



Solution Brief

Change the Rules of Database Management and Reap the Rewards

Intel® Optane™ DC persistent memory raises the ceiling on SAP HANA® platform performance.

Data Management Is Today's Business Challenge

The way organizations make decisions about current and future business strategies hasn't changed. They rely on data to acquire insights into their customer base, discover new markets, make financial projections, improve operational efficiencies, and plan future initiatives. What *has* changed is the amount of data that must be captured and analyzed. In today's data-driven world, organizations face an exponentially growing volume of digital data, with an estimated 2.5 quintillion bytes of data created every day.¹ The amount of data being produced has risen dramatically in a short time, with 90 percent of all currently existing data being generated in the last two years.¹ And this onslaught shows no signs of slowing down. On the contrary, this growth is likely to keep increasing, both in sheer volume and granularity of detail.

Staying ahead of the competition boils down to being able to process higher data volumes, faster, in addition to applying complex data analysis. The other critical factor is time, specifically time to value. You have likely heard the saying that "time is money." Perhaps nowhere does this come more sharply into focus than when organizations seek to validate the effectiveness of their investments into data-management systems. Long development cycles are a luxury that organizations can no longer afford. Organizations are constantly under pressure to deliver products and services to market sooner, or they risk missing revenue opportunities.

For organizations that thrive or die on their data-driven operations, the SAP HANA® platform is the system of choice for high-volume, high-speed data analysis. Of course, as data-storage capacities and processing demands increase, the SAP HANA infrastructure must be expanded to meet them, which can be expensive. An expanded SAP HANA platform can also present new challenges for IT administrators. Routine maintenance can become more time-consuming simply because more systems must be kept up to date. SAP HANA instance monitoring and troubleshooting might be hampered by the increased complexity of the expanded network. Database restarts, whether planned or unplanned, are slowed by having to recover data from, and boot up, multiple servers.

New Technologies Escalate Demands on Enterprise Resource Planning

In addition to dealing with larger data volumes, organizations expect to get more business value from their data. Enterprise resource planning (ERP) systems must include advanced analytics on live transactions and real-time operational reporting. Complex predictions are derived from broad and diverse datasets, such as the contextual data analysis of massive volumes of Internet of Things (IoT) sensor data or detailed geospatial and graph analyses of drone imagery. New technologies, such as artificial intelligence (AI) and machine learning (ML), intuitively and automatically respond to user behavior, including sophisticated language processing.

Memory Limitations Constrain Traditional Data Tier Management

To address the challenges of larger data volumes, faster processing speeds, deeper data analysis, and shorter time to value, organizations must continue to evolve their data-management strategies. They need more in-memory database capacity to support new technologies such as artificial intelligence (AI), machine learning (ML), and hybrid transaction and analytics processing. They need an infrastructure that increases database uptime, streamlines platform management, and cost-effectively scales up or out.

Older hardware can significantly limit SAP HANA performance, hampering its ability to keep up with today's high-volume, high-speed data environment. This constrains organizations from implementing data-management strategies that are affordable, reliable, and high-speed. DRAM is essential for high-speed, in-memory data processing; real-time and complex analytics on diverse datasets would not be possible without it. But it has some limitations. First, it is low-density memory, meaning that large workloads require the enlistment of multiple relatively small SAP HANA nodes. DRAM is also expensive, so scaling up becomes prohibitively costly for large infrastructure expansions. And DRAM is volatile memory, meaning that data does not persist when the server is rebooted or turned off. Data must be reloaded from warm- or cold-tier storage during server startup, which can take a significant amount of time for large datasets.

Raising the ceiling on the SAP HANA platform's potential for advanced analytics processing requires increasing data capacity in the hot and warm tiers. Fulfilling this requirement is severely limited by DRAM's volatility, low density, and high cost per SAP HANA instance. The slow performance of data storage based on solid-state drives (SSDs) and hard-disk drives (HDDs) plays a role in constraining data processing as well. These memory and storage limitations present bottlenecks to growing data storage volumes and processing velocities.

