

FUJITSU Storage ETERNUS DX200 S3 Performance

Silverton Consulting, Inc. StorInt™ Briefing



Introduction

The entry-level Fujitsu ETERNUS DX200 S3 is a new smart storage system for small to medium business (SMB) data centers. ETERNUS DX200 S3 storage combines all the same functionality of larger ETERNUS DX storage systems at a significantly lower price point. The ETERNUS DX200 S3 also has some impressive performance credentials. As testament to this fact, Fujitsu recently published an independently validated storage benchmark using an all-flash version of the ETERNUS DX200 S3, which produced enterprise-class performance results.

ETERNUS DX200 S3 storage system

The new ETERNUS DX200 S3 system supports unified storage, specifically NFS and CIFS/SMB 2.0 protocols for file storage and iSCSI, FC and FCoE protocols for block storage and SAS for directly accessed server storage. The storage system offers a maximum of 264 drives that can be



expanded using up to 10 drive enclosures. ETERNUS DX200 S3 drive options include the following:

- **2.5" form factor** - 15KRPM 300GB disk drives; 10KRPM 300GB, 600GB, 900GB or 1.2TB disk drives; 7.2KRPM 1TB disk drives; and self-encrypting 10KRPM 900GB or 1.2TB disk drives; and
- **3.5" form factor** - 7.2KRPM 2TB, 3TB or 4TB disk drives, as well as SSD storage using 400GB or 800GB flash storage modules.

Customers can use the multiple drive options available with the ETERNUS DX200 S3 to support many different application performance requirements.

Application input/output (I/O) performance requirements

IT storage performance needs are very diverse. One data center may deploy highly interactive online transaction processing (OLTP) application environments that generate extensive read/write I/O activity while updating databases and other structured information all day long. Heavily virtualized environments, on the other hand, may result in a much more randomized I/O workload. End-user email and file storage services may, in turn, display a more general-purpose, file services I/O profile.

In any case, ETERNUS DX200 S3 storage configuration options allow each IT operation to tailor its storage to match just about any application environment. Data centers that need extreme performance may opt for an all-flash ETERNUS DX200 S3 storage system. Other data centers may need more restrained, disk-level performance with periodic high performance for demanding data. For these customers, an ETERNUS DX200 S3 with a relatively small amount of SSD storage might be configured with the remaining capacity as disk drives and used in conjunction with sophisticated ETERNUS SF automated storage tiering software. Where high levels of performance are not a prerequisite, a couple of tiers of 15KRPM, 10KRPM or 7.2KRPM disk storage with storage tiering may suffice.

ETERNUS SF automated storage tiering (AST)

Most auto-tiering solutions have some shortcomings. For example, I/O patterns can change from day to day and from hour to hour, meaning that today's best data storage tiering strategy isn't necessarily tomorrow's. Another potential problem is that storage system data movement can interfere with ongoing I/O activity. In other words, a system consumes valuable storage bandwidth and compute resources while it moves data, slowing down other I/O activity in the process. In addition, many auto-tiering solutions support only two tiers of storage, and some customers may require more flexible performance capabilities.

Finally, some auto-tiering functionality may move too large an amount of data (GB or more) or too small (MB or less). The problem with smaller auto-tiering movement granularity is that it requires more housekeeping to monitor, analyze and move data. For larger auto-tiering granularity, some data that just lies close to frequently accessed data may also be moved to SSD along with frequently accessed data, potentially wasting SSD storage.

Auto-tiering is intended to speed up critical data I/O, and Fujitsu ETERNUS SF AST functionality ensures that the most performance-critical data is placed on the fastest storage available to improve I/O performance. In most cases, frequently referenced data is migrated to SSD storage while less frequently accessed data is left on slower storage.

ETERNUS SF AST functionality is split between the ETERNUS DX storage system microcode and ETERNUS SF Storage Cruiser software, which operates on an attached server. ETERNUS SF Storage Cruiser provides analysis and movement scheduling functionality for ETERNUS SF AST. With ETERNUS SF Storage Cruiser, ETERNUS SF AST's analysis period can be modified by the customer and can be set to hours, days, weeks or even a whole month. In this way, temporary I/O performance spikes can be smoothed out so that AST optimizes ETERNUS DX storage tiering performance for a longer baseline of I/O activity.

ETERNUS SF AST supports up to three tiers of disk and flash storage for its auto-tiering, and ETERNUS SF AST data movement can be scheduled during off hours so as not to impact ongoing storage operation. Moreover, ETERNUS SF AST data movement granularity is 252MB, which is not so small as to increase monitoring, analysis and movement overhead and not so large as to waste flash storage on cold data.

