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Blockchain Technology

Prapti Chaware
prapti.c@somaiya.edu
K. J. Somaiya Polytechnic, Mumbai, Maharashtra

Adhyatmika Ghodvinde
adhyatmika.g@somaiya.edu
K. J. Somaiya Polytechnic, Mumbai, Maharashtra

Harshal Gawade
harshal.gawade@somaiya.edu
K. J. Somaiya Polytechnic, Mumbai, Maharashtra

ABSTRACT

Blockchain is a method of recording information that makes it impossible or difficult for the system to be changed, hacked, or manipulated. Blockchain is a decentralized and distributed ledger technology that enables secure and transparent record-keeping of data. Here are some basic concepts and features of blockchain.

Keywords: *Blockchain, Decentralized System, Security*

CONCEPT

Decentralization: Unlike traditional centralized systems, blockchain operates on a network of computers (nodes) distributed across the globe. Each node has a copy of the entire blockchain, and no single entity controls the entire network.

Blocks: Data is grouped into blocks, and each block contains a list of transactions. These blocks are linked together in chronological order, forming a chain. Each block contains a reference to the previous block, creating a secure and tamper-resistant structure.

Consensus Mechanism: To agree on the state of the blockchain, a consensus mechanism is used. The most common mechanism is Proof of Work (PoW), where participants (miners) solve complex mathematical problems to validate transactions and create new blocks. Another mechanism is Proof of Stake (PoS), where validators are chosen based on the amount of cryptocurrency they hold and are willing to "stake" as collateral.

Cryptographic Hash Functions: Each block contains a unique identifier called a cryptographic hash, generated by a mathematical algorithm. This hash is based on the block's content and the hash of the previous block, making it nearly impossible to alter a block without changing all subsequent blocks.

Immutable Ledger: Once a block is added to the blockchain, it is extremely difficult to modify or delete the information within it. This immutability ensures a high level of security and trust in the data recorded on the blockchain.

Smart Contracts: Smart contracts are self-executing contracts with the terms of the agreement directly written into code. These contracts automatically execute when predefined conditions are met, providing automation and efficiency in various applications.

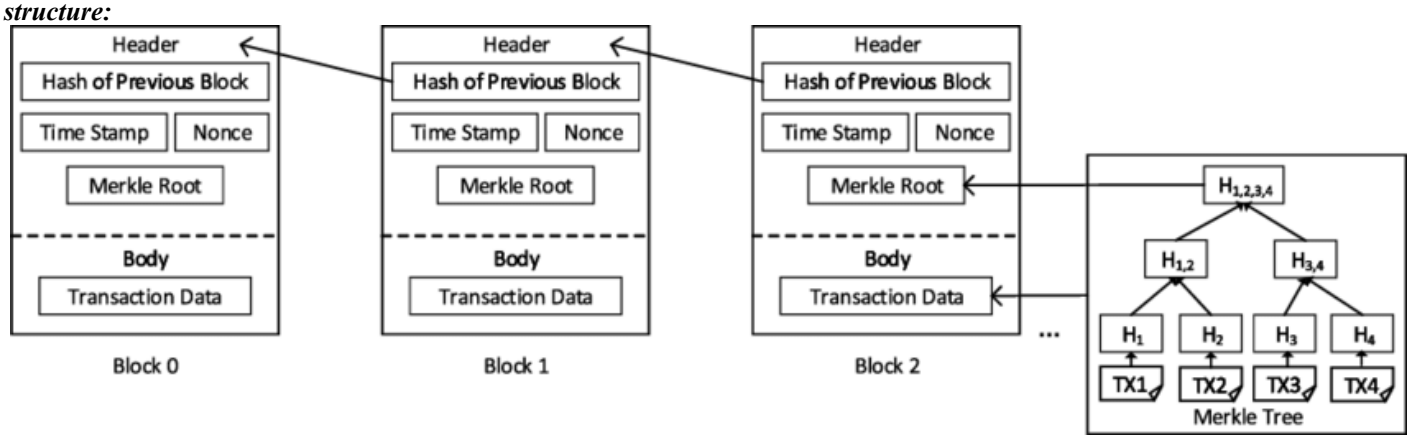
PERMISSIONED VS. PERMISSIONLESS BLOCKCHAINS

In a permissionless (public) blockchain, anyone can participate in the network, validate transactions, and create new blocks. In a permissioned (private) blockchain, access and participation are restricted to a specific group of participants, allowing for more control over the network.

