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**Intelligent computing - Test methods for graph computing
performance**

智能计算 图计算性能测试方法

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Table of Contents

- 2 Normative references
- 5 Test Objects and Test Metrics
 - 5.2 Test Indicators
 - 5.2.1 Graph Query System
- 6 Test Requirements
 - 6.1 General Requirements
 - 6.1.1 Test Environment
 - 6.2 Graph Query
 - 6.3 Graphical Analysis
 - 6.4 Graph Learning
- 7 Testing Process
 - 7.1 Graph Query System
 - 7.1.1 Response timeliness and throughput
 - 7.1.2 Storage Usage
 - 7.1.3 Extensibility
 - 7.2 Graph Analysis System
 - 7.2.1 Algorithm Execution Time
 - 7.2.2 Storage Usage
 - 7.2.3 Extensibility

2 Normative references

This document has no normative references.

4. Abbreviations The following abbreviations apply to this document. CPU. Central Processing Unit GPU. Graphics Processing Unit I/O. Input/Output JDK. Java Development Kit SDK. Software Development Kit SF. Scale Factor

5 Test Objects and Test Metrics

5.1 Test Object The test subjects include graph query systems, graph analysis systems, and graph learning systems.

5.2.1 Graph Query System

a) Throughput Throughput represents the number of query requests that a graph query system can process per unit of time, and is used to measure the overall throughput of a graph query system. Processing capacity. Calculated according to formula (1).

5.2.2 Graph Analysis System The performance test of the graph analysis system includes the following metrics.

a) Algorithm running time Algorithm runtime represents the time consumed by a graph analysis system to execute a specified graph analysis algorithm on a selected test dataset and obtain results. The time interval is used to measure the efficiency of the graph analysis system in handling graph analysis tasks. It is calculated according to formula (5).

5.2.3 Graph Learning System The performance test of a graph learning system includes the following metrics.

a) Model effect Model performance indicates the quality of the model obtained after the graph learning system completes the graph learning training task. Depending on the task type, the model performance varies. The performance indicators of the different models vary. 1) For classification tasks, the model performance metrics include precision, recall, and F1 score, which are calculated according to formulas (6) to (8), respectively.

6.1.1 Test Environment

6.1.1.1 Test Environment Components The test environment should include the system under test, the test-driven system, the test network, and test auxiliary tools, the components of which are as follows:

- a) The system under test. the graph query system, graph analysis system, or graph learning system to be tested;
- b) Test-Driven System. This includes the test load (data), the test driver that loads the test load to perform performance testing on the system under test, and... The software and hardware environment required for its operation;
- c) Test Network. Consists of network devices and their configurations used to build the test network environment;
- d) Test support tools. including various tools that support the testing process, such as data import, monitoring and logging, and data analysis.

6.1.1.2 Comparability of Test Environments The hardware and software environments of different systems under test should be kept consistent to ensure the comparability of test results. When the consistency of the hardware environment of the system under test cannot be guaranteed, the computational costs of the system under test should be disclosed to facilitate the evaluation of its performance-price ratio. Node quantity information and compute node hardware and software configuration information, wherein the compute node hardware and software configuration information of the tested system should specifically

include the following. aspect.

a) Software configuration information. 1) Operating system type and version information; 2) JDK version information (if applicable); 3) MySQL version information (if applicable).

b) Hardware configuration information. 1) CPU information, including model, number of cores, and clock speed; 2) Memory information, including capacity and type; 3) Hard drive information, including type, capacity, and interface type; 4) Network interface card (NIC) information, including model and bandwidth; 5) Switch information, including model and switching capacity; 6) GPU information (if applicable), including model, number of cores, computing power, and interface type; 7) Video memory information (if applicable), including capacity, type, and bandwidth; 8) Information on dedicated chips (if applicable), including model and main performance parameters.

6.1.2 Test Prerequisites Before conducting formal performance testing, the functionality of the system under test should be verified.

6.2 Graph Query

6.2.1 Test Code The system under test should preferably use a query language that can flexibly express query objectives. The code written for graph query performance testing should be disclosed, including... This includes, but is not limited to, query languages, SDKs, and drivers.

6.2.2 Test Dataset The test dataset used for performance testing should be divided into two parts. One part should be loaded into the graph query system in batches before performance testing to serve as the base dataset. The basic data, which should comprise at least 80% of the total dataset, and the remaining portion, used as test load data during performance testing, constitute the other part. The dataset should not exceed 20% of the total dataset. The test dataset should also meet the following requirements.

a) The test dataset is constructed and generated based on a representative real-world graph application data model. The dataset simulates real-world application scenarios. The data status during typical time periods in the scene reflects the characteristics of real-world scene data, including data volume, percentage of various types of vertices, etc. Attribute values, relationship distribution, and typical query load patterns, etc.

b) The test dataset is scalable, capable of generating test datasets of different sizes based on different SF values to adapt to different requirements. A graph query system for models.

6.2.3 Test-Driven Test-driven testing is used for process control at various stages of testing, such as result verification and performance testing, and should meet the following requirements.

a) It includes modules for data loading, load generation, result statistics, result verification, and report generation;

- b) It has functions such as result correctness verification and performance stress testing;
- c) It has parameter configuration functions, which can be used to adjust the test load pressure, load mixing ratio, and test duration. Adjustment;

Note. Load mixing ratio refers to the ratio of different types of operations in the test load, such as the ratio of read and write operations, or the ratio of operations with different query complexities.

- d) Supports loading test load data as input for graph queries;
- e) Supports various query runtime statistics during performance stress testing and provides an automatic test report generation function;
- f) Provides a good integration interface to facilitate quick access by the system under test.

6.2.4 Test Load Test loads used for performance testing should include various query operations targeting points, edges, attributes, and matching rules. Complex queries within the load are also important. Simple queries, as well as the ratio, order, and time interval of read and write operations, should simulate real-world application scenarios.

6.3 Graphical Analysis

6.3.1 Test Code The system under test should provide a test-specific interface or executable program that can be invoked through the test driver. The code written for test driver invocation... The code should be disclosed.

6.3.2 Test Dataset The test dataset serves as the foundational data for loading into the graph analysis system for algorithm testing and meets the following requirements.

- a) The test dataset should use representative real-world or generated graph data, and should reflect the characteristics of real-world scene data;
- b) The test dataset should include graph topology data and preferably include the correct execution results of the test algorithm to verify the graph algorithm of the system under test. Is the result of the operation correct?

6.3.3 Test Algorithm The test algorithm is a benchmark used to test the functionality of the basic operator model contained in the system under test, and should meet the following requirements.

- a) Supports graph traversal algorithms;
- b) Supports path lookup algorithms;
- c) Supports importance analysis algorithms;
- d) Supports community detection algorithms;
- e) Supports correlation analysis algorithms;