

# Deliver Dynamic Business Continuity for the Enterprise with Dell Compellent Live Volume

*Avoid downtime from planned outages,  
balance workloads on demand, and easily shift  
resources across the cloud*

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A Dell Technical White Paper

Dell | Compellent



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## Executive overview

For many organizations, planned outages and impending events account for the vast majority of IT downtime. Upgrading software, planned power outages, replacing hardware components, adjusting system configurations, and other common maintenance activities can result in disruptions that have a serious impact on the business—as do severe weather events and periodic spikes in server workload. Today’s businesses increasingly rely on around-the-clock operations without disruption—the inability to run certain applications or access data when needed can diminish employee productivity and frustrate customers.

Data center technology vendors are well aware of the potential disruptions caused by planned outages and foreseen events, but few vendors include those variables when they advertise “five-nines” availability for their products. IT organizations need a new business continuity solution to help eliminate downtime related to anticipated data center activity—one that complements existing hardware and software infrastructure and helps deliver the level of availability promised. The solution must not only provide on-demand capability, but built-in automation for virtualized data centers and the cloud.

Dell Compellent Live Volume, an innovative software feature for the Dell Compellent Storage Center storage area network (SAN), is designed to deliver dynamic business continuity, helping organizations keep applications online and data accessible during planned downtime. Live Volume provides a new layer of virtualization that enables a physical server or virtual machine (VM) to share a virtual storage volume between two Storage Center SANs in a semi-synchronous configuration.

When preparing for planned maintenance or anticipating another type of outage or disruption, administrators can quickly and easily designate primary status to the secondary system on demand—in either the same data center or another local data center—ensuring continued availability without disrupting user access to data. Live Volume also helps organizations balance workloads on demand without disruption. With dynamic horizontal movement of data between systems, administrators can easily migrate data sets to a new array, optimize I/O performance, maximize resource utilization, and accommodate demand spikes caused by end-of-quarter financials, retail promotions, or other short-term periodic events.

In addition, Live Volume works in any hypervisor environment, automatically moving storage volumes in sync with VM movement between hosts. An important complement to remote replication and server virtualization, Live Volume can help organizations reach a new level of availability and flexibility. Storage is no longer tied to one production SAN, but rather virtualized between two SANs, with semi-synchronous replication for continuous data protection regardless of physical location—data is written first to the volume on the primary SAN and upon completion of the write, immediately replicated to the other instance of the volume on the secondary SAN.

This white paper discusses how Live Volume provides dynamic business continuity through the following functionality:

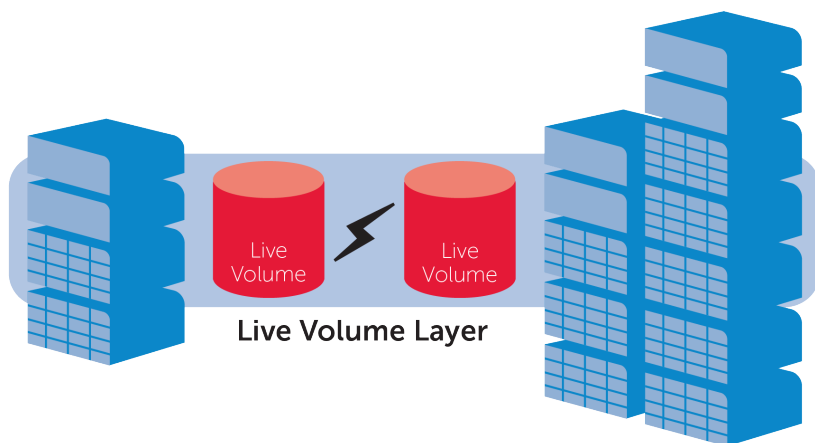
- Creating a new layer of storage virtualization
- Achieving semi-synchronous inter-array replication
- Realizing zero-downtime system maintenance
- Establishing on-demand load balancing between SANs

- Ensuring smooth migration of data to a new system
- Facilitating seamless scalability
- Introducing on-demand resource allocation for the cloud

## 1. Creating a new layer of storage virtualization

Live Volume operates as a storage hypervisor that abstracts storage volumes or logical units (LUNs) from physical storage systems, providing a new layer of virtualization for enterprise storage (Figure 1). With Live Volume, a physical or virtual server is simultaneously mapped to two instances of the same storage volume on two distinct Dell Compellent Storage Center SANs. Though the server sees only a single consistent volume, Live Volume enables administrators to seamlessly move storage workloads from one SAN to another on demand. One SAN is assigned primary status and the other is assigned secondary status, with these roles reversed at any time according to changing business needs.

