

ESG Lab Review

Always Available Dell Storage SC Series

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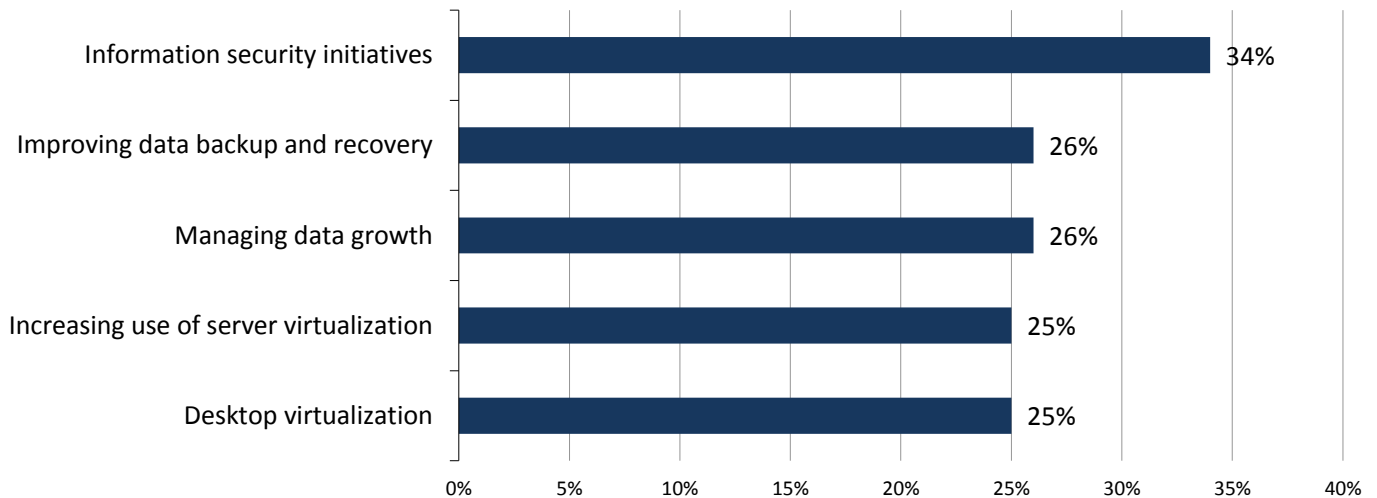
Abstract: This report documents ESG Lab testing of Dell Storage SC Series with a focus on the value of enhanced Live Volume support that provides always available access with great ease of use and economics.

The Challenges

IT managers are struggling to keep up with the “always available” demands of the business. Data growth and the nearly ubiquitous adoption of server virtualization among mid-market and enterprise organizations are increasing the cost and complexity of keeping up with the storage and data availability needs of the business. As a result, it’s no surprise that ESG’s *2015 IT Spending Intentions Survey* revealed that, as they have been since 2010, managing data growth, improving data backup and recovery, information security initiatives, and the increased use of server virtualization were at the top of the list of 2015 IT priorities (see Figure 1).¹

Figure 1. Top Five IT Priorities

Top 5 most important IT priorities over the next 12 months.
(Percent of respondents, N=601, ten responses accepted)



Source: Enterprise Strategy Group, 2015.

ESG’s annual IT spending intentions research survey looked not only at the top IT priorities on the CIO whiteboard, but also examined how IT purchases are being justified to business management teams. The top two considerations for justifying IT spending reported in 2015 were security/risk management and cost reduction.² A storage solution that provides business continuity across multiple sites is a great way to reduce risk and improve information security, but historically most organizations haven’t been able to justify the cost and complexity.

¹ Source: ESG Research Report, [2015 IT Spending Intentions Survey](#), February 2015.

² *ibid.*

The goal of ESG Lab reports is to educate IT professionals about data center technology products for companies of all types and sizes. ESG Lab 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 objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab’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. This ESG Lab report was sponsored by Dell.

Always Available Dell Storage SC Series

Live Volume with auto failover is a powerful new business continuity feature of the SC Series family of Dell Storage solutions introduced in version 6.7 of the SC Storage Center Operating System (SCOS).

