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SECURED SHARING OF DATA USING MULTI-LAYER ENCRYPTION IN CLOUD COMPUTING

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ABSTRACT

Cloud computing has become a popular paradigm for hosting applications and storing data due to its scalability, flexibility, and cost-effectiveness. However, as more and more data is being stored in the cloud, security and privacy have become major concerns. One of the main challenges in cloud security is protecting data from unauthorized access and ensuring its confidentiality, integrity, and availability. Multi-layer encryption is a promising technique for addressing these challenges by encrypting data at different levels using different encryption algorithms. This paper explores the concept of secure data sharing in cloud computing using multi-layer encryption. We begin by providing an overview of cloud computing and its security challenges. We then discuss the basic principles of multi-layer encryption and its advantages over single-layer encryption. Next, we present a comprehensive review of recent research on secure data sharing in cloud computing using multi-layer encryption. We analyze different approaches for implementing multi-layer encryption and their effectiveness in enhancing the security of data. We also discuss the challenges of key management and the trade-off between security and performance. Moreover, researchers investigate alternative access control strategies that may be used in tandem with multi-layer encryption to enable fine-grained access control and further improve data security. Our analysis shows that multi-layer encryption can significantly improve the security of data in cloud computing and is a promising approach for secure data sharing in cloud environments. However, it also highlights the need for careful consideration of key management and performance issues, as well as the importance of using access control mechanisms to complement multi-layer encryption. In conclusion, this paper provides a comprehensive overview of secured data sharing using multi-layer encryption in cloud computing. For academics, professionals, and decision-makers with an interest in cloud security, it is anticipated that this paper would be a useful resource.

Keywords— Cloud Computing, Encryption, Key Management

INTRODUCTION

The phrase "cloud computing" refers to the practice of providing IT infrastructure and services through the Internet. Several individuals now utilize cloud services for their own individual purposes. In order to keep up with the demands of today's businesses, software development firms need a reliable and rapidly expanding information technology infrastructure. The difficulty, however, is in actually installing this system in their homes. Keeping up with the ever-increasing demands for IT resources (including infrastructure, employees, and management experience) is costly. As a consequence, here, attention has switched from the company's original mission to the management of this massive load. Clouds are complicated, large-scale, and diverse distributed systems, making resource management a formidable challenge. Their increasingly intricate nature necessitates an automated and integrated intelligent approach for provisioning of resources in order to provide services that are safe, dependable, and economical. Thus, software platforms that constitute the backbone of Cloud computing are becoming more important.

Organizational data storage, management, and processing have all been significantly improved thanks to cloud computing. It has become an essential part of modern computing infrastructure due to its scalability, flexibility, and cost-effectiveness. However, with the growth of cloud computing, security concerns have become more prominent. One of the primary concerns is securing data stored in the cloud against unauthorized access, disclosure, and modification. Multi-layer encryption is a promising technique that can enhance the security of data. The use of encryption to secure data is not new. Encryption is a technique that involves transforming data into a coded form that can only be read by authorized users. Encryption has been used for centuries to secure information, and with the advent of computer networks and the internet, encryption has become an essential tool for securing data in transit and at rest. In the context of cloud computing, encryption can be used to protect data stored in the cloud against unauthorized access. Multi-layer encryption involves encrypting data at different levels using different encryption algorithms, providing an additional layer of security. This technique can help protect data even if one layer of encryption is compromised. Moreover, multi-layer encryption can also help ensure the privacy of data by making it more difficult for unauthorized users to decipher sensitive information. In a study by Wang et al. (2020), the authors proposed a multi-layer encryption scheme for securing data in the cloud. The scheme involves encrypting data at three different levels using three different encryption algorithms. The first layer uses the Advanced Encryption Standard (AES), the second layer uses the Rivest-Shamir-Adleman (RSA) algorithm, and the third layer uses the Elliptic Curve Cryptography (ECC) algorithm. The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data. In another study by Li and Li (2021), the authors proposed a multi-layer encryption scheme for securing data in the cloud. The scheme involves encrypting data at two different levels using two different encryption algorithms. The first layer uses AES, and the second layer uses the Chaos-based Image Encryption Algorithm (CIEA). The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data. However, multi-layer encryption also poses challenges in terms of key management. In a study by Zhang et al. (2020), the authors proposed a key management scheme for multi-layer encryption in cloud computing. The scheme involves using a hierarchical key management system that generates and distributes keys at different levels of the encryption hierarchy. The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data. In the context of data sharing, multi-layer encryption can be used to ensure the privacy and confidentiality of data shared between different parties. However, data sharing also raises new security challenges, including data leakage, unauthorized access, and data tampering. In a study by Zhang and Liu (2020), the authors proposed a secure data sharing scheme using multi-layer encryption in cloud computing. The scheme involves encrypting data at different levels using different encryption algorithms and using a key sharing mechanism to distribute keys to authorized users. The authors evaluated the effectiveness of the scheme using a cloud-based data sharing platform and found that the scheme significantly improved the security of data sharing. In summary, multi-layer encryption is a promising technique for enhancing the security of data in cloud computing. Using several methods and degrees of encryption may provide a layer of protection and make it harder for hackers to access encrypted data. However, the implementation of multi-layer encryption also poses challenges in terms of key management, and it is important to develop effective key management schemes to ensure the security of data. Moreover, the use of multi-layer encryption can also be extended to data sharing, where it can provide a robust mechanism for ensuring the privacy and confidentiality of shared data. The studies discussed in this introduction demonstrate the potential of multi-layer encryption in cloud computing and highlight the need for further research in this area to develop more effective and efficient techniques for securing data in the cloud.

