

TPC-H Benchmark Workflow

In the following, the steps need to be taken (according to [1]) in order to perform the TPC-H Benchmark are described in a nutshell.

1. Perform a Load Test, which checks how long the database engine takes to completely create the database, i.e. to populate the tables and create the indexes for primary and foreign keys, as well as for the columns of date type. All the data are generated by DBGEN script along with a predefined Scale Factor (SF) by the user. A SF of 0.1 means that DBGEN will create a dataset with size of 100MB, while a SF of 1 will create a dataset with size of 1GB.

Table Name	Number of Rows
Region	5
Nation	25
Supplier	10,000 × SF
Customer	150,000 × SF
Part	200,000 × SF
Partsupp	300,000 × SF
Orders	1,500,000 × SF
Lineitem	6,000,000 × SF

2. Perform the Performance Test, which is composed of two runs:

2.1. *Power Test*: aims at measuring how fast can the system compute the answer to a query stream by sequentially running each one of the 22 standard queries of TPC-H. It also includes two refresh functions, i.e., update procedures.

Power Test Workflow:

- (i) execution of a refresh function 1;
- (ii) execution of the query stream (by sequentially running the 22 queries);
- (iii) execution of a refresh function 2;

2.2. *Throughput Test*: it is used to demonstrate the performance of the system against a multi-user workload, possibly taking advantage of I/O and paralelism.

(i) For 1GB of data, two query stream sessions must be executed in parallel. For 10GB, three sessions; for 30GB, four sessions and for 100GB, five sessions.

3. In the end of the process, there will be four types of performance metrics (evaluated in seconds):

- (i) the database load time (L_s);
- (ii) the measurement interval (T_s), i.e. the amount time needed to execute the throughput test;

- (iii) the time interval $QI(i,s)$, i.e. the execution time for the query Q_i within the query stream s , where $1 \leq i \leq 22$.
- (iv) the time interval $RI(j,s)$, which represents the execution time for the refresh function RF_j within a refresh stream s , where $1 \leq j \leq 2$.

4. The QphH@Size metric

Timing measurements results must be somewhat combined to produce global, comparable metrics. Thus, TPC-H has defined a primary performance metric indexed by the database size: the *query-per-hour performance metric* (QphH@Size), where *size* represents the size of the database. E.g. QphH@Size 1GB. QphH@Size is defined by Equation 1:

$$QphH@Size = \sqrt{Power@Size \times Throughput@Size} \quad (1)$$

Where $Power@Size$ and $Throughput@Size$ are defined by Equations 2 and 3, respectively.

$$Power@Size = \frac{3600}{\sqrt[24]{\prod_{i=1}^{22} QI(i,0) \times \prod_{j=1}^2 RI(j,0)}} \times SF \quad (2)$$

$$Throughput@Size = \frac{S \times 22}{T_s} \times 3600 \times SF \quad (3)$$

REFERENCES

[1] Thanopoulou, Anna, Paulo Carreira, and Helena Galhardas. "Benchmarking with TPC-H on off-the-shelf hardware." ICEIS (1) (2012): 205-208.

APPENDIX - TPC-H REFRESH FUNCTIONS

Refresh Function 1

```

LOOP (SF * 1500) TIMES
  INSERT a new row into the ORDERS table
  LOOP RANDOM(1, 7) TIMES
    INSERT a new row into the LINEITEM table
  END LOOP
END LOOP

```

Refresh Function 2

```

LOOP (SF * 1500) TIMES
  DELETE FROM ORDERS WHERE O_ORDERKEY = [value]
  DELETE FROM LINEITEM WHERE L_ORDERKEY = [value]
END LOOP

```