



**SECP 3713 (01) – DATABASE ADMINISTRATION**

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**The Transaction Processing Performance Council (TPC)**

**GROUP MEMBERS**

| NAME                         | MATRIC NO. |
|------------------------------|------------|
| MADINA SURAYA BINTI ZHARIN   | A20EC0203  |
| ADRINA ASYIQIN BINTI MD ADHA | A20C0174   |

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## Transaction Processing

Online Transaction Processing Benchmark (OLTP) contains multiple transaction types with more complex databases and overall execution structure.

There are a total of 20 TPC benchmarks

### 1. TPC - C

The transactions being measured in transactions per minute (tpmC).

For instance, the activity of wholesale suppliers such as managing, selling, or distributing a product or service.

### 2. TPC - E

TPC-E involves a mix of twelve concurrent transactions of different types and complexity, either executed on-line or triggered by price or time criteria

### 3. TPC - DI

Data Integration (DI), also known as ETL, is the analysis, combination, and transformation of data from a variety of sources and formats into a unified data model representation. Data Integration is a key element of data warehousing, application integration, and business analytics.

### 4. TPC-H

Decision support systems that examine large volumes of data, execute queries with a high degree of complexity, and give answers to critical business questions. Multiple aspects of the capability of the system to process queries. It includes selected database size against which the queries are executed, the query processing power when queries are submitted by a single stream, and the query throughput when queries are submitted by multiple concurrent users.

## 5. TCP-DS

Measures query response time in single user mode, query throughput in multi user mode and data maintenance performance for a given hardware, operating system, and data processing system configuration under a controlled, complex, multi-user decision support workload.

## 6. TPCx-V (Express Benchmark V)

Measures the performance of a virtualized server platform under a demanding database workload. It stresses CPU and memory hardware, storage, networking, hypervisor, and the guest operating system. TPCx-V workload is database-centric and models many properties of cloud services, such as multiple VMs running at different load demand levels, and large fluctuations in the load level of each VM. Unlike previous TPC benchmarks, TPCx-V has a publicly-available, end-to-end benchmarking kit, which was developed specifically for this benchmark. It loads the databases, runs the benchmark, validates the results, and even performs many of the routine audit steps. Another unique characteristic of TPCx-V is an elastic workload that varies the load delivered to each of the VMs by as much as 16x, while maintaining a constant load at the host level.

## 7. TPCx-HCI (Express Benchmark HCI)

Measures the performance of Hyper-Converged Infrastructure clusters under a demanding database workload. The TPCx-HCI workload is database-centric and models many properties of cloud services, such as multiple VMs running at different load demand levels, and large fluctuations in the load level of each VM.

Unique characteristics:

- a. It has an elastic workload that varies the load delivered to each of the VMs by as much as 16x, while maintaining a constant load at the cluster level.
- b. A node is powered down ungracefully, and the benchmark continues to run on the other nodes.

## 8. TPCx-HS

The Hadoop ecosystem is moving fast beyond batch processing with MapReduce. Introduced in 2016 TPCx-HS V2 is based on TPCx-HS V1 with support for Apache Spark - a popular platform for in-memory data processing that enables real-time analytics on Apache Hadoop. TPCx-HS V2 also supports MapReduce (MR2) and supports publications on traditional on premise deployments and clouds. The TPCx-HS v2 benchmark can be used to assess a broad range of system topologies and implementation methodologies in a technically rigorous and directly comparable, in a vendor-neutral manner.

## 9. TPCx-BB

Measures the performance of Hadoop-based Big Data systems systems. It measures the performance of both hardware and software components by executing 30 frequently performed analytical queries in the context of retailers with physical and online store presence. The queries are expressed in SQL for structured data and in machine learning algorithms for semi-structured and unstructured data. The SQL queries can use Hive or Spark, while the machine learning algorithms use machine learning libraries, user defined functions, and procedural programs.

## 10. TPCx-IoT

industry's first benchmark which enables direct comparison of different software and hardware solutions for IoT gateways. Positioned between edge architecture and the back-end data center, gateway systems perform functions such as data aggregation, real-time analytics and persistent storage. TPCx-IoT was specifically designed to provide verifiable performance, price-performance and availability metrics for commercially available systems that typically ingest massive amounts of data from large numbers of devices, while running real-time analytic queries.

## 11. TCPx-AI

The benchmark measures the performance of an end-to-end machine learning or data science platform. The benchmark development has focused on emulating the behavior of representative industry AI solutions that are relevant in current production data centers and cloud environments.

