Technical Report

NetApp DataMotion for vFiler

Roger Weeks and Raghunatha Reddy, NetApp
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Executive Summary

This document is an overview of NetApp® DataMotion™ for vFiler®, which is one of the foundation pieces of nondisruptive data mobility, providing nondisruptive data migration. It also describes the best practices for using DataMotion for vFiler.

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1 Introduction

This document is an overview of and describes best practices for NetApp DataMotion for vFiler.

1.1 Scope

This document discusses the following topics:

- Overview of NetApp DataMotion for vFiler
- Components of DataMotion for vFiler
- When to use DataMotion for vFiler
- Software and hardware requirements of DataMotion for vFiler
- Configurations supported by DataMotion for vFiler
- How DataMotion for vFiler works
- How to use DataMotion for vFiler
- Limitations of DataMotion for vFiler

This document does not replace any other papers or guides related to various components of NetApp DataMotion for vFiler, such as NetApp MultiStore®, NetApp SnapMirror®, and NetApp OnCommand™ Unified Manager. For information relevant to earlier versions of Data ONTAP, refer to TR-3814: NetApp Data Motion for vFiler.

1.2 Intended Audience

This document is intended for use by:

- Storage and system administrators
- Data center managers
- IT-as-a-service (ITaaS) providers

1.3 Prerequisites

This document assumes that readers are familiar with the following subjects:

- Basic knowledge of NetApp FAS systems and the NetApp Data ONTAP® operating system
- Overview of NetApp SnapMirror, MultiStore, and OnCommand Unified Manager

A complete understanding of all OnCommand Unified Manager features is not necessary. Basic knowledge of host and vFiler management from OnCommand Unified Manager is sufficient.

2 Overview of DataMotion for vFiler

DataMotion for vFiler is a foundation feature of Data ONTAP. It helps to achieve data mobility by significantly improving the availability of shared-storage infrastructure by avoiding the service outages associated with planned activities, such as storage lifecycle management and cost/service-level optimization.

2.1 Business Challenge

As customers and service providers consolidate more and more applications and workloads onto shared-storage infrastructures, it becomes increasingly difficult to coordinate outages for planned downtime for activities like hardware refreshes. This is because many different users, groups, or customers can be using the shared-storage infrastructure at the same time. Users expect these infrastructures to be available 24/7, so it is imperative that service outages required for storage lifecycle management,

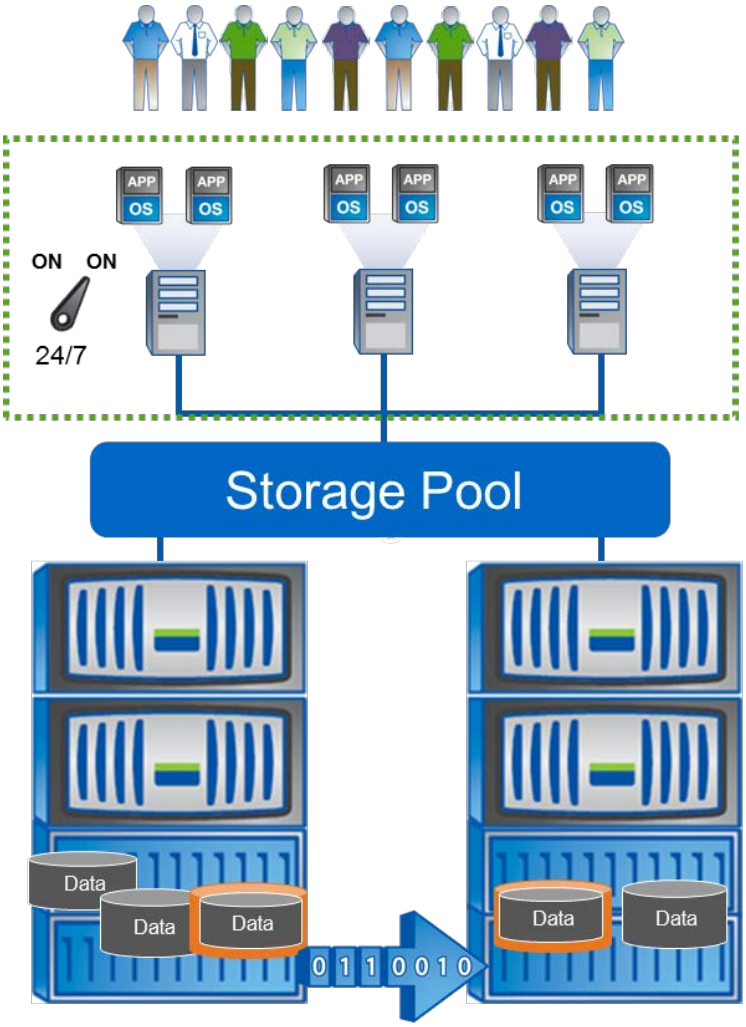
cost/service-level optimization, and any other planned downtime don't disturb the availability of the nondisruptive infrastructure.

2.2 What Is DataMotion for vFiler?

NetApp DataMotion for vFiler is one of the foundation pieces of nondisruptive data mobility, providing nondisruptive migration of MultiStore vFiler units for NetApp FAS systems, NetApp MetroCluster™ software, and NetApp V-Series storage systems. It is the data mobility component of NetApp's cloud solutions.

Figure 1 shows how DataMotion for vFiler moves data from one Data ONTAP system to another while applications continue to run uninterrupted. DataMotion for vFiler also provides data mobility for multi-tenant environments, because data is aggregated into secure virtual storage containers (vFiler units) that can correspond to a single customer, department, or application.

Figure 1) DataMotion for vFiler.



2.3 Business Value of DataMotion for vFiler

DataMotion for vFiler significantly improves the availability of shared storage infrastructure by avoiding the service outages associated with planned activities, such as storage lifecycle management and cost/service-level optimization, which helps customers to enable a nondisruptive IT environment.

Some of the business values of DataMotion for vFiler include:

- No planned downtime for:
  - Storage capacity expansions
  - Scheduled maintenance outages
  - Technology refreshes
- Improved service-level agreement (SLA) flexibility
  - On-demand load balancing
  - Adjustable storage tiers
- Application transparency
  - No performance impact
  - Transaction integrity

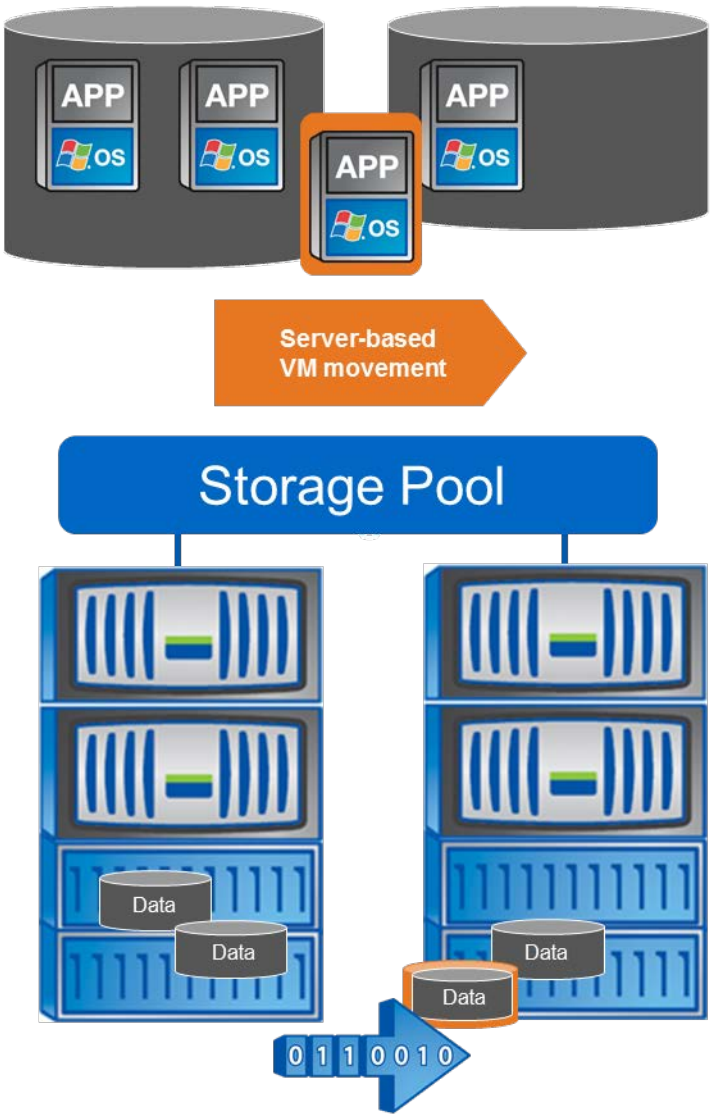
3 Use Cases for DataMotion for vFiler

To most effectively use the DataMotion for vFiler feature in virtual environments, it is necessary to understand the most appropriate use cases. The following sections discuss some of these use cases in a variety of environments.

