

Applications of Blockchain Technology in Various Sectors:A Review

Mrs. Bharati M. Ramageri, Dr. Maithili V. Arjunwadkar

PES Modern Institute of Computer Application, Pune, Maharashtra, India

Abstract

In present scenario ways to create and capture and store data is changing, as approaches of advanced technologies have developed. Blockchain technology has started capturing many organizations in the area of finance, government, retail, supply chain, education to bring significant benefits in security. This paper focuses on Blockchain studies, its advantages, disadvantages, its recent and future trends. This paper also includes applications and future of Blockchain Technology.

Keywords-*Blockchain, Advantages of Blockchain, Disadvantages of Blockchain, Cryptocurrency, Bitcoin*

I. INTRODUCTION

In today's technology world Blockchain has drawn interest of many organizations to build secured, noncorruptive and immutable way of accessing data. This has transformed the way of businesses and transactions conducted in the organization (Behnke & Janssen, 2019; Cermeno, 2016). Satoshi Nakamoto introduced Blockchain in the year 2008[16] which use Bitcoin cryptocurrency Network. A Blockchain is explained as chain of blocks that records data in hash function with timestamp and links to next and previous block. Blockchain consists of distributed ledger which contains all transactions ever executed within its network, imposed with cryptography and uses peer-to-peer nodes. [1] Hence, anything that is built on the Blockchain is transparent and everyone involved are responsible for their actions. [18].Data stored in a Blockchain cannot be lost. Data is replicated as many times as the number of nodes in the network. Nodes go on adding new data to the Blockchain. Therefore, if implemented properly, Blockchain technology can be secured, immutable and transparent [22].

II. BLOCKCHAIN ARCHITECTURE

There are two main categories in Blockchain

- Public Blockchain
- Private Blockchain

In public Blockchain architecture data access is for all who are participating in the network. For example Bitcoin, Ethereum and Litecoin Blockchain systems. Private Blockchain system is controlled by users from specific organization only authorized user can participate in the network. Maintaining the Integrity of the Specifications

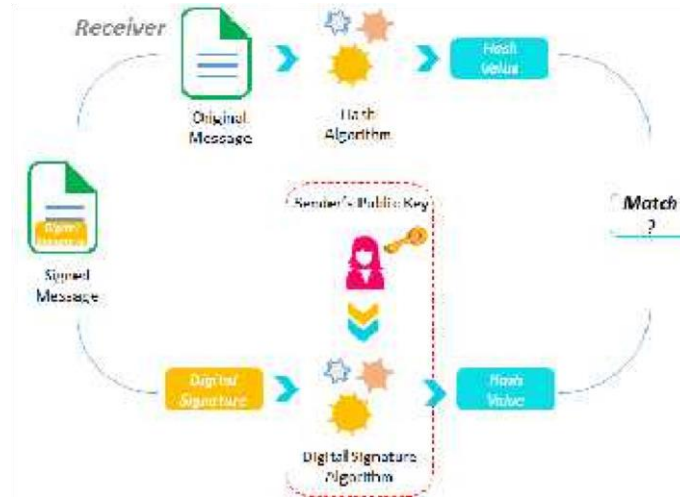


Figure 1. Blockchain Technology

A. How Blockchain works:

Users who are participating in the network are called as Node. Each node has an independent copy of Blockchain ledger. Transaction is nothing but records or information which serves as the purpose of Blockchain. Block is the data structure which contains set of transactions which is distributed to all the nodes in the network. Chain is sequence of Block in the order (Lee Kuo Chuen, 2015). Miner is a specific node which performs the block verification and forming a chain. Consensus is protocol to carry out Blockchain operations. A Blockchain processes transactions on its database, same as entries in the physical ledger. Small group of transaction is formed for every 10 minutes which are called block. Each transaction generates string of numbers and letter called hash. The hash depends on the transaction. Small change in the transaction creates entirely new hash. The nodes check to make sure a transaction has not been changed by inspecting the hash. If a transaction is approved by a majority of the nodes then it is written into a block. Each block refers to the previous block and together make the Blockchain. [10]

