

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

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September 14, 2017

**TPC**<sup>TM</sup>



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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)

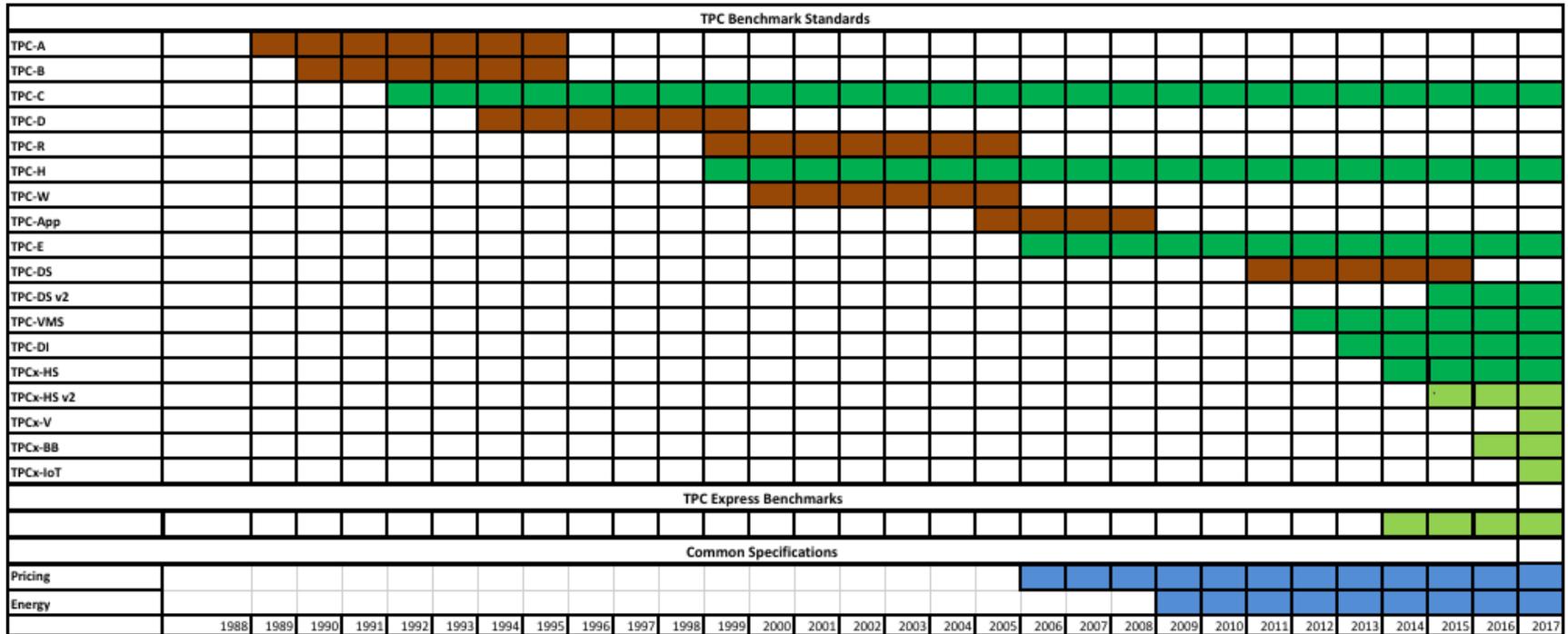
## Full Members

## Associate Members

		
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# TPC Timeline (1988-2017)



