Technical Review

Dell EMC SC Series: Cost-efficient Storage with Enterprise Capabilities

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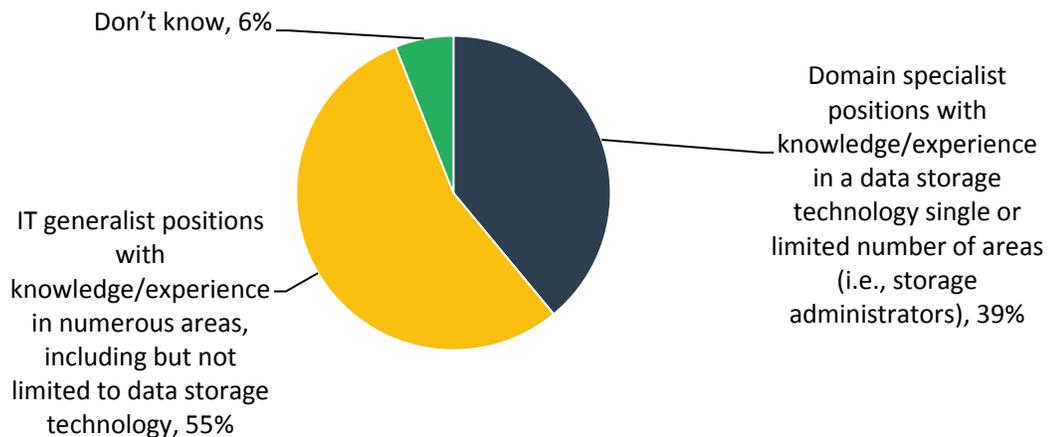
Abstract

This ESG Technical Review documents Dell EMC SC Series testing with a focus on the enterprise-class performance, availability, and management, particularly accompanying the SCOS firmware version 7.3.

The Challenges

Recent storage innovations have produced tremendous benefits in performance, availability, and management. But technologies like flash drives, stretched clusters, aggregated array management, and cloud-based analytics should not be available only to deep-pocketed enterprises. Midmarket organizations need these technologies at least as much, if not more so, given their often-stricter constraints on budgets and staffing. These constraints lead them to rely on IT generalists; in an ESG research study, 55% of respondents at midmarket and enterprise organizations indicated that the majority of storage staff they planned to hire were IT generalists rather than domain specialists (see Figure 1).[1]

Figure 1. Storage Hiring Trends

Considering your IT organization's expected staff openings and hirings in the area of storage infrastructure management over the next 12 months, which of the following best describes the majority of positions? (Percent of respondents, N=356)

Don't know, 6%

Domain specialist positions with knowledge/experience in a data storage technology single or limited number of areas (i.e., storage administrators), 39%

IT generalist positions with knowledge/experience in numerous areas, including but not limited to data storage technology, 55%

Source: Enterprise Strategy Group

Midrange organizations need storage arrays that are cost-efficient and simple to manage, but with enterprise-class performance and functionality.

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[1] Source: ESG Brief, *A Data Center Revolution in Storage Technology*, October 2017.

The Solution: Dell EMC SC Series

ESG has conducted several validations on the SC Series,[2] a midrange block storage array that delivers true enterprise-class capabilities at a midrange price. While a full product description is beyond the scope of this paper, the following is a brief overview. With a range of capacity-sized models—from entry-level to 6PB—SC Series arrays can be direct- or SAN-attached, and offer HDD, SSD, and hybrid configurations. They support Fibre Channel, iSCSI (including 100Gb and 25Gb), and SAS front-ends, with dual controllers and 64GB-256GB memory per controller. Key features include auto-tiering with Data Progression, in which data is first written to tier-1 drives at RAID 10 and then converted over time to more economical drives at RAID 5/6. This is one of many features designed to optimize cost while maintaining high levels of performance. Other features include deduplication, compression, and thin snapshots/clones for storage efficiency, plus multi-array federation to consolidate management and maintain both server mappings and snapshot relationships during migration. Live Migrate keeps workloads running during migrations, load balancing, and planned outages, while Live Volume Auto Failover maintains uptime during unplanned outages as well. Finally, Dell EMC offers world-class services and support, broad third-party integration, and a Future-Proof Loyalty Program for investment protection.