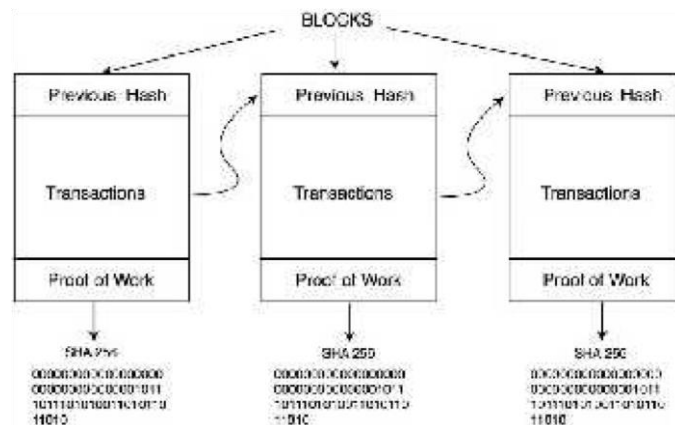


Figure 2. Chain of Blocks by Blockchain [5]

A block is thus a permanent store of records which, once written, cannot be altered or removed. Blocks are formed by miners. When one makes a Bitcoin transaction, it is held in a transaction pool [4]. Block header fields are given below

- Version: Describes the structure of the data inside the block. This is used so that computers can read the contents of each block correctly.

- Last Block: An identification number for the previous block. We are trying to get one of these for the current candidate block.
- Merkle Root: All of the transactions inside the block hashed together to form a single line of text.
- Time: The current time.
- Target: A value that miners work with to try and add candidate block to the Blockchain.

Nonce is a random number used in a cryptographic communication. Once nonce works it means, the block is generated and all of the transactions in this block are added to the Blockchain.

III. ADVANTAGES OF BLOCKCHAIN TECHNOLOGY

The Blockchain technology uses decentralised systems there is no involvement of third party organization or any central administrator. It means there is no intermediately data storage and all participants of Blockchain make their decisions. Because of this, risk of hacking is reduced. The data records are available publicly and these cannot be changed or deleted. This gives Blockchain more trustworthy, transparent and immutable.

As there is no involvement of third-party servers so no need to pay for centralized entities or intermediately servers. Different level of securities can be allocated because of this organizations can do faster transactions with the help of Blockchain. Reconciliation of account can also be easily done.

IV. DISADVANTAGES OF BLOCKCHAIN TECHNOLOGY

During the study it is found that the main disadvantage is high energy consumption. There is large need of energy to keep real time ledger and node creation. Time to communicate with each and other node also consumes lot of power. There are other disadvantages of Blockchain which includes network miners need to validate transactions, which also consumes lot of electric energy [8][15]. As each transaction must be signed with cryptographic scheme the signature verification is the big challenge[3].The studies in many Blockchain transactions shows that the cost cover by energy consumption is \$75-\$160 [8][15].

David Schwartz, CTO of Ripple “To build a secured, Blockchain system it is very difficult, as compared to centralised server system”. The performance of the Blockchain is worse compared to centralised system. Central government has the authority to create modern money, until it gives permission, Bitcoin cannot be accepted by any financial institutions [15]. Blockchain is not a secured technology it may be attacked by different threats.

Two miners calculate hash code at the same time there may be possibility that both miner get same hash value which leads to network disruption. Attack 51% and double spending occur when it disrupts. Cryptocurrency can be stolen and thief would erase the transaction or will send multiple packets to the network, reversing the transactions [13].

Recently one of Bitcoin’s hard forked currencies, Bitcoin Gold, suffered a 51% attack on its network which led to a \$72,000 double-spending problem in the chain [11].