3.1 DataMotion for vFiler in Virtualized Environments

Virtualization is driving large-scale consolidation of many applications in the same shared infrastructure, resulting in significant cost savings through greater utilization, reduced infrastructure, minimized floor space, and smaller power needs. It is now much more difficult to coordinate outages across many different application teams or business units, and this is where NetApp DataMotion for vFiler steps in. This combination, with other mobility solutions that are generally available with virtual server infrastructure, such as VMware® vSphere™, can provide nondisruptive data mobility at every layer of the virtual infrastructure.

Figure 2) DataMotion for vFiler in a virtualized environment.



Virtual server software, such as VMware vSphere, supports live migration of virtual machines across different server nodes in the cluster (VMotion®). It also offers the ability to move the virtual disks associated with the virtual machines online from one storage repository (or datastore) to another (storage VMotion). NetApp DataMotion for vFiler complements migration technologies that are available from server virtualization vendors.

Note: The online migration technologies provided by DataMotion for vFiler are designed to address the need for data mobility at the storage layer of the infrastructure in the data center environment.

Virtual server administrators use virtual server-based migration to move individual virtual machines between datastores for purposes such as capacity balancing between individual datastores. These migrations move one virtual machine at a time and consume host server resources, such as CPU cycles, memory, and network. DataMotion for vFiler in a virtual server environment can be used to move entire datastores between storage arrays nondisruptively. Enterprise storage administration teams typically perform these operations.

Table 1 describes the online migration techniques that can be used in a virtual infrastructure.

Table 1) Migration techniques.

Migration Scenario	Tool to Be Used	Use Case	Used by	Typical Occurrence	Target Customer
Virtual machine management (migration of individual VMs)	VMware storage VMotion	Movement of virtual disks associated with a VM	Virtual administrator	Daily or weekly	Any customer using a virtual infrastructure
Storage infrastructure management (migration of entire datastore)	NetApp DataMotion for vFiler	Movement of an entire datastore, customer, department, or application	Storage administrator	Monthly	Enterprise, service provider, ITaaS, platform as a service (PaaS)

3.2 NetApp DataMotion for vFiler in Physical Environments

This section describes using DataMotion for vFiler in physical environments.

Database and Messaging

Databases and messaging systems are the heartbeat of most companies, with nearly every staff member using them constantly. As businesses become more global, even after-hours outages on these systems can affect many individuals and can also cause restarting the applications to take much longer than the outage itself. The ability to move the application data from one array to another without shutting down the application is extremely compelling.

Web Applications

Externally facing Web applications are in use all the time, so routine maintenance can mean lost business with customers on the Web. Web users expect immediate gratification, and if a site is down, they may go elsewhere. DataMotion for vFiler removes the need for outages for lifecycle management, maintenance, and capacity and performance management of Web application environments.

3.3 Enabling the Dynamic Data Center

DataMotion for vFiler is one of the enablers of NetApp's vision of the dynamic data center, where avoiding planned downtime in any part of the infrastructure is of paramount interest. The following sections describe some use cases of DataMotion for vFiler in this context.

Secure Multi-Tenancy

DataMotion for vFiler is inherently enabled for multi-tenancy, because it is based on MultiStore technology. This provides mobility for individual customers, departments, or application datasets that need to be isolated and secure.

Dynamic Capacity Scaling

Where application data exceeds the storage capacity of an existing FAS or V-Series system, new storage systems can be installed, and existing data can be transitioned to the new storage without any disruption to applications.

Service-Level Optimization

For flexible SLA management, DataMotion for vFiler can be used to move data across storage controllers for load balancing. Data can also be moved across storage tiers (slower disks to faster disks) to optimize performance.

4 Components of DataMotion for vFiler

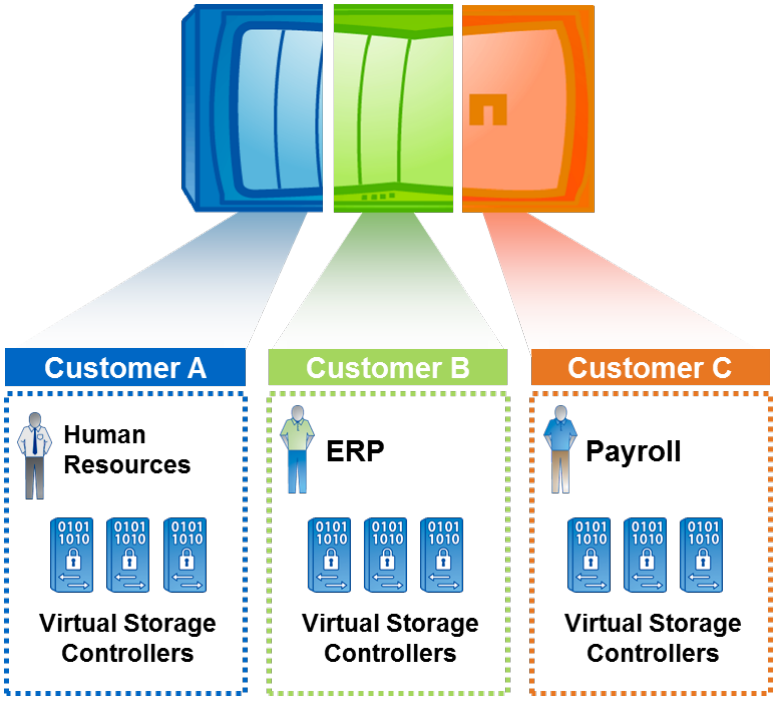
NetApp DataMotion for vFiler is a solution enabled by the combination of features from three NetApp products:

- **MultiStore.** Provides the capability to partition a physical NetApp storage system into virtual systems, called vFiler units, which are the units of migration in DataMotion for vFiler. In other words, MultiStore enables secure logical partitioning of network and storage resources in Data ONTAP into vFiler units.
- **OnCommand Unified Manager.** Provides the software interface for performing DataMotion for vFiler migrations.
- **SnapMirror.** Data is migrated by using SnapMirror data replication software. SnapMirror asynchronous mode is used for the initial baseline transfer phase of DataMotion for vFiler. However, once the migration cutover process starts (that is, when the control of the vFiler unit actually migrates from one physical storage system to another), SnapMirror switches to a semi-synchronous mode of transfer.

4.1 Multistore

NetApp MultiStore software, as shown in Figure 3, offers separate and completely private logical partitions on a single NetApp storage system as discrete administrative domains, called vFiler units. These vFiler units make a single physical storage controller appear to be many logical controllers. Each vFiler unit can be individually managed with different sets of administrative and policy characteristics.

Figure 3) NetApp MultiStore.



