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Preserving Data and Identity Privacy in an Un Trusted Cloud Environment Where Membership of The Group Is Ever Changing. (MONA(.NET))

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Abstract:

Cloud computing is computing in which large groups of remote servers are networked to allow centralized data storage and online access to computer services or resources. Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a utility (like the electricity grid) over a network. Sharing data in a multi-owner manner while preserving data and identity privacy from an untrusted cloud is still a challenging issue, due to the frequent change of the membership. To preserve data privacy, a basic solution is to encrypt data files, and then upload the encrypted data into the cloud.

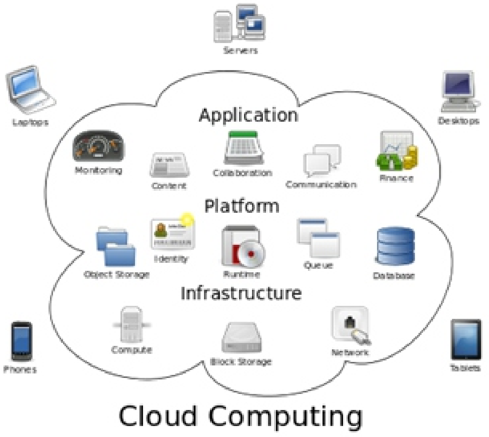
In this paper, we propose a secure multi-owner data sharing scheme, for dynamic groups in the cloud. By including group signature and stateless broadcast encryption techniques, any cloud user can anonymously share data with others. Meanwhile, the storage overhead, length of the signature and the running time of the signing algorithm are independent with the number of group members. This paper proposes how user can access data after the time out. The storage overhead and encryption computation cost of our scheme are independent with the number of revoked users.

Keywords:

Privacy, encryption, cloud computing, secure sharing, identity privacy, multi owner, dynamic groups .

Introduction:

In a cloud computing system, there’s a significant workload shift. Local computers no longer have to do all the heavy lifting when it comes to running applications. The network of computers that make up the cloud handles them instead. Hardware and software demands on the user’s side decrease. The only thing the user’s computer needs to be able to run is the cloud computing system’s interface software, which can be as simple as a Web browser, and the cloud’s network takes care of the rest.



The National Institute of Standards and Technology’s definition of cloud computing identifies “five essential characteristics”:On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider. Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations). Resource pooling: The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. Rapid elasticity: Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand.

To the consumer, the capabilities available for provisioning often appear unlimited and can be appropriated in any quantity at any time.Measured service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Related Work/Background:

Kallahalla et al. proposed a cryptographic storage system that enables secure file sharing on untrusted servers, named Plutus. By dividing files into filegroups and encrypting each file group with a unique file-block key, the data owner can share the file groups with others through delivering the corresponding lockbox key, where the lockbox key is used to encrypt the file-block keys. However, it brings about a heavy key distribution overhead for large-scale file sharing. Additionally, the file-block key needs to be updated and distributed again for a user revocation.

In files stored on the untrusted server include two parts: file metadata and file data. The file metadata implies the access control information including a series of encrypted key blocks, each of which is Encrypted under the public key of authorized users. Thus, the size of the file metadata is proportional to the number of authorized users. The user revocation in the scheme is an intractable issue especially for large-scale sharing, since the file metadata needs to be updated. In their extension version, the NNL construction is used for efficient key revocation.

However, when a new user joins the group, the private key of each user in an NNL system needs to be recomputed, which may limit the application for dynamic groups. Another concern is that the computation overhead of encryption linearly increases with the sharing scale.Ateniese et al leveraged proxy re encryptions to secure distributed storage. Specifically, the data owner encrypts blocks of content with unique and symmetric content keys, which are further encrypted under a master public key. For access control, the server uses proxy cryptography to directly reencrypt the appropriate content key(s) from the master public key to a granted user's public key. Unfortunately, a collusion attack between the untrusted server and any revoked malicious user can be launched, which enables them to learn the decryption keys of all the encrypted blocks. Yu et al. presented a scalable and fine-grained data access control scheme in cloud computing based on the KP-ABE technique. The data owner uses a random key to encrypt a file, where the random key is further encrypted with a set of attributes using KP-ABE.

Then, the group manager assigns an access structure and the corresponding secret key to authorized users, such that a user can only decrypt a ciphertext if and only if the data file attributes satisfy the access structure. To achieve user revocation, the manager delegate's tasks of data file reencryption and user secret key update to cloud servers. However, the single-owner manner may hinder the implementation of applications with the scenario, where any member in a group should be allowed to store and share data files with others.

Lu et al. proposed a secure provenance scheme, which is built upon group signatures and ciphertext-policy attributebased encryption techniques. Particularly, the system in their scheme is set with a single attribute. Each user obtains two keys after the registration: a group signature key and an attribute key. Thus, any user is able to encrypt a data file using attribute-based encryption and others in the group can decrypt the encrypted data using their attribute keys. Meanwhile, the user signs encrypted data with her group signature key for privacy preserving and traceability. However, user revocation is not supported in their scheme.From the above analysis, we can observe that how to securely share data files in a multiple-owner manner for dynamic groups while preserving identity privacy from an untrusted cloud remains to be a challenging issue. In this paper, we propose a novel Mona protocol for secure data sharing in cloud computing. Compared with the existing works, any user in the group can store and share data files with others by the cloud.