# Active Benchmark Standards

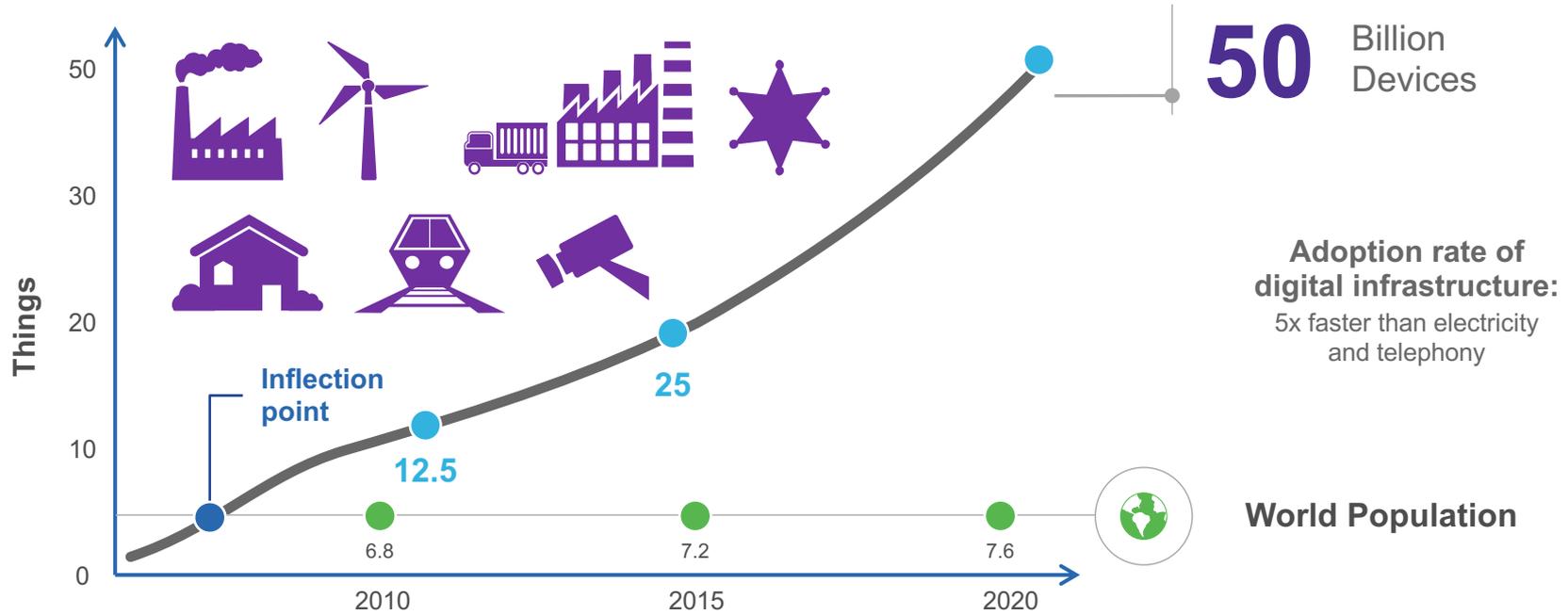
- Transaction Processing
  - TPC-C
  - TPC-E
- Decision Support
  - TPC-H
  - TPC-DI
- Virtualization
  - TPC-VMS
  - TPCx-V
  - TPCx-HCI (WiP)
- Big Data and Analytics
  - TPCx-HS
  - TPCx-BB
  - TPCx-IoT
  - TPC-DS V2
- Internet of Things
  - TPCx-IoT

