SOVEREIGNWALLET

WHITE PAPER

MUI MetaBlockchain

Denationalization of Money and Rewriting Satoshi's Vision

MUI-MetaBlockchain
DENATIONALIZATION OF MONEY AND REWRITING SATOSHI'S VISION

Phantom Seokgu Yun, Frances Kim Ph. D

phantom@sovereignwallet.network

frannie@sovereignwallet.network

Sovereign Wallet Network,

Tallinn, Estonia

October 26, 2020

Version 1.0

SOVEREIGNWALLET
www.sovereignwallet.network

Abstract

MUI MetaBlockchain[1][10][11][12] is a blockchain that can programmatically generate another blockchain internally. It can be used for the generation of digital currencies and digital assets. This enables decentralized credit banking that each person or bank can generate new currency based on their collateralized asset and have their own blockchain. MUI MetaBlockchain is a hybrid blockchain of tokenized cheque and tokenized cash and decentralized the concept of NetCheque[14] and NetCash[15]. Bank Node inside the MUI MetaBlockchain is an anonymous cash publisher and acts as a clearinghouse for micropayment. Bank Nodes are consensus nodes and validate the tokenized cheque payments and transfers. This hybrid architecture guarantees both high-speed and low-cost micropayment and highly secure cheque payment. Bank Node is a master node of multiple blockchains inside the MUI MetaBlockchain and performs inter-blockchain protocol to guarantee the atomic swap of each different digital currencies or digital assets. When publishing a digital currency, a specific Bank Node becomes the central bank node and proves the collateralized assets, and guarantees the transaction fees of all users. In MUI MetaBlockchain, the transfer of the token is bind to the identity of the user, not to the address derived from the private key. The signing private key is stored on the user's wallet and the public key is registered on the decentralized public key infrastructure as part of the Identity Blockchain inside the MUI MetaBlockchain. Oracle problems of the collateralized assets can be proved by verifiable credentials issued by public identity on the Identity Blockchain. Bank Node assists Mobile Node to act as a full node of digital currencies generated on MUI MetaBlockchain. Mobile users can operate the mobile node to participate in the consensus protocol of specific digital currencies and receive incentives based on the contribution. MUI MetaBlockchain is designed as a self-evolving blockchain. Main programming code and chain codes on the MUI MetaBlockchain are targets of the consensus and governance protocol and upgradable. Chain code runs on the edge, that is on the node, of the network, not on the network and only the resulting data is stored on the blockchain. This greatly reduces the required data storage in the blockchain. Special operation of chain code by the Bank Node makes it possible to implement universal basic income.

This can be implemented by the addition operation of chain code to every designated identity accounts in the nation. Redenomination of the national currency can be instant with the multiplication operation of chain code by the Bank Node to every identity accounts in the nation. Force transfer or inheritance is implemented by subtraction and addition operation of chain code on the specific identity accounts. This requires verifiable credentials from the node operated by the legal entity and presented to the Bank Node that performs the operation. Bank node has built-in Algorithmic Central Bank(ACB) to implement digitized monetary policy. ACB's monetary policy criteria are agreed upon by the consensus process of the governance committee. Policy candidate generated by ACB node is challenged by other adversarial nodes and ACB node learn and update the policy by the federated or decentralized learning process. Financial big data feed by Banks Nodes and Mobile Nodes are the source of federated machine learning by ACBs in the MUI MetaBlockchain.

1. Introduction

According to the book, "Denationalization of Money"[19], Friedrich Hayek claimed that money can be a product that private issued good money should be selected based on the market mechanism. He also mentioned that government debt and over-issuance of currency supply is the fundamental cause of the economic cycle. Satoshi Nakamoto, the inventor of Bitcoin[16], left the message in the genesis block of Bitcoin. He quoted the headline news of THE TIMES, "Chancellor on brink of second bailout for banks". He designed the Bitcoin issuance protocol as decentralized, miner with correct hash calculation can generate new Bitcoin, and limit the maximum supply of Bitcoin as 21 million to prevent the hyperinflation and value depreciation of the Bitcoin.

To fulfill the dream of Friedrich Hayek, there is one pre-condition. It should be inexpensive to publish and use the currency. With the invention of smart contract, an application programming technology on the blockchain, and the second-generation blockchain platforms such as Ethereum, it is possible to publish cryptocurrencies relatively easily. However, the high usage fee of the transaction and slow performance hindered the wide-spread usage of these technologies.

There has been lots of effort to overcome the popular problem of trilemma in the blockchain, saying that decentralization, security, and scalability can not be achieved at the same time. This leads to third-generation blockchain technologies such as Algorand[21], Avalanche[22], Hedera Hashgraph[24], etc. However, we are still left with some of the problems that are unsolved. How to verify the user's identity during the transaction to

MUI MetaBlockchain is a 4th generation blockchain that inherits all the advancements of blockchain and digital currency technologies. It has an identity-based account structure to avoid money laundering while protecting user's privacy. The bank node publishes the digital currency based on the collateralized assets to avoid hyperinflation. Bank node assisted mobile node can act as a full node of digital currencies created on the MUI MetaBlockchain. Chain code runs on the mobile device and supports offline operation. This opens the door to a whole new level of decentralized applications.

With the dynamic creation of blockchain for the new digital currency, MUI MetaBlockchain supports the currency multiplication of the modern banking system. Commercial banks can dynamically publish their own version of digital currency based on M1 or M2 fiat currency. MUI MetaBlockchain treats chain code as a target data of the consensus. This supports the various economic model such as universal basic income, programmable redenomination, and inheritance, and automatic taxation. This will start the era of decentralized credit banking.

