhead of data managements by migrating the local Managements systeminto cloud servers.

However, security concerns become the main constraint as we now outsource the storage of data,

which is possibly sensitive, to cloud providers. To preserve data privacy, a common approach is to encrypt data files before the clients upload the encrypted data into the cloud. Unfortunately, it is difficult to design a secure and efficient data sharing scheme, especially for dynamic groups in the cloud.

Kallahalla et al. presented a cryptographic storage system that enables secure data sharing on untrustworthy servers based on the techniques that dividing files into file groups and encrypting each file group with a file-block key. However, the file-block keys need to be updated and distributed for a user revocation, therefore, the system had a heavy key distribution overhead. However, the complexities of user participation and revocation in these schemes are linearly increasing with the number of data owners and the revoked users.

Yu et al. exploited and combined techniques of key policy attribute based encryption, proxy re-encryption and lazy re-encryption to achieve fine-grained data access control without disclosing data contents. However, the single owner manner may hinder the implementation of applications, where any member in the group can use the cloud service to store and share data files with others.

Lu et al. Proposed a secure provenance scheme by leveraging group signatures and cipher text-policy attribute-based encryption techniques. Each user obtains two keys after the registration while the attribute key is used to decrypt the data which is encrypted by the attribute-based encryption and the group signature key is used for privacy-preserving and traceability. However, the revocation is not supported in this scheme.

Liu et al. presented a secure multi-owner data sharing scheme, named Mona. It is claimed that the scheme can achieve fine-grained access control and revoked users will not be able to access the sharing data again once they are revoked. However, the scheme will easily suffer from the collusion attack by the revoked user and the cloud . The revoked user can use his private key to decrypt the encrypted data file and get the secret data after his revocation by conspiring with the cloud. In the phase of file access, first of all, the revoked user sends his request to the cloud, then the cloud responds the corresponding encrypted data file and revocation list to the revoked user without verifications. Next, the revoked user can compute the decryption key with the help of the attack algorithm. Finally, this attack can lead to the revoked users getting the sharing data and disclosing other secrets of legitimate members

Why Cloud Computing?

The goal of cloud computing is to apply traditional supercomputing, and high-performance computing power, normally used by military and research facilities, to perform tens of trillions of computations per second, in consumer-oriented applications such as financial portfolios, to deliver personalized information, to provide data storage or to power large, immersive computer games.

The cloud computing uses networks of large groups of servers typically running low-cost consumer PC technology with specialized connections to spread data-processing chores across them. This shared IT infrastructure contains large pools of systems that are linked together. Often, virtualization techniques are used to maximize the power of cloud computing.

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2. THREAT AND SYSTEM MODELS:

2.1 Threat Model:

As the threat model, in this paper, we propose our scheme based on the Delov-Yao model , in which the adversary can overhear, intercept, and synthesis any message at the communication channels. With the Delov-Yao model, the only way to protect the information from attacking by the passive eavesdroppers and active saboteurs is to design the effective security protocols. This means there is not any secure communication channels between the communication entities. Therefore, this kind of threaten model can be more effective and practical to demonstrate the communication in the real world.

2.2 System Model:

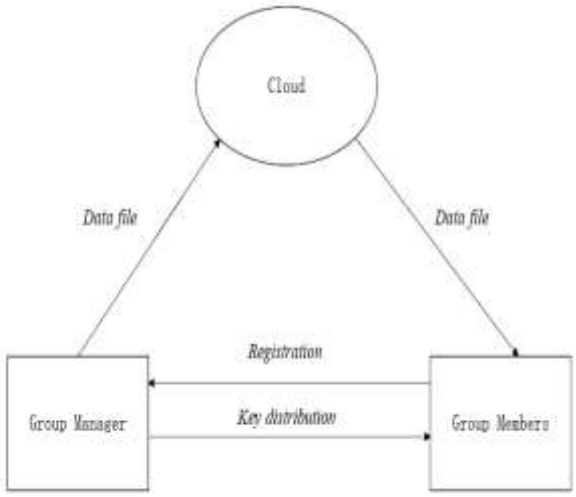
As illustrated in Fig, the system model consists of three different entities: the cloud, a group manager and a large number of group members.

The cloud, maintained by the cloud service providers, provides storage space for hosting data files in a pay-as-you-go manner. However, the cloud is untrusted since the cloud service providers are easily to become untrusted. Therefore, the cloud will try to learn the content of the stored data.