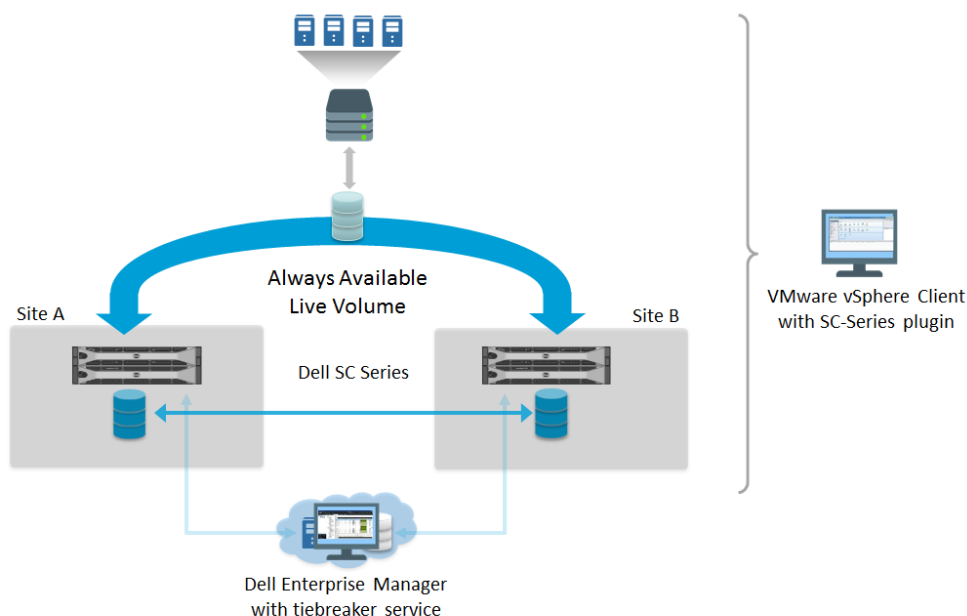
The Dell Storage SC Series was architected from the ground up with a software defined architecture that virtualizes and automates the movement and protection of data while taking advantage of the latest capabilities of industry standard hardware. The SC Series architecture optimizes data efficiency with a virtualized abstraction layer that automatically moves data between different tiers of storage media. The architecture reduces storage capacity costs with a number of efficiency technologies including thin provisioning and compression. That same architecture provides a solid foundation for the delivery of powerful and efficient data protection and recovery services including point in time data recovery within a data center (Data Instant Replay) and disaster recovery and data mobility between data centers (Live Volume).

Thousands of organizations have been leveraging the asynchronous remote mirroring technology at the heart of the first release of Live Volume support (SCOS version 5.4) for a number of powerful tasks including:

- Automatic storage migration (e.g., migrating a virtualized application from one data center to another).
- Zero downtime maintenance (e.g., moving Dell Storage between racks or power grids).
- Disaster avoidance (e.g., migrating workloads away from the path of a hurricane).
- Disaster Recovery (e.g., application recovery at a remote site after a site-level power outage).

In the latest release, Live Volume with auto failover leverages *synchronous remote mirroring* technology with a goal of extending the value of remote replication from disaster recovery to always available business continuity. As shown in Figure 2, a Live Volume with auto failover appears and behaves like any other internal or SAN attached disk, yet behind the scenes, data is replicated between two sites. The two sites can be located within the same campus or region with a WAN latency of 10 milliseconds or less for optimal application performance. The tiebreaker service, which eliminates the possibility of two SC Series arrays getting confused about whether the other array is alive, lives in a Dell Enterprise Manager VM that's deployed in a public or private cloud. Once configured, the highly available storage can be managed from the Dell Enterprise Manager or the vSphere management console with the Dell Storage SC Series plugin.