The focus of this paper is on new features added with the latest SC operating system, SCOS version 7.3, a free firmware upgrade for existing SC Series customers with current support contracts. Key features include:

- *Performance*. Significant software-based performance improvements. Dell EMC now boasts up to 2.2M IOPS per array, with a 2X increase in maximum IOPS and 50K-100K more mixed workload IOPS on every SC model.
- *Availability*. Distributed sparing results in faster rebuilds for not only efficiency but also reduced risk of data loss; enhancements to Live Volume deliver lower latency and reduced network traffic.
- *Management*. Addition of Unisphere for SC HTML 5 web UI, and CloudIQ cloud-based storage analytics.

Figure 2. SC Series Firmware Update

SC Series All Flash or Hybrid

SCOS 7.3 Firmware Update

Performance
- Software-based performance increase
- Max and mixed workload IOPS gains
- Faster drive rebuilds

Availability
- Distributed sparing improves and reduces risk of data loss
- Live Volume ALUA optimization for lower latency

Management
- Unisphere for single/multi SC arrays
- HTML5 web interface
- CloudIQ web-based storage analytics

Source: Enterprise Strategy Group

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[2] ESG's most recent validation: *ESG Lab Review: Dell EMC SC 5020 Storage Array*, November 2017.

ESG Tested

ESG validated Dell EMC testing of upgrades in performance, availability, and management with SCOS v7.3. Dell EMC did extensive testing to demonstrate the software-based performance improvements, testing all models from the entry-level SCv3000 series through the SC9000; the company tested each array with FC, iSCSI, and SAS, and with different drive sizes, RAID types, queue depths, and I/O patterns.

Performance

Several key features of SCOS 7.3 impact performance.

- On the front-end, improvements such as multithreading for SCSI targets and mutex thread processing increase performance for heavy loads like sequential reads, while increased CPU interrupt handling and RAID queue reordering increase performance for random and mixed workloads.

- On the back-end, the company implemented distributed sparing across drives, instead of keeping idle spare drives in case of need; distributed sparing enables SC Series arrays to rebuild 32 extents at once instead of four. According to Dell EMC's testing, drive rebuild times are 2x-5x faster depending on RAID level and drive size; now a large HDD can be rebuilt in a couple of hours instead of a couple of days. SSDs are rebuilt in minutes.

Dell EMC reports that for a typical OLTP-like workload (4K, 100% random, 70/30 read/write I/O) there is a 42% performance boost from the recent SCOS 7.2 to 7.3, and an 85% improvement compared to the 6.7 firmware most customers are currently running.[3] This came with the addition of deduplication and compression, so the array became both more efficient and more performant. Bandwidth tests show that while the SC9000 hits 33GB/sec, even the entry-level SC array delivers 19GB/sec, an impressive showing that enables these arrays to handle workloads such as 4K HD streaming and editing without dropping frames. Dell EMC max IOPS results for both sequential read and mixed random workloads demonstrate true enterprise-class performance.

ESG did validate Dell EMC's testing of virtual desktop infrastructure (VDI) and SQL Server workloads. To compare V7.2 and 7.3, the testbed included an SC9000 with 100 SSDs, 2 x 32 node clusters, and VMware Horizon 7. Login VSI simulated a heavy workload of 6,000 desktops delivering 40 IOPS/desktop, 80% writes. It should be noted that a typical VDI knowledge worker desktop uses 5 IOPS for administrative work; a heavy user of word processing, email, presentations, and spreadsheets uses 15 IOPS; and a heavy CAD user needs 20-40 IOPS. Figure 3 shows that in this testing, v7.3 delivered 37.5% more desktops, 33% more IOPS, and 11% faster response time.

