



SOVEREIGNWALLET

WHITE PAPER

MUI MetaBlockchain

Denationalization of Money
and Rewriting Satoshi's Vision

MUI–MetaBlockchain

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MUI–MetaBlockchain DENATIONALIZATION OF MONEY AND REWRITING SATOSHI’S VISION



SOVEREIGNWALLET
www.sovereignwallet.network

Phantom Seokgu Yun, Frances Kim Ph. D

phantom@sovereignwallet.network

frannie@sovereignwallet.network

Sovereign Wallet Network,

Tallinn, Estonia

September 9, 2020

Version 0.9

Abstract

MUI MetaBlockchain[1][10][11][12] can programmatically generate separate blockchain for each digital currencies and other digital assets. This enables decentralized credit banking that each person or bank can generate new currency based on their collateralized asset. This is a kind of tokenized cheque or tokenized credit card or the decentralized version of NetCash[14] and NetCheque[15]. Bank Node assists Mobile Node acts as a full node to maintain programmatically generated blockchain of digital currency. In MUI MetaBlockchain, chain codes are the target data of consensus protocol. 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. In MUI MetaBlockchain, transfer of the token is bind to the identity of the node, not the address derived from the private key. The signing private key and the registered public key can be replaced after proper verification of the user's identity. Special operation of chain code by the Bank Node makes it possible to implement basic income. This is an additional operation of all designated identity account in the nation. Redenomination of the national currency can be instant with the multiplication operation of chain code by the Bank Node. 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. Atomic exchange of each different digital currencies on the MUI MetaBlockchain is implemented by the mediation of the bank node of each digital currencies.



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 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 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 widespread 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 avoid money laundering? How to solve the impossibility trilemma in economics, saying free capital flow, fixed exchange rate, and sovereign monetary policy can not be achieved at the same time. What about the data scalability? With all data is mixed together as a hashed chain, it is not possible to store the terabytes of data on a mobile device and it is not possible to realize the vision of Nick Szabo’s personal and secure device with smart contract execution.

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 meta-blockchain. Chain code runs on the mobile device and supports the offline operation. This opens the door to a whole new level of decentralized applications.

With the dynamic creation of blockchain of new digital currency, MUI MetaBlockchain supports 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 consensus data. This supports the various economic model of basic income, programmable redenomination, and inheritance, and automatic taxation.

2. MUI MetaBlockchain Architecture

2.1 Hybrid Blockchain Nodes – Bank Node and Mobile Node

MUI MetaBlockchain is a hybrid blockchain that consists of Bank Node and Mobile Node. 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 permission node that requires the permission from existing Bank Nodes. 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.