2. MUI MetaBlockchain Architecture

2.1 Two-tier Blockchain Nodes – Bank Node and Mobile Node

MUI MetaBlockchain has two different kinds of blockchain nodes, Bank Node and Mobile Node. Bank Node is a consensus node for all blockchains inside the MUI MetaBlockchain. Mobile Node is a user node and partial consensus node, that is an endorser node for specific digital currency generated on MUI MetaBlockchain. Users can choose to participate in the consensus process of any digital currency and earn rewards in proof of contribution fashion.

Bank Node is always on the network node and contains all kinds of pre-build blockchains and dynamic blockchains that will be created when generating new digital currencies. Bank Node is a permissioned node that requires permission from existing Bank Nodes to join. Pre-build blockchains are identity blockchain, chaincode registration blockchain, chaincode execution blockchain, asset registration blockchain, and digital currency registration blockchain. Dynamically created blockchains are each digital currency blockchain and digital currency summary ledger pairs. Here, the term blockchain is used to represent the data structure that is composed of a chain of hashed blocks, i.e., blockchain, and ledger to represent the data structure of decentralized data storage.

A mobile node is a full node of newly generated digital currency and it resides on the user's mobile devices. A mobile node is a permissionless node that only requires the registration of DID(Decentralized Identity) and public key pair on Identity Blockchain inside the MetaBlockchain. A mobile node is assumed that it is not always online. A mobile node can only contain a digital currency summary ledger. The digital currency summary ledger is not a blockchain ledger and it only contains a snapshot balance of digital currency for all identity users.

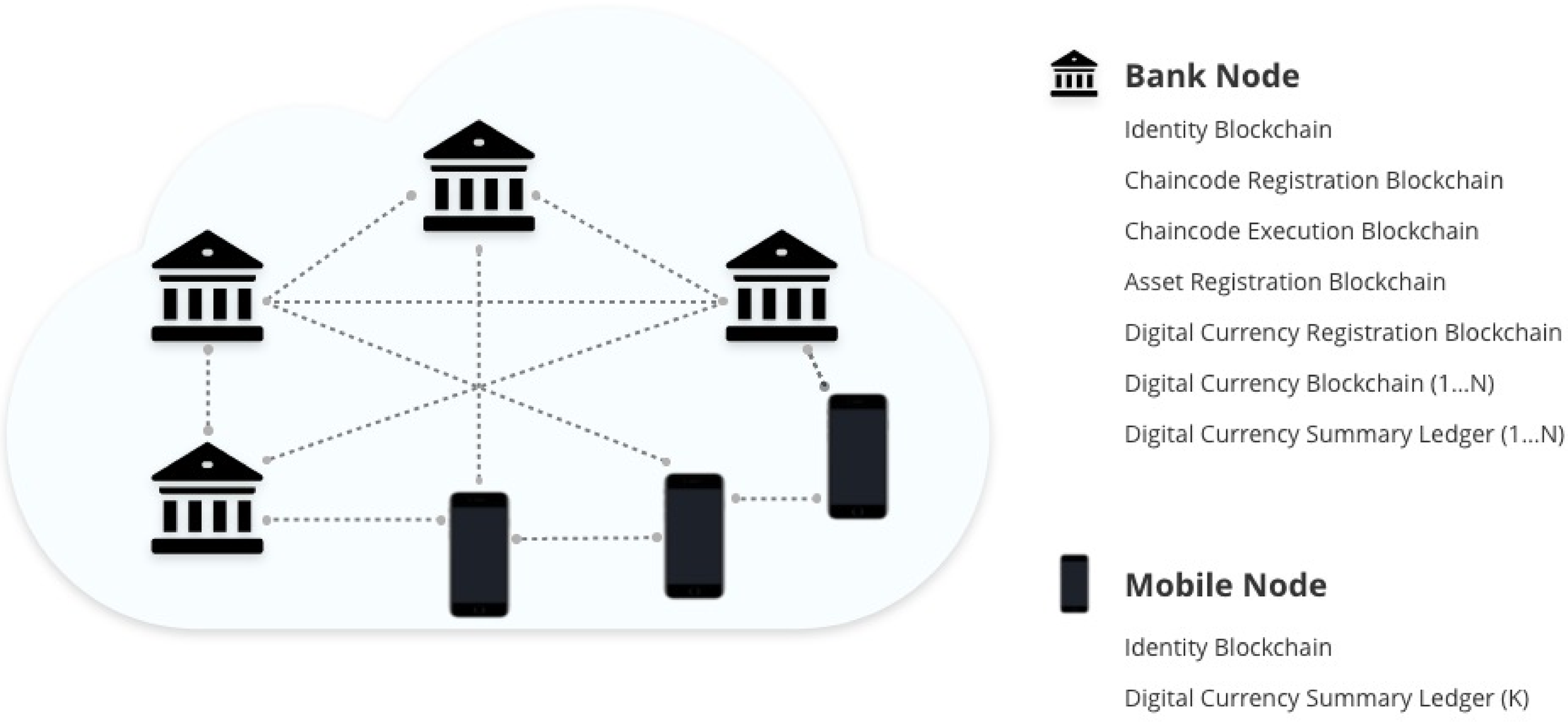

Figure 1 : MUI MetaBlockchain Network

2.2 Meta-Blockchain – Blockchain generating blockchain

IOne of the unique features of MUI MetaBlockchain is the ability to generate a new blockchain for a new digital currency using chaincode execution. Each new digital currency generated on MUI MetaBlockchain can have its own blockchain instead of sharing and mixing the data with hosted blockchain. This enables MUI MetaBlockchain to manage the storage space efficiently. The blockchain data that is used by depreciated digital currency can selectively be deleted from the storage.