Technology service and cloud providers can leverage MultiStore to enable multiple customers to share the same storage resources with no compromise in privacy or security and even delegate administrative control of the vFiler unit directly to the customer.

For more information about MultiStore, refer to TR-3462: Storage Virtualization and DR Using MultiStore (vFiler).

4.2 OnCommand Unified Manager

The OnCommand Unified Manager Provisioning feature enables storage administrators to use policy-based automation to create repeatable, automated provisioning processes. These processes are faster than manually provisioning storage, are easier to maintain than scripts, and help to minimize the risk of data loss due to incorrect storage configuration.

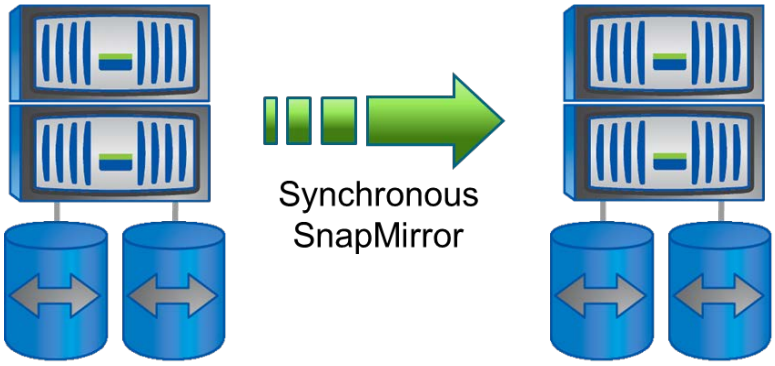
OnCommand Unified Manager is responsible for the end-to-end workflow of DataMotion for vFiler processes.

For more information about OnCommand Unified Manager, refer to the product page on the NetApp Support site.

4.3 SnapMirror – Asynchronous and Synchronous

SnapMirror is a data replication feature that efficiently mirrors data between two NetApp storage controllers. The source and destination controllers can live in the same data center or be geographically separated, because both LAN and WAN links are supported. SnapMirror runs at scheduled intervals to keep the destination controller up to date so that the recovery point objective (RPO), which is the amount of data not yet backed up, is dramatically lower than with legacy periodic backup routines. A SnapMirror relationship can also be placed into synchronous or semi-synchronous mode, which effectively reduces the RPO to almost zero. A NetApp destination system is more than a simple backup or replica depot; it can also serve as the source system in a disaster recovery scenario. This means that the recovery time objective (RTO), which is the time from disaster to being back online, is also minimal.

Figure 4) Synchronous SnapMirror.



DataMotion for vFiler transfers are initially set up in SnapMirror asynchronous mode; however, once the baseline transfer is complete and the cutover phase is initiated, the transfers are performed in SnapMirror semi-synchronous mode. During the cutover phase, every NetApp FlexVol® volume owned by a vFiler unit must be migrated in semi-synchronous mode at the same time.

For more information about SnapMirror, refer to TR-3446: SnapMirror Async Overview and Best Practices Guide and TR-3326: SnapMirror Sync and SnapMirror Semi-Sync Overview and Design Considerations.

5 Supported Platforms and Requirements

The following sections are a detailed overview of supported platforms and the software and hardware requirements for DataMotion for vFiler.

5.1 Software Requirements

DataMotion for vFiler software requirements include:

- Data ONTAP 8.1
  - Contains vFiler migration enhancements and APIs required by NetApp DataMotion for vFiler
  - Storage system should have Data ONTAP 8.1 operating in 7-Mode installed for vFiler migration
- Supported protocols
  - Network File System (NFS) or iSCSI
  - Common Internet File System protocol (CIFS) requires clients to reconnect after the migration

There is currently no support for FCP or FCoE.

- Data ONTAP licenses
  - NFS/iSCSI
  - SnapMirror, SnapMirror Sync

5.2 Hardware Requirements

The following NetApp FAS storage systems are supported by DataMotion for vFiler:

- FAS2240
- FAS2040
- FAS32xx
- FAS31xx
- FAS3070
- FAS3040
- FAS62xx
- FAS60xx

6 DataMotion for vFiler Workflow and Process

NetApp OnCommand Unified Manager provides the user interface for the DataMotion for vFiler process; it also controls the entire workflow.

Although OnCommand Unified Manager is required to perform a DataMotion for vFiler migration, it is not required to create or provision the vFiler units that are migrated with DataMotion for vFiler. OnCommand Unified Manager automatically detects any preexisting vFiler units in the environment or vFiler units that were created with other tools or processes.

6.1 Advantages of Using OnCommand Unified Manager Provisioning for DataMotion for vFiler Workflow Control

The advantages of using OnCommand Unified Manager for the DataMotion for vFiler workflow include:

- **Enforcement.** OnCommand Unified Manager automatically enforces DataMotion for vFiler requirements. It aids successful migrations and helps prevent application outages.

- **Automation and ease of use.** Manual completion of the DataMotion for vFiler steps, such as establishing and starting the SnapMirror transfers, postmigration cleanup, and so on, is not necessary. Here are some example scenarios that can disrupt a manual online migration process, which can be avoided by using OnCommand Unified Manager:
  - Too much load on the systems involved
  - Configuration changes made between the SnapMirror initialization and the cutover (for example, new networks or volumes added)
  - Other SnapMirror relationships that are performing transfers and using transfer queues

6.2 Phases of DataMotion for vFiler

A DataMotion for vFiler workflow can be divided into three high-level phases:

- Initial baseline transfer
- Cutover
- Cleanup

Note: After the cutover phase, it is possible to quickly roll back the vFiler unit to the original source if the cleanup phase has not yet executed. This provides rapid online migration of the vFiler unit from the destination storage system to the source storage system without going through the initial baseline transfer phase again.

When starting the initial baseline transfer process from OnCommand Unified Manager, there is an option to cut over automatically after data transfer. This option enables one-step migration of the vFiler unit where the NetApp storage system automatically performs the cutover operation after the initial baseline transfer is completed. By default, this option is not selected. Therefore, under a default scenario, users must manually initiate the cutover operation at any time after the data is transferred.

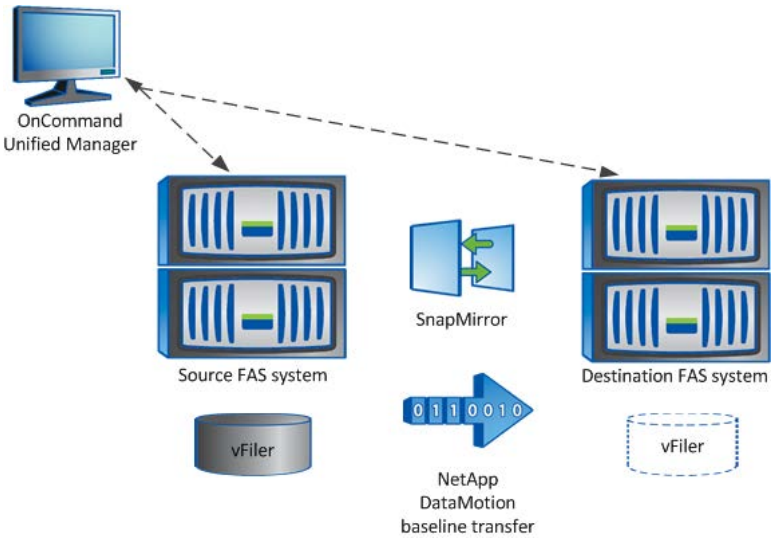
Initial Baseline Transfer Phase

During the baseline transfer phase:

- The DataMotion for vFiler process is initiated from the OnCommand Unified Manager interface.
- Provisioning with OnCommand Unified Manager performs the following steps:
  - Verifies that systems meet DataMotion for vFiler requirements.
  - Creates destination VLAN interfaces and IP spaces. (VLANs must be enabled on destination switch ports by the administrator.)
  - Creates destination FlexVol volumes.
  - Initiates SnapMirror baseline transfers.
  - Schedules SnapMirror to asynchronously update every 3 minutes.
  - When the baseline is complete, migration status is set to Cutover Required.

