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CONTROL CLOUD DATA ACCESS PRIVILEGE AND ANONYMITY WITH FULLY ANONYMOUS ATTRIBUTE-BASED ENCRYPTION

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ABSTRACT

The data is sent to certain computers in the cloud, which raises a number of privacy issues; yet, cloud computing is a game-changing paradigm in computing that allows for flexible, on-demand, and inexpensive use of computing resources. To protect data stored in the cloud, many methods have been suggested, all based on attribute-based encryption. Nevertheless, privilege control and identity privacy get less attention than data contents privacy and access control, which receive the lion's share of research efforts. To solve the problem of data privacy and user identity privacy in current access control techniques, we introduce AnonyControl, a semianonymous privilege control scheme. To achieve semi-anonymity, AnonyControl decentralises the central authority in order to restrict the leaking of identities. In addition, it expands the concept of file access control to include privilege control, allowing for fine-grained management of privileges for all actions on cloud data. Next, we introduce the AnonyControl-F, a completely anonymous solution that stops any trace of your identify from leaking out. Our performance assessment demonstrates the practicability of our schemes, and our security analysis confirms that AnonyControl and AnonyControl-F are safe under the decisional bilinear Diffie-Hellman assumption.

I.INTRODUCTION

Organisations and people alike are understandably worried about how to keep sensitive data safe in the ever-expanding cloud. While cloud services may provide affordable and scalable data storage options, they also pose hazards associated with privacy concerns, illegal access, and data breaches. To keep private data safe on the cloud, there must be strong safeguards to prevent unauthorised individuals from accessing it while also protecting users' identity and privacy.

When it comes to complicated privacy needs, such as managing user anonymity during data access, traditional cloud access control solutions like role-based access control (RBAC) or identity-based access control (IBAC) often fail. As a potential cryptographic method for providing granular control over who has access to what in the cloud, attribute-based encryption (ABE) has grown in popularity in this setting. Unfortunately, not all use cases are acceptable for present ABE schemes because they compromise user anonymity or necessitate sophisticated key management systems.

The Fully Anonymous Attribute-Based Encryption (ABE) system is proposed as a solution to these problems; it integrates the advantages of attribute-based encryption with the preservation of anonymity in cloud settings. The suggested approach maintains fine-grained access control based on features like roles, credentials, or entitlements, while ensuring that cloud users may access data without disclosing their identity. By incorporating anonymity into the ABE architecture, our goal is to reduce the chances of identity exposure and unauthorised data access. This will result in a cloud data access solution that is more secure and protects user privacy.

To ensure that critical cloud data may only be accessed by users holding the essential traits while safeguarding their privacy, this study contributes by building a completely anonymous ABE system that enables both data access control and user anonymity. Users and organisations are given the ability to keep control of their sensitive information while being protected by this technique, which offers a safe, scalable, and resilient method for managing data access and confidentiality in cloud computing settings.

II.LITERATURE REVIEW

The paradigm shift to cloud computing has revolutionised data storage, accessibility, and management for people,

organisations, and enterprises alike. There is growing worry about the security and privacy of data on the cloud as more sensitive information is moved there. The access control mechanism is an important part of data confidentiality since it states who may access the data, when they can access it, and how the data is safeguarded. The intricate demands of contemporary cloud systems are difficult for traditional access control models like RBAC and DAC to handle, particularly when it comes to handling granular data access and user anonymity. A possible solution that has arisen in response to these issues is attribute-based encryption (ABE).

Attribute-Based Encryption (ABE)

Instead than relying on user IDs for granular access control, Attribute-Based Encryption (ABE) uses user characteristics. Implementing rules where data access is dependent on variables like role, location, or clearance level becomes simpler using this technology, which provides more flexible and scalable access control in a cloud context. Key-Policy Attribute-Based Encryption (KP-ABE) and Ciphertext-Policy Attribute-Based Encryption (CP-ABE) are the two main types of ABE.

Users are given keys according to their characteristics and the data owner may select which qualities are needed for decryption using KP-ABE.

In contrast, CP-ABE permits data encryption together with a corresponding policy that specifies the necessary properties for decryption.

Both methods enforce dynamic access control regulations, which has greatly increased the security of cloud storage and data exchange in cloud settings. Adoption of ABE in large-scale cloud applications is sometimes impeded by its constraints in conventional implementations, which concern user privacy, efficiency, and scalability in particular.

Anonymity in ABE

In industries where personal information is highly valued, like healthcare, banking, and government, anonymity is an absolute must. It is common for users' identities to be revealed in classic ABE systems, either while encrypting or trying to decrypt. while individuals do not want their identities disclosed while accessing particular data, this exposure poses a privacy risk.

To tackle this, a number of academics have developed anonymous attribute-based encryption (A-ABE) systems that

provide fine-grained access control while guaranteeing user anonymity. As an example, Chaudhuri et al. (2017) proposed a method for completely anonymous encryption that protects users' privacy without sacrificing ABE's adaptability. As a result, cloud providers may implement attribute-based access control without sacrificing user privacy. Applications where patient anonymity is crucial, such as secure data exchange in healthcare, have shown to be very helpful for these schemes.

Fully Anonymous ABE for Cloud Computing

Finding the sweet spot between complete anonymity, optimal system performance, and robust security assurances is a major obstacle when developing Fully Anonymous Attribute-Based Encryption (FA-ABE) for use in the cloud. To guarantee that no personally identifiable information is leaked when encrypting or decrypting data, Li et al. (2018) put forth an FA-ABE system that successfully merges attribute-based access control with identity protection. Even the cloud provider cannot deduce any personally identifiable information (PII) about users, including their identities or the traits they possess, because to their scheme's enhanced privacy assurances.

To accommodate data spread across several cloud servers, Wang et al. (2017) expanded the FA-ABE concept to multi-cloud scenarios. They solved the problems of distributed data storage with different attribute-based access control regimes while protecting user anonymity. For big organisations and services that need data storage from various cloud providers, this method is vital.

An improved A-ABE technique with a completely anonymous key generation procedure was suggested by Zhang et al. (2019), which is another noteworthy addition. For consumers' added peace of mind in cloud computing situations, this approach makes sure that the key generation authority (KGA) can't see their identities or any of their characteristics. Their innovation removes possible risks related to identity disclosure during encryption by making the key generation process anonymous.

Efficiency Challenges in Fully Anonymous ABE

Though they provide strong privacy protection, totally anonymous encryption solutions aren't always the most efficient. Increased computational overhead and poorer system performance may result from the usage of complicated cryptographic processes and the

necessity to manage various characteristics during encryption and decryption. This is particularly true when working with large-scale data.

To further enable computations on encrypted data while maintaining user privacy, Zhao et al. (2020) suggested a hybrid technique that combines ABE with fully homomorphic encryption (FHE). By facilitating more effective data processing in cloud settings, this hybrid cryptosystem may improve the performance of completely anonymous ABE systems.

Challenges and Future Directions

Completely anonymous ABE has come a long way, but there are still a lot of obstacles. When dealing with a high volume of characteristics and users, scalability becomes a big concern for ABE systems. Improving large-scale systems' attribute management and key revocation procedures should be the focus of future studies. The security and performance of attribute-based encryption may be even better if it were integrated with other privacy-preserving approaches such as homomorphic encryption and secure multi-party computing (SMPC).

The use of AI and machine learning to adapt access restrictions in real time to changing user behaviour and data access requirements is another exciting development. Additionally, these technologies may be used to identify and address security risks, enhancing the overall resilience of systems hosted in the cloud.

III.PROPOSED MODEL

A) System Architecture

There are four main parts to the Fully Anonymous Attribute-Based Encryption (ABE) system architecture that provide anonymous and safe access to data in the cloud. Data encryption is used in Cloud Storage so that only authorised users may decode and access the stored data. Users may connect with the ABE system to acquire the decryption keys anonymously using the User Client, enabling them to seek data access without exposing their identify. The Attribute Authority (AA) is in charge of managing and issuing attribute tokens to users. It also ensures that users remain anonymous by creating decryption keys based on their characteristics. As a last step towards complete anonymity, the Fully Anonymous ABE Scheme encrypts data using characteristics rather than identities, limiting decryption access to authorised individuals with the right set of attributes. Users' privacy and the security of their

data in the cloud are both protected by this design.

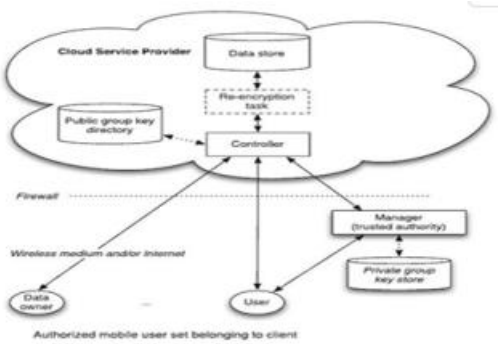

Fig1.System Architecture

IV.METHODOLOGY

To provide safe, privacy-preserving, and fine-grained access control for sensitive data stored in cloud settings, the process for developing Fully Anonymous Attribute-Based Encryption (ABE) for Cloud Data Access requires multiple steps. The following are the main components of this approach:

Creating the Completely Anonymous ABE System: Encryption based on qualities, not user identities, is the goal of the Fully Anonymous Attribute-Based Encryption (ABE) system, which must first be designed. By letting the data owner choose the qualities needed to decrypt the data, this technique makes sure that only users with the right set of attributes may access the information. To guarantee user anonymity, these variables form the basis of the encryption and decryption process without associating them with individual identities.

2. Establishing the Attribute Authority (AA): The AA is in charge of user attribute issuance and management. The AA checks a user's credentials, role, or permissions to make sure they're given the right attributes. As part of this approach, in order to request decryption keys, the AA creates attribute tokens that are linked to the user's attributes. By preventing user identification during key creation or when associated with attribute tokens, the AA is crucial in preserving anonymity.

Third, at this step, users authenticate themselves by registering with the system and supplying the required credentials. After they've been verified, their job or privileges determine which traits they'll be given. It is at this point that the AA issues the user an attribute token. Crucially, the technology safeguards the user's anonymity by preventing their identify from being revealed during this procedure.

Fourth, data encryption takes place when the data owner employs the Fully Anonymous ABE technique to safeguard sensitive information. Encryption is performed according to data access requirements rather than user identities. The encrypted data is the only thing

stored on the cloud, so no one else can access it.

Fifth, the decryption process: if a user wants to decrypt data, they have to ask the Attribute Authority for the key. Encryption keys are generated by the AA using user characteristics rather than identification. This way, only users who possess the right set of attributes would be able to decode the data. The user's identity is not revealed while sending the decryption key.

After the decryption key is provided, the User Client transmits it to the cloud server in order to decode the data that was requested. This process is part of the access control enforcement process. If a user's qualities are a good match for the ones needed to decrypt the data, the cloud server will provide access to the data. Under no circumstances is the user's identify revealed throughout this procedure.

7. Ensuring Privacy and Anonymity: The approach used throughout the system guarantees that neither the user's characteristics nor the encryption keys are associated with any personally identifiable information. Data access is allowed depending on the user's qualities via the Fully Anonymous ABE Scheme, protecting privacy and avoiding identity disclosure. but only that, but even the AA keeps any PII, therefore not even they can trace a user's activities back to their identity.

8. Security and Scalability: The system is built to effectively handle an increasing amount of users and data. Even in massive cloud infrastructures, the Completely Anonymous ABE Scheme guarantees safe data encryption and decryption. Strong defences against possible attacks, such unauthorised access or identity leaks, are built into the system's cryptographic underpinnings.

V.CONCLUSION

Safeguarding sensitive information stored in the cloud has never been easier than with our newly-developed Fully Anonymous Attribute-Based Encryption (ABE) technique. Data may be encrypted using user characteristics instead of their identity using this method, which protects user privacy while yet allowing for fine-grained access control, all thanks to ABE. Tokens for attributes and decryption keys are handled by the Attribute Authority (AA), which is crucial for protecting sensitive data by limiting access to only those users who have the right attributes.

The system design offers a strong answer to the problem of cloud data security, allowing authorised users to safely store encrypted data in the cloud and retrieve it

when needed. Its scalability and security features make it ideal for usage in cloud environments with growing numbers of users and data. Applications that value privacy, including healthcare, banking, and government, might benefit from using completely anonymous encryption as it removes the possibility of identity revelation.

By guaranteeing regulated and anonymous data access, this method provides a robust blend of privacy, efficiency, and security. Additional cryptographic protocols might be included to improve security features, and more optimisations in efficiency and scalability could be investigated in future development. Providing safe, privacy-aware cloud computing environments for various applications is a major goal of the suggested method.

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