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[3] ESG did not retest and validate all of the performance results. While prospects should perform their own due diligence, it should be noted that Dell EMC's legal department is notoriously stringent about required proof before reporting internal results.

Figure 3. SC Series VDI Performance Improvements: SCOS 7.2-7.3

37.5% more desktops   33% more IOPS   11% faster response time

Source: Enterprise Strategy Group

Database testing was done with SQL Server 2017 running on Windows Server 2016, varying the amount of SQL memory for the highest I/O. Testing used a 5TB database, 48 GB of SQL memory, and a simulated online stock transactions workload. While there were increases in total IOPS, reads, and writes, the most relatable metrics for online transactions are transactions per second and read latency. As Figure 4 shows, SCOS 7.3 delivered 44% more transactions per second (enabling 44% more work or 44% more users) and 136% lower read latency, enabling faster performance.

Figure 4. SQL Performance Improvements: SCOS 7.2-7.3

44% more transactions/sec   136% faster reads
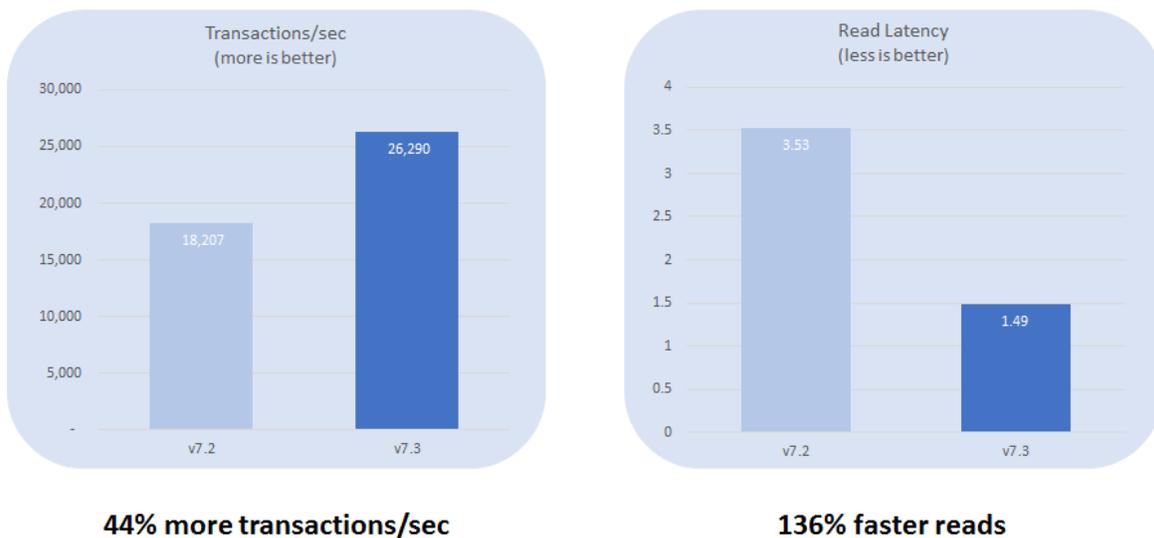
Source: Enterprise Strategy Group

Availability

In the past, availability of infrastructure components was an important metric for purchasers. Today, the discussion centers on high availability of data rather than infrastructure. Dell EMC's combination of resilient hardware and innovative software delivers enterprise-class data availability for midmarket organizations.

Hardware Resiliency

Resiliency is built into SC Series arrays with dual, hot-swappable, active-active controllers, plus redundant fabric ports, ASICs, and drives. Other availability features include data-in-place upgrades, snapshots and replication between heterogeneous arrays, and Live Volume for both planned and unplanned outages. In recent Dell EMC tracking of customer system uptime for a three-month period, a sample of nearly 50,000 SC arrays around the world delivered 99.99942% uptime, an impressive rate.