Group manager takes charge of system parameters generation, user registration, and user revocation. In the practical applications, the group manager usually is the leader of the group. Therefore, we assume that the group manager is fully trusted by the other parties.

Group members (users) are a set of registered users that will store their own data into the cloud and share them with others. In the scheme, the group membership is dynamically changed, due to the new user registration and user revocation.

2.2.1 SYSTEM ARCHITECTURE:



2.2.2 Modules:

- **Cloud :** In this module, we create a local Cloud and the users can upload their data in the cloud. We develop this module, where the cloud storage can be made secure.
- **Group Manager :** The group manager is fully trusted by the other parties. The Group manager is the admin. The group manager has the logs of each and every process in the cloud. The group manager is responsible for user registration and also user revocation.

  Group manager takes charge of followings:

  1. System parameters generation
  2. User registration
  3. User revocation

- **Group Member :** The group membership is dynamically changed, due to the staff resignation and new employee participation in the company. The group member has the ownership of changing the files in the group. Whoever are in the group can view the files which are uploaded in their group and also modify it.

  Group members are a set of registered users that will :

  1. Store their private data into the cloud server and
  2. Share them with others in the group.

Using Triple DES algorithm, unique keys are generated by the system, group manager sends the generated keys to the user through e-mail each time he uploads a file from the group.

2.3 Design Goals:

We describe the main design goals of the proposed scheme including key distribution, data confidentiality, access control and efficiency as follows:

Key distribution: The requirement of key distribution is that users can securely obtain their private keys from the group manager without any Certificate Authorities. In other existing schemes, this goal is achieved by assuming that the communication channel is secure, however, in our scheme, we can achieve it without this strong assumption.

Access control: Firstly, group members are able to use the cloud resource for data storage and data sharing. Second, unauthorized users cannot access the cloud resource at any time, and revoked users will be incapable of using the cloud resource again once they are revoked.

Data confidentiality: Data confidentiality requires that unauthorized users including the cloud are incapable of learning the content of the stored data. To maintain the availability of data confidentiality for dynamic groups is still an important and challenging issue. Specifically, revoked users are unable to decrypt the stored data file after the revocation.

Efficiency: Any group member can store and share data files with others in the group by the cloud. User revocation can be achieved without involving the others, which means that the remaining users do not need to update their private keys.

3. EXISTING SYSTEM :

- Kallahalla et al presented a cryptographic storage system that enables secure data sharing on untrustworthy servers based on the techniques that dividing files into file groups and encrypting each file group with a file-block key.
- Yu et al exploited and combined techniques of key policy attribute-based encryption, proxy re-encryption and lazy re-encryption to achieve fine-grained data access control without disclosing data contents

DISADVANTAGES OF EXISTING SYSTEM :

- The file-block keys need to be updated and distributed for a user revocation; therefore, the system had a heavy key distribution overhead.

- The complexities of user participation and revocation in these schemes are linearly increasing with the number of data owners and the revoked users.
- The single-owner manner may hinder the implementation of applications, where any member in the group can use the cloud service to store and share data files with others.

4. PROPOSED SYSTEM:

- In this paper, we propose a secure data sharing scheme, which can achieve secure key distribution and data sharing for dynamic group.
- We provide a secure way for key distribution without any secure communication channels. The users can securely obtain their private keys from group manager without any Certificate Authorities due to the verification for the public key of the user.
- Our scheme can achieve fine-grained access control, with the help of the group user list, any user in the group can use the source in the cloud and revoked users cannot access the cloud again after they are revoked.
- We propose a secure data sharing scheme which can be protected from collusion attack. The revoked users can not be able to get the original data files once they are revoked even if they conspire with the untrusted cloud. Our scheme can achieve secure user revocation with the help of polynomial function.
- Our scheme is able to support dynamic groups efficiently, when a new user joins in the group or a user is revoked from the group, the private keys of the other users do not need to be recomputed and updated.
- We provide security analysis to prove the security of our scheme.