Figure 2. Always Available Dell Storage SC Series

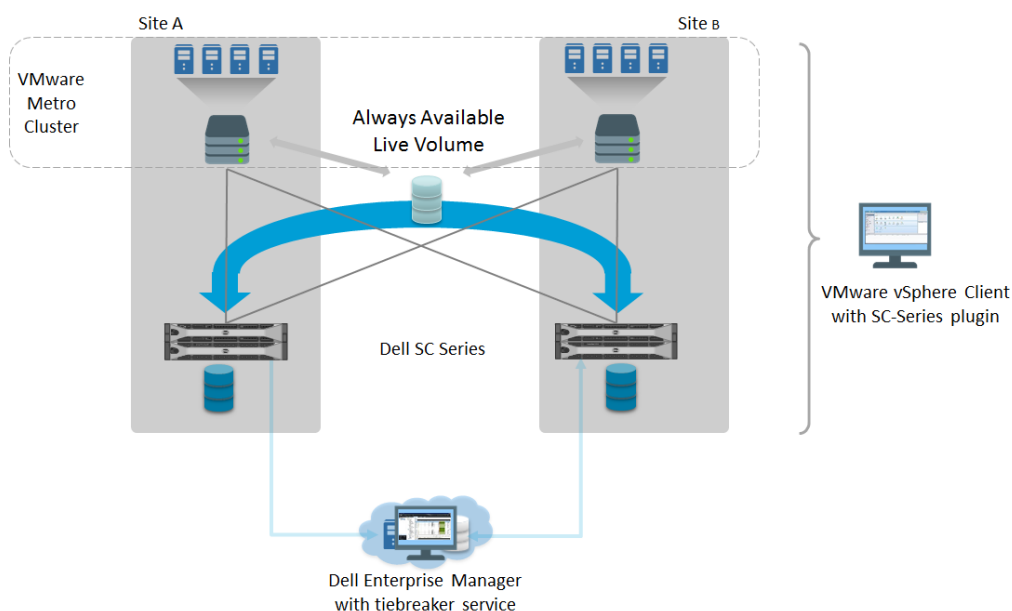


ESG Lab Review

ESG Lab tested Live Volumes in a VMware Metro Cluster environment with a focus on the value of enterprise-class business continuity with fully automated failover and zero interruption to the business. Testing began with a quick review of the Live Volume architecture and the test bed as shown in Figure 3.

A VMware Metro Cluster is used to deploy an application infrastructure that is spread over two data centers in different locations. An application running in Site A accesses a Live Volume through a multi-path driver that is locally SAN connected to a Dell Storage SC Series storage in Site A and remotely connected through a dark fiber or WAN connection to Site B. The distance between the two sites depends on the latency of the network connection between sites. When data is written in Site A, it is mirrored to Site B before the application is notified that the I/O has completed. If a disaster occurs in Site A, failover to Site B is fully automated and seamless. From an application, operating system, and hypervisor perspective, it is totally transparent which Dell Storage SC Series is servicing I/O requests.

Figure 3. VMware Metro Cluster with Dell Storage SC Series Always Live Volumes



During ESG Lab testing, VMware Metro Cluster provided the automated failover of the application at the host level while the Dell Storage SC Series provided always available access to volumes from either location. Live Volume with auto failover did not require any additional hardware (e.g., an in-band virtualization appliance) or software. No host-based agent or host-based scripts were needed to manage the failover and failback. Failover and failback were totally transparent and the Volumes were always synchronized and could be accessed from either site.

The tiebreaker service (a.k.a., quorum) provided the locking and intelligence that's need to keep the contents of the Live Volume synchronized between sites. The tiebreaker was deployed in a virtual machine running the Dell Enterprise Manager application.

ESG Lab emulated a two data center configuration within a single data center with the VMware servers, SC Series storage, and the Dell Enterprise Manager VM configured in a single rack. In a typical deployment, the Dell Storage SC Series would be deployed in separate sites and Dell Enterprise Manager would be deployed in a public or private cloud at a third location. This innovative approach of implementing the tiebreaker service in a virtualized management console deployed in the cloud increases fault tolerance and reduces the cost and complexity of providing enterprise-class business continuity for mission-critical applications.

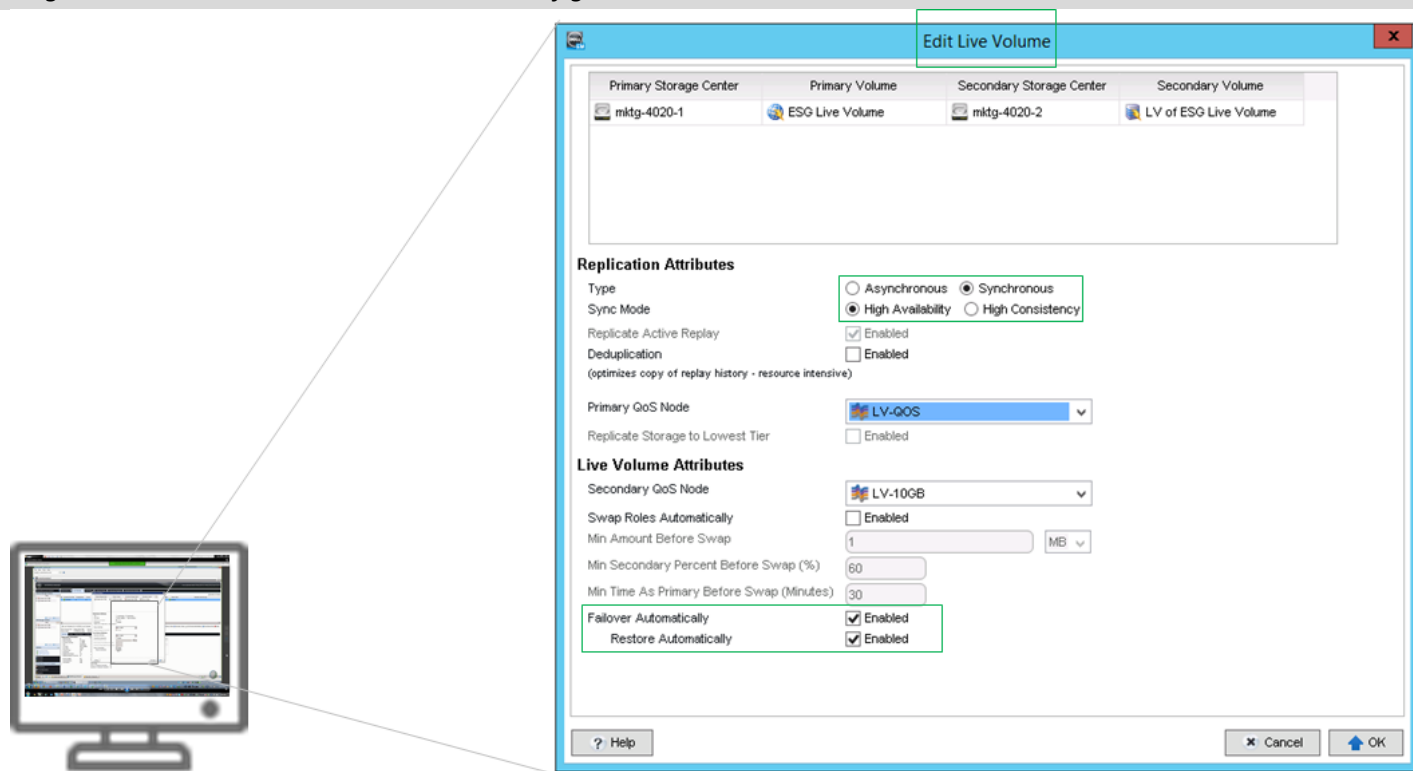
Live Volume with auto failover ensures business continuity after a number of failures beyond what was tested by ESG Lab (e.g., a total site failure due to a power outage). It can also be used for non-disruptive maintenance and application agility (e.g., migrate workloads to another site without incurring the delay and overhead of VMware Storage vMotion).