Live Migrate/Live Volume Software[4]

On the software side, SC arrays offer Live Migrate and Live Volume, stretched-cluster capabilities for continuous availability and data mobility. Live Migrate keeps applications working throughout planned activities such as maintenance, capacity expansion, and resource balancing, allowing the easy migration of workloads between arrays without requiring hosts to be remapped. The included Volume Advisor feature recommends the best initial data placement within an array cluster (or "federation"), then offers proactive alerts and load balancing recommendations as the environment evolves.

For unplanned outages Dell EMC offers Live Volume with Auto Failover, ensuring that applications continue to access data even when disaster strikes. Live Volume maintains mirrored LUNs across campus or metro distances, synchronously replicating data on different arrays. If there is an outage at Site 1, Site 2 will continue to serve I/O seamlessly to the application with no data loss. An HTML5-managed tiebreaker service manages the failover to enable automatic repair/recovery while ensuring that data changes are properly included. Live Migrate and Live Volume are integrated with VMware Storage Metro Cluster and work within a 10ms latency range.

With SCOS v 7.3, Live Volume gains even better application performance and more efficient path utilization with the round-robin path selection, the configuration that allows administrators to "set it and forget it." Typically, using round robin means using all available data paths equally; with synchronous mirrors, therefore, data will flow either from the local Site 1 LUN or the metro-distance Site 2 LUN, and any time Site 2 is used, there will be increased latency. With SCOS 7.3 Live Volume ALUA, the path to the Site 2 LUN—which could be 10 ms away—will be available if needed, but designated as non-optimal, so round-robin path configurations will use the faster local LUN during normal operations.

Other updates include extending replication and live migration to the entry-level SCv2000 series and increasing the number of Live Volumes to 500 and Live Volumes with Auto Failover to 150.

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[4] For details on ESG testing of Live Volume with Auto Failover, please refer to *ESG Lab Review: Always Available Dell Storage SC Series*, October 2015.

Figure 5. SC Series Live Volume with Auto-failover/Failback
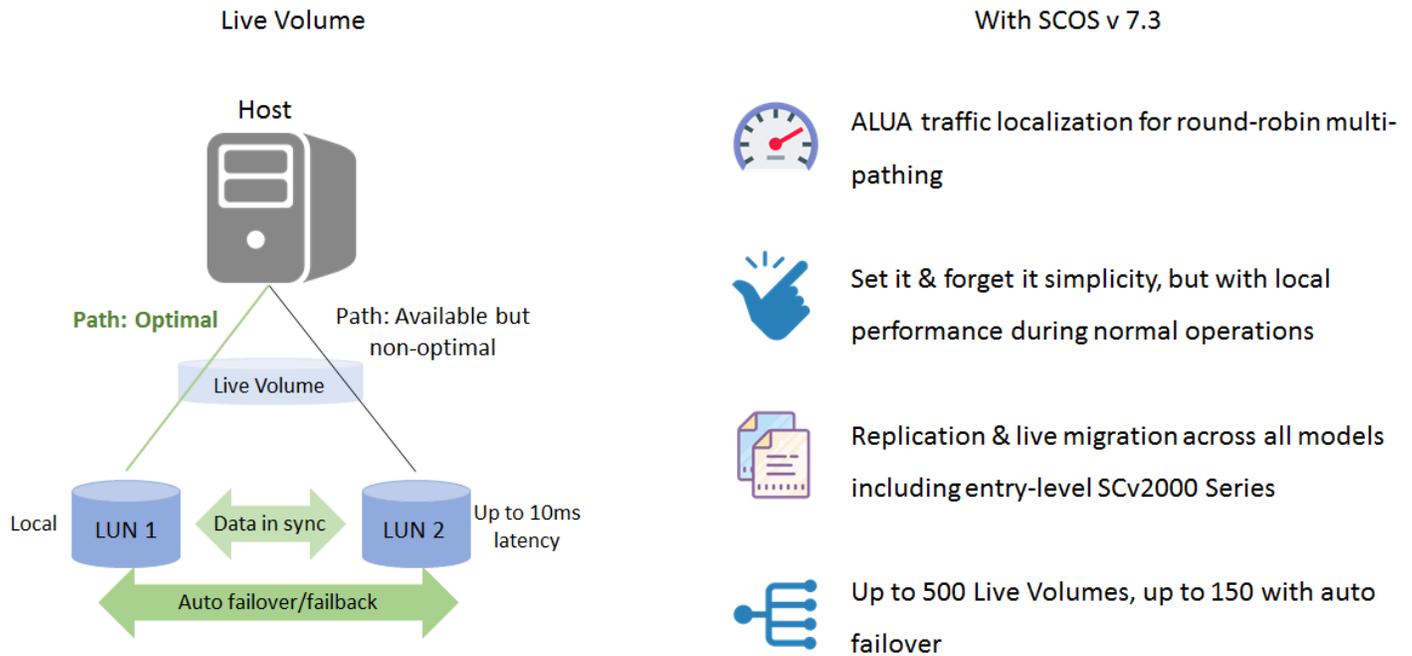
Source: Enterprise Strategy Group

