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HPE Application Tuner Express (HPE-ATX):

Performance Proof Points

Version 3
May 2020

Houston, we have a problem!

- Many existing applications today were designed for older 2- and 4-socket systems (20 to 40 cores) and are NUMA unaware.

- Scaling these applications to large current 16-socket / 240-core systems can show significant application performance issues.

- In larger systems with multiple cores and sockets memory latency can be a big problem if memory and cores are not kept together.

- It's difficult to correctly design and code applications to have core and memory co-location in a NUMA system.

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Non Uniform Memory Access (NUMA)
Quick recap

Modern computers have their memory
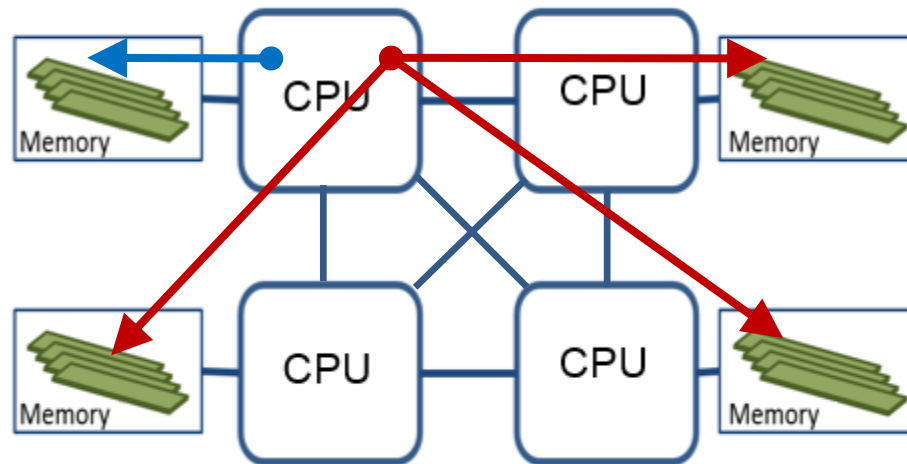controlled by processors
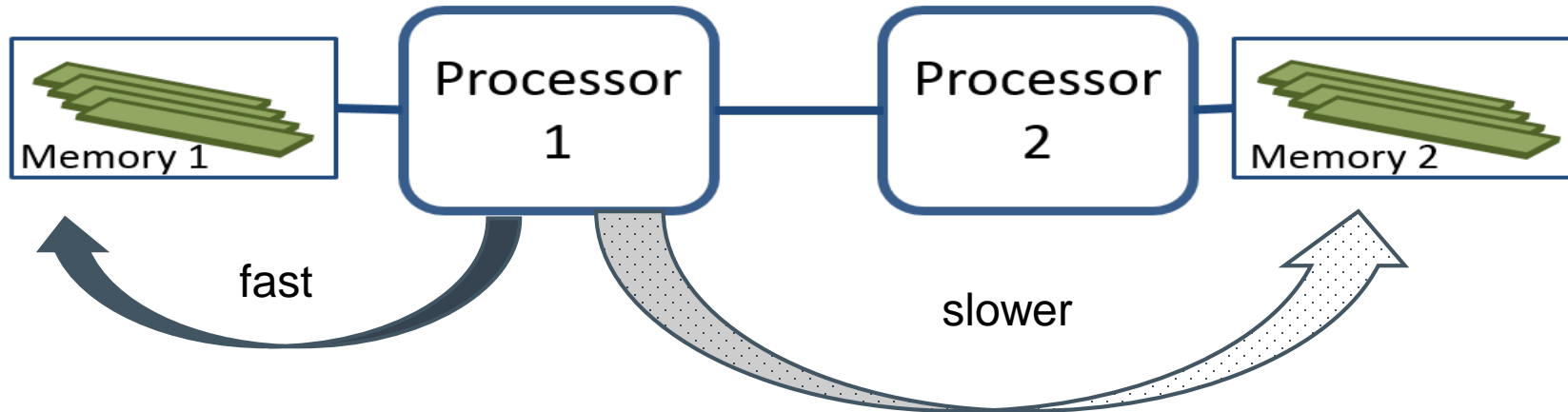
Accessing remote memory takes longer
than accessing local memory

