Boosting storage performance and efficiency for diversified workloads

By Achmad Chadran, Dylan Locsin and Jeff Junker

The steep increase of data quantities and workload diversity in virtualized environments requires storage that can keep up. The latest generation of Dell EqualLogic storage helps organizations meet the challenge while minimizing management complexity.

Performance and efficiency simplified for the real world

Unlock the power of flash and 10 Gigabit Ethernet with the next-generation Dell EqualLogic PS6210 Series storage array.

- High-performance, cost-effective flash storage helps reduce latency for demanding applications.
- Exceptional throughput boosts performance for sequential workloads.
- Performance and capacity can be scaled linearly while avoiding disruption.
- Day-to-day management is streamlined with automated data protection, tiering and workload balancing capabilities.

Continuous growth in the volume and complexity of data from diverse applications and private cloud rollouts has intensified the need for robust storage that is easy to use and manage. While IT decision makers face escalating requirements for storage capacity and performance, their IT staff may already be overtasked and budgets constrained. At the same time, many organizations lack IT administrators with specialized storage expertise.

To help meet these challenges, the latest generation of Dell EqualLogic arrays is designed to optimize storage performance, efficiency and management. Dell is also updating the EqualLogic FS7600 and EqualLogic FS7610 network attached storage (NAS) appliances with version 3 of Dell Fluid File System (FluidFS). Moreover, the Dell SupportAssist functionality in EqualLogic SAN Headquarters (SAN HQ) v3.0 has been enhanced to boost administrator productivity.

Challenges of virtualization

Many different factors put pressure on IT organizations to make sure storage resources meet today's real-world demands. In particular, the rapid growth of unstructured data calls for efficient storage management of emerging data types. IT leaders are looking to deploy additional storage to meet this growth without intensifying administrative overhead.

Meanwhile, the steady march toward virtualization in data centers is driving increasingly concentrated server environments. Today's multi-core servers are designed to handle a mix of different workloads as organizations combine diverse applications onto fewer physical servers than before. However, virtualization consolidates not only processing but also I/O.

The combined workloads present a concentrated blend of randomized I/O to a consolidated storage infrastructure, which can lead to degraded storage performance on traditional, frame-based architectures. For example, an organization in the healthcare industry might need to simultaneously manage a high volume of MRI images, store patient records and other electronic documents, and meet stringent retention requirements — resulting in a mix of workloads with different requirements from a storage standpoint. Organizations need storage

systems with the performance to meet these workload challenges while making it simple to expand capacity on demand and balance the load among storage resources for maximum efficiency.

Intelligent storage for virtualized environments

EqualLogic virtualized storage is designed to simplify operations by abstracting multiple storage processes and components to let administrators manage at the resource-pool level instead of at a disk or RAID level. The latest EqualLogic releases retain key features and characteristics that have become hallmarks of the storage family, such as automated load balancing and tiered storage for perpetual self-optimization; scale-out architecture to support on-demand, just-in-time expansion; and integrated storage area network (SAN) and NAS management for enhanced productivity.

Built-in intelligence helps lower the skills barrier for storage management, in line with the emergence of the generalist role in IT organizations — team members tasked with managing and understanding end-to-end systems from servers to networking to storage. In addition to these capabilities, the latest EqualLogic releases enable the performance and efficiency enhancements that organizations need today.

Scalable storage performance

The widespread use of flash solid-state drives (SSDs), alone or in hybrid arrays, has strained the performance capabilities of storage system controllers on traditional SAN systems. Controllers can be hard-pressed to keep up with the high throughput of SSDs, so the storage system may fail to fully leverage the SSD speed advantage.

Moreover, overall performance can suffer. Because traditional scale-up storage systems with fixed dual-controller designs are often challenged to support growing numbers of SSDs, other workloads and drives within the same array may be deprived of their processing resources.

In contrast, the scale-out EqualLogic architecture enables organizations to rapidly obtain additional processing performance, capacity, throughput and bandwidth by simply deploying another EqualLogic array in the storage pool. This scale-out capability helps organizations handle the performance demands of SSDs and minimize I/O bottlenecks as workloads grow.

