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CONTENTS

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SECURE AND SCALABLE DATA SHARING IN CLOUD STORAGE WITH KEY-AGGREGATE CRYPTOSYSTEM

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ABSTRACT

Cloud storage means storing of data online in cloud which is accessible from multiple and connected resources. Cloud storage is having important functionality i.e. securely, efficiently, flexibly sharing data with others. Cloud storage can provide good accessibility and reliability, strong protection, disaster recovery, and lowest cost. New Encryption Scheme public–key encryption which is called as Key- aggregate cryptosystem (KAC) is introduced. Key-aggregate cryptosystem produce constant size cipher texts such that efficient organization of decryption rights for any set of cipher text are possible. Any set of secret keys can be aggregated and make the m as single key, which incorporate power of all the keys being aggregated. This aggregate key can be sent to the others for decryption of cipher text set and left over encrypted files outside the set are remains confidential.

KEYWORDS

Cloud storage, Key-aggregate cryptosystem (KAC), Cipher text, Encryption, Decryption, secret key.

INTRODUCTION

Cloud storage is gaining extreme popularity nowadays and became a very popular storage system. The rise in need for data outsourcing demands the strategic management of corporate information. It is also used as a fundamental technology behind many online services for personal applications. Nowadays, it is easy to apply for free email accounts, social networking sites accounts; file sharing or remote access, with storage size more than 25GB. Users can access almost all of their files and emails by a mobile phone in any region of the world. Cloud storage is storing of data off-site to the physical storage which is maintained by third party. Cloud storage is saving of digital data in logical pool and physical storage spans multiple servers which are control by third party. Third party is responsible for keeping data available and accessible and physical environment should b e protected and running at all time. Instead of storing data to the hard drive or any other local storage mediums, we save data to remote storage which is accessible from anywhere and anytime. It decreases the efforts of carrying physical storage to everywhere. By using cloud storage we can access information from any computer through internet which excludes limitation of accessing information from same computer where it is stored.

While considering data privacy, we cannot depend up on traditional technique of authentication; because of unexpected privilege amplification will expose all data. Solution to this is to encrypt data before uploading to the server with user's own key. Data sharing is again an important functionality of cloud storage, because user can share and access data from anywhere and anytime to anyone. For example, organization ma y grant privileges to access part of sensitive data to their employees. But challenging task is that how to share encrypted data. Traditional way is user can download the encrypted data from storage, decrypt that data and send it to share with others, but it loses the importance of cloud storage.

In order to overcome the above problem Cryptography technique can be applied in two ways- one is symmetric key encryption and other is asymmetric key encryption. In symmetric key encryption, encryption and decryption of data is done with same keys, where as in asymmetric key encryption different keys are used, public key for encryption and private key for decryption. Using asymmetric key encryption is more flexible for our approach. This can be illustrated by following example.

Suppose Alice store all data on Box.com and she does not want to reveal her data to everyone. Due to chance of data leakage possibility she doesn't trust on privacy mechanism provided by Box.com, so she encrypts all data before uploading to the server. If Bob ask her to share some data then Alice use share function of Box.com. But problem now is that how to share encrypted data. There are two severe ways: 1. Alice encrypt data with single secret key and share that secret key directly with the Bob. 2. Alice can encrypt data with distinct keys and send Bob corresponding keys to Bob via secure channel. In first approach, there is a chance of unwanted data also get expose to the Bob, which is inadequate. In second approach, number of keys is as many as number of shared files, which may be hundred or thousand, as well as transferring these keys require secure channel and storage space which can be expensive.

Therefore best solution to above problem is Alice encrypts data with distinct public keys, but send single decryption key of constant size to Bob. Since the decryption key should be sent via secure channel and kept secret small size is always desirable. To design an efficient public-key encryption scheme which supports flexible delegation in the sense that any subset of the cipher texts (produced by the encryption scheme) is decrypt able by a constant-size decryption key (generated by the owner of the master-secret key).[1]

RELATED WORK

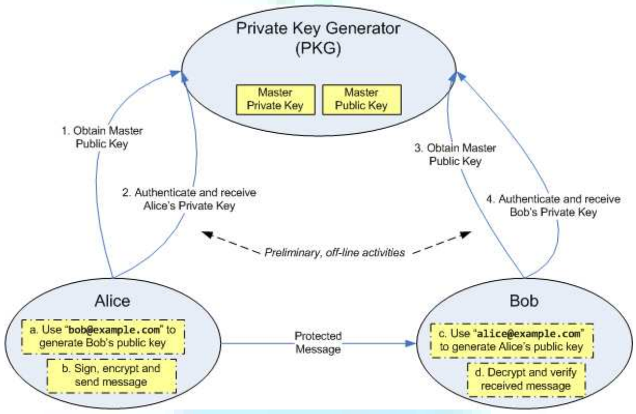
SYMMETRIC-KEY ENCRYPTION WITH COMPACT KEY