For 2-socket servers such as the HPE DL380:

- **50%** of the memory is **local memory**

- **50%** of the memory is **remote** with a **1.6x memory latency**
  (accessing remote memory takes 1.6 times longer)

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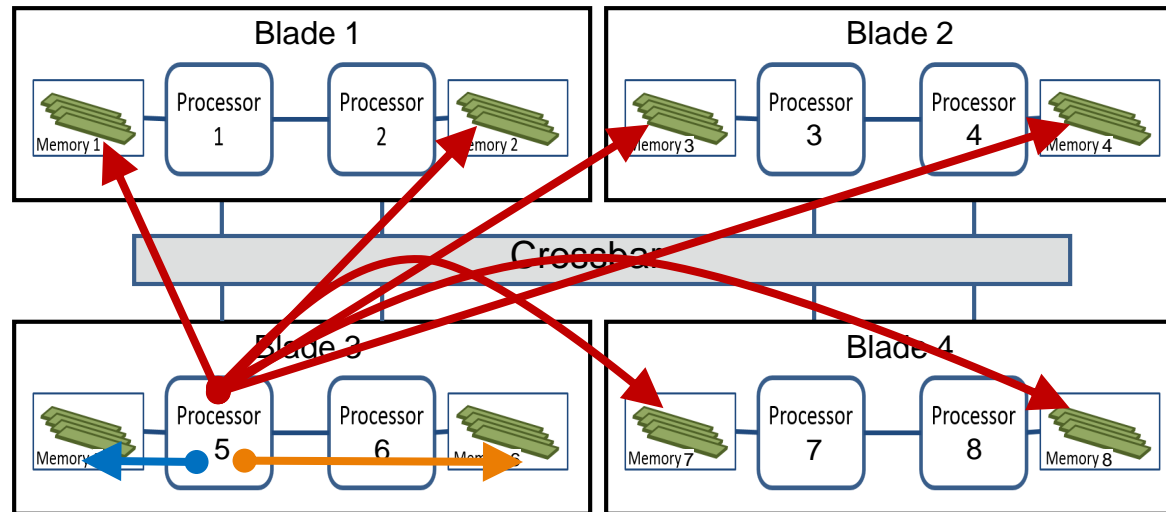Enterprise

Non Uniform Memory Access (NUMA)
HPE DL580 Conceptual NUMA Topology

- **25%** of the memory is **local memory**

- **75%** of the memory is **remote** with a **1.6x memory latency**
  (accessing remote memory takes 1.6 times longer)

Non Uniform Memory Access (NUMA)
8-socket HPE Superdome X Conceptual NUMA Topology

- **Only 12.5%** of the memory is **local memory**

- **12.5%** of the memory is **remote on-blade** with a **1.6x memory latency**

- **75%** of the memory is **remote off-blade** with a **3.0x memory latency**
  (accessing remote off-blade memory takes 3.0 times longer)

