



## Turbo-Charge Your Applications with Persistent Memory Today

NetApp Memory Accelerated (MAX) Data\* provides transparent application access to Intel® Optane™ DC persistent memory with plug-and-play ease of deployment.



### Big Data, Big Opportunities, Big Challenges

Big data presents big opportunities to gain valuable insights in the enterprise through advanced analytics and machine learning (ML) technologies. Traditional IT infrastructure cannot keep up with the vast amounts of data that must be analyzed and shared in real time. This gap between capabilities and necessity has created a need for a new class of memory-based data services. These services need to handle use cases that require ultra-low latency or the ability to support huge datasets, such as:

- Financial trading, real-time market analytics, and fraud and cyberthreat detection
- Healthcare diagnostics, therapeutics, and genomics workflows
- E-commerce
- Weather forecasting
- Social-media environments that use personalization algorithms
- Internet of Things (IoT) workloads
- Artificial intelligence (AI) and ML inference models

### Breaking Barriers with Intel Optane DC Persistent Memory

Intel® Optane™ DC persistent memory is a new memory technology in a DIMM form factor that meets the need for speed and enables a new cost-effective memory tier for managing large datasets. Intel Optane DC persistent memory breaks two barriers that limit DDR4 DRAM:

- **Density barrier.** Intel Optane DC persistent memory makes dense memory tiers economically feasible by supporting up to 512 GB per DIMM at a lower cost than DRAM in large-capacity modules.
- **Volatility barrier.** Intel Optane DC persistent memory offers full data persistence, unlike volatile DRAM; data in Intel Optane DC persistent memory remains as you left it after a restart.

Intel Optane DC persistent memory provides low-latency, solid-state persistent memory in the server, next to the processor. It can drive performance gains that enable developers, users, and administrators to rethink how and where they store data.

These use cases depend on database and analytics applications that value in-memory compute capabilities and are fueled by massive datasets. Organizations are searching for new technologies to increase the limits on memory and the size of working datasets in a cost-effective manner.

"IDC expects solutions such as MAX Data to be deployed with both existing, latency-sensitive relational database applications and newer workloads that include real-time and batch-oriented big data analytics and many technical computing applications ... where their performance drives compelling, bottom-line business benefits."

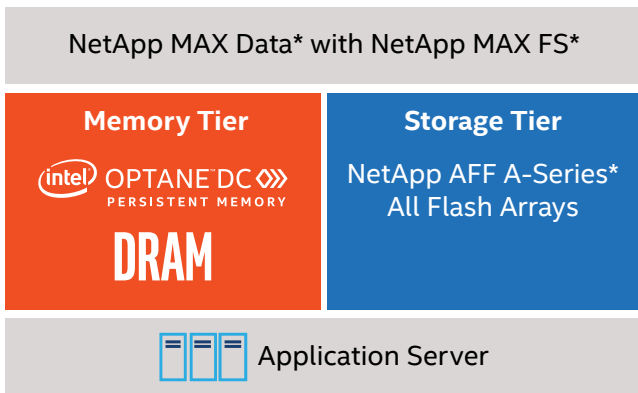
— IDC<sup>1</sup>

Data persistence comes when Intel Optane DC persistent memory is used in App Direct Mode. Intel Optane DC persistent memory in App Direct Mode acts as fine-grained, byte-addressable memory while current applications are generally written to use traditional, block-addressable storage. Organizations will need to wait for widespread availability of applications that can accommodate Intel Optane DC persistent memory in App Direct Mode—unless they use NetApp MAX Data\*, which provides a fast path for organizations to realize the full potential of Intel Optane DC persistent memory today.

## NetApp MAX Data: Persistent Memory for All Your Applications

NetApp MAX Data server software changes the game for companies that want to reap the full benefits of Intel Optane DC persistent memory right away. No rewriting of applications is required because MAX Data is a seamless, plug-and-play software solution. NetApp has created a software layer right on the application server that makes the features of Intel Optane DC persistent memory—including data persistence in App Direct Mode—available to all the applications on the server.

MAX Data is not a caching system that makes a copy of hot data in memory for fast read access. Instead, it's a *tiering* system that makes the memory tier the primary location for hot data for fast read *and* write operations. As the memory tier fills, cooler data is moved (not copied) to the warm data-storage tier (see Figure 1).