Configuring and Managing Dell Storage SC Series Live Volume with Auto Failover Functionality

Next, ESG Lab examined how Live Volumes are configured and managed with the Dell Enterprise Manager GUI and the vSphere management console with the Dell Storage SC Series plugin. Dell Enterprise Manager makes it easy to manage many Dell Storage SC Series from a single pane of glass.

As shown in Figure 4, turning a Dell Storage SC Series volume into a Live Volume with auto failover is as simple as checking a couple of option boxes on the **Edit Live Volume** configuration panel from the Dell Enterprise Manager GUI. A Live Volume with auto failover is configured by selecting the **Synchronous and High Availability** options. Note that optional automatic failover and failback can be enabled from the same panel.

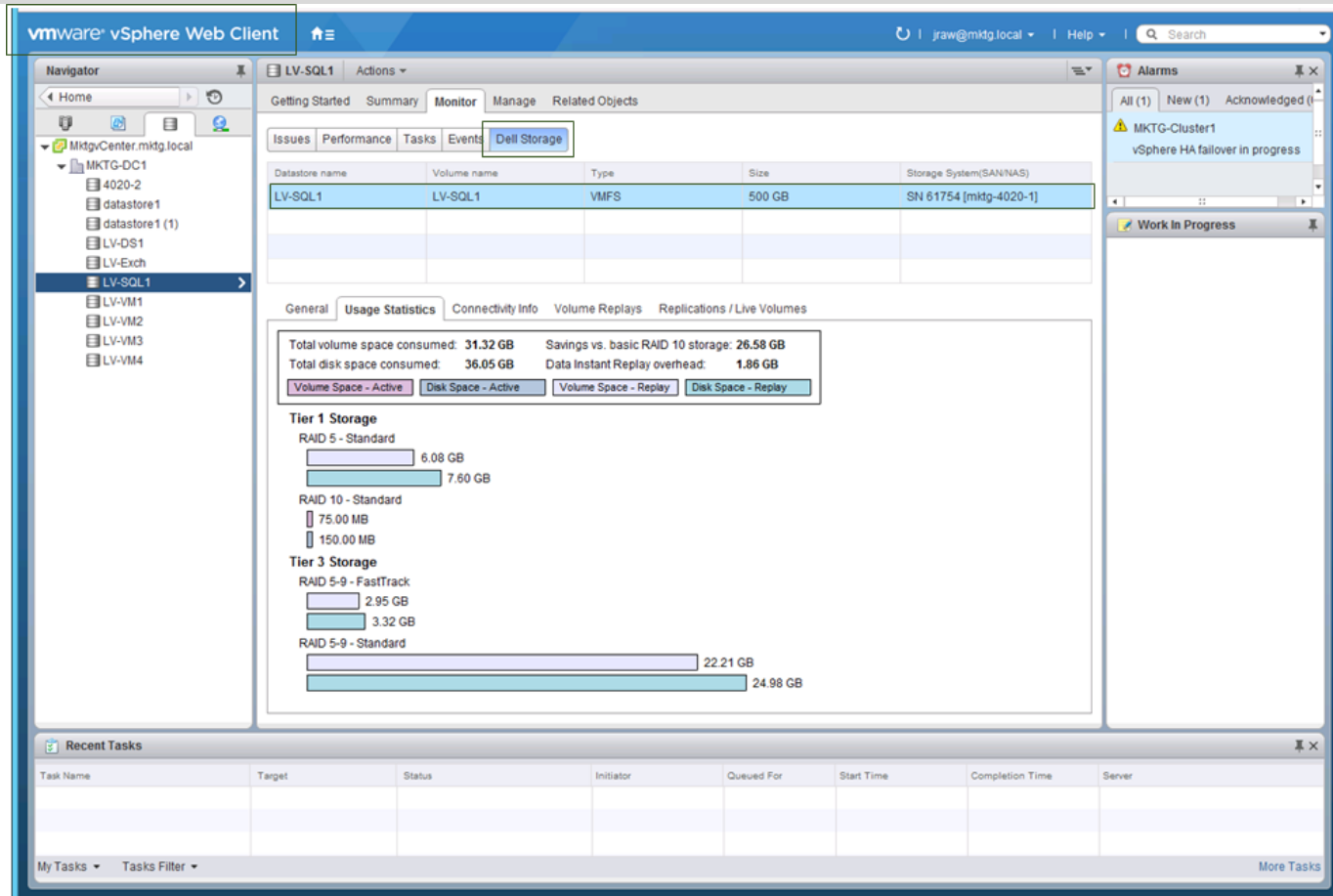
Figure 4. Live Volume with Auto Failover Configuration