## SC Series Availability Exceeds Traditional On-site "5 9s"

The combination of the SC Series hardware resiliency and software functionality deliver true enterprise-class availability. Companies have for some time been measuring availability in terms of "9s"—that is, the ability to keep infrastructure up and running 99% of the time, stretched out with additional decimal points (99.999% being "5 9s"). With the SC Series, the hardware operates at more than 5 9s, but adding Live Volume software with its stretched clusters, auto failover, and optimized path management create a system that collectively extends 5 9s beyond the traditional on-site data center to include remote sites with automatic failover. This delivers high *application* availability, not just hardware, a critical, enterprise-class feature that Dell EMC provides for midrange customers at midrange prices.

Management: Unisphere and CloudIQ

With SCOS v7.3 come two key improvements to SC Series management: the additions of Unisphere with the HTML5 client and CloudIQ storage analytics. These unify the midrange product lines in terms of management as well as look and feel. ESG evaluated a demo environment of both applications and offers a brief overview of each.

Unisphere/Unisphere Central

Unisphere for SC can manage individual arrays, and Unisphere Central with the Data Collector can manage multiple arrays. Both are accessed through any browser and retain similarity to the previous SC Series management GUI, making it easy for legacy users. HTML5 provides the ability for administrators to customize the dashboard. In our demo, the top-level overview screen of Unisphere Central showed an inventory of three Dell Storage Centers, 21 volumes, and 40 servers;
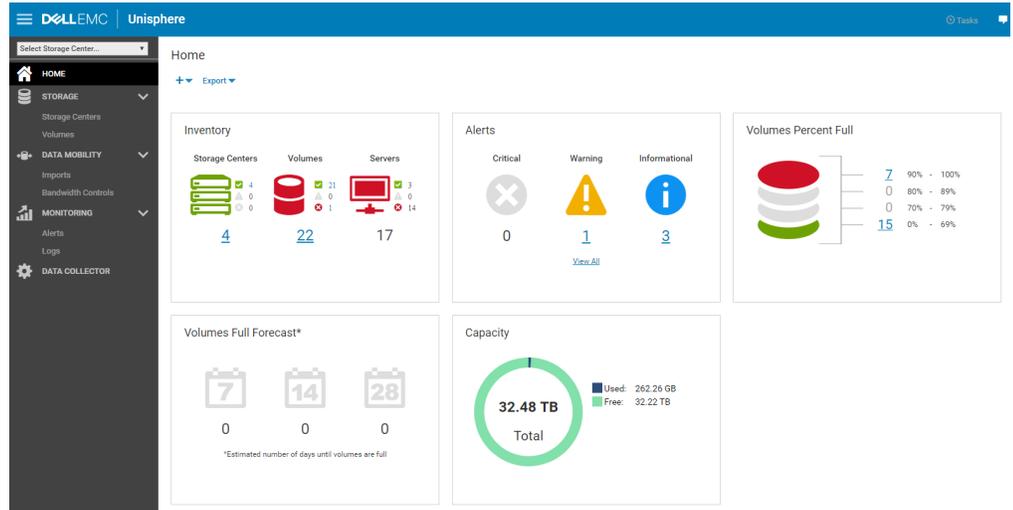
the home screen also showed storage capacity, volumes % full, and a forecast of when volumes would be full. Using the navigation, administrators can monitor and manage arrays and volumes, and drill down into individual components. Unisphere Central enables administrators to view aggregate information, such as all the alerts on all arrays. The figure above shows the Storage Centers view, showing common tasks for SC22; in addition to inventory, alerts, and volume details, it shows overviews of assigned disk, hardware, and performance as well as drill-down details.

