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NEW IDENTITY-BASED ENCRYPTION WITH OUTSOURCED REVOCATION IN CLOUD COMPUTING

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ABSTRACT:

Identity-Based Encryption (IBE) which simplifies the public key and certificate management at Public Key Infrastructure (PKI) is an important alternative to public key encryption. However, one of the main efficiency drawbacks of IBE is the overhead computation at Private Key Generator (PKG) during user revocation. Efficient revocation has been well studied in traditional PKI setting, but the cumbersome management of certificates is precisely the burden that IBE strives to alleviate. In this paper, aiming at tackling the critical issue of identity revocation, we introduce outsourcing computation into IBE for the first time and propose a revocable IBE scheme in the server-aided setting. Our scheme offloads most of the key generation related operations during key-issuing and key-update processes to a Key Update Cloud Service Provider, leaving only a constant number of simple operations for PKG and users to perform locally. This goal is achieved by utilizing a novel collusion-resistant technique: we

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employ a hybrid private key for each user, in which an AND gate is involved to connect and bound the identity component and the time component. Furthermore, we propose another construction which is provable secure under the recently formulized Refereed Delegation of Computation model. Finally, we provide extensive

Index Terms—Cloud storage, data sharing, key-aggregate encryption, patient-controlled encryption.

INTRODUCTION:

CLOUD storage is gaining popularity recently. In enterprise settings, we see the rise in demand for data outsourcing, which assists in the strategic management of corporate data. It is also used as a core technology behind many online services for personal applications. Nowadays, it is easy to apply for free accounts for email, photo album, file sharing and/or remote access, with storage size more than 25 GB (or a few dollars for more than 1 TB). Together with the current wireless technology, users can access almost all of their files and emails by a mobile phone in any corner of the world.

Considering data privacy, a traditional way to ensure it is to rely on the server to enforce the access control after authentication (e.g., [1]), which means any unexpected privilege escalation will expose all data. In a shared-tenancy cloud computing environment, things become even worse. Data from different clients can be hosted on separate virtual machines (VMs) but reside on a single physical machine. Data in a target VM could be stolen by instantiating another VM coresident with the target one. Regarding availability of

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files, there are a series of cryptographic schemes which go as far as allowing a third-party auditor to check the availability of files on behalf of the data owner without leaking anything about the data [3], or without compromising the data owners anonymity . Likewise, cloud users probably will not hold the strong belief that the cloud server is doing a good job in terms of confidentiality. A cryptographic solution, for example, [5], with proven security relied on number theoretic assumptions is more desirable, whenever the user is not perfectly happy with trusting the security of the VM or the honesty of the technical staff. These users are motivated to encrypt their data with their own keys before uploading them to the server.

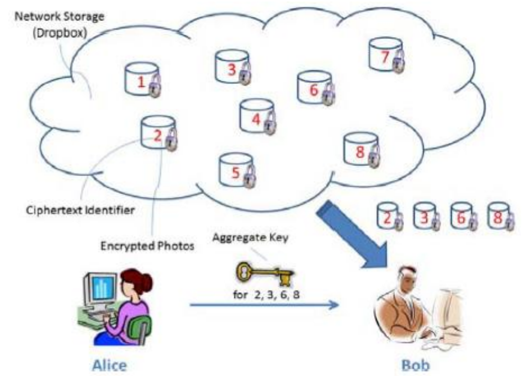

Fig. 1. Alice shares files with identifiers 2, 3, 6, and 8 with Bob by sending him a single aggregate key.

Existing System

We first give the framework and definition for key aggregate encryption. Then we describe how to use KAC in a scenario of its application in cloud storage. A key-aggregate encryption scheme consists of five polynomial-time algorithms as follows. The data owner establishes the public system parameter via Setup and generates a public/master-secret3 key pair via KeyGen. Messages can be encrypted via Encrypt by anyone who also decides what ciphertext class is associated with the plaintext

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message to be encrypted. The data owner can use the master-secret to generate an aggregate decryption key for a set of ciphertext classes via Extract. The generated keys can be passed to delegates securely (via secure e-mails or secure devices) 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.

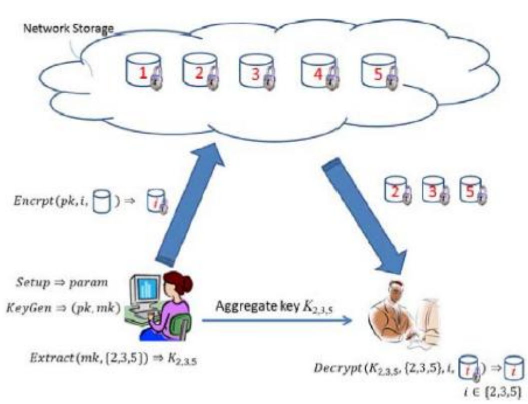

Fig. 2. Using KAC for data sharing in cloud storage.