The latest-generation EqualLogic PS6210 Series arrays feature a redesigned controller that is optimized to support much higher I/Os per second (IOPS) and throughput than the previous generation. The flash-based EqualLogic PS6210 Series arrays have demonstrated up to three times the maximum IOPS compared to prior-generation EqualLogic arrays and significantly higher IOPS when scaled out in large groups. (For more information on EqualLogic PS6210 Series performance, see the sidebar, "Raising the bar.")

Additionally, the EqualLogic PS6210 Series arrays allow Dell to offer EqualLogic flash-based solutions at the price of hard disks. For instance, for a 30,000 IOPS online transaction processing (OLTP) database workload requiring 10 TB of usable space, an EqualLogic PS6210S flash array can outperform four EqualLogic PS6210XV 15,000 rpm disk arrays at a lower cost.[1]

The EqualLogic PS6210 Series have two active 10 Gigabit Ethernet (10GbE) ports per controller; in comparison, the previous generation of controllers supported one port. The latest controllers can drive up to approximately 2 GB/sec of throughput per array for heavy sequential large-block workloads.[2]

The latest generation of controllers runs EqualLogic PS Series array software v7, which features a 64-bit kernel for the array's operating system. The 64-bit kernel enables the array to take advantage of the controller's additional memory and cache to speed up system operations, as well as support technology updates in software.[3]

Crucially, the EqualLogic PS6210 performance enhancements do not lead to extra complexity in storage management. Administrators can easily incorporate EqualLogic PS6210 Series arrays into existing EqualLogic SANs to grow capacity and throughput. When all EqualLogic arrays are upgraded to the same array software release, the addition of each array to an existing pool — which may contain multiple generations of EqualLogic storage — is designed to trigger an automatic rebalance of all the arrays in the pool. Administrators can also create a new pool, such as one comprising only flash-based EqualLogic PS6210 Series arrays, and shift over existing volumes and workloads.

Policy-based data reduction

As part of its coordinated set of releases, Dell also has updated FluidFS to help organizations boost efficiency while simplifying operations. FluidFS v3 powers the EqualLogic FS7600 and EqualLogic FS7610 NAS appliances, enabling enterprise-class file storage to scale beyond the file system and file share capacity limits of conventional file systems.

With FluidFS v3, the EqualLogic family now incorporates Fluid Data Reduction, a policy-driven, variable block deduplication and compression technology that helps

[1] Based on November 2013 Dell internal analysis of US list pricing, technical specifications and performance testing when comparing the EqualLogic PS6210XV and EqualLogic PS6210S arrays with 70/30 read/write random workload and 8 KB block size. System comparisons will vary depending on the workload and configuration.

[2] Performance may vary depending on the workload and drive type. Based on September 2013 Dell performance testing comparing the EqualLogic PS6210XS and EqualLogic PS6110XS arrays with sequential 1 MB block read I/Os.

[3] EqualLogic PS Series array software v7 also supports a 32-bit kernel for certain previous-generation array models that cannot support the 64-bit kernel.

Raising the bar

In September 2013 at Dell Labs, Dell engineers tested the performance of the EqualLogic PS6210 Series arrays. One of the models tested was the EqualLogic PS6210XS, a hybrid flash array that is designed to increase performance by providing twice the solid-state drive (SSD) capacity of an earlier-generation hybrid model.

Results indicated that the EqualLogic PS6210XS array delivered substantially higher random I/O performance than the EqualLogic PS6110XS array (*see figure*):

- Approximately three times the 100 percent–random read workload performance with one-third the latency[a]
- More than two times the simulated online transaction processing (OLTP) database workload performance with less than half the latency[b]

Moreover, one pool comprising eight EqualLogic PS6210XS arrays was able to scale to 1.2 million I/Os per second (IOPS) during testing.[c]