Non Uniform Memory Access (NUMA)
16-socket HPE Superdome X Conceptual NUMA Topology
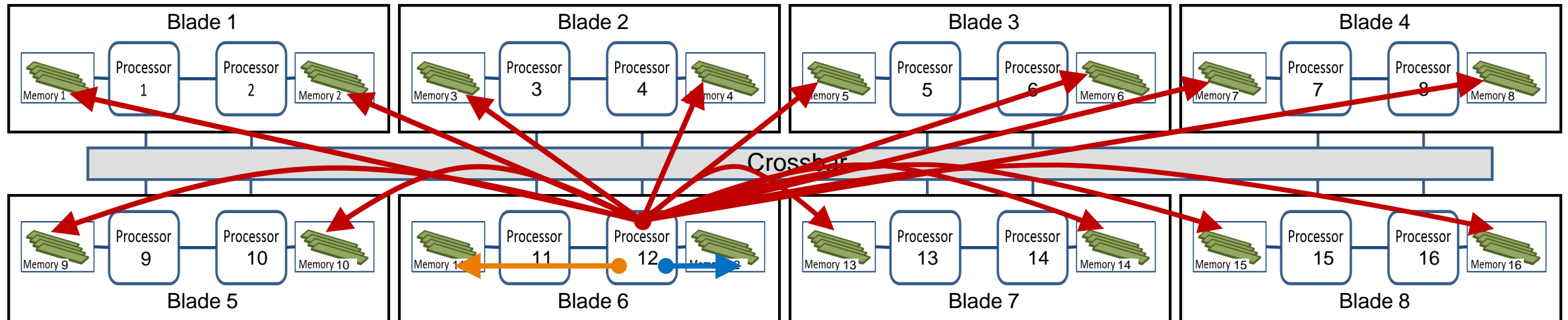
- **Only 6.25%** of the memory is **local memory**

- **6.25%** of the memory is **remote on-blade** with a **1.6x memory latency**

- **87.5%** of the memory is **remote off-blade** with a **3.0x memory latency**
  (accessing remote off-blade memory takes 3.0 times longer)

Keep Your Applications Organized

- As systems get larger the chance of accessing remote memory increases

- When applications are scheduled close to their memory performance increases significantly

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What is HPE-ATX?

- Utility that makes NUMA unaware applications more NUMA aware
  - **No application changes are needed!**

- Controls the distribution of an application's processes and threads in a NUMA environment
  - Several NUMA node and CPU Launch Policies are provided to obtain an optimal distribution

- HPE-ATX vs `numactl`:
  - `numactl` **constrains** an application to a set of NUMA nodes
  - HPE-ATX **distributes** an application around a set of nodes

- Benefit of HPE-ATX varies by platform and application
  - Higher socket count platforms benefit more than lower socket count platforms
  - NUMA-unaware applications benefit more than applications built with NUMA awareness

Realize significant OLTP performance gains with HPE-ATX

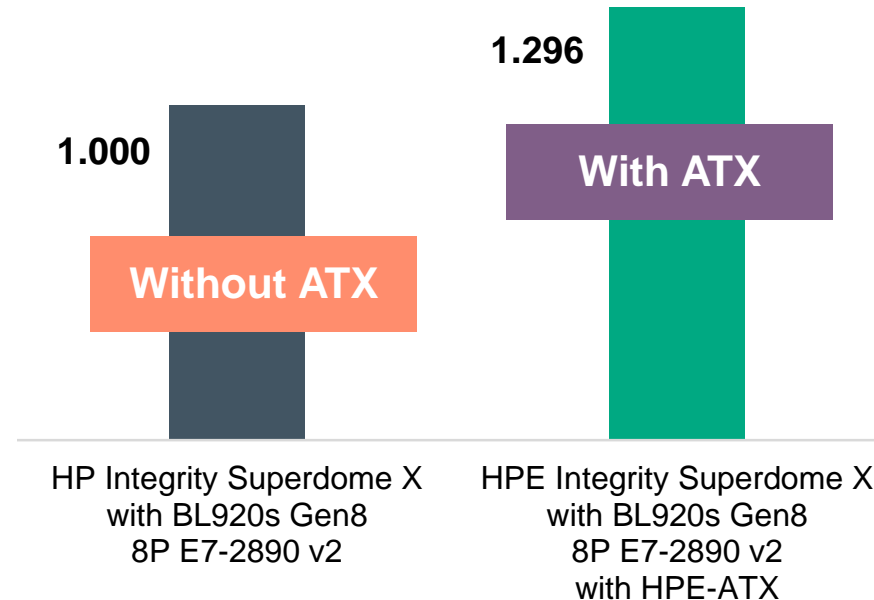## Up to 29.6% performance improvement on Superdome X Gen8