ESG observed the intuitive GUI, easy-to-execute provisioning and tasks, and good monitoring features such as the ability to hover over data points in a performance graph for additional timeline detail. We created a new volume in just a few clicks;
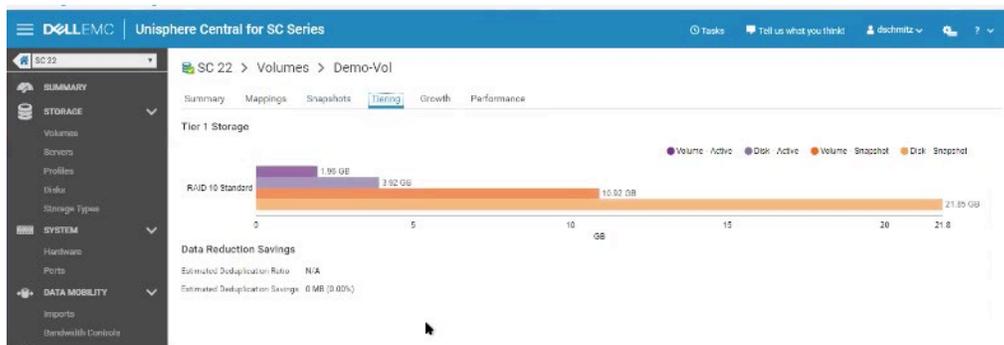
all details were added on a single page, including provisioning, mapping to servers, and configuring snapshot schedules, QoS, deduplication, and compression. We put some files in the new volume and were able to view the familiar SC Series tiering graph showing active and snapshot data.
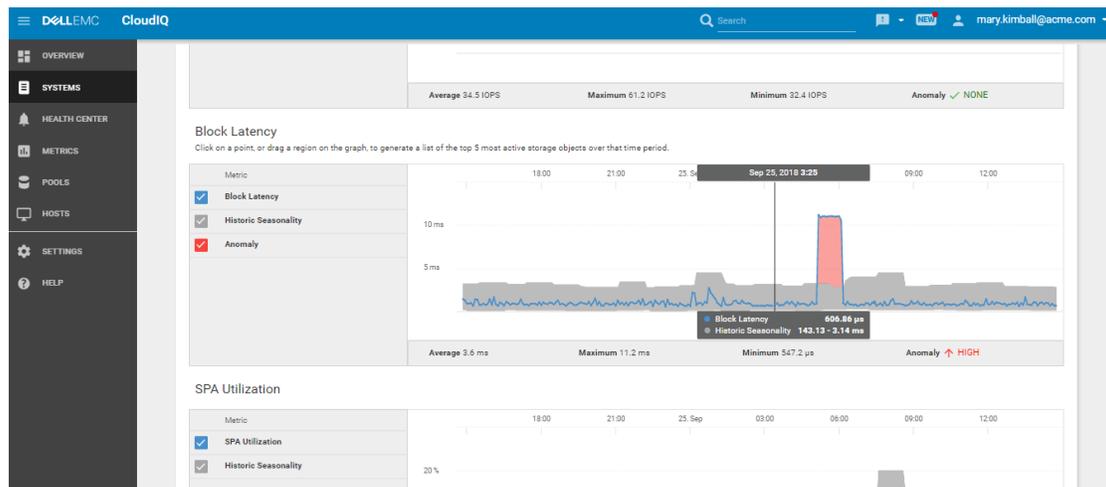
Unisphere offers details on RAID levels, data location, data progression, and much more that are worth reviewing. At this time, the thin HTML5 client includes most day-to-day functions, while some advanced functions in the fat client will be added in future releases.