For each digital currency blockchain to be created, there should be at least one Bank Node that acts as an algorithmic central bank(ACB) for the new digital currency. ACB Bank Node should guarantee entire network operation fees including transaction fees of the users who will be using the new digital currency. Also, ACB Bank can optionally prove the existence of collateralized assets for the new digital currency by having verifiable credentials issued by a trusted entity in the Identity Blockchain. After the staking of guarantee, ACB Bank can execute chaincode to generate digital currency. ACB Bank downloads the chaincode locally and executes the code. After the execution, resulting data is stored in chaincode execution blockchain and information related to newly created digital currency is registered in digital currency registration blockchain. This execution also creates a new digital currency blockchain and corresponding digital currency summary ledger pair.

Genesis block of the new digital currency contains the account balance of all users. Initially, ACB Bank Node will hold all tokens of the new digital currency. All Bank Nodes including ACB Bank Node and participating Mobile Nodes will be involved in the consensus protocol for the new digital currency. Bank Node is a leader node and can propose a block. A mobile node who wishes to participate in the digital currency consensus can only endorse the block that is proposed by the selected Bank Node.

Bank Node is a master full node of all pre-build blockchains and all digital currencies created on-chain. Therefore it can perform an inter-blockchain atomic swap among multiple currencies and assets on the MUI MetaBlockchain.

The followings are the difference between the Bank Node and the Mobile Node.

	BANK NODE	MOBILE NODE
Permission	Permissioned (Acceptance Voting)	Permissionless (Identity Registration)
Public/Private	Public	Public
Blockchain/ Ledgers	Chaincode Registration Blockchain Chaincode Execution Blockchain Digital Currency Registration Blockchain Asset Registration Blockchain N * Digital Currency Blockchain (Upon Creation) N * Digital Currency Summary Ledger (Upon Creation)	Digital Currency Summary Ledger (Upon Creation)
Function	Chaincode Creation and Registration Digital Currency Creation and Registration Asset Registration Digital Currency Blockchain Consensus (Block Proposer) Digital Currency Summary Maintenance	Digital Currency Blockchain Consensus (Block Endorser) Digital Currency Transaction

Table 1 : Comparisons of Bank node and Mobile node

2.3 Hybrid Blockchain – Centralized Cash and Decentralized Cheque

MUI MetaBlockchain is claimed to solve the blockchain trilemma by having a hybrid architecture. For micropayment, we used centralized architecture to achieve high performance and high security. For higher volume payment, we used decentralized architecture to achieve high security and decentralization.

Bank Node is a publisher of anonymous tokenized cash. Users can choose Bank Node service providers and have a token contract to issue digital cash. Based on the contract, it can be a debit card or credit card type.

When the user pays the merchant with digital cash, the merchant can claim the digital currency to the issuing Bank Node. The performance of this payment process should be equal or better than normal credit card payment.

For high volume money transfer, MUI MetaBlockchain utilizes normal blockchain consensus protocol. All Bank Nodes are involved in the consensus of multiple digital currencies. Since this a transfer between identities, it is a kind of digital cheque payment. Also since we are using blockchain consensus to do so instead of a centralized server for cheque clearance, this is a decentralized cheque system. This payment process is slower than the conventional credit card payment but it is much faster and cost less than an account-based international bank transfer.

2.4 Chain code

In MUI MetaBlockchain, chain codes are first-class citizens and they can be downloaded. Also, chain codes are the target of consensus and therefore it can be upgraded. Chain codes are downloaded and run on local devices, not on the network.

Bank node can propose a new chain code to register or update to existing chain code. Other Bank Node review the proposed chain code and vote for the chain code. The proposed chain code with the majority vote is confirmed to register or update.

Mobile Node can download the chain code in their device and customize the application to use the newly generated digital currency. In MUI MetaBlockchain, both blockchain ledger and chain code to perform transactions on digital currency are created dynamically.

2.5 Identity Blockchain

MUI MetaBlockchain has a built-in Identity Blockchain. All transfer in the MUI MetaBlockchain is performed based on DID(Decentralized Identity) on this Identity Blockchain. Identity Blockchain registers and maintains DID and public key pair. The corresponding private key is stored in the user's device. MUI MetaBlockchain DID is a Self-Sovereign Identity. Bank Node requires to have a public DID on Identity Blockchain. New Bank Node withes to join the network is required to get VC(Verifiable Credential)s from more than half of the Bank Nodes in the

[Digital_Currency_ID, Sender_DID, Receiver_DID, Token_Amount] || Sign_Sender(Hash_Value)

- Digital_Currency_ID: ID number of Digital Currency, When Bank Node creates a new digital currency, ID number is registered on Digital Currency Registration Blockchain.

- Sender_DID: DID of Sender, it is registered on Identity Blockchain

- Receiver_DID: DID of Receiver, it is registered on Identity Blockchain

- Token_Amount: Amount to transfer the token

- Sign_Sender(x): Digital signing function using the sender's private key on the value x

- Hash_Value: Hash value of hash function on input value of [Digital_Currency_ID, Sender_DID, Receiver_DID, Token_Amount]

- x || y: Concatenation operation of string x and y

2.6 Consensus Protocol

MUI MetaBlockchain's consensus protocol is a combination of PBFT(Practical Byzantine Fault Tolerance) and PoS(Proof of Stake). Only Bank Nodes participate in the consensus of built-in blockchains. Bank Node can be a block proposer and endorser of both built-in blockchains and all digital currency blockchains. The mobile node can participate in the consensus of newly created digital currencies as an endorser. In the case of digital currency consensus, only Bank Node can be a leader or the block proposer.

The leader node is scheduled to be chosen based on the stake, previous performance, hash value of DID, and hash value of the previous block. There is always only one block proposer in a single view. Therefore, there is no possibility of a fork and once the block earns the majority vote, the proposed block is committed and finalized.

