Utilization of Blockchain Technology for Digital Assets Case Study Makes a Comparison Algorithm for Bitcoin and Etherium

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Abstract - Rise of digital assets, such as cryptocurrencies, has heralded a new era in financial technology, where blockchain technology plays a fundamental role. This study conducts a comparative analysis of the blockchain algorithms underlying two of the most prominent digital assets, Bitcoin and Ethereum, to evaluate their efficacy and applicability in various use cases. Through a detailed examination of the consensus mechanisms, security features, and transaction handling capacities of both blockchains, this paper aims to provide insights into the distinct functionalities and potential scalability of each system.

1. INTRODUCTION

The emergence of blockchain technology has revolutionized the concept of digital assets, providing a decentralized and secure platform for transactions without the need for intermediaries. Bitcoin introduced the first blockchain as a public ledger for transactions using a Proof of Work (PoW) consensus mechanism. Ethereum later emerged, offering not only a platform for transactions but also for executing smart contracts, initially using PoW but transitioning to a Proof of Stake (PoS) mechanism. In this digital age, the emergence of digital assets like cryptocurrencies and tokens has transformed the financial landscape. Blockchain, the technology underlying these digital assets, offers an innovative solution for securing ownership and transfer of digital assets in a secure, transparent, and decentralized manner. This paper aims to provide a comprehensive understanding of blockchain, investigate its potential in managing digital assets, and analyze two prime examples: Bitcoin and Ethereum.

Understanding Blockchain: The Foundation of Digital Assets

Blockchain, a distributed digital ledger, stores records of transactions permanently and transparently. Each

record, called a "block," contains transaction information and is cryptographically linked to the previous block, forming an unalterable chain. Key features of blockchain that make it ideal for digital assets include:

- **Security:** Cryptography and network consensus ensure data authenticity and integrity.

- **Transparency:** All network participants can view the history of asset ownership.

- **Decentralization:** No single authority controls the network, minimizing the risk of manipulation and fraud.

Blockchain can be utilized for various types of digital assets, such as:

- **Cryptocurrency:** Bitcoin and Ethereum are examples of cryptocurrencies that utilize blockchain to track ownership and transfer of digital units.

- **Tokenized Assets:** Physical assets like property or artwork can be represented by digital tokens on the blockchain, enabling fractional ownership and more efficient trading.

- **Data Management:** Blockchain can be used to store and track the ownership history of digital data, enhancing security and trust.

Additionally, blockchain can also be utilized in Internet of Things (IoT) applications. The combination of blockchain and IoT can enhance security and privacy in processing data generated by IoT devices or example, in smart city data collection systems, blockchain can be used to provide secure verification and validation of the collected data. Despite the many benefits that blockchain offers, there are still some challenges to overcome. One of the biggest challenges is scalability. In blockchain, every transaction must be verified by nodes in the network before being stored on the blockchain. This can slow down the process and increase transaction

costs when the network is under heavy load.

2. RESEARCH METHODOLOGY

a. Literature Review

To support this research, the comprehensive review of relevant literature from the past five years. focusing on the utilization of blockchain technology for digital assets and the algorithms used by Bitcoin and Ethereum. The search was conducted using academic databases such as Semantic Scholar, and the search terms included "blockchain technology," "digital assets," "Bitcoin," "Ethereum," and "algorithm." The inclusion criteria for the studies included in the review were that they were published within the past five years, focused on the utilization of blockchain technology for digital assets, and discussed the algorithms used by Bitcoin and Ethereum

2.2 Theoretical Basis

1. BlockChain

Blockchain is a technology based on cryptography that utilizes the principles of distributed ledgers. This technology offers various advantages, especially in terms of security. The way blockchain works involves independent nodes that store and retrieve decentralized data. Blockchain connects data blocks sequentially in a distributed ledger. Each block stores various contents, including a "hash," which is a unique identifier of that block.

