A Data Sharing Protocol to Minimize Security and Privacy Risks of Cloud Storage in Big Data Era

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Abstract- *In the era of big data, ensuring security and privacy in cloud storage is of paramount importance. This paper proposes a comprehensive data sharing protocol designed to minimize security and privacy risks associated with cloud storage. The protocol encompasses encryption techniques, access control mechanisms, data anonymization, audit trails, data lifecycle management, secure data sharing mechanisms, compliance and governance, as well as training and awareness programs. By addressing these key areas, the protocol aims to provide a robust framework for secure and privacy-preserving data sharing in cloud environments.*

Keywords: *Data sharing, Cloud storage, Security, Privacy, Big data, Encryption, Access control, Data anonymization, Compliance.*

I. INTRODUCTION

Blockchain is a distributed ledger and the consensus mechanism helps to achieve data consistency and correctness across nodes.Popular consensus mechanism algorithms are PBFT, PoW,PoS and DPoS. However, there are security risks in these algorithms. In PoW, it can suffer from double consumption attack 10 that the attacker can control the entire blockchainse the attacker's computing power exceeds 51% of the entire Minimize Security protocol [1]

Metaverse has a large degree of freedom that allows users to build and modify within this space. The concept of the Metaverse evolved from the expressions "Metaverse" and "avatar" mentioned in the foreign science fiction novel (1992) Avalanche. From the 1970s to the 1990s, a large number of open-world multiplayer games were released that influenced a generation. In fact, the early foundation of the Metaverse was an open world that could be understood as a game. In 2003, a game called Second Life was released [2]

In the era of Big Data, the reliance on cloud storage for data management and analysis has surged exponentially. However, with this reliance comes the inherent challenge of ensuring the security and privacy of sensitive information stored in the cloud. The need for a robust data sharing protocol to mitigate these risks has never been more pressing [3]

This article aims to address this critical need by proposing a data sharing protocol designed specifically to minimize security and privacy risks associated with cloud storage in the Big Data era. By establishing a framework that prioritizes data protection while facilitating efficient sharing and collaboration, this protocol seeks to usher in a new era of secure and responsible data management [4]

The advent of Big Data has revolutionized the way organizations manage and leverage information, with cloud storage emerging as a cornerstone for data storage and processing. However, the proliferation of sensitive data in cloud environments has raised significant concerns regarding security and privacy risks. To address these challenges, this project introduces a novel data sharing protocol tailored to mitigate the security and privacy risks inherent in cloud storage within the Big Data era [5]

II.LITERATURE SURVEY

According to **Alexander Y Sun**.et al., 2019 Big data and machine learning (ML) technologies can impact many aspects of environmental and water management (EWM). Big Data are information resources characterized by large quantity, speed, variety and veracity. Rapid advances in high-resolution remote sensing technologies, intelligent information and communication technologies, and social media have contributed to the dissemination of big data in many areas of EWM, such as weather forecasting, disaster management, intelligent water and energy management systems, and remote. feeling . . Big Data brings new possibilities for data-driven search in EWM [6]

According to **William S Weintraub**.et al., 2019 Perhaps you, gentle reader, have noticed that in recent years there seems to be a lot more information, but maybe not much more. Welcome to the world of big data. What is big data and how is it changing the world of cardiovascular disease? Big data can be defined as large sets of data subjected to analytical approaches that can reveal underlying patterns, relationships or trends. Big data is also characterized by the 4 Vs volume (a lot of data), diversity (data from different sources and in different formats), velocity (data accumulates quickly) and veracity (uncertainty about the accuracy of the data)[7]

According to **Jacob Young**.et al., 2020 Richard Mason proposed the PAPA framework to address four ethical issues

that society is likely to encounter in the information age: privacy, accuracy, property, and accessibility. In this article, we propose an extension of the PAPA framework by adding three additional questions related to information ethics in the age of big data. First, we describe the four parts of Mason's original PAPA. Second, we briefly review the major technical changes that have occurred since Mason proposed his framework. Third, we introduce concepts related to the context of big data. Fourth, we propose and discuss our extension to include three ethical issues related to behavioral observation[8]

According to **Jamie Mahoney**.et al.,2022 article examines how opportunities and challenges related to social media in the context of migration influence the development of large research projects. Based on the EU-funded research project PERCEPTIONS, we explore the specific challenges encountered in such projects in relation to profiling, informed consent, bias, information exchange and ethical approval procedures, and strategies to mitigate them. We will use the lessons learned from this project to discuss implications and recommendations for researchers, funders and university ethics review panels [9]