# 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



# IoT Market

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>

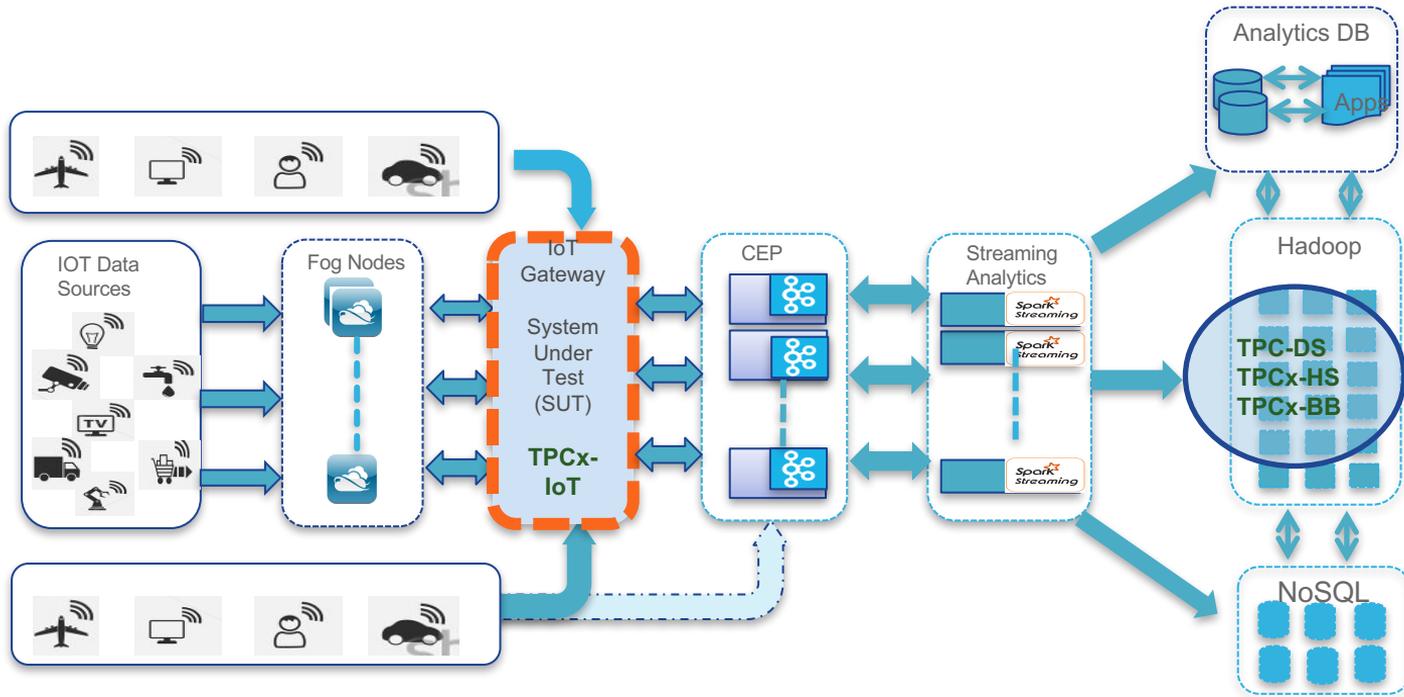
Gartner said, "while consumers purchase more devices, businesses spend more. In 2017, in terms of hardware spending, the use of connected things among businesses will drive \$964 billion (see Table 2). Consumer applications will amount to \$725 billion in 2017. By 2020, hardware spending from both segments 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>

