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Blockchain and distributed ledger technology - Interoperability - Part 1: General technical specification for cross-chain operation

区块链和分布式记账技术 互操作 第1部分：跨链通用技术规范

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5.1 Functional Technical Requirements for Cross-Chain Interoperability Components

5.1.1 Overview The inter-chain interoperability components consist of a network module, a storage module, a verification module, a certificate module, a permission module, a transaction management module, and a consensus management module. Module composition. Each module may be located within a single physical unit or distributed across different physical units.

5.1.2 Network Module The network module provides network communication functionality for interoperable components. The network module should meet the following requirements.

a) Supports establishing secure and encrypted network channel links;

b) Supports data exchange between inter-chain interoperability components and blockchains, and between inter-chain interoperability components themselves;

c) Supports reconnection upon failure;

d) Supports one or more functions. network access to different blockchain systems, supports receiving business transactions from different blockchain applications, etc. It supports format conversion of transactions from different blockchain systems and facilitates cross-chain transaction transmission.

5.1.3 Storage Module The storage module provides storage functionality for interoperable components. The storage module should meet the following requirements.

a) Store cross-chain configuration information, cross-chain startup data, cross-chain transaction execution status, system operation logs, system certificates, and cross-chain proof documents;

b) Supports encrypted storage of cross-chain transaction data in ledger mode; the ledger cannot be modified or deleted.

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c) Supports querying, modifying, and deleting stored status information;

d) Supports storing cross-chain smart contract information and cross-chain transaction list information, including cross-chain transactions to be executed and completed cross-chain transactions. Easy, cross-chain transactions await retry, etc.

5.1.4 Verification Module The verification module provides verification functionality for interoperable components. The verification module should meet the following requirements.

a) Supports the verification of the legitimacy of cross-chain transactions, such as parameter checking, permission checking, relay signature verification, and confirmation of transaction execution results;

b) Supports authentication of message identity and validity.

5.2 Performance Technical Requirements

5.2.1 Consistency Cross-chain communication should meet the following consistency requirements.

a) Ensure transaction consistency throughout the entire cross-chain transaction process;

b) Supports a transaction timeout handling mechanism to roll back transactions when they time out and fail to meet consistency requirements;

c) Supports real-time or periodic transaction inspection mechanisms;

d) Allow third-party intervention to ensure transaction consistency when transaction rollback fails.

5.2.2 Network Connectivity Inter-chain interoperability components should function normally when network service quality requirements (round-trip latency, packet loss rate) meet Internet access quality.

5.2.3 Concurrency Cross-chain operations should meet the following concurrency performance requirements.

a) Supports inter-chain interoperability components in receiving concurrent blockchain requests;

b) Support inter-chain interoperability components to receive concurrent requests from other inter-chain interoperability components.

5.2.4 Availability The availability requirements for cross-chain communication are as follows:

a) Automatic rollback should be supported in the event of a failure in the inter-chain interoperability component;

b) It should support no single-node failures and can adopt multi-active or load balancing methods;

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c) Automatic backup of cross-chain transaction data and configurations should be supported;

d) It should support data backup and enable rapid recovery of the business environment in the event of system failure using backup data;

6.1 Functional Testing of Cross-Chain Inter-Chain Interoperability Components

6.1.1 Network Module The testing methods for network modules are shown in Table 1.

6.1.2 Storage Module The testing methods for the storage module are shown in Table 2.

6.1.3 Verification Module The testing methods for the verification module are shown in Table 3.

6.1.4 Certificate Module The testing methods for the certificate management module are shown in Table 4.

6.1.5 Access Control Module The testing methods for the permission management module are shown in Table 5.

6.1.6 Trading Module The testing methods for the transaction module are shown in Table 6.

6.1.7 Consensus Management Module The testing methods for the consensus management module are shown in Table 7.

6.2 Performance Testing of Cross-Chain Inter-Chain Interoperability Components

6.2.1 Consistency The consistency testing methods are as shown in Table 8.

6.2.2 Network Connectivity The testing methods for network connectivity are shown in Table 9.

6.2.3 Concurrency The testing methods for concurrency are shown in Table 10.

6.2.4 Availability Usability testing methods are shown in Table 11.

6.2.5 Access Control Security The testing methods for access control security are shown in Table 12.

6.2.6 Access Security The testing methods for access security are shown in Table 13.

6.2.7 Data Security The testing methods for data security are shown in Table 14.

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