V. APPLICATION OF BLOCKCHAIN

Blockchain technology has been applied in many domain like finance, retail, healthcare, IoT, social networks [12][6][4][19].

A. *Banking and Finance*

In banking and finance domain Blockchain technology has simplified the businesses making them safer, trustworthy [23]. As Blockchain does not use centralised server systems, no single point server failure problem occur. Blockchain operate using distributed open source protocols, no need of third party trust to execute transaction. Blockchain technology allows applications and user to operate with a high degree of confidence. In general Blockchain technology allows more secured and trustworthy transaction in the domain of finance and banking.

B. *Internet of Things (IoT)*

Tomaso Aste, Paolo Tasca, and Tiziana Di Matteo describe how the technology is widespread from bitcoin to decentralized digital currency [14].

Automobile industry is growing and started equipping with sensors and they have capability of making them as a part of IoT Ecosystem. Blockchain network will enable trusted exchange of information, secured and improved connectivity to maintain vehicle records [12].

In Agriculture sensor data from farm stored on the Blockchain can provide useful information regarding origin of products, improved transparency and informed decision making for farmers and as well as customers[12].

Blockchain does not include centralised servers, it will make the transactions either by machine to machine or person to machine transactions using cryptocurrencies, this enable faster, cheaper and secured payment. Blockchain can be combined with IoT ensure secured transactions [20].

C. *Security and Privacy*

[24]Has demonstrated how multiple industries are using Blockchain technology in healthcare industry, finance, government and manufacturing where security needs to be implemented.

Price prediction is proposed and performed using a time series consisting of daily Ether cryptocurrency of Blockchain technology using machine learning algorithm linear regression and support vector machine by closing prices [21].

Machine learning algorithms linear regression and support vector machine are used to propose and perform time series of daily Ether cryptocurrency of Blockchain Technology.[24] explained how Blockchain Technology is adopted in Chinese financial industry.

VI. FUTURE OF BLOCKCHAIN

Blockchain is playing one of the important roles in financial sectors , IoT and Social Media concerning fraud detection, to manage the history of customers, trade finance, smart contracts, privacy , security etc.,

It is predicted in Block-chain Blog that by 2030 [3], most governments around the world will create or adopt some form of virtual currency. Some use cases for the types of data stored on a Blockchain-based identity platform may include

- Ticketing

- Government records (e.g., date of birth, etc.)
- Document management
- Reputation and trust scores (e.g., credit history)
- Certificates and attestations (e.g., university diploma)
- Healthcare and medical records
- Tax identification records
- Employment records

The Blockchain technology is growing every day and more usage opportunities are created in many sectors and many organizations also started switching to Blockchain Technology.

Block Chain Technology will be the future across the Globe. Now it is in beginning stage only. Developed countries such as US, UK and Europe started implementing this technology in various fields. Few developing countries also started thinking of implementing of Blockchain Technology. Blockchain will be the future technology and having bright future.

VII. CONCLUSION

Blockchain technology is evolved with the success seen in the cryptocurrency called Bitcoin. Blockchain is behind the development of bitcoin and is the key part. Blockchain is ledger based technology that allows various use cases in wide range of applications. In this paper the pros and cons of Blockchain technology are discussed. The various use cases using Blockchain technology are identified. The proposed and implementations of Blockchain technology in various domains are also reviewed. This paper also dealt with various possible applications, where Blockchain technology which can be applied in future. A future challenge of Blockchain in the area of security is also discussed.

