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Blockchain Technologies

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Abstract: *Blockchain technology has proven to be particularly effective at securely processing distributed transactions. They may be used to handle bitcoin coins and smart contracts, among other things. Blockchain has lately being investigated for data science applications. This study looks at blockchain technology and how it can be used in data science and cyber security. Blockchain allows for the transmission of value at a minimal cost, allowing data from smart devices to be used to generate economic value. The goal of this study is to create a high-performance blockchain platform that uses technologies such distributed network architecture, intelligent device node mapping, and the PBFT-DPOC consensus algorithm to achieve intelligent device decentralisation. The impact of network delay on blockchain forking behavior, as well as probable violations of the six confirmations convention for transaction approval, are investigated in this research. We reduce the blockchain's data structure to speed up our simulations and avoid the massive processing necessary in proof-of-work systems (POW). We demonstrate that the six confirmations standard is sensitive to peer-to-peer network delay through simulation, as well as how quickly it is violated with a lower difficulty of POW mining.*

Keywords: Blockchain technology

I. INTRODUCTION

Blockchains are "tamper evident and tamper resistant digital ledgers built in a distributed form (i.e., without a single repository) and usually without a central authority (i.e., a bank, enterprise, or government)," according to the National Institute of Standards and Technology (NIST). In essence, blockchain technologies provide a platform for the secure movement of data that is part of any transaction, including financial transactions and contracts. Cryptography, which ensures that the data being exchanged is not tampered with and offers authenticity and integrity, is at the heart of blockchain. Blockchain transactions are just asset transfers, and the assets are essentially data that could represent financial information, healthcare information, or even company information. Bitcoin, which is essentially a currency, is one of the most prominent blockchain applications cryptocurrency. Bitcoin transfers between separate wallets are possible. Blockchains allow for the execution of individuals. Another popular application of blockchain technology, in addition to Bitcoin, is Etherium is a cryptocurrency based on blockchain. says that Etherium is a metal "has been designed not just to carry out transactions, but also to carry out other tasks. contracts that include conditional transactions rules."

People are increasingly profiting from technological advancements, and intelligent gadgets such as traffic lights, automatic vending machines, and other intelligent devices provide more convenient and efficient services. People did not aware or could not capture the vast amounts of valuable data generated by these gadgets in the past. However, with the rise in knowledge brought on by the big data boom, there is now unanimous agreement that data is a company's most valuable asset. People are attempting to make greater use of the data generated by intelligent gadgets while ensuring that data privacy is protected. However, there is currently no comprehensive platform that can enable intelligent devices simple to access and exchange data value at a reasonable cost.

Bitcoin, Satoshi Nakamoto's peer-to-peer payment system and cybercurrency, has achieved phenomenal success in terms of market price and the number of users of its cybercurrency. Its popularity is largely due to the technology that underpins it: blockchain, a distributed ledger that securely maintains bitcoin transaction history. Because of the blockchain's security, Bitcoin transactions are easily traceable and difficult to mess with. The success of Bitcoin has drawn interest to blockchain-based cryptocurrencies and other blockchain-based applications.

II. BLOCKCHAIN TECHNOLOGIES

A blockchain is made up of a series of blocks that are linked together via chains. A block is essentially a file that includes transaction-related data. Data from one block can be shared across numerous blocks. A block may also receive data from multiple other blocks. Each block's data is permanent and unchangeable. As the transaction progresses, blocks can be added to the blockchain. In addition, each transition must be confirmed. In contrast to non-blockchain systems, where transactions are often validated by a central authority, blockchain transactions are verified by a distributed collection of processes.

Blocks can be published with or without permissions, as mentioned in the NIST article, which means that anybody can publish a block, or with permissions, which means that blocks can only be published with the approval of a centralized or decentralized authority. Cryptographic hash functions are an important part of blockchain. This is a type of message digest in which checksums are calculated based on the contents of the message.

III. RELATED WORK

This article examines the characteristics and mechanisms of blockchain technology and the intelligent devices network in order to develop an effective blockchain network for intelligent devices.

3.1 Blockchain Technology

Blockchain is a new technology that combines decentralization, distributed processing, asymmetric encryption, timestamping, and a consensus algorithm. It provides a distributed ledger that uses encryption techniques and a distributed message transmission protocol to simplify account reconciliation and retains a huge volume of data through decentralization.

3.2 Intelligent Device Internet

Most intelligent gadgets are now connected to their relevant carriers' central servers via network optical fibre to improve maintenance efficiency. At the same time, there are very few intelligent devices that can help people make better use of their data. Intelligent devices can now obtain information on actual users thanks to advancements in online payment technology. It can achieve functions such as distributing the rights and interests of users' consumption data through intelligent devices and pushing targeted adverts, as well as realize higher data value, through additional analysis and usage of data.