Cryptocurrencies: Many blockchains, such as Bitcoin and Ethereum, have their native cryptocurrencies (BTC and ETH, respectively), which are used for transaction fees, incentives for validators, and as a store of value.

Blockchain technology has found applications beyond cryptocurrencies, including supply chain management, voting systems, healthcare, finance, and more. Its decentralized and transparent nature makes it appealing for various industries seeking increased security, efficiency, and trust in their transactions and data.

structure:



Advantages of blockchain

1. Decentralization: Blockchain operates on a decentralized network, meaning that no single entity or authority has control over the entire system. This reduces the risk of a single point of failure and enhances the overall security of the network.

2. Transparency: The blockchain is a transparent and immutable ledger, where every transaction is recorded and visible to all participants in the network. This transparency enhances trust among users, as they can independently verify transactions and data.

3. **Security:** Blockchain uses cryptographic techniques to secure transactions. Once a block is added to the chain, it is nearly impossible to alter the information within it. This makes blockchain highly resistant to fraud and tampering.

4. Immutability: Once data is added to the blockchain, it becomes extremely difficult to change or delete. This immutability ensures the integrity of the information stored on the blockchain.

5. Efficiency and Speed: Blockchain eliminates the need for intermediaries in many processes, reducing transaction time and costs. Smart contracts, which are self-executing contracts with the terms directly written into code, automate and streamline various operations.

6. Cost Reduction: By removing intermediaries, blockchain reduces the costs associated with traditional transaction processes. It can lead to significant cost savings in industries such as finance, supply chain, and healthcare.

7. Traceability and Audibility: Every transaction on the blockchain is traceable, providing a comprehensive and immutable history of assets or information. This feature is especially valuable in supply chain management, where the source and journey of products can be easily traced.

8. Inclusivity: Blockchain technology can provide financial services to individuals who are unbanked or underbanked, allowing them to participate in economic activities and have access to a global financial system.

Application of blockchain:

1. Cryptocurrencies: Blockchain is the underlying technology for cryptocurrencies like Bitcoin and Ethereum. It enables secure, transparent, and decentralized peer-to-peer transactions without the need for intermediaries.

2. Supply Chain Management: Blockchain can be used to create transparent and traceable supply chains. It allows all participants in the supply chain to record and verify transactions, ensuring authenticity, reducing fraud, and improving traceability.

3. Smart Contracts: Smart contracts are self-executing contracts with the terms directly written into code. They automate and enforce the execution of contractual agreements, reducing the need for intermediaries and streamlining various processes across industries, including legal, real estate, and insurance.

4. Cross-Border Payments: Blockchain facilitates faster and more cost-effective cross-border payments by eliminating intermediaries and providing a transparent, decentralized ledger for tracking transactions.

5. Identity Management: Blockchain can be used for secure and decentralized identity management. Individuals can have control over their personal information and grant permission to entities, enhancing privacy and reducing the risk of identity theft.

6. Healthcare Data Management: Blockchain can secure and streamline healthcare data management. Patient records, clinical trials, and medical histories can be stored on a tamper-resistant and transparent ledger, ensuring data integrity and accessibility.

7. Voting Systems: Blockchain-based voting systems can enhance the security and transparency of elections. Each vote is recorded on the blockchain, making it tamper-resistant and reducing the risk of fraud.

8. Intellectual Property Protection: Blockchain can be used to timestamp and authenticate intellectual property, such as patents, copyrights, and trademarks. This ensures the ownership and provenance of creative works.

9. Real Estate Transactions: Blockchain simplifies and secures real estate transactions by providing a transparent and unchangeable record of property ownership and transactions. This can reduce fraud and streamline the process of property transfers.

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