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**Information technology - Big data - Functional testing
requirements for storage and processing systems**

信息技术 大数据

存储与处理系统功能测试要求

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Table of Contents

Foreword.....	3
1 Scope.....	4
2 Normative references.....	4
3 Terms and definitions	4
4 Abbreviations	4
5 Overview	5
6 Functional testing requirements for big data storage subsystems	5
6.1 Testing requirements for basic functions	5
6.2 Functional testing requirements for distributed file storage	6
6.3 Functional testing requirements for distributed structured data storage.....	7
6.4 Functional testing requirements for distributed columnar data storage	8
6.5 Functional testing requirements for distributed graph data storage	8
7 Functional testing requirements for big data processing subsystems	9
7.1 Testing requirements for basic functions	9
7.2 Functional testing requirements for batch processing framework	10
7.3 Functional testing requirements for stream processing framework	11
7.4 Functional testing requirements for graph computing framework.....	12
7.5 Functional testing requirements for memory computing framework.....	12
7.6 Functional testing requirements for batch-stream fusion computing framework	13

Information technology - Big data - Functional testing requirements for storage and processing systems

1 Scope

This Standard specifies the testing requirements for basic functions, distributed file storage, distributed structured data storage, distributed columnar data storage, distributed graph data storage, batch processing framework, stream processing framework, graph computing framework, memory computing framework, and batch-stream fusion computing framework of big data storage and processing systems.

This Standard applies to the testing of big data storage and processing systems.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (including all the amendments) are applicable to this document.

GB/T 37722-2019 Information technology - Technical requirements for big data storage and processing systems

3 Terms and definitions

The terms and definitions defined in GB/T 37722-2019 are applicable to this document.

4 Abbreviations

The following abbreviations apply to this document.

API: Application Programming Interface

CPU: Central Processing Unit

DAG: Directed Acyclic Graph

GPU: Graphics Processing Unit

structured data, semi-structured data, and unstructured data that exist in big data storage subsystems; test whether the operations are performed normally;

- i) It shall be tested whether big data storage subsystems can read data from the message queue and write the calculation results to the database in real time;
- j) It shall be tested whether big data storage subsystems can collect data to the real-time retrieval platform, and perform real-time query based on the primary index key.

Note: The testing requirements in this clause correspond to the requirements in 6.1 of GB/T 37722-2019.

6.2 Functional testing requirements for distributed file storage

The functional testing requirements for distributed file storage are as follows:

- a) It shall be tested whether big data storage subsystems can perform file upload, download, read-write, copy, move, deletion, access control and other operations;
- b) It shall be tested whether big data storage subsystems can back up multiple copies of files and recover the original data through the copies;
- c) It shall be tested that when the big data storage subsystem node/software fails, such as power failure, data node failure, etc., it will not affect the normal operation of the system and business;
- d) It shall write to the copy file, and then check the block check file, to verify that the block check file of the node where the copy file is located is the same;
- e) It shall be tested that before deleting a node, a single data node first exits the service cluster; cluster data is redistributed; data is not damaged; and business is not interrupted;
- f) It shall be verified that after a node is added, the node joins the cluster; the system data is redistributed; and the business is not interrupted;
- g) It shall be tested that according to the configured compression and encryption algorithms, the data is compressed, encrypted and decrypted, the original data will be not damaged or lost;
- h) It shall be tested whether big data storage subsystems can perform unified retrieval, cataloging, adding and deleting operations on file data;

6.4 Functional testing requirements for distributed columnar data storage

The functional testing requirements for distributed columnar data storage are as follows:

- a) It shall create a table, write data, to test data can be stored in big data storage subsystems in the form of key value.
- b) It shall set user permissions for tables, column families, and columns respectively, including read, write, and create, etc., to test whether the corresponding users can create, read, and write tables, column families, and columns.
- c) It shall encrypt the specified column, create a table, and write data. Test whether the attributes of the table are column encrypted and whether the data is stored in non-plain text.
- d) It shall be tested whether big data storage subsystems can back up and restore database objects including tables, indexes, functions, triggers, etc.; test the progress and history of data backup and restoration tasks.
- e) It shall import data in batches, create secondary indexes when importing; to test whether big data storage subsystems can query the imported data through indexes.
- f) It shall construct multiple tables and import data, to test whether the contents of the tables merged by big data storage subsystems according to the association rules/relationships are consistent with expectations.