Satoshi Nakamoto originally mentioned blockchain in his Bitcoin paper [1] in 2009, claiming that it enables advanced decentralized peer-to-peer security for Bitcoin transactions without the use of authorized third parties.

Beyond the security of cybercurrency activities, the confluence of Blockchain technology with many developing network applications presents a slew of opportunities and challenges. Crosby et al and Lo et al. published papers on the suitability of implementing Blockchain technology to various scenarios. Some researchers created blockchain-based infrastructure for the Internet of Things (IoT), and the privacy and legality concerns surrounding Blockchain technology are also addressed. Sharma et al. looked at how VANETs are being used in smart city applications and proposed a distributed architecture for VANETs based on blockchain.

IV. PROPOSED SOLUTION

The inherent properties of intelligent devices, such as functional specialization and minimum system configuration, are thoroughly considered in the system design to assure the system's security and stability.

4.1 Architecture of the Network

This system is primarily built on a three- layer design, which includes the intelligent device layer, blockchain layer, and DAPP layer, with the intelligent devices and blockchain nodes connected by a node-to- node mapping mechanism, as illustrated in Fig. 1 below. The use of a distributed architecture among blockchain nodes enables the sharing and maintenance of accounts via a consensus method. The DAPP layer primarily serves as a data service interface for data users.

4.2 Mapping of Intelligent Device Nodes

Because intelligent devices have limited hardware resources, using them for resource-intensive 3mining operations may result in device downtime or other issues. As a result, a node-to-node mapping technique is proposed in this study. Through the identity registration protocol, each intelligent device can be mapped to a node in the blockchain network and then participate in the verification and maintenance of the complete intelligent device blockchain.

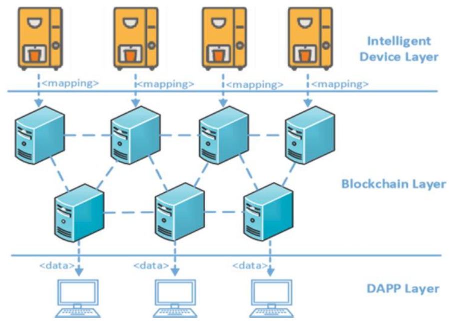

Fig. 1. Network architecture of intelligent device blockchain platform

V. BLOCK CONVERGENCE

Because the bulk of the mining population maintains a global unification of blockchain data, blockchain is quite effective in practise. We define block convergence of blockchain in this study as the state in which every node in the network has exactly the same chain copy, with a consistent sequence on both the blocks on the longest chain and the transactions within each block. Different Bitcoin users' blockchains must periodically accomplish block convergence by synchronizing new validated blocks or upgrading themselves to a longer blockchain from other nodes throughout the network. The POW mining scheme and blockchain consensus protocol, which are supported by robust and fast Internet access, create a favourable environment for nodes to align themselves toward block convergence. POW mining is a type of computation that is difficult for blockchain miners to solve but simple for other users to validate. Miners must solve a hash puzzle of a predetermined difficulty level for each newly mined block. The low computational effort of validating the full blockchain is due to the simplicity of hash-based POW. Any change to block content is visible on the POW hash, and resolving a POW hash puzzle is just as computationally difficult as solving the original published solution.

VI. CONCLUSION

We addressed blockchain technologies and their applications in this paper. The construction of a high-performance blockchain framework for intelligent devices is the paper's key contribution. Through the node-to-node mapping method of intelligent devices, the platform achieves efficient connection of intelligent devices. Simultaneously, we develop a blockchain consensus method for intelligent devices that improves consensus efficiency while maintaining decentralisation and increasing efficiency. This technology can increase the productivity and benefits of all parties involved in intelligent devices, resulting in a multi-win situation.

The impact of a wide range of network delay options on blockchain security is investigated in this article. To quantify blockchain security in our simulation, we define a concept called global block convergence. We primarily look at block convergence speed and how substantial peerto-peer network latencies effect the security of blockchain's six-block confirmation norm. According to the simulations, the time spent on block convergence increases proportionally as network latency increases; however, there is no clear relationship between block convergence speed and network population size or mining difficulty. Furthermore, the security of the blockchain's six confirmations convention for transaction commitment is significantly dependent on both POW mining difficulty and peer-to-peer latency.

Finally, we demonstrate that network latency variance is an important factor to track: we quantify the extent to which nodes with consistently lower network latency gain a significant unfair advantage from POW mining; in some cases, low-latency simulation groups control more than half of the blocks on the world's longest blockchain.

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