**Figure 1. Live Volume Enables Shared Virtual Storage in a Semi-Synchronous Configuration.**



Once Live Volume functionality is activated, administrators can create numerous shared volumes—“live volumes”—between paired arrays. Because the volumes are abstracted from the physical hardware, they are not confined to certain disk groups or RAID groups within each SAN. Instead, the volumes share a pool of virtualized storage within each SAN, with the option to create designated sub-pools if desired.

The SANs can be located in the same facility or in two distinct locations. To ensure effective and rapid transfer of data between the SANs, Dell Compellent recommends a maximum distance of 60 miles between the two systems. Administrators can designate any volume within a SAN as a live volume, eliminating the need for pre-planning or pre-definition. Users can change the inter-array relationship of these shared volumes at any time, discontinuing the relationship or moving the volumes to another pair of SANs.

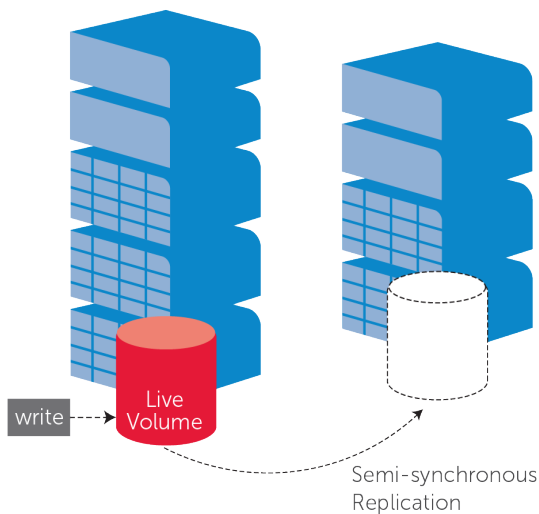
Live Volume is fully integrated with the other intelligent software features of the Dell Compellent Storage Center SAN. Unlike other data movement solutions, it isn't bolted onto the operating system, doesn't utilize an external appliance, and doesn't require any server-side agents. The functionality supports all major virtualized server environments, including VMware® vSphere™, Microsoft® Hyper-V™, and Citrix® XenServer® environments. In addition, it supports multiple connectivity protocols, including

Fibre Channel, Internet SCSI (iSCSI), and Fibre Channel over Ethernet (FCoE). The only requirements are two Storage Center SANs and the availability of high-bandwidth, low-latency network connectivity so application performance isn't affected as data moves between the two systems.

## 2. Achieving semi-synchronous inter-array replication

Live Volume uses a semi-synchronous approach to keeping data volumes up to date on the Storage Center SANs. When Live Volume is deployed, administrators designate a primary and secondary SAN. The volume that is actually live at any given time is the volume on the primary SAN. Data is written first to this instance of the volume on the primary SAN and upon completion of the write, immediately replicated to the other instance of the volume on the secondary SAN. Data on the two SANs is synchronized until the next write begins, ensuring that the SAN with secondary status is ready to take over production at any time (Figure 2).

**Figure 2.** Data Is Written First to the Primary SAN and Then Replicated to the Secondary SAN.



Live Volume integrates seamlessly with Dell Compellent Data Instant Replay and Remote Instant Replay software to deliver rapid and efficient data movement from one SAN to the other. Data Instant Replay creates space-efficient snapshots (called Replays) of data on the primary SAN for continuous data protection with near-instant recovery to any point in time. Once an initial base Replay is taken of a “live volume,” each subsequent Replay writes only the data that has changed since the previous Replay to save storage space. Each Replay contains virtual pointers to the location of the other, unchanged data for volume integrity. Replay data is then replicated to the secondary SAN using Remote Instant Replay, the Dell Compellent remote replication functionality. After initial synchronization, only incremental data changes are replicated between the two SANs. This “thin replication” approach saves storage space on the secondary SAN, facilitates rapid transfer of data from the primary to the secondary system and allows users to leverage existing IP connections, if preferred, for the actual transfer of data.