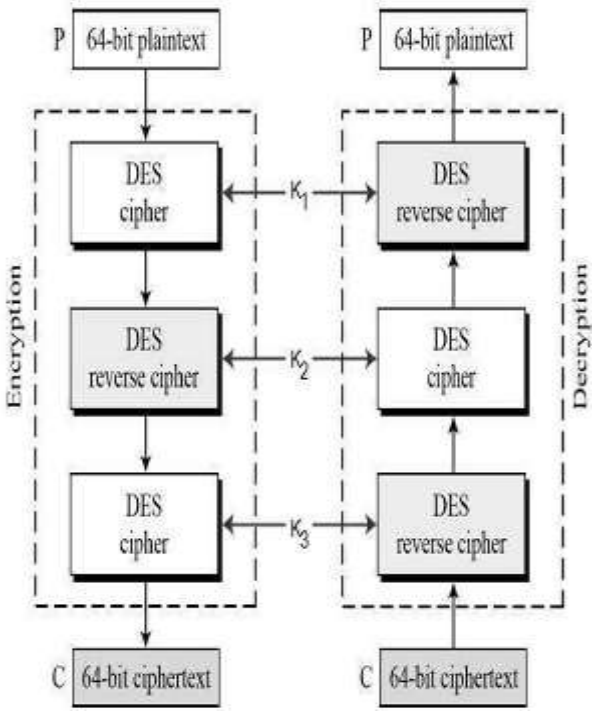
4.1 Implementation :

4.1.1 Algorithm Used : TRIPLE DES

In cryptography, **Triple DES** (**3DES**), officially the **Triple Data Encryption Algorithm** is a symmetric-key block cipher, which applies the Data Encryption Standard (DES) cipher algorithm three times to each data block.

4.1.2 Working of Triple DES:

Before using 3TDES, user first generate and distribute a 3TDES key K, which consists of three different DES keys K_1, K_2 and K_3. This means that the actual 3TDES key has length $3\times56 = 168$ bits. The encryption scheme is illustrated as follows –



The encryption-decryption process is as follows –

- Encrypt the plaintext blocks using single DES with key K_1.
- Now decrypt the output of step 1 using single DES with key K_2.
- Finally, encrypt the output of step 2 using single DES with key K_3.
- The output of step 3 is the cipher text.
- Decryption of a cipher text is a reverse process. User first decrypt using K_3, then encrypt with K_2, and finally decrypt with K_1.

Due to this design of Triple DES as an encrypt–decrypt–encrypt process, it is possible to use a 3TDES (hardware) implementation for single DES by setting K_1, K_2, and K_3 to be the same value. This provides backwards compatibility with DES.

Second variant of Triple DES (2TDES) is identical to 3TDES except that $K_3$is replaced by K_1. In other words, user encrypts plaintext blocks with key K_1, then decrypt with key K_2, and finally encrypt with K_1 again. Therefore, 2TDES has a key length of 112 bits.

Triple DES systems are significantly more secure than single DES, but these are clearly a much slower process than encryption using single DES.

ADVANTAGES OF PROPOSED SYSTEM:

- The computation cost is irrelevant to the number of revoked users in RBAC scheme. The reason is that no matter how many users are revoked, the operations for members to decrypt the data files almost remain the same.
- The cost is irrelevant to the number of the revoked users. The reason is that the computation cost of the cloud for file upload in our scheme consists of two verifications for signature, which is irrelevant to the number of the revoked users. The reason for the small computation cost of the cloud in the phase of file upload in RBAC scheme is that the verifications between communication entities are not concerned in this scheme.
- In our scheme, the users can securely obtain their private keys from group manager Certificate Authorities and secure communication channels. Also, our scheme is able to support dynamic groups efficiently, when a new user joins in the group or a user is revoked from the group, the private keys of the other users do not need to be recomputed and updated.

5. RESULTS:

In general, our scheme can achieve secure key distribution, fine access control and secure user revocation. For clearly seeing the advantages of security of our proposed scheme, as illustrated in table 3, we list a table compared with Mona, which is Liu et al.'s scheme, the RBAC scheme, which is Zhou et al.'s scheme and ODBE scheme, which is Delerablee et al.'s scheme. The √ in the blank means the scheme can achieve the corresponding goal.

Table for Security performance comparison

	Secure key distribution	Access control	Secure user revocation	Anti-collusion attack	Data confidentiali
Mona		√			
RBAC scheme		√			
ODBE		√	√	√	
Our scheme	√	√	√	√	√

6 CONCLUSION:

In this paper, we design a secure anti-collusion data sharing scheme for dynamic groups in the cloud. In our scheme, the users can securely obtain their private keys from group manager Certificate Authorities and secure communication channels. Also, our scheme is able to support dynamic groups efficiently, when a new user joins in the group or a user is revoked from the group, the private keys of the other users do not need to be recomputed and updated. Moreover, our scheme can achieve secure user revocation, the revoked users can not be able to get the original data files once they are revoked even if they conspire with the untrusted cloud

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