

Dell EMC SC Series Live Migrate and Volume Advisor

Abstract

This document provides best practices for Dell EMC™ SC Series Live Migrate and Volume Advisor, features which allow SAN workloads to be seamlessly migrated from one SC Series array to another.

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Revisions

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August 2016	Initial release
June 2018	Updated to include Volume Advisor

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Executive summary

Data center administrators are challenged with balancing workloads and resources while containing costs. Just as server virtualization enabled the mobility of application workloads across the server boundary, Dell EMC™ SC Series Live Migrate and Volume Advisor enable the mobility of storage workloads across the SAN boundary. Applications are no longer tied to an individual silo of storage or physical location; they can be seamlessly migrated to a location that best meets the current needs.

With SC Series Live Migrate and Volume Advisor, workload mobility takes a leap forward. SAN workloads can be seamlessly migrated from one SC Series array to another, without application downtime or disruption, regardless of the operating system. Whatever the reason — migrating a heavy I/O workload to a faster or less-resource-bound SC Series array, retiring an older workload to a lower-cost SC Series storage solution, or rebalancing the federation and expanding it with a new SC Series array — Live Migrate will get it there.

This document describes the two methods for initiating Live Migrate. With either method, the process will run smoothly when the best practices discussed in this document are implemented.

1 Introduction to Live Migrate and Volume Advisor

Live Migrate moves a volume from one SC Series array to another without application downtime or disruption to I/O. It is not dependent on server-side agents, application integrations, or OS features, and is completely OS and application agnostic. This enables storage administrators to make more efficient use of an SC Series storage environment by providing the ability to move storage workloads to the most appropriate array for that workload and point in time.

Live Migrate utilizes some of the underlying Dell™ Storage Center OS (SCOS) capabilities that power Live Volume, an SC Series feature that enables SAN volume high availability. Live Volume creates synchronous or asynchronous live copies of data on separate SC Series arrays, transparently maintaining and swapping the primary host source. Live Migrate provides a one-time migration of a volume from one SC Series array to another. Live Migrate is not dependent on Live Volume licensing, and licensing for Live Migrate is included at the base level.

Volume Advisor is a layer of software intelligence natively built into SC Series arrays. In terms of Live Migrate federation and data mobility, there are two methods to initiate a Live Migration. Live Migrate can be initiated manually by selecting a volume or multiple volumes within Dell Storage Manager (DSM). Live Migration can also be initiated from a recommendation made by Volume Advisor within DSM. Volume Advisor recommendations are based on thresholds defined by the DSM administrator. When a threshold is exceeded, an alert is generated by DSM. Depending on the alert, the DSM administrator can choose to follow the Volume Advisor recommendation to initiate a Live Migration to resolve the problem.