Proposed System:

This section we compare our basic KAC scheme with other possible solutions on sharing in secure cloud storage. We summarize our comparisons in Table We take the tree structure as an example. Alice can first classify the ciphertext classes according to their subjects like Fig. 3. Each node in the tree represents a secret key, while the leaf nodes represents the keys for individual ciphertext classes. Filled circles represent the keys for the classes to be

delegated and circles circumvented by dotted lines represent the keys to be granted. Note that every key of the non leaf node can derive the keys of its descendant nodes. In Fig. 3a, if Alice wants to share all the files in the "personal" category, she only needs to grant the key for the node "personal," which automatically grants the delegate the keys of all the descendant nodes ("photo," "music"). This is the ideal case, where most classes to be shared belong to

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the same branch and thus a parent key of them is sufficient.

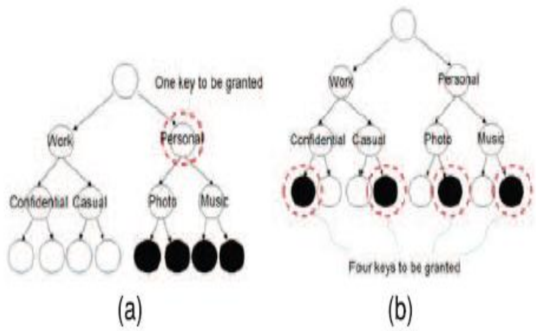

Fig. 3. Compact key is not always possible for a fixed hierarchy.

PERFORMANCE ANALYSIS

Compression Factors

For a concrete comparison, we investigate the space requirements of the tree-based key assignment approach we described in Section 3.1. This is used in the complete subtree scheme, which is a representative solution to the broadcast encryption problem following the well-known subset-cover framework [33]. It employs a static logical key hierarchy, which is materialized with a full binary key tree of height h (equals to 3 in Fig. 3), and thus can support up to 2h ciphertext classes, a selected part of which is intended for an authorized delegatee. In an ideal case as depicted in Fig. 3a, the delegatee can be granted the access to 2hs classes with the possession of only one key, where hs is the height of a certain subtree (e.g., hs ¼ 2 in Fig. 3a). On the other hand, to decrypt ciphertexts of a set of classes, sometimes the delegatee may have to hold a large number of keys, as depicted in Fig. 3b. Therefore, we are interested in na, the number of symmetrickeys to be assigned in this hierarchical key approach, in an average sense.

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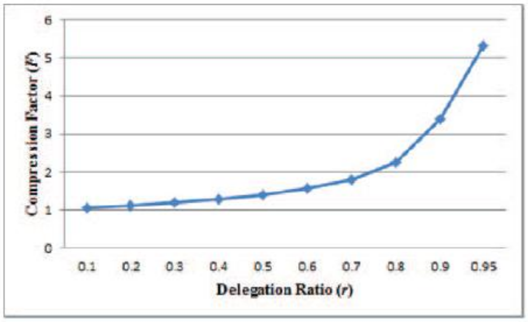
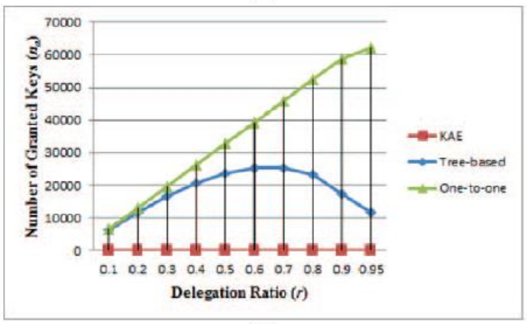


(a)



(b)

Fig. 5. (a) Compression achieved by the tree-based approach for delegating different ratio of the classes.

(b) Number of granted keys (na) required for different approaches in the case of 65,536 classes of data.

NEW PATIENT-CONTROLLED ENCRYPTION (PCE)

Motivated by the nationwide effort to computerize America's medical records, the concept of patient-controlled encryption has been studied [8]. In PCE, the health record is decomposed into a hierarchical representation based on the use of different ontologies, and patients are the parties who generate and store secret keys. When there is a need for a

healthcare personnel to access part of the record, a patient will release the secret key for the concerned part of the record. In the work of Benaloh et al. [8], three solutions have been provided, which are symmetric-key PCE for fixed hierarchy (the "folklore" tree-based method in Section 3.1), public-key PCE for fixed hierarchy (the IBE analog of the folklore method, as mentioned in Section 3.1), and RSAbased symmetric-key PCE for "flexible hierarchy" (which is the "set membership" access policy as we explained).

CONCLUSION

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How to protect users' data privacy is a central question of cloud storage. With more mathematical tools, cryptographic schemes are getting more versatile and often involve multiple keys for a single application. In this paper, we consider how to "compress" secret keys in public-key cryptosystems which support delegation of secret keys for different ciphertext classes in cloud storage. No matter which one among the power set of classes, the delegatee can always get an aggregate key of constant size. Our approach is more flexible than hierarchical key assignment which can only save spaces if all key-holders share a similar set of privileges. A limitation in our work is the predefined bound of the number of maximum ciphertext classes. In cloud storage, the number of ciphertexts usually grows rapidly. So we have to reserve enough ciphertext classes for the future extension.

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