Revolutionary Intel Optane DC Technology Helps Organizations Get the Most out of Their SAP HANA Deployments

Intel® Optane™ DC persistent memory is a revolutionary approach to data management that clears the barriers imposed by DRAM in SAP HANA deployments. In comparison to DRAM, Intel Optane DC persistent memory provides higher memory density, non-volatile data persistence, near-DRAM processing speeds, and a significantly lower cost per terabyte processed. With Intel Optane DC persistent memory, organizations can achieve lower total cost of ownership (TCO), more robust business continuity, and dramatically increased memory capacities for their SAP HANA deployments.

Lower Platform TCO for SAP HANA

Organizations seeking to lower their TCO can install Intel Optane DC persistent memory and realize better infrastructure consolidation, more efficient processing, and lower costs for transactional and analytical workloads running on SAP HANA. For example, a workload for online analytical processing (OLAP) running on a traditional SAP HANA deployment might need to use data from an online transaction processing (OLTP) database, SAP® ERP Central Component (ECC), and a supply-chain management (SCM) inventory database, and this data must be replicated using SAP Landscape Transformation. SAP HANA tenant databases enable the consolidation of separate databases, such as ECC and SCM, into one SAP HANA instance, which significantly reduces DRAM processing loads and simplifies database management.

Adding Intel Optane DC persistent memory lets organizations consolidate their SAP HANA tenant databases even further by increasing the memory density per server. By increasing the number of DRAM-only systems that can be consolidated, organizations can run a complex, hybrid workload on a single SAP HANA instance configured with DRAM and Intel Optane DC persistent memory. In other words, they get real-time insights into live transactions being processed together in the same server.

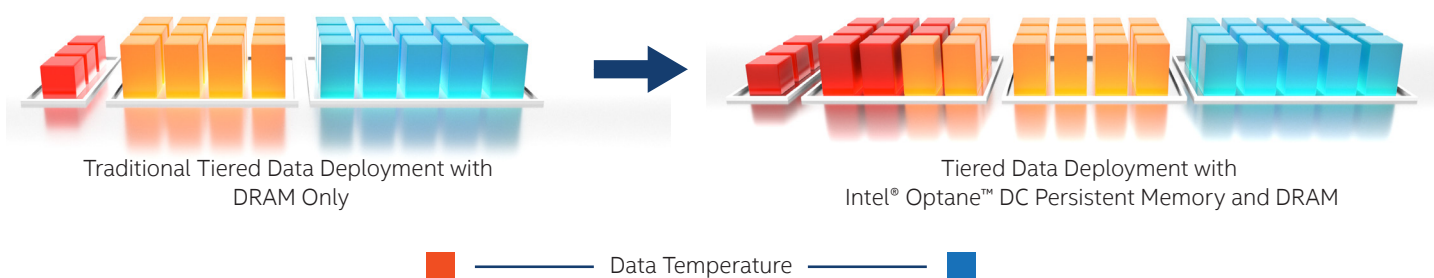


Figure 1. Intel® Optane™ DC technology evolves traditional tiered data management to support higher memory capacities for the warm and hot data tiers

The bottom line is that an SAP HANA multiple-tenant database deployment configured with DRAM and Intel Optane DC persistent memory can offer up to 6× greater system memory for OLAP workloads and up to 3× more capacity for OLTP workloads, when comparing 2nd Generation Intel® Xeon® Platinum processors to prior-generation Intel Xeon Platinum processors.^{2,3} This allows you to use fewer nodes or CPU sockets on a single node, with possible lower total costs compared to a traditional, DRAM-only configuration.

In many cases, SAP HANA landscapes can be consolidated into fewer servers, each one having a larger memory footprint.⁴ For example, one eight-socket server configured with DRAM and Intel Optane DC persistent memory can be configured to process the same volume of data, at nearly the same speed, as six four-socket DRAM-only servers.⁵ This server consolidation not only alleviates the need to purchase additional infrastructure hardware and expensive DRAM, but it also achieves the same, or even better, processing performance and costs less than a DRAM-only server deployment.

A simplified SAP HANA infrastructure streamlines data-tier management. Spending less time on monitoring, maintenance, upgrades, troubleshooting, and backups can help reduce IT administration costs.

Build Better Business Continuity

Robust business continuity is one of those operational imperatives that can always be improved, and Intel Optane DC persistent memory provides a number of ways to achieve this. It can help increase uptime and availability by providing faster SAP HANA database restart times and streamlining disaster recovery. It can also improve overall platform efficiency by allowing the consolidation of multiple functions onto an SAP HANA node.

