CLAIMS

1. A computer-implemented method for processing blockchain data under a trusted execution environment (TEE), the computer-implemented method comprising:

receiving, by a blockchain node, a request to execute one or more software instructions in a TEE executing on the blockchain node;

determining, by a virtual machine in the TEE, data associated with a plurality of blockchain accounts to execute the one or more software instructions based on the request, wherein the data associated with the plurality of blockchain accounts are key-value pairs (KVPs), and an internal cache hash table stores the KVPs associated with frequently accessed storage contents of a plurality of accounts of a blockchain, wherein the plurality of blockchain accounts comprise one or more of externally owned accounts or contract accounts;

traversing, by the virtual machine, the internal cache hash table stored in the TEE to determine a first portion of the KVPs included in the internal cache hash table and a second portion of KVPs that is not included in the internal cache hash table;

traversing, by the blockchain node, an external cache hash table through direct memory access to determine that the second portion of the KVPs is included in the external cache hash table;

in response to determining that the first portion of the KVPs is included in the internal cache hash table and the second portion of the KVPs is included in the external cache hash table, executing, by the virtual machine, the one or more software instructions by retrieving the first portion of the KVPs from the internal cache hash table and by retrieving the second portion of the KVPs from the external cache hash table;

updating, by the blockchain node, the external cache hash table in response to executing the one or more software instructions; and

synchronizing, by the blockchain node, the external cache hash table with a global state of a blockchain stored in a database separate from the TEE , wherein the global state comprises a mapping between addresses and states of the plurality of blockchain accounts of the blockchain, and wherein each of the contracts accounts comprises a storage root and wherein the storage root comprises a hash of a root node of a Merkle Patricia tree (MPT), and wherein the MPT encodes hash of storage contents of a respective contract account.

2. The computer-implemented method of claim 1, wherein the external cache hash table stores the KVPs associated with states and storage content of frequently accessed accounts of the blockchain.

3. The computer-implemented method of any of the preceding claims, further comprising:

executing, by the virtual machine, the one or more software instructions by retrieving the at least a portion of the KVPs from the global state, if the second portion of the KVPs are not included in the internal cache hash table or the external cache hash table; and

updating, by the blockchain node, the global state in response to executing the one or more software instructions.

4. The computer-implemented method of any of the preceding claims, wherein the global state is stored in the database outside of an enclave as the MPT.

5. The computer-implemented method of any of the preceding claims, wherein each of the states of the plurality of blockchain accounts comprises a nonce representing a number of transactions sent from a respective account address.

6. The computer-implemented method of any of the preceding claims, wherein the MPT comprises one or more branch nodes and leaf nodes that store contract data or variables.

7. A system for processing blockchain data under a TEE, comprising:

one or more processors; and

one or more computer-readable memories coupled to the one or more processors and having instructions stored thereon which are executable by the one or more processors to perform the computer-implemented method of any of claims 1-6.

8. An apparatus for processing blockchain data under a TEE, the apparatus comprising a plurality of modules for performing the computer-implemented method of any one of claims 1-6.