



# Scale Up For Faster Time to Insight

## Scale-up servers with Intel® Optane™ DC persistent memory will accelerate answers for Intel business analysts

### At a Glance:

- A scale-up system running the 2nd generation Intel® Xeon® Scalable processor with Intel® Optane™ DC persistent memory resulted in an average 2.4x<sup>1</sup> performance increase, accelerating time to insight
- A scale-up SAP HANA\* 2 landscape with 2nd gen Intel Xeon Scalable processors, DRAM, and Intel Optane DC persistent memory provided up to 52 percent<sup>2</sup> more total system memory at a lower cost, compared with a scale-out landscape with 2nd gen Intel Xeon Scalable processors and DRAM only

Like many IT organizations, Intel IT is continuously challenged with making the business more efficient. This is critical in Intel's complex supply chain where real-time analytics underpin rapid data-driven decisions. For this reason, Intel IT recently carried out a proof of concept (PoC) exploring the benefits of moving from a scale-out to a scale-up system to speed time to insight.

### Challenge

- Improve the agility and efficiency of Intel's supply chain by enabling faster decision-making based on real-time data analytics

### Solution

- A PoC was run to test the hypothesis that moving from a scale-out to a scale-up solution using Intel® Optane™ DC persistent memory would improve analytics performance
- Intel IT's SAP HANA\* business analyst compared performance of Intel's current SAP HANA 2 finance analytics cluster comprised of three four-year-old servers versus a single server based on 2nd gen Intel® Xeon® Scalable processors and Intel Optane DC persistent memory. For this, they used an IT-developed automated test, comprised of 50 queries

### Results

- The PoC showed that one scale-up server with 2nd gen Intel Xeon Scalable processors and Intel Optane DC persistent memory delivered an average 2.4x<sup>1</sup> faster time to insights than a four-year-old three-server system
- In addition, a scale-up SAP HANA 2 landscape with 2nd gen Intel Xeon Scalable processors, DRAM, and Intel Optane DC persistent memory provided up to 52 percent<sup>2</sup> more total system memory at a lower cost, compared with a scale-out landscape with 2nd gen Intel Xeon Scalable processors and DRAM only
- Ultimately, implementing scale-up servers will help Intel IT to provide Intel supply chain analysts with faster insights from its supply chain data for a lower total cost of ownership, improving decision making and positioning the company for future growth and success

## Business Challenge: Making the Supply Chain More Efficient

Intel's supply chain is vast and complex, spanning 63 countries – with more than 600 facilities and 19,000 suppliers – fulfilling one million orders, and shipping one billion units per year. As Intel's business continues to grow, evolve, and accelerate, improving the efficiency and agility of this supply chain is critical to Intel's continued success.