In this example, Live Volumes were configured with a pair of Dell Storage SC Series in two simulated remote sites from the same Dell Enterprise Manager interface. Enterprise Manager was used to manage another test bed with more than a dozen Dell Storage SC Series from a single user interface during ESG Lab testing.

The screen shot shown in Figure 5 illustrates how Live Volumes were managed during ESG Lab testing from a VMware web client using the **Dell Storage** tab that’s provided by the Dell Storage SC Series plugin. This example shows the usage statistics for a Live Volume that was running a Microsoft SQL Server script during failover and failback testing.

Figure 5. Managing Live Volumes from VMware vSphere



After initial configuration of a Live Volume with automatic failover, the VMware management console can be used as the primary user interface for managing virtual machines and Dell Storage SC Series storage.

Why This Matters

Data growth and the rapid proliferation of virtualized applications are increasing the cost and complexity of storing, securing, and protecting business critical information assets. An “always available” storage solution with management tools that makes it easy to deploy and centrally manage a multi-site storage deployment reduces time, money, and risk.

ESG Lab has confirmed that a Live Volume with auto failover that’s deployed across multiple sites in a VMware Metro Cluster is easy to configure and manage. Simply checking a few boxes to enable fully automated auto failover and failback is a novel approach compared to the complexity associated with legacy synchronous remote mirroring solutions.

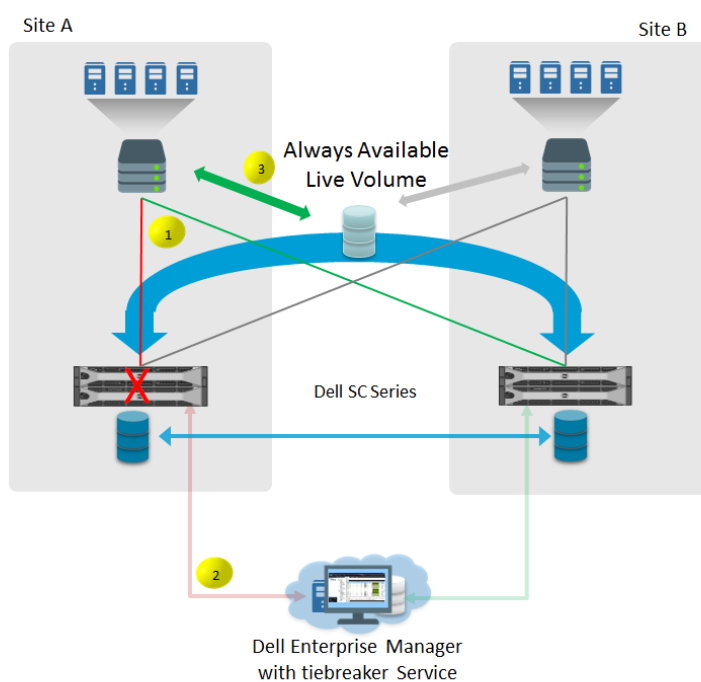
No extra hardware or host-based software is needed. Virtual server administrators can manage Live Volumes with the familiar VMware vSphere management console and the Dell Storage SC Series plugin. This simplified management approach reduces the complexity of providing enterprise-class levels of business continuity.