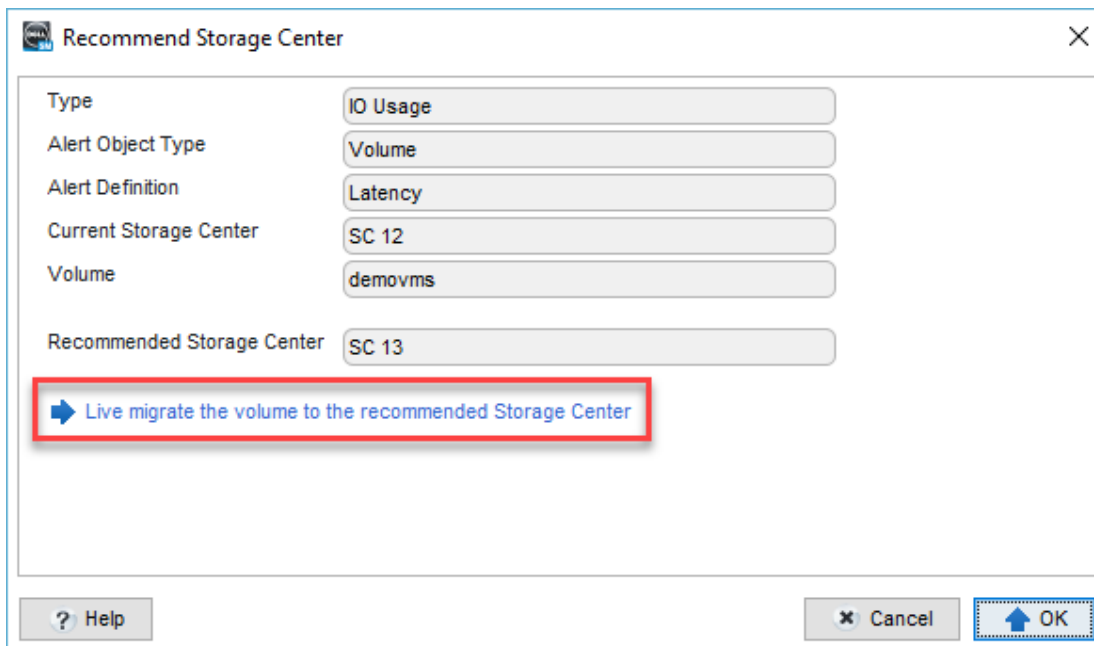


Figure 1 Volume Advisor recommendation to initiate Live Migrate

For a complete list of thresholds that can be defined for use with Volume Advisor, refer to the *Dell Storage Manager Administrator's Guide* available on Dell.com/Support.

1.1 Live Migrate states

Live Migrate moves a volume from one SC Series array to another without I/O or application disruption. During a Live Migrate, both the source and destination arrays can accept reads and writes for the volume being moved.

During a Live Migrate, the relationship between the server, source and destination arrays; the volume; and where a read or write I/O is serviced; goes through several different states. The Live Migrate process has four significant phases listed as follows:

- Before Live Migrate
- During data movement
- After role swap
- Completion

1.1.1 Before Live Migrate

Figure 2 illustrates the environment layout prior to Live Migrate configuration. The server (1) is connected with iSCSI, FC, or FCoE (2) to the source SC Series array (3), which currently hosts the volume (4). All I/O requests for the volume are serviced by the source array. If the server is not defined and connected to the destination SC Series array (5), then during the configuration of the Live Migrate for the volume, this will be detected and the administrator will be prompted to resolve the connection. If replication (6) between the source and destination is not configured, Live Migrate will prompt for this to be configured and a source replication QoS node to be created.

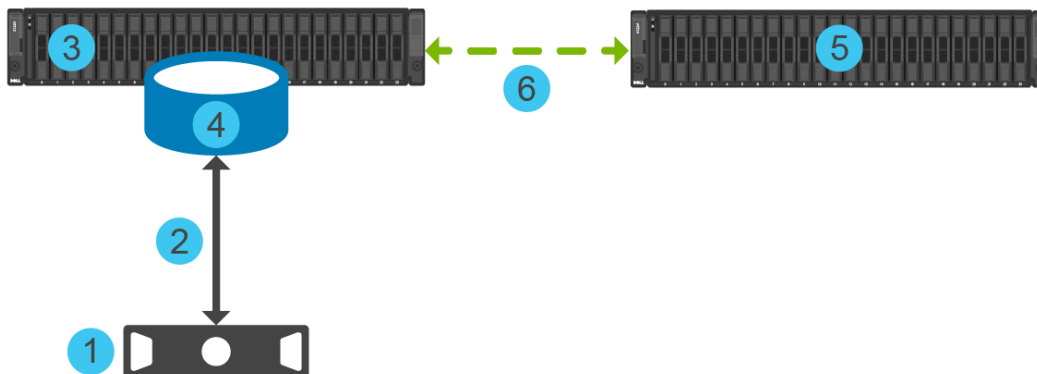


Figure 2 Configuration of environment prior to Live Migrate

1.1.2 During data movement

Figure 3 shows that once Live Migrate is configured and running, the server (1) is mapped to both the source volume (3) on the source SC Series array and the newly created destination volume (4) on the destination SC Series array. Data is asynchronously replicated from the source SC Series array to the destination array using the configured replication connection fabric (5). The source volume and destination volume appear to the server as a single volume with additional paths (2). The server cannot distinguish between the paths leading to the source volume and those leading to the destination volume. The server may send I/O down any available path. The path selection policy will determine which path(s) are used. If the source and destination SC Series arrays are running SCOS version 7.3 or newer, and the server is using an ALUA-aware round robin path selection policy, this will also dictate which path(s) are actively used. Regardless of which array receives the I/O, it will be handled correctly. During the Live Migrate, but before the role swap, read I/O requests can be serviced by the array that receives the request. In the case of the destination array receiving a read request for a page that has yet to be replicated, the read request will be forwarded (6) to the source array. Write I/Os received by the source array are acknowledged and replicated asynchronously. Writes received by the destination array, are forwarded (6) to the source, acknowledged, and replicated asynchronously. The replication progress and sync status of the Live Migrate operation can be observed on the volume **Summary** screen and on the **Live Migrate** page under **Replication and Live Volumes**.