CloudIQ

CloudIQ is another no-cost feature. This cloud-native app is hosted on the Dell EMC private cloud and proactively monitors and measures the overall health of SC (and Dell EMC Unity) arrays with intelligent, predictive analytics. New features are added non-disruptively and users are alerted through the *What's New* button.

CloudIQ is easy to install and provides high-level and detailed health information on performance, capacity, components, configurations, data protection, and replication. Administrators can easily view health scores, connectivity issues, performance anomalies (in the context of a three-week rolling threshold for each metric), storage usage and when storage pools will run out of capacity, system alerts, and support. This screenshot shows the three-week block latency trend for a volume in gray, the current performance as a blue line, and the anomaly in red. You can see that some small latency spikes were considered normal, while the anomaly was outside of the contextual parameters.

Health scores provide high-level views, so administrators can see which arrays or pools need attention and can drill down to identify problems (see Figure 6).

Figure 6. CloudIQ Multi-system Health Scores
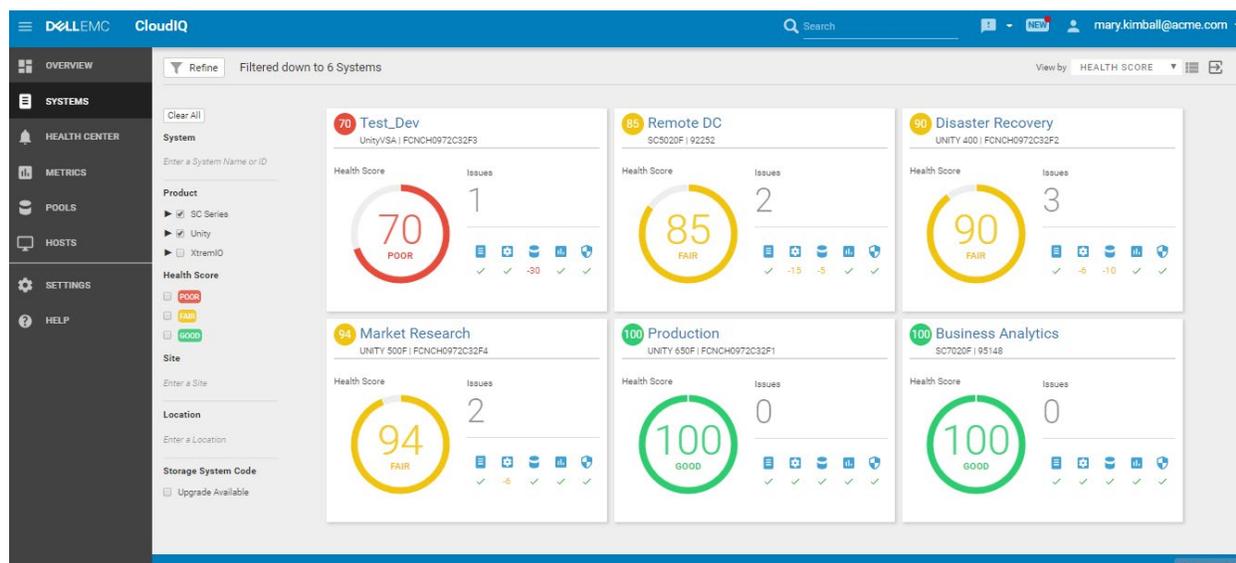
Source: Enterprise Strategy Group