REFERENCES

- [1] Aissam Outchakoucht, Hamza Es-Samaali, Jean Philippe Leroy, "Dynamic Access Control Policy based on Blockchain and Machine Learning for the Internet of Things" International Journal of Advanced Computer Science and Applications Vol 8, No 7, 2017
- [2] BitFury Group, "Proof of Stake versus Proof of work. White paper",
- [3] Blockchain technology, "Advantages & Disadvantages of Blockchain Technology" [online]. 2016. Available from:
<https://blockchaintechnologycom.wordpress.com/2016/11/21/advantages-disadvantages/>
- [4] Greg Walker, 26 February 2015, <https://learnmeabitcoin.com/beginners/blocks> (accessed on 24/01/2020)
- [5] <https://bitcoin.org/en/blockchain-guide> (accessed on 20/01/2020)
- [6] https://www.stmassoc.org/2017_04_27_Annual_Conference_Peck_What_is_Bitcoin.pdf
- [7] <https://mlsdev.com/blog/156-how-to-build-your-own-blockchainarchitecture>
- [8] <https://data-flair.training/blogs/advantages-and-disadvantages-ofblockchain/>
- [9] <https://www.enterprisetimes.co.uk/2018/10/15/blockchaindisadvantages-10-possible-reasons-not-to-enthuse/>

- [10] <https://cointelegraph.com/bitcoin-for-beginners/how-blockchaintechnology-works-guide-for-beginners> (accessed on 15/01/2020)
- [11] <https://coinspace.com/news/altcoin-news/bitcoin-gold-suffers-51-attackleads-double-spend-problem>
- [12] Internet of Things and Blockchain Integration: Use cases and implementation Challenges "Business Information Systems Workshops: BIS 2019 International Workshops"
- [13] Jake Frankenfield, "Doubling Spending",
"<https://www.investopedia.com/terms/d/doublespending.asp>
- [14] Jonathan Sean Callan Patent Application , "Blockchain based digital certificate provisioning of internet of things devices"
- [15] Julija Golosova, Andrejs Romanovs, "The Advantages and Disadvantages of the Blockchain Technology", https://www.researchgate.net/publication/330028734_The_Advantages_and_Disadvantages_of_the_Blockchain_Technology
- [16] Lee Kuo Chuen, D. (Ed.) (2015) "Handbook of Digital Currency", 1st ed., Elsevier publication
- [17] Lim Hong Hin, "Critical Review: Future of Block Chain Economy in Financial Services", Global Journal of Management and Business
Research: BEconomics and Commerce, vol 19, Issue 7 , Global Journals
- [18] Mattila J, Seppala T, Naucner C, Stahl R, Tikkanen M, Badenlid A, et al. Industrial blockchain platforms: "An exercise in use case development in the energy industry.", <<https://www.etla.fi/julkaisut/industrialblockchain-platforms-an-exercise-in-use-case-development-in-the-energy-industry/>>,[accessed 5/0/6/2017]
- [19] S. Nakamoto, "Bitcoin : A Peer-to-Peer Electronic Cash System," pp. 1–9, 2008
- [20] Nir Kshetri, "Can Blockchain Strengthen the Internet of Things?,"
<https://ieeexplore.ieee.org/abstract/document/8012302/authors#authors>
- [21] Poongodi M. Ashutosh Sharmab Vijayakumar V. Vaibhav Bhardwaj C, Abhinav Parkash Sharma Razi Iqbal Rajiv Kumare, "Predication of the price of Ethereum blockchain cryptocurrency in an industrial finance system"
- [22] Salviotti, G., De Rossi, L. M., & Abbatemarco, N. (2018, January). "A structured framework to assess the business application landscape of blockchain technologies.", Proceedings of the 51st Hawaii International
- [23] Shuchih Ernest Chang, Hueimin Louis Luo and YiChian Chen ,Sustainability 2020, <https://www.mdpi.com/2071-1050/12/1/188>
- [24] Tareq Ahram ; Arman Sargolzaei ; Saman Sargolzaei ; Jeff Daniels ; Ben Amab , "Blockchain technology innovations", 2017 IEEE Technology & Engineering Management Conference
- [25] Ziwei Zhao Daojuan Wang Xianhua Wei, A Combinative Perspective on
Technology Adoption: A Case Analysis of Blockchain Technology
Adoption in the Chinese Financial Industry.