Benaloh et al. [2] presented an encryption scheme which is primarily projected for quickly transmitting large number of keys in broadcast scenario [3]. The creation is simple and we briefly analyze its key source process here for a actual description of what are the desirable properties we want to attain. The derivation of the key for a set of classes (which is a subset of all possible cipher text classes) is as follows. A composite modulus is chosen where p and q are two large random primes. A master secret key is chosen at random. Each class is connected with a distinct prime. All these prime numbers can be put in the public system parameter. A constant-size key for set can be generated. For those who have been delegated the access rights for S can be generated. However, it is designed for the symmetric-key setting instead. The content provider needs to get the equivalent secret keys to encrypt data, which is not appropriate for many applications. Because method is used to generate a secret value rather than a pair of public/secret keys, it is ambiguous how to apply this idea for public-key encryption scheme. Finally, we note that there are schemes which try to reduce the key size for achieving authentication in symmetric-key encryption, e.g., [4]. However, sharing of decryption power is not a concern in these schemes.

ID-BASED ENCRYPTION WITH COMPACT KEY

Identity-based encryption (IBE) (e.g., [5], [6], [7]) is a public-key encryption is the procedure in which the public-key of a user can be set as an identity-string of the user (e.g., an email address, mobile number). There is a private key generator (PKG) in IBE which holds a master-secret key and issues a secret key to each user with respect to the user identity. The content provider can take the public parameter and a user identity to encrypt a message. The receiver can decrypt this ciphertext by using his secret key. Guo et al. [8], [9] tried to build IBE with key aggregation. In their schemes, key aggregation is controlled in the sense that all keys to be aggregated must come from dissimilar —identity divisions. While there are an exponential number of identities and thus secret keys, only a polynomial number of them can be aggregated.[1] This considerably increases the costs of storing and transmitting cipher texts, which is not possible in many situations such as shared cloud storage. As Another way to do this is to apply hash function to the string denoting the class, and keep hashing repeatedly until a prime is obtained as the output of the hash function. we mentioned, our schemes feature constant cipher text size, and their security holds in the standard model. In fuzzy IBE [10], one single compact secret key can decrypt cipher texts encrypted in many identities which are close in a certain metric space, but not for an arbitrary set of identities and for that reason it do not match up with our idea of key aggregation.

FIGURE 1: ID BASED ENCRYPTION SYSTEM



ID BASED ENCRYPTION FRAMEWORK

- **Setup**: This algorithm is run by the PKG one time for creating the whole IBE environment. The master key is kept secret and used to derive users' private keys, while the system parameters are made public. It accepts a security parameter (i.e. binary length of key material) and outputs:
  1. A set of system parameters, including the message space and cipher text space and,
  2. a master key .
- **Extract**: This algorithm is run by the PKG when a user requests his private key. Note that the verification of the authenticity of the requestor and the secure transport of are problems with which IBE protocols do not try to deal. It takes as input, and an identifier and returns the private key for user.
- **Encrypt**: Takes, a message and and outputs the encryption.
- **Decrypt**: Accepts, and and returns.

ATTRIBUTE-BASED ENCRYPTION

Attribute-based encryption (ABE) [11], [12] allows each ciphertext to be linked with an attribute, and the master-secret key holder can extract a secret key for a strategy of these attributes so that a ciphertext can be decrypted by this key if its associated attribute conforms to the strategy. For example, with the secret key for the policy (1 ˅ 3 ˅ 6 ˅ 8), one can decrypt ciphertext tagged with class 1,3, 6 or 8. However, the major anxiety in ABE is collusion-resistance but not the compression of secret keys. Indeed, the size of the key often increases linearly with the number of attributes it encompasses, or the ciphertext-size is not constant (e.g., [13]).

KEY-AGGREGATE CRYPTOSYSTEM

In key-aggregate cryptosystem (KAC), users encrypt a message not only under a public-key, but also under an identifier of ciphertext called class. That means the ciphertexts are further categorized into different classes. The key owner holds a master-secret called master-secret key, which can be used to extract secret keys for different classes. More significantly, the extracted key can have an aggregate key which is as compact as a secret key for a single class, but aggregates the power of many such keys, i.e., the decryption power for any subset of ciphertext classes.[1]