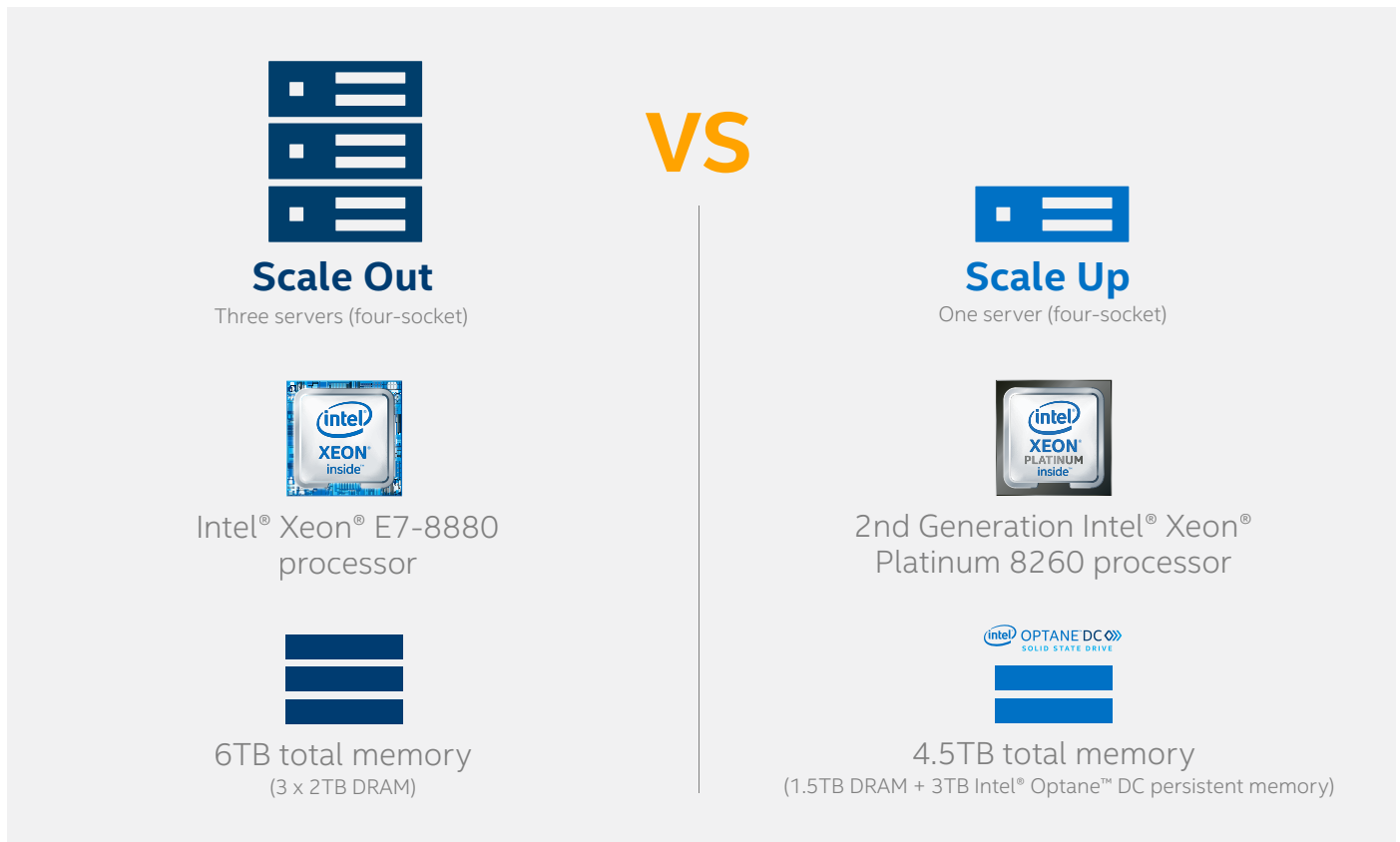
Central to this, is advanced, real-time analytics. The ability to make rapid, data-driven decisions to optimize order taking, resource procurement, manufacturing, testing, and final product delivery across the supply chain is essential. But the analytics engines required at scale are a major investment, and architectural decisions have multi-year, multi-million-dollar implications.

Intel IT uses the SAP HANA 2 in-memory database with Cloudera Distribution for Hadoop\* to operate real-time analytics within Intel's global supply chain. In the past, IT used a scale-out approach to meet compute and memory requirements. But they wanted to investigate the benefits of a scale-up system.

## Proof of Concept: Scale Out Versus Scale Up

Intel IT ran a POC to evaluate the performance gains of switching to a single-node server using Intel Optane DC persistent memory. Intel Optane DC persistent memory represents a new way of managing data for demanding workloads like the SAP HANA platform. It is non-volatile, meaning data does not need to be re-loaded from persistent storage to memory after a shutdown. Meanwhile, it runs at near-DRAM speeds, keeping up with the performance needs and expectations of complex SAP HANA environments, and their users.

Intel IT wanted to use the PoC to test the hypothesis that by limiting data transfer, one scale-up node would offer superior performance over three scale-out nodes. It compared its current SAP HANA 2 finance analytics cluster comprised of three Intel® Xeon® E7-8880 processor v3-based servers versus a single server based on 2nd gen Intel Xeon Scalable processors. Each older server had two terabytes of DRAM, for a total of six terabytes of memory. The new single server was configured with 1.5 terabytes of DRAM and three terabytes of Intel Optane DC persistent memory, for a total of 4.5 terabytes of memory – see figure 1.