**Up to 29.6% improvement
for Gen8 with HPE-ATX!**

Key performance takeaways

– **Gen8 plus HPE-ATX software utility:**

   Up to 29.6% performance gain with
   HPE ATX software utility on
   Superdome X Gen8

– Outstanding results with the Red Hat
   Enterprise Linux 6.6 operating system

1.296

1.000

With ATX

Without ATX

HP Integrity Superdome X
with BL920s Gen8
8P E7-2890 v2

HPE Integrity Superdome X
with BL920s Gen8
8P E7-2890 v2
with HPE-ATX

8P

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HPE Integrity MC990 X OLTP performance boost with HPE-ATX
Significant database performance gains for the HPE Integrity MC990 X server

Key performance takeaways:

– **HPE-ATX software utility gains:**

Up to 59% performance gain with the HPE-ATX software utility on HPE MC990 X servers for improved throughput
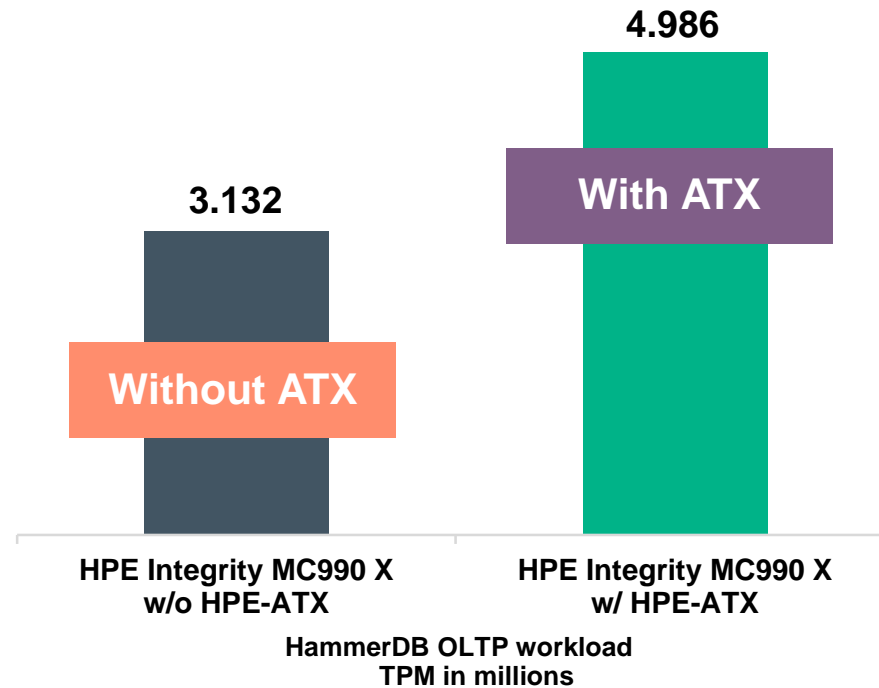
– **Database licensing costs:**

Same database workload requires fewer cores

HPE Application Tuner Express (ATX) utility: A launch policy controller that facilitates more efficient use of application processes and threads for a NUMA environment

Up to 59% improvement on 8P with HPE-ATX!

4.986

With ATX

3.132

Without ATX

| HPE Integrity MC990 X w/o HPE-ATX | HPE Integrity MC990 X w/ HPE-ATX |

HammerDB OLTP workload TPM in millions

HPE Integrity MC990 X with 8 Intel® Xeon® E7-8890 v3 processors

Cut your per-core licensing costs by almost 40%!