Deploying Intel Optane DC persistent memory can help increase the availability of systems and services by dramatically decreasing SAP HANA downtime during planned and unplanned restarts. Data persistence keeps in-memory data fully available during boot ups, eliminating the initial loading of the column store and

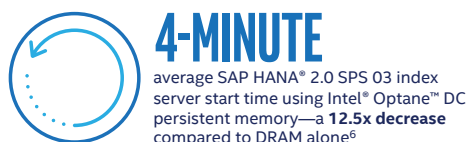


Figure 2. Intel® Optane™ DC persistent memory delivers faster SAP HANA® database starts to help ensure business continuity and meet service-level agreements (SLAs)

resulting in up to 12.5× shorter database restart times.⁶ A startup time of 50 minutes for an SAP HANA instance configured with traditional DRAM and a 6 TB database can be reduced to just four minutes using a combination of DRAM and Intel Optane DC persistent memory.⁶

Higher memory capacity, in combination with data persistence, can accelerate disaster recovery, getting systems back up and running sooner after a power outage or other unplanned downtime. System configurations from multiple servers can be easily replicated to a separate, larger data center configured with Intel Optane DC persistent memory. System data is held in persistent memory, which means it can be instantly activated during disaster recovery. For production systems, data can be replicated to a remote sandbox that serves multiple purposes, in addition to a production data repository, such as quality assurance (QA) and test and development for data scientists, system architects, and database administrators. Production data is stored in persistent memory, so that, should a disaster-recovery scenario arise, it is instantly available for recovery.

Increase Memory Capacity

Deploying Intel Optane DC persistent memory to increase SAP HANA memory capacities can help organizations get better utilization of new technologies and expose larger datasets to advanced analytics. SAP HANA extension nodes configured with Intel Optane DC persistent memory extend advanced analytics processing capabilities even further compared to dynamic data-tiering approaches.

Increased memory density with Intel Optane DC persistent memory can enable organizations to support larger datasets, particularly for the hot data tier, which can benefit AI, ML, and advanced analytics. Placing more data in the hot and warm data tiers means faster access to structured and unstructured data. Larger data models and faster response times help lower the time required for training AI, which decreases the time to value for AI deployments.

Greater in-memory capacity is also particularly important for database compliance requirements that accompany transaction processing. OLTP databases must comply with various regulations to ensure that personal and financial information is carefully secured during online transactions. Any delays in maintaining database compliance put organizations at serious legal and financial risk. Security processing—such as encryption, user authentication and authorization, data anonymization and masking, and database change tracking—is applied simultaneously to live transaction processing, further adding to the OLTP workload.

SAP HANA 2.2 and below stores warm-tier data in SSDs and uses dynamic tiering to shuttle warm-tier data to the hot tier for in-memory processing by DRAM. This traditional deployment comes at the cost of slow data access from SSDs and is limited in the types of data it can transport. Now, SAP HANA 2.3 extension nodes offer a better approach to processing warm- and hot-tier data. When configured with DRAM and Intel Optane DC persistent memory, SAP HANA 2.3 extension nodes not only increase the capacity of the hot tier, but they support all data types. Warm data is stored in persistent memory as a full SAP HANA instance, which increases the volume of hot data allowed to run multi-model and advanced analytics—such as hybrid transactional and analytics

processing, predictive AI and ML, geospatial and graph analysis of drone imagery, central procurement with guided buying, contextual analysis of Internet of Things (IoT) sensor data, and more. This alternative to dynamic tiering can also reduce the cost of data storage by increasing the capacity of warm-tier data storage, and the new warm SAP HANA instance is less costly per terabyte than hot-tier data storage.

Intel Optane DC Persistent Memory Is a Game-Changer for Data Management

Intel Optane DC persistent memory, combined with DRAM, revolutionizes the SAP HANA landscape by helping organizations achieve lower overall TCO, ensure business continuity, and increase the memory capacities of their SAP HANA deployments.

Reduce infrastructure and operational costs with server consolidation that places larger datasets, faster processing, and more functionality on fewer SAP HANA nodes. Easily scale up

or scale out SAP HANA instances with persistent memory that costs less per TB than DRAM. Use data persistence to get faster SAP HANA restart times and higher service availability. Give SAP HANA the power to support new technologies and hybrid workloads by adding higher memory capacities and near-DRAM processing performance.

