ENTERPRISE APPLICATIONS WITH MAX DATA PERFORMANCE

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NETAPP MAX DATA OVERVIEW

Recently, a new type of high-performance storage has become available that can offer dramatic performance advantages. This non-volatile, or persistent memory has the potential to significantly improve performance, but challenges remain in order for applications to utilize this technology without being re-written and while providing enterprise levels of data protection critical applications require. Evaluator Group worked with NetApp to test a FlexPod along with NetApp MAX Data software which is able to accelerate critical application performance through the intelligent use of persistent memory technologies.

Architecture

NetApp MAX Data consists of several components that together provide high-performance with enterprise class reliability and data protection features. The MAX filesystem (MAX FS) works by combining high-speed persistent memory modules within a server along with traditional enterprise storage from NetApp ONTAP all-flash systems. MAX FS intelligently moves data between tiers of persistent memory and storage to provide performance with enterprise level protection. The MAX FS is designed to coordinate data protection with underlying NetApp storage for data integrity and protection capabilities. Additionally, MAX Recovery works to replicate data from persistent memory to another target system with persistent memory at high speeds.

An overview of MAX Data is shown below in Figure 1.

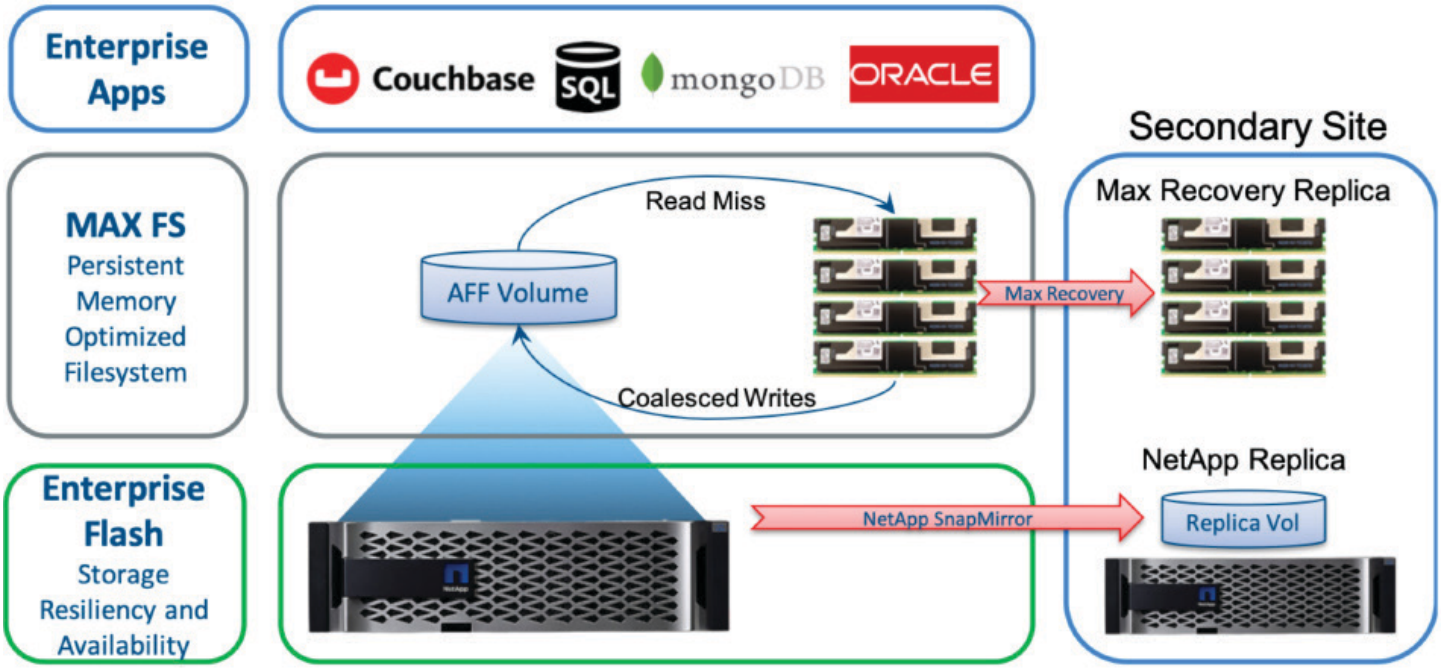

Figure 1: Max Data architecture for tier-1 applications

TEST RESULTS

Working with NetApp, Evaluator Group and NetApp personnel performed tests designed to validate performance capabilities, both in terms of how fast I/O requests were serviced (measured as latency) as well as how many I/O's were performed per second (measured as I/O per second, aka. IOPs).