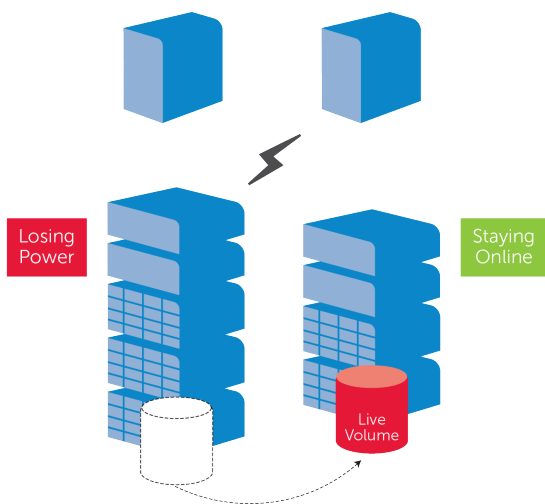
While Live Volume utilizes the technology behind Remote Instant Replay to replicate data between paired SANs, it doesn't replace Remote Instant Replay as the core remote replication technology for disaster recovery (DR). With DR solutions, the recovery process is typically triggered by an unplanned disaster or outage. Once the disaster occurs, the most current snapshot needs to be found, mounted, mapped to the server, and then restored. Even using automated solutions such as VMware vCenter™ Site Recovery Manager, there is still downtime as servers are migrated and volumes are remapped.

By contrast, Live Volume helps to eliminate downtime during recovery by maintaining a continuous, ongoing relationship between a virtual or physical server and two instances of a volume on two distinct Storage Center SANs. When administrators decide to assign the primary SAN role to the secondary SAN, no remapping is required and users experience no downtime or disruption. The change occurs the instant that the last write is replicated to the secondary SAN. So, while DR solutions help organizations get back to business quickly after natural disasters and other sources of unexpected outages, Live Volume helps organizations avoid disruption from planned outages and foreseen events.

### 3. Realizing zero-downtime system maintenance

To help organizations eliminate the downtime associated with planned maintenance and other anticipated outages, Live Volume monitors the I/O between servers and storage (Figure 3). In the event that administrators need to upgrade software, repair a server, or conduct another kind of scheduled maintenance, they can move VMs from one physical host to another using VMware vMotion™ or a similar movement engine. If the new physical host is at a remote location and connected to the secondary SAN, Live Volume automatically detects the change in I/O locality, and then automatically swaps the roles of the SANs. The secondary SAN becomes the primary SAN for that volume—in other words, the production volume is now on the other SAN. Live Volume also automatically changes the direction of replication from the new primary SAN to the new secondary SAN. If and when the VM is later moved back to its original server and a change in I/O locality is detected, Live Volume will automatically swap the roles of the SANs again and once again reverse direction of replication.

**Figure 3. Live Volume Can Move Production Volumes In Sync with VM Movement Between Hosts.**



As previously illustrated, Live Volume can also help sustain availability if one of the SANs requires maintenance or when an organization anticipates a power outage or natural disaster that could bring the SAN down. In that case, or for planned maintenance, administrators can manually designate the other SAN, at a distinct geographic location, as the primary SAN for the volumes managed by Live Volume. All I/O is migrated to the secondary SAN nondisruptively while both systems remain online to ensure a rapid and seamless switch to the newly assigned primary SAN. During the site outage or system maintenance, the production volume will no longer be shared. Once the event ends or the threat passes, administrators can easily reverse the process to resume normal operations.

### **Accommodating temporary demand spikes**

Organizations across a range of industries can face occasional spikes in system demand that place significant burdens on IT resources. For example, a music venue or ticket reseller could experience tremendous traffic for its transactional database in the hours after concert tickets go on sale. An online retailer might experience even more sustained demand during certain seasons or during promotional events. Or a large-scale public enterprise might register peak loads on financial systems at the end of every quarter. Live Volume can help provide the IT flexibility organizations need to accommodate these anticipated short-term changes in demand so they can deliver a positive customer experience and maximize enterprise efficiency. The administrator simply designates primary status for the production volume being taxed to another SAN with less workload. This not only gives the demanding application more storage resources during the spike, but enables all other applications utilizing the first SAN to perform as usual.

## **4. Establishing on-demand load balancing between SANs**

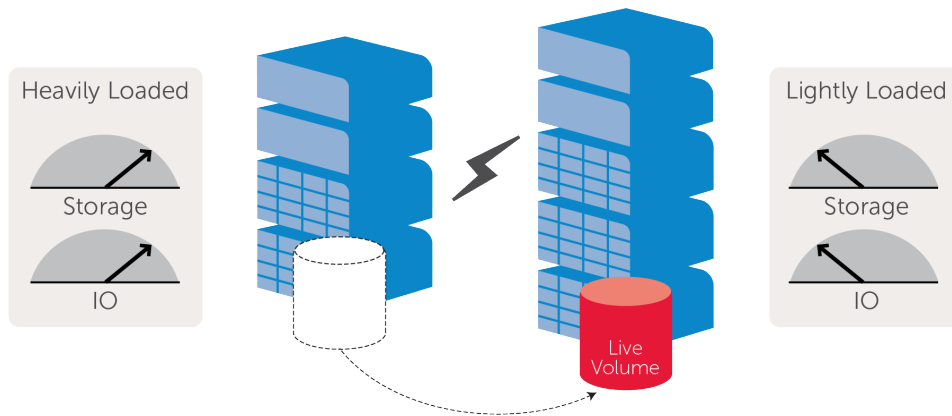
In addition to eliminating downtime associated with planned outages, Live Volume offers an easy and effective way to balance workloads among Storage Center SANs. It provides on-demand movement of data between SANs to accommodate short-term demand spikes or other changes in storage needs without having to expand a storage system (Figure 4).