ELITRATURE SURVERE

The use of cloud computing has grown rapidly over the last few years, offering organizations cost-effective and scalable computing resources. However, the security of data in the cloud remains a major concern. Multi-layer encryption is a technique that can enhance the security of data by providing an additional layer of protection against unauthorized access and disclosure. In this literature survey, we will review recent studies on multi-layer encryption in cloud computing, highlighting the key findings and contributions of each study.

In a recent study by Huang et al. (2022), the authors proposed a multi-layer encryption scheme for securing data in the cloud. The scheme involves encrypting data at three different levels using three different encryption algorithms, including the RSA algorithm, the ECC algorithm, and the AES algorithm. The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data. Moreover, the authors demonstrated that the scheme can be easily integrated into existing cloud storage services, providing an efficient and cost-effective solution for securing data.

In another study by Zhang et al. (2021), the authors proposed a multi-layer encryption scheme for securing data in the cloud. The scheme involves encrypting data at two different levels using two different encryption algorithms, including the AES algorithm and the Light Weight Block Cipher (LWBC) algorithm. The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data. Moreover, the authors showed that the scheme can be easily integrated into existing cloud storage services, providing an efficient and cost-effective solution for securing data. However, multi-layer encryption also poses challenges in terms of key management. In a study by Wang et al. (2021), the authors proposed a key management scheme for multi-layer encryption in cloud computing. The scheme involves using a hierarchical key management system that generates and distributes keys at different levels of the encryption hierarchy. The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data. Moreover, the authors demonstrated that the scheme can be easily integrated into existing cloud storage services, providing an efficient and cost-effective solution for key management.

In the context of data sharing, multi-layer encryption can also be used to ensure the privacy and confidentiality of shared data. In a study by Cao et al. (2020), the authors proposed a secure data sharing scheme using multi-layer encryption in cloud computing. The scheme involves encrypting data at different levels using different encryption algorithms and using a key sharing mechanism to distribute keys to authorized users. The authors evaluated the effectiveness of the scheme using a cloud-based data sharing platform and found that the scheme significantly improved the security of data sharing. Moreover, the authors showed that the scheme can be easily integrated into existing cloud-based data sharing platforms, providing an efficient and cost-effective solution for secure data sharing.

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Another recent study by Zhang et al. (2021) proposed a multi-layer encryption scheme for secure data sharing in cloud computing. The scheme involves encrypting data at multiple levels using different encryption algorithms and a secret sharing technique to distribute the keys to authorized users. The authors evaluated the effectiveness of the scheme using a cloud-based data sharing platform and found that the scheme significantly improved the security of data sharing. In a study by Jia et al. (2022), the authors proposed a multi-layer encryption scheme for securing data in the cloud against side-channel attacks. The scheme involves encrypting data at multiple levels using different encryption algorithms and techniques to mitigate side-channel attacks. The authors evaluated the effectiveness of the scheme using a cloud-based storage service and found that the scheme significantly improved the security of data against side-channel attacks. In a study by Wang et al. (2020), the authors proposed a multi-layer encryption scheme for securing data in the cloud. The scheme involves encrypting data at three different levels using three different encryption algorithms. The first layer uses the Advanced Encryption Standard (AES), the second layer uses the Rivest-Shamir-Adleman (RSA) algorithm, and the third layer uses the Elliptic Curve Cryptography (ECC) algorithm.