Live Volume with Auto Failover and Failback Testing

ESG Lab tested automatic failover and failback testing with a mix of emulated real-world application workloads running in virtual machines deployed in Site A. A simulated disaster was emulated by turning off the power to the Dell Storage SC Series in Site A. The SC Series in Site B automatically detected the failure, due to a break in the mirrored data path between sites and a lack of tiebreaker updates from Site A. Figure 6 shows how applications continued running during the simulated disaster:

1. A VMware multi-path connection failed over automatically from Site A to Site B.
2. The tiebreaker service noted that it could no longer communicate with the SC Series in Site A.
3. Live Volume remained available and continued running without error.

Figure 6. Error Injection Testing

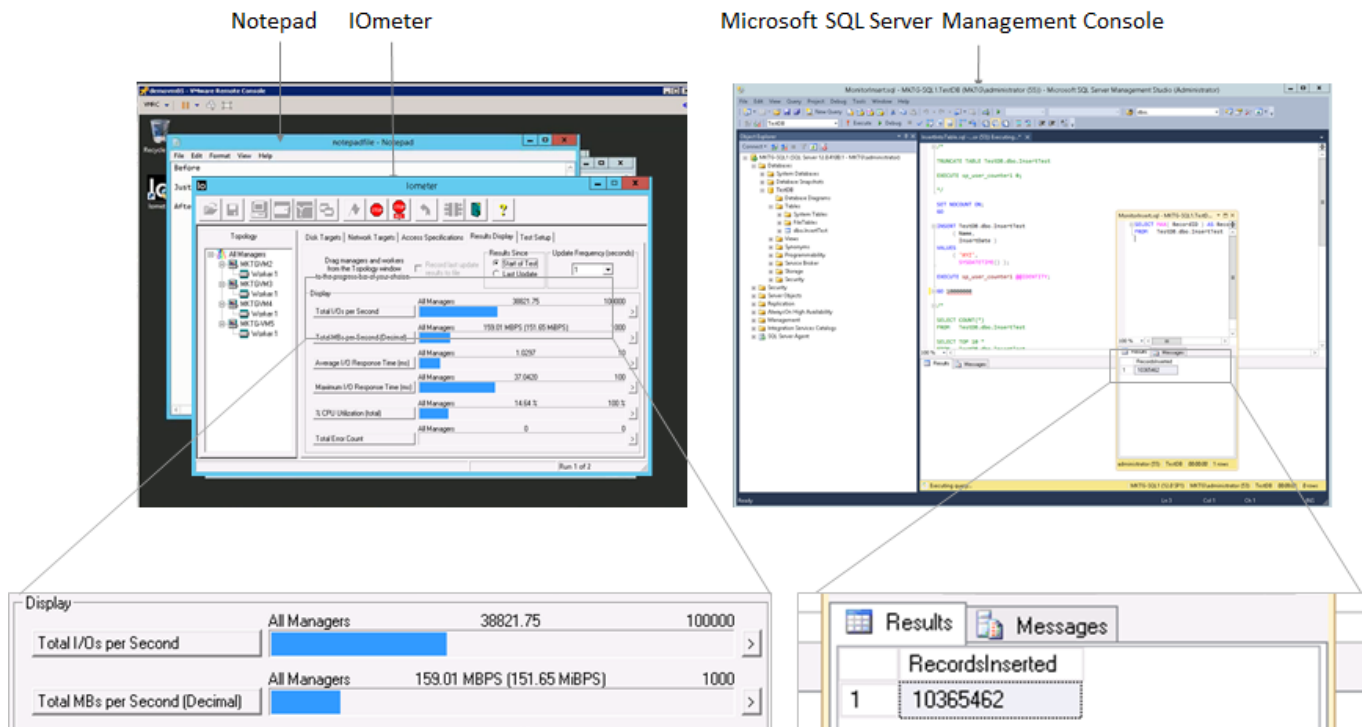


Application workloads were run in three virtual machines in Site A with a goal of monitoring what happens before, during, and after a simulated disaster:

1. The industry standard IOmeter utility workload emulated the I/O activity of an interactive multi-user application.
2. A Microsoft SQL Server script counted rows being added to a table in an endless loop.
3. A text file was edited with the Microsoft notepad utility with a goal of monitoring changes that were made just before and after a simulated disaster.