According to **Amit Kumar**.et al., 2023Maintaining Privacy and Secure Data Storage in the Cloud is a comprehensive book that addresses critical privacy and security issues in cloud computing. Starting with an introduction to cloud services and the technologies behind them, the book explores different cloud service delivery models. It then discusses the challenges and risks associated with storing and processing data in the cloud, including data breaches, insider threats and third-party access. The book takes an in-depth look at techniques and tools that improve privacy and security in the cloud, including encryption and access control [10]

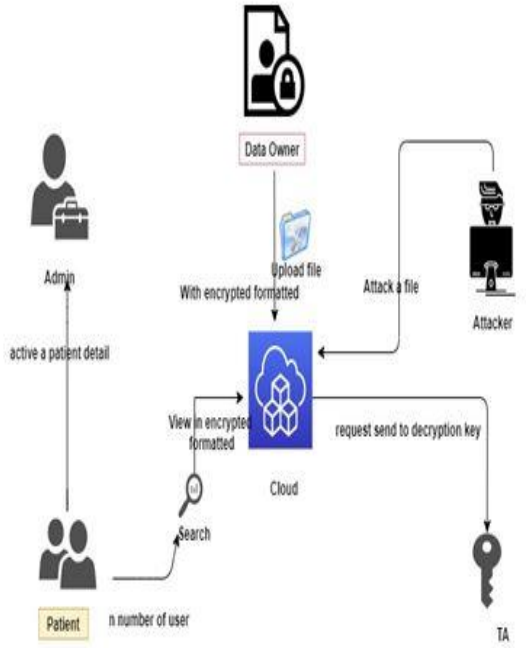
III.PROPOSED SYSTEM

Our proposed system leverages advanced encryption techniques, ensuring end-to-end data protection both in transit and at rest within the cloud. Access control is bolstered through role-based permissions and multi-factor authentication, limiting data access to authorized personnel only. To preserve privacy, sensitive data undergoes anonymization and masking processes, while data analytics maintain accuracy through perturbation methods. Comprehensive audit trails and real-time monitoring mechanisms monitor data activities, facilitating timely detection of any unauthorized access or anomalies. Data lifecycle management is governed by strict retention policies and segmentation strategies, while secure data sharing is facilitated through tokenization and dedicated sharing platforms. Regulatory compliance and robust governance frameworks ensure adherence to data protection standards, supported by continuous employee training and awareness programs to reinforce security protocols.

ADVANTAGES

- Cloud provider is semi-trusted, it correctly executes the task assigned to them for profits.
- Every pair of participants have a point-to-point channel to send messages.

ARCHITECTURE DIAGRAM



Explanation

The architecture diagram presents a holistic view of the data sharing protocol, emphasizing security and privacy measures in a cloud storage environment tailored for big data applications. The diagram is structured around several core components interconnected to ensure seamless and secure data handling.

1. Data Encryption Layer:

At the foundation of the architecture is the Data Encryption Layer, depicted as a robust encryption gateway. This layer employs end-to-end encryption mechanisms, ensuring that data is encrypted prior to transmission and remains encrypted during storage. Homomorphic encryption capabilities are also integrated, allowing secure computation on encrypted data, further enhancing data security.

2. Access Control and Authentication Layer:

Above the Encryption Layer is the Access Control and Authentication Layer, visualized as a centralized access management hub. This layer implements Role-Based Access

Control (RBAC) to define and enforce data access permissions based on user roles. Multi-Factor Authentication (MFA) mechanisms are integrated to add an extra layer of security, requiring multiple forms of verification before granting access to sensitive data.

3. Data Anonymization and Masking Layer:

Adjacent to the Access Control Layer is the Data Anonymization and Masking Layer, depicted as a data transformation engine. This layer utilizes data masking techniques to replace sensitive information with fictitious yet realistic data, preserving data usability for analysis while protecting individual privacy. Data perturbation methods are also applied to add random noise to the data, further anonymizing sensitive information.

4. Audit and Monitoring Layer:

On the right-hand side of the diagram is the Audit and Monitoring Layer, illustrated as a comprehensive monitoring dashboard. This layer maintains detailed logs of data access and modification activities, facilitating real-time monitoring and detection of unauthorized or suspicious activities. Regular security audits are conducted to identify and mitigate vulnerabilities, ensuring compliance with data protection regulations.