Virtualized Database Workload

Databases are the basis for many enterprise applications, and in particular require low latency to improve performance. With approximately 50% of the database resident within the MAX Data persistent memory tier, performance increased by nearly 2X, while using 50% fewer CPU cores.

Evaluator Group Comments: Testing MAX Data v 1.3 showed up to 2X increase in random write rates with an 18X decrease in latency for virtual environments. Since this testing, new versions of MAX Data are available that provide better performance. New MAX Data v 1.5 has shown up to a 2X increase over version 1.3 for virtual environments.

MAX Data benefits vs. XFS for Database workload with a DBT2 (TPC-C like workload):

- **3.8X higher efficiency than XFS:** Nearly 2X performance with 50% fewer CPU cores
- **Database:** PostgreSQL, 320 GB database with DBT2 running "TPC-C like" workload
- **MAX FS config:** 12 vCPU's, 40 GB RAM, 180 GB DCPMM for MAX-FS, NetApp AFF A300
- **XFS config:** 24 vCPU's, 80 GB DRAM, XFS filesystem on NetApp AFF A300 LUNs (4)

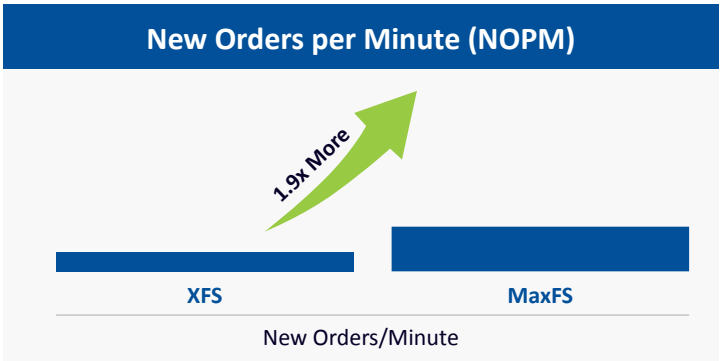

Figure 2: XFS Vs. MAX FS – Transactions

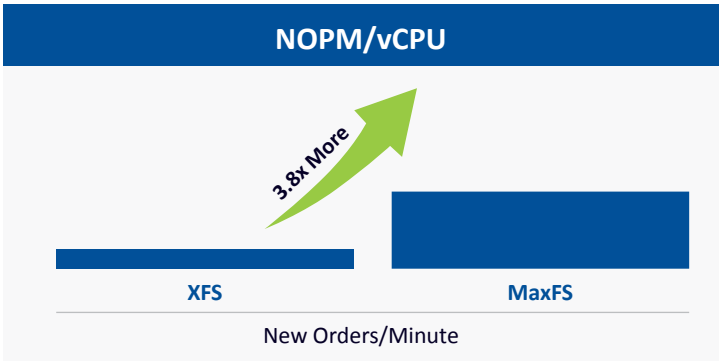

Figure 3: XFS Vs. MAX FS – Transactions / VCPU

Physical Environment

MAX FS was compared to XFS with a synthetic workload generated by "fio". Testing was performed with physical host infrastructure, with storage residing on XFS on a NetApp AFF A300 system.

MAX Data with MAX FS provided the following benefits vs. XFS

- MAX FS provided 5X random write I/O increase, 40X latency decrease vs. XFS
- Write latency < 35 us 600,000 random 4K IOPs @ 2.4 GB/s
- Read latency < 30 us 750,000 random 4K IOPs @ 3.0 GB/s
- XFS: 115,000 random 4K IOPs, 1,100 us; NetApp AFF A300 (4) LUNs, XFS

Evaluator Group Comments: The performance benefits of MAX Data are significant, delivering up to 5X higher I/O rates than a leading all-flash array, while also decreasing latencies by up to 40X for writes. With typical latency improvements of less than 2X between systems, the 40X reduction in latency MAX Data delivers is impressive.

FINAL THOUGHTS

There are few issues of greater importance than the ability to run enterprise applications at the speed businesses need, while still ensuring enterprise levels of data availability and protection exist for the application. NetApp's MAX Data delivers the ability to utilize persistent memory technology for Tier-1 enterprise applications without any changes to the application. By combining data resiliency and protection features with storage media that can deliver an order of magnitude of performance improvement is of interest to any business. As demonstrated in this technical evaluation, Evaluator Group found that MAX Data was able to accelerate critical application workloads through the intelligent use of persistent memory, while providing enterprise storage features and the potential for TCO benefits.