CLAIMS

1. A system comprising:

one or more processors; and

a computer-readable storage device storing instructions which, when executed by the one or more processors, operate a custodian module that holds customer tokens for processing a transaction associated with the customer tokens and to redeem the customer tokens, wherein a customer is independent of an operator of custodian module and wherein the customer owns the customer tokens and wherein the instructions further cause the one or more processors to perform operations comprising:

creating, via the custodian module, a respective blockchain ledger on a respective blockchain node of a blockchain network, the blockchain network comprising a plurality of distributed nodes communicating via a computer network, and

operating a consensus algorithm to record transactions across a distributed blockchain ledger configured across the plurality of distributed nodes to render the transactions as permanent and unalterable on the distributed blockchain ledger, wherein the distributed blockchain ledger comprises the distributed blockchain ledger and wherein the blockchain network comprises:

one or more governance modules with a governance module blockchain node;

a plurality of custodian modules with a custodial module blockchain node;

a plurality of blockchain ledgers per custodian module;

a plurality of trader modules; and

a peer-to-peer messaging capability, wherein the blockchain network implements the consensus algorithm and uses a transaction broadcasting protocol and a privacy level;

receiving, via the custodian module, a request to tokenize assets;

tokenizing, via the custodian module and based on the request and according to the consensus algorithm, the assets onto the distributed blockchain ledger to yield the customer tokens;

receiving, via the custodian module, a redemption request;

burning, via the custodian module and based on the redemption request and according to the consensus algorithm, the customer tokens off the distributed blockchain ledger such that the customer tokens are unspendable;

performing, via the custodian module, an atomic transaction commitment as part of a two-phase commit process across two different custodians that triggers a transaction finality;

performing, via the custodian module, a net settlement computation based on trading transactions in blocks, the net settlement computation further comprising net settlement movements comprising instructions to outside services separate from the custodian module;

reading, via a trader module for interacting with the custodian module via a wallet and operating on a trader device, unspent transaction outputs and sums for balances;

enabling, via the trader module, access to traders to an order entry system;

performing, via the order entry system, a real-time pre-trade credit check;

entering, via the order entry system, bids and offers or request for quote or otherwise negotiating pricing;

submitting, via the order entry system, orders to a matching engine that matches trades;

initiating, via the trader module, issuance and redemption requests to the custodian module;

managing, via the trader module, a public key and a private key for the traders;

receiving, via an atomic swap module configured on an atomic swap compute device, transactions from the matching engine;

obtaining, via the atomic swap module, a signing of the transactions with the private key to yield signed transactions;

adding, via the atomic swap module, the signed transactions to a mempool;

ensuring, via the atomic swap module, that an atomic swap occurs that changes ownership of assets concurrently with two respective distributed blockchain ledgers to yield a trade execution;

notifying, via the atomic swap module, the matching engine or other systems of a successful or failed trade execution;

calculating, via a cross-custodian net settlement module configured on a cross-custodian net settlement compute device, net settlement amounts due for all users in each asset between any two separate custodian modules and their related separate distributed blockchain ledgers;

generating, via the cross-custodian net settlement module and based on the net settlement amounts, a full allocation report for all users, all assets all related the

unspent transaction outputs and proofs, the full allocation report comprising netted quantities and residual quantities;

loading, via the cross-custodian net settlement module, the residual quantities into a blockchain-based smart contract or otherwise creating movement instructions over non-blockchain ledger rails; and

creating, via the cross-custodian net settlement module, an atomic transaction that burns and reallocates the netted quantities and invokes the blockchain-based smart contract or other traditional rail payments.

2. The system of claim 1, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

performing arbitrary payment transactions between blockchain ledger addresses.

3. The system of claim 1, wherein the consensus algorithm comprises on of a just-in-time consensus algorithm.

4. The system of claim 1, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

performing, via the atomic swap module, a credit check against an unspent output set totals for users in question; and

receiving, via the atomic swap module, as blockchain transactions or creating blockchain transactions that spend the unspent output associated with the users in question.

5. The system of claim 1, wherein obtaining the signing of the transactions with the private key as performed by the atomic swap module occurs via (1) the trader module performing a

delegated signing with a supplied private key from the customer; or (2) sending the transactions to the trader module for signing by the private key.

6. The system of claim 1, wherein ensuring that the atomic swap changes ownership of the assets as performed by the atomic swap module further comprises calling a governance blockchain node which validates transactions and changes status of mempool transactions and invoking a two-phase commit protocol with custodial distributed blockchain ledgers related to affected unspent output.

7. The system of claim 1, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

connecting, via the order entry system, to a credit engine and margin engine and performing calculations for determining a client buying power.

8. The system of claim 7, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

performing, via the order entry system, one-way payment orders.

9. The system of claim 1, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

receiving, via the matching engine, quotes and orders from third parties; and

executing, via the matching engine, order matches in lit book or dark book or both.

10. The system of claim 9, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

maintaining, via the matching engine, and publishing an order book; and

aggregating, via the matching engine, outside order books and routing orders to the outside order books for execution.

11. The system of claim 1, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations further comprising:

interacting, via a virtual custodian module and via a wallet, with the blockchain-based smart contract for time-locked transactions related to an atomic swap; and

facilitating, via the virtual custodian module, the atomic swap between smart contract-held assets and the custodian module with assets on distributed blockchain ledgers.

12. The system of claim 1, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

lending as an on-chain reposition transaction wherein the on-chain reposition transaction that is expected to be and can be forced to be unwound with a countervailing transaction based on collateral and risk rules.

13. The system of claim 12, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

performing programmatic intraday borrowing based on preset rules and preferences managed within the trader module.

14. The system of claim 13, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

executing on the blockchain network between assets on different distributed blockchain ledgers at one of more custodian modules.

15. The system of claim 1, wherein the system is integrated with a decentralized exchange and both puts liquidity into the decentralized exchange and takes liquidity off of the decentralized exchange.

16. The system of claim 15, wherein the computer-readable storage device stores additional instructions which, when executed by the one or more processors, cause the one or more processors to perform operations comprising:

maintaining atomic swaps between the blockchain-based smart contract and the distributed blockchain ledger.

17. A method to operate a custodian module operating on a custodian compute device that holds customer tokens for processing a transaction associated with the customer tokens and to redeem the customer tokens, the method comprising:

creating a respective blockchain ledger on a respective blockchain node of a blockchain network, the blockchain network comprising a plurality of distributed nodes communicating via a computer network, and

operating a consensus algorithm to record transactions across a distributed blockchain ledger configured across the plurality of distributed nodes to render the transactions as

permanent and unalterable on the distributed blockchain ledger, wherein the distributed blockchain ledger comprises the distributed blockchain ledger and wherein a customer is independent of an operator of the custodian module and wherein the customer owns the customer tokens and wherein the blockchain network comprises:

one or more governance modules with a governance module blockchain node;

a plurality of custodian modules with a custodial module blockchain node;

a plurality of blockchain ledgers per custodian module;

a plurality of trader modules; and a peer-to-peer messaging capability, wherein the blockchain network implements the consensus algorithm and uses a transaction broadcasting protocol and a privacy level;

receiving, via the custodian module operating on the custodian compute device, a request to tokenize assets;

tokenizing, via the custodian module and based on the request and according to the consensus algorithm, the assets onto the distributed blockchain ledger to yield the customer tokens;

receiving, via the custodian module, a redemption request;

burning, via the custodian module and based on the redemption request and according to the consensus algorithm, the customer tokens off the distributed blockchain ledger such that the customer tokens are unspendable;

performing, via the custodian module, an atomic transaction commitment as part of a two-phase commit process across two different custodians that triggers a transaction finality;

performing, via the custodian module, a net settlement computation based on trading transactions in blocks, the net settlement computation further comprising net settlement movements comprising instructions to outside services separate from the custodian module;

reading, via a trader module for interacting with the custodian module via a wallet and operating on a trader device, unspent transaction outputs and sums for balances;

enabling, via the trader module, access to traders to an order entry system;

performing, via the order entry system, a real-time pre-trade credit check;

entering, via the order entry system, bids and offers or request for quote or otherwise negotiating pricing;

submitting, via the order entry system, orders to a matching engine that matches trades;

initiating, via the trader module, issuance and redemption requests to the custodian module; and

managing, via the trader module, a public key and a private key for the traders;

receiving, via an atomic swap module configured on an atomic swap compute device, transactions from the matching engine;

obtaining, via the atomic swap module, a signing of the transactions with the private key to yield signed transactions;

adding, via the atomic swap module, the signed transactions to a mempool;

ensuring, via the atomic swap module, that an atomic swap occurs that changes ownership of assets concurrently with two respective distributed blockchain ledgers to yield a trade execution;

notifying, via the atomic swap module, the matching engine or other systems of a successful or failed trade execution;

calculating, via a cross-custodian net settlement module configured on a cross-custodian net settlement compute device, net settlement amounts due for all users in each asset between any two separate custodian modules and their related separate distributed blockchain ledgers;

generating, via the cross-custodian net settlement module and based on the net settlement amounts, a full allocation report for all users, all assets all related unspent transaction outputs and proofs, the full allocation report comprising netted quantities and residual quantities;

loading, via the cross-custodian net settlement module, the residual quantities into a blockchain-based smart contract or otherwise creating movement instructions over non-blockchain ledger rails; and

creating, via the cross-custodian net settlement module, an atomic transaction that burns and reallocates the netted quantities and invokes the blockchain-based smart contract or other traditional rail payments.

18. A non-transitory computer-readable storage device storing instructions which, when executed by one or more processors, cause the one or more processors to perform operations to operate a custodian module operating on a custodian compute device that holds customer tokens for processing a transaction associated with the customer tokens and to redeem the customer tokens, the operations comprising:

creating a respective blockchain ledger on a respective blockchain node of a blockchain network, the blockchain network comprising a plurality of distributed nodes communicating via a computer network, and

operating a consensus algorithm to record transactions across a distributed blockchain ledger configured across the plurality of distributed nodes to render the transactions as permanent and unalterable on the distributed blockchain ledger, wherein the distributed blockchain ledger comprises the distributed blockchain ledger and wherein a customer is independent of an operator of the custodian module and wherein the customer owns the customer tokens and wherein the blockchain network comprises:

one or more governance modules with a governance module blockchain node;

a plurality of custodian modules with a custodial module blockchain node;

a plurality of blockchain ledgers per custodian module;

a plurality of trader modules; and a peer-to-peer messaging capability, wherein the blockchain network implements the consensus algorithm and uses a transaction broadcasting protocol and a privacy level;

receiving, via the custodian module operating on the custodian compute device, a request to tokenize assets;

tokenizing, via the custodian module and based on the request and according to the consensus algorithm, the assets onto the distributed blockchain ledger to yield the customer tokens;

receiving, via the custodian module, a redemption request;

burning, via the custodian module and based on the redemption request and according to the consensus algorithm, the customer tokens off the distributed blockchain ledger such that the customer tokens are unspendable;

performing, via the custodian module, an atomic transaction commitment as part of a two-phase commit process across two different custodians that triggers a transaction finality;

performing, via the custodian module, a net settlement computation based on trading transactions in blocks, the net settlement computation further comprising net settlement movements comprising instructions to outside services separate from the custodian module;

reading, via a trader module for interacting with the custodian module via a wallet and operating on a trader device, unspent transaction outputs and sums for balances;

enabling, via the trader module, access to traders to an order entry system;

performing, via the order entry system, a real-time pre-trade credit check;

entering, via the order entry system, bids and offers or request for quote or otherwise negotiating pricing;

submitting, via the order entry system, orders to a matching engine that matches trades;

initiating, via the trader module, issuance and redemption requests to the custodian module; and

managing, via the trader module, a public key and a private key for the traders;

receiving, via an atomic swap module configured on an atomic swap compute device, transactions from the matching engine;

obtaining, via the atomic swap module, a signing of the transactions with the private key to yield signed transactions;

adding, via the atomic swap module, the signed transactions to a mempool;

ensuring, via the atomic swap module, that an atomic swap occurs that changes ownership of assets concurrently with two respective distributed blockchain ledgers to yield a trade execution;

notifying, via the atomic swap module, the matching engine or other systems of a successful or failed trade execution;

calculating, via a cross-custodian net settlement module configured on a cross-custodian net settlement compute device, net settlement amounts due for all users in each asset between any two separate custodian modules and their related separate distributed blockchain ledgers;

generating, via the cross-custodian net settlement module and based on the net settlement amounts, a full allocation report for all users, all assets all related unspent outputs and proofs, the full allocation report comprising netted quantities and residual quantities;

loading, via the cross-custodian net settlement module, the residual quantities into a blockchain-based smart contract or otherwise creating movement instructions over non-blockchain ledger rails; and

creating, via the cross-custodian net settlement module, an atomic transaction that burns and reallocates the netted quantities and invokes the blockchain-based smart contract or other traditional rail payments.