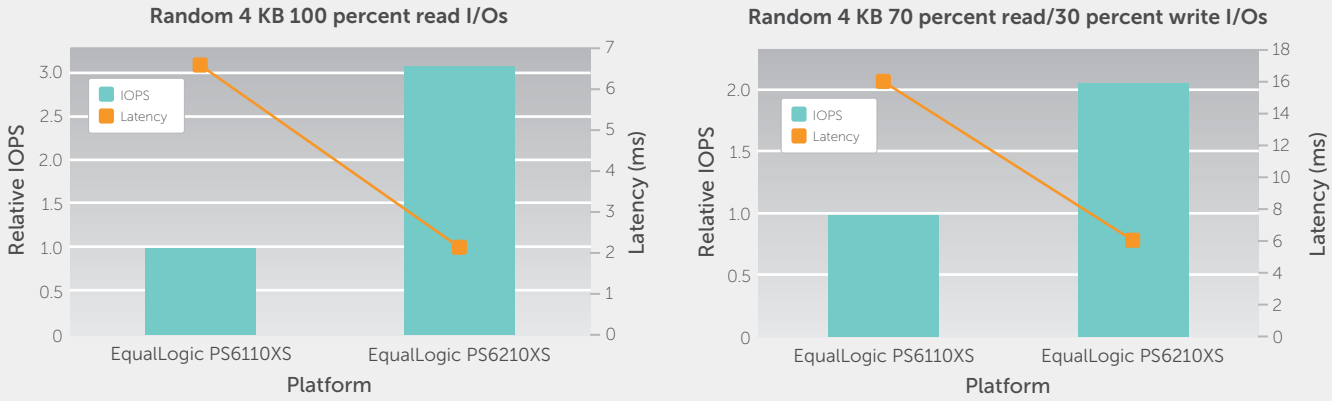
In tests of sequential read and write performance, a single EqualLogic PS6210XS array demonstrated more than twice the simulated decision support system (DSS) query and load performance with less than half the latency, compared to a single EqualLogic PS6110XS array (*see figure*).[d]

[a] Performance may vary depending on the workload and drive type. Based on September 2013 Dell performance testing comparing the EqualLogic PS6210XS and EqualLogic PS6110XS arrays with 4 KB block and 100 percent random read I/Os.

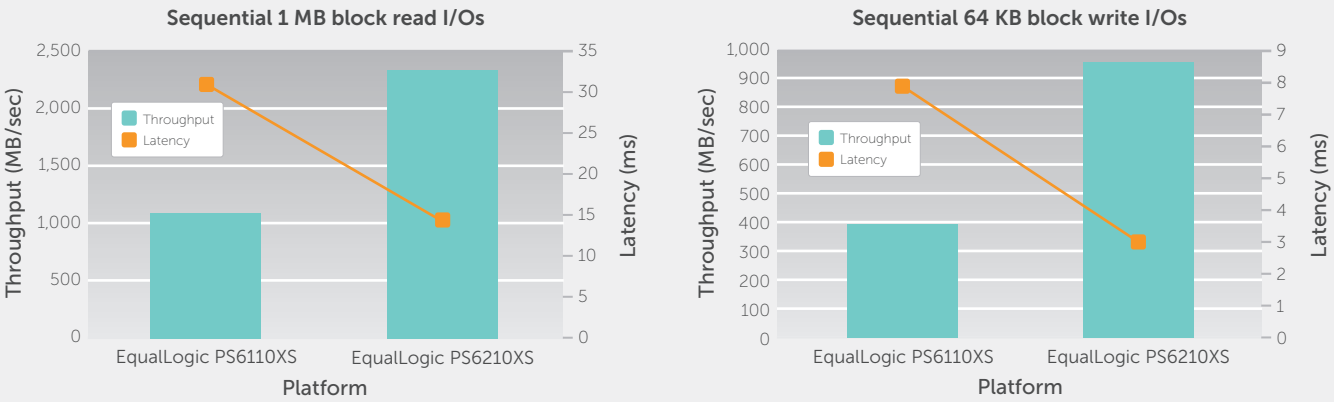
[b] Performance may vary depending on the workload and drive type. Based on September 2013 Dell performance testing comparing the EqualLogic PS6210XS and EqualLogic PS6110XS arrays with 4 KB block and 70/30 read/write random I/Os.

[c] Performance may vary depending on the workload and drive type. Based on September 2013 Dell performance testing using eight EqualLogic PS6210XS arrays with Dell PowerEdge R620 and PowerEdge R610 servers and Dell Networking switches, under 100 percent read workloads.

