TOP 10 REASONS
TO DEPLOY INTEL® OPTANE™ TECHNOLOGY IN THE DATA CENTER

As the first major memory and storage breakthrough in over 25 years, Intel® Optane™ technology combines industry-leading low latency, high endurance, QoS, and high throughput that allows the creation of solutions to remove data bottlenecks, and unleash CPU utilization. With Intel Optane technology, data centers can deploy bigger and more affordable datasets to gain new insights from large memory pools.

Here are 10 ways Intel Optane technology can make a difference for your business.

1 ACCESS DATA FASTER FOR GREATER INSIGHTS

Organizations are clamoring for faster, more efficient, and more affordable ways to consume, process, and extract useful insights from the mountains of data they deal with every day. And the amount of data out there is not only growing—it's constantly evolving. Intel Optane technology brings access to much more data closer to the CPU. This means faster computing of real-time analytics, financial transactions, electronic medical records, fraud detection, and other use cases that require predictably fast read-response times—when averaged response times are not good enough.

MOUNTAINS OF DATA

2 BOOST THE BOTTOM LINE

The Intel® Optane™ DC SSD does more work with the same servers when compared to alternative solutions. You can use the savings to reduce costs or expand capabilities and services.

√	**Bigger, more affordable memory**
√	**Cost-optimized for storage consolidation**
√	**More scale per server**
√	**Faster insight and larger memory pools**
√	**High endurance**
=	**Improve overall system with balanced cost, capacity, and performance**

3 INNOVATE WITH A FLEXIBLE ARCHITECTURE

Intel delivers a wide range of products to provide data center architects with design flexibility and exceptional performance.

2nd Gen Intel® Xeon® Scalable Processors

2nd Gen Intel® Xeon® Scalable processors optimize interconnectivity with a focus on speed without compromising data security.

Intel® Optane™ DC Persistent Memory

Intel® Optane™ DC persistent memory sits directly on the memory bus, and represents a new class of memory and storage technology architected to extract further value from data. It can be used with the Intel Optane SSD DC P4800X as a fast-cache storage tier.

Intel® Optane™ DC SSDs

Intel® Optane™ DC SSDs allow architects to optimize, store, and accelerate large complex datasets. The exceptional combination of low latency, high endurance, and consistent responsiveness is ideal for fast caching or fast storage. Near DRAM speed and persistence of traditional SSDs helps to solve the most demanding memory and storage challenges, even in the most dynamic environments.