**Figure 1:** Comparing the performance of three Intel® Xeon® E7-8880 processor v3-based servers versus a single server based on 2nd generation Intel® Xeon® Scalable processors with Intel® Optane™ DC persistent memory

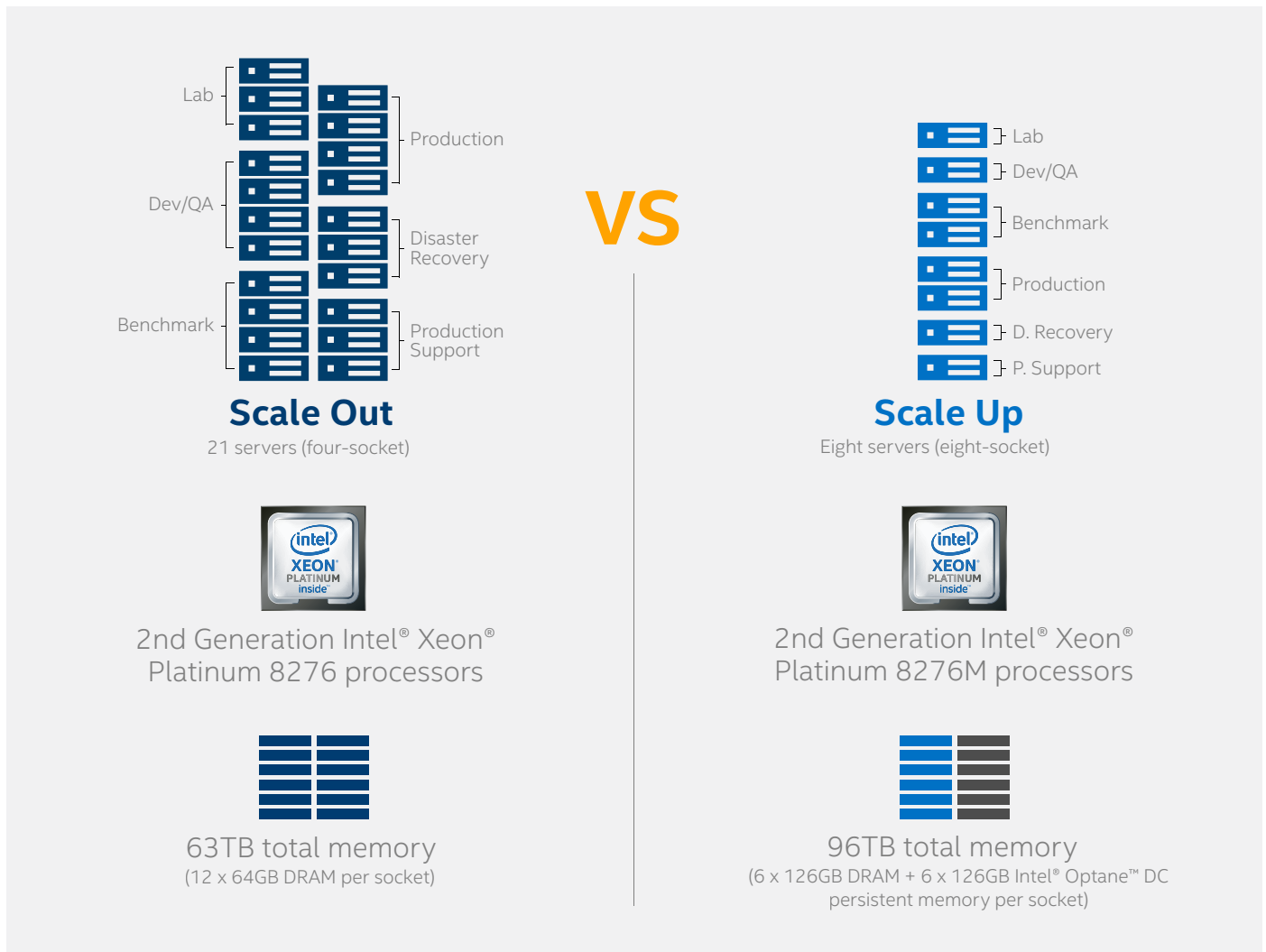
Intel IT used an automated test comprised of 50 production queries and ran the test for three hours. Once all the test had been performed on both the benchmark and the new Intel Optane DC persistent memory-based system, Intel IT then removed the Intel Optane DC persistent memory from the new system, reinstalled DRAM and ran the tests again.

