

# Delivering Breakthrough MongoDB Acceleration

Key-Value Based Acceleration with Zero Code Changes



## Introduction

MongoDB is a NoSQL document database market leader that is associated with a broad set of real-time applications including e-commerce, gaming, healthcare, IoT, among others. It is popular for its rich functionality, flexibility, reliability, and data type diversity. Recently, MongoDB added new cutting-edge features such as vector database capabilities for Generative AI.

MongoDB delivers excellent performance for small-to-medium-scale deployments that manage up to a few terabytes of data. However, as the deployments grow in size, the focus shifts from developer experience to performance and scalability. In such settings, MongoDB struggles to provide cost-effective solutions.

Many of MongoDB's performance challenges stem from the architecture of its storage management layer named WiredTiger. This component, while extremely powerful in terms of data management semantics, fails to fully exploit the galloping access rates of modern NVMe flash drives.

With the limited intra-node scale-up potential, enterprise customers are increasingly having to scale their MongoDB clusters by adding more nodes to keep up with the service level agreements (SLAs) – but this results in an increase in operational overhead and expenses.

To solve these issues, Pliops' has introduced *XDP-Mongo*, an accelerated MongoDB solution that leverages the breakthrough Pliops Extreme Data Processor (XDP) hardware accelerator to re-architect WiredTiger for an order-of-magnitude higher throughput and two orders-of-magnitude lower tail latency at the application level.

This innovation enables data- and performance-hungry applications such as real-time AI. XDP-Mongo provides drop-in compatibility to existing MongoDB deployments – with zero change to client applications. Finally, XDP-Mongo excels in data reliability with zero-overhead RAID5 support.

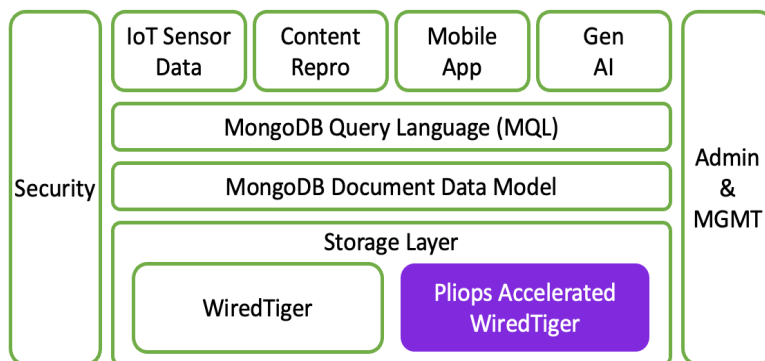
## Accelerated MongoDB Solution

Pliops Extreme Data Processor (XDP) provides a key-value (KV) abstraction for SSD storage. XDP completely bypasses the traditional filesystem interface to storage and implements offload engines targeted for intensive KV data access.

XDP-Mongo updates the WiredTiger layer around the KV platform. The XDP-enabled WiredTiger is the first technology to employ *KV separation* – a technique for split management of keys and values – to the popular B<sup>+</sup>-tree data layout used by MongoDB document storage. This approach enables highly granular and efficient access to flash storage, which translates to significant end-user performance gains.

XDP-Mongo is based on the modern open-source MongoDB 7.0.2, with only minimal changes to the MongoDB code as it focuses on the low-level data storage layer. This scoped change enables continual alignment with rapid pace of the MongoDB application-level features.

Our industry-standard YCSB benchmark results demonstrate up to 6x increase in transactions per second and up to ~200x reduction in tail latency for data-intensive real-time applications. This acceleration is key for achieving high-performance, low-TCO platform deployments.