Blockchain can be defined as a collection of blocks containing transaction data that are linked together in a chain. Each new or most recent block that is connected always contains the hash information of the previous block. Each block refers to the previous block, forming a continuous chain.

2. Digital Assets

Digital assets are assets that are issued and transferred using distributed ledger or blockchain technology. These assets are often referred to as crypto-assets, digital tokens, or cryptocurrencies. They can take the form of securities, currencies, or commodities. Despite the variety of terms used to describe them, financial regulators have emphasized that financial activities, services, and participants must comply with relevant laws and regulations, regardless of the terminology used. For digital assets, depending on their specific characteristics, this compliance might include adherence to securities laws and regulations. A key distinction between digital and traditional assets lies in the ownership and transfer processes. Traditional assets are typically recorded in private ledgers managed by central intermediaries, whereas digital assets are usually recorded on a decentralized digital ledger.

3. Ethereum

Ethereum is a platform that provides the capability to create and execute smart contracts on blockchain technology. Ethereum features a virtual computing machine known as the Ethereum Virtual Machine (EVM). The EVM allows each node in the network to send computation requests, which are then verified, validated, and executed by other nodes. This process results in status changes in the EVM, which are propagated across the entire network. These computation requests are known as transaction requests, and all transaction records as well as the EVM status are stored on the blockchain, which is then stored and approved by all nodes in the network.

The EVM executes Application Binary Interface (ABI) code and can be accessed publicly and without permission. The outcome of computations on the Ethereum blockchain is decentralized applications. Ethereum uses the proof of work (PoW) consensus algorithm. but transitioning to a Proof of Stake (PoS) mechanism.

4. Bitcoin

Bitcoin, the inaugural decentralized digital currency, was introduced by an individual or group under the pseudonym Satoshi Nakamoto in 2008. It was subsequently launched as open-source software in 2009. Bitcoin facilitates direct value exchange between users, eliminating the need for intermediaries like banks or financial institutions.

Transactions in the Bitcoin network are authenticated by network nodes using cryptography and recorded in a publicly accessible ledger known as the blockchain. Each transaction is appended to a block, forming a secure and transparent chain of blocks linked to the preceding one.

Bitcoin employs a consensus mechanism known as proof of work (PoW), where miners vie to solve intricate mathematical puzzles to append new blocks to the blockchain. Successful miners receive a designated amount of Bitcoin as a reward for solving these puzzles.

2.3 How Blockchain Works

In Blockchain technology, in general a block consists of 3 things, namely data, the hash of the block itself, and the hash of the previous block. So to stay connected in a chain, each block must have its own cryptographic hash as well as the hash of the previous block. The hash here contains a unique alphanumeric number calculated based on data from the block itself, its timestamp, as well as the hash of the previous block (Hasan, 2020). Blockchain databases store data in a grouped structure. Each data set or block stores a certain amount of information. Once filled, each block will be connected to the previous block (the block behind it) and also with the block after it (the block in front of it), thus forming a Blockchain chain. Blocks that have been included in the chain serve as a permanent data record (cannot be changed or deleted), are stored with a clear timestamp, and are connected to the network indefinitely. In simple terms, how this blockchain works can be described as in the diagram below.

Figure 1. How Blockchain Technology

Source : https://medium.com/@ipspecialist/how-blockchain-technology-works-e6109c033034
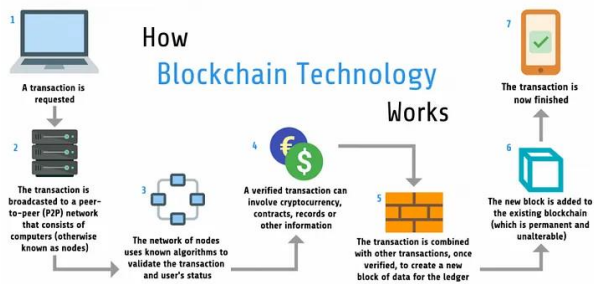
2.4 Blockchain fitur

1. **Validation/Consensus**: There are many consensus algorithms commonly used to validate blocks before they enter the chain. Some examples of these algorithms are: Proof of Elapsed Time, Proof of Stack (POS), Proof of capacity, Proof of Work (POW) and others.