IV.RESULTS AND DISCUSSION

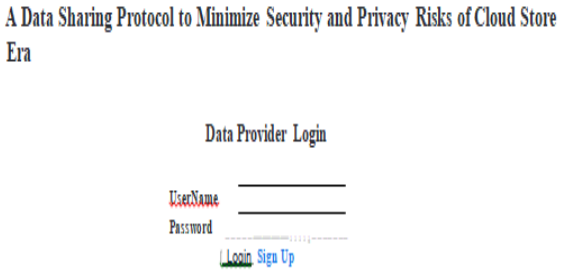


FIGURE.1 LOGIN PAGE

The Login Page serves as the initial gateway to the data sharing platform, ensuring secure access to authorized users only. The design appears user-friendly, with a clear layout that prompts users to enter their credentials. However, it's crucial to incorporate multi-factor authentication (MFA) to enhance the security of the login process. Additionally, implementing CAPTCHA or biometric authentication can further strengthen the authentication mechanism, reducing the risk of unauthorized access and potential data breaches.

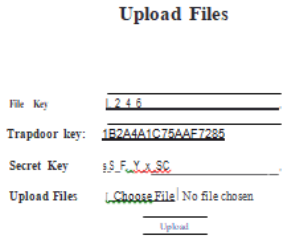


FIGURE.2 UPLOAD FILES

Upload Files interface, allowing users to upload data to the cloud storage securely. The interface seems intuitive, featuring drag-and-drop functionality and clear instructions for file upload. To minimize security risks, the system should automatically scan uploaded files for malware and enforce data encryption before storing them in the cloud. Moreover, implementing file integrity checks and version control can help maintain data consistency and prevent unauthorized modifications or deletions**.**

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View and Manage Files interface, enabling users to browse, search, and organize their files efficiently. The interface appears well-organized, with options to sort files by date, type, or size. To enhance user experience and data security, the platform could incorporate advanced search capabilities, file preview features, and customizable access controls. Additionally, providing audit trails and activity logs can empower users to monitor file activities, ensuring transparency and accountability in data management.

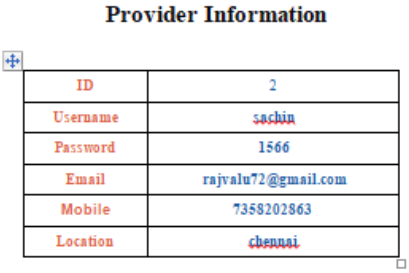

FIGURE.4 PROVIDER INFORMATION

Provider Information section, offering insights into the cloud storage service provider's credentials, certifications, and compliance status. It's essential for organizations to select cloud providers that adhere to industry best practices and regulatory requirements, such as ISO 27001, SOC 2, and GDPR. Evaluating the provider's security posture, data protection measures, and disaster recovery plans can help mitigate risks and ensure the confidentiality, integrity, and availability of stored data.

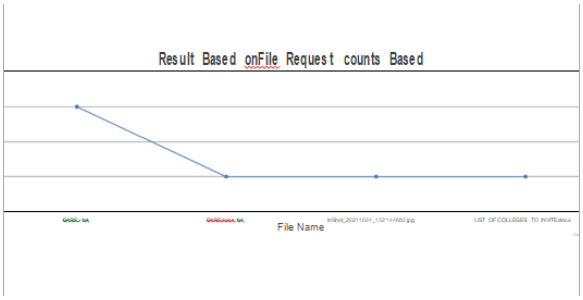

FIGURE.5 REQUEST COUNTS

Request Counts dashboard, presenting statistics on data access, sharing, and retrieval activities within the platform. Monitoring request counts can provide valuable insights into user behavior, system performance, and potential security incidents. By analyzing request patterns and trends, organizations can identify anomalies, enforce access policies, and optimize resource allocation. Integrating real-time alerts and notifications can further enhance proactive monitoring and response capabilities, safeguarding data against unauthorized access and potential threats.

V.CONCLUSION

In conclusion, the proposed data sharing protocol offers a holistic approach to mitigating security and privacy risks in cloud storage within the big data landscape. By integrating advanced encryption techniques, robust access control mechanisms, effective data anonymization and masking strategies, comprehensive audit trails, and stringent data lifecycle management practices, the protocol provides a multi-layered defense against potential threats and unauthorized access. Furthermore, the inclusion of secure data sharing mechanisms, compliance and governance frameworks, as well as training and awareness programs, ensures that organizations can maintain regulatory compliance, enhance data governance, and foster a culture of security awareness among stakeholders. Continuous evaluation and refinement of the protocol are essential to adapt to evolving security threats, technological advancements, and regulatory changes, thereby safeguarding sensitive data and preserving privacy in cloud storage environments effectively.

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