8P HPE Integrity MC990 X

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Significant OLTP multi-tenant performance gains with HPE-ATX

Database performance gains with HPE Integrity Superdome X Gen9

Key performance takeaways:

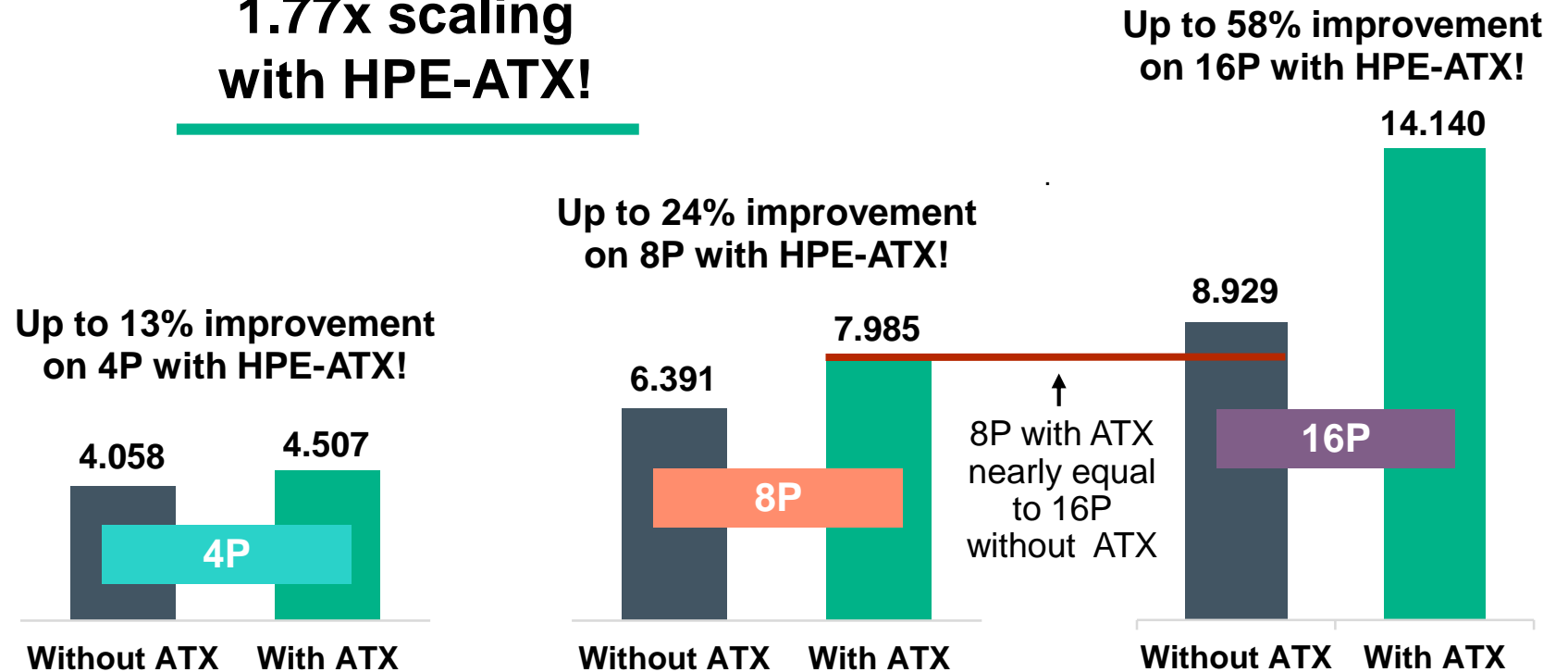– **HPE-ATX software utility gains:**

Up to 58% performance gain with the HPE-ATX software utility on HPE Superdome X with BL920s Gen9 blades

– **Database Licensing Costs:**

8P performance with ATX is almost the same as 16P performance without ATX (see the red line)

Cut your per-core licensing costs almost in half!

1.77x scaling with HPE-ATX!

Up to 58% improvement on 16P with HPE-ATX!

14.140

Up to 24% improvement on 8P with HPE-ATX!

8.929

7.985

Up to 13% improvement on 4P with HPE-ATX!

