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BLOCK SHARE: A BLOCKCHAIN-BASED LARGE DATA COOPERATION SYSTEM FOR SECURE AND DECENTRALIZED DATA SHARING

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ABSTRACT

This paper proposes a conceptual framework for secure cooperation between organizations based on the permissioned blockchain, smart contracts, encryption, decentralized identities, and off-chain storages. The paper reviews recent literature, reveals research gaps, provides a reference architecture, discusses security aspects, implementation issues, limitations, and future directions. The paper aims to contribute to the research field by providing a review and proposed-framework academic report rather than presenting original researchresults.

KEYWORDS: Big Data; Blockchain; Security; Hyperledger Fabric; Smart Contracts; Data Sharing; Access Control.

1. INTRODUCTION

Organizations increasingly exchange large amounts of structured and unstructured data. Conventional centralized platforms pose challenges related to trust, privacy, integrity, insider attacks, and single-point-of-failure risks. Blockchain technology enables transaction verifiability, trustlessness, being tamper-proof, and auditability. Combined with off-chain big-data storage platforms, blockchain can help organizations achieve collaborative data sharing with accountability.

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2. Literature Review Wang et al. (2024): 'BBS: A Secure and Autonomous Blockchain-Based Big-Data Sharing System' – The article highlights strengths and threats of the blockchain-based big-data sharing system.

IEEE Survey (2023): 'A survey of blockchain-based schemes for data sharing and exchange' – The article provides an in-depth overview of blockchain data sharing methods.

IET Networks (2023): 'Cross-organisation data sharing framework based on blockchain-probes' – The article highlights strengths and threats of the blockchain-based data sharing system.

IET Blockchain (2023): 'An access control model for data security sharing cross-domain in consortium blockchain' – The article highlights strengths and threats of the blockchain-based data sharing system.

BlockHDFS (2021): 'BlockHDFS: Blockchain-enabled Hadoop distributed file system' – The article highlights strengths and threats of the blockchain-based data sharing system.

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3. Research Gap Literature lacks comprehensive studies that address both security and scalability concerns when designing cross-organization data sharing systems utilizing blockchain technology. 4. Objectives - Enable secure cross-organization data sharing.

- Ensure data integrity and traceability.
- Reduce reliance on centralized authorities.
- Facilitate auditable data access via smart contracts.
- Allow for scalable data storage using off-chain solutions.

5. Proposed Framework Entities: Organization A,Organization B, Permissioned Blockchain Network, Certificate Authority, Off-chain Data Lake, Smart Contracts, Identity Management, Audit Dashboard.

Workflow

1. Data are encrypted. 2. Data stored off-chain. 3. Hash stored on blockchain. 4. Smart contract validates requester. 5. Authorized user retrieves encrypted data. 6. Hash verification ensures integrity. 7. All actions logged immutably. 6. Methodology The design-science methodology has been applied to develop this framework by designing an innovative solution and assessing its fitness-for-purpose.

The framework is based on a set of foundational assumptions, including the application of Hyperledger Fabric as a permissioned blockchain platform, AES encryption, role-based access control, certificate-based authentication, and SHA-256 hashing. This paper uses conceptual evaluation to determine the proposed framework's ability to meet design specifications, considering confidentiality, integrity, availability, accountability, and performance dimensions. 7. Algorithm.

Algorithm

Input: Data request.

Step1: Authenticate organization. Step2: Verify role through smart contract. Step 3: Retrieve encrypted object.

Step 4: Compare blockchain hash.

Step 5: If matched, decrypt and deliver; otherwise reject. 8. Security Analysis Integrity: Blockchain hashes prevent tampering.

Confidentiality: Encryption and permissioned access. Availability: Distributed architecture improves resilience. Authentication: Digital certificates.

Non-repudiation: Immutable transaction logs. Auditability: Complete trace of all access events. Integrity: Blockchain hashes prevent tampering. Confidentiality: Encryption and permissioned access. Availability: Distributed architecture improves resilience. Authentication: Digital certificates.

Non-repudiation: Immutable transaction logs. Auditability: Complete trace of all access events.

9. Discussion The paper demonstrates how blockchain technology can support the big-data platform in enabling cross-organization data sharing while maintaining accountability. The proposed framework allows organizations to benefit from both worlds: storing large objects in off-chain data lakes and using blockchain for trust establishment, provenance tracking, and audit trail generation. However, practical implementation may involve significant governance and legal-related challenges that need to be addressed. 10.

Limitations The transaction rate of blockchain networks, storage scalability, privacy regulations, interoperability standards, and cost-effectiveness are some of the key limitations of the proposed framework. 11. Future Scope Future research can explore the application of the framework in different organizational contexts and industries, as well as consider additional factors beyond confidentiality and integrity, such as data availability and auditability. 12.

Conclusion Blockchain technology can be employed to secure cooperation between organizations by establishing provable trust, provenance tracking, and accountability while enabling large-scale data storage in off-chain data lakes. Further research is needed to evaluate the framework's effectiveness through prototype implementation and performance assessment.

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