Administrators can initiate load balancing at any time to optimize performance and improve capacity utilization. To do so, administrators simply move one or more production volumes from one SAN to the other—that is, they reassign the secondary SAN as the primary SAN for those volumes. Because Live Volume leverages Remote Instant Replay for semi-synchronous replication, keeping data up to date on both SANs, there is no lengthy transfer of data required. As a result, there is no disruption to the operation of applications or servers, or to user access to data.

Live Volume also can handle load balancing automatically to accommodate I/O demand spikes from certain servers. Live Volume closely monitors I/O demand coming from servers to both the primary and secondary SANs. If demand from servers located physically close to the secondary SAN exceeds demand from servers close to the primary site, Live Volume can automatically swap the roles of the SANs based on I/O locality.

By designating the SAN closest to the high-demand servers as the primary SAN, Live Volume can help improve performance and accommodate that increased demand. At the same time, the change will reduce the impact on network resources since data does not have to travel first to a distant SAN.

**Figure 4. Administrators Can Seamlessly Balance Storage and I/O Loads On Demand.**



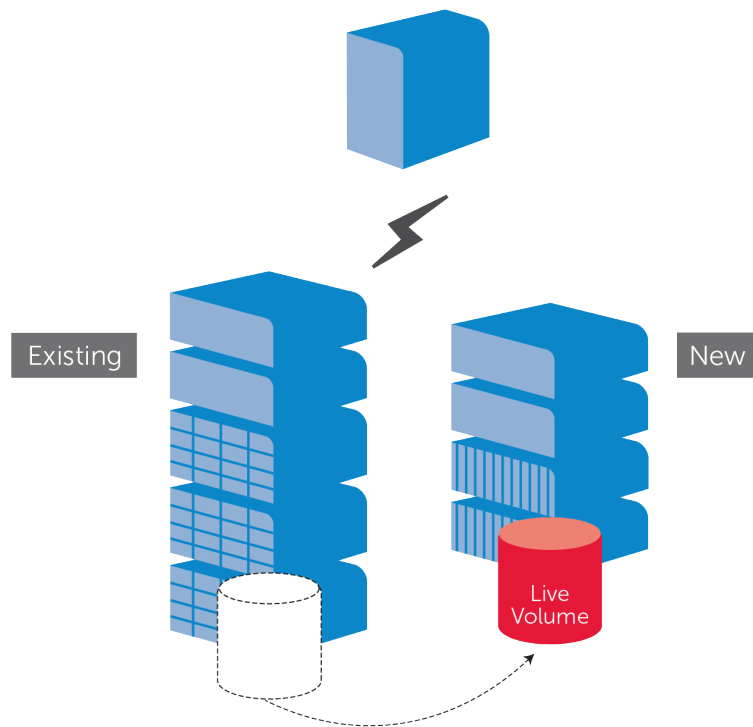
Unlike other software solutions that move storage volumes, Live Volume doesn't rely on servers to do the work of making changes. In many situations where load balancing is required, servers are already overtaxed. With Live Volume, the reassignment of primary and secondary array status to offset unusually high I/O is completed at the storage level without affecting storage performance. Live Volume removes that burden from servers to help accelerate the return to their optimal operating state.

## 5. Ensuring smooth migration of data to a new system

As organizations refresh storage or add arrays, Live Volume can facilitate smooth data migration. For example, if an organization is installing a new Storage Center drive enclosure, administrators can migrate the volumes on the hardware to be upgraded temporarily to another array within the same campus (Figure 5).

Once the installation is complete, the volume can be moved back to its original location. If an organization is moving data to an all-new array, Live Volume moves the volumes from the existing array to the new one transparently. Applications continue to run as usual.