The PoC showed that one scale-up server with 2nd gen Intel Xeon Scalable processors and Intel Optane DC persistent memory delivered an average 2.4x<sup>1</sup> faster time to insights than a four-year-old three-server system. Also, the time taken by SAP HANA 2 to generate the performance plan on the first execution is significantly accelerated on the scale-up system. This improvement in the first runtime is beneficial for ad-hoc queries which are run once and never again.

### Future Memory Capacity

Intel IT also evaluated the benefits of refreshing its whole SAP HANA 2 landscape, or path to production, with the 2nd gen Intel Xeon Scalable processors and Intel Optane DC persistent memory. This includes servers for lab, development and quality assurance, benchmarking, production, disaster recovery, and production support.

Intel IT looked at two likely scenarios: a scale-out cluster with 21 four-socket servers and 63 terabytes of memory, or a scale-up cluster with eight eight-socket servers and 96 terabytes of memory – see figure 2. It found that a scale-up SAP HANA 2 landscape with 2nd gen Intel Xeon Scalable processors, DRAM, and Intel Optane DC persistent memory provided up to 52 percent<sup>2</sup> more total system memory at a lower cost, compared with a scale-out landscape with 2nd gen Intel Xeon Scalable processors and DRAM only.



**Figure 2.** Comparing the capacity of 21 scale-out servers versus eight scale-up servers based on Intel® Optane® DC persistent memory

## Business-Enabling Benefits

By accelerating the time taken to return a query, the scale-up system will help Intel IT to meet its challenge of providing Intel's supply chain analysts with faster answers to their business questions. Ultimately, this faster time to insight will speed decision making and ensure Intel's supply chain is agile and efficient - positioning the company for future growth.

The scale up system will also help Intel IT to lower the total cost of ownership (TCO) of its SAP HANA 2 landscape and significantly improve operational efficiency in its data center. By reducing the overall number of servers needed, Intel IT will have fewer servers to patch, land, power and connect, resulting in time as well as cost savings.

From an application perspective, the scale up system also consolidates data tables around data distribution since those writing and running queries do not have to redistribute and repartition tables across nodes. Everything runs on the one system, improving utilization and performance.

Finally, a scale-up system based on Intel Optane DC persistent memory offers huge benefits with regards to scaling memory capacity. Being able to scale memory will offer Intel IT greater flexibility as it adds more data into its SAP HANA environment.

## Conclusion

The PoC showed that implementing scale-up servers with 2nd gen Intel Xeon Scalable processors and Intel Optane DC persistent memory will provide Intel with fast and reliable insights from its supply chain data for a lower total cost of ownership, helping Intel IT meet its challenge of driving business efficiency while positioning the company for future growth and success.

As a next step, Intel IT is testing SAP HANA Extension Nodes with Intel Optane DC persistent memory at a ratio of 1:8 for warm tiering. This will allow the team to seamlessly integrate warm data, saving the time taken to manually retrieve archived data for one-off queries and providing a seamless user experience, while also benefitting from lower storage costs.

## Technical Components of Solution

- **Intel® Optane® DC persistent memory** delivers a unique combination of affordable large capacity and support for data persistence for demanding workloads like the SAP HANA\* 2 platform
- **SAP HANA 2** contains innovations that are designed to enhance support for complex challenges like advanced analytics, development and data management
- **2nd generation Intel® Xeon® Scalable processors** deliver industry leading, workload optimized performance with built-in artificial intelligence acceleration, providing a seamless performance foundation from the multi-cloud to the intelligent edge and back
- **Intel® Select Solutions for SAP HANA**  
Pre-tuned and tested configurations optimized for SAP HANA 2 utilizing both 2nd Gen Intel Xeon Scalable processors and Intel Optane DC persistent memory are now offered through solution providers in the Intel Select Solutions program.  
For more information visit [intel.com/selectsolutions](https://www.intel.com/selectsolutions)

## Spotlight on Intel IT

Intel IT plays a central role in increasing the value of Intel's business. It continuously works at the boundaries of innovation, developing data-driven solutions to improve Intel's operations and processes.

