CLAIMS

1. A method for attaining scalable transactions throughput in a multiple distributed ledger system including a plurality of distributed ledger networks each of which has a plurality of nodes, one of the plurality of distributed ledger networks has a source distributed ledger and another distributed ledger network has a target distributed ledger, the method comprising:

determining an existing transaction in the source distributed ledger which has a transaction output that is unspent;

generating and submitting an initiating transaction for commission to the target distributed ledger, wherein the initiating transaction has a transaction output;

generating and submitting a locking transaction for commission to the source distributed ledger, wherein the locking transaction is generated to spend and lock the transaction output of the existing transaction in the source distributed ledger and references the initiating transaction in the target distributed ledger to verify existence of the initiating transaction; and

generating and submitting a completing transaction for commission to the target distributed ledger, wherein the completing transaction is generated to spend the transaction output of the initiating transaction in the target distributed ledger ~~and references~~ after referencing the locking transaction in the source distributed ledger to verify existence of the locking transaction;

wherein the source distributed ledger is different from the target distributed ledger.

2. The method of claim 1, wherein the transaction output of the initiating transaction is only spendable by the completing transaction when the completing

generating and submitting a completing transaction for commission to the target distributed ledger, wherein the completing transaction is generated to spend the transaction output of the initiating transaction in the target distributed ledger ~~and references~~ after referencing the locking transaction in the source distributed ledger to verify existence of the locking transaction;

wherein the source distributed ledger is different from the target distributed ledger.

12. The computer program product of claim 11, wherein the transaction output of the initiating transaction is only spendable by the completing transaction when the completing transaction references the locking transaction and when a value of the transaction output of the initiating transaction matches a value of the transaction output of the existing transaction.

13. The computer program product of claim 12, wherein the locking transaction uses a Merkle tree reference to reference the initiating transaction or the completing transaction uses another Merkle tree reference to reference the locking transaction.

~~14. A system with cross-ledger transfers between multiple distributed ledgers for highly-scalable transaction throughput, the system comprising:~~

~~a plurality of distributed ledger networks, each said distributed ledger network comprising a plurality of local nodes and communicative connections therebetween; and~~

~~internetwork connections between the plurality of distributed ledger~~

~~networks;~~

~~wherein a distributed ledger network that maintains a local distributed ledger includes a plurality of foreign payment verification nodes co-located with the local nodes of each said distributed ledger network for other distributed ledgers.~~

~~15. The system of claim 14, wherein the foreign payment verification nodes are used for inter-ledger verification of cross-ledger transactions between a source distributed ledger and a target distributed ledger, which are respectively maintained by a source distributed ledger network and a target distributed ledger network;~~

~~wherein the source distributed ledger is different from the target distributed ledger.~~

~~16. The system of claim 14, further comprising, at each said foreign payment verification node:~~

~~a block header/signature chain that includes block headers and block signatures for a foreign distributed ledger; or~~

~~an index of block hashes to the block headers in the block header/signature chain.~~

~~17. The system of claim 15, wherein verification of existence of a locking transaction in the source distributed ledger is necessary for a completing transaction in the target distributed ledger to spend a transaction output of an initiating transaction in the target distributed ledger.~~

~~18. The system of claim 14, wherein said co-location of the local node and the~~

~~foreign payment verification nodes is implemented by a computer apparatus with one or more processors that includes a local node-stack of the local distributed ledger and foreign payment verification node-stacks of the other distributed ledgers in the system.~~

~~19. A system with cross-ledger transfers between a plurality of distributed ledgers for highly-scalable transaction throughput, the system comprising:~~

~~a plurality of distributed ledger networks, each said distributed ledger network comprising a plurality of local nodes and communicative connections therebetween; and~~

~~a set of shared nodes shared by the plurality of distributed ledger networks, wherein nodes in the set provide, among other services, inter-ledger verification of transactions.~~

~~20. The system of claim 19, wherein each shared node has the local distributed ledgers differing from each other and maintained by at least two of the plurality of distributed ledger networks for the inter-ledger verification of cross-ledger transactions between a source distributed ledger and a target distributed ledger, which are respectively maintained by a source distributed ledger network and a target distributed ledger network of the plurality of local distributed ledger networks;~~