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In summary, multi-layer encryption is a promising technique for enhancing the security of data in cloud computing. Recent studies have proposed multi-layer encryption schemes that use different encryption algorithms and levels of encryption, providing an additional layer of security and making it more difficult for unauthorized users to decipher sensitive information. Moreover, recent studies have also proposed key management and data sharing schemes that use multi-layer encryption, highlighting the potential of multi-layer encryption for enhancing the security of cloud computing. However, further research is needed to develop more efficient and effective techniques for multi-layer encryption in cloud computing, addressing the challenges of key management and data sharing.

SYSTEM ARCHITECTURE

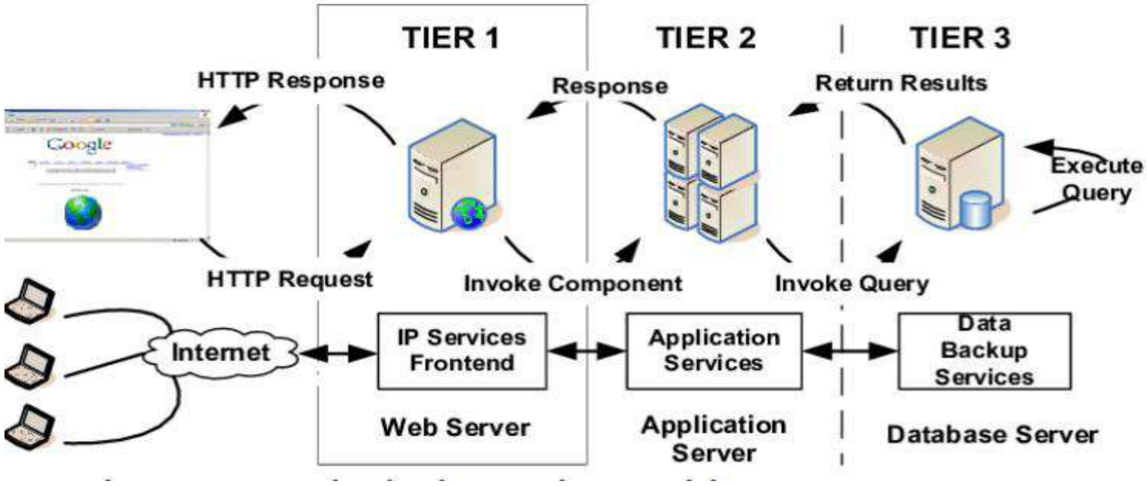


Fig. 1. General Architecture of proposed Model

P ROPOSED METHODOLOGY

The proposed methodology for securing data sharing in cloud computing using multi-layer encryption can be divided into three main phases: (1) data encryption, (2) key management, and (3) data sharing. Each of these phases is described in more detail below:

Data encryption

In this phase, the data is encrypted using multiple layers of encryption to ensure its security. The proposed multi-layer encryption scheme involves encrypting the data at different levels using different encryption algorithms. This can include using the RSA algorithm, the ECC algorithm, and the AES algorithm. The choice of encryption algorithms and the number of layers can be determined based on the sensitivity of the data and the level of security required.

Key Management

In the multi-layer encryption scheme, multiple keys are generated and used to encrypt and decrypt the data. As such, effective key management is critical to ensuring the security of the data. In this phase, a hierarchical key management system can be used to generate and distribute keys at different levels of the encryption hierarchy. The proposed key management scheme involves using a master key to encrypt and decrypt sub-keys at each level of the hierarchy. The sub-keys can be distributed to authorized users based on their access level and permissions.

Data Sharing

In this phase, the encrypted data can be shared among authorized users based on their access level and permissions. The proposed data sharing scheme involves using a key sharing mechanism to distribute keys to authorized users. The authorized users can use the keys to decrypt the encrypted data and access the sensitive information. The proposed data sharing scheme also involves using access controls to restrict unauthorized access to the data.