Figure 5 shows an initial baseline transfer provisioning with OnCommand Unified Manager with DataMotion for vFiler.

Figure 5) Initial baseline transfer.



When the initial baseline transfer is complete and the migration status is changed to Started, Cutover Required, the administrator has the option to perform an update before proceeding to the next state, which is the cutover phase. The migration update feature should be used if the cutover phase is not initiated immediately after the completion of the initial baseline transfer.

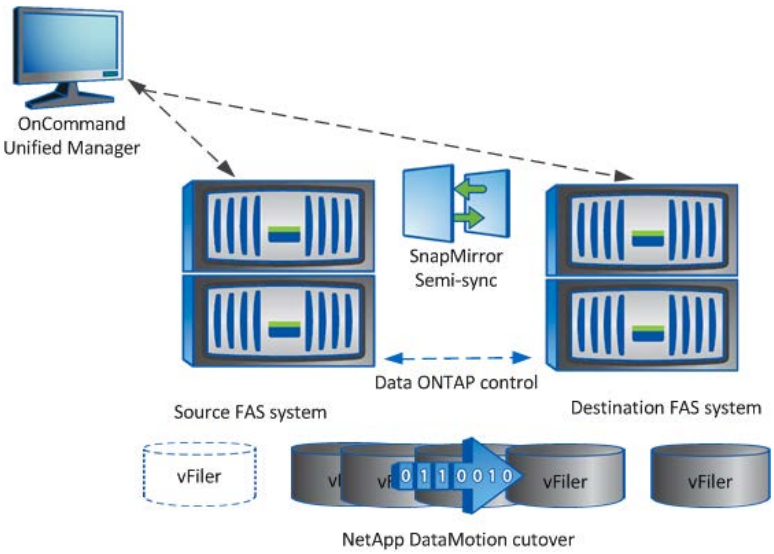
Cutover Phase

During the cutover phase, the following actions occur:

- The cutover is either initiated manually from OnCommand Unified Manager, or it is started automatically (if the automatic cutover option is selected at the start of the DataMotion for vFiler process).
- OnCommand Unified Manager then performs the following steps:
  - Verifies that systems meet DataMotion for vFiler requirements.
  - Checks the vFiler unit for configuration changes since the start of migration.
  - Converts the SnapMirror relationships from asynchronous mode to semi-synchronous mode.
  - Starts transparent vFiler migration.
  - If CIFS is enabled on the source vFiler unit, it is stopped and then restarted after cutover.

  DataMotion for vFiler fences some administrator operations on the vFiler volumes before cutover. Some typical administrator operations that are fenced include creation of Snapshot™ copies, creation of file or LUN FlexClone® volumes, SnapMirror or SnapVault updates on the vFiler volumes, and so on. This is required for smooth cutover operation. Fencing continues until cutover is complete.
- The cutover process is managed by Data ONTAP:
  - During the cutover, the migration must complete within the 120-second window. The two Data ONTAP 8.1 systems negotiate with each other to perform the migration. OnCommand Unified Manager is not involved in this part of the process, so its failure during this time would not cause a failure of the DataMotion for vFiler migration or an application outage.
  - Data ONTAP maintains timers that monitor the migration process.
  - If the cutover fails or exceeds the 120-second window, the process is aborted and the original vFiler unit is restarted within the same 120-second window.

Figure 6) Cutover phase.



During the cutover phase, OnCommand Unified Manager performs several configuration steps (such as converting all asynchronous SnapMirror relationships to semi-synchronous before cutover and waiting for the relationships to synchronize) before starting the actual cutover. These configuration steps may take some time to complete. Effectively, the cutover job in OnCommand Unified Manager may take a long time to complete even though the actual cutover takes a maximum of 120 seconds. Fencing of administrator operations on the vFiler volumes continue for the entire duration of the cutover process.

Clients may experience the following during online migration:

- iSCSI clients experience up to 120-second pause in input/output (I/O).
- NFS clients experience up to 120-second pause in I/O.
- Clients reestablish NFS locks as they would during a high-availability takeover.
- CIFS client sessions are terminated after cutover and clients must reconnect.

FCP clients are not currently supported by DataMotion for vFiler.

Upon successful completion of a DataMotion for vFiler cutover, OnCommand Unified Manager automates the following postmigration tasks:

- Migrates any Protection Manager relationships.
- Modifies OnCommand Unified Manager dataset memberships.
- Migrates Operations Manager history.
- Network Data Management Protocol (NDMP) backups from vFiler units (not direct to tape) continue as normal.
- The original source volumes are maintained in an offline state to support the optional rollback feature.

Additionally, NDMP backups from vFiler0 corresponding to the vFiler volumes must be reconfigured.

If the DataMotion for vFiler cutover fails, the following actions occur:

- Data ONTAP makes sure that the original vFiler unit is brought back online.
- OnCommand Unified Manager performs these postfailure steps:
  - SnapMirror relationships are maintained for cutover retry.
  - SnapMirror relationships are set back to asynchronous mode.

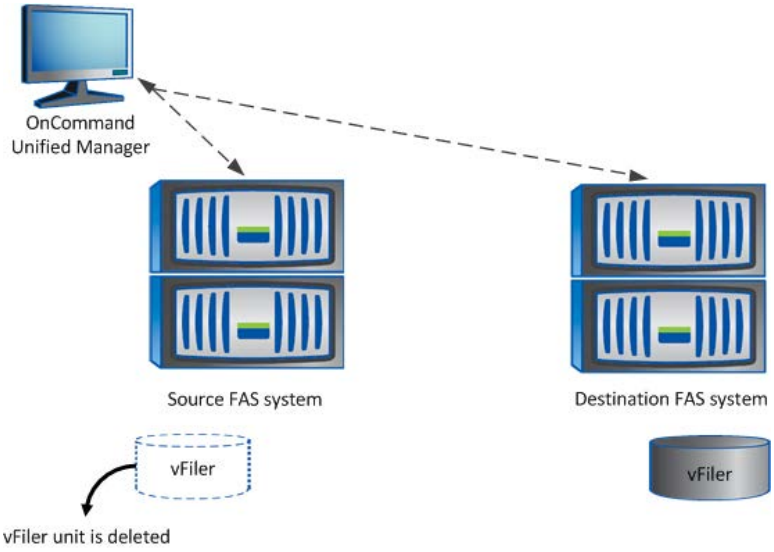
The user can later retry the cutover from OnCommand Unified Manager.

- If migration is canceled after failure, OnCommand Unified Manager cleans up all new SnapMirror relationships, VLAN interfaces, IP spaces, FlexVol volumes, and so on.

Cleanup Phase

The cleanup phase is executed only when it is initiated from OnCommand Unified Manager. During this phase, OnCommand Unified Manager automatically removes all source FlexVol volumes.

Figure 7) Cleanup phase.