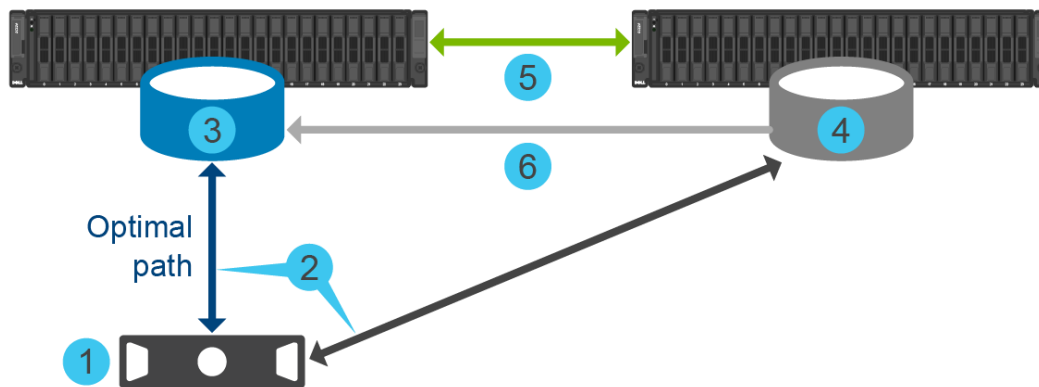


Figure 3 Data paths during Live Migrate

1.1.3 After role swap

Once the destination SC Series array is in sync with the source array as shown in Figure 4, all the existing volume data resides on the destination array. New writes can be quickly acknowledged and replicated so that a role swap can be performed. By default, Live Migrate configures this to occur automatically, which is preferred in most cases where Live Migrate is being leveraged to address an existing problem or pending risk. However, it may be configured as a manual task if desired. After the role swap, the volume (1) on the destination SC Series array becomes the target volume for all writes. Writes received by the source array are forwarded (2) to the destination array and acknowledged. Writes received by the destination array are acknowledged but not replicated back to the volume (3) on the source SC Series array. This is also the case with read I/Os.

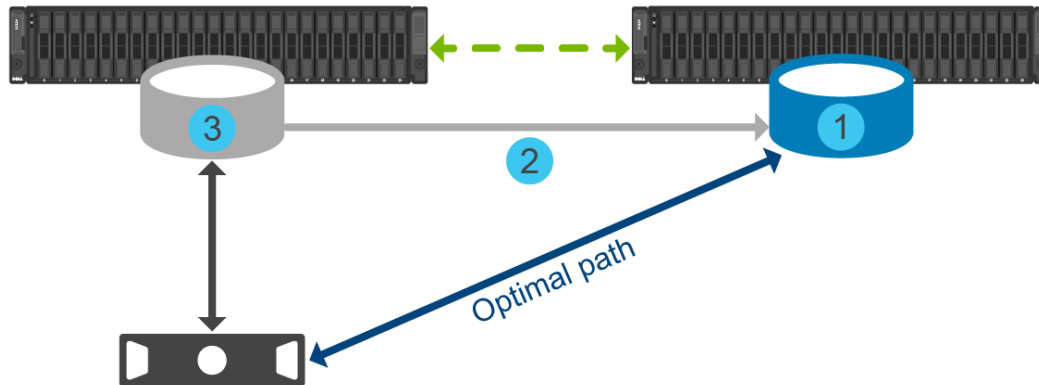


Figure 4 Data paths after role swap

1.1.4 Completion

Once the role swap has occurred, new writes are no longer committed to the source volume, but the server is still mapped to it and may be sending I/O to it depending on the server's path selection policy. The storage administrator must mark the Live Migrate task as completed, which will offline the volume (1) and remove the mapping between the server and volume on the source SC Series array. It is important to emphasize that in this step, paths will be removed from the volume on the source array. A storage rescan should have been performed as part of the step, During data movement (section 1.1.2), and verified that the server recognizes available paths to the volume on the destination array so that there is no storage interruption in the step, After role swap (section 1.1.3). Now, the server is only mapped (2) to the volume (3) on the destination SC array, shown in Figure 5. The administrator can now delete the original volume on the source SC Series array (1).