2. **Smart Contracts**: This Smart Contract is a peace code or agreement code between two people in the Blockchain network which contains special terms and conditions. Transactions will only occur if certain terms and conditions are met between two nodes, without involving third party intervention. This can happen because the entire Smart Contract process is carried out automatically in the Blockchain system.

3. RESULTS AND DISCUSSION

Use of Crypto Bitcoin and Ethereum as Digital Assets Bitcoins can be obtained by accepting them as payment for goods and services, by purchasing from other people or directly from exchanges/vending machines. Bitcoins can be transacted through software, applications, or various online platforms that provide bitcoin wallets. Another way to earn bitcoins is through mining and is explained below. The Bitcoin system runs on a peer-to-peer (P2P) network and transactions occur directly between users without intermediaries. Bitcoin decentralizes the responsibility of verifying the validity of transactions to the entire network. Transactions are recorded in a public ledger, the blockchain, and verified by network nodes, which can be any individual using a computer system with Bitcoin software installed on it. Once a user makes a transfer, the transaction will be broadcast between users. Transactions will be confirmed by the network. After verification, it will be recorded in the blockchain and the transfer is complete. The process of recording is referred to as 'mining' and the person offering the computing power to do so is called a 'miner'. Bitcoin was created as an incentive (to solve cryptographic puzzles using transaction data) and because successful miners are rewarded with newly created bitcoins, in addition to transaction fees.

3.0 We have investigated how many users use

Crypto Bitcoin and Etherium as digital assets

1. How do the different parts of the digital asset ecosystem work together?
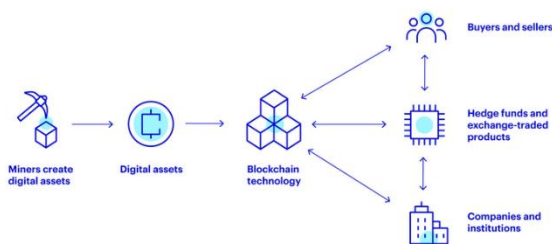
Picture 2. The digital asset ecosystem
Source:
https://www.invesco.com/us/en/insights/investors-guide-digital-assets.html

Seeing how the various aspects of the digital asset ecosystem work together can help investors identify opportunities to get exposure to the asset class (see the simplified, hypothetical visual below). Miners create cryptocurrency and other digital assets, which come in various forms and types. The creation, transaction, and recording of these digital assets take place using blockchain technology. Buyers and sellers of digital assets can exchange them via blockchain technology or get exposure to them via investment funds, like hedge funds and exchange-traded products (ETPs) including The Invesco Galaxy Bitcoin ETF (BTCO). These types of investment funds either invest directly in digital assets or invest in companies and institutions that leverage blockchain technology.

3.0 Reserch Gate Bitcoin and etherium

Picture 3.

What Is It?	bitcoin (BTC)	Ether (ETH)
	A currency	A token
Supply Style	Deflationary (a finite # of bitcoin will be made)	Inflationary (much like fiat money, where more tokens can be made over time)
Supply Cap	21 million in total	18 million every year
Smallest Unit	1 Satoshi = 0.00000001 BTC	1 Wei = 0.000000000000000001 ETH
New token issuance time	Every 10 minutes approximately	Every 10 to 20 seconds
Amount of new token at issuance	12.5 at the moment. Half at every 210,000 blocks	5 per every new block
Utility	Used for purchasing goods and services, as well as storing value (much like how we currently use gold)	Used for making Decentralized Applications (DApps) on the Ethereum Blockchain
Price	Around $6,293.27 at the moment	Around $199.52 at the moment
Purpose	A new currency created to compete against the gold standard and fiat currencies	A token capable of facilitating Smart Contracts (For example: a lawyer's contract, an exchange of ownership of property, and voting)

Source: https://www.researchgate.net/figure/Bitcoin-VS-Ether-from-One-Month_tbl2_334626679

The image above explains the differences and advantages between Bitcoin and Ethereum, so which one is suitable to be used as a digital asset? the answer is bitcoin, because bitcoin has a fairly large price to date, and bitcoin will continue to rise.