6.391

16P

4.058   4.507

8P with ATX nearly equal to 16P without ATX

4P

8P

16P

Without ATX   With ATX   **Without ATX   With ATX**   **Without ATX   With ATX**

Hammer DB OLTP multi-tenant workload

HPE Superdome X using BL920s Gen9 blades with Intel® Xeon® E7-8890 v3 processors

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HPE ProLiant DL580 OLTP performance boost with HPE-ATX

Significant database performance gains for the HPE ProLiant DL580 server

Key performance takeaways:

– **HPE-ATX software utility gains:**

  Up to 10% performance gain with the HPE-ATX software utility on HPE DL580 servers for improved throughput
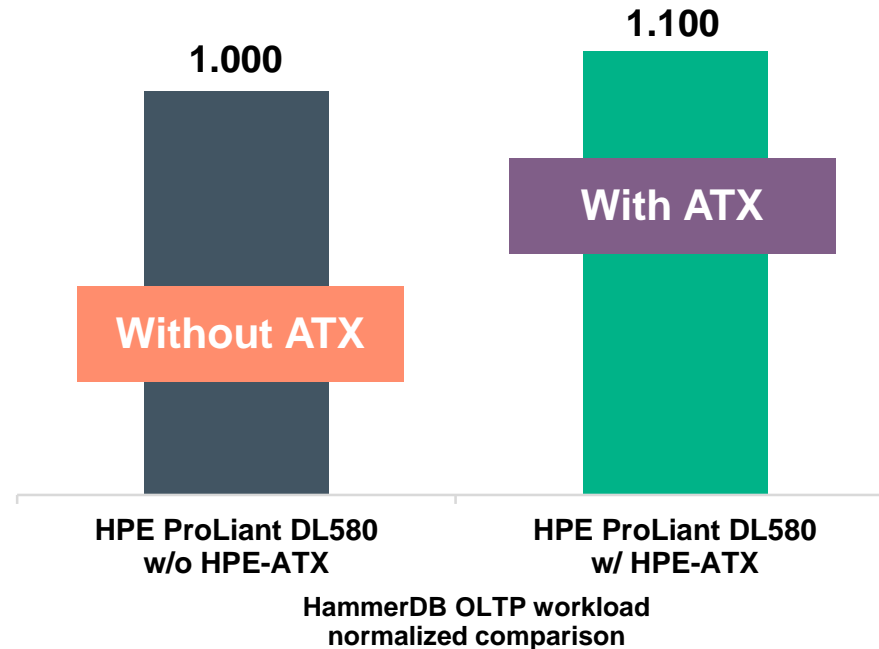
– **Database licensing costs:**

  Same database workload requires fewer cores

HPE Application Tuner Express (ATX) utility: A launch policy controller that facilitates more efficient use of application processes and threads for a NUMA environment

Up to 10% improvement on 4P with HPE-ATX!

1.000

1.100

With ATX

Without ATX

HPE ProLiant DL580
w/o HPE-ATX

HPE ProLiant DL580
w/ HPE-ATX

**HammerDB OLTP workload
normalized comparison**

HPE ProLiant DL580 with 4 Intel® Xeon® E7-8890 v3 processors

Cut your per-core database licensing costs!

