Kx Optane Memory

Intel Optane DC persistent memory (Optane Memory) is a new hardware technology from Intel. It has the potential to disrupt the memory and storage landscape.

Earlier versions of kdb+ already supported Optane Memory in its Storage and Cached-memory modes. Kx and Intel engineers have collaborated, and kdb+ 4.0 supports App Direct Memory mode, giving individual applications fine-grained control over their use of Optane Memory.

Architectural Constraints

A typical kdb+ application uses a combination of memory and storage to gather, persist and analyze enormous datasets. Kdb+'s structured use of on-disk data allows efficient access to databases up to petabyte scale. The size of in-memory datasets, however, is primarily restricted by the size of the accessible memory space.

Once datasets grow beyond the available memory capacity, users have three main options:

- read and write data from files, introducing I/O delays
- scale horizontally, across multiple machines, introducing IPC delays
- scale vertically, with expensive DRAM

Of these, vertical scaling keeps data most accessible, and is preferred for kdb+ systems. But it is limited by the price of DRAM memory, and the number of hardware slots available for it.

The Disruption

Optane Memory disrupts the traditional hierarchy, by introducing a new category that sits between memory and storage. Using the same DDR4 DIMM slots (and memory bus) as DRAM, Optane Memory sits close to the CPU, and allows applications to directly address it as memory. By combining the best aspects of storage and memory, Optane Memory is at once high-performance, high-capacity, and cost-efficient.

At a Glance

Using Intel's Optane Memory to power high-performance, high-capacity, and cost-efficient applications on kdb+

The Kx Advantage

- On-disk databases run faster using Optane Memory
- In-memory databases scale vertically using Optane as a larger memory space
- App-level control of Optane Memory through App Direct Memory mode
- Partnership with Intel engineers

Deployment Options

Storage Mode

In Storage mode, Optane Memory behaves like a file system visible to kdb+. The file system is explicitly optimized for the underlying technology, and offers significantly better operational latencies than anything seen so far. Data passes quickly between storage and memory. Optane Memory is particularly fast at small, random reads, speeding up kdb+ historical queries.

Cached Memory Mode

In Cached Memory mode, DRAM mixes its memory address space with Optane Memory, dramatically increasing the amount of memory seen by the kernel and hence available to kdb+.

Significantly extended memory space enables calculations on a single machine, rather than a cluster. This removes or reduces the complexities and performance cost of IPC, allowing users to run simpler, more efficient analytics.

App Direct Memory Mode

In kdb+ 4.0, App Direct Memory mode lets applications talk directly to the Optane Memory. Kdb+ sees Optane Memory and DRAM as two separate pools, and gives users control over which entities reside in each. As a result, users can optimize their applications and schemas, keeping hot data in fast DRAM while still taking full advantage of the expanded memory capacity.

High Performance

Optane technology is markedly faster than existing storage media, as shown by Optane DC SSD. Optane Memory offers another significant performance improvement:

- Direct CPU access to individual bytes, rather than blocks
- Minimal latency and maximal throughput via the memory bus, versus PCIe connections for SSDs

High Capacity

The retail prices of Optane Memory should sit between the prices for DRAM and NVMe Optane storage. For a kdb+ solution that uses a lot of active memory for streaming or real-time analytics, or needs extremely fast access to hot data in a HDB, this may make such a solution more affordable than just using DRAM.

The increased memory size also provides an opportunity to consolidate workloads onto fewer nodes, reducing TCO by lowering hardware, software, datacenter and operations costs.

Support

Kx has created a new technology and marketing partnership with Intel, around Optane Memory. By working closely with Intel's engineers, we ensure kdb+ takes full advantage of the features of Optane Memory.

We also have a team of engineers ready to help Kx customers evaluate Optane Memory. Through a POC, we can determine the best way to deploy the new technology to new and existing use cases.

Please contact optane@kx.com to coordinate any such POC, or for any technical questions.

See code.kx.com/q/kb/optane to learn more.

About Kx

Kx is a division of First Derivatives, a global technology provider with more than 20 years of experience working with some of the world's largest finance, technology, automotive, utility, manufacturing and energy institutions. Kx technology, incorporating the kdb+ time-series database, is a leader in high-performance, in-memory computing, streaming analytics and operational intelligence. Kx delivers the best possible performance and flexibility for high-volume, data-intensive analytics and applications across multiple industries. The Group operates from 15 offices across Europe, North America and Asia Pacific, including its headquarters in Newry, and employs more than 2,400 people worldwide. For more information about Kx please visit www.kx.com. For general enquiries, write to info@kx.com. For press inquiries, write to pr@firstderivatives.com.

Head Office
3 Canal Quay,
Newry,
BT35 6BP
N. Ireland
+44 (0)283 025 2242

London
Cannon Green Building,
27 Bush Lane,
EC4R 0AN
United Kingdom
+44 (0)207 337 1210

New York
45 Broadway,
NY 10006
USA
+1 (212) 447 6700

Singapore
One Raffles Quay,
North Tower,
#30-03,
048583
Singapore
+65 6592 1960

Sydney
22 Pitt Street,
NSW 2000
Australia
+61 (02) 9236 700

Toronto
31 Lakeshore Road
East, Suite 201
Mississauga, On,
L5G 4V5
Canada
+1 289 329 0636

Tokyo
20th Floor,
Shin-Marunouchi
Center Building,
1-6-2, Marunouchi,
Chiyoda-ku,
Tokyo, Japan
+81 (0)36 634 9799