- Here we provide python program code using the Request algorithm and using the API from CoinGecho for comparison between the two Cryptos

```python
import requests

def get_latest_price(coin):
    url = f"https://api.coingecko.com/api/v3/simple/price?ids={coin}&vs_currencies=usd"
    response = requests.get(url)
    data = response.json()
    return data[coin]["usd"]

def get_top_investors(coin):
    url = f"https://api.coingecko.com/api/v3/coins/{coin}/market_chart?vs_currency=usd&days=1"
    response = requests.get(url)
    data = response.json()
    return data["total_volumes"][-1][1]
```

Picture 4. Source my computer screenshot

we use the coingecho api as the latest data from both cryptos, namely Bitcoin and Etherium From the program above we use a request to the Request algorithm as a comparison between the two data,

```python
bitcoin_price = get_latest_price("bitcoin")
ethereum_price = get_latest_price("ethereum")

bitcoin_investors = get_top_investors("bitcoin")
ethereum_investors = get_top_investors("ethereum")


print("Harga Bitcoin:", bitcoin_price, "USD")
print("Harga Ethereum:", ethereum_price, "USD")
print("Jumlah investor terbanyak Bitcoin:", bitcoin_investors)
print("Jumlah investor terbanyak Ethereum:", ethereum_investors)
```

Picture 5 . Source My computer Screenshot

Here there are 2 variables called bitcoin and etherium price and this variable is to display data from the Coingecho API and also the Bitcoin investor and etherium investor variables are to display the current number of investors who bought the coin.

```
Harga Bitcoin: 61821 USD
Harga Ethereum: 2910.58 USD
Jumlah investor terbanyak Bitcoin: 29393289732.990776
Jumlah investor terbanyak Ethereum: 13103844061.790188
Bitcoin memiliki harga lebih tinggi.
Bitcoin memiliki jumlah investor terbanyak.
PS C:\Users\Raihan>
```

Picture 6 . Source My Computer ScreenShot

The output that comes out is like this, if compared using the request algorithm and using the latest data from the Coingecho Api then Bitcoin is superior to the number of investors and the price is higher.

- Because the price of bitcoin is superior to ethereum, let's analyze the bitcoin graph using the plotly library.

The plotly.express module (usually imported as px) contains functions that can create entire drawings at once, and is referred to as Plotly Express or PX. Plotly Express is a built-in part of the plotly library, and is the recommended starting point for creating most common drawings. Each Plotly Express function uses a graph object internally and returns a plotly.graph_objects.Figureinstance. Throughout plotly's documentation, you'll find the Plotly Express way of creating figures at the top of any applicable page,

followed by a section on how to use graphic objects to create similar figures. Any drawing created in a single function call with Plotly Express can be created using graph objects alone, but with between 5 and 100 times more code.

As a case study, here we use Google Colab to write Python code so that we don't need to install the Plotly library and import Pandas.

```python
import pandas as pd
import plotly.graph_objects as go
from google.colab import files

#untuk Unggah file CSV
uploaded = files.upload()
file_name = list(uploaded.keys())[0]
df = pd.read_csv(file_name)

df['Tanggal'] = pd.to_datetime(df['Tanggal'], format='%d/%m/%Y', errors='coerce')


df = df.dropna(subset=['Tanggal'])
```