## 12. TPC-A

TPC-A measures performance in update-intensive database environments typical in on-line transaction processing applications. exercises the system components necessary to perform tasks associated with that class of on-line transaction processing (OLTP) environments emphasizing update-intensive database services. This benchmark uses terminology and metrics which are similar to other benchmarks, originated by the TPC and others. Such similarity in terminology does not in any way imply that results are comparable to benchmarks other than TPC Benchmark A.

## 13. TPC-App

TPC-App is an Application Server and web services benchmark. The workload is performed in a managed environment that simulates the activities of a business-to-business transactional application server operating in a 24x7 environment. TPC-App showcases the performance capabilities of application server systems.

## 14. TPC-B

TPC-B measures throughput in terms of how many transactions per second a system can perform. TPC-B demands that a system demonstrate they can meet the reliability and security features of the ACID (atomicity, consistency, isolation, durability) tests. In particular, there are three durability tests. One requires the removal of power (or memory) while the system is operating fully loaded with ongoing transactions. This causes the database manager to exercise its recovery functions when power (or memory) is restored. A second test requires the failure of a disk volume containing a portion of the database. Here again, the database manager is forced to restore the database to a consistent state.

The third test requires the failure of a logging or journaling device during transaction submittal, and of course the database manager must continue operating at the same stressful rate as in the performance runs.

#### 15. TPC-D

TPC-D represents a broad range of decision support (DS) applications that require complex, long running queries against large complex data structures. The TPC approved its fourth benchmark in April, 1995. It differs from the existing benchmarks which focus on light and midweight customer oriented transactions. TPC-D represents a broad range of decision support (DS) applications that require complex, long running queries against large complex data structures.

#### 16. TPC-R

TPC-R is a business reporting, decision support benchmark. In which it allows additional optimizations based on advance knowledge of the queries. It consists of a suite of business oriented queries and concurrent data modifications. The performance metric reported by TPC-R is called the TPC-R Composite Query-per-Hour Performance Metric (QphR@Size), and reflects multiple aspects of the capability of the system to process queries. These aspects include the selected database size against which the queries are executed, the query processing power when queries are submitted by a single stream, and the query throughput when queries are submitted by multiple concurrent users. The TPC-R Price/Performance metric is expressed as \$/QphR@Size.

#### 17. TPC-VMS

This is a Data Virtualization Benchmark. The intent of TPC-VMS is to represent a Virtualization Environment where three database workloads are consolidated onto one server. Test sponsors choose one of the four benchmark workloads (TPC-C, TPC-E, TPC-H, or TPC-DS) and runs one instance of that benchmark workload in each of the 3 virtual machines (VMs) on the system under test. The 3 virtualized databases must have the same attributes, e.g. the same number of TPC-C warehouses, the same number of

TPC-E Load Units, or the same TPC-DS or TPC-H scale factors. The TPC-VMS Primary Performance Metric is the minimum value of the three TPC Benchmark Primary metrics for the TPC Benchmarks run in the Virtualization Environment.

#### 18. TPC-W

TPC-W is a transactional web e-Commerce benchmark. The workload is performed in a controlled internet commerce environment that simulates the activities of a business oriented transactional web server. The workload exercises a breadth of system components associated with such environments. TPC-W simulates three different profiles by varying the ratio of browse to buy: primarily shopping (WIPS), browsing (WIPSb) and web-based ordering (WIPSo). The primary metrics are the WIPS rate, the associated price per WIPS (\$/WIPS), and the availability date of the priced configuration.

#### 19. TPC-Pricing

TPC-Pricing is an add-on to other TPC benchmarks. Approved in February of 2005, TPC-Pricing is a consistent set of pricing procedures and methodologies for all TPC benchmarks. TPC Pricing includes various pricing methodologies and models to allow benchmark sponsors to produce verifiable prices for benchmarks executed on both physically acquired hardware and licensed compute services (Cloud).

#### 20. TPC-energy

TPC-Energy is an add-on to other TPC benchmarks, measuring the electrical energy required for a benchmark. The Energy Specification is a continuation of ongoing efforts to meet the needs of a rapidly changing industry. Customers will be able to go to the TPC Web site to identify systems that meet their price, performance and energy requirements. Systems that use less energy also have reduced cooling requirements. The reporting of energy metrics are optional to not restrict TPC benchmark publications and allow time for implementers to invest in required infrastructure. Competitive demands will encourage test sponsors to include energy metrics as soon as possible. TPC-Energy Measurement System (EMS) - a software package designed to help TPC Benchmark sponsors reduce

the cost and difficulty of implementing the TPC Energy Specification. EMS provides services like power instrumentation interfacing, power and temperature logging, report generation and more. The EMS is accessible via the TPC's Web site. The source code for all modules except the Power Temperature Daemon (licensed from the Standard Performance Evaluation Corporation) is available for download. This code is provided under the terms and conditions specified in the End User License Agreement (EULA).