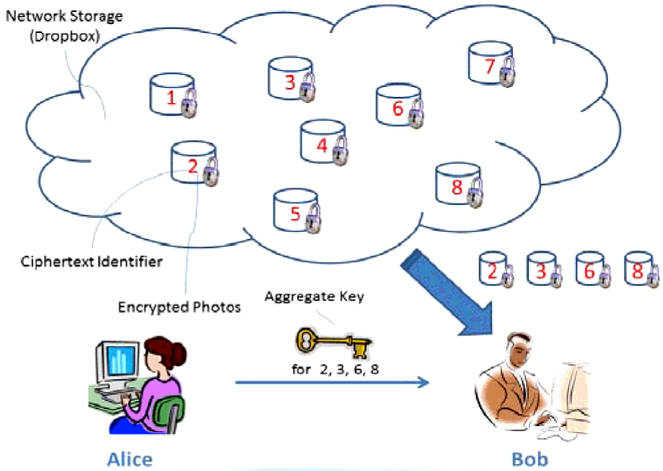
With our example, Alice can send Bob a single aggregate key through a secure e-mail. Bob can download the encrypted photos from Alice's Box.com space and then use this aggregate key to decrypt these encrypted data. The sizes of ciphertext, public-key, master-secret key and aggregate key in KAC schemes are all of constant size. The public system parameter has size linear in the number of ciphertext classes, but only a small part of it is required each time and it can be fetched on demand from large cloud storage.

FRAMEWORK

The data owner establishes the public system parameter through Setup and generates a public/master-secret key pair through KeyGen. Data can be encrypted using Encrypt by any person who also decides what ciphertext class is connected with the plaintext message to be encrypted. The data owner can use the master-secret key pair to produce an aggregate decryption key for a set of ciphertext classes through Extract. The generated keys can be passed to delegates securely through secure e-mails or secure plans Finally, any user with an aggregate key can decrypt any ciphertext provided that the ciphertext's class is contained in the aggregate key via Decrypt. Key aggregate encryption schemes consist of five polynomial time algorithms as follows:

1. Setup (1λ , n) : The data owner establish public system parameter via Setup. On input of a security level parameter 1λ and number of ciphertext classes n , it outputs the public system parameter param
2. KeyGen: It is executed by data owner to randomly generate a public/ master-secret key pair (Pk, msk).
3. Encrypt (pk, i, m) : It is executed by data owner and for message m and index i ,it computes the ciphertext as C.
4. Extract (msk, S): It is executed by data owner for delegating the decrypting power for a certain set of ciphertext classes and it outputs the aggregate key for set S denoted by Ks.
5. Decrypt (Ks, S, I, C): It is executed by a delegate who received, an aggregate key Ks generated by Extract. On input Ks, set S, an index i denoting the ciphertext class ciphertext C belongs to and output is decrypted result m.

FIGURE 2: KEY-AGGREGATE CRYPTOSYSTEM



SHARING ENCRYPTED DATA

A canonical application of KAC is data sharing. The key aggregation property is especially useful when we expect delegation to be efficient and flexible. The KAC schemes enable a content provider to share her data in a confidential and selective way, with a fixed and small ciphertext expansion, by distributing to each authorized user a single and small aggregate key.

Data sharing in cloud storage using KAC, illustrated in Figure 1. Suppose Alice wants to share her data m1,m2,....,mn on the server. She first performs Setup (1λ, n) to get param and execute KeyGen to get the

public/master-secret key pair (pk, msk). The system parameter param and public-key pk can be made public and master-secret key msk should be kept secret by Alice. Anyone can then encrypt each mi by Ci = Encrypt (pk, i, mi). The encrypted data are uploaded to the server. With param and pk, people who cooperate with Alice can update Alice's data on the server. Once Alice is willing to share a set S of her data with a friend Bob, she can compute

the aggregate key KS for Bob by performing Extract (msk, S). Since KS is just a constant size key, it is easy to be sent to Bob through a secure e-mail. After obtaining the aggregate key, Bob can download the data he is authorized to access. That is, for each i ϵ S, Bob downloads Ci from the server. With the aggregate key KS, Bob can decrypt each Ci by Decrypt (KS, S, i, Ci) for each i ϵ S.

TABLE 1: COMPARISON BETWEEN KAC SCHEME AND OTHER RELATED SCHEME

Different Schemes	Ciphertext size	Decryption key size	Encryption type
Key assignment schemes	Constant	Non-constant	Symmetric or public-key
Symmetric-key encryption with compact key	Constant	Constant	Symmetric key
IBE with compact key	Non-constant	Constant	Public key
Attribute based encryption	Constant	Non-constant	Public key
KAC	Constant	Constant	Public key

CONCLUSION

Through this paper i conclude that providing security for the users data stored in cloud storage is important. So here we use public-key cryptosystems which support allocation of secret keys for distinctive cipher text classes in cloud storage No matter which one among the power set of classes, the delegate can always get an aggregate key of constant size. In cloud storage, the number of cipher texts generally grows quickly without any limitations. So we have to reserve enough cipher text classes for the future extension. Or else, we need to increase the public-key. Although the parameter can be downloaded with cipher texts, it would be better if its size is independent of the maximum number of cipher text classes.

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