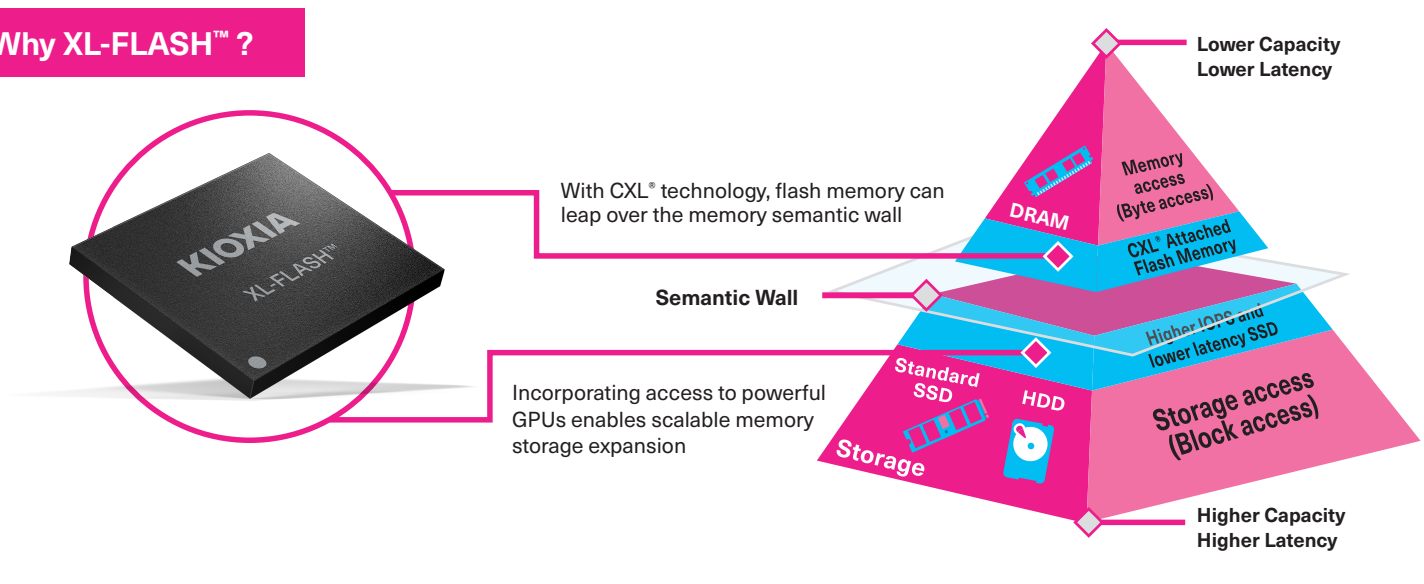
Opening New Doors in the Big Data Era

Low-Latency Flash as a Catalyst for Innovation

KIOXIA XL-FLASH™ is an extremely low-latency, high-performance flash memory. XL-FLASH™ is designed to address the performance gap that currently exists between volatile memories such as DRAM and current flash memory.

Many applications, including AI and database, increasingly demand more host memory. KIOXIA's XL-FLASH™ offers an innovative solution to meet these memory requirements

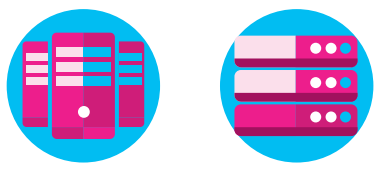
Why XL-FLASH™ ?



Use Case for CXL® Attached Memory Expansion

Utilizing CXL® Technology enables memory expansion. In addition to capacity and bandwidth, cost is a key consideration. With CXL® technology, it is now possible to expand host memory with flash memory, and the way to balance bit cost with memory scaling is an XL-FLASH™ with CXL® solution.