Figure 7 shows the applications that were running during the simulated disaster.

Figure 7. Application Workloads During Error Injection Testing



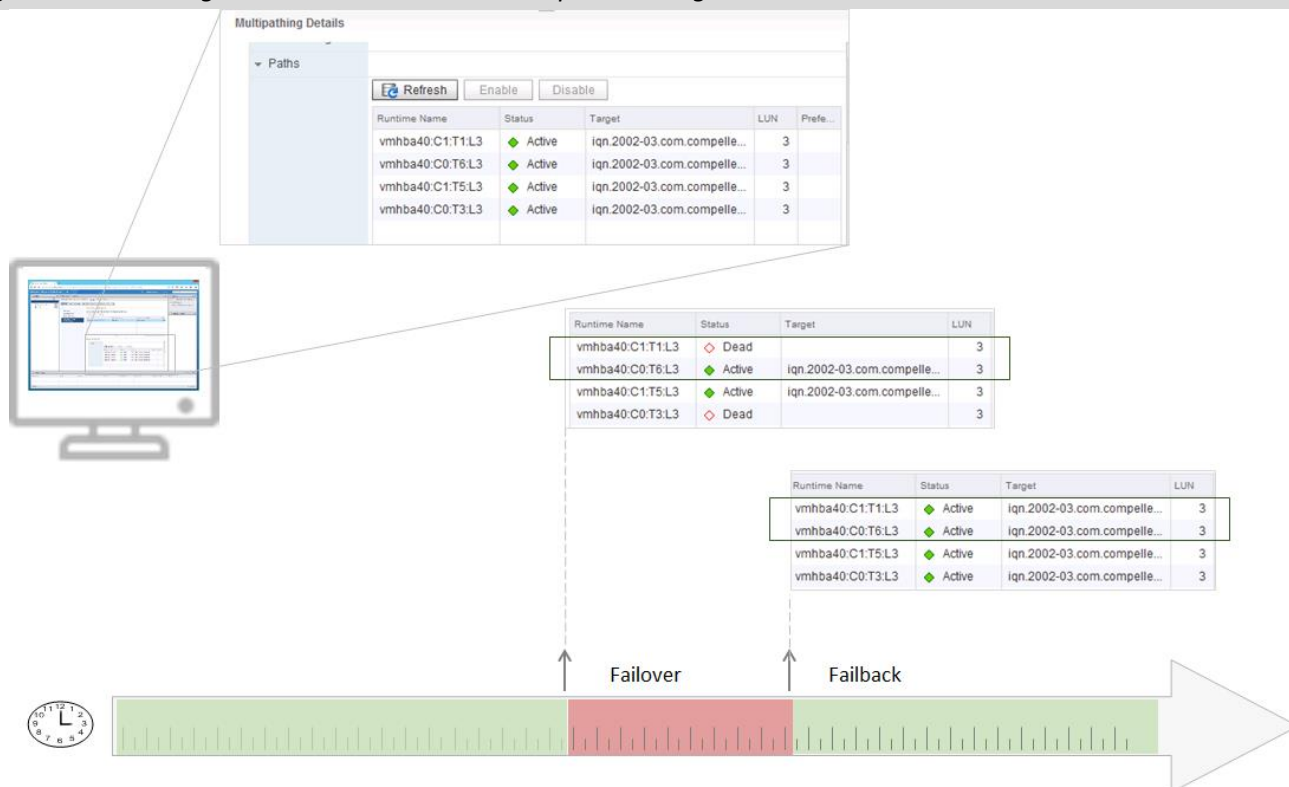
Dell Enterprise Manager was used to monitor the state of the mirrored Live Volumes and the level of I/O activity during failover and failback testing. A short 20 second pause in application I/O activity was observed just after the Dell Series was powered off in Site A. The tiebreaker service managed the switch in ownership between sites during this short pause. Applications continued running and no errors reported.

The Dell Storage SC Series in Site A was powered back on with a goal of simulating what happens after the problem(s) that caused the disaster have been fixed. The failback was totally automated and once again, it was invisible to applications which continued to run without error.

No errors were logged by applications or the Windows Server operator system during failover and failback testing. The only errors that were logged at the server level were the expected multi-path failover warnings from VMware.

The Dell Storage Enterprise Manager screen shot excerpts shown in Figure 8 show how the state of Live Volumes transitioned from *Protected* to *Auto Failed Over* and back during failover and failback testing.