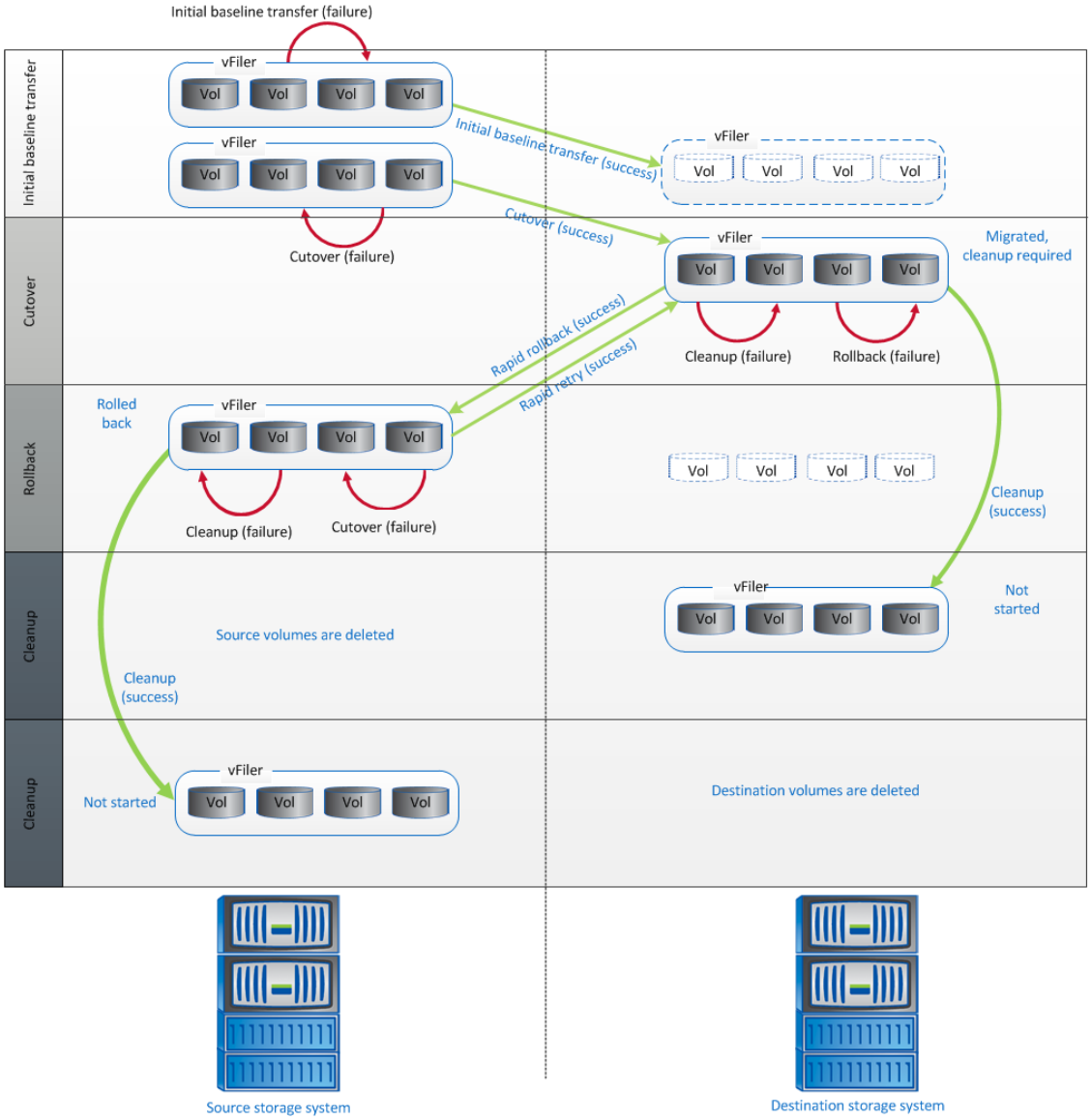


Rollback Feature (Optional)

The rollback feature of DataMotion for vFiler offers the ability to quickly migrate the vFiler unit back to the source controller after a successful cutover. This feature can be used only when the administrator has not executed the cleanup phase.

This feature can be useful if any unforeseen issues arise after cutover, such as performance degradation, and it is necessary to revert to the original configuration quickly without performing the initial baseline transfer phase again.

Figure 8) DataMotion vFiler migration status.



Additional DataMotion for vFiler Workflow Features

Additional DataMotion for vFiler workflow features include:

- All backup relationships are migrated when used with Protection Manager.
- NetApp AutoSupport™ reports are generated for any DataMotion for vFiler failures that have an impact on application availability, such as cutover exceeding the 120-second window or the source vFiler unit not coming up within the 120-second window after an aborted cutover process.

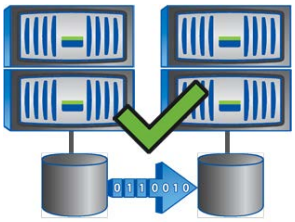
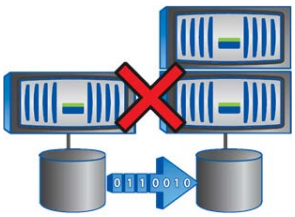
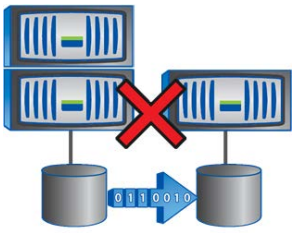
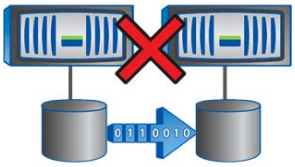
7 Supported Configurations

Hardware and software configurations play an important role in the DataMotion for vFiler process. The following sections describe the supported configurations, migration scenarios, and other requirements for using DataMotion for vFiler.

7.1 Supported Migration Scenarios

Note: DataMotion for vFiler is not supported within a NetApp controller or a NetApp high-availability pair.

Table 2) Supported migration scenarios.

Migration Scenario	Description	Supported
	Between controller heads of different high-availability pairs	Yes
	Between a single controller head and a controller head of a high-availability pair	No
	Between the controller head of a high-availability pair and a single controller head	No
	Between two single controller heads	No
	Within a controller (between aggregates)	No
	Between controller heads of the same high-availability pair	No

Storage-Controller-Related Requirements for DataMotion for vFiler

Storage-controller-related requirements for DataMotion for vFiler include:

- DataMotion for vFiler supports migration of vFiler units from a storage controller head that is part of a NetApp high-availability pair to another controller head that is part of a different NetApp high-availability pair. Both source and destination high-availability clusters should be up and running. If source or destination heads are in takeover or failback mode, then DataMotion for vFiler is not supported and execution of this scenario is prevented by OnCommand Unified Manager.
- DataMotion for vFiler migration between the two controller heads of a NetApp high-availability pair is not supported and execution of this scenario is prevented by OnCommand Unified Manager.
- DataMotion for vFiler migration from a single controller head to another single controller head (neither of which is part of any high-availability pair) is not supported.

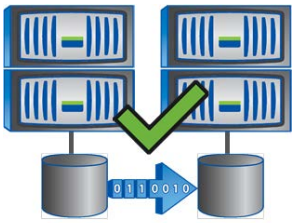
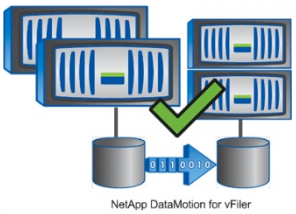
  Note: Although OnCommand Unified Manager does not prevent the execution of this migration scenario, NetApp does not recommend it.

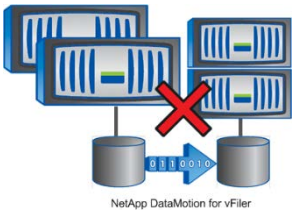
- DataMotion for vFiler migration is not supported from a single controller head to another controller head that is part of a NetApp high-availability controller pair and vice versa.

  Note: Although OnCommand Unified Manager does not prevent the execution of these migration scenarios, NetApp does not recommend them.

As shown in Table 3, DataMotion for vFiler is supported only between similar system models (that is, between systems that have the same amount of NVRAM) or from a low-end system model to a high-end system model (that is, from a system with smaller NVRAM to a system with larger NVRAM).

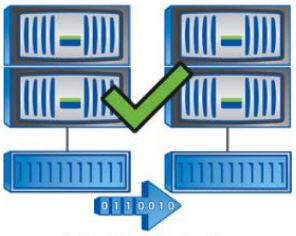
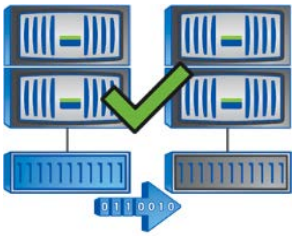
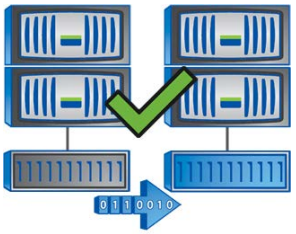
Table 3) Supported migration scenarios – NVRAM considerations.

Migration Scenario	Description	Supported
	Between two high-availability pairs that have the same NVRAM	Yes
	From a high-availability controller that has smaller NVRAM to a high-availability controller that has larger NVRAM	Yes
	From a high-availability controller in the FAS6000 or FAS6200 series that has larger NVRAM to a high-availability controller that has smaller NVRAM in the FAS3000 series or FAS3200 series	Yes

Migration Scenario	Description	Supported
	From a high-availability controller in the FAS6000, FAS6200, FAS3200, or FAS3000 series to a high-availability controller in the FAS2000 series	No

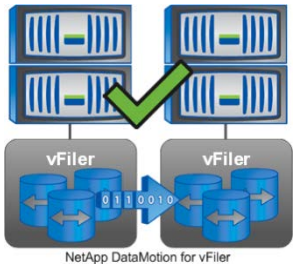
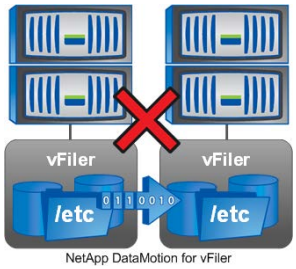
As shown in Table 4, DataMotion for vFiler is supported between same-speed drives, from slower to faster drives, and from faster to slower drives.

Table 4) Supported migration scenarios – drive speed considerations.

Migration Scenario	Description	Supported
	Between same-speed drives	Yes
	From slower to faster drives	Yes
	From faster to slower drives	Yes

As shown in Table 5, DataMotion for vFiler is supported only for vFiler units that own FlexVol volumes as storage containers.

Table 5) Supported migration scenarios – FlexVol volume considerations.

Migration Scenario	Description	Supported?
	vFiler units that own FlexVol volumes where an owned FlexVol volume might contain qtrees	Yes
	• vFiler units that own qtrees whose owning FlexVol volumes reside outside the vFiler unit • vFiler units that own traditional volumes	No

7.2 Supported vFiler Configurations

DataMotion for vFiler performs migrations by migrating entire vFiler units, so all FlexVol volumes owned by the vFiler unit must be migrated together in one operation. Table 6 lists the maximum number of FlexVol volumes per vFiler unit supported by DataMotion for vFiler corresponding to different storage platforms.

Note: These restrictions were chosen for the first release of NetApp DataMotion for vFiler based on tests performed to verify successful migrations under certain load conditions. As more conditions are qualified, these limitations could be relaxed.

Table 6 lists the maximum number of FlexVol volumes per vFiler unit.

Table 6) Maximum number of FlexVol volumes per vFiler unit.

Source Storage Platform	Destination Storage Platform	FlexVol Volumes per vFiler Unit
FAS62xx, FAS60xx	FAS62xx, FAS60xx	20 FlexVol volumes
FAS62xx, FAS60xx	FAS32xx, FAS31xx, FAS3070, FAS3040	8 FlexVol volumes
FAS32xx, FAS31xx, FAS3070, FAS3040	FAS62xx, FAS60xx, FAS32xx, FAS31xx, FAS3070, FAS3040	8 FlexVol volumes
FAS2240, FAS2040	FAS62xx, FAS60xx, FAS32xx, FAS31xx, FAS3070, FAS3040, FAS2240, FAS2040	4 FlexVol volumes

7.3 FlexVol Requirements for DataMotion for vFiler

In DataMotion for vFiler, the primary data component is a FlexVol volume. The following sections describe the recommended configurations for and limitations of using FlexVol volumes.

Size of FlexVol Volumes

- DataMotion for vFiler requires FlexVol volumes owned by a vFiler unit to be at least 10GB in size. This is a requirement of synchronous SnapMirror.
- The vFiler unit's root volume is typically less than 10GB. In that case, DataMotion for vFiler automatically increases the size of the FlexVol volume to 10GB, performs the migration, and then resizes the volume to its original size.

Size of Aggregates

To achieve the maximum number of FlexVol volumes per vFiler unit, NetApp recommends that aggregates contain at least 12 disks.

SnapLock Not Supported

NetApp SnapLock® volumes cannot be migrated with DataMotion for vFiler.

Support for CIFS

CIFS shares in FlexVol volumes owned by the vFiler unit are migrated as part of DataMotion for vFiler. However, the CIFS sessions are terminated and clients must reconnect. Unlike NFS and iSCSI, which are stateless protocols, CIFS is a session-oriented protocol, which can result in adverse effects on clients and applications during migrations. Administrators should instruct users to end their sessions before the cutover.

Support for Deduplication and File or LUN FlexClone

- DataMotion for vFiler is supported with deduplication or FlexClone at the file or LUN level. However, the combination of having to manage resources associated with nondisruptive migration and metadata for deduplication or FlexClone could result in a small possibility of degradation to the performance of client applications. This might happen only if DataMotion for vFiler is performed under a high load (greater than 60%). Therefore DataMotion for vFiler migration should not be attempted under such conditions.
- As a best practice, NetApp recommends that DataMotion for vFiler be performed in off-peak periods or periods of lower load to enable the fastest migration times and to minimize impact. In this release, NetApp recommends that customers actively monitor the system performance during the DataMotion for vFiler cutover operation for systems that have deduplication or FlexClone at the file or LUN level (on either the source or the destination system). For more information about monitoring during the DataMotion for vFiler cutover period, refer to this KB article. If excessive load is encountered during the migration, DataMotion for vFiler can be aborted by the storage administrator while maintaining access to data.
- After a successful DataMotion for vFiler cutover, the deduplicated volume remains deduplicated on the destination array, but before another dedupe process can run on the volume, the dedupe fingerprint database must be rebuilt. DataMotion for vFiler software automatically starts rebuilding the fingerprint database after a successful migration.

Support for Volume FlexClone and LUN Clone

FlexClone volumes can be members of vFiler units that are migrated with DataMotion for vFiler. FlexClone volumes are expanded at the destination, meaning that they are full-size independent volumes at the destination. NetApp DataMotion for vFiler supports LUN clones contained inside the volumes that are members of the vFiler unit being migrated.

Table 7 describes three FlexClone scenarios and specifies whether they are supported by DataMotion for vFiler.

Table 7) FlexClone support.

Parent Volume	FlexClone Volume	NetApp DataMotion for vFiler Supported
Inside the vFiler unit being migrated	Inside the vFiler unit being migrated	Yes, FlexClone volumes are expanded at the destination.
Outside the vFiler unit being migrated (that is, inside another vFiler unit or in vFiler0)	Inside the vFiler unit being migrated	No
Inside the vFiler unit being migrated	Outside the vFiler unit being migrated (that is, inside another vFiler or vFiler0)	No

7.4 Using DataMotion for vFiler with Other NetApp Products

Table 8 describes using DataMotion for vFiler with other NetApp products.

Table 8) DataMotion for vFiler compatibility with other NetApp products.