**Figure 5. Live Volume Facilitates Nondisruptive Migration to New Systems.**



## 6. Facilitating seamless scalability

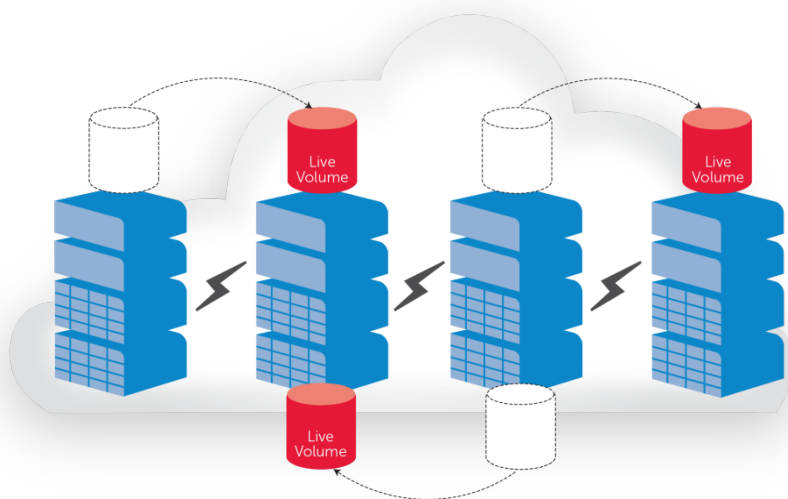
Live Volume can play a key role in facilitating the exceptional scalability of the Dell Compellent Storage Center SAN. The Dell Compellent SAN provides a cloud storage architecture that enables organizations to scale, nondisruptively, across numerous controllers. When organizations need more capacity or performance than they can achieve with the existing controller pair, they can simply add more controller pairs and drives.

Administrators use Live Volume to migrate volumes seamlessly, spreading volume workloads across new controller pairs nondisruptively while avoid the time-consuming process of manual data migration. After creating a live volume replica on the added controllers, administrators swap the primary role for the volume to the new controllers and then remove the live volume replica from the source. The process takes about the same number of clicks as using VMware vMotion.

## 7. Introducing on-demand resource allocation for the cloud

Live Volume gives administrators the flexibility to change how applications interact with storage based on current needs. For example, administrators can use Live Volume to match a particular workload with higher performance disks (Figure 6). Just as automated tiering through Dell Compellent Data Progression software optimizes performance within a SAN by pairing data with the right storage tier, Live Volume helps organizations improve performance across SANs.

**Figure 6. IT Groups Can Deliver Resources Needed Without Disrupting End-User Data Access.**



Administrators might choose to designate a SAN with solid-state disks as the primary SAN for data volumes associated with high-performance workloads. With Live Volume, administrators can place data where it makes the most sense according to cost, performance, and availability requirements. Multiple servers can be mapped to the same live volume, dynamically handing off active mapping based on which has primary status at the time.

By increasing IT flexibility, Live Volume can play a key role in helping organizations build cloud computing environments. Organizations are increasingly turning to cloud computing to enhance computing agility, improve resource utilization, and reduce costs. Whether an organization is constructing an internal or external cloud, Live Volume enables IT groups to deliver the resources needed, when they are needed, without disrupting end-user access to data.

Live Volume creation and control is built into Dell Compellent Enterprise Manager software, a centralized console used for managing multiple local and remote Storage Center SANs. A wizard-based tool simplifies volume creation and server mapping. The assignment of primary and secondary SANs for multiple volumes can be swapped with a single click. Administrators use the same interface to

configure and verify replication processes, monitor storage capacity and disk utilization in real time, and generate detailed storage usage and performance reports.

## Conclusion

Planned outages will always be a part of IT management. But those outages do not need to disrupt application availability or curtail user access to data. By maintaining a constant relationship between a server and a shared production volume managed on two distinct Storage Center SANs, and by facilitating seamless movement of the volume in sync with VMs among physical hosts, Live Volume helps organizations achieve dynamic business continuity despite inevitable everyday circumstances. By introducing a new layer of storage virtualization, Live Volume upsets the status quo, removing the downtime, disruption, and latency associated with planned outages and foreseen events.

Live Volume also provides a simple and effective way to balance workloads among Storage Center SANs. Administrators can initiate changes on demand and take advantage of automated load-balancing capabilities to sustain high performance, accommodate demand spikes, and optimize resource utilization. The ability to shift storage resources on demand, whether within one data center or between two local data centers, is particularly useful for cloud computing environments.

The benefits to the business are clear. By eliminating downtime, organizations can sustain employee productivity and improve the customer experience. By balancing workloads, IT groups can better provide employees and customers with the system performance and service levels required while making the most of existing investments. Live Volume delivers the availability to keep business moving and the flexibility to accommodate change.