The leader proposes the block and other nodes endorse the block. The Majority vote confirms the block in a first come first incentive-based rule. Since all Bank Node and Mobile Node have to register DID in Identity Blockchain, it is always known that how many Bank Nodes exist in the Blockchain. The earliest half of endorsement can be counted and endorsements that are included in the block receive the incentive.

The leader node also acts as a serializer to serialize transactions. The leader node receives block reward and transaction fees. Endorser also receives the endorsing rewards when the node's endorsement is included in the majority vote. When there's no transaction during the 5 seconds of view period, the leader announces the no transaction, and no block is created. When there's at least one pending transaction, the leader proposes the block immediately. The leader can propose multiple blocks with 5 seconds of view period. In case the leader node failed to produce a block proposal or no block announcement within 5 seconds, the leader node's locked bond will be slashed.

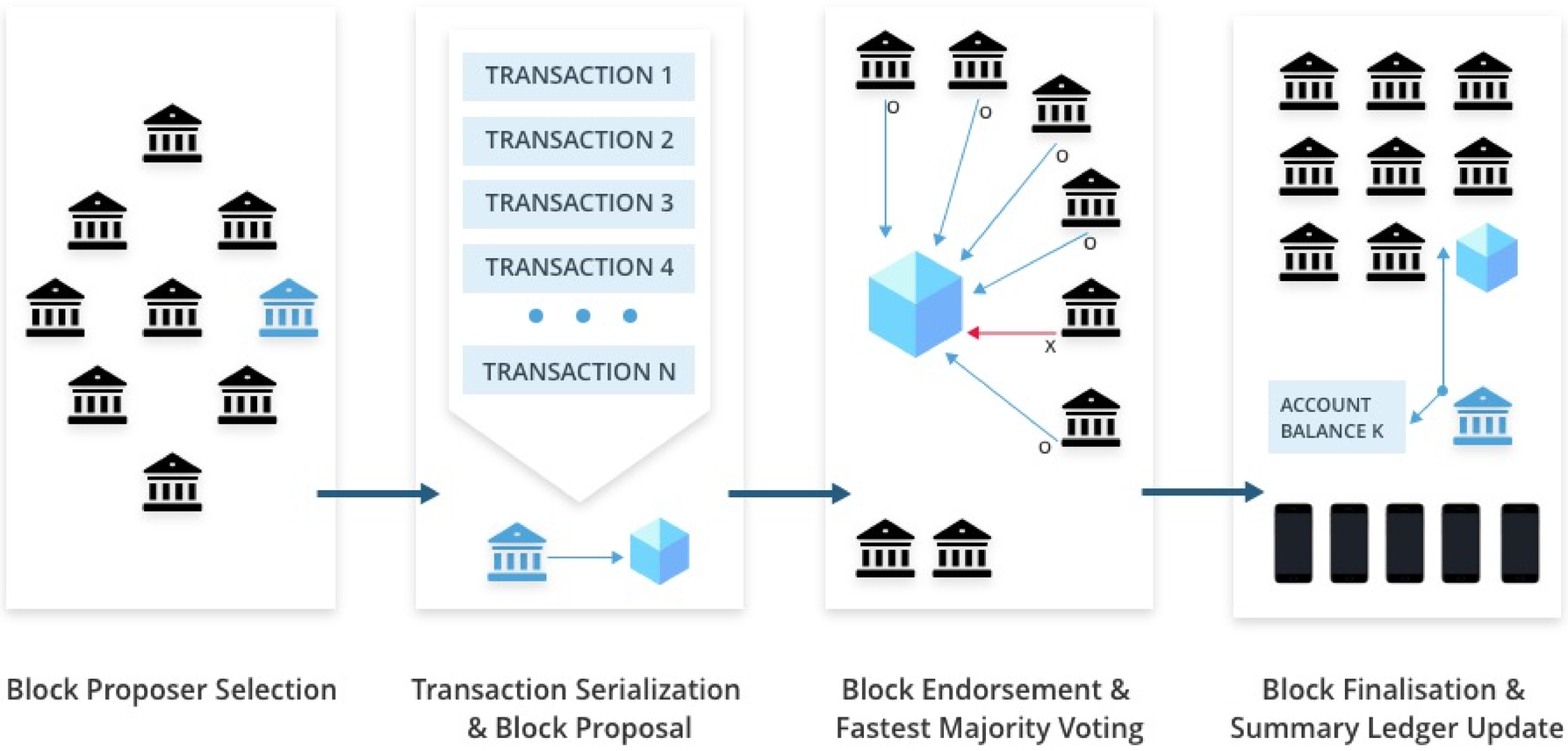

Figure 2: MUI MetsBlockchain Consensus Protocol

2.7 Event Sourcing Ledger (Blockchain) and Summary Ledger

MUI MetaBlockchain has two different structures to store transaction data. One is Event Sourcing Ledger. This is a normal blockchain ledger and it is stored in the form of a hashed chain of blocks. The problem with this form of storage is that it is needed to trace all the blockchain data to calculate the user's current account balance. A blockchain-style data store is secure but it is not efficient in terms of computation, communication, and data point of view. To overcome these limitations, Bank Node calculates each user's account balance after each block creation and store the account balance in the summary ledger. The bank node contains both Event Sourcing Ledger and Summary Ledger. Summary Ledger data is signed by the Bank node that created it and it can be downloaded to a mobile node to be stored. The mobile node receives updates of the balance after each block is finalized.

2.8 Rebasing of Genesis Block

Every 100 blocks, the Bank node agrees on the checkpoints. At the checkpoints, each user's account balance is calculated. This information is updated to the Genesis Block of each digital currency and the Genesis Block with the new account balance of all users becomes the new Genesis Block of that digital currency. All previous blockchain data before the checkpoint can be safely deleted. This is called the rebasing of the Genesis Block.