One key feature is the link to launch Unisphere on most pages; if CloudIQ indicates a problem, administrators can go directly from that page to the Unisphere element manager for that array to take action. Another is the Reclaimable Storage view, showing which arrays/volumes are good candidates for deletion to free up storage. CloudIQ details are available by system and storage pool for inventory (including drives by type, SSD endurance remaining, RAID type, and firmware), configuration, capacity (used, free, efficiency, snapshots, and data reduction), and performance (including 24-hour IOPS, latency, bandwidth, and utilization by controller), and all systems can be compared. Individual blocks can be viewed by properties, performance, and data protection such as replication details; the host view shows IP address, operating system, initiator protocol, size, and storage assigned.

ℹ Why This Matters

Budget and staffing constraints often keep midmarket organizations (and departments of enterprises) from having the latest innovations in technology. This is a shame because many of the latest innovations are designed to save money and provide better functioning infrastructure, both common goals for smaller organizations.

ESG audited Dell EMC testing of SCOS v7.3 in terms of performance, availability, and management. For VDI workloads, ESG validated 37.5% more desktops, 33% more IOPS, and 11% lower latency, and for SQL Server OLTP, 44% more transactions per second and 136% faster reads. These save money by enabling organizations to get more work done faster and by more users.

The SC Series exceeds the traditional on-site 5 9s availability, extending application uptime with Live Migration and Live Volume stretched clusters. The combination of hardware resiliency and Live Volume software provides organizations with application continuity during planned outages and disaster, as well as automatic failover and failback. SCOS v7.3 delivers traffic localization for better performance.

Management improvements include bringing Unisphere to the SC Series, delivering the same intuitive, HTML5-based, midrange management interface, while maintaining popular and familiar SC Series tools. Bringing CloudIQ to the SC Series provides cloud-based analytics to proactively monitor system health, saving organizations money and time.

The Bigger Truth

ESG has been evaluating the SC Series for many years, since well before Dell EMC purchased it. It has always been a cost-efficient, well-featured array for smaller organizations. But the SC Series of today, while remaining cost-efficient, looks like an enterprise-class array in terms of performance and functionality.

The marriage of the old Dell (with a generally midmarket focus) and EMC (with an enterprise focus) has produced a commitment to storage arrays for smaller organizations with big company features, and a regular cadence of performance and feature improvements. Virtualization has created an IT landscape more populated by IT generalists that need simple yet robust features, and Dell EMC has responded. Today's SC Series—particularly with the upgrades in SCOS v 7.3—looks like storage for Fortune 500 companies, but without the high cost.

ESG validated key additions with v7.3 that come at no additional cost: software-based performance improvements and faster drive rebuild times; hardware resiliency and updated Live Volume software that deliver the high application availability that keeps organizations productive longer; and Unisphere/HTML5 management and CloudIQ storage analytics. These are not only enterprise-class features, but also pull together the Dell EMC midrange storage portfolio in capabilities as well as in look and feel.

The Dell EMC SC Series delivers high-end functionality and performance across its portfolio, even at the entry-level. These capabilities are delivered in arrays that start around $25K. Smaller organizations have never dreamed of having these types of capabilities, but with the Dell EMC SC Series, they can do more than just dream.

The goal of ESG Validation reports is to educate IT professionals about information technology solutions for companies of all types and sizes. ESG Validation reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objectives are to explore some of the more valuable features and functions of IT solutions, show how they can be used to solve real customer problems, and identify any areas needing improvement. The ESG Validation Team's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments.