



Enhancing OLTP database performance with automated storage tiering

By Chhandomay Mandal, Suresh Jasrasaria, and Bob Ganley

OLTP application workloads require high-performance storage for rapid access to dynamic data. By automating data tiering at the sub-volume level, Dell™ EqualLogic™ PS6010XVS series hybrid arrays can dramatically enhance OLTP application performance.

To be effective, online transaction processing (OLTP) applications often need to deliver extremely fast response times and rapid access to high-demand data in a multiuser environment. For many organizations, however, growing data set size and the move to virtualization are placing unprecedented demands on storage infrastructures. This demand can lead to performance bottlenecks and decreased application responsiveness.

To help boost storage performance, many organizations are turning to solid-state drive (SSD) technology. SSDs offer extremely high throughput and low latency for high-demand data. However, typical approaches to SSD deployment, such as adding SSD cache cards to servers or deploying all-SSD arrays, are often expensive, static, and deliver only targeted performance benefits.

Dell EqualLogic PS6010XVS and EqualLogic PS6000XVS Internet SCSI (iSCSI) storage area network (SAN) arrays offer automated, dynamic data tiering between different drive types at the sub-volume level. Automated tiering enables organizations to enhance storage performance in a simple, broad, and cost-effective manner. EqualLogic PS6010XVS series hybrid arrays support both SSD and traditional hard disk drive (HDD) storage within a single chassis. Combined with dynamic, automated sub-volume tiering and

load balancing, EqualLogic PS6010XVS series hybrid arrays are designed to help optimize the balance between responsiveness and capacity.

In fact, benchmark testing at Dell Labs in February 2011 showed that EqualLogic PS6010XVS storage arrays can support nearly three times the number of concurrent end users in a typical OLTP application environment as a traditional HDD-based array—with no performance degradation.¹ By deploying EqualLogic PS6010XVS series hybrid storage arrays, organizations can support increased numbers of end users, help ensure fast response times, and significantly enhance the performance and cost-effectiveness of their transaction-intensive workloads.

Combining drive types in a single array

Dell EqualLogic PS6010XVS and EqualLogic PS6000XVS hybrid storage arrays are designed to support fast access to high-demand, or “hot,” data in a multitiered workload environment. These arrays are particularly well suited to multitiered workloads such as virtual desktop infrastructure (VDI) and OLTP environments in which a high percentage of I/O traffic is distributed to a relatively small percentage of the total data set.

Each array has 16 drives, including eight high-performance 100 GB SSDs and eight high-capacity 15,000 rpm, 450 GB Serial Attached SCSI (SAS) drives, for a total raw capacity of 4.4 TB. EqualLogic PS Series firmware provides dynamic,

Automated data tiering in OLTP environments

Dell EqualLogic PS Series hybrid arrays can effectively support fast access to high-demand data in a multitiered data set. This technical report provides details from the testing at Dell Labs described in this article.

bit.ly/ejRhZr

¹ For more information on these tests, see “Benefits of Automatic Data Tiering in OLTP Database Environments with Dell EqualLogic Hybrid Arrays,” Dell Inc., March 2011, bit.ly/ejRhZr.

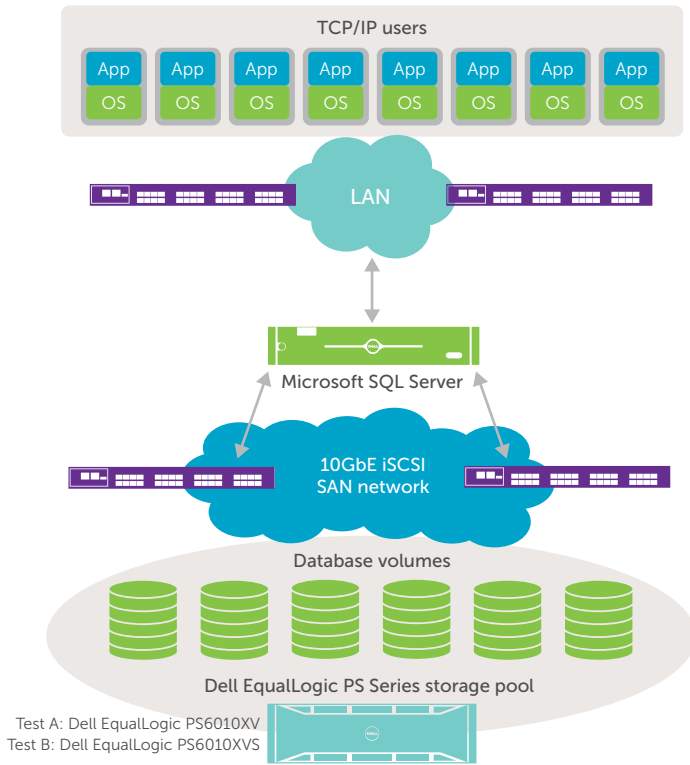
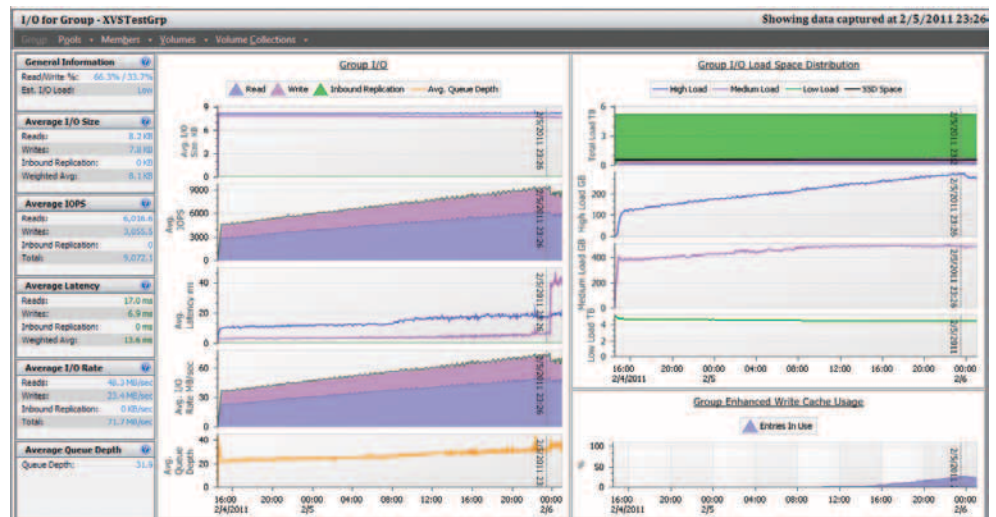


Figure 1. Simulated OLTP environment for performance testing

Figure 2. Dell EqualLogic SAN HeadQuarters (SAN HQ) metrics for the EqualLogic PS6010XVS array at the OLTP workload saturation point



automated tiering and load balancing at the sub-volume level—moving more frequently accessed data to SSDs and less frequently accessed data to HDDs—helping optimize the balance between responsiveness and capacity.

By offering two drive types—SSD and SAS—within a single array, combined with automated tiering and load balancing, EqualLogic PS6010XVS series arrays offer a cost-effective storage option that helps deliver outstanding performance, response time, and capacity for OLTP applications.

Testing the EqualLogic PS6010XVS array in an OLTP environment

Dell engineers conducted benchmark testing at Dell Labs in February 2011 to measure the performance benefits enabled by Dell EqualLogic PS6000XVS series hybrid storage arrays. Testing compared the performance of an EqualLogic PS6010XVS hybrid array relative to a traditional, all-HDD array in a typical OLTP application environment.

The testing consisted of running a simulated OLTP application load on identically configured infrastructures hosted by both an EqualLogic PS6010XV all-SAS drive array and an EqualLogic PS6010XVS SSD and SAS drive hybrid array (see Figure 1). Metrics measured for each storage array configuration were total number of concurrent end users supported, number of Transaction Processing Performance Council Benchmark C (TPC-C) transactions per second (TPS) completed, and I/Os per second (IOPS) delivered such that read or write I/O latency was less than or equal to 20 ms.

Test configuration

The workload simulated in the test was a standard TPC-C benchmark load, which simulates the transaction activity in a typical OLTP environment. Transactions include entering orders,

Test attributes		End-user experience attributes				TPC-C performance results		
Test	Storage array and RAID	Usable capacity	Capacity utilization	TPC-C transaction response time	Storage read or write I/O latency	Concurrent end users	TPC-C TPS	TPC-C IOPS
A	EqualLogic PS6010XV RAID-10	2.7 TB	74%	Less than 0.23 seconds	Less than or equal to 20 ms	2,650	137	2,000
B	EqualLogic PS6010XVS RAID-6	2.5 TB	80%	Less than 0.23 seconds	Less than or equal to 20 ms	7,150	371	9,200
Dell EqualLogic PS6010XVS array performance increase compared to the EqualLogic PS6010XV array						170%	170%	360%

Figure 3. Test results for the TPC-C workload simulation

recording payments, checking status, and monitoring inventory. The performance metric measured is TPC-C transactions per second (TPS), which is the number of TPC-C workload transactions that can be fully processed per second.

Two storage configurations were tested. Test A was conducted on an all-SAS configuration, which consisted of an EqualLogic PS6010XV array with sixteen 15,000 rpm, 450 GB SAS drives with RAID-10 configuration. Test B was conducted using a hybrid SSD and SAS drive configuration, which consisted of an EqualLogic PS6010XVS hybrid storage array with eight 100 GB SSDs and eight 15,000 rpm, 450 GB SAS drives with accelerated RAID-6 configuration. For both tests, ten 200 GB volumes were created on each array, with each volume populated by a Microsoft® SQL Server® database containing Benchmark Factory for Databases TPC-C schema and test data.


Test results

For the Test A configuration, the TPC-C benchmark was run against 10 SQL Server databases on the EqualLogic PS6010XV array with all SAS drives. The EqualLogic PS6010XV array was able to support 2,650 concurrent end users with approximately 137 TPC-C transactions per second and 2,000 IOPS with a read/write latency of less than or equal to 20 ms.

For the Test B configuration, the TPC-C benchmark was run against 10 SQL Server databases on the EqualLogic PS6010XVS hybrid array containing mixed SSD and SAS drives. The EqualLogic PS6010XVS array was able to support 7,150 concurrent end users with approximately 371 TPC-C transactions per second and 9,200 IOPS with a read/write latency of less than or equal to 20 ms (see Figure 2).

The test results show that the EqualLogic PS6010XVS hybrid array was able to support 170 percent more concurrent end users and complete 170 percent more transactions per second than an EqualLogic PS6010XV array for the same TPC-C workload while maintaining a 20 ms or less response time (see Figure 3). Additionally, the EqualLogic PS6010XVS array performed 360 percent more IOPS than the EqualLogic PS6010XV array.

Enhancing transactional workload performances

As the benchmark results show, Dell EqualLogic PS6010XVS series hybrid storage arrays can deliver enhanced performance, response time, and capacity required for handling transactional workloads like OLTP databases. By enabling organizations to leverage storage on both SSDs and HDDs within a single array and by automating the dynamic tiering of hot data, EqualLogic PS6010XVS and EqualLogic PS6000XVS hybrid arrays help organizations simply and cost-effectively support transactional workloads—helping to reduce costs, enhance user experience, and improve productivity. 

Authors

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