NetApp Products	Supported for NetApp DataMotion for vFiler	Comments
OnCommand Unified Manager	Yes	The Provisioning feature in OnCommand Unified Manager controls the workflow of DataMotion for vFiler.
SnapDrive® for UNIX® and Linux® v4.x	Yes	
SnapDrive for Microsoft® Windows® v6.3	Yes	
FlexVol volume	Yes	
Fractional reservations	Yes	
FlexClone volume	Partial	For more information, refer to “Support for Volume FlexClone and LUN Clone” in section 7.3.
LUN cloning	Yes	
Snapshot	Yes	
Fabric MetroCluster	Yes	
Qtree SnapMirror	Yes	Operation is fenced during the cutover phase.
Volume SnapMirror Async	Yes	Operation is fenced during the cutover phase.
SyncMirror®	Yes	
SnapManager® for Oracle® 3.1	Yes	Using NFS v3
SnapManager for SAP® 3.1	Yes	

NetApp Products	Supported for NetApp DataMotion for vFiler	Comments
SnapManager for Virtual Infrastructure (SMVI) 2.0	Yes	
SnapManager for Microsoft Hyper-V™ 1.0	Yes	
Deduplication	Partial	For more information, refer to “Support for Deduplication and File or LUN FlexClone” in section 7.3.
File or LUN FlexClone volumes	Partial	For more information, refer to “Support for Deduplication and File or LUN FlexClone” in section 7.3.
NDMP/Dump	Yes	Operation is fenced during the cutover phase.
Flash Cache	Yes	The working set that is cached in the Flash Cache card of the source storage system for the vFiler volumes is not transferred to the destination storage system during DataMotion for vFiler migration. So after migration is complete, the working set must be populated again on the destination storage system (that is, Flash Cache must be warmed back up); throughput may be degraded during this time.
Volume SnapMirror Sync	Partial	Supported only in default vFiler interfaces. Also, operation is fenced during the cutover phase.
SnapVault®	Partial	A SnapVault source can be a vFiler unit, but the destination should not.
FlexCache®	No	Only FlexCache source volumes can be migrated with DataMotion for vFiler.
SnapLock Compliance	No	SnapLock volumes are not supported for DataMotion for vFiler.
SnapLock Enterprise	No	SnapLock volumes are not supported for DataMotion for vFiler.
SnapManager 6.0 for Microsoft Exchange	Yes	
SnapManager 5.1 for Microsoft SQL Server®	Yes	
SnapManager 6.0 for Microsoft Office SharePoint® Server	Yes	
Thin provisioning	Yes	

8 IP Networking Requirements for DataMotion for vFiler

With the vFiler unit as the unit of migration in DataMotion for vFiler, all networking requirements that are specific to MultiStore must be met. For details about MultiStore networking methods, refer to the Data ONTAP 8.1 MultiStore Management Guide on the NetApp Support site.

Best Practices

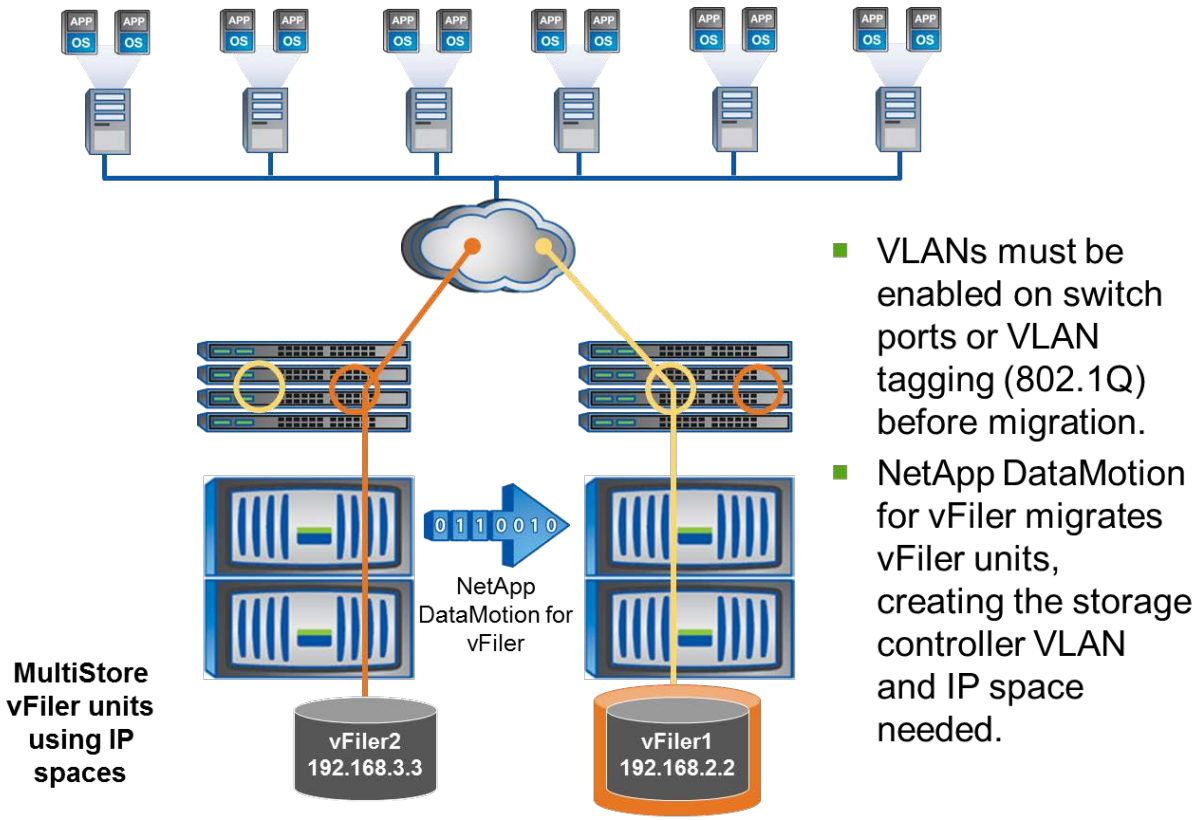
Both 802.1q (VLAN tagging) and 802.3ad (trunking) standards must be used together to enable vFiler units with VLANs interfaces to migrate without disruption.

When using IP spaces and VLAN tagging, make sure that the team managing the switches has trunked the necessary VLANs across all switch ports on the redundant switches in the environment. Any physical switch port on the redundant switches through which the vFiler unit might be accessed must have the correct VLAN preconfigured or trunked, even if that port will never be accessed by that VLAN prior to the migration.

When migration is performed, DataMotion for vFiler creates VLANs on the destination NetApp array, but it cannot configure the VLAN trunking of ports on the network switch. Therefore, it is very important to configure this before migration. DataMotion for vFiler is not capable of checking the switch to make sure that the VLANs are properly configured. If the VLANs are not configured properly on the switch that is connected to the destination array, the DataMotion for vFiler migration completes; however, the clients will not be able to access the vFiler unit at the new location, and this could cause an application outage.

Figure 9 shows how DataMotion for vFiler migrates vFiler units.

Figure 9) vFiler units using VLAN tagging and IP spaces.



8.1 Other Networking Considerations

Before migration, make sure that the destination NetApp system is accessible by clients of the migrating vFiler unit. VLANs must be preenabled on all possible destination switch ports.

A bandwidth throttle feature is available for the baseline data transfer phase of DataMotion for vFiler. This limit throttles SnapMirror streams for all the FlexVol volumes assigned to the vFiler unit, and DataMotion for vFiler intelligently distributes this bandwidth across the vFiler volumes.

DataMotion for vFiler replicates the vFiler unit network configuration from source to destination; this includes jumbo frames support, IP spaces, routing tables, and vFiler options.

The following layered networking configurations are supported:

- Multiple IP addresses per vFiler unit
- Physical interfaces and multiple aliases
- VLANs hosted on second-level VIFs
- Static routes defined in the IP space of the vFiler unit
- Shared IP spaces between multiple vFiler units

9 DataMotion for vFiler Best Practices

The following sections describe the best-practice guidelines for DataMotion for vFiler.

9.1 Component-Level Best Practices for MultiStore, SnapMirror, and OnCommand Unified Manager

This section describes component-level best practices for MultiStore, SnapMirror, and provisioning in OnCommand Unified Manager.