[d] Performance may vary depending on the workload and drive type. Based on September 2013 Dell performance testing comparing the EqualLogic PS6210XS and EqualLogic PS6110XS arrays with sequential 1 MB block read I/Os and sequential 64 KB block write I/Os.



Comparison of single-array random I/O performance



Comparison of single-array sequential I/O performance

decrease the capacity needed for common enterprise data by 48 percent.[4]

After files are written to an EqualLogic FS Series appliance, they are deduplicated in accordance with criteria set in administrator-defined policies. When a file is modified, FluidFS rehydrates only the portion of the file with write activity, minimizing I/O.

File data can be compressed after deduplication. Fluid Data Reduction implements the Level Zero Processing System (LZPS) compression algorithm, which is designed to use minimal processor resources.

FluidFS v3 also helps improve scalability by enabling each EqualLogic FS Series appliance to manage up to 10,000 active Server Message Block (SMB) sessions at the same time. Along with SMB v2 and SMB v2.1, Fluid FS v3 supports version 4 of the Network File System (NFS) protocol, which heightens storage efficiency by minimizing internal messaging among subcomponents.

Together, these capabilities enable organizations to increase storage density, ultimately helping to reduce the cost of storage.

Enhanced operational efficiency

EqualLogic PS Series array software v7 includes updates to EqualLogic Group Manager to streamline storage management. For example, support for access control policies helps simplify ongoing management of clustered and medium-to-large virtual server environments. Administrators can set policies for access and reuse these policies for multiple hosts, instead of re-creating traditional access control lists (ACLs) for each host and volume — helping free up time for IT staff and avoid error-prone operations.

Management is also streamlined thanks to a revamped graphical user interface (GUI) that now includes search capabilities. The EqualLogic Group Manager GUI incorporates the Dell Clarity E style, an approach that applies current principles of usability, readability and graphic design consistently across Dell GUIs.

Additionally, the updated array software supports 4,096-byte, or 4K, sector volumes and hard drives, helping ease the upcoming transition from today's 512-byte native sector format. The use of 4K native (4Kn) sectors in hard drives enables larger capacities than are available with 512-byte sector drives. The 4Kn sector hard drive technology is also designed to provide better data protection and error correction for large-capacity drives, compared to 512-byte sector drives.

With EqualLogic PS Series array software v7, administrators can present volumes in either the 512-byte or the 4K sector format, regardless of the underlying drive technology. Organizations that prefer 512-byte sector volumes can continue to use them, again regardless of drive type. Moreover, administrators can establish an EqualLogic pool that includes arrays containing 512-byte native sector drives along with arrays containing 4Kn sector drives when they are introduced in 2014.

To further enhance efficiency and ease of management in the data center, Dell has released EqualLogic SAN HQ v3.0 along with EqualLogic PS Series array software v7. SAN HQ v3.0, a centralized performance and event monitoring tool, extends the capabilities of Dell SupportAssist for an automated and streamlined service experience. SAN HQ v3.0 and SupportAssist now feature expanded automated support case creation as well as reporting and tracking of open EqualLogic support cases from within the SAN HQ GUI.

Strong return on storage investment

As enterprises deal with rapidly expanding data volumes and concentrated workloads, they require storage systems that make growing capacity and performance easier and more predictable than ever. And as budgets contract or remain flat, IT needs systems that are easy to deploy and manage, automatically balancing workloads across storage resources.

The latest Dell EqualLogic arrays, incorporating EqualLogic PS Series array software v7, are designed to meet these demands without added complexity. The arrays provide a virtualized scale-out architecture and easy-to-manage operations to accelerate efficiency gains while helping eliminate the requirement for specialized storage administration skills. In addition, updated EqualLogic FS Series NAS appliances support FluidFS v3, which features powerful policy-based deduplication and compression that can be used to minimize the data footprint and maximize an organization's return on investment in EqualLogic storage. PS

Authors

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Learn more

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qrs.ly/ws3o6q6

[4] Based on May 2013 internal Dell analysis of the Dell Fluid File System v3 with Fluid Data Reduction, using a real-world home share environment comprising Microsoft® Office (21 percent), gzip (19 percent) and flat (19 percent) files, among others.