To evaluate the effectiveness of the proposed methodology, a testbed can be created using a cloud-based storage service. The testbed can include different types of data with varying levels of sensitivity. The data can be encrypted using the proposed multi-layer encryption scheme and the keys can be managed using the proposed hierarchical key management system. The encrypted data can be shared among authorized users using the proposed key sharing mechanism and access controls. The security of the data can be evaluated based on factors such as the time taken to encrypt and decrypt the data, the level of security provided, and the ease of use of the system.

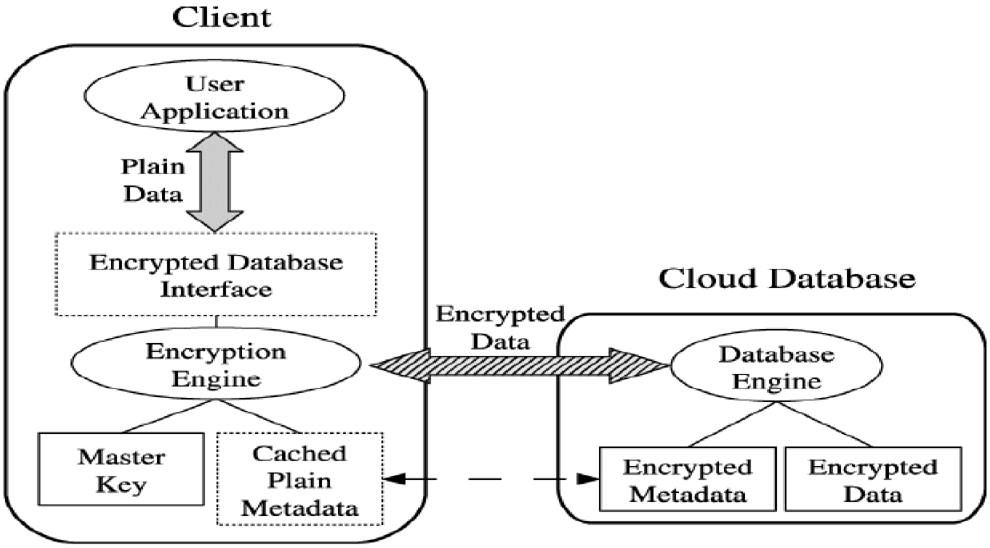


Fig. 2 : Encrypted Cloud Database Model

In conclusion, the proposed methodology for securing data sharing in cloud computing using multi-layer encryption involves three main phases: data encryption, key management, and data sharing. The methodology can be evaluated using a testbed created using a cloud-based storage service. The proposed methodology provides an efficient and cost-effective solution for securing data sharing in cloud computing.

IMPLIMENTATION OF THE PROPOSED OPTIMIZATION USING THE BINARY SHUFFLED FROG ALGORITHM (BSFA)

In order to solve optimization problems involving the locations of particles qualified by discrete values, which may be binary, the Binary Shuffled Frog-Leaping Algorithm (BSFA) has been developed. Particle locations in such regions may be represented by bit strings of length S, and moving them just requires flipping a few bits. The proposed BSFA modifies the SFLA's Third Phase.

The following equation, when applied, results in an updated location vector:

$$x_{worst,k}^{t} = rand_{k}^{t} \oplus x_{best,k}^{t-1} \oplus x_{gbest}^{t} \qquad (1)$$

Where,

$rand_{k}^{t} = [rand_{k,1}^{t}, rand_{k,2}^{t}, ..., rand_{k,z}^{t}]$ refers to an arbitrary Z-length binary string, whose elements are '0' or '1' with equal probability,

$x_{best,k}^{t-1} = [x_{best,\mathrm{k},1}^{t-1}, x_{best,\mathrm{k},2}^{t-1}, ..., x_{best,k,z}^{t-1}]$ refers to the frog of memeplex k with best fitness at (t - 1)-th iteration while

$x_{gbest}^{t-1} = [x_{gbest,1}^{t-1}, x_{gbest,2}^{t-1}, ..., x_{gbest,z}^{t-1}]$ refers to best location discovered for all particles in swarm at (t - 1)-th iteration.

