

SOLUTION BRIEF

Maximize Database Instances for Better Multi-Instance Deployments



Ultrastar DC ME200 Memory Extension Drive, NVMe[™] U.2 and AIC HH-HL form factors

TCO Highlights

- Better management of database instances for larger DRAM capacities
- Improve memory density
- Overcome limitations of DIMM slots per server for database intances
- Reduce overall data center footprint and power consumption
- Expand effective server RAM up to 8 times

Product Features

- Up to 24TiB software-defined memory per 2U server (U.2)
- Works transparently with existing Linux[®] distrubutions and application stacks

Ultrastar[®] DC ME200 Memory Extension Drive for databases allows for better memory management for improved server utilization

Relational databases are foundational to business structures across all industries. Organizations and enterprises of all sizes use databases to store everything from contact information, on-line and off-line transactions, warehouse inventories, payroll, and additional transactions of record. Individual organizations can have hundreds or thousands of these types of databases. There are even multiple service providers whose primary focus is managing and keeping these database platforms-as-a-service running as cloud offerings.

Often these databases are not large or performance critical enough to warrant the deployment of a server per instance. Database administrators can make better use of their server infrastructure by running multiple database instances on a single server. This multi-instance deployment architecture lets them more fully employ the compute, storage, and networking of modern servers.

Multi-Instance Databases Limited by Memory

The problem is that each database instance uses a portion of main system memory to cache data and updates. In many cases the larger the set-aside memory, the faster the database, so database administrators try to make these RAM allocations as large as possible. For service providers or internal data center architects which are trying to maximize the number of databases hosted on each server, these pools often consume all of system memory before processing or storage limits are reached. Administrators have to make the choice to increase operating costs, by running servers at lower load than they'd like to in order to allocate enough RAM or increase initial costs by outfitting servers with expensive high-capacity memory subsystems.

Maximizing Database Consolidation

The Ultrastar DC ME200 Memory Extension Drive gives architects and administrators another choice, by expanding system memory up to 8 times the capacity of its physical DRAM, at a fraction of the cost of DRAM, using a custom NVMe-based solution. Such memory extension allows database administers to offer appropriately sized per-database buffer memories while simultaneously allowing data center architects to maximize the number of database instances with near-memory performance per server and increase server utilization.

¹ Memory capacity is indicated by GiB and TiB and based on binary values such that one gibibyte (GiB) is equal to 2³⁰ bytes and one tebibyte (TiB) is equal to 1024 GiB (2⁴⁰) bytes. Suggested expansion of 8x DRAM based on internal performance testing across a variety of industry standard benchmarks.

Ultrastar DC ME200 Memory Extension Drive Overview

...into system memory capacity





The Ultrastar DC ME200 combines one or more custom NVMe drives, tuned for performance, with a software layer that expands system RAM onto them. Unmodified Linux operating systems using this technology can address system memory up to eight times the physical DRAM installed in a server with near-DRAM speeds. Memory-intensive multiple database instances can utilize this extra system RAM without any changes. For example, a 1U server with 256 GiB installed can make use of up to 2 TiB of Ultrastar memory.

Figure – The left diagram depicts the traditional compute-memory-storage architecture, The right digram depicts how database instance configurations can take advantage of Ultrastar memory drives to augment server DRAM to create a virtualized memory pool to enable greater memory expansion.



Replacing DRAM with Ultrastar DC ME200 Memory Extension Drive

To validate the value of the Ultrastar memory drive when consolidating multiple OLTP database instances, Western Digital ran a series of tests comparing the performance of a 768 GiB DRAM-only configuration versus that of the same server with only 192 GiB of DRAM combined with the Ultrastar DC ME200. Multiple instances of Oracle® MySQL™, a popular open-source database, were run in parallel while using an OLTP (TPC-C-like) test generator. The aggregate performance of the full DRAM configuration was compared to the aggregate performance of the four-times and eight-times extended configurations. As shown in the graph below, the Ultrastar DC ME200 system with only 192 GiB of DRAM and a four-times expansion factor provided 70% of the performance of the 768 GiB DRAM system, showing how multiple instances can be run with significantly less DRAM while still performing acceptably.²

For More Information

Contact your Western Digital representative or go to https://www.westerndigital.com/ products/data-center-drives/ultrastar-dcme200-memory-extension-drive to get more detailed product information on the Ultrastar DC ME200 Memory Extension Drive.

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² Performance comparison based on internal testing. Results may vary based on system configuration, load, and other factors.