SAP HANA 2.3 is the first large-scale data platform optimized for Intel Optane DC persistent memory. Along with select Intel Xeon Scalable processors, Intel Optane DC persistent memory can transform the traditional SAP HANA data-tier infrastructure and revolutionize data processing and storage. Together, these technologies give organizations faster access to higher volumes of data than ever before, in addition to better performance for advanced data processing technologies.

To learn more, visit intel.com/OptaneDCPersistentMemory, intel.com/sap, sap.com/persistent-memory, or sap.com/hana.

¹ Domo. "Data Never Sleeps 5.0." 2017. domo.com/learn/data-never-sleeps-5.

² Up to 6x greater system memory supported versus recently available solutions (representing the currently installed data center base). For online analytical processing (OLAP) workloads, SAP has certified its SAP HANA® 2 platform to support up to 18 TB of memory per system for a 4-socket configuration (or 36 TB for an 8-socket configuration) using the 2nd Generation Intel® Xeon® processor Scalable family installed with Intel® Optane™ DC persistent memory. Systems using the previous-generation Intel Xeon processor Scalable family (representing the typical data center installed base infrastructure) could only support 3 TB for a 4-socket configuration (or 6 TB for an 8-socket configuration). For comparative purposes, SAP certifies support for up to 3 TB of memory for the previous-generation Intel Xeon processor Scalable family in a 4-socket configuration, so 2nd Generation Intel Xeon processor Scalable family-based systems are certified to support up to 50 percent greater system memory than the generation they replace.

³ Up to 3x greater system memory supported versus recently available solutions (representing the currently installed data center base). For online transaction processing (OLTP) workloads, SAP has certified its SAP HANA® 2 platform to support up to 18 TB of memory per system for a 4-socket configuration (or 36 TB for an 8-socket configuration) using the 2nd Generation Intel® Xeon® processor Scalable family installed with Intel® Optane™ DC persistent memory. Systems using the previous-generation Intel Xeon processor Scalable family (representing the typical data center installed base infrastructure) could only support 6 TB for a 4-socket configuration (or 12 TB in an 8-socket configuration). For comparative purposes, SAP certifies support for up to 6 TB of memory for the previous-generation Intel Xeon processor Scalable family in a 4-socket configuration, so 2nd Generation Intel Xeon processor Scalable family-based systems are certified to support up to 50 percent greater system memory than the generation they replace.

⁴ The level of server consolidation may vary depending on existing hardware. The consolidated SAP HANA® instance must comply with sizing guidelines, including CPU and DRAM capacities.

⁵ Consolidation example is based on standard hardware specifications of 3 TB per socket, up to 24 TB database storage, and Intel® Optane™ DC persistent memory capacities of up to 512 GB per DIMM.

⁶ SAP HANA® simulated workload for SAP® BW edition for SAP HANA Standard Application Benchmark Version 2 as of May 30, 2018. Baseline configuration with traditional DRAM: Lenovo ThinkSystem SR950* server with 8 x Intel® Xeon® Platinum 8176M processors (28 cores, 165 watt, 2.1 GHz). Total memory consists of 48 x 16 GB TruDDR4* 2,666 MHz RDIMMs, and 5 x ThinkSystem 2.5" PM1633a 3.84 TB capacity SAS 12 Gb hot swap SSDs for SAP HANA storage. The operating system is SUSE* Linux* Enterprise Server (SLES*) 12 SP3 and uses SAP HANA 2.0 SPS 03 with a 6 TB dataset. Start time: 50 minutes.

New configuration with a combination of DRAM and Intel® Optane™ DC persistent memory: Lenovo ThinkSystem SR950 server with 8 x Intel Xeon Platinum 8176M processors (28 cores, 165 watt, 2.1 GHz). Total memory consists of 48 x 16 GB TruDDR4 2,666 MHz RDIMMs and 48 x 128 GB Intel Optane DC persistent memory modules (PMMs), and 5 x ThinkSystem 2.5" PM1633a 3.84 TB capacity SAS 12 Gb hot swap SSDs for SAP HANA storage. The operating system is SLES 12 SP3 and uses SAP HANA 2.0 SPS 03 with a 6 TB dataset. Start time: 4 minutes.

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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