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Scalable Data Sharing in Cloud Storage by Using Key-Aggregate Cryptosystem

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ABSTRACT:

Data sharing is an important functionality in cloud storage. In this article, we show how to securely, efficiently, and flexibly share data with others in cloud storage. We describe new public-key cryptosystems which produce constant-size cipher-texts such that efficient delegation of decryption rights for any set of cipher-texts are possible. The novelty is that one can aggregate any set of secret keys and make them as compact as a single key, but encompassing the power of all the keys being aggregated. In other words, the secret key holder can release a constant-size aggregate key for flexible choices of cipher-text set in cloud storage, but the other encrypted files outside the set remain confidential.

This compact aggregate key can be conveniently sent to others or be stored in a smart card with very limited secure storage. We provide formal security analysis of our schemes in the standard model. We also describe other application of our schemes. In particular, our schemes give the first public-key patient-controlled encryption for flexible hierarchy, which was yet to be known.

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 25GB (or a few dollars for more than 1TB). 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, 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 co-resident with the target one. Regarding availability of 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, 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, 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.

Data sharing is an important functionality in cloud storage. For example, bloggers can let their friends view a subset of their private pictures; an enterprise may grant her employees access to a portion of sensitive data.

Existing System:

There exist several expressive ABE schemes where the decryption algorithm only requires a constant number of pairing computations. Recently, Green et al. proposed a remedy to this problem by introducing the notion of ABE with outsourced decryption, which largely eliminates the decryption overhead for users. Based on the existing ABE schemes, Green et al. also presented concrete ABE schemes with outsourced decryption.In these existing schemes, a user provides an untrusted server, say a proxy operated by a cloud service provider, with a transformation key TK that allows the latter to translate any ABE cipher-text CT satisfied by that user's attributes or access policy into a simple cipher-text CT', and it only incurs a small overhead for the user to recover the plaintext from the transformed cipher-text CT'.

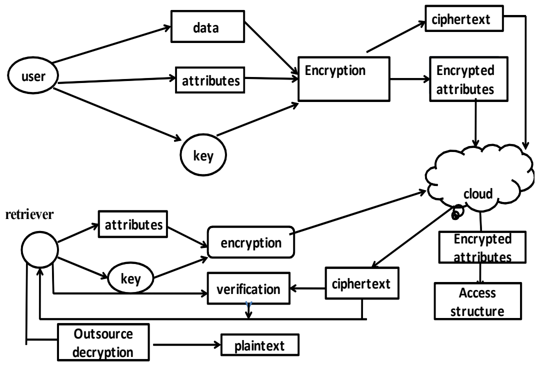
The security property of the ABE scheme with outsourced decryption guarantees that an adversary (including the malicious cloud server) be not able to learn anything about the encrypted message; however, the scheme provides no guarantee on the correctness of the transformation done by the cloud server. In the cloud computing setting, cloud service providers may have strong financial incentives to return incorrect answers, if such answers require less work and are unlikely to be detected by users.

Proposed System:

We considered the verifiability of the cloud's transformation and provided a method to check the correctness of the transformation. However, the we did not formally define verifiability. But it is not feasible to construct ABE schemes with verifiable outsourced decryption following the model defined in the existing. Moreover, the method proposed in existing relies on random oracles (RO). Unfortunately, the RO model is heuristic, and a proof of security in the RO model does not directly imply anything about the security of an ABE scheme in the real world. It is well known that there exist cryptographic schemes which are secure in the RO model but are inherently insecure when the RO is instantiated with any real hash function.In this thesis work, firstly modify the original model of ABE with outsourced decryption in the existing to allow for verifiability of the transformations. After describing the formal definition of verifiability, we propose a new ABE model and based on this new model construct a concrete ABE scheme with verifiable outsourced decryption.

Our scheme does not rely on random oracles.In this paper we only focus on CP-ABE with verifiable outsourced decryption. The same approach applies to KP-ABE with verifiable outsourced decryption.To assess the performance of our ABE scheme with verifiable outsourced decryption, we implement the CP-ABE scheme with verifiable outsourced decryption and conduct experiments on both an ARM-based mobile device and an Intel-core personal computer to model a mobile user and a proxy, respectively.

Architecture:



Modules:

1.Setup Phase
2.Encrypt Phase
3.KeyGen Phase,
4.Decrypt Phase

Module description

1. SETUP PHASE

The setup algorithm takes no input other than the implicit security parameter. It outputs the public parameters PK and a master key MK.

2. ENCRYPT PHASE

Encrypt(PK,M, A). The encryption algorithm takes as input the public parameters PK, a message M, and an access structure A over the universe of attributes. The algorithm will encrypt M and produce a ciphertext CT such that only a user that possesses a set of attributes that satisfies the access structure will be able to decrypt the message. We will assume that the ciphertext implicitly contains A.

3. KEY GEN PHASE

Key Generation(MK,S). The key generation algorithm takes as input the master key MK and a set of attributes S that describe the key. It outputs a private key SK

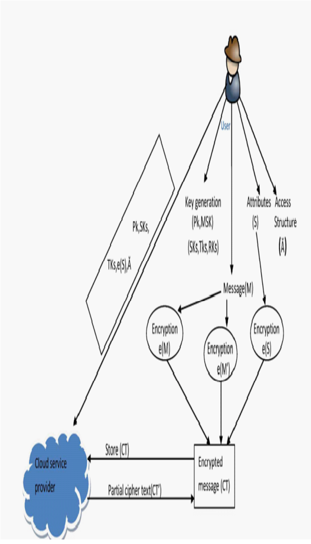


Fig Key generation schematic diagram

4. DECRYPT PHASE:

Decrypt(PK, CT, SK). The decryption algorithm takes as input the public parameters PK, a ciphertext CT, which contains an access policy A, and a privatekey SK, which is a private key for a set S of attributes. If the set S of attributes satisfies the access structure A then the algorithm will decrypt the ciphertext and return a message M.

Conclusions:

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 article, 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. Otherwise, we need to expand the public-key as we described in Section 4.2. Although the parameter can be downloaded with ciphertexts, it would be better if its size is independent of the maximum number of ciphertext classes. On the other hand, when one carries the delegated keys around in a mobile device without using special trusted hardware, the key is prompt to leakage, designing a leakage resilient cryptosystem yet allows efficient and flexible key delegation is also an interesting direction .

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