Figure 8. Monitoring Live Volumes with Dell Enterprise Manager



While ESG Lab tested automated failover and failback with a storage system power outage, Dell testing has confirmed that Live Volumes have been tested with a goal of ensuring business continuity after a variety of failures in a VMware Metro Cluster including:

- A total site outage (e.g., a power failure due to a flood).
- A catastrophic storage area network failure (e.g., a double switch failure).
- A physical server failure (e.g., a VMware Metro Cluster failover to a remote data center).
- A connectivity issue between sites (e.g., a backhoe cutting the dark fiber connections between data centers).

Why This Matters

IT managers are struggling with the conflicting demands of keeping costs in check while keeping up with data growth and the availability needs of the business. For most organizations, service level agreements are getting stricter and recovery time objectives (RTO) and recovery point objectives (RPO) are shrinking to zero for business critical applications. Compliance initiatives exacerbates the challenges.

ESG has confirmed that Live Volume with auto failover can be used to dramatically lower the cost and complexity of ensuring business continuity. ESG Lab testing with no additional hardware or software in a VMware Metro cluster environment proved that failover and failback after a simulated site-level disaster can be totally automated. Except for an expected multi-path failover warning message in the VMware console and a short 20 second pause in activity, the automated repair of the highly available storage infrastructure was totally transparent to applications.

The Bigger Truth

Always on application availability is a problem that IT managers have been struggling with for decades. Complexity and cost has prevented most organizations from being able to deal with this problem for anything but the most mission-critical application in the largest of enterprise-class organizations. Historically, always on availability has been addressed with expensive enterprise-class storage solutions with synchronous remote mirroring that's integrated with host-based clustering software. The advantage of this approach is that each and every application update is mirrored to two data centers with a goal of ensuring zero data loss and quick recovery from a site-level disaster. The biggest disadvantage of this approach is the high cost of enterprise-class storage arrays that support synchronous remote mirroring. Integration with host-resident, often application-specific, clustering software and host-based scripts adds to the cost and complexity of this historical approach.

Dell's SC storage products have dramatically reduced the cost and complexity of delivering enterprise-class levels of business continuity and agility with Live Volume with auto failover support. ESG Lab testing in a VMware Metro Cluster confirmed that seamless failover after a site-level disaster is totally automated with zero interruption to business. No extra hardware or host-based software was required. Except for a small delay of 20 seconds for tiebreaker synchronization during failover, fully automated recovery with zero workload downtime was totally transparent to applications.

Synchronous remote mirroring is an enterprise-class feature that's relatively easy to describe (mirror writes to storage in another data center), but extremely difficult to implement and test. Keeping track of changes when WAN links go down and maintaining data consistency between sites during failover and failback are a few of the many challenges that need to be dealt with. Making synchronous remote mirroring transparent to host applications without the need for extra hardware (e.g., an in-band storage virtualization appliance) or host-resident software (e.g., agents) is even harder. ESG knows of, and has tested, only one enterprise-class class storage solution that delivers similar levels of next-generation synchronous remote mirroring technology and that doesn't require extra hardware or host-based software. And as you might expect, that enterprise-class solution has an enterprise-class price tag that's significantly higher than the Dell Storage SC Series.

Due to the complexity associated with developing, testing, and qualifying always available storage, it's no surprise to ESG that synchronous remote mirroring isn't supported by most of the all-flash and hybrid storage startups that have emerged recently. Nearly all of the all-flash and hybrid storage startups that have emerged over the past couple of years support asynchronous remote mirroring which provides some level of data protection and mobility, but they can't provide always available application access without some level of data loss. Asynchronous remote mirroring is great for disaster avoidance, data center migrations, and planned maintenance as ESG Lab demonstrated when it first tested Live Volume support during an ESG Lab Validation in 2011.³ Dell Storage Center version 6.7 extends the value of Live Volumes with synchronous remote mirroring support. That value can be amplified for even greater levels of business continuity and agility with three site support for out of region disaster recoverability and federated environments with a mix of Dell Storage solutions.

Dell indicates that advanced replication topologies (e.g., many to one) and clustering solutions beyond the VMware Metro Cluster support that was presented in this report are planned. This is more of a test and qualification effort than a development effort due to the fact that host-based software is not required.

The bottom line with this innovative new technology from Dell is simple. Live Volume with auto failover provides enterprise-class levels of business continuity that's not available from most all-flash startups and is simpler and costs a lot less than legacy storage solutions with similar functionality. If you're a Dell Storage SC Series customer who already has a Live Volume license, you should try this valuable capability after a no charge perpetual software upgrade. If you're an IT manager in a mid-sized to enterprise-class organization and you're looking to reduce risk with a disaster recovery plan that fits on one page, ESG recommends that you contact your local Dell representative with a goal of architecting a proof of concept that fits the needs—and budget—of your business.

³ ESG Lab Validation Report, [Dell Compellent Storage Center 5.4: Fluid Networked Storage](#), November 2011.



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