**Figure 1.** NetApp MAX Data\* transparently manages the location of application data across memory and storage tiers

MAX Data autotiering happens transparently to the application because it presents both storage and Intel Optane DC persistent memory as a Portable Operating System Interface\* (POSIX\*) system to applications. It uses NetApp Memory Accelerated File System\* (MAX FS\*), a purpose-built file system that removes much of the unnecessary input/output (I/O) overhead of traditional block file systems. MAX FS also integrates seamlessly with the storage-management features of a NetApp ONTAP\* clustered storage environment.

## MAX Data Services

Intel Optane DC persistent memory supports both reads and writes. However, in order to take full advantage of the non-volatile nature of Intel Optane DC persistent memory for real-time workloads, you need a way to back up and protect that data by using enterprise data services. MAX Data enables data resilience with minimal impact on performance and provides last-write safety, which helps ensure the consistency of database applications. The NetApp Memory Accelerated Recovery\* (MAX Recovery\*) feature enables you to mirror and protect Intel Optane DC persistent memory in a server and to use snapshot copies for fast data recovery. As data ages, you can tier it to a NetApp All-Flash FAS\* (AFF\*) system based on NetApp ONTAP\* and make use of all the data-management capabilities in ONTAP, including high availability, cloning, deduplication, snapshot copies, backup, disaster recovery, and encryption.

## A Winning Combination for High-Performance Data Applications

The combination of MAX Data with Intel Optane DC persistent memory delivers a seamless end-to-end solution for improving the performance of applications that value in-memory compute and big datasets. In addition to helping organizations realize all the benefits of Intel Optane technology today for POSIX-compliant applications, NetApp brings the additional benefits of its storage-management environment to the data center.

INTEL® OPTANE™ DC PERSISTENT MEMORY
<ul style="list-style-type: none"> <li>• Persistent byte-addressable data close to the CPU on the memory bus</li> <li>• Higher density than DRAM, at much lower latency than flash; shrinks latency from microseconds to nanoseconds<sup>2</sup></li> <li>• High performance and low latency, with fewer servers, for an attractive total cost of ownership (TCO)</li> <li>• Possibility of lower server-application licensing costs with fewer servers (even after accounting for the cost of the MAX Data license)</li> </ul>

NETAPP MAX DATA* AND RELATED NETAPP* SERVER SOFTWARE
<ul style="list-style-type: none"> <li>• Benefits of Intel Optane DC persistent memory made available today to applications</li> <li>• Data-management features include mirroring, cloning, and snapshot copies with NetApp ONTAP*</li> <li>• Rapid recovery with memory-to-memory replication using the NetApp MAX Recovery* server</li> <li>• Extraordinary “six-nines” reliability—32 seconds or less of downtime per year<sup>1</sup></li> </ul>

**Table 1.** Benefits of Intel® Optane™ DC persistent memory with NetApp MAX Data\*

## Conclusion

Intel Optane DC persistent memory is a new technology that brings working data close to the CPU as high capacity, low latency, non-volatile DIMMs on the memory bus. Companies are eager for these capabilities to support the demanding workloads of in-memory databases, real-time analytics, and AI applications. MAX Data provides a plug-and-play layer of memory- and storage-management software on the server that transparently provides applications with access to the full benefits of Intel Optane technology and integrates seamlessly with the rest of the NetApp high-availability environment.

## Learn More

To learn more about NetApp MAX Data, visit: [netapp.com/us/products/data-management-software/max-data.aspx](https://netapp.com/us/products/data-management-software/max-data.aspx)

## NetApp MAX Data\* Solution at a Glance

- Intel® Optane™ DC persistent memory is a fast new technology that is accessed like DRAM on the memory bus but is persistent like NAND flash storage.
- NetApp MAX Data is a seamless, plug-and-play server software solution that enables existing applications to make use of Intel Optane DC persistent memory without being modified or rewritten.
- This combination of Intel Optane technology and NetApp\* software is a fast path to high performance and reliability for business applications that require low latency and the ability to work with large datasets in memory.



<sup>1</sup> IDC. "True Enterprise-Class Persistent Memory Solutions Will Open Up a New, Higher-Performance Storage Tier." October 2018. [netapp.com/us/forms/campaign/enterprise-class-persistent-memory-solutions.aspx](https://netapp.com/us/forms/campaign/enterprise-class-persistent-memory-solutions.aspx).

<sup>2</sup> Intel. "Fact Sheet: New Intel Architectures and Technologies Target Expanded Market Opportunities." December 2018. <https://newsroom.intel.com/articles/new-intel-architectures-technologies-target-expanded-market-opportunities/>.

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