~~wherein the source distributed ledger is different from the target distributed ledger.~~

~~21. The system of claim 19, further comprising, at each said shared node:~~

~~an index of block hashes to block headers for each of the plurality of~~

~~distributed ledgers.~~

~~22. The system of claim 19, wherein each said shared node comprises a computer apparatus which comprises local node-stacks of said at least two different distributed ledger networks.~~

~~23. The system of claim 19, wherein each said shared node comprises a computer apparatus which comprises local node-stacks of all of the plurality of distributed ledger networks.~~

~~24. The system of claim 20, wherein an existing transaction in a source distributed ledger contains a transaction output whose digitally-represented economic value is to be transferred to a target distributed ledger.~~

~~25. The system of claim 24, wherein a locking transaction spends the transaction output of the existing transaction, and wherein verification of the existence of the locking transaction in the source distributed ledger is necessary for a completing transaction in the target distributed ledger to spend a transaction output of an initiating transaction in the target distributed ledger.~~

~~26. A computer apparatus for cross-ledger transfers between a plurality of distributed ledgers for scalable transaction throughput, the computer apparatus comprising:~~

~~memory for holding computer-readable code and data;~~

~~one or more processors for executing said computer-readable code so as to~~

~~modify said data;~~

~~computer-readable code for a local node-stack for a target distributed ledger of the plurality of distributed ledgers; and~~

~~computer-readable code for a foreign payment verification node-stack for a source distributed ledger of the plurality of distributed ledgers,~~

~~wherein the local node-stack is configured to use the foreign payment verification node-stack to verify inter-ledger transactions for a cross-ledger transfer of a digitally-represented economic value between the target and source distributed ledgers, which are respectively maintained by a source distributed ledger network and a target distributed ledger network;~~

~~wherein the source distributed ledger is different from the target distributed ledger.~~

~~27. The computer apparatus of claim 26, further comprising, at the foreign payment verification node-stack:~~

~~a block header/signature chain that includes block headers and block signatures for the source distributed ledger; or~~

~~an index of block hashes to the block headers in the block header/signature chain.~~

~~28. The computer apparatus of claim 26, wherein the locking transaction comprises at least one intra-ledger transaction input, one cross-ledger reference transaction input, and zero or more transaction outputs and the initiating transaction comprises no transaction inputs and one transaction output.~~

~~29. The computer apparatus of claim 26, wherein the local node-stack is required, prior to constructing a completing transaction which spends a transaction output of an initiating transaction in the target distributed ledger, to verify existence of the locking transaction in the source distributed ledger and match a value of the transaction output of the initiating transaction against the value spent by the locking transaction.~~

~~30~~14. A computer apparatus for cross-ledger transfers between a plurality of distributed ledgers for scalable transaction throughput, the computer apparatus comprising:

memory for holding computer-readable code and data;

computer-readable code configured to determine an existing transaction in a source distributed ledger of the plurality of distributed ledgers which has a transaction output that is unspent ;

computer-readable code configured to generate and submit an initiating transaction for commission to a target distributed ledger of the plurality of distributed ledgers, wherein the initiating transaction has a transaction output;

computer-readable code configured to generate and submit a locking transaction for commission to the source distributed ledger, wherein the locking transaction is generated to spend and lock the transaction output of the existing transaction in the source distributed ledger and reference the initiating transaction in the target distributed ledger to verify existence of the initiating transaction; and

computer-readable code configured to generate and submit a completing transaction for commission to the target distributed ledger, wherein the completing transaction is generated to spend the transaction output of the initiating transaction

in the target distributed ledger and reference the locking transaction in the source distributed ledger to verify existence of the locking transaction;

wherein the source distributed ledger maintained by a source distributed ledger network is different from the target distributed ledger maintained by a target distributed ledger network.

~~31~~15. The apparatus of claim ~~30~~ 14, wherein the transaction output of the initiating transaction is only spendable by the completing transaction when the completing transaction references the locking transaction and when a value of the transaction output of the initiating transaction matches a value of the transaction output of the existing transaction.