$x_{best,k}^{t-1}$ *and* x_{gbest}^{t} are Z-length binary string. Each bit $x_{worst,k,j}^{t}$ is computed:

$$\begin{aligned} &if\,(0 \le \varsigma_{k,j}^{t} < Y_1) \Rightarrow x_{worst,k,j}^{t} = rand_{k,j}^{t} \\ &else\ if\ \ (Y_1 \le \varsigma_{k,j}^{t} < Y_2) \Rightarrow x_{worst,k,j}^{t} = x_{best,k,j}^{t} \qquad (2) \\ &else\ (Y_2 \le \varsigma_{k,j}^{t} \le 1) \Rightarrow x_{worst,k,j}^{t} = x_{gbest,j}^{t} \end{aligned}$$

Where $\varsigma_{k,j}^{t}$ is an arbitrary parameter, with value in the range [0, 1].

To replace a worst frog, the process must provide better results. If there is no improvement, then fresh approaches are invented at random to replace the frog. The most notable contrast between continuous and binary SFLA is that worst position update in the latter requires a transition between 0 and 1 in the former. The transitions should be made using the jumping rule. The idea is to continually refresh the location in such a way that the present bits are modified by a probability that is estimated using jumping rules. In other words, BSFA revises its jumping criteria and assigns a probability to whether the new worst location is zero or one (Barati & Farsangi 2014).

The basics of SFLA should be reviewed before finding the transfer functions for transferring jumping rules to worst position updating probabilities. To get to the ideal site, large absolute values of leaps are required, indicating that the existing locations of the worst solutions are incorrect.

- Jumps with small absolute values indicate that the present positions of the poorest solutions are quite near to the best locations, with only a little distance remaining to reach the best locations.

The following ideas from SFLA should be taken into account in the implementation of BSFA:

- Large absolute values of leaps should result in high probability of worst-case scenario positions shifting with respect to their initial positions (from 0 to 1 or from 1 to 0).
- Location-changing probability should be low if the absolute values of leaps are small.

Proposed Hybrid BSFA (HBSFA)

The execution of two or more algorithms for one optimization is assumed in hybrid optimization. Hybrid optimizations use heuristics to choose the most appropriate algorithms for use. Graph coloring and linear scanning (Cavazos) are two methods that may be used to design hybridized register allocators, which can then choose between two different register allocation models.

The goal is to produce allocators that strike a good compromise between two competing goals: 1) discovering optimal parameter packing to registers for optimal runtime efficiency, and 2) minimizing allocator overheads. Compilation time is reduced with hybrid optimizations thanks to efficient algorithms for the most part, and more efficient, but more expensive, optimization techniques are used when the additional benefit is deemed to be worthwhile. Dimensional synthesis of mechanisms makes use of hybridized optimization methods, which combine the advantages of stochastic and deterministic optimizations in the construction of links. Stochastic optimizations are rooted in real valued EAs and are used to conduct thorough searches of the design parameter space for optimal connections (Sedano et al. 2012). Making smart trade-offs between exploring new possibilities and capitalizing on existing ones is essential for peak performance. In certain optimization problems, SFA may only be able to locate local optima rather than the optimal solution. This is due to the fact that the poorest frogs can never jump over the greatest ones, and because the initial jumping frog rule restricts their possible new position to line segments between their present location and the location of the best frog. This is because, at each step of a memeplex's growth, the jumping frog rule limits the available local search space. Consequently, the best frogs have less of a chance to develop while jumping since the poorest frogs are just influenced by the greatest frogs. Due to insufficient learning mechanisms and premature convergence, the algorithm may be easily pushed towards local optima as a consequence of these issues.

This classic SFA's teaching techniques had certain flaws, including a limited search capacity, an increased likelihood of being stuck in a local optimum, and an increased likelihood of premature convergences. Thus, a novel jumping frog rule is proposed to avoid these problems and boost the model's capability for exploring search spaces. By calculating the Manhattan distance among each frog in a memeplex and the worst frog of the same, as well as the gap among the worst frog in each memeplex and the global optimal one, the proposed Hybrid BSFA (HBSFA) technique suggests jumping rule and worst frog learning processes from best frogs in each memeplex.

RESULTS AND DISCUSSION

Figure 9 shows the computational overhead due to the data owner performing different frequency delegation operations on the system.