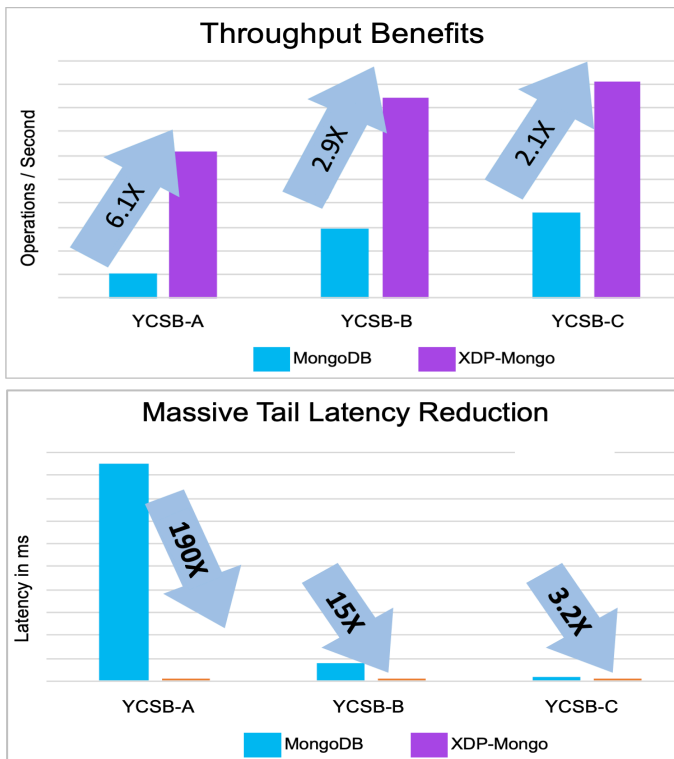


# Evaluation Results

The XDP-Mongo solution was evaluated with a Lenovo server, a single XDP, and two NVMe SSDs.

<b>Accelerator Card</b>	Pliops Extreme Data Processor (XDP) PCIe x8 Low Profile HHHL (6.6" x 2.536") form factor
<b>Storage</b>	Samsung SSD 3.8TB SSD Data Set 2.8TB, Key: 24 bytes and Values: 1KB
<b>Server</b>	Lenovo SR630
<b>CPU</b>	Dual Intel® Xeon® Gold 6434 CPU @3.7 Ghz
<b>Memory</b>	512 GB DDR4 2667 MT/s
<b>OS</b>	Ubuntu 22.04.2 LTS
<b>Kernel</b>	Linux 5.19.0-50-generic

The standard Yahoo Cloud Serving Benchmark ([YCSB](#)) was used to evaluate XDP-Mongo versus the MongoDB baseline: YCSB-A (50% read/50% write), YCSB-B (95% read/5% write), and YCSB-C (100% read) workloads generated by 64 concurrent client connections.



## Key Solution Benefits

- Validated for diverse workloads: Write-intensive, Read-mostly, and Read-only.
- High hardware utilization - up to 10X throughput increase for write-intensive workloads.
- Low response time – up to 200X p99 latency reduction for write-intensive workloads, 15X reduction for read-mostly workloads.
- Process billions of records per hour within given SLA requirements.
- Built-in Data Protection at storage RAID 5-like protection - with no capacity penalties.
- TCO Savings: 51-98%

## Conclusion

Enterprises require a MongoDB database solution that is both fast and flexible. With XDP-Mongo, a Pliops-accelerated MongoDB solution, they can build a modern data platform that allows for cost-effective scaling of their data infrastructure while keeping up with their application demands.

> To schedule your own XDP-Mongo evaluation, please reach out to: [demo@pliops.com](mailto:demo@pliops.com)

> Learn more about XDP and Pliops KV Accelerated solutions at: <https://pliops.com/AccelKV>

## About Pliops

Pliops overcomes storage inefficiencies to massively accelerate performance and dramatically reduce overall infrastructure costs for data-hungry applications. Founded in 2017, Pliops is a winner of the 'Flash Storage Solution of the Year' Award in the Data Breakthrough Awards program and has been named a few times one of the 10 hottest semiconductor startups. Pliops global investors include KDT, State of Mind Ventures Momentum, Intel Capital, Viola Ventures, SoftBank Ventures Asia, Expon Capital, NVIDIA, AMD, Western Digital, SK Hynix and Alicorn.