Target Application

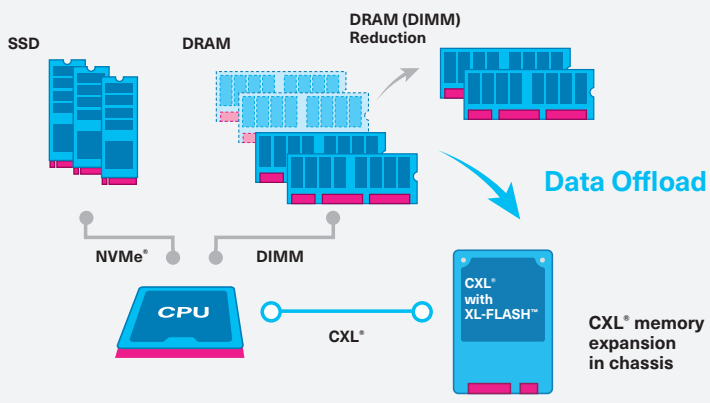


Data Center Enterprise

CXL® Attached Flash Memory

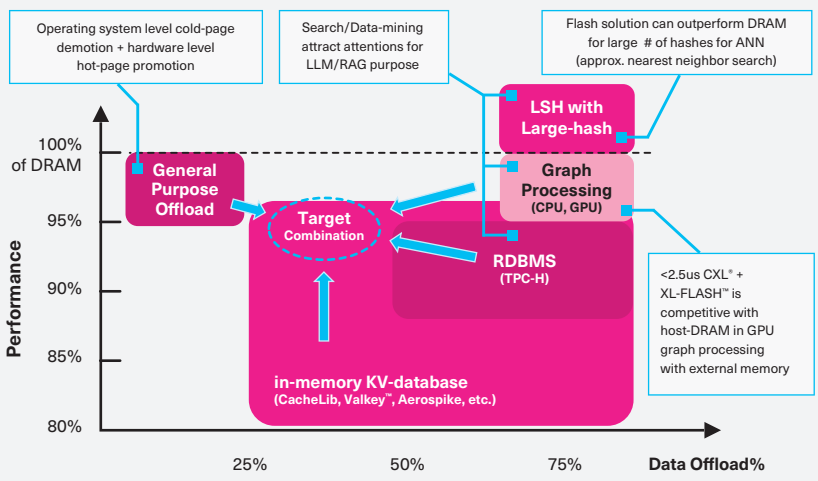
- **Protocol: CXL.mem/CXL.io**
- **Requirement:**
  Latency < 10us
  Tail Latency < 100us (P99.9999)

Target :
By offloading cold-data to CXL® with XL-FLASH™, it will mitigate the bigger density DRAM requirement with lower cost and acceptable performance



All Applications Are Not The Same

- Some applications perform well without the full performance of DRAM
- Applications may not be tuned for leveraging memory hierarchy optimally



	Application	
	Data in DRAM	Data in FLASH
Graph Processing[*1]	vertex	edge
LSH (Locality Sensitive Hashing)[*2]	hash table	index list
RDBMS (PostgreSQL)	small table	large table
In-memory KV-database[*3]	index tree/hash	all-or cold-data
General Purpose Offload	hot pages	cold pages

[*1] GPU Graph Processing on CXL®-Based Microsecond-Latency External Memory (SC23 MSTA), Approaching DRAM performance by using microsecond-latency flash memory for small-sized random read accesses: a new access method and its graph applications (VLDB 2021)

[*2] Implementing and Evaluating E2LSH on Storage (EDBT 2023)

[*3] CacheLib (FMS 2023), Aerospike (FMS 2022), Redis® (FMS2025), ScyllaDB (FMS 2025) SIGMOD 2025: Analysis and Evaluation of Using Microsecond-Latency Memory for In-Memory Indices and Caches in SSD-Based Key-Value Stores

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Measurement Result

CXL® with XL-FLASH™ memory expansion

DRAM shortages are a serious issue. If a dataset does not fit in DRAM, performance will degrade significantly. When using CXL® with XL-FLASH™ to provide the same total memory capacity as a DRAM-only configuration, the total system performance drop is only about <5%.

Data Allocation	Baseline	Combination of 1/3 CXL® with XL-FLASH™
DRAM DIMM	225 GB	148 GB
CXL® with XL-FLASH™	0 GB	77 GB

34%

- **Tested Condition:**

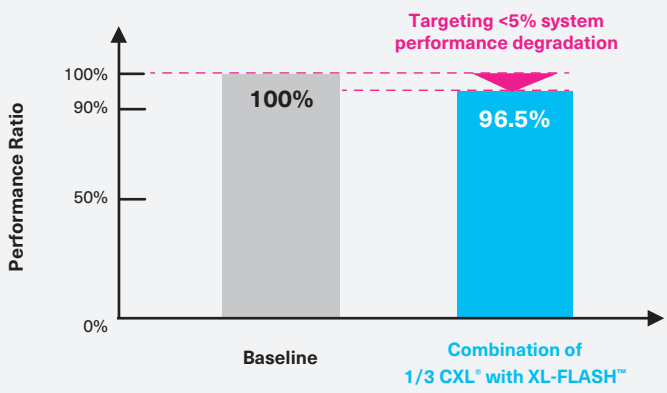
[CPU]
6th Generation Intel® Xeon® Scalable processors 32 core (4 + 28) / 192††

[Memory allocation for test (baseline)]
DIMM 225GB

[Memory allocation for test (Combination of CXL® with XL-FLASH™)]
DIMM 148GB + CXL® with XL-FLASH™ Emulation 77GB (FPGA†††)

[OS]
Linux™ v6.8.0

[Application]
Redis® OSS v8.4.0 with modification†



This evaluation was carried out in collaboration with **H3 Platform Inc.** who supplied the hardware environment and engineering support.

† This evaluation uses an implementation forked and modified from Redis® OSS v8.4.0 to optimize for our hardware. This implementation is not endorsed, certified, or supported by Redis Ltd. Redis is a registered trademark of Redis Ltd. Any rights therein are reserved to Redis Ltd.

†† On a 192-core system, we allocated 4 cores to the database and 28 cores to compute-intensive tasks during the benchmark run.

††† Internal 1GB read cache, 256MB write cache with hit ratio 80-90%, configured latency values: P50 <10 µs, P99 <20 µs, P99.99 <100 µs

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KIC v1.0 - US | October 2026