Picture 7 . Source my Computer screenshot

The program above is to call the graph plotly library as data storage and then upload it as an upload of bitcoin historical data which is downloaded at https://id.investing.com/crypto/bitcoin/historical-data then after that upload the CSV file that has been downloaded then the program will display below.

```
Pilih File   BTC.csv
• BTC.csv(text/csv) - 4650 bytes, last modified: 11/5/2024 - 100% done
Saving BTC.csv to BTC (2).csv
      Tanggal      Terakhir    Pembukaan      Tertinggi     Terendah   \
0  01/05/2024   984.849.984   997.945.024  1.050.000.000  925.148.032
1  01/04/2024   997.947.008 1.129.260.032  1.155.000.064  970.136.000
2  01/03/2024 1.129.259.008   965.342.976  1.149.990.016  952.000.000
3  01/02/2024   965.000.000   674.232.000    998.280.000  662.473.984
4  01/01/2024   674.232.000   663.249.984    762.000.000  605.003.008

     Vol. Perubahan%
0  0,48K    -1,31%
1  1,50K   -11,63%
2  2,54K    17,02%
3  1,64K    43,13%
4  1,55K     1,66%
```

Picture 8.
Source:
https://colab.research.google.com/drive/14M3pytUkrY4kHwL4oKBSJXF9TIVxrZt?authuser=2&hl=id#scrollTo=YDg1MLjOwxI0

This data is the latest data from bitcoin and the price of bitcoin has now touched $62,000 which is very suitable for investors who want to store bitcoin as a digital asset.

```python
# Buat grafik candlestick
fig = go.Figure(data=[go.Candlestick(
    x=df['Tanggal'],
    open=df['Pembukaan'].str.replace('.', '').str.replace(',', '.').astype(float),
    high=df['Tertinggi'].str.replace('.', '').str.replace(',', '.').astype(float),
    low=df['Terendah'].str.replace('.', '').str.replace(',', '.').astype(float),
    close=df['Terakhir'].str.replace('.', '').str.replace(',', '.').astype(float),
    increasing_line_color="green",
    decreasing_line_color="red"
)])

# Tambahkan judul dan label sumbu
fig.update_layout(title='Grafik Candlestick',
                  xaxis_title='Tanggal',
                  yaxis_title='Harga')

# Tampilkan grafik
fig.show()
```

Picture 9 .
Source:
https://colab.research.google.com/drive/14M3pytUkrY4kHwL4oKB

SJXF9TIVxrZt?authuser=2&hl=id#scrollTo=YDg1MLjOwxI0

This second program is to create a candlestick chart using data that we have downloaded at investing.com and make sure the data name must be the same as what was uploaded to Google Colab.

Picture 10 .

Source:
https://colab.research.google.com/drive/14M3pytUkrY4kHwL4oKBSJXF9TIVxrZt?authuser=2&hl=id#scrollTo=YDg1MLjOwxI0

So the output of the program above will appear a graph like this, and this graph is the latest bitcoin data from 2020 - 2024 and bitcoin is the crypto with the most investors currently.

3.1 Digital asset Crypto Binence

Binance.US strives to be a reliable and efficient evaluate and offer coins, tokens, and trading pairs on Binance.US in accordance with our Digital Asset Risk Assessment Framework, community input, and market marketplace that provides access and trading of a healthy range of digital assets. We will continue to demand Cryptocurrency trading pairs are an important part of the cryptoeconomy, as they allow the exchange of one token for another. other tokens easily. An effective trading pair represents how much of one token you can buy with a certain number of different tokens.

4. CONCLUSION

The conclusion of this research shows that blockchain technology is a permanent and transparent transaction data storage system, with main characteristics such as security, transparency, and decentralization. This technology is especially suitable for digital assets such as cryptocurrencies (Bitcoin and Ethereum) and tokenization of physical assets.

Bitcoin uses the Proof of Work (PoW) algorithm to validate transactions, offering price stability and a high number of investors. Meanwhile, Ethereum, which originally also used PoW, has switched to Proof of Stake (PoS). Ethereum is known for its ability to execute smart contracts via the Ethereum Virtual Machine (EVM).