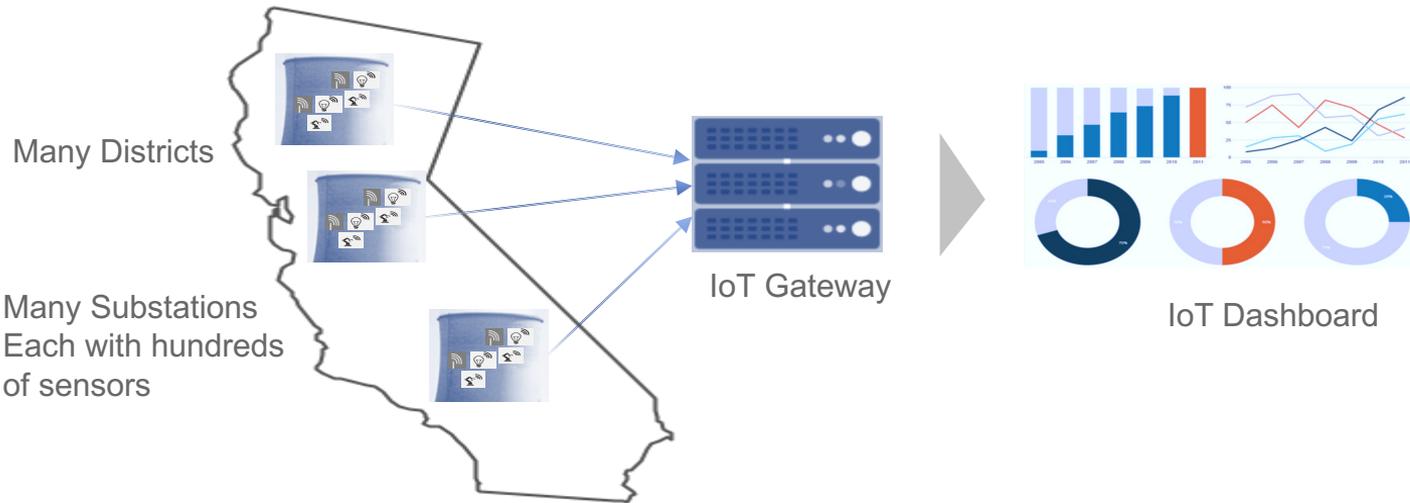
# TPCx-IoT Benchmark

- 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

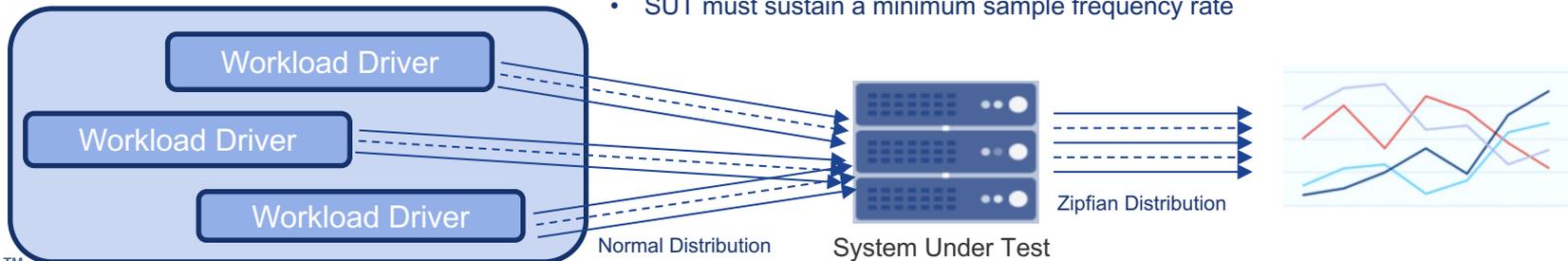
# TPCx-IoT Benchmark Positioning



# Business Model: Electric Utility



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



# For More Information

- TPC Main Page: [www.tpc.org](http://www.tpc.org)
- TPCx–IoT Page [www.tpc.org/tpcx-iot/default.asp](http://www.tpc.org/tpcx-iot/default.asp)
- TPC Kit and Documentation Page:  
[www.tpc.org/tpc\\_documents\\_current\\_versions/current\\_specifications.asp](http://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](mailto: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:

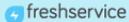
Andy Bond (Red Hat), Bhaskar Gowda (Intel), Karthik Kulkarni (Cisco), Chinmayi Narasimhadevara (Cisco), Chaitanya Kundety (Huawei), Da Qi Ren (Huawei), David Grimes (Dell), Meikel Poess (Oracle), Nicholas Wakou (Dell), Jamie Reding (Microsoft), John Poelman (IBM), Ken Rule (Intel), Hamesh Patel (Intel),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

# TPCx-IoT In the Press – Examples



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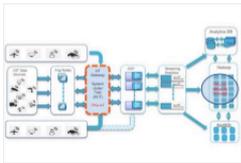
Emergent Tech - Internet of Things

## IoT gateways get a benchmark from the TPC

You're going to run a pair of servers to tend 'things' and pre-analyse their data. OK?

By Simon Sharwood, APAC Editor 15 Sep 2017 at 02:03

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Where the TPC-IoT benchmark does its best work

The Transaction Processing Performance Council (TPC) has decided the world needs a benchmark for the Internet of Things, or at least for the gateways that will do initial processing of data that things generate.