- NetApp recommends not making any configuration changes until the DataMotion for vFiler cutover phase is complete. If any configuration change related to the vFiler unit has been done after starting the initial baseline transfer, perform a DataMotion for vFiler update before proceeding to the cutover phase.
- Because the entire DataMotion for vFiler process is controlled through the Provisioning feature in OnCommand Unified Manager, do not make any manual modifications to any configuration related to the vFiler units or to SnapMirror (for example, the `snapmirror.conf` file).
- Before starting the cutover process from Provisioning, refresh the source and the destination storage systems in OnCommand Unified Manager by using the `dfm host discover` command.

9.2 Process-Level Best Practices

- If there is a long gap between the completion of the initial baseline transfer phase and the subsequent cutover initiation, first perform an update before proceeding to the cutover.
- Retain a stable backup of all storage entities (volumes and LUNs) associated with the vFiler unit before migration or cutover, to be able to revert to the stable state if something goes wrong.
- The current release of DataMotion for vFiler supports cutover or rollback only between same-speed disk drives or from slower to faster disk drives. If a rapid rollback or rapid cutover operation is planned after successful migration, carefully check the disk type of the source and destination aggregates between which the vFiler unit migrates. Rapid rollback or rapid retry after a successful migration is possible only between aggregates that have same-speed disk drives.
- The current release of DataMotion for vFiler supports cutover or rollback only between similar storage system models or from smaller to larger storage system models. If a rapid rollback or rapid cutover operation is planned after successful migration, carefully check the model type of the source and

destination storage systems between which the vFiler migrates. Rapid rollback or rapid retry after a successful migration is possible only between similar storage system models.

9.3 Performance Consideration

When the cutover phase is initiated, OnCommand Unified Manager uses a built-in algorithm to decide whether the cutover can succeed. The decision-making process takes into account various dynamic factors like CPU utilization in the destination and source storage systems, disk I/O on the aggregate of the destination system, and so on. If OnCommand Unified Manager decides that the cutover cannot be completed successfully, it does not proceed with the cutover process. In that case, the migration status is left at the Cutover Required state. In that scenario, DataMotion for vFiler cutover must be reinitiated from OnCommand Unified Manager.

NetApp recommends that during cutover the CPU and disk I/O load on the source and destination storage systems should be in the low to medium range. Because semi-synchronous SnapMirror is involved in the cutover phase, additional headroom must be reserved for the CPU and disk I/O load before initiating the cutover.

Note: When choosing a DataMotion for vFiler destination, make sure that it can handle the workload being migrated.

NetApp recommends that customers actively monitor system performance during the cutover operation for systems that have deduplication or FlexClone volumes at the file or LUN level (on either the source or the destination system). If excessive load is encountered during the migration, DataMotion for vFiler migration can be aborted by the storage administrator.

9.4 IP Network Configuration Best Practices

Network configuration is a core piece of DataMotion for vFiler. This section describes best practices for IP network configuration.

- NetApp recommends using VLAN trunking on the network switches of any storage system that might be a source or a destination for DataMotion for vFiler.
- All required VLANs must be preenabled on destination switch ports. Before migration, make sure that the destination FAS system is accessible by clients of the migrating vFiler unit.

When the migration is performed, DataMotion for vFiler creates the VLANs on the destination NetApp array, but it cannot configure the VLAN trunking of ports on the network switch. Therefore it is very important to configure this before migration. DataMotion for vFiler is not capable of checking the switch to make sure that the VLANs are properly configured. If the VLANs are not configured properly on the switch that is connected to the destination array, the migration completes; however, the clients will not be able to access the vFiler unit at the new location, and this could cause an application outage.

- The network of the vFiler unit must be configured inside an IP space associated with a VLAN interface over a VIF created on the storage system.
- NetApp recommends using a separate IP space per vFiler unit (corresponding to different tenants, departments, or applications). For more information, refer to section 8, “IP Networking Requirements for DataMotion for vFiler.”

9.5 Storage-Level Best Practices

This section summarizes storage-level best practices.

Required Data ONTAP Configuration

The following Data ONTAP licenses must be installed for DataMotion for vFiler: iSCSI and/or NFS, MultiStore, SnapMirror, and Synchronous SnapMirror.

For a complete list of hardware and software requirements, refer to section 5, “Supported Platforms and Requirements.”

Support for Deduplication and File or LUN FlexClone

DataMotion for vFiler supports deduplication and FlexClone at the file or LUN level under low-to-medium load. For fastest migration times and minimal impact, NetApp recommends performing DataMotion for vFiler migration during nonpeak times or lower load periods.

Volume FlexClone Support

FlexClone volumes can be members of vFiler units that are migrated with DataMotion for vFiler. For more information, refer to “Support for Volume FlexClone and LUN Clone” in section 7.3.

Disk Type Support

DataMotion for vFiler supports migration between all disk types. Migration between slower and faster disks, such as migration from SAS to SATA disks, is supported.

SnapDrive and SnapManager Best Practices

- Do not create or delete any LUN inside volumes associated with the vFiler unit after starting the migration process or before cutover is complete. NetApp recommends performing all vFiler resource changes related to dataset operations before the initial baseline transfer.
- During the cutover or rollback, any backup and restore operations would be unsuccessful for SnapManager products (SME, SMSQL, SMVI, SMHV, SMO, SMSAP, and SMOSS) because there are no retry options from SnapDrive (SDW and SDU). NetApp recommends not using any backup and restore command during the cutover and rollback phases.

Host Operating System Disk Timeout Settings

- Set the disk timeouts in the host operating systems by using the NetApp Host Utilities Kit (HUK). Refer to the NetApp Host Utilities Installation and Setup Guide for your host operating system (Windows, ESX, Linux, and so on) for the procedure.
- Sample disk timeout values include 190 seconds for a guest operating system running on VMware ESX, 120 seconds for a standalone Windows host without multipath input/output (MPIO), and 20 seconds or 60 seconds for HUK v5.3 and later with MPIO.

Active-Active Controller Configuration

DataMotion for vFiler does not support cutover when one storage controller of a NetApp active-active HA pair takes over the other. If the takeover event happens after the cutover operation has started, the cutover fails.

MetroCluster

DataMotion for vFiler does not support cutover when one storage node of the MetroCluster system has taken over the partner either automatically or manually. If the takeover event happens after the cutover operation has started, the cutover fails.

9.6 Best Practices for Supporting a Server Virtualization Environment

This section describes the best practices for supporting a server virtualization environment.

- Set the disk timeout values in the guest operating systems running on a VMware ESX server by using the NetApp Host Utilities Kit.

- If OnCommand Unified Manager is used to create and assign storage volumes (NFS) to vFiler units, those NFS volumes are exported as qtrees. Due to a limitation in OnCommand Unified Manager, when VMware datastores are created that correspond to these NFS exports, the storage savings obtained through various NetApp storage efficiency technologies on the datastore are not directly visible in the VMware vCenter™ management interface. A workaround to overcome this limitation is to manually modify the exports created by OnCommand Unified Manager to export the root of the FlexVol volume (that is, the name of the dataset) instead and mount that on the VMware ESX server. For VMware VI3 and vSphere, NetApp recommends using FlexVol volumes instead of qtrees for VMware NFS datastores. This leads to a simplified architecture and also makes the value of NetApp's storage efficiency technologies visible to the VMware server administrator. For more information, refer to TR-3428: NetApp and VMware Virtual Infrastructure 3 Storage Best Practices and TR-3749: NetApp Storage Best Practices for VMware vSphere.

References

- Storage Virtualization and DR Using MultiStore vFiler
  http://media.netapp.com/documents/tr-3462.pdf
- Data ONTAP 8.x MultiStore Management Guide
  www.netapp.com/us/products/management-software/provisioning.html
- Nondisruptive Operations Community
  http://communities.netapp.com/groups/non-disruptive-operations

Authors

Roger Weeks, Technical Marketing Engineer, NetApp

Raghunatha Reddy, Technical Marketing Engineer, NetApp

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