CLAIMS

1. A storage system comprising:

a multi-tier storage subsystem comprising a plurality of tiers of storage devices;

an input/output (I/O) subsystem comprising:

one or more first processors; and

one or more first computer-readable memories coupled to the one or more first processors and having first instructions stored thereon that are executable by the one or more first processors to perform first operations comprising:

receiving blockchain data generated by a blockchain network, wherein the blockchain data comprise one or more types of data comprising blockchain block data, blockchain transaction data, and blockchain state data, wherein the blockchain block data comprise at least one block in a blockchain and a hash value of a previous block in the blockchain, and the blockchain state data comprise a world state of the blockchain network;

performing a write operation of the blockchain data into a data log file, wherein the data log file is an append-only file that stores the blockchain data and the data log file is stored in one of the plurality of tiers of storage devices, wherein performing the write operation comprises appending the blockchain data in a chronological order according to a time when the blockchain data are generated by the blockchain network; and

in response to determining a seal condition is met, sealing the data log file and refraining from writing additional blockchain data into the data log file, wherein the seal condition comprises a predetermined threshold of writing into the data log file; and

a back-end data management subsystem comprising:

one or more second processors; and

one or more second computer-readable memories coupled to the one or more second processors and having second instructions stored thereon that are executable by the one or more second processors to perform second operations comprising performing a management operation of the data log file that stores the blockchain data, wherein

performing the management operation of the data log file comprises performing the management operation of the data log file by the back-end data management subsystem independently from performing the write operation by the I/O subsystem, by performing the management operation, by the back-end data management subsystem, of the data log file after the data log file is sealed;

wherein the first operations further comprise:

generating, by the I/O subsystem, an index that indicates a physical location of the data log file stored in the one of the plurality of tiers of storage devices;

storing, by the I/O subsystem, the index into an index log file that is stored in one of the plurality of tiers of storage devices that has a fastest access speed among the plurality of tiers of storage devices; and

in response to determining a second seal condition is met, sealing, by the I/O subsystem, the index log file and refraining from writing additional index data into the index log file, wherein the second seal condition comprises a second predetermined threshold of writing into the index log file; and

wherein the second operations further comprise:

performing, by the back-end data management subsystem, a management operation of the index log file after the index log file is sealed; and

generating, by the back-end data management subsystem, a second index log file indicating location information of the data log file after performing the management operation of the data log file after the data log file is sealed.

2. The storage system of claim 1, wherein: the plurality of tiers of storage devices comprise a plurality of tiers of storage devices that have different access speeds; and the second operations comprise migrating the data log file stored in the one of the plurality of tiers of storage devices into another one of the plurality of tiers of storage devices.

3. The storage system of claim 1, wherein the plurality of tiers of storage devices comprise one or more of: a cloud disk, a network attached storage (NAS) device, or an object storage service (OSS) device.

4. The storage system of claim 1, wherein the management operation comprises one or more of tiering, compaction, compression, erasure coding, or snapshot.

5. The storage system of claim 1, wherein the first operations further comprise importing, by the I/O subsystem, the second index log file generated by the back-end data management subsystem.

6. The storage system of claim 1, wherein the storage system is implemented by each consensus node of the blockchain network.

7. The storage system of claim 1, wherein the storage system is connected to a distributive storage system built by a client node of the blockchain network.

8. A network node of a blockchain network comprising a storage system of any one of claims 1 to 7.

9. A blockchain network comprising:

a plurality of consensus nodes, wherein each of the plurality of consensus nodes comprises a storage system of any one of claims 1 to 7.