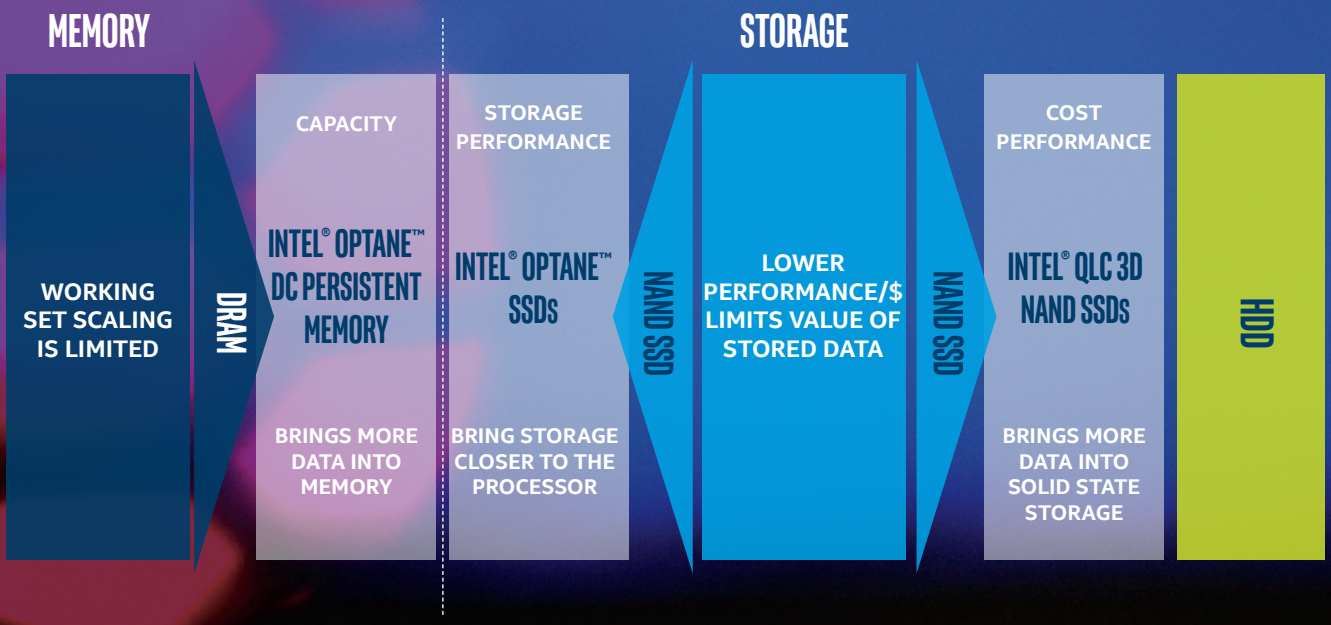
Intel® QLC 3D NAND SSDs

Intel® QLC 3D NAND SSDs are reducing the cost gap between SSDs and traditional spinning hard drives, making all-flash storage an affordable option.

4 BRIDGE THE MEMORY AND STORAGE GAP

Today's storage technologies leave a technology gap in data storage tiers. Memory is great from a performance standpoint, since it's close to the processor on the memory bus, but it's expensive and the ability to scale capacity for larger working sets is limited. NAND brings capacity and is inexpensive relative to DRAM, but it's not on the memory bus and therefore doesn't approach the performance of memory. This leaves data center architecture gaps when trying to balance capacity, performance, and cost considerations.

Intel Optane technology and Intel QLC 3D NAND SSDs enable system architects to break through the bottlenecks in the working data caching tier while cost-effectively increasing the capacity for data storage. In tandem, these unique technologies bridge the gaps between localized hot data (near the CPU) and larger capacity data.



5 ACCELERATE RESPONSE AND PERFORMANCE

Intel® Optane™ SSD DC P4800X vs. 3D NAND SSDs

BREAKTHROUGH PERFORMANCE	**High throughput (fast movement of data)** Reads and writes at bit level (not pages and blocks like NAND). This means no garbage collection for faster write times. Performance does not decay under stress.	UP TO 6X FASTER queue depth 1, 4K 70/30 RW IOPS[1]
PREDICTABLY FAST SERVICE	**High QoS (fast performing on mixed workload benchmarks)** In an environment of fast growing data and demanding requirements, data centers must deploy solutions that enable predictably fast service.	UP TO 60X BETTER 99% QoS[2]
RESPONSIVE UNDER LOAD	**Low latency, fast response time** With NAND-based SSDs, random write operations can add significant delay to the read operations. Intel Optane technology maintains consistent response times regardless of write throughput. You can consistently experience fast service under any load even at low queue depth where most applications generate storage workloads.	UP TO 63X FASTER response times[3]

6 CACHE DATA EFFICIENTLY

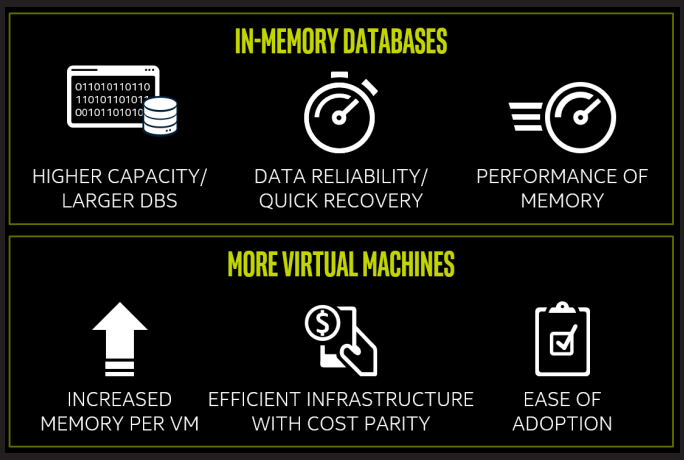
Fast storage or cache refers to the tiering and layering which enable a better memory-to-storage hierarchy. Intel Optane technology's combination of low and predictable latency and high endurance allows it to function much more efficiently as a caching device vs. NAND-based solutions.