Note: The testing requirements in this clause correspond to the requirements in 6.4 of GB/T 37722-2019.

6.5 Functional testing requirements for distributed graph data storage

The functional testing requirements for distributed graph data storage are as follows:

- a) It shall define the graph data model, upload data files and graph rule mapping files, to test whether the queried graph data is consistent with the defined data model;
- b) It shall write/import graph data to test whether it is possible to query, traverse, and analyze graph data;
- c) It shall be tested whether big data storage subsystems can, through the graph database development interface, perform operations such as metadata management, graph data management;

- f) It shall test the dynamic resource scheduling strategy of task, check the changes in the resource occupation during the task operation;
- g) It shall create a first-level tenant, to test whether it is possible to create multiple levels of sub-tenants under it, configure the upper limit of resource usage for it; the sum of resources of each level of sub-tenants does not exceed the parent tenant;
- h) It shall create a first-level tenant A and tenant B, respectively allocate a certain amount of resources, specify tenant A to submit tasks; the task occupying resources far exceeds its configured resource capacity; to test whether the task can be successfully submitted, and whether the resources of tenant B can be reduced. Then specify tenant B to submit tasks; the task occupies resources for its full allocation; to test whether the task can be submitted successfully, and whether the resources of tenant A can be reduced;
- i) It shall submit the tasks of various distributed computing frameworks at the same time, to test whether the tasks can be successfully executed;
- j) It shall construct task A and task B, with the output of A being the input of B, submit task A and task B, to test whether A and B can be automatically scheduled according to the dependency;
- k) It shall submit the task, to view the changes in its resource occupation; after the task is completed, the task's resource occupation shall be checked again; to test whether big data processing subsystems can dynamically allocate computing resources according to job requirements, and automatically manage and recycle resources;
- l) It shall submit multiple tasks; these tasks are topologically sorted in a non-loop directed graph; to test whether the tasks can be automatically scheduled according to the topological results;
- m) It shall submit a complex task, to test whether the amount of CPU and memory scheduled by big data processing subsystems for different subtasks is different.

Note: The testing requirements in this clause correspond to the requirements in 7.1 of GB/T 37722-2019.

7.2 Functional testing requirements for batch processing framework

The functional testing requirements for batch processing framework are as follows:

- a) It shall create tables for the data by creating structured and unstructured

- e) It shall create a message processing task, construct abnormalities such as nodes and processes in the process of message processing, to test whether the messages on abnormal nodes will be redistributed to other normal nodes and processes for processing.

Note: The testing requirements in this clause correspond to the requirements in 7.3 of GB/T 37722-2019.

7.4 Functional testing requirements for graph computing framework

The functional testing requirements for graph computing framework are as follows:

- a) It shall read the graph data through the API to find the attributes of a certain edge/point, to test whether the results are consistent with expectations;
- b) It shall be tested whether big data processing subsystems provide tools/command lines/graphical interfaces for full import and incremental import of data to define the import;
- c) It shall be tested whether big data processing subsystems support analysis and query of real-time graph data;
- d) It shall define the graph data model, upload data files and graph rule mapping files (tags and attributes on nodes/edges), to test whether the file upload is successful;
- e) It shall be tested whether big data processing subsystems support the built-in common graph indicator calculation function, such as counting the number of points and edges, etc.;
- f) It shall use tools to pressurize, to test whether big data processing subsystems can automatically allocate the added graph data calculation and query services to different nodes;
- g) It shall initiate the graph database query request by simulating multiple clients, to test whether the corresponding data result can be queried.

Note: The testing requirements in this clause correspond to the requirements in 7.4 of GB/T 37722-2019.

7.5 Functional testing requirements for memory computing framework

The functional testing requirements for memory computing framework are as follows:

- a) It shall in a distributed computing environment, test the function of

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