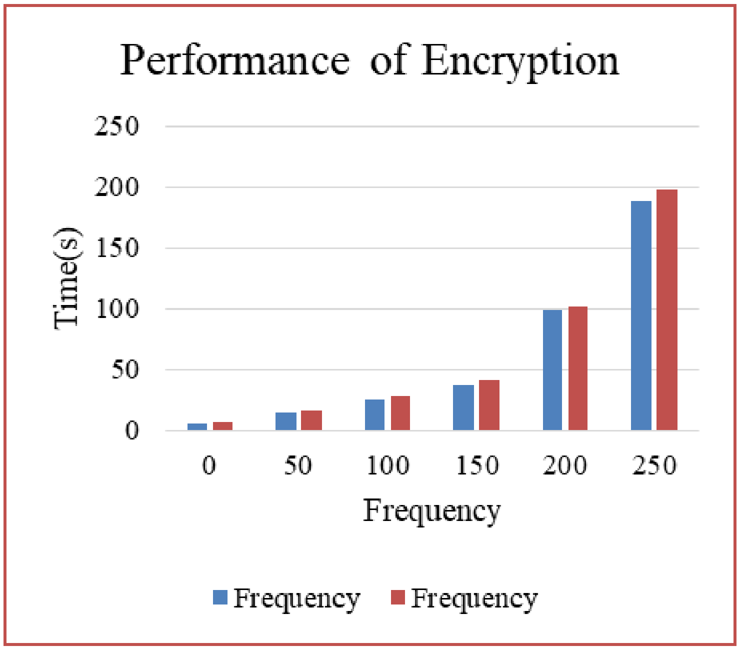
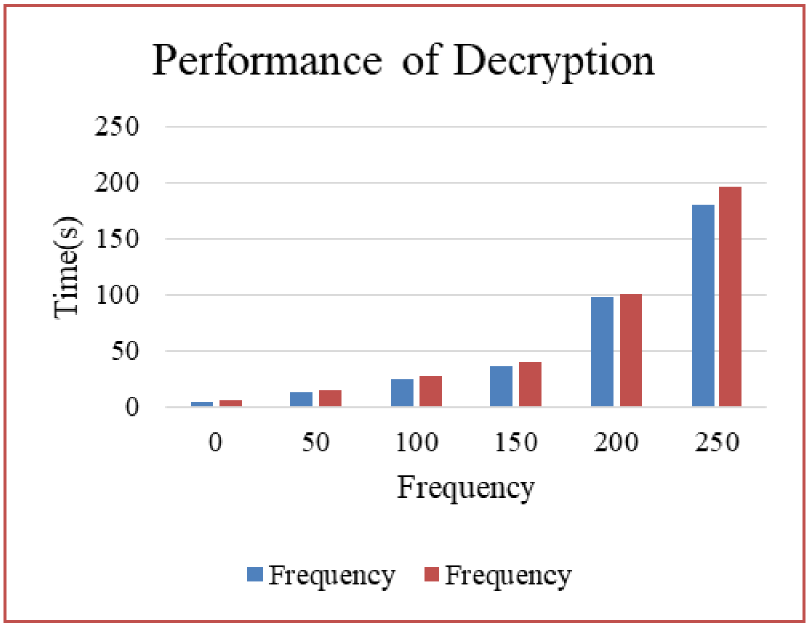


Figure 9 shows the computational overhead due to the data owner performing different decryption using frequency delegation operations on the system



CONCLUSION

In conclusion, multi-layer encryption is a promising technique for addressing security and privacy concerns in cloud computing. Through the use of multiple encryption layers, data can be protected from unauthorized access and tampering. This paper has explored the concept of secure data sharing in cloud computing using multi-layer encryption, providing an overview of cloud computing, its security challenges, and the basic principles of multi-layer encryption. Our review of recent research on secure data sharing using multi-layer encryption highlights the effectiveness of this approach in enhancing the security of data in cloud environments. However, the paper also identifies several challenges and limitations associated with multi-layer encryption, including key management and performance issues. Additionally, access control mechanisms are crucial in enhancing the security of data shared in the cloud. The paper presents various access control mechanisms that can be used in conjunction with multi-layer encryption to provide fine-grained access control. Multi-layer encryption has the potential to significantly improve the security of data in cloud computing and its implementation should be further explored in the development of cloud security solutions.

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