2.9 Algorithmic Central Bank

Each digital currency should have at least one Bank Node that acts as an Algorithmic Central Bank. This ACB Bank Node provides collateralized assets to support the value of the digital currency and controls the circulating volumes of the currency to controls the inflation and deflation rates. In the currency multiplication model, ACB Bank Node will determine the fractional reserve rate to limit the multiplication rate by Commercial Bank Node. Commercial Bank Node can prove deposited balance in the Central Bank Node as a collateralized asset for the generation of currency multiplication.

3. MUI MetaBlockchain Ecosystem

MUI is a utility token for the following products and services.

3.1 SovereignWallet

SovereignWallet[2][3][4] is an identity-based cryptocurrency and digital currency wallet. User can transfer the token with a friend's profile and wallet automatically retrieve the friend's crypto address and transfer the token. The user's private key is an HD(Hierarchical Deterministic) Key generated using BIP39(Bitcoin Improvement Proposal #39)[28] standard with 24 Mnemonic words. SovereignWallet uses zero-knowledge encryption and key vaporization method to protect the user's private key. Application self-protection technology[5][6][7][8][9] is applied to SovereignWallet to protect the application by creating a virtual secure execution environment. SovereignWallet provides a non-custodian staking service so that users can receive extra rewards while safely holding their own token in the wallet. SovereignWallet provides the self-sovereign staking of Tezos[23] and Algorand[21].

3.2 MUI SSID(Self-Sovereign Identity) Wallet

Self-Sovereign Identity Wallet is a mobile application that is connected to the Identity Blockchain of MUI MetaBlockchain. Self-Sovereign Identity is a decentralized identity technology that user is in control of their identity information, compared to other digital identity systems that centralized entity or group of entities are in control of the information. MUI SSID Wallet uses zero-knowledge proof to minimize the exposure of private information. It also has the capability of establishing pairwise trust. In pairwise trust, both users and the service site identify themselves. Since the service site also proves its identity to the user, a phishing attack with a fake web site can be avoided.

3.3 MetaBlock Exchange

MetaBlock Exchange is one of the first identity-based crypto exchanges. MetaBlock Exchange provides an identity-based crypto wallet to all users. Cryptocurrency from an identity-based wallet, MetaBlock Exchange's Web Wallet, and SovereignWallet can be deposited to MetaBlock Exchange. Cryptocurrency withdrawal is also limited to MetaBlock Wallet and SovereignWallet. This satisfies FATF(Financial Action Task Force)'s recommendation 15 of FATF recommendation to virtual assets and virtual asset service providers[27] also known as a "travel rule". This satisfaction with the legal framework makes MetaBlock Exchange an ideal platform for STO(Security Token Offering).

3.4 MUI MetaBlockchain

MUI MetaBlockchain is one of the first "Meta" Blockchain platforms that can create another blockchain programmatically. What this means is that users can publish cryptocurrencies, digital currencies, and tokenized assets and have its own blockchain. In a smart contract or chain code-based approach, the published token resides on top of underlying blockchains such as Ethereum[17] or Hyperledger[26]. Since all tokens share the same already congested blockchain, performance is severely limited and transaction cost is very high. Developing mainnet blockchain costs a lot considering the development of the entire ecosystem including consensus protocol, blockchain node, user wallet, etc. Most critically, building a platform that satisfies FATF recommendations are not feasible without the adaption of Identity Blockchain. Publishing local currency and digital coupons on MUI MetaBlockchain solves the problem of both transaction cost and development cost.

4. MUI Token-economics

MUI is the utility token for the MUI MetaBlockchain ecosystem. There are MUI Bank nodes that act as a decentralized central bank for MUI token. MUI Bank nodes will accumulate operating profits of MUI MetaMetaBlockchain in the Treasury Bank Node of MUI. MUI Bank Node uses this asset to back up the value of the MUI token. Various fees received by MUI Bank Node are used to incentivize other Bank Node and Mobile Node based on their contribution. The followings are income sources of MUI MetaBlockchain :

1. New digital currency creation and operation - chain code to publish a new digital currency requires the payment of 1 million MUI. The Bank Node requires to stake 10 million MUI to run the chain code and the deposit of 1 million MUI per year for the operation of various transactions of new digital currency. The Bank Node can accept the network fee with the new digital currency from the users of new digital currency. Based on the number of transactions and other operations, the total payment of operation can exceed the deposit. In that case, another 1 million MUI should be deposited. This network operation fee will be distributed to contributing bank nodes and mobile nodes based on proof-of-contribution protocol.

2. Special chain code operation – Basic income chain code requires 1 million MUI to run the code. Redenomination chain code also requires 1 million MUI to run. Inheritance chain code requires 10K MUI. The account recovery chain code requires 10K MUI.

3. Identity Registration and MUI token transfer are free of service. However, a change of registered public key requires 100 MUI for the operation.

4. Verifiable Credential issuance requires 100 MUI

5. The offline operation of various chain codes is free. This includes the establishment of pairwise trust, zero-knowledge proof of identity, etc.

5. MUI MetaBlockchain Use Cases

5.1 Central Bank Digital Currency

The most beneficial application domain of MUI MetaBlockchain is the publication of CBDC(Central Bank Digital Currency). Utilizing the structure of Bank Node, MUI MetaBlockchain supports the model of M2 currency

dynamically on MUI MetaBlockchain. SovereignWallet users use CBDC and can participate in operating CBDC with mobile full node. MUI MetaBlockchain supports the fractional reserve banking model. Currency Exchange between digital currencies published on MUI MetaBlockchain can be swapped atomically. This provides a simple currency exchange on a mobile device.

