DDN® STORAGE

WHITE PAPER

Overcoming Flash Performance Barriers At-Scale

A Scale-Out Storage Cache for the Flash Era

A Time for New Approach to Faster I/O

Several key factors, both technological and commercial, are creating demand for a new approach to high performance I/O:

- Non-volatile memory (NVM) device technologies are continuing to develop and improve, and media capacities are increasing rapidly.
- Diverse many-core processor strategies are pushing higher I/O volumes and more demanding I/O profiles.
- A new generation of high-business-value markets are taking advantage of analytics and machine learning and further stressing performance boundaries.

Flash is rapidly replacing the performance tier of most workflows today. As SSD capacities surpass HDD capacities and pricing commoditizes, flash will eventually also replace HDD as the leading capacity media.

Flash-based media does not have the same characteristics as HDD. The most obvious difference is that latencies are several orders of magnitude lower for Flash. *Software that cannot distinguish an SSD from an HDD are now at a critical disadvantage, neither being able to exploit flash performance characteristics nor handle endurance optimally.*

A new race is afoot across multiple industries to develop machine learning ecosystems that support emerging markets in IoT, from self-driving cars to clinical analysis. This new wave of applications introduces different stresses from conventional HPC to the I/O subsystem, often being highly threaded and read-intensive.

Even today with the emerging factors outlined above, an increasing number of cases arise where the parallel file system becomes the limiting bottleneck for user applications. There are two routes to resolving this parallel file system bottleneck and improving performance:

- Modify the application: Rewrite I/O-bound codes typically optimizing I/O sizes, reducing I/O processes, and move to a new API or introduce new middleware libraries to transpose problematic I/O patterns to efficient ones and maintain those modifications indefinitely.
- Redesign the I/O path and subsystem: Make the new I/O system application transparent and optimized for a broader set of I/O patterns

PROBLEMS PLAGUING FLASH PERFORMANCE AT-SCALE

POSIX I/O AND PFS BOTTLENECKS

Parallel file systems were not designed for today's mixed-I/O and massively parallel I/O access patterns.

STORAGE LATENCY

HDD seek times and network queuing effects add latency.

FRAGMENTED I/O PATTERNS

Mal-aligned apps slow down the parallel file system for all applications sharing it.

OUT-OF-CORE DATA

Many data sets are becoming too big to fit in DRAM.

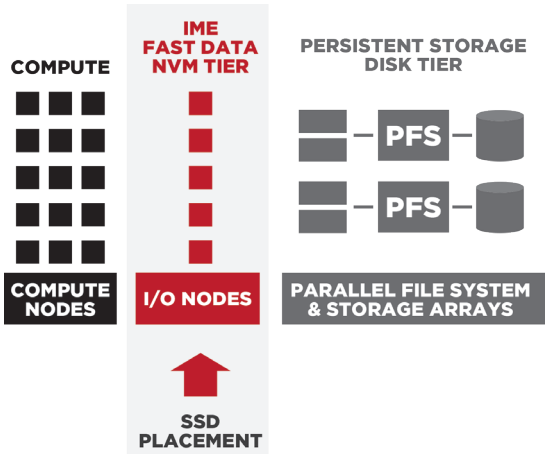
THE SOLUTION

DDN IME uses distributed and high-performance storage capabilities to address these challenges and provide a high-performance, tiered storage system.

Introducing Infinite Memory Engine (IME)

IME is software with a server and a client component. Rather than issuing I/O to a parallel file system client, the IME client intercepts the I/O fragments and issues these to the IME server layer which manages the NVM media and stores and protects the data.

Prior to synchronizing the data to the backing file system, IME coalesces and aligns the I/O optimally for the file system. The read case works in the reverse: file data is ingested into the cache efficiently in parallel across the IME server layer and will satisfy reads from here in fragments according to the read request.



Software

Designed for Non-Volatile Memory

Distributed Architecture

Extremely Fast

Invisible to Applications

Invisible to the File System

IME manages at-scale flash to eliminate file system bottlenecks and the burden of creating and maintaining application-specific optimizations. It delivers:

- New levels of I/O performance for predictable job completion in even the most demanding and complex high-performance environments.
- Performance scaling independent of storage capacity for system designs with order of magnitude reductions in hardware.
- Application transparency that eliminates the need to create and maintain application-specific optimizations.

ABOUT DDN®

DataDirect Networks (DDN) is the world's leading big data storage supplier to data-intensive, global organizations. DDN has designed, developed, deployed, and optimized systems, software, and solutions that enable enterprises, service providers, research facilities, and government agencies to generate more value and to accelerate time to insight from their data and information, on premise and in the cloud. For more information, visit our website www.ddn.com or call 1-800-837-2298.

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