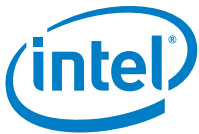
## Lessons Learned

The key lesson that enterprises can learn from Intel IT's experience is to ensure that systems are built by the original equipment manufacturer (OEM) and then shipped rather than trying to build the system on site.

## Learn More

- **Intel and SAP:**  
<https://www.intel.com/sap>
- **Intel® Xeon® Scalable processor:**  
<https://www.intel.com/content/www/us/en/products/processors/xeon/scalable.html>
- **Intel® Optane™ DC persistent memory:**  
<https://www.intel.com/optanedcpersistentmemory>
- **SAP HANA\*:**  
<https://www.sap.com/persistent-memory>
- **Intel® Select Solutions for SAP HANA\*:**  
<https://www.intel.com/selectsolutions>

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Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit [www.intel.com/benchmarks](https://www.intel.com/benchmarks)

<sup>1</sup> 2.4x better runtime performance. **Baseline:** three-node (1-master + 2-slave) SAP HANA® 2 scale-out configuration. Per node: 4 x Intel® Xeon® processor E7-8880 v3 (2.3GHz, 150W, 18 cores), CPU sockets: 4; Microcode:0x400001c; RAM capacity: 64 x 32GB DIMM, RAM model: DDR4 2,133Mbps; storage: GPFS\*, approximately 21.8TB of formatted local storage per node, SAN storage for backup space only; network: redundant 10 gigabit Ethernet (GbE) network for storage and access, redundant 10G network for node-to-node; OS: SUSE\* 12 SP2, SAP HANA®: 2.00.035, GPFS\*: 4.2.3.10. Average time of 50 individual test queries executed 30–50 times each, for a total of approximately 25,000 steps: 2.81 seconds. **New configuration:** one master node SAP HANA® 2 scale-up configuration: CPU: 4 x 2<sup>nd</sup> Generation Intel® Xeon® Platinum 8260 processor (2.2GHz, 165W, 24 cores), CPU sockets: 4; Microcode: 0x400001c, RAM capacity: 24 x 64GB DIMM, RAM model: DDR4 2,133 Mbps; Intel® Optane™ DC persistent memory: 24 x 126GB PMM; storage: XFS\*, 21TB; network: redundant 10 GbE network; OS: SUSE\* 15, SAP HANA®: 2.00.035, Intel® BKC: WW06. Average time of 50 individual test queries executed 30–50 times each, for a total of approximately 25,000 steps: 1.13 seconds. Testing carried out by Intel, 03/04/19.

<sup>2</sup> 52% more data capacity at same or lower cost: **Scale-up configuration:** 8-node SAP HANA® 2 landscape. Per node: 8-socket 2<sup>nd</sup> Generation Intel® Xeon® Platinum 8276M processors. Memory capacity per socket: 6 x 128GB DDR4 2,133 MHz. and 6 x128GB Intel® Optane™ DC persistent memory. Estimated total cost is \$2,369,496. Estimated cost per server is \$296,187 (CPU=\$93,776; memory=\$119,808; storage=\$45,000; other=\$37,603). **Scale-out configuration:** 21-node SAP HANA® 2 landscape. Per node: 4-socket 2<sup>nd</sup> Generation Intel® Xeon® Platinum 8276 processor. Memory capacity per socket: 12 x 64GB DDR4 2, 133 MHz. Estimated total cost is \$2,834,433. Estimated cost per server is \$134,973 (CPU=\$34,876; memory=\$33,994; storage=\$21,000; other=\$45,103). Pricing guidance as of 03/15/19. Results have been estimated by Intel IT as of 03/04/19.

Performance results are based on testing as of the date set forth in the configurations and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure.

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