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Upgrading from Fusion® ioMemory® to Ultrastar® DC SN200 SSDs

Replace existing Fusion® ioMemory® design-ins with modern Ultrastar® DC SN200 NVMe™ SSDs and instantly receive higher I/O performance, lower CPU and DRAM utilization, and faster application response times.

The Fusion ioMemory device line can be replaced with Ultrastar DC SN200 SSDs with little effort and little risk in most applications, while delivering massive performance and usability improvements. This paper summarizes the benefits received and demonstrates some preliminary performance comparisons using Fusion internal ioMemory test suite.

Increase Performance up to 400%

The HH-HL add-in card (AIC) form factor of the Ultrastar DC SN200 SSD, can quadruple read performance and in most cases match or exceed write performance of the fastest Fusion ioMemory products. The actual Fusion ioMemory test suite was run on a pre-production 6.4TB[1] Ultrastar DC SN200 add-in-card (running firmware version 0.4), and its performance was compared to the 6.4TB Fusion ioMemory SX350 and the 5.2TB Fusion ioMemory PX600. Performance was normalized to 100% for all charts to simplify the comparison.

As is dramatically visible below in Figures 1 and 2, for the clear majority of real-life workloads the Ultrastar DC SN200 SSD delivers up to 4x the performance of the fastest Fusion ioMemory devices in read-heavy environments, and up to 2x the mixed read and write workload performance.
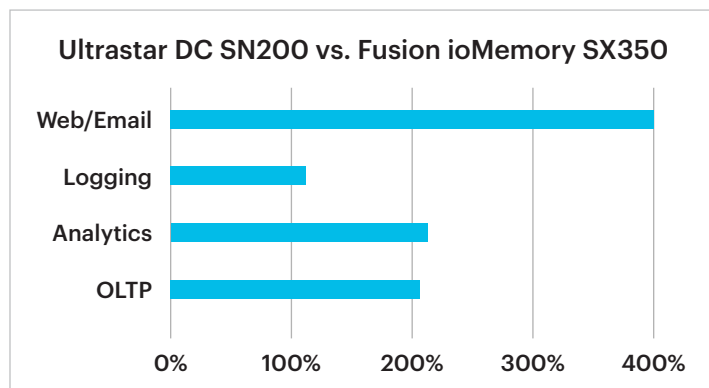
Figure 1 shows the relative performance comparison for these four workloads on an Ultrastar DC SN200 card as compared to a 6.4TB Fusion ioMemory SX350 card.

Ultrastar DC SN200 vs. Fusion ioMemory SX350

Figure 1. Workload performance of Ultrastar DC SN200 AIC vs. Fusion ioMemory SX350 at 6.4TB

Performance Comparison

Four different workloads were considered, in order to approximate real-world application profiles. These were run against fully preconditioned, steady-state Fusion ioMemory devices and a pre-production Ultrastar DC SN200 NVMe SSD at version 0.4 firmware:

- Web/Email-serving (4KB random reads)
- Logging (64KB sequential writes)
- Business Analytics (1MB sequential reads)
- OLTP Database (mixed 50% read, 50% write random 64KB blocks)

Upgrade Benefits At-a-Glance

- No custom device drivers needed
  — Built-in drivers for latest versions of Linux®, Microsoft Windows® and VMWare® operating systems
- Massively higher read bandwidths
  — Application reads of over 6GB/s
  — NVMe-compliant PCI Express® Gen 3 interface doubles the bandwidth as ioMemory's Gen 2 with same physical connector
- Smaller with higher capacities and lower power
  — Ultrastar DC SN200 SSD is available in a half-height, half-length 6.4TB or 7.68TB add-in-card
  — Hardwired controller = cooler operation
- Enhanced write lifetime vs. ioMemory SX350 series
  — 35PBW lifetime (Ultrastar DC SN200 6.4TB)
- No CPU or memory overhead
  — Ultrastar DC SN200 drives contain CPU and DRAM for flash management
  — Up to 16GB of server DRAM freed compared to the VSL™ software (Fusion ioMemory driver)
- Industry standard SMART monitoring

[1] One gigabyte (GB) is equal to 1,000MB (one billion bytes) and one terabyte (TB) is equal to 1,000GB (one trillion bytes) when referring to storage capacity. Accessible capacity will vary from the stated capacity due to formatting and partitioning of the drive, the computer's operating system, and other factors.
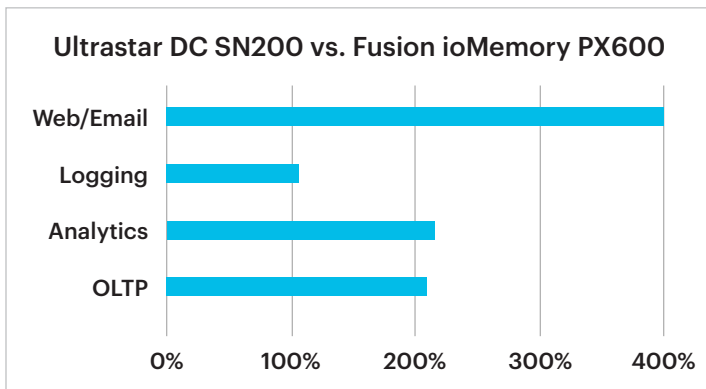
Figure 2. Workload performance of Ultrastar DC SN200 AIC vs. Fusion ioMemory PX600 at 6.4TB

Figure 2 above shows the same workloads but compared to the performance of a 5.2TB Fusion ioMemory PX600 card. Note that the Ultrastar DC SN200 has a full 6.4TB available for user data, 23% more than the PX600.

Lifetime Comparison

The Western Digital reporting mechanism for the SSD lifetime is "drive writes per day" (DW/D), while the lifetime for Fusion ioMemory devices was specified as "petabytes written" (PBW). Ultrastar DC SN200 SSDs carry a 5-year warranty, so converting to PBW is done by multiplying the DW/D number by the capacity and the number of days in a year.

For example, the Ultrastar DC SN200 at 6.4TB with 3DW/D provides a calculated 35PBW lifetime, well above the Fusion ioMemory SX350 6.4TB lifetime of 22PBW. For applications that require higher write lifetimes, contact Western Digital Support to learn about ways of extending the PBW capability.

General Considerations

There are a few application or administrator-level differences when moving from the Fusion ioMemory devices to the Ultrastar DC SN200, namely:

- The Ultrastar Device Manager (UDM) tool is utilized instead of the suite of ioMemory utilities for device management and upgrade, with a corresponding difference in the set of supported operations.

- Ultrastar DC SN200 SSDs are delivered from the factory formatted with a 4KB sector size, but may be reformatted to 512B sector size before use, if needed.

- There is no support for the customized MySQL® Atomic Writes in Percona Server®. Administrators should disable this configuration option in their MY.CNF files.

- Up to 128 NVMe namespaces are supported, and may be used in place of custom partitioning in certain situations. As always, there may be other differences as well. Please consult the product specific documentation and your Western Digital supplier for more details about your specific usage.

Summary

As shown above, the transition from Fusion ioMemory devices to Ultrastar DC SN200 cards is relatively painless. It provides enhanced usability and simplicity, in addition to great performance gains in mixed and read-intensive workloads. Host CPU and DRAM resources are also freed for use by customer applications, thanks to the onboard controller. For administrators, the fact that the Ultrastar DC SN200 drives do not need a custom device driver also simplifies deployment and maintenance.

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