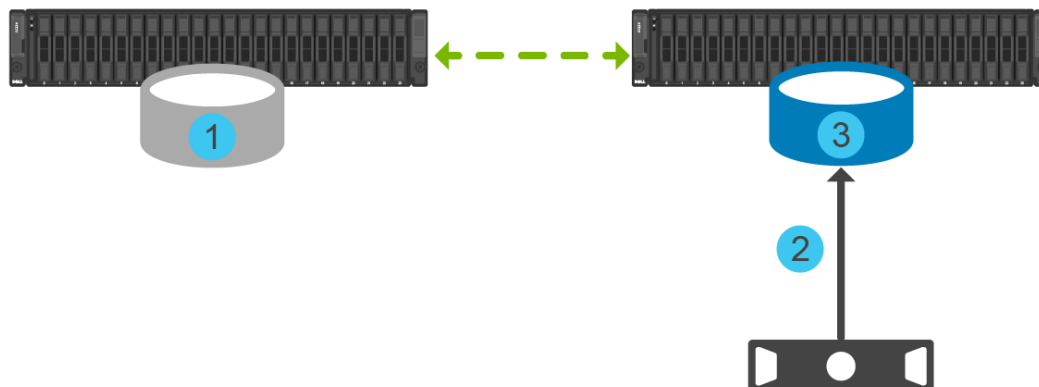


Figure 5 Configuration of environment after Live Migrate

2 Requirements for Live Migrate

Live Migrate has the following requirements:

- Dell Storage Manager 2016 R2 or newer
- SCOS version 7.1 or newer
- No additional licensing is required, Live Migrate is included in the base licensing package
- Live Migrate is available on all SC Series platforms compatible with SCOS 7.1 as well as Series 40 arrays with SCOS 6.7.30
- Replication must be configured between the primary and secondary SC Series arrays, including replication QoS node definitions on the primary SC Series array; these can be configured during Live Migrate configuration
- The server must be defined on both the primary and secondary SC Series arrays

Live Migrate has the following limitations:

- A volume cannot be configured for Live Migrate if it is already configured for replication or Live Volume
- A volume configured for Live Migrate cannot be configured for replication or Live Volume until the Live Migrate is completed
- Live Migration is not supported with the VMware® vSphere® Virtual Volumes™ feature

3 Requirements for Volume Advisor

Volume Advisor shares the same requirements as Live Migrate and has a few additional requirements:

- The source and destination SC Series arrays must be on the same major and minor SCOS versions (for example, running SCOS 7.1 on both arrays is compliant, but running SCOS 7.1 on the source array and SCOS 7.3 on the destination array is not compliant).
- The source and destination SC Series arrays must have the same tier 1 disk type (for example, both arrays have 15K HDDs in tier 1, or both arrays have SSDs in tier 1).

If these requirements are not met, Volume Advisor will not recommend a Live Migration between two arrays and the Live Migrate will need to be performed manually without the assistance of Volume Advisor if the following requirements are met.

4 Best practices for Live Migrate and Volume Advisor

Live Migrate is a simple-to-use feature of Dell Storage Manager that makes it easier to efficiently use and manage storage. However, it is important to understand what is occurring in the background, as discussed in section 1.1, Live Migrate states. Use the following best practices to help ensure smooth and efficient movement of data.

Volume selection: While Live Migrate makes it easier to move a data workload from one SC Series array to another, this does not mean that workloads should be moved without consideration. After all, it still takes time and resources to move the data. Planning and attention should be exercised when selecting which workload to migrate. When choosing between several volumes to migrate, select the volume with the least amount of storage in tier 1, RAID 5. When Live Migrate replicates a volume, it leverages Live Volume asynchronous replication to perform the data movement, which by default replicates the data to the lowest tier available on the destination array. Depending on its configuration, the read performance of the array could be lower because reads would come from tier 3. Writes on the destination SC Series array will go to tier 1, RAID 10 as normal.

Note: Enabling the option **Edit Data Collector Settings > Replication Settings > Allow Select to Lowest Tier on Replication Create** provides the option to **Replicate Storage to Lowest Tier** when configuring Live Migrate. If this default option is not selected when creating a Live Migrate, the replicated volume on the destination array will be placed into tier 1, and Data Progression will move inactive or less-active pages to lower tiers over time. Care should be taken in selecting this option because it may cause tier 1 to fill up, which would result in some writes being sent to lower-performing tiers of storage.