Implementation of the algorithm using the API from CoinGecko shows that Bitcoin has a higher number of investors and prices than Ethereum. Bitcoin price chart analysis using Plotly confirms a significant increase in value, making it a profitable asset for investors.

Additionally, blockchain technology has great potential to improve security and privacy in Internet of Things (IoT) applications and digital data management.

Recommendations from this study suggest that investors should consider Bitcoin for long-term investment due to its stability and high price. However, Ethereum is also worth considering for applications that require smart contracts. Further research is needed to overcome blockchain scalability challenges and explore more potential applications in various industrie.

REFERENCE

[1] metatags generator, "Studi atas Pemanfaatan Blockchain bagi Internet of Things (IoT) | Jurnal RESTI (Rekayasa Sistem dan Teknologi Informasi)," jurnal.iaii.or.id, Nov. 2022, Accessed: May 13, 2024. [Online]. Available: https://jurnal.iaii.or.id/index.php/RESTI/article/view/26

[2] A. Faturahman, V. Agarwal, and C. Lukita, "Blockchain Technology - The Use Of Cryptocurrencies In Digital Revolution," IAIC Transactions on Sustainable Digital Innovation (ITSDI), vol. 3, no. 1, pp. 53–59, Oct. 2021, doi: https://doi.org/10.34306/itsdi.v3i1.523.

[3] U. Khan, Z. Y. An, and A. Imran, "A Blockchain Ethereum Technology-Enabled Digital Content: Development of Trading and Sharing Economy Data," IEEE Access, vol. 8, pp. 217045–217056, 2020, doi: https://doi.org/10.1109/access.2020.3041317.

[4] R. N. Ilham, I. Sadalia, N. Irawati, and I. Sinta, "Risk And Return Model of Digital Cryptocurrency Asset Investment In Indonesia," Al Qalam: Jurnal Ilmiah Keagamaan dan Kemasyarakatan, vol. 16, no. 1, p. 357, Jan. 2022, doi: https://doi.org/10.35931/aq.v16i1.854.

[5] P. A. Sunarya, "Penerapan Sertifikat pada Sistem Keamanan menggunakan Teknologi Blockchain," Jurnal MENTARI: Manajemen, Pendidikan dan Teknologi Informasi, vol. 1, no. 1, pp. 58–67, Sep. 2022, doi: https://doi.org/10.34306/mentari.v1i1.139.

[6] E. Su, "Digital Assets and SEC Regulation," 2020.Available:https://www.everycrsreport.com/files/20200130_R46208_8c73c5838d376d44e3d841ead7bb65df15744fb3.pdf

[7] Teguh Prasetyo Utomo "IMPLEMENTASI TEKNOLOGI BLOCKCHAIN DI PERPUSTAKAAN : PELUANG, TANTANGAN DAN HAMBATAN" jurnal.iaii.or.id, 2021 Accessed : May 14, 2024 [Online] Available : https://journal.uii.ac.id/Buletin-Perpustakaan/article/download/22232/11938/61373

[8] Mugi Mabruroh, Anggun, Favian Dewanta, and Aulia Arif Wardana., "Implementasi Ethereum Blockchain dan Smart Contract pada Jaringan Smart Energy Meter" jurnal.iaii.or.id, oct . 2021 Accessed : May 14, 2024 [Online] Available : https://jurnal.pnj.ac.id/index.php/multinetics/article/download/4122/2315/9719

[9] Wira Eka Suryawijaya, Tito., "Strengthening Data Security through Blockchain Technology: Exploring Successful Implementations in Digital Transformation in Indonesia" jurnal.iaii.or.id, may . 2023 Accessed : May 14, 2024 [Online] Available :

https://jurnal.kemendagri.go.id/index.php/jskp/article/download/1682/612/9805

[10] Asif, R, and Syed, R.H (2023). "Shaping the future of Ethereum: exploring energy consumption in Proof-of-Work and Proof-of-Stake consensus" Accessed : May 14, 2024 Available: https://www.frontiersin.org/articles/10.3389/fbloc.2023.1151724/full