ETERNUS DX200 S3 performance results

Fujitsu submitted an all-flash, ETERNUS DX200 S3 system for a Storage Performance Council SPC-1 benchmark.¹ The SPC-1 benchmark simulates a highly active, OLTP block storage environment and measures maximum I/Os per second, response time and other factors of storage under stress.

¹ Fujitsu ETERNUS DX200 S3 SPC-1 results available from http://www.storageperformance.org/results/benchmark_results_spc1/ as of 25 February 2014.

The SPC-1 ETERNUS DX200 S3 system was configured as an all-flash/all-SSD system using 29 400GB SSDs. The storage system was connected to host servers using 16Gbps FC ports and supported by 3.3TB of RAID 1-protected data storage at a total cost of \$154K.

Typically, all-flash storage systems are able to sustain very high I/Os per second with low access latencies. Indeed, the DX200 S3 supplied a maximum of 200K I/O operations per second (IOPS). This unusually high level of performance was within the top 30 storage systems' SPC-1 IOPS performance of all time.

As for access latency, Figure 1 shows the top 10 current SPC-1 Least Response Time (LRT™) results for all storage systems.

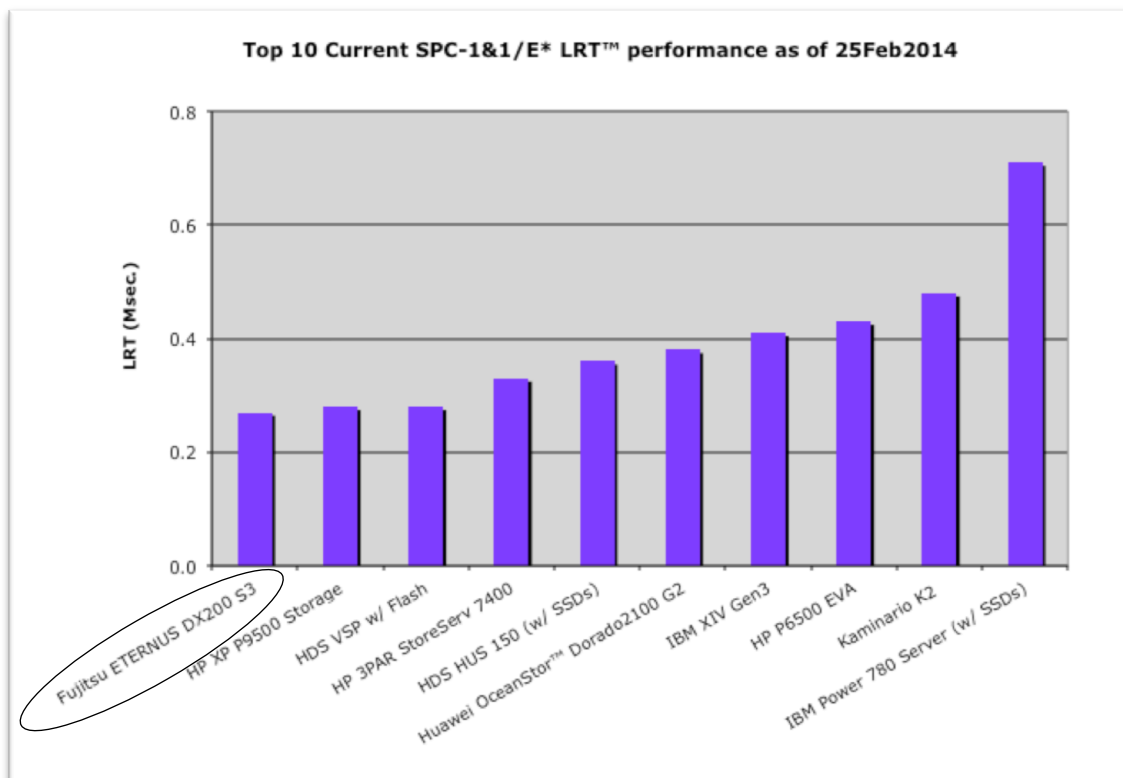


Figure 1 Top 10 Current SPC-1 LRT results

As the chart shows, the ETERNUS DX200 S3 came in first place with an LRT of 0.27 milliseconds, a result exceeding those from all other current high-end, enterprise-class storage systems. SPC-1 LRT is measured at a 10% level of I/O activity, which for the ETERNUS DX200 S3 was 20,000 IOPS. SPC-1 also measures other response times. One is recorded at maximum IOPS or 100% IO load but it's usually ignored because it's so long. However, the DX200 S3 had the best maximum IOPS response time at 0.63 milliseconds of the top 10 LRT storage systems. Such low-latency performance would be a real advantage for customers with heavy OLTP processing requirements. Indeed, this consistent a level of low access latency exhibited by an SMB storage subsystem across its entire range of IOPS represents a phenomenal level of performance.

Figure 2 shows another benchmark-reported metric called SPC-1 Price Performance™.

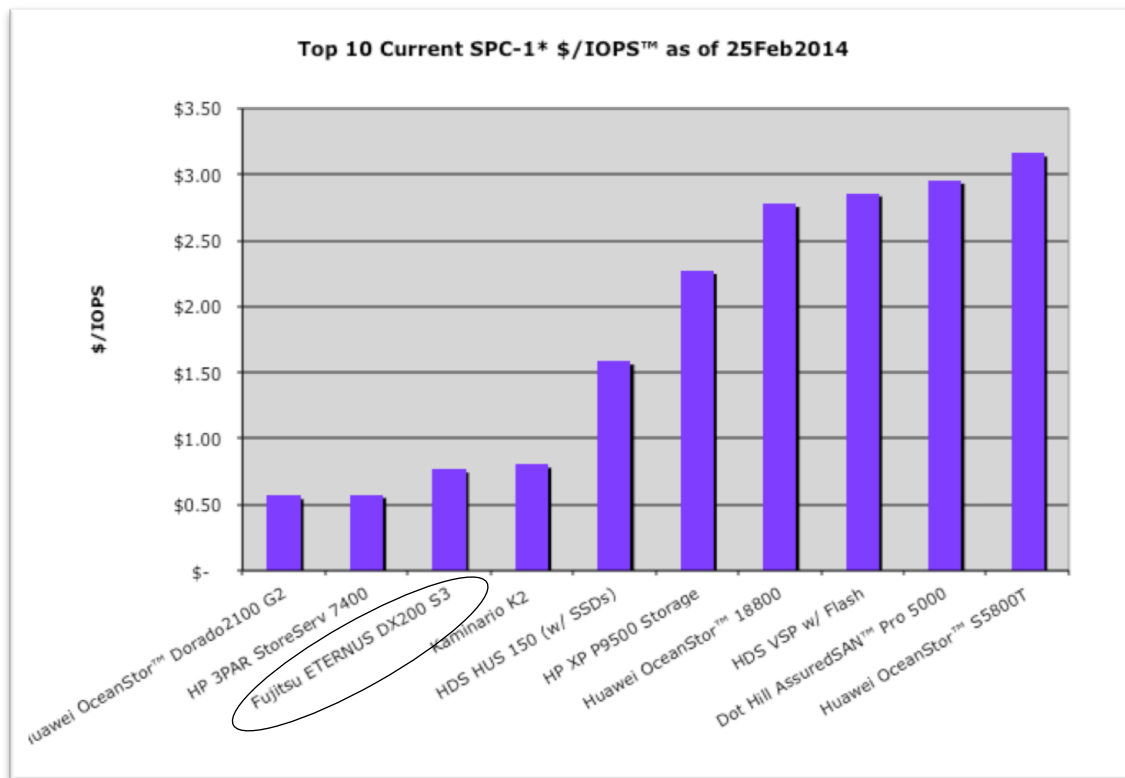


Figure 2 Top 10 Current SPC-1 price performance results

SPC-1 \$/IOPS measures the cost of a subsystem divided by its maximum IOPS performance. As shown in Figure 2, the ETERNUS DX200 S3 came in third place with a price performance of \$0.77/IOPS. ETERNUS DX200 S3's surprisingly good IOPS performance together with its entry-level pricing offers superior price performance storage.

Summary

ETERNUS DX200 S3 delivers superior IOPS, access latency and price performance that exceed that which is available from many other high-end, enterprise-class storage offerings. In addition, the versatile ETERNUS DX200 S3 offers multiple tiers of storage and advanced ETERNUS SF AST functionality, enabling it to support varying levels of I/O performance suitable for a wide range of application environments.

Gaining such performance and functionality from an SMB storage system is remarkable. With its enterprise-class performance, advanced storage functionality and entry-level pricing, the ETERNUS DX200 S3 is truly an exceptional storage system appropriate for most any SMB data center environment.

Silverton Consulting, Inc., is a U.S.-based Storage, Strategy & Systems consulting firm offering products and services to the data storage community.