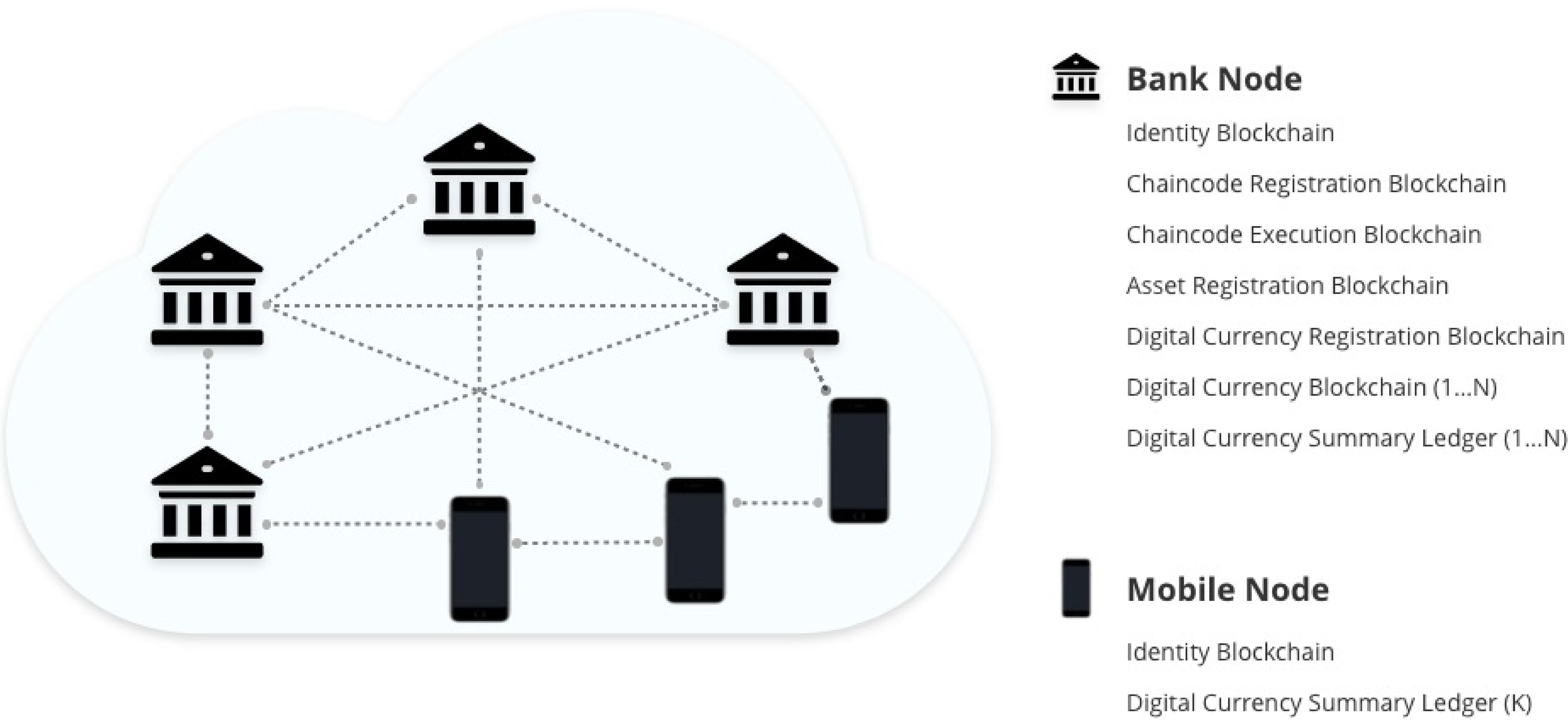


Figure 1 : MUI MetaBlockchain Network

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 Identity Blockchain

MUI MetaBlockchain has 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 network. Following is the token transfer format of digital currency.

[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

2.4 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 pervious block. There is always only one block proposer in the single view. Therefore, there is no possibility of fork and once the block earn the majority vote, the proposed block is committed and finalized.

The leader proposes the block and other node endorses 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. Earliest half of endorsement can be counted and endorsements those are included in the block receives 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 that leader node failed to produce block proposal or no block announcement within 5 seconds, leader node's locked bond will be slashed.

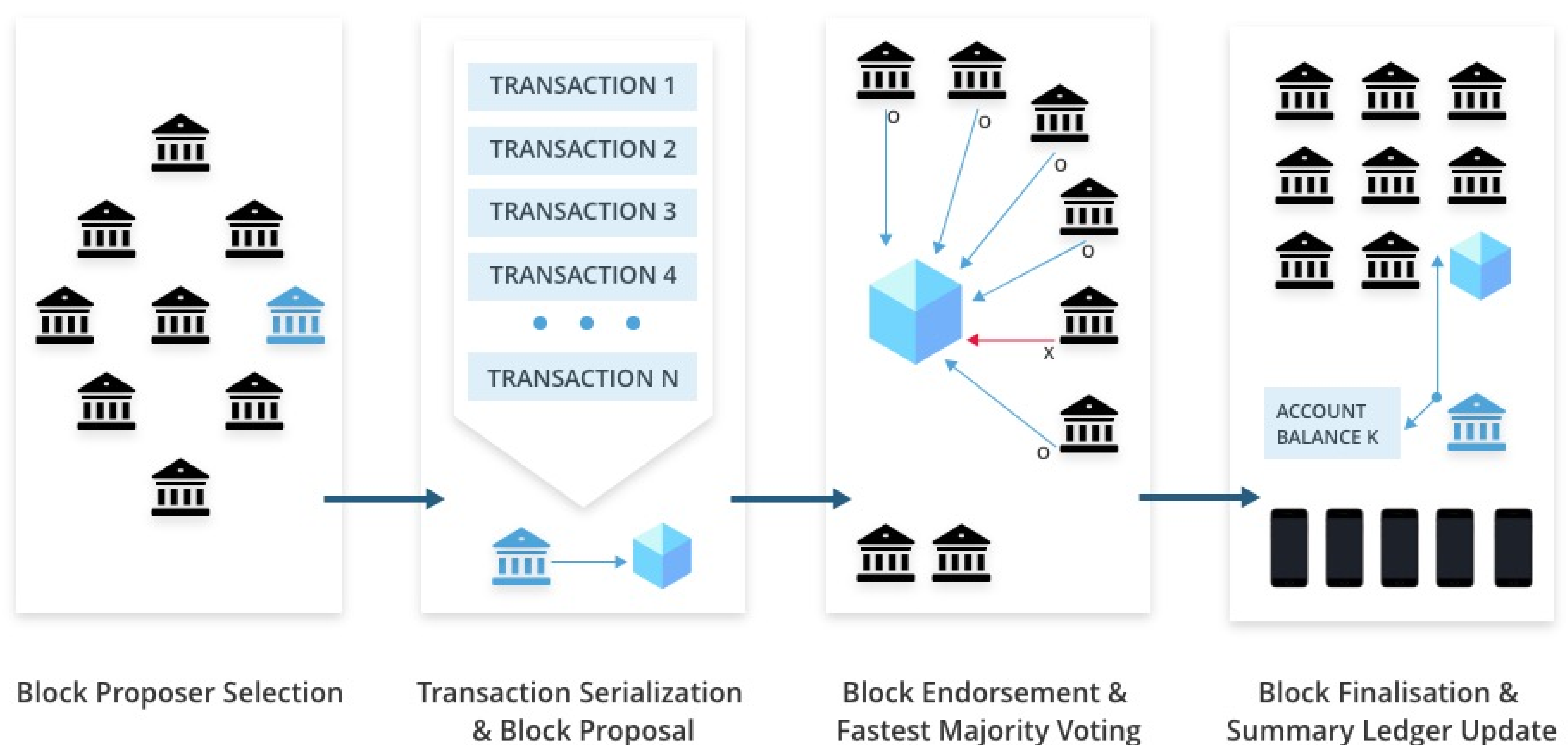


Figure 2: MUI MetsBlockchain Consensus Protocol

2.5 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 of this form of storage is that it is needed to trace all the blockchain data to calculate the user's current account balance.