MUI MetaBlockchain's unique chain code structure and identity-based account system enable special monetary policy to be implemented. **Redenomination** of CBDC can be performed on-chain. The cost of performing on-chain redenomination is just a fraction of the cost of publishing new paper currency and collecting and destroying old currencies.

With MUI MetaBlockchain's chain code, the implementation of **basic income** or **disaster-aid** can be paid programmatically. By running the basic income chain code, it is possible to increase the balance of all citizen's account balance. Based on the user's identity, eligible users can be selected or the user can prove himself or herself to receive the money by presenting VC(Verifiable Credential)s.

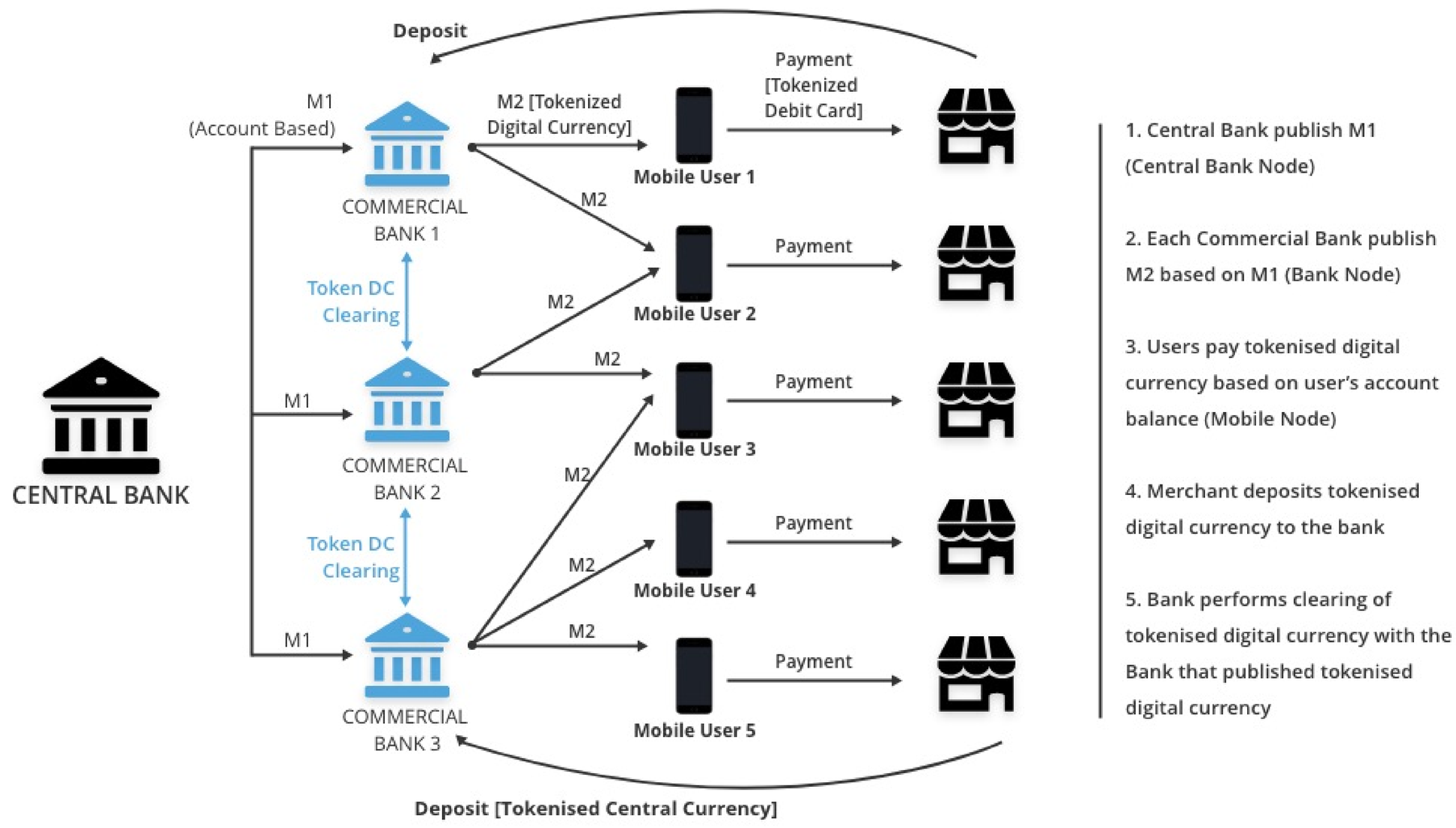

Figure 3: Central Bank Digital Currency Model utilizing MUI MetaBlockchain

5.2 Digital Stock Exchange

With its identity-based feature, MUI MetaBlockchain is a perfect tool to build Digital Stock Exchange. Corporate stock can be published easily on MUI MetaBlockchain. Since MUI MetaBlockchain uses identity-based transfer, the transfer of tokenized stock is actually an ownership transfer. Also, MUI MetaBlockchain's Identity Blockchain eliminates the need for paper-based public notarization.

Various Assets can be tokenized on MUI MetaBlockchain. There is a direct link between the ownership of assets and the user's identity in MUI MetaBlockchain. This simplifies the ownership transfer along with the token transfer. With Asset Registration Blockchain, the oracle problem of the link between the tokenized assets and physical assets can be established. With Public DID(Decentralized Identity) on Identity Blockchain and VC(Verifiable Credential) from the legal entity, legal and physical ownership can also be verified.

When users are trading digital stocks or assets in a peer-to-peer way, MUI MetaBlockchain provides an atomic swap of digital stock and digital currency. Since digital stock is bind to the user's identity, ownership transfer notification and tax payment can happen at the same time with the stock trade. This eliminates the need for separate shareholder registration, issuance of shareholder certificate, tax report to the government, and tax payments.