4P HPE ProLiant DL580

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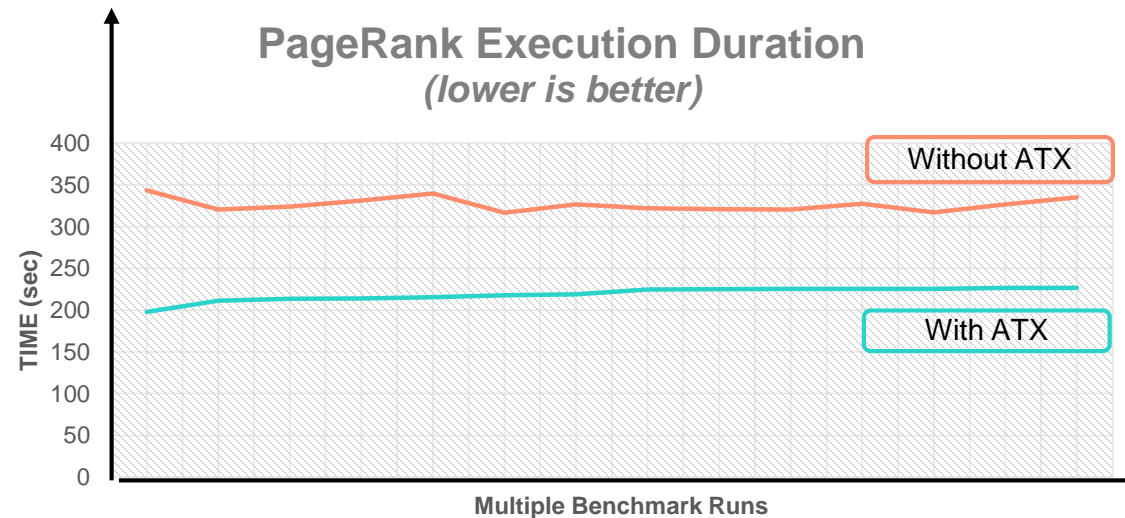# Significant Apache® Spark™ Performance Gains with HPE-ATX
Up to 39% performance improvement on Superdome X

An 8-node machine-learning cluster of 2-socket servers running the **PageRank ML Benchmark** (OpenJDK 8, RHEL 7.3)

Key performance takeaways

– **Gen8 plus HPE-ATX:**

Up to **39%** performance gain with HPE ATX software utility on Superdome X using eight BL920s Gen8 blades with Intel® Xeon® E7-8893 v2 processors.

Up to 39% improvement with HPE-ATX!

PageRank Execution Duration
(lower is better)

Without ATX

With ATX

TIME (sec): 400, 350, 300, 250, 200, 150, 100, 50, 0

Multiple Benchmark Runs

(8) nPars

HPE Integrity Superdome X with Intel® Xeon® E7-8893 v2 processors

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HPE-ATX Performance Demo Videos

HPE Solution Demonstration Portal (https://hpedemoportal.ext.hpe.com/)

https://hpedemoportal.ext.hpe.com/search/HPE-ATX

Demo: HPE Automatic Tuner Express (HPE-ATX) (8P Superdome X)

Demo: HPE Integrity MC990 X OLTP perf improvement with HPE-ATX (8P MC990 X)

Demo: Database consolidation perf enhancement with HPE-ATX (16P Superdome X)

To view in full screen mode click on ⤢ when playing or login to download the demo video

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14

For additional information

Publicly Available Resources

– **HPE-ATX product page:**
  - http://downloads.linux.hpe.com/SDR/project/hpe-atx

– **HPE-ATX download:**

  - **HPE My License Depot**
    - https://myenterpriselicense.hpe.com/cwp-ui/evaluation/HPE-ATX

  - **HPE Software Delivery Repository**
    - http://downloads.linux.hpe.com/SDR/project/hpe-atx/repo.html

– **Documentation: Installing HPE-ATX**
  - http://downloads.linux.hpe.com//SDR/project/hpe-atx/Installing_HPE-ATX_v_1.0.3.pdf

– **Documentation: Launching applications with HPE-ATX**
  - http://downloads.linux.hpe.com//SDR/project/hpe-atx/Using_HPE-ATX_v_1.0.3.pdf

– **Documentation: HPE-ATX Performance Proof Points**
  - http://downloads.linux.hpe.com//SDR/project/hpe-atx/HPE-ATX_proof_points_v3.pdf

– **Demo Videos on the HPE Solution Demonstration Portal**
  - https://hpedemoportal.ext.hpe.com/search/HPE-ATX

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Thank you