Introducing
TPC Express Benchmark IoT
(TPCx-IoT)
Industry’s First Standard for Internet of Things

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About the TPC
TPC’s Mission

The TPC is a non-profit corporation focused on developing data-centric benchmark standards and disseminating objective, verifiable performance data to the industry

Founded in 1988
TPC Membership (September, 2017)

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Active Benchmark Standards

- Transaction Processing
  - TPC-C
  - TPC-E
- Decision Support
  - TPC-H
  - TPC-DI
- Virtualization
  - TPC-VMS
  - TPCx-V
  - TPCx-HCI (WiP)
- Big Data and Analytics
  - TPCx-HS
  - TPCx-BB
  - TPCx-IoT
  - TPC-DS V2
- Internet of Things
  - TPCx-IoT
Benchmark Classes

• A benchmark class is a set of benchmark standards that share the same characteristics and the same rules for creation, maintenance, and publication

• TPC currently defines two classes
  • **Enterprise** benchmarks typically are more complex, have longer development cycles and certification and availability requirements. Kits provided to facilitate execution but require additional work to execute the benchmark: TPC-C, TPC-E, TPC-H, TPC-DS, TPC-DI, TPC-VMS
  • **Express** benchmarks have shorter development cycles and less strict certification and availability rules. Complete kits provided to enable execution of the benchmark: TPCx-HS, TPCx-BB, TPCx-V, TPCx-IoT
TPCx-IoT –
A Benchmark for IoT Gateways
IoT is Here Now

Adoption rate of digital infrastructure: 5x faster than electricity and telephony

World Population

Things

50 Billion Devices

2010

2015

2020

Inflection point

World Population

12.5

25

6.8

7.2

7.6

25

12.5

6.8

7.2

7.6

0

10

20

30

40

50
International Data Corporation (IDC) Worldwide Semiannual Internet of Things Spending Guide forecasts worldwide spending on the Internet of Things (IoT) to grow 16.7% year over year in 2017, reaching just over $800 billion. By 2021, global IoT spending is expected to total nearly $1.4 trillion as organizations continue to invest in the hardware, software, services, and connectivity that enable the IoT. Source: http://www.idc.com/getdoc.jsp?containerId=prUS42799917

Gartner said, "while consumers purchase more devices, businesses spend more. In 2017, in terms of hardware spending, the use of connected things among businesses will drive $964 billion (see Table 2). Consumer applications will amount to $725 billion in 2017. By 2020, hardware spending from both segments will reach almost $3 trillion. Source: http://www.gartner.com/newsroom/id/3598917

McKinsey Global Institute report, The Internet of Things: Mapping the value beyond the hype, attempts to determine exactly how IoT technology can create real economic value. “Our bottom-up analysis for the applications we size estimates that the IoT has a total potential economic impact of $3.9 trillion to $11.1 trillion a year by 2025”. http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world
TPCx-IoT Benchmark

• A benchmark for IoT Gateway systems. x: Express, IoT: Internet of Things

• Full kit is provided by the TPC. Vendors are required to use the kit for result publication

• Provides an objective measure of performance and performance of commercially available software and hardware systems in IoT gateway environments

• Realistic dataset based on data from sensors from modern electric power substations

• The workload represents data inject into an IoT Gateway with continuous real-time analytic queries
TPCx-IoT Benchmark Positioning

TPCx-IoT Gateway

System Under Test (SUT)

IOT Data Sources

Fog Nodes

CEP

Streaming Analytics

Analytics DB

Hadoop

NoSQL

TPCx-DS
TPCx-HS
TPCx-BB

TPCx-IoT

TPC™
Business Model: Electric Utility

Many Districts

Many Substations Each with hundreds of sensors

IoT Gateway

IoT Dashboard

• 200 sensor types
• SUT must sustain a minimum sample frequency rate

System Under Test

Workload Driver

Normal Distribution

Zipfian Distribution
For More Information

• TPC Main Page: www.tpc.org
• TPCx–IoT Page www.tpc.org/tpcx-iot/default.asp
• TPC Kit and Documentation Page: www.tpc.org/tpc_documents_current_versions/current_specifications.asp
How to Add Support for a New Database?

• Follow the instructions in the ‘How to add a new database’ document included in the kit

• Or Contact the TPC at info@tpc.org
Contributors

Developing an industry standard benchmark for a new environment like IoT required the dedicated effort of experts from many companies. Thanks to:

Andy Bond (Red Hat), Bhaskar Gowda (Intel), Karthik Kulkarni (Cisco), Chinmayi Narasimhadevara (Cisco), Chaitanya Kundety (Huawei), Da Qi Ren (Huawei), David Grimes (Dell), Meikel Poess (Oracle), Nicholas Wakou (Dell), Jamie Reding (Microsoft), John Poelman (IBM), Ken Rule (Intel), Hamesh Patel (Intel), Mike Brey (Oracle), Matthew Emmerton (IBM), Paul Cao (HPE), Reza Taheri (VMware), and Tariq Magdon-Ismail (VMWare)
TPCx-IoT In the Press – Examples

https://www.theregister.co.uk/2017/09/15/tpcx_iot_benchmark/


TPCx-IoT In the Press – Examples

Transaction Processing Performance Council Introduces First Benchmark Standard for IoT Gateway Systems

SAN FRANCISCO, Sept. 14, 2017 — Today the Transaction Processing Performance Council (TPC) announced the immediate availability of TPCx-IoT, the industry’s first benchmark which enables direct comparison of different software and hardware solutions for IoT gateways. 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.

Positioned between edge architecture and the back-end data center, gateway systems perform functions such as data aggregation, real-time analytics and persistent storage. Despite the proliferation of IoT devices, until now, there have been no standard metrics available which enable direct comparison of different software and hardware platforms across IoT environments. This has led to substantial challenges when trying to compare systems.

The TPC had set up a new working group, chaired by Benthin, to develop a set of benchmarks for the performance of IoT hardware and software.


Developing an industry standard benchmark for a new environment like IoT required the dedicated effort of experts from many companies. Thanks to Andy Bond (Red Hat), Karthik Kulkarni (Cisco), Chinmayi Narasimhadevara (Cisco), Chaitanya Kundety (Huawei), Da Qi Ren (Huawei), David Grimes (Dell), Meikel Poess (Oracle), Nicholas Wakou (Dell), Jamie Reding (Microsoft), John Poelman (IBM), Ken Rule (Intel), Hamesh Patel (Intel), Mike Brey (Oracle), Matthew Emmerton (IBM), Paul Cao (HPE), Reza Taheri (VMware), and Tariq Magdon-Ismail (VMWare)
As we have seen historically standards such as TPCx-IoT will be a useful benchmark standard to
• vendors in demonstrating competitiveness of their products,
• buyers as they evaluate new systems in terms of performance, price/performance and energy efficiency,
• and enable healthy competition ….