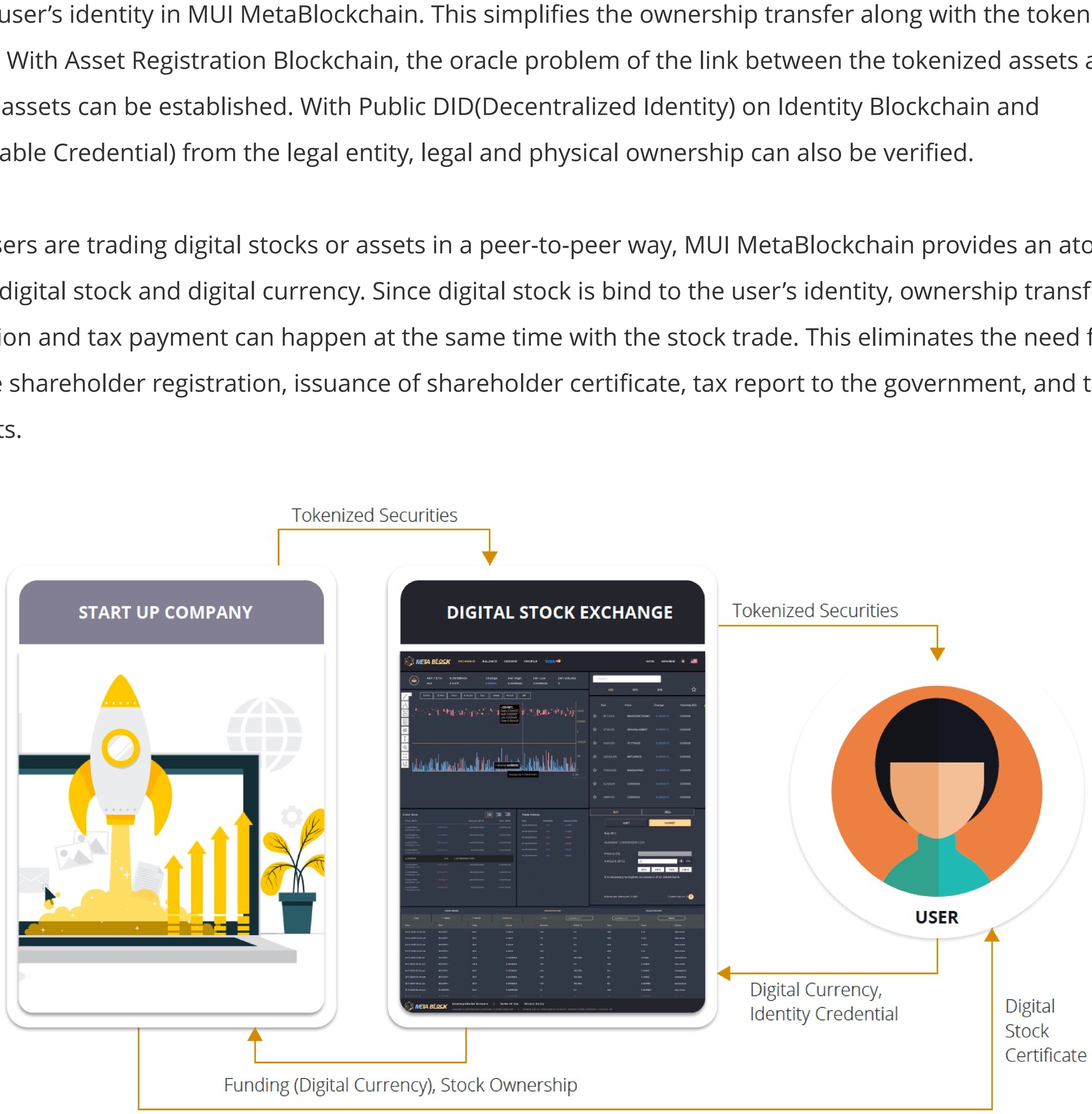

Figure 4: Tokenized Securities Service Model

5.3 Stable Coins, Tokenized Assets, and Wrapped Cryptocurrencies

With its collateralized asset blockchain and a digital certificate issued by a trusted identity, MUI MetaBlockchain provides a one-stop solution to generate stable coins and tokenized assets. MUI provides identity-based token transfer and it is fully compliant with FATF(Financial Action Task Force)'s recommendations. It can be used by the conventional financial institute to publish stable coins backed by various assets such as gold, oil, or other fiat currency.

With MUI MetaBlockchain, it is possible to overcome the cost and performance issues of many cryptocurrencies. Based on the collateralized asset of Bitcoin, the user can generate a MetaBlockchain version of Bitcoin, let's name it Meta-Bitcoin. This Meta-Bitcoin is then traded with other users or use it as a payment to purchase other goods or services. Then the merchant who received Meta-Bitcoin has a 100% guarantee that it can be converted to original Bitcoin by claiming Meta-Bitcoin to the Bank Node who published it.

6. Future extensions

The on-chain governance mechanism of MUI MetaBlockchain's chain code makes it possible to upgrade various parts of MUI MetaBlockchain. MUI MetaBlockchain team will continuously upgrade the protocol and chain code in the future. Online voting protocol combined with Identity Blockchain will lead to the implementation of secure voting on top of MUI MetaBlockchain.

The digitalization of currency opens up new opportunities for digitalized monetary decision making. Bank node is an early form of Algorithmic Central Bank that makes monetary decisions based on financial big data. It is possible to apply a federated learning algorithm at the central bank node and collect and learn a decentralized model on many mobile nodes.

