

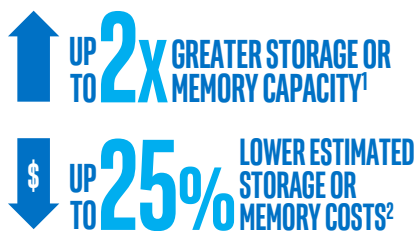
BUSINESS BRIEF

Data Center
High Performance Computing



Dynamically Match Memory and Storage to HPC Application Needs With a Flex Memory Solution

Intel® Optane™ DC SSDs with Intel® Memory Drive Technology deliver up to **2X** more storage or fat memory nodes¹ with up to **25 percent** lower estimated storage or memory costs²



Industry challenges

HPC environments can be as complex as the problems they are designed to solve. One of the most challenging aspects is the high number of applications and their varying requirements. With sharply rising data volumes, initial “standard” HPC configurations may no longer be adequate. But even if they can handle the more standard workloads, many of today’s HPC applications need particularly fast storage access or particularly high memory capacity. Responding to these needs, organizations may add high-end I/O nodes and/or fat (memory-heavy) nodes. This is an expensive solution that creates “islands” of dedicated hardware. In fact, these specialty islands can make up as much as 10 percent of HPC infrastructure.³

Organizations need a way to meet the needs of all applications—responsively and affordably. This will help them move important research forward faster, solve problems using bigger datasets for better insights and solutions, and conserve precious research and development dollars.

Intel® Optane™ SSDs with Intel® Memory Drive Technology is an affordable new option for flexible use of an HPC data center’s existing resources—allowing the choice of increased memory capacity or improved storage performance, with on-demand provisioning to match application and user needs. This “flex memory” capability enables prioritization of more memory for memory-hungry workloads and more storage for latency-sensitive workloads. It can deliver up to twice the memory or storage capacity¹—at up to 25 percent lower estimated storage or memory costs.² Switching between memory and storage modes can be integrated with cluster management tools and/or workload schedule and provisioned during reboot cycle to meet specific needs.

HPC is used in an increasing number of industries and research segments, and flex memory can help increase the size and speed of computations across a broad range of use cases. These are just a few examples:

Where Used

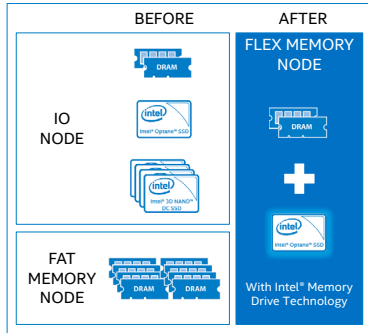
- Life Sciences
- Astrophysics
- Computational chemistry
- Pharmaceuticals
- Atmospheric research

How Used

- Big data analytics
- Modeling and simulation
- Predictive analysis
- Data mining
- Mathematical calculations

Business drivers and desired outcomes

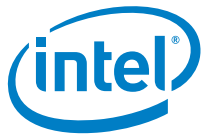
- Run increasingly intensive computations to meet business or research needs
- Make best use of huge data volumes to spark breakthroughs and solutions for complex problems
- Stretch budgets to accomplish more faster with current infrastructure
- Serve a wide variety of application needs efficiently



Intel® Optane™ SSDs with Intel® Memory Drive Technology allows the choice of increased memory capacity or fast storage, with on-demand provisioning to match application and user needs.

Flex memory = big benefits for HPC

- **Flexibility:** Provides more memory or faster storage, provisioned in advance or on-demand, as needed by a wide variety of HPC applications
- **Affordability:** Enables switching between memory and storage modes, with no need to add DRAM or hardware
- **Price/performance:** Delivers more from existing infrastructure investment



Digital transformation and business innovation

Digital transformation is all about using new technologies to make a significant difference in the way people work and the work they can accomplish. Today's scientists and researchers have the opportunity to solve pressing challenges for our world. New technology tools enable them to apply the massive volume of data now available to explore new solutions and move their areas of specialty forward. Flex memory mode allows larger datasets, eliminating the need for distributed implementation or sending data to disks. A more streamlined approach employs Intel Optane SSDs and Intel® Memory Drive Technology, which can result in increased performance, reduced cost, and less programming complexity.

Solution summary

The combination of Intel Optane DC SSDs and Intel Memory Drive Technology is a cost-saving flex memory solution that prioritizes memory or storage depending on the needs of a wide variety of applications typically used in HPC environments. Switching between the two modes is simple, requires no change in hardware or operating system, and is an affordable alternative to adding DRAM or specialized nodes.

Intel technology foundation

The development of Intel® Optane™ technology was a breakthrough in storage and memory solutions, with a combination of low latency, high endurance, high quality of service (QoS), and high throughput. From client computing to data centers, Intel Optane SSDs are delivering these benefits and helping to enhance a growing number of third-party software applications. Now the combination of Intel Optane DC SSDs and Intel Memory Drive Technology offers a flex memory solution uniquely suited for the challenges and opportunities of HPC.

Where to get more information:

- Intel® Memory Drive Technology
- Intel® Optane™ DC SSDs
- "Benefits of Intel Memory Drive Technology for Scientific Applications"
- Intel® HPC Products Portfolio

¹ 2x greater storage or memory based upon flexibility to configure an Intel® Optane™ SSD DC P4800X with Intel® Memory Drive Technology as either 100 percent storage or 100 percent memory, from a respective baseline of 50 percent for each memory and storage.

² Source: Memory4Less: Pricing as of May 21, 2019.

Baseline cost for fat memory nodes and I/O nodes: Fat memory nodes: Five nodes * 16x Samsung M393AAK40B42-CWD70* 128 GB PC4-21300 DDR4-2666 MHz ECC Registered @ \$1422.76/each: memory4less.com/samsung-128gb-ddr4-pc21300-m393aak40b42-cwd70 + 16x Samsung M393A2K40DB2-CTD* 16 GB PC4-21300 DDR4-2666 MHz ECC Registered @ \$186.89/each: memory4less.com/samsung-16gb-ddr4-pc21300-m393a2k40db2-ctd. I/O nodes: Intel: manufacturer's suggested retail price (MSRP) as of May 21, 2019 for Intel® SSD DC P4610 1.6 TB. \$659/each * 5 nodes. **Total cost = about \$119,000.**

New configuration: Intel and Memory4Less: 10 nodes * Intel® Optane™ SSD DC P4800X MSRP as of May 21, 2019: 2x Intel® Optane™ SSD DC P4800X 750 GB with Intel® Memory Drive Technology configured to 640 GB each = \$6480; DRAM configuration: 12x Samsung M393A2K40DB2-CTD* 16 GB PC4-21300 DDR4-2666 MHz ECC Registered @ \$186.89/each: memory4less.com/samsung-16gb-ddr4-pc21300-m393a2k40db2-ctd. **Total cost = about \$88,000.**

Cost reduction scenarios described are intended as examples of how a given Intel-based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction.

³ Based on Intel internal estimates.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. 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

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