## Transaction Processing Performance Council Establishes Internet of Things Working Group (TPC-IoT)

August 03, 2015 11:00 AM Eastern Daylight Time

SAN FRANCISCO—(BUSINESS WIRE)—The Transaction Processing Performance Council (TPC) today announced the formation of a new Working Group (TPC-IoT), tasked with developing industry standard benchmarks for both hardware and software platforms associated with the Internet of Things (IoT).

"The Internet of Things is revolutionizing the entire technology landscape, and impacts industries across all major sectors"

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The IoT ecosystem contains a complex mix of technologies and products from data collection and data curation to complex analytics. As the number of interconnected platforms continues to multiply, vendors and customers increasingly require an impartial means of comparing performance, cost-of-ownership and energy consumption across a widening array of hardware and software systems.

"The Internet of Things is revolutionizing the entire technology landscape, and impacts industries across all major sectors," said Raghunath Nambiar, distinguished engineer at Cisco and elected chairman of the new TPC-IoT Working Group. "Analyst firm IDC predicts that the worldwide IoT market will grow to \$1.7 trillion by the year 2020. To put that in perspective, only 16 economies in the world had gross domestic product exceeding \$1 trillion in 2014. Formation of this Working Group is the first major step in bringing industry and the research community together – to develop a set of standardized workloads and metrics – which enable fair comparisons across technologies and products."

"The TPC – with its lengthy history as one of the most respected standards bodies in the world – is perfectly positioned to develop such standards," continued Nambiar. "Year after year, the TPC continues to introduce new Working Groups and define new metrics, to meet the needs of a continually evolving industry."

Since 2009, the TPC's annual Technology Conference on Performance Evaluation and Benchmarking (TPCTC) has served as a forum for leading vendors and researchers to gather and identify innovative areas for benchmark research and development. The TPCTC has had a sustained impact on benchmark exploration, and past conferences have resulted in the creation of benchmark committees in Virtualization, Data Integration and Big Data. Most recently in 2014, IoT was identified as an area for benchmark development, prompting TPC-IoT's formation.

The next TPCTC will be held on August 31, and will be collocated with VLDB 2015 in Kohala Coast, Hawaii. Additional information is available online: <http://www.tpc.org/tpctc/tpctc2015/default.asp>.



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PRESS RELEASE

## TPC INTRODUCES THE FIRST BENCHMARK STANDARD FOR INTERNET OF THINGS (IoT) GATEWAY SYSTEMS

written by Press Release September 15, 2017



AS405: RESTRICTIONS FAIL

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UPCOMING EVENT

N/A, September 27, 2017 – S 28, 2017 – 15th Annual Pharm IT Congress

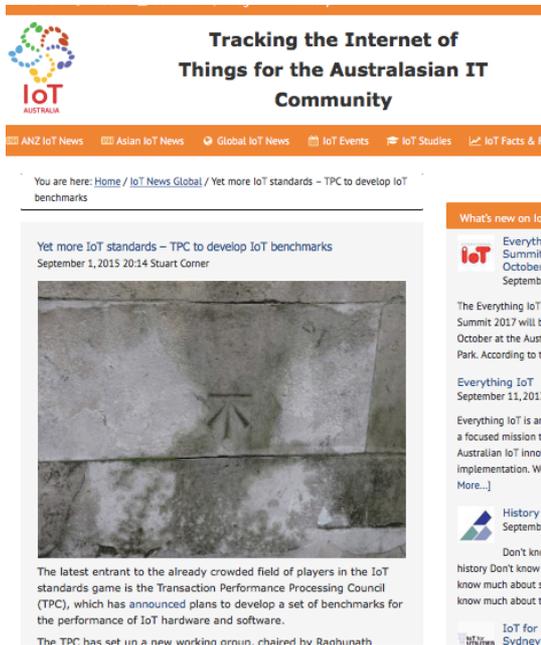
9:00 am – 5:00 pm, October 4, 2017 – Big Data Workshop/TPC Systems Sun Community Day