7. References

[1] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Blockchain System that includes Bank Nodes each having separate Ledgers for Identity, Digital Currency and other functions, and operation method thereof", KR10-2020-0110742, 2020

[2] Seokgu Yun, Sovereign Wallet Co.,Ltd., "e-Wallet, Server Performing the e-Wallet, and Atomic Swapping Method of Different Blockchain Tokens using the Server", KR10-2020-0066895, KR10-2020-0066902, KR10-2020-0066908, 2020

[3] Seokgu Yun, Sovereign Wallet Co.,Ltd., "e-Wallet and Atomic Swapping method of Two Different Blockchain Tokens using the e-Wallet", KR10-2020-0035777, 2020

[4] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Operation Method of Blockchain Currency Remittance Service System and Electronic Wallet for Currency Remittance", KR10-2020-0017717, 2020

[5] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Method for Operating Application Performing Security Function and Corresponding Application", KR10-2101614, KR10-1951201, KR10-1951201, 2019, 2016

[6] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Device for Self-Defense Security based on System Environment and User Behavior Analysis and Operating Method thereof", Singapore 11201804011V, Japan 2018-547246, 2018

[7] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Self Defense Security Server with Behavior and Environment Analysis and Operating Method thereof", KR10-1905771, PCT/KR2017/000204, 2016

[8] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Method of Securing Application using Self-Protection", KR10-2016-0032906, 2016

[9] Seokgu Yun, Sovereign Wallet Co.,Ltd., "Secure Chat Method using Distributed Key Exchange Protocol and Self-Defense Security", KR10-1596479, PCT/KR/2016/000887, 2015

[10] Mehrdad Kiamari, Bhaskar Krishnamachari, Muhammad Naveed, and Seokgu Yun, "Blizzard: Distributed Consensus for Mobile Devices using Online Brokers", In IEEE International Conference on Blockchain and Cryptocurrency, 2020

[11] Martin Martinez, Arvin Hekmati, Bhaskar Krishnamachari, and Seokgu Yun, "Mobile Encounter-based Social Sybil Control", In The Seventh International Conference on Software Defined Systems (SDS-2020), 2020

[12] Martin Martinez, Arvin Hekmati, Bhaskar Krishnamachari, Seokgu Yun, "Mitigating Mobile Device-based Sybil Attacks using Supervised Machine Learning and Generative Adversarial Networks", In IEEE Conference on Computer Communications, 2021

[13] David Chaum, Amos Fiat, and Moni Naor. "Untraceable Electronic Cash". In Proceedings of the 8th Annual International Cryptology Conference on Advances in Cryptology. CRYPTO '88. London, UK, UK: Springer-Verlag, 1990, pp. 319-327. ISBN: 3-540-97196-3. URL: http://dl.acm.org/citation.cfm?id=646753.704915

[14] B. Clifford Neuman and Gennady Medvinsky, "Requirements for Network Payment: The NetCheque Perspective", In Proceedings of IEEE COMPCON'95, March 1995

[15] Gennady Medvinsky and B. Clifford Neuman. "NetCash: A design for practical electronic currency on the Internet". In Proceedings of the First ACM Conference on Computer and Communications Security, November 1993.

[16] Satoshi Nakamoto. "Bitcoin: A peer-to-peer electronic cash system". In: Consulted 1 (2008), p.2012

[17] Gavin Wood. "Ethereum: A Secure Decentralized Generalized Transaction Ledger", In https://ethereum.github.io/yellowpaper/paper.pdf, September 2020

[18] Leonard Adleman, Rolfe R. Schmidt. "Designing Money [Extended Abstract]". In https://adleman.usc.edu/aurum-digital-currency/, March 2018

[19] Friedrich Von Hayek. "The Denationalization of Money: An Analysis of the Theory and Practice of Concurrent Currencies", The Institute of Economic Affairs, Third Edition, 1990

[20] Ittay Eyal, Adem Efe Gencer, Emin Gun Sirer, Robbert van Renesse, "Bitcoin-NG: A Scalable Blockchain Protocol". In Proceedings of the 13th USENIX Symposium on Networked Systems Design and Implementation, March 2016

[21] Jing Chen, Silvio Micali, "Algorand: A secure and efficient distributed ledger", In arXiv report http://arxiv.org/abs/1607.01341, May 2017

[22] Team Rocket, Maofan Yin, Kevin Sekniqi, Robbert van Renesse, Emin Gun Sirer, "(Avalanche) Scalable and Probabilistic Leaderless BFT Consensus through Metastability", In arXiv report https://arxiv.org/abs/1906.08936, Aug 2020

[23] L.M Goodman, "Tezos – a self-amending crypto-ledger White paper", In https://tezos.com/static/white_paper-2dc8c02267a8fb86bd67a108199441bf.pdf, September 2014

[24] Leemon Baird, Mance Harmon, and Paul Madsen, "Hedera: A Public Hashgraph Network & Governing Council", In https://www.hedera.com/hh-whitepaper-v2.0-17Sep19.pdf, September 2019

[25] Ethan Buchman, Jae Kwon, and Zarko Milosevic, "(Tendermint) The latest gossip on BFT consensus", In http://arxiv.org/abs/1807.04938, November 2019

[26] Elli Androulaki, Artem Barger, Vita Bortnikov, et al., "Hyperledger Fabric: A Distributed Operating System for Permissioned Blockchains", In https://arxiv.org/abs/1801.10228, April 2018

[27] The Financial Action Task Force, "12-Month Review of The Revised FATF Standards on Virtual Assets and Virtual Asset Service Providers", In https://www.fatf-gafi.org/publications/fatfrecommendations/documents/12-month-review-virtual-assets-vasps.html, July 2020

[28] Marek Palatinus, Pavol Rusnak, Aaron Voisine, and Sean Bowe, "BIP39: Mnemonic code for generating deterministic keys", In https://github.com/bitcoin/bips/blob/master/bip-0039.mediawiki , September 2013