Monitoring performance: Because Live Migrate is not a part of the typical day-to-day I/O activity, it is important to monitor the impact this additional workload has on the environment and ensure it does not impact application performance. If either SC Series array becomes overburdened, corrective action should be taken. In most circumstances, adjusting the source replication QoS node to a lower percentage is sufficient corrective action, although this may take longer. In some circumstances, it may be necessary to perform Live Migrate during a period of lower I/O.

Time of day: Live Migrate is nondisruptive with regards to interruption of I/O or connectivity. However, the data replication, particularly the replication of current writes, places an additional load on both arrays and the switch fabric. Choosing to perform Live Migrate at a time of lower workload (for example, outside of normal business hours) will lower the impact this additional workload may have on other applications. It is also important to consider other concurrent replications and replication QoS node settings.

Transport type: Replication between SC Series arrays can occur over any transport type they have in common. Local replication can therefore utilize iSCSI, FC, and FCoE protocols to transport the data. This is unlike remote replication which typically will only have iSCSI. It is recommended that administrators explicitly select a transport type, and not select **All Available Transports**. This ensures that replication will occur over a known route, and greatly eases troubleshooting should issues occur.

Replication performance: Regardless of the selected transport type, steps should be taken to ensure that sufficient bandwidth is available on the switch fabric (Ethernet or Fibre Channel), and that Dell EMC and industry best practices have been followed in creating the switch fabric. If utilizing iSCSI for replication, ensure that both arrays are configured with the same packet frame size and that the switching fabric meets or exceeds this.

Replication QoS: Replication QoS enables administrators to limit the amount of bandwidth consumed at a particular time of day or day of the week. All replications occurring at a point in time that are configured to use

a particular source replication QoS node must share the limitations of that QoS, regardless of destination array. This can result in a Live Migrate taking longer than necessary (for example, the QoS node used was designed to protect remote replication network links from bandwidth saturation). Create a separate source replication QoS node for use with Live Migrate, and other local migration needs, to avoid this issue.

Automatically Swap Roles After In Sync: It is recommended to leave this check box in its default checked state. This enables Live Migrate to present the volume on the destination array as the target volume, and take the volume on the source array offline. The benefit of this is that writes are only committed to the volume on the destination, and not replicated back to the original source volume. See section 1.1 for additional details.

Deduplication: It is not recommended to enable replication deduplication. This feature is beneficial when replicating volumes over lower bandwidth WAN links by reducing the amount of data to be transmitted, at a cost of increased load on the SC Series controller processor. Local replication, as is the case with Live Migrate, is not bandwidth bound.

Data protection and disaster recovery: While Live Migrate is nondisruptive from an I/O and application perspective, it can potentially affect backup/recovery and HA/DR procedures. It may be necessary to update those procedures to reflect the relocation of the volume to a different SC Series array.

Data Collector Schedules: DSM alerts are generated based on data gathered by the Data Collector, and Volume Advisor recommendations are based on these alerts. To alert and receive Volume Advisor recommendations more aggressively, tune the data gathering to occur more frequently than the default values.

The screenshot shows the 'Edit Data Collector Settings' window. The left sidebar contains a list of settings: General, SMTP Server, SupportAssist, Automated Reports, Server Agent, Schedules (selected), and Replication Settings. The main content area is divided into two sections. The top section is 'Replication Restore Point Settings', which includes a checkbox for 'Automatically save and validate restore points' (unchecked), a 'Frequency' dropdown set to 'Every Hour', and a 'Time' dropdown set to '00:00'. The bottom section is 'Storage Center Report Gathering Settings', which is highlighted with a red border. It contains four dropdown menus: 'IO Usage' (1 minute), 'Replication Usage' (15 minutes), 'Storage Usage' (4 Hours), and 'Storage Usage Time' (00:00). A red warning icon and text are present: 'Data may not be able to be gathered at this rate and it may cause IO performance to go down'.

Figure 6 Optimizing Storage Center Report Gathering Settings for Volume Advisor

A Additional resources

[Dell.com/support](https://dell.com/support) is focused on meeting customer needs with proven services and support.

[Dell TechCenter](#) is an online technical community where IT professionals have access to numerous resources for Dell EMC software, hardware, and services.

[Storage Solutions Technical Documents](#) on Dell TechCenter provide expertise that helps to ensure customer success on Dell EMC storage platforms.