[https://www.theregister.co.uk/2017/09/15/tpcx\\_iot\\_benchmark/](https://www.theregister.co.uk/2017/09/15/tpcx_iot_benchmark/)

<http://www.businesswire.com/news/home/20150803005308/en/Transaction-Processing-Performance-Council-Establishes-Internet-Things>

<http://www.datacenterjournal.com/tpc-introduces-first-benchmark-standard-internet-things-iot-gateway-systems/>

# TPCx-IoT In the Press – Examples



**Tracking the Internet of Things for the Australasian IT Community**

**Yet more IoT standards – TPC to develop IoT benchmarks**

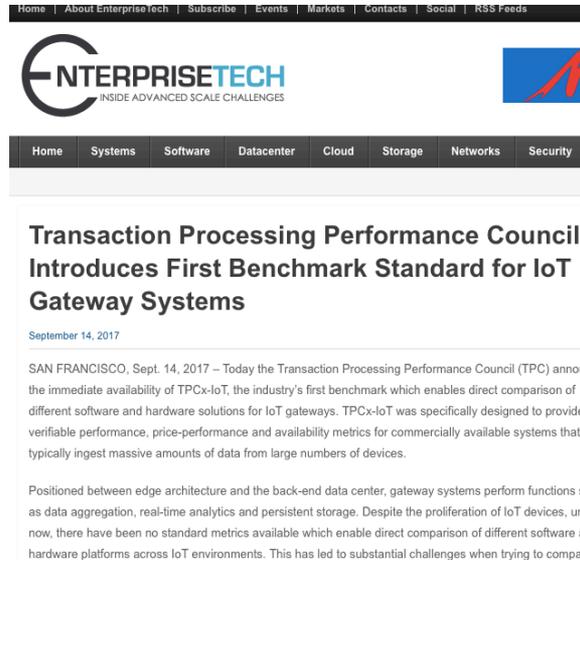
September 1, 2015 20:14 Stuart Corner



The latest entrant to the already crowded field of players in the IoT standards game is the Transaction Performance Processing Council (TPC), which has announced plans to develop a set of benchmarks for the performance of IoT hardware and software.

The TPC has set up a new working group, chaired by Raghunath

<https://www.iotaustralia.org.au/2015/09/01/iotnews/global/yet-more-iot-standards-tpc-to-develop-iot-benchmarks/>



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

September 14, 2017

SAN FRANCISCO, Sept. 14, 2017 – Today the Transaction Processing Performance Council (TPC) announce 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

<https://www.enterprisetech.com/2017/09/14/transaction-processing-performance-council-introduces-first-benchmark-standard-iot-gateway-systems/>



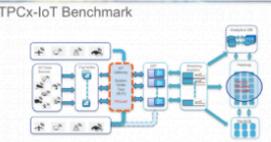
**IOT SOLUTION PROVIDER**  
Powering the business behind the Internet of things

**INTRODUCING THE FIRST BENCHMARK STANDARD FOR IOT**

Fri, 09/15/2017 - 12:02 – Anonymous (not verified)

Raghunath Nambiar

**TPCx-IoT Benchmark**



The TPC Express Benchmark™ IoT (TPCx-IoT) is the industry's first benchmark for measuring the performance of IoT gateway systems. TPCx-IoT was developed to provide the industry with an objective measure of the hardware, operating system, data storage and data management systems for IoT gateway systems.

We have reached a point where virtually every electronic device can be connected to the internet and interact with its surrounding environment. The explosive growth of the Internet of Things shows no signs of slowing down, and in fact, may actually be speeding up.

[Read more](#)

<http://www.iotsolutionprovider.com/industrial/introducing-the-first-benchmark-standard-for-iot>

# TPCx-IoT In the Press – Examples

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-Ismael (VMWare)

# Outlook ...

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 ....