1. The computational effort for signing and verification are independent with the number of members leave the group.
2. User revocation can be achieved without updating the private keys of the remaining users.
3. The length of group's public key independent of the number of group members.

EXISTING SYSTEM:

To preserve data privacy, a basic solution is to encrypt data files, and then upload the encrypted data into the cloud. Unfortunately, designing an efficient and secure data sharing scheme for groups in the cloud is not an easy task.In the existing System data owners store the encrypted data files in untrusted storage and distribute the corresponding decryption keys only to authorized users. Thus, unauthorized users as well as storage servers cannot learn the content of the data files because they have no knowledge of the decryption keys. However, the complexities of user participation and revocation in these schemes are linearly increasing with the number of data owners and the number of revoked users, respectively.

DISADVANTAGES OF EXISTING SYSTEM:

•In the existing Systems, identity privacy is one of the most significant obstacles for the wide deployment of cloud computing. Without the guarantee of identity privacy, users may be unwilling to join in cloud computing systems because their real identities could be easily disclosed to cloud providers and attackers. On the other hand, unconditional identity privacy may incur the abuse of privacy. For example, a misbehaved staff can deceive others in the company by sharing false files without being traceable.

•Only the group manager can store and modify data in the cloud

•The changes of membership make secure data sharing extremely difficult the issue of user revocation is not addressed

PROPOSED SYSTEM:

1. We propose a secure multi-owner data sharing scheme. It implies that any user in the group can securely share data with others by the untrusted cloud.

2. Our proposed scheme is able to support dynamic groups efficiently. Specifically, new granted users can directly decrypt data files uploaded before their participation without contacting with data owners.User revocation can be easily achieved through a novel revocation list without updating the secret keys of the remaining users. The size and computation overhead of encryption are constant and independent with the number of revoked users.

3. We provide secure and privacy-preserving access control to users, which guarantees any member in a group to anonymously utilize the cloud resource. Moreover, the real identities of data owners can be revealed by the group manager when disputes occur.

4. We provide rigorous security analysis, and perform extensive simulations to demonstrate the efficiency of our scheme in terms of storage and computation overhead.

ADVANTAGES OF PROPOSED SYSTEM:

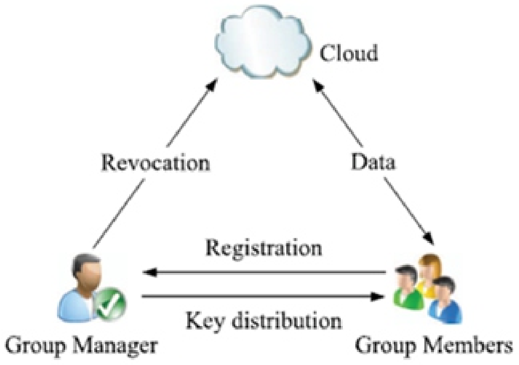
•Any user in the group can store and share data files with others by the cloud.

•The encryption complexity and size of ciphertexts are independent with the number of revoked users in the system.

•User revocation can be achieved without updating the private keys of the remaining users.

•A new user can directly decrypt the files stored in the cloud before his participation.

SYSTEM ARCHITECTURE:



System model.

Algorithms Used:

» Signature Generation

» Signature Verification

» Revocation Verification

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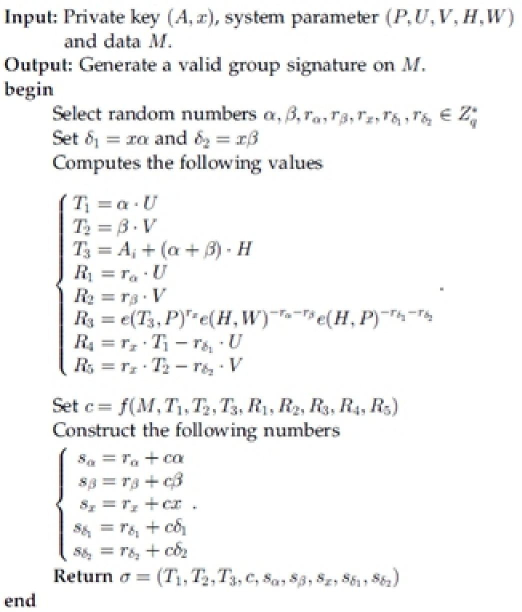
ALGORITHMS DESCRIPTION:

» Signature Generation:



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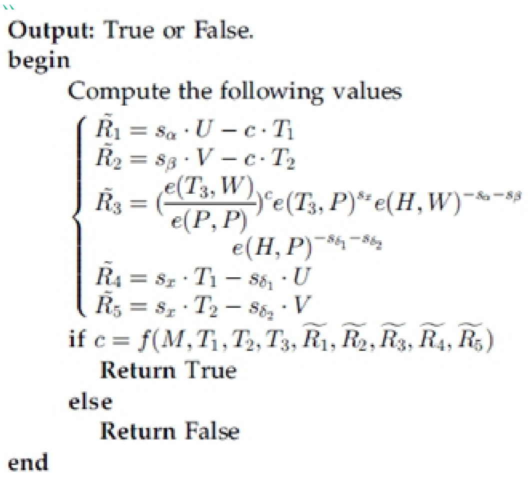
Input: Private key $(A, x)$, system parameter $(P, U, V, H, W)$
        and data $M$.
Output: Generate a valid group signature on $M$.
begin
    Select random numbers $\alpha, \beta, r_\alpha, r_\beta, r_x, r_{\delta_1}, r_{\delta_2} \in Z_q^*$
    Set $\delta_1 = x\alpha$ and $\delta_2 = x\beta$
    Computes the following values
    $\begin{cases} T_1 = \alpha \cdot U \\ T_2 = \beta \cdot V \\ T_3 = A_i + (\alpha + \beta) \cdot H \\ R_1 = r_\alpha \cdot U \\ R_2 = r_\beta \cdot V \\ R_3 = e(T_3, P)^{r_x} e(H, W)^{-r_\alpha - r_\beta} e(H, P)^{-r_{\delta_1} - r_{\delta_2}} \\ R_4 = r_x \cdot T_1 - r_{\delta_1} \cdot U \\ R_5 = r_x \cdot T_2 - r_{\delta_2} \cdot V \end{cases}$ .
    Set $c = f(M, T_1, T_2, T_3, R_1, R_2, R_3, R_4, R_5)$
    Construct the following numbers
    $\begin{cases} s_\alpha = r_\alpha + c\alpha \\ s_\beta = r_\beta + c\beta \\ s_x = r_x + cx \\ s_{\delta_1} = r_{\delta_1} + c\delta_1 \\ s_{\delta_2} = r_{\delta_2} + c\delta_2 \end{cases}$ .
    Return $\sigma = (T_1, T_2, T_3, c, s_\alpha, s_\beta, s_x, s_{\delta_1}, s_{\delta_2})$
end
```

» Signature Verification:



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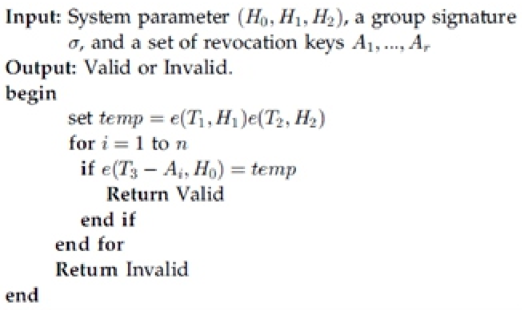
Output: True or False.
begin
    Compute the following values
    $\begin{cases} \tilde{R}_1 = s_\alpha \cdot U - c \cdot T_1 \\ \tilde{R}_2 = s_\beta \cdot V - c \cdot T_2 \\ \tilde{R}_3 = (\frac{e(T_3, W)}{e(P, P)})^c e(T_3, P)^{s_x} e(H, W)^{-s_\alpha - s_\beta} \\ \qquad e(H, P)^{-s_{\delta_1} - s_{\delta_2}} \\ \tilde{R}_4 = s_x \cdot T_1 - s_{\delta_1} \cdot U \\ \tilde{R}_5 = s_x \cdot T_2 - s_{\delta_2} \cdot V \end{cases}$
    if $c = f(M, T_1, T_2, T_3, \widetilde{R_1}, \widetilde{R_2}, \widetilde{R_3}, \widetilde{R_4}, \widetilde{R_5})$
        Return True
    else
        Return False
end
```

» Revocation Verification



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Input: System parameter $(H_0, H_1, H_2)$, a group signature
        $\sigma$, and a set of revocation keys $A_1, ..., A_r$
Output: Valid or Invalid.
begin
    set $temp = e(T_1, H_1)e(T_2, H_2)$
    for $i = 1$ to $n$
      if $e(T_3 - A_i, H_0) = temp$
          Return Valid
      end if
    end for
    Retum Invalid
end
```

(Source: Xuefeng Liu, Yuqing Zhang, Boyang Wang, and Jingbo Yan, "Mona: Secure Multi-Owner Data Sharing for Dynamic Groups in the Cloud", IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS, VOL. 24, NO. 6, JUNE 2013.)

Conclusion:

In this paper, we studied and implemented a secure data sharing scheme, for dynamic groups in an untrusted cloud. A user is able to share data with others in the group without revealing identity privacy to the cloud.

Additionally, it supports efficient user revocation and new user joining. More specially, efficient user revocation can be achieved through a public revocation list without updating the private keys of the remaining users, and new users can directly decrypt files stored in the cloud before their participation. Moreover, the storage overhead, length of the signature and the running time of the signing algorithm are independent with the number of group members.

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