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 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.

2.6 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. This is called the rebasing of the Genesis Block.

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 non-custodian staking service so that users can receive extra rewards while safely holding their own token in the wallet. SovereignWallet provides 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 user 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 of 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 platform 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, 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 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 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 publication. Based on the asset of M1 base currency from the central bank, commercial banks can generate 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.

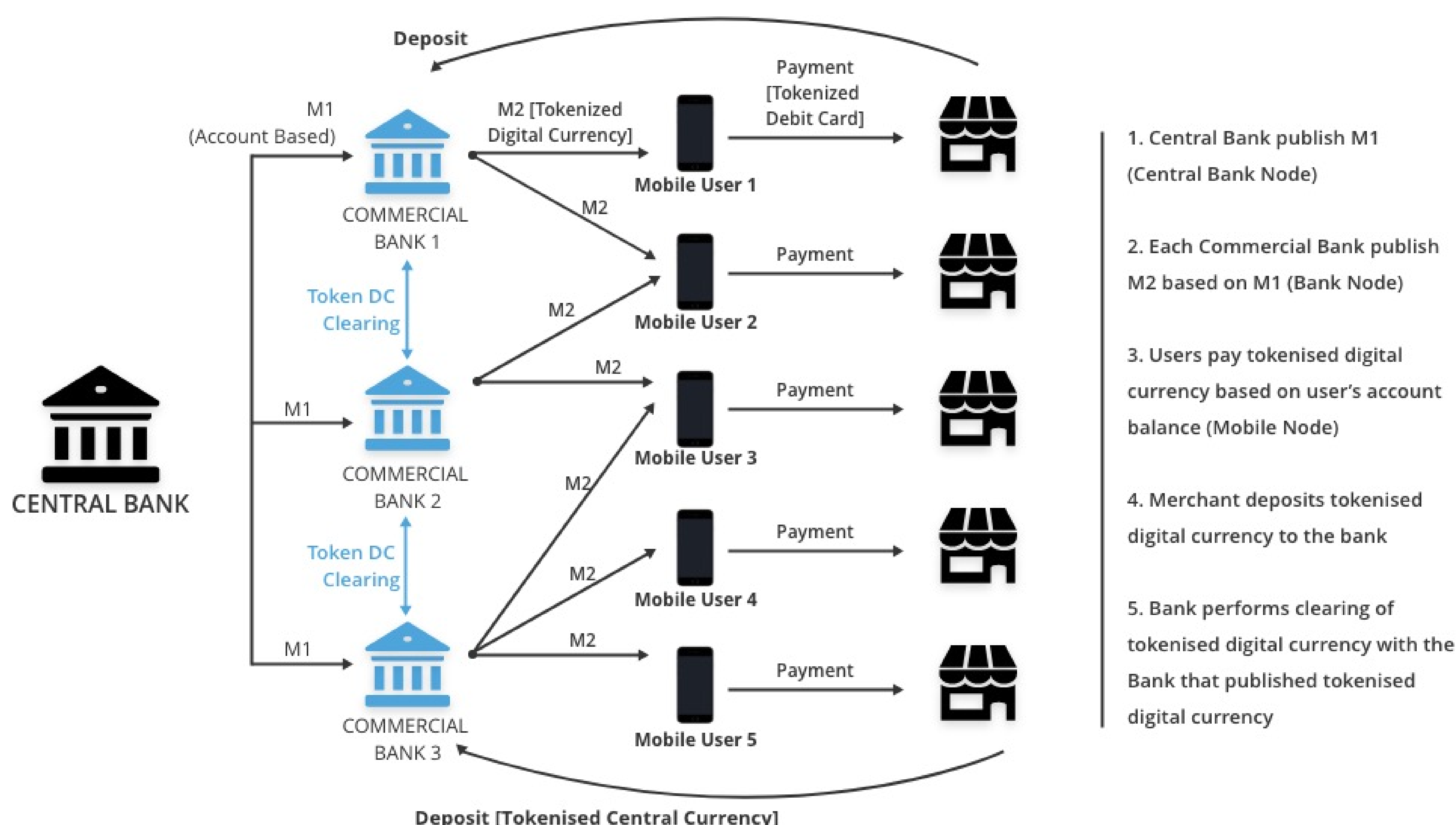


Figure 3: Central Bank Digital Currency Model utilizing MUI MetaBlockchain



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 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 on Identity Blockchain and VC from the legal entity, legal and physical ownership can also be verified.

5.3 Wrapped Cryptocurrencies

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.

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.



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