A system built on Intel Xeon Scalable processors, using Intel Optane SSD DC P4800X drives for the caching layer delivered up to 3x better price/performance levels than previous generation systems and storage media.[4]

3x BETTER PRICE PER PERFORMANCE[4]

7 EXPAND MEMORY

Intel Optane DC persistent memory is an innovative new tier in the memory hierarchy that is applicable to workloads across cloud, in-memory computing, and storage. This new application of Intel Optane technology in a DIMM form factor allows large amounts of data to be moved closer to the CPU—providing fast access, processing, and analysis in real time—comparable to DRAM at low latencies. The DIMM also offers higher capacity and data persistence, allowing data to remain in memory even when power cycles occur. The flexibility of Intel Optane DC persistent memory enables system architects and designers to accelerate industry-trending In-Memory Databases, and support more Virtual Machines and larger memory for each.



8 HANDLE THE BREADTH OF STORAGE WORKLOADS

With Intel Optane DC SSD, each server can do more, across applications. This data center SSD is ideal for working data and real-time data stored in large volumes; highly random storage bound applications; and random workloads at low queue depths, which is where the majority of activity occurs in real-world scenarios.

STORAGE | CLOUD & VMS | DATABASE | AI / ANALYTICS | HPC | COMMS

9 FULLY CONNECTED PLATFORM

Data defines the future, and Intel's unique position as a technology leader and breadth of capabilities can help customers deliver something new, or reimagine what they do, only better. This takes memory and platform innovation. Intel's end-to-end integrated architecture optimizes the Intel Xeon Scalable processor, Intel Optane technology and Intel 3D NAND technology to create an efficient data center that can move data faster, store more of it, and process everything from cloud to the edge. Platform-connected capabilities link the compute and storage pools to efficiently manage storage at scale, accelerate applications, and simplify systems.

10 EXPERIENCE THE INTEL DIFFERENCE

With over 50 years of experience, Intel is redesigning the fabric of how new systems are architected, building storage directly into the DNA of new system designs. The combination of Intel Optane DC persistent memory with the performance-optimized Intel Optane SSDs and next-generation cost-optimized Intel® 3D NAND SSDs with QLC technology is redefining the storage hierarchy and defining the future of storage—a future that is driven by Intel.

BREAKTHROUGH PERFORMANCE EXPANDS DATASETS, ELIMINATES BOTTLENECKS

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1. Source – Intel-tested: 4K 70/30 RW Performance at Low Queue Depth. Measured using FIO 3.1. Common Configuration - Intel 2U Server System, OS: CentOS 7.5, Kernel 4.17.6-1.el7.x86_64, CPU 2 x Intel® Xeon® 6154 Gold @ 3.0GHz (18 cores), RAM 256GB DDR4 @ 2666MHz. Configuration – Intel® Optane™ SSD DC P4800X 375GB compared to *Intel® SSD DC P4600 1.6TB. Intel Microcode: 0x2000043; System BIOS: 00.01.0013; ME Firmware: 04.00.04.294; BMC Firmware: 1.43.91f76955; FRUSDR: 1.43. Performance results are based on testing as of November 30, 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.
2. Source – Intel-tested: Measures 99 percent QoS under 4K 70–30 workload at QD1. See configuration in Footnote 1 above. Performance results are based on testing as of July 24, 2018 and may not reflect all publicly available security updates.
3. Source – Intel-tested: Response Time refers to average read latency measured at queue depth 1 during 4K random write workload. See configuration in Footnote 1 above. Performance results are based on testing as of July 24, 2018 and may not reflect all publicly available security updates.
4. Tests by The Evaluator Group. See config details at https://www.evaluatorgroup.com/document/lab-insight-latest-intel-technologies-power-new-performance-levels-vmware-vsan